PINE POINT MINING LIMITED

Document Map for Pine Point Project Environmental Assessment Initiation Package

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PINE POINT
MINING LIMITED

February 2, 2021

Mark Cliffe-Phillips
Executive Director
Mackenzie Valley Environmental Impact Review Board
200 Scotia Centre
Box 938, 5102-50th Ave
Yellowknife, NT X1A 2N7

Upcoming Application for Mining Authorizations

Pine Point Mining Limited (PPML) holds authorizations to explore in the Pine Point area under land use permits MV2017C0024, MV2018C0005, and water license MV2018L2-0003.

PPML has published a Preliminary Economic Assessment (PEA) of the project that concluded the project has positive economic benefit. The PEA concluded that additional technical studies should be undertaken and that an environmental assessment of the project should be undertaken.

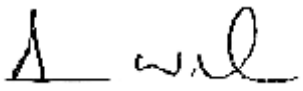
PPML has applied for new authorizations (MV2020C0017 and MV2020L2-0008) to allow PPML to undertake the technical field studies that includes exploration, deposit delineation, geotechnical investigations, metallurgical sampling, and groundwater studies at Pine Point.

PPML has prepared an Environmental Assessment Initiation Package for the proposed mine development, as suggested by the Review Board's Draft Environmental Assessment Initiation Guidelines for Developers of Major Projects (2018).

PPML understands that this proposed development will likely require an environmental assessment by the Review Board under Section 126 of the Mackenzie Valley Resource Management Act (MVRMA) as there might be significant impacts to the environment or public concern about the proposed development unless appropriately mitigated.

To expedite the initiation of the environmental assessment, PPML is requesting that the Review Board initiate an environmental assessment using its authority under Section 126(3) of the MVRMA.

Please do not hesitate to contact the undersigned at 416-209-2056 or acwilliams@live.ca.



Andrew Williams
Environment Manager
Pine Point Mining Limited

Copy:
Mackenzie Valley Land and Water Board
GNWT Department of Lands
K'atlodeeche First Nation
Deninu K'ue First Nation
Northwest Territory Métis Nation
Akaitcho Dene First Nation
Dehcho First Nation
Smith Landing
Salt River First Nation
Hamlet of Fort Resolution
Town of Hay River
West Point First Nation
Timberworks Inc.

1100, avenue des Canadiens-de-Montréal, suite 300, Montréal, Québec, Canada H3B 2S2
Telephone (514) 861-4441 Fax (514) 861-1333

Volume 1 -
Project Description

PINE POINT
MINING LIMITED

Project Description
for the
Pine Point Project

DOCUMENT MAINTENANCE AND CONTROL

Pine Point Mining Limited is responsible for the distribution, maintenance, and updating of this document. Changes that do not affect the intent of the document will be made as required (e.g., phone numbers, names of individuals). The table below indicates the version of this document, and a summary of revisions made.

VERSION HISTORY

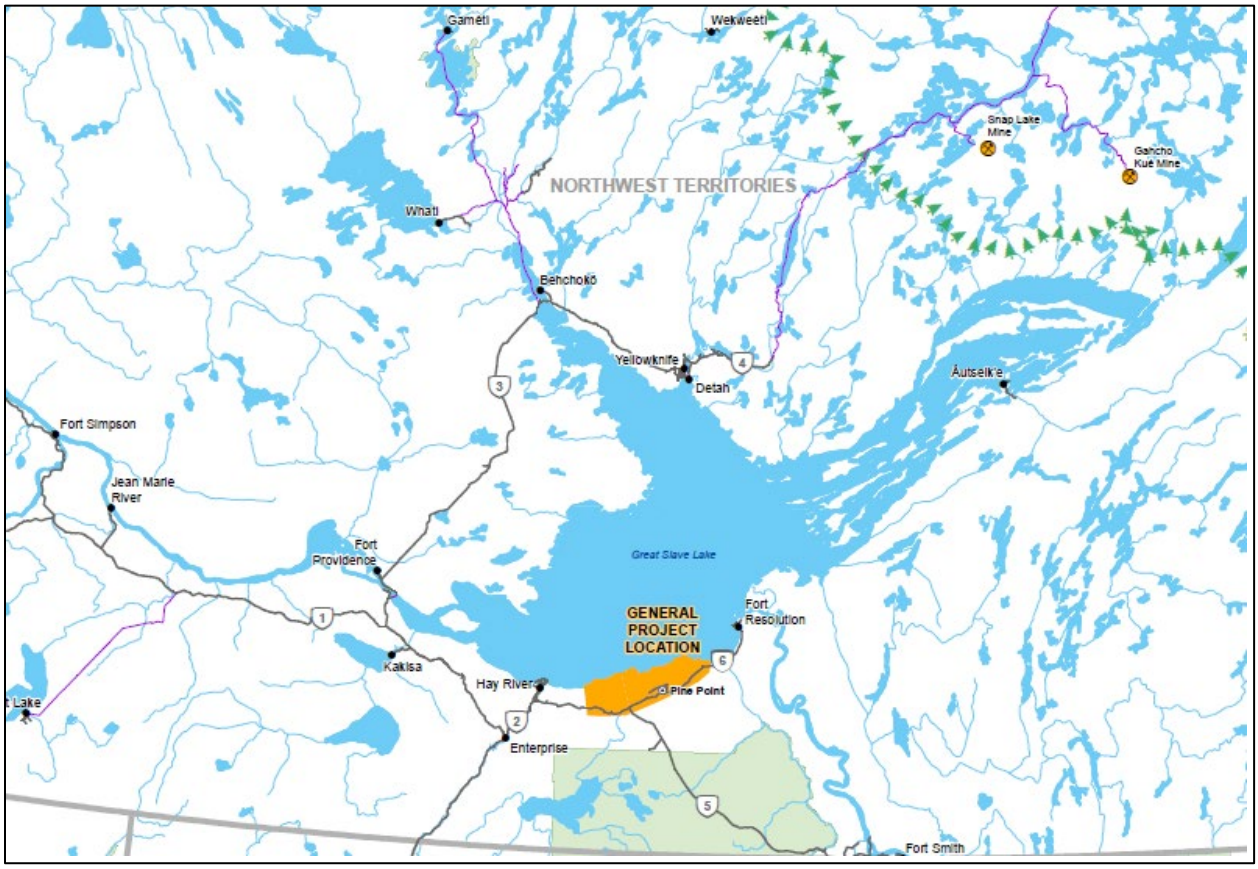
Revision #	Section(s) Revised	Description of Revision	Prepared by	Issue Date
0	-	All	Pine Point Mining Limited	15 December 2020

PLAIN LANGUAGE SUMMARY

This document is a plain language summary of the Project Description for the Pine Point Project. It is much shorter than the Project Description and covers only some of the topics. Readers should read the full Project Description if they are interested in more details about this information.

Overview

Pine Point Mining Limited (PPML) is proposing to build the Pine Point Project (Project), a zinc and lead mine, in the Northwest Territories (NWT), 175 kilometres (km) south of Yellowknife, 42 km east of Hay River and 53 km southwest of Fort Resolution. The property where the mine will be built is a “brownfield” site, meaning that the land has been used historically for mining activities.



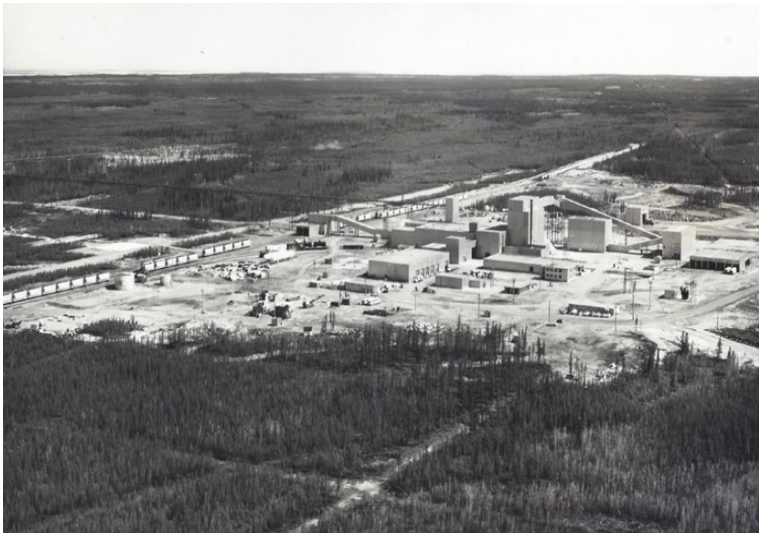
Zinc and lead will be mined using open-pit and underground mining methods. A process plant, camp, and other facilities will be built to support the mining operation. In total, about 40 million tonnes of rock containing zinc and lead will be mined for the Project. Zinc and lead will be sold to smelters, mainly in North America and Asia.

Developer

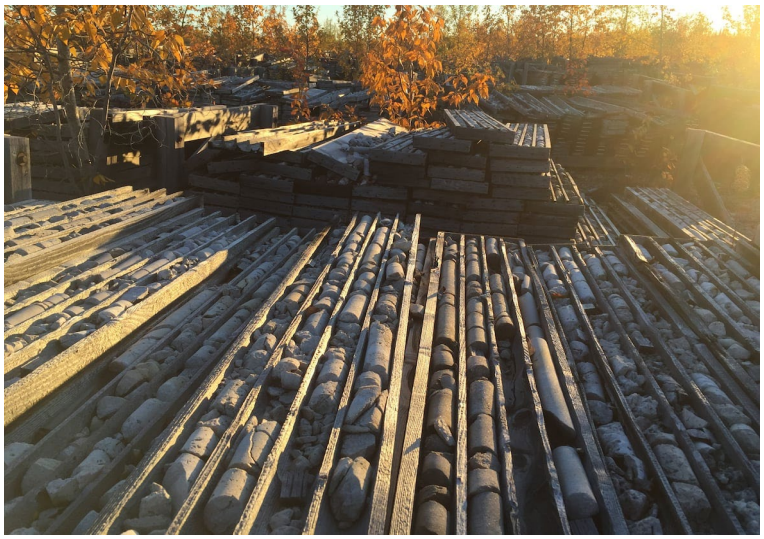
PPML is owned by Osisko Metals Limited (Osisko). Osisko is a Canadian exploration and mining company that focuses on mining of zinc.

Historical Mining at Pine Point

Zinc and lead were first discovered at Pine Point in 1898 by prospectors heading to the Klondike gold rush. Following several years of exploration, Cominco Ltd. (Cominco) built and operated a mine at the Pine Point property between 1964 and 1988. About 50 open pits and some of the facilities used by Cominco remain on the property.



Exploration at Pine Point continued throughout the 1990s and 2000s by Tamerlane Ventures Inc., Darnley Bay Resources Ltd., and PPML. Osisko bought PPML in 2018 with the purpose of developing a new mine at the property.



Project Schedule

To develop the Project, PPML must first obtain a number of permits and licences from the governments of Canada and the NWT. An environmental assessment of the Project is also required. This process will take about two years.

Construction for the Project is expected to begin in 2023 and will take about a year and a half to complete. During the construction period, the mine facilities will be built, and the site will be prepared for mining. Mining will take about 10 to 15 years and will begin in about 2024. The operation period will include mining the open pits and underground mines and processing the mined rock at the processing plant.

Once mining is finished, in about 2037, closure and reclamation will take place. Closure and reclamation activities will take about 15 years. More information about this topic can be found in the "Closure and Reclamation" section below.

Nearby Communities

The mine site is located on the traditional territories of the Deninu Kué First Nation, the K'atl'odeeche First Nation, and the Northwest Territories Métis Nation. The communities closest to the mine are the Deninu Kųé First Nation, the K'atl'odeeche First Nation, Hay River Métis, Fort Resolution Métis, and Fort Smith Métis.

Engagement

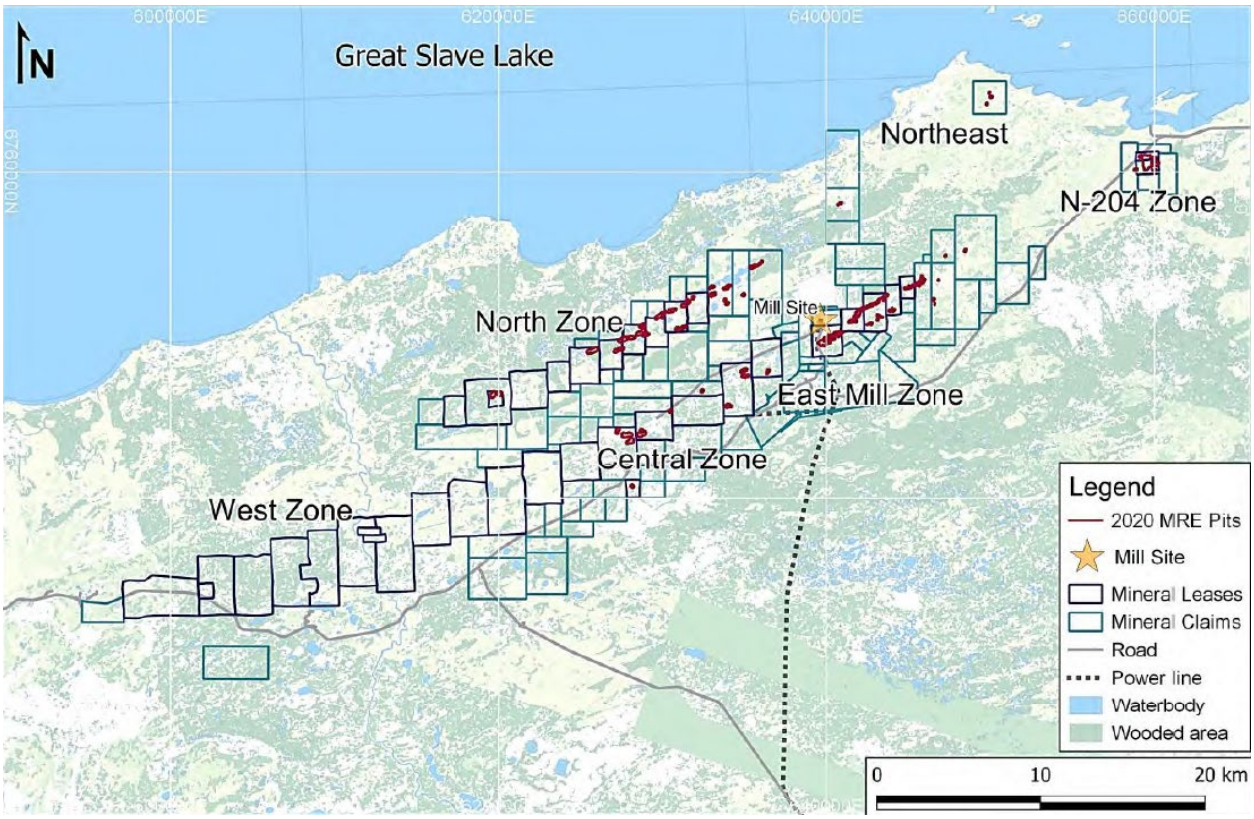
PPML has engaged with affected communities about the details of the Project. During engagement, comments, concerns, and insights provided by community members were recorded and considered in the Project design.

To accompany the Project Description, PPML has prepared an engagement plan framework for the Project. The purpose of the engagement plan is to explain how PPML will continue to engage with affected communities and other interested parties. The engagement plan can be found in a document called the "Engagement and Collaboration Framework" in Volume 2.

Mining

There are about 60 zinc-lead deposits at the Pine Point property. Deposits are locations where there are concentrations of lead or zinc minerals. Most of the lead and zinc will be mined from open pits. However, some of it is deeper in the ground and will be removed using underground mining.

Open pits are mainly located on the east side of the property in the "East Mill Zone", shown on the map below. Underground mines are located in the "West Zone" and "Central Zone".



Rock containing lead and zinc will be mined using excavators or shovels and haul trucks.

Processing

A new processing plant will be built to process the mined rock. Haul trucks will move the rock from the open pits and underground mines to the plant. The processing plant will crush the rock and concentrate the zinc and lead into a final product that can be sold to smelters.

Waste Management

Some of the rock removed from the open pits and underground mines is not useable. This rock is called “waste rock”. Some of the waste rock will be used for construction purposes, such as to build roads. The rest of it will be stored in piles or in open pits. Tailings, which are the leftover materials from processing, will also be stored in open pits.

Using existing open pits for storing waste rock or tailings will reduce the need for new land disturbances at the site.

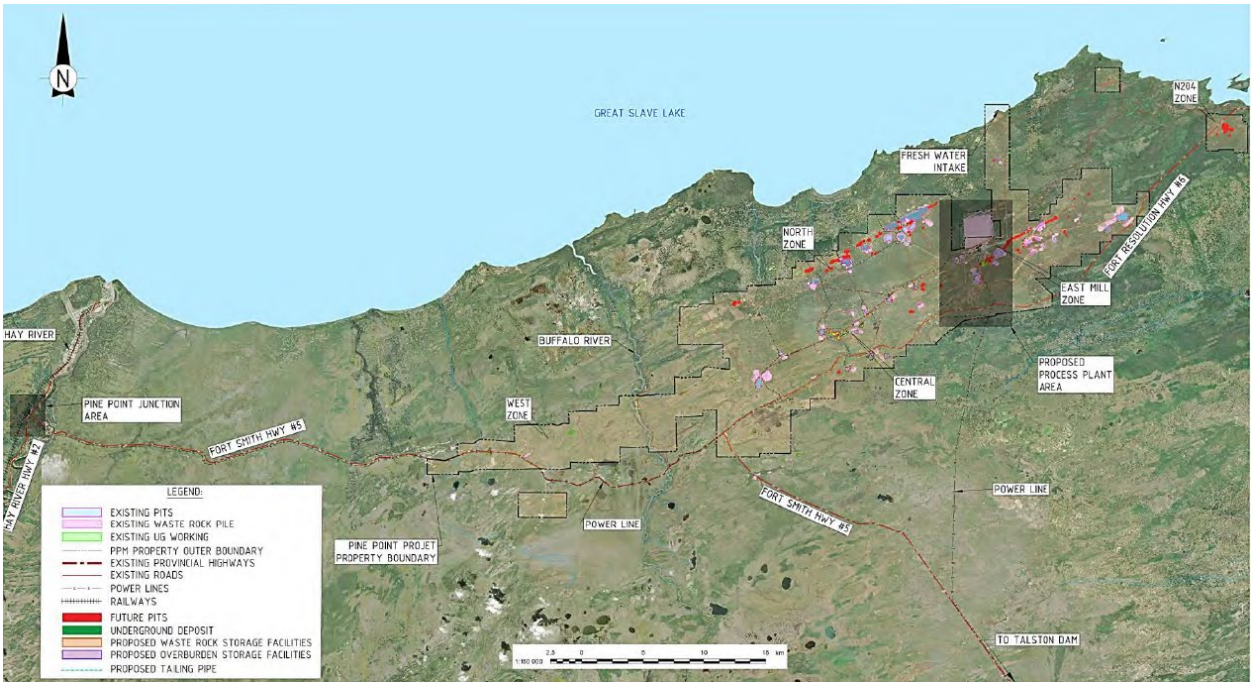
Water Management

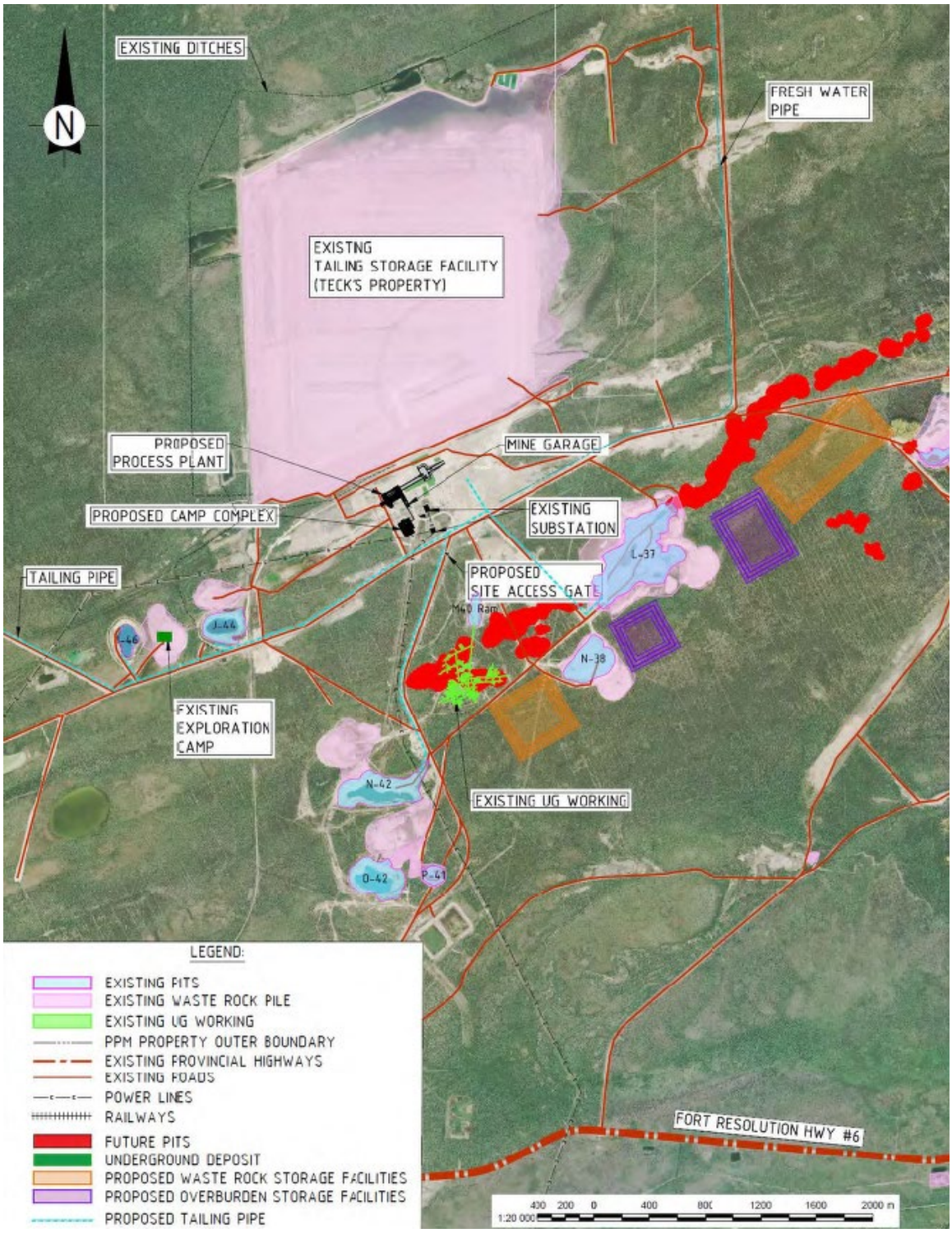
An important part of the mining operation will be the management of water on site. The goal for water management will be to prevent water from flowing into areas where it could become contaminated and by collecting and managing rainfall and runoff within the mine site area. Water that flows into the open pits and underground mines will be pumped into existing open pits or injected deep into the ground.

Water will be used at the processing plant, in the camp, and at other facilities. Water for drinking, showers, and cooking will come from Great Slave Lake. Water for processing and other uses may come from nearby open pits, storage lagoons, or maybe Great Slave Lake.

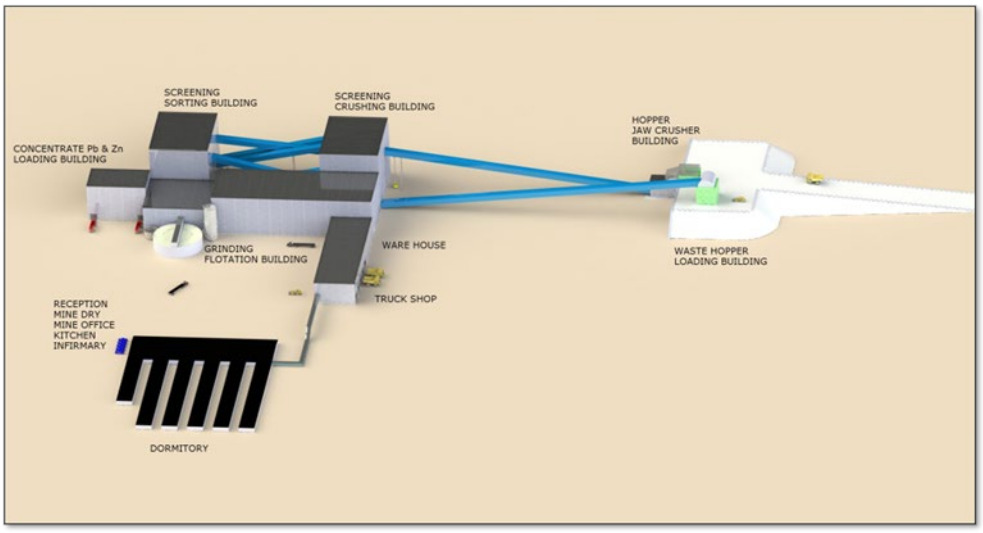
Buildings and Infrastructure

New buildings and infrastructure will be needed to support the mining operation. A gate house will be built at the mine entrance, along with fencing and a parking area. Other facilities will include maintenance buildings and a warehouse. A laydown area will be built to store equipment and supplies.



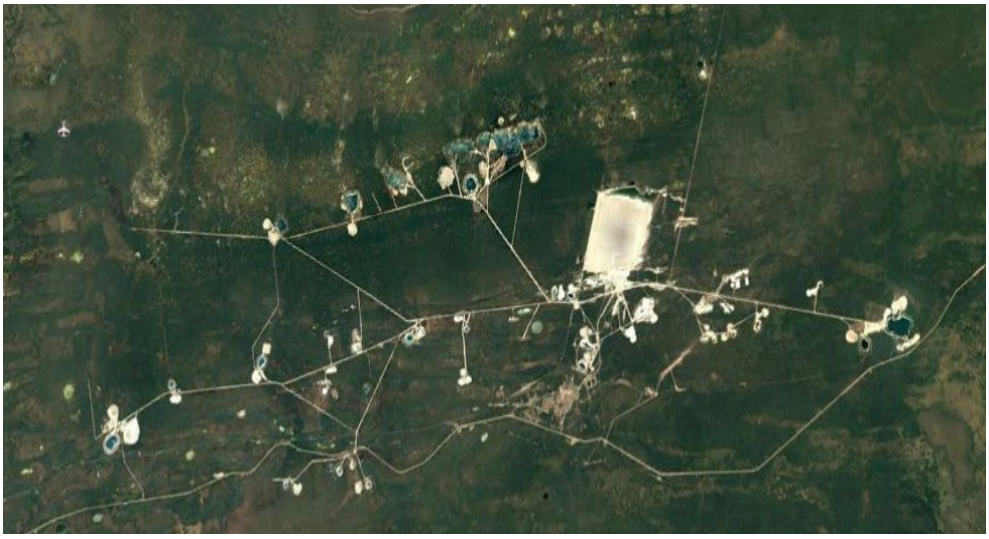


The new processing plant will be built at the same location as the historical Cominco mill site. Some of the infrastructure that was leftover by Comino will be used for the new plant, including the water storage ponds and the open pits that are close by.



Workers will stay in a camp that will be large enough for about 500 people during construction and for about 250 people during operation. The camp will have washroom and shower facilities, dining and kitchen areas, and a gymnasium and fitness room. An office and dry will be built next to the camp.

Over 100 km of roads built by Cominco remain on the property and provide good access throughout the mine site. These roads will be used for the Project as much as possible. Some of these roads may need to be upgraded so they are safe to use and some new roads may be needed for the Project.



Power for the mine will come from the Northwest Territories Power Corporation, who own and operate the Taltson Hydro Dam, and the mine site will also generate its own power from natural gas, with diesel as a back-up.

Explosives will be used during mining to help break the rock into smaller pieces so it can be more easily removed. Explosives will be transported to the mine site by truck and will be stored in special buildings on or storage pads away from other buildings and facilities.

The mining operation will use different types of chemicals and fuels, including diesel, gasoline, engine oil, antifreeze, and propane. Chemicals and fuels will be stored in a secure area that will be designed to catch hazardous materials if they leak or spill.

Jobs and Opportunities

The Project will be good for the economy of the NWT. It will operate for several years after the closure of some of the other mines in the NWT and will provide a continued source of jobs for nearby communities. During construction, there will be about 280 people employed at the mine, with a peak of about 500. About 460 people (two shifts of 230 on rotation) will be needed during mine operations.

The Project has entered into “Collaboration Agreements” with the Deninu Kųę First Nation and the Northwest Territories Métis Nation, and an “Exploration Agreement” with K'atl'odeeche First Nation. These agreements are aimed at providing jobs and business opportunities for these communities, as well as training and education opportunities.

Closure and Reclamation

Once mining is finished, closure and reclamation will occur. The mine facilities will be dismantled and taken away or disposed of in open pits. Brownfield areas, previously used for mining, and used by the Project will be returned to their current state. “Greenfield” areas that are not affected by historical mining activity will be returned to a sustainable and healthy environment that is similar to the current state. The closed mine site will be monitored until the site meets regulatory requirements.

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ABBREVIATIONS

Abbreviation	Definition
ABA	Acid Base Accounting
AEMP	Aquatic Effects Monitoring Program
AMC	AMC Mining Consultants Canada
ARD	acid rock drainage
ATV	all-terrain vehicle
$CaCO_3$	calcium carbonate
CNG	compressed natural gas
Cominco	Cominco Ltd.
DMS	Dense Media Separation
EA	Environmental Assessment
ESR	Excavation Support Ratio
GNWT	Government of the Northwest Territories
HDPE	high density polyethylene
HNO_3	nitric acid
HTD	hydrothermal dolomitization
HVAC	heating, ventilation, and air conditioning
ICP-MS	inductively coupled plasma mass spectrometry
ID	identification
ITK	Indigenous Traditional Knowledge
km	kilometre
LOM	Life of Mine
ML	metal leaching
MPA	maximum potential acidity
MRE	Mineral Resource Estimate
MVEIRB	Mackenzie Valley Environmental Impact Review Board
MVLWB	Mackenzie Valley Land and Water Board
MW	megawatt
NAG	net-acid generation
non-PAG	non-potentially acid generating
NP	neutralization potential
NPR	neutralization potential ratio
NSR	gross revenue
NTPC	Northwest Territories Power Corporation
NWT	Northwest Territories
OB	overburden
Osisko Metals	Osisko Metals Incorporated

Abbreviation	Definition
PAG	potentially acid-generating
PEA	Preliminary Economic Assessment
PPML	Pine Point Mining Limited
Project	Pine Point Project
PRS	Pressure Reduction System
QXRD	quantitative X-ray diffraction
RMR	rock mass ratio
SEMP	Socio-economic Management Plan
SFE	Shake Flask Extraction
SOR	Statutory Orders and Regulations of Canada
Tamerlane	Tamerlane Ventures Inc.
TDA	tailings disposal area
TEDV	typical element distribution values
WR	waste rock
WRSF	waste rock storage facility
XRF	X-Ray Fluorescence
XRT	X-Ray Transmission
ZnEq	zinc equivalent

UNITS OF MEASURE

Units of Measure	Definition
ha	hectare
hp	horsepower
km	kilometre
kv	kilovolt
kw	kilowatt
kwh	kilowatt hour
m	metre
m/s	metres per second
m^3	cubic metre
m^3/d	cubic metres per day
m^3/h	cubic metres per hour
Mlb	million imperial pounds
mm	millimetre
Mm^3	million cubic metres
Mt	million tonnes

Units of Measure	Definition
MW	megawatt
t	tonne
t/m^3	tonnes per cubic metre
tpd	tonnes per day
V	volt

1 PROJECT OVERVIEW

1.1 General Project Information

1.1.1 Project Title

Pine Point Project

1.1.2 Name and Address of the Developer

Pine Point Mining Limited (PPML; Table 1-1) is the sole proponent for the Pine Point Project (the Project). PPML is a 100% owned subsidiary of Osisko Metals Incorporated (Osisko Metals).

Table 1-1: Name and Contact Information of Applicant

Name of Applicant	Pine Point Mining Limited
Address	1100 Avenue des Canadiens-de-Montréal, Suite 300
City	Montreal
Province	Québec
Postal Code	H3B 2S2
Telephone	514-513 6710
Chief Operating Officer and President	Jeff Hussey

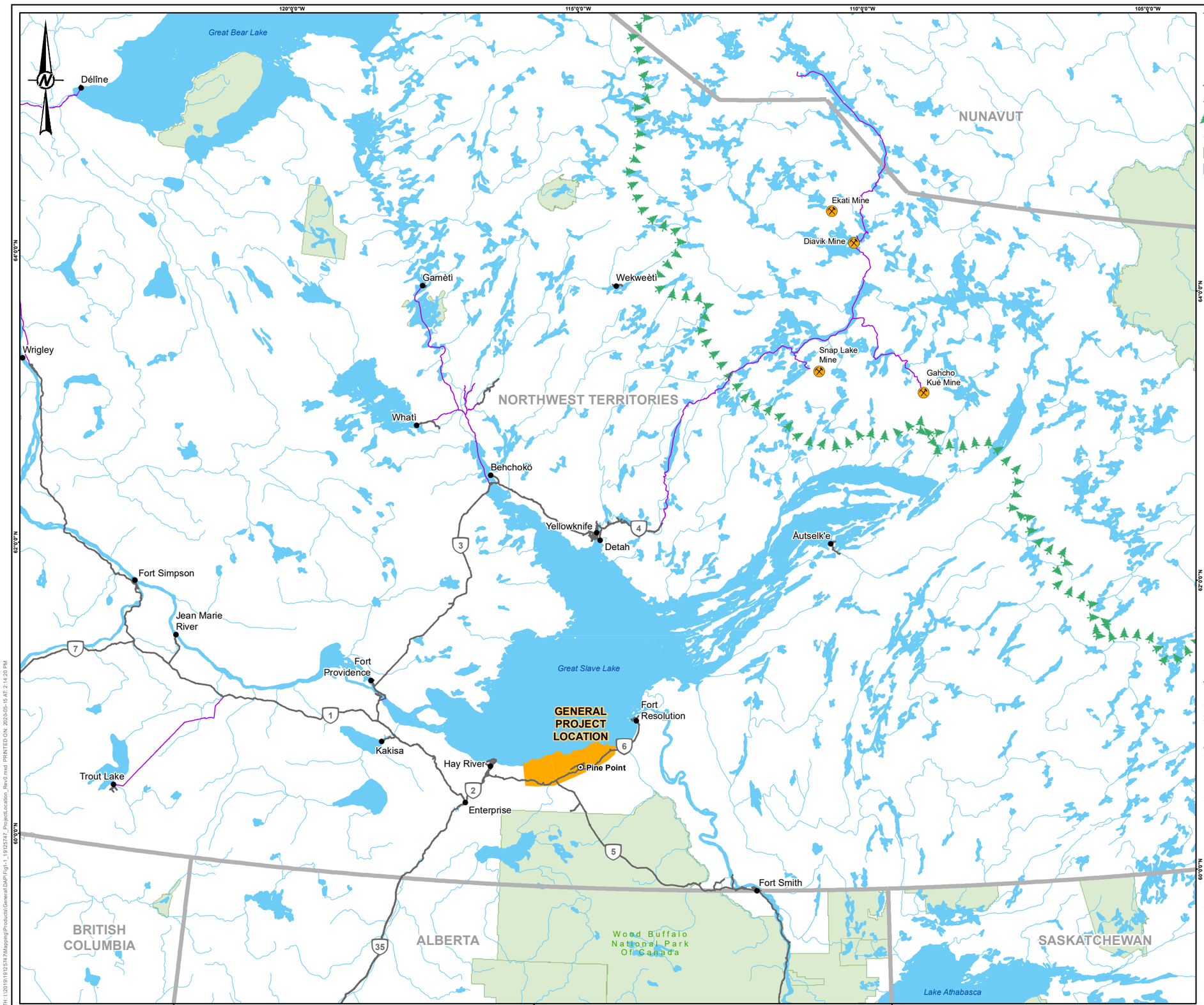
1.1.3 Project Type

Pine Point is a brownfield site and the location of the former Pine Point Mine managed by Cominco Ltd. (Cominco), operated between 1964 and 1988. The Project is currently composed of approximately 72 deposits of which 58 deposits are included in the 2020 Mineral Resource Estimate totaling approximately 52.4 Million tonnes (Mt) of mineralized material grading 4.64% zinc and 1.83% lead (6.47% Zinc Equivalent [ZnEq]) containing approximately 5.3 billion pounds of zinc and 2.1 billion pounds of lead in-situ. A total of 39.1 Mt of combined mineralized material is planned to be mined for the Project using open pit and underground mining methods. The planned processing capacity is 6,000 tonnes per day (tpd) ramping up to 11,250 tpd with an associated mine life of 10 years or longer following a Preliminary Economic Assessment (PEA) with considerable resource expansion and exploration potential.

The Project will consist of open pit and underground mining for zinc and lead, construction and operation of a processing plant (or “concentrator”) that will include pre-concentration facilities, storage and management of processed mineralized material and waste materials, water management, construction and operation of ancillary support facilities including a camp for workers and the transportation of zinc and lead concentrates to global markets.

1.1.4 Project Location

The Pine Point Project is located in the South Slave Mining District, south of Great Slave Lake in the Northwest Territories (NWT), approximately 175 km directly south of Yellowknife, 75 km east of Hay River, and 53 km southwest of Fort Resolution (Figure 1-1). It is located on a brownfield site resulting from Cominco’s historical mining and milling operations and includes the area of the former town of Pine Point and associated working accommodations.



LEGEND

- FORMER PINE POINT TOWN SITE
- POPULATED PLACE
- EXISTING MINE
- ALL-SEASON ROAD
- WINTER ROAD
- TREELINE
- WATERCOURSE
- PARK/PROTECTED AREA
- WATERBODY
- GENERAL PROJECT LOCATION

0 50 100

1:3,000,000 KILOMETRES

REFERENCE(S)

1. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
2. PARKS AND PROTECTED AREAS OBTAINED FROM CONSERVATION AREAS REPORTING AND TRACKING SYSTEM (CARTS), CANADIAN COUNCIL ON ECOLOGICAL AREAS, 2017.

PROJECTION: ALBERS CONIC EQUAL AREA

CLIENT
PINE POINT MINING LTD.

PROJECT
PINE POINT PROJECT

TITLE
LOCATION OF PROJECT

CONSULTANT
GOLDER

YYYY-MM-DD	2020-05-15
DESIGNED	DC
PREPARED	BW
REVIEWED	LY
APPROVED	LY

PROJECT NO.	PHASE	REV.	FIGURE
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The mineral claims and mining leases that comprise the Project currently encompass a total of 46,553 ha including 106 mineral claims, 40 mining leases and four surface leases. The closest major transportation hubs are Hay River, Yellowknife, and Edmonton. Access to the Project is presently via all-weather Highways 5 and 6. Table 1-2 provides the coordinates for the proposed Project.

Table 1-2: Approximate Project Coordinates

Extent	Coordinates (degrees, minutes, seconds)
Minimum latitude	60°43'5.16"N
Maximum latitude	60°57'12.6"N
Minimum longitude	115°13'9.84"N
Maximum longitude	114°2'25.08"W
Map Sheets	NTS 85B 11, 14, 15 and 16

The Project is within the South Slave Region, and the traditional territories of the Akaitcho Dene First Nations, K'atl'odeeche First Nation, and the Northwest Territories Métis Nation. Of the Akaitcho Dene First Nation member nations, the Deninu Kųę First Nation is in close proximity to the Project. The Hay River Métis Council and the Fort Resolution Métis Council have been engaged under the Northwest Territories Métis Nation. The Project is also within the eastern extent of the Interim Measures areas for the Dehcho First Nations of which the K'atl'odeeche First Nation is a member. Currently the land claims in the area remain unsettled. Lands are managed by the Government of the Northwest Territories (GNWT), except for the historical railbed between Hay River and Pine Point, which remains federally managed land. Outside of the Project claims and leases, there is a surrounding Land Withdrawal Order (South Slave Region) for surface and subsurface rights (R-058-2014 under the *Northwest Territories Lands Act*).

1.1.5 Project Timeline

A conceptual Project timeline for the permitting, construction, and operational stages is presented in Table 1-3 below.

Table 1-3: Pine Point Project Schedule

Activity	Start	End
Feasibility Study	Q3 2020	Q3 2022
Environmental Assessment	Q4 2020	Q2 2022
Permitting	Q3 2022	Q3 2023
Confirmation and Exploration Field Program	Q1 2021	Q3 2023
Construction	Q3 2023	Q4 2024
Production (Operations)	Q4 2024	Q4 2037
Closure and Reclamation (excluding progressive closure activities)	Q4 2037	Q4 2042
Transition	Q4 2037	Q4 2039
Active Care	Q4 2039	Q4 2042
Passive Care	Q4 2042	Approx. 2052

1.2 Purpose of the Project

1.2.1 Objective

A PEA was completed by PPML and made publicly available[1] on July 30, 2020. The PEA was based on the NI 43-101 Mineral Resource Estimate listed in Table 1-4 The NI 43-101 PEA report was prepared by experienced and qualified independent consultants using recognized engineering standards. The results of the study indicate that the proposed Project has technical and financial merit using the base case assumptions. The results are considered sufficiently reliable to guide PPML's management in a decision to advance to the next phase of the Project development: that being the initiation of a feasibility study, which anticipates potentially redeveloping the former Pine Point mine site to produce concentrates of zinc and lead for shipment to independent smelters worldwide.

The concentrates produced from the mine (zinc and lead) are to be sold to smelters for use in industrial applications. Zinc is used for galvanization (60%), die-casting alloys (14%), brass castings (10%), paints, rubber, and other products, while lead is used, for example, in car batteries, pigments, ammunition, and lead crystal glass.

Table 1-4: Pine Point Indicated and Inferred Mineral Resources Estimate

Method	Zone	Cut-off Grade (ZnEq%)	Indicated Mineral Resources				Inferred Mineral Resources			
			Tonnage (kt)	ZnEq (%)	Pb (%)	Zn (%)	Tonnage (kt)	ZnEq (%)	Pb (%)	Zn (%)
Pit Constrained Mineral Resources	Central	1.85	1,700	7.31	1.71	5.61	3,200	7.89	2.02	5.86
	East Mill	1.85	6,000	5.38	1.39	4.00	3,800	5.05	1.02	4.03
	North	1.90	5,300	6.98	2.12	4.86	10,800	5.70	1.64	4.06
	N204	2.05	-	-	-	-	9,400	4.58	0.99	3.59
Underground Mineral Resources	Central	5.00	-	-	-	-	2,300	7.38	1.58	5.80
	West	5.00	-	-	-	-	8,200	11.04	3.78	7.25
Total Pit Constrained		**1.85 - 2.05**	**12,900**	**6.29**	**1.73**	**4.56**	**27,200**	**5.48**	**1.37**	**4.11**
Total Underground		**5.00**	-	-	-	-	**10,500**	**10.23**	**3.30**	**6.93**
	Total Combined		**12,900**	**6.29**	**1.73**	**4.56**	**37,600**	**6.80**	**1.91**	**4.89**

1.2.2 Need for the Development

PPML expects to begin production at Pine Point in 2024 and continue until 2034 based on the current Mineral Resource Estimate. The Project will benefit the NWT workforce and provide commercial opportunities in the region, especially the South Slave.

The Project will commence production in the year prior to the current forecasted closure of Diavik Diamond Mine (2025) (Rio Tinto 2020). The Gahcho Kué Diamond Mine is expected to cease operations around 2029 after 12 years of operations (De Beers 2020). The closure dates for these two mines will be influenced by their mine plans. The Ekati Diamond Mine is currently scheduled for closure in 2034 (Dominion 2020) after completion of the Jay and Misery Underground projects.

[1] Posted to SEDAR – System of Electronic Data Analysis And Retrieval, www.sedar.com

The Jay project was delayed in 2018 and is currently expected to recommence in 2021 (CBC 2018). The Jay project, if it proceeds, has an estimated mine life of 11 years.

The Project is anticipated to span the closure of both the Diavik and Gahcho Kué mines and will provide substantial continued employment opportunities for the workforce of the NWT with skill sets applicable to open-pit mining and underground mining operations, such as heavy equipment operators and maintenance personnel.

The Project will take advantage of the proximity of the Taltson Hydroelectric facility and use the available power, supplemented by onsite diesel and compressed natural gas generators.

1.2.3 Economic Projections

The following summarizes key outcomes as determined from the updated Mineral Resource Estimate (MRE) and PEA Study:

- pit constrained Indicated Mineral Resources[2] of 12.9 Mt grading 1.73% Pb and 4.56% Zn
- underground and pit constrained Inferred Mineral Resources[3] of 37.6 Mt grading 1.91% Pb and 4.89% Zn
- production of 3,279 million pounds (Mlb) of zinc and 1,438 Mlb of lead over a 10-year mine life from 39.1 Mt of mineral inventory, with an average diluted grade of 1.79% Pb and 4.38% Zn (6.17% ZnEq)
- Life of Mine (LOM) lead and zinc concentrate grades of 63% and 59%, respectively; LOM lead and zinc recoveries of 92.8% and 86.7%, respectively
- gross revenue (NSR) of $4.44 billion
- initial capital costs of $556 million, including a $71 million contingency. Sustaining capital costs of $410.9 million. Reclamation and closure costs of $62.8 million
- LOM operating costs of $1.76 billion, with federal, territorial mining taxes of $528.8 million
- average of approximately 280 workers during the construction period (peak of 500) and approximately 456 employees, staff and labour (local and fly-in-fly-out), will be required during operations
- process plant commissioning in Q1 2025; full commercial production by Q4 2025

As Project planning advances and the understanding of the associated workforce requirements evolves, information related to procurement strategies, taxation and royalty revenues, and economic predictions (i.e., Gross Domestic Product) will become available.

PPML has entered into two separate Collaboration Agreements regarding the Project with the Deninu Kųé First Nation and the Northwest Territories Métis Nation. These parties have entered into the agreements to promote a cooperative and mutually respectful relationship governing the

[2] An Indicated Mineral Resource is that part of a Mineral Resource for which quantity, grade or quality, densities, shape and physical characteristics can be estimated with a level of confidence sufficient to allow the appropriate application of technical and economic parameters, to support mine planning and evaluation of the economic viability of the deposit.

[3] An Inferred Mineral Resource is that part of a Mineral Resource for which quantity and grade or quality can be estimated on the basis of geological evidence and limited sampling and reasonably assumed, but not verified, geological and grade continuity.

proposed exploration and development activities in the Pine Point area. The agreements reflect the intention to work with each Indigenous community regarding education and training, employment, business and contracting opportunities, information sharing, site visits, and broad outlines of topics for future agreements.

1.3 Project History

1.3.1 Site History

The first Pine Point lead-zinc deposit was discovered in 1898 by prospectors heading to the Klondike gold rush. Cominco Ltd. (Cominco) began exploration at Pine Point in 1929, with test-pitting, drilling, and shaft sinking. In 1948, Cominco began major exploration work and by the early 1960s had advanced the project to construction, which included a railroad, hydroelectric dam, and a town where up to 2,000 people could live.

Cominco commenced large-scale mine production in 1964 based on 21.5 million tonnes averaging 7.2% zinc and 4% lead. The mine eventually ramped up to a production rate of 10,000 tpd. The Pine Point Mine was an assemblage of open pits and underground deposits, distributed along a 70 km trend. Cominco operated the Pine Point Mine between 1964 and 1988 (Figure 1-2, Photo 1), producing 64 Mt grading 7.0% zinc and 3.1% lead from the 52 deposits mined. Fifty deposits were mined by open pit and two using underground mining methods. This historical production illustrates that the mine was composed of several small deposits rather than a single deposit or a few large deposits. The historical deposits mined varied between a minimum of 49,000 tonnes (X-17) to a maximum of 17,500,000 tonnes (X-15), with an average of 1,300,000 tonnes per deposit. Grades during the Cominco era ranged from 4% to 21% Zn + Pb, with an average of 9.9% Zn + Pb combined. The Cominco concentrator eventually processed mineralization at a level of 10,000 tonnes per day (tpd) (Figure 1-2, Photo 2).

Photo 1: Example of one of Cominco's open-pit mines at Pine Point –1960s

Photo 2: Pine Point Process Plant Site looking West Southwest from 1960s

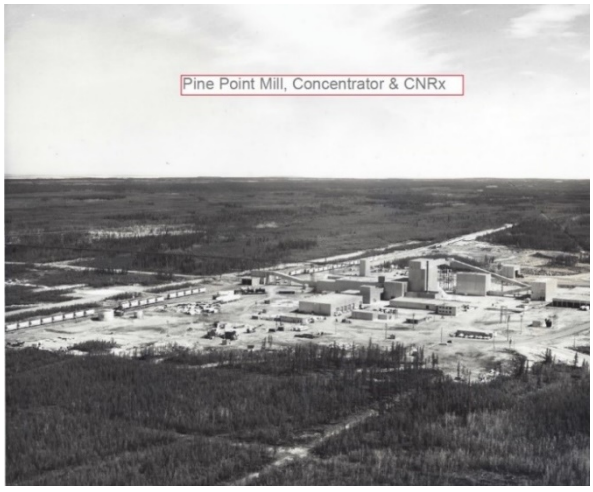


Figure 1-2: Historical Pine Point Mine Photos

Source: Photos courtesy of John Jewitt.

During the same period, Western Mines (later known as Westmin Resources Ltd.), acquired claims west of Cominco's project and mainly west of the Buffalo River. The exploration program was referred to as “The Great Slave Reef Project”. This project was a joint venture of Westmin, controlled by Boliden of Sweden, DuPont Exploration Canada, and Phillip Brothers. Drilling programs conducted between 1975 and 1981 outlined seven additional lead-zinc deposits on the Great Slave Reef Project. Westmin drilled 885 holes totalling 154,816 m from 1975 to 1981.

High operating costs related to the town of Pine Point, high power consumption for mine dewatering, and the acquisition of the Red Dog deposit with nearly double the average grades and better mining characteristics, are some of the reasons that may have prompted Cominco to close its Pine Point mining operation in 1988. Processing of stockpiled material continued until 1988. Reclamation of the mine site was completed in 1991 and included removal of the concentrator, townsite, and railroad.

By August 2001, all of Cominco’s and Westmin claims and mining leases had expired. Prospective parts of the district were staked a few years later by Ross Burns on behalf of the Kent-Burns Group (later Karst Investments LLC).

In 2004, the claims were optioned by Tamerlane Ventures Inc. (Tamerlane), who then acquired 100% interest in 2006. Tamerlane did extensive work including the compilation of historical data, exploration drilling, geophysical surveys, geological interpretation, and multiple mining studies including the Pine Point Pilot Project.

Environmental baseline studies were also conducted by EBA Engineering Consultants Ltd. in 2005 and 2006 and included water quality and stream assessment, vegetation/ecosystem studies, a rare plant survey, wildlife surveys, and a water quality sampling program.

After Tamerlane declared bankruptcy in 2013, limited work continued nonetheless, including targeted underground and open-pit mine plan development that was published in economic studies and Technical Reports.

Avalon Rare Metals, who was developing the Nechalacho rare earth elements project at Thor Lake during that period, considered building a hydrometallurgical plant at the historical Pine Point Mine site. Their plan included the disposal of tailings in the historical mined-out pits. They obtained the approval from the Mackenzie Valley Environmental Impact Review Board (MVEIRB) following an environmental assessment but did not pursue this plan.

Darnley Bay Resources Ltd. acquired the Pine Point assets from Tamerlane in 2016 and changed the company name to Pine Point Mining Limited (PPML) in 2017. They continued with exploration and published two Technical Reports in 2017, including a phased approach for the mine development plan.

In February 2018, Osisko Metals acquired PPML and became sole owner of the Project.

1.3.1.1 Existing Disturbances

All the past mining and exploration activities described in Section 1.3.1 have resulted in existing disturbance being present over a large portion of the area of the Project (i.e., brownfield site). Subsequent to the discovery of lead and zinc at Pine Point and the first exploration efforts in in 1929, the area has seen extensive exploration and mining up to 1988. Following the closure of

the mines in 1988, only small scale, and very localized, exploration has occurred. Surface disturbances documented herein are extensive and largely related to activities prior to 1988.

The disturbance is related to the presence of existing bush roads, cutlines, historic railbed, waste rock piles, and backfilled and mined pits (Figure 1-3 to Figure 1-7). As a result of past mining activities and the brownfield nature of the site, existing conditions do not necessarily reflect historical background conditions (i.e., before any industrial development occurred). Rather, existing conditions represent the outcome of historical and current environmental and socio-economic pressures or factors that have shaped the observed condition of biophysical, social, economic, and cultural components of the surrounding environment.

Photo 1: View of existing open pit N42 at the historical Pine Point Mine site.

Photo 2: View of existing open pit L37 at the historical Pine Point Mine site.

Photo 3: View of existing haul road at the historical Pine Point Mine site.

Photo 4: View of one of many existing roads at the historical Pine Point Mine site.

Figure 1-3: Current Photos of the Historical Pine Point Mine Site

In 2018 and 2019, PPML surveyed the area in the vicinity the Project with LiDAR airborne surveys. This system provides the ability to image the ground surface with vegetation removed at a precision of 0.5 m or better and with the ability to show where the ground surface has been disturbed under the current vegetation. Additionally, GNWT high resolution air photos from 2016-2018 were compiled to provide current photographic documentation of the area of the Project and current state of vegetation (Figure 1-4).

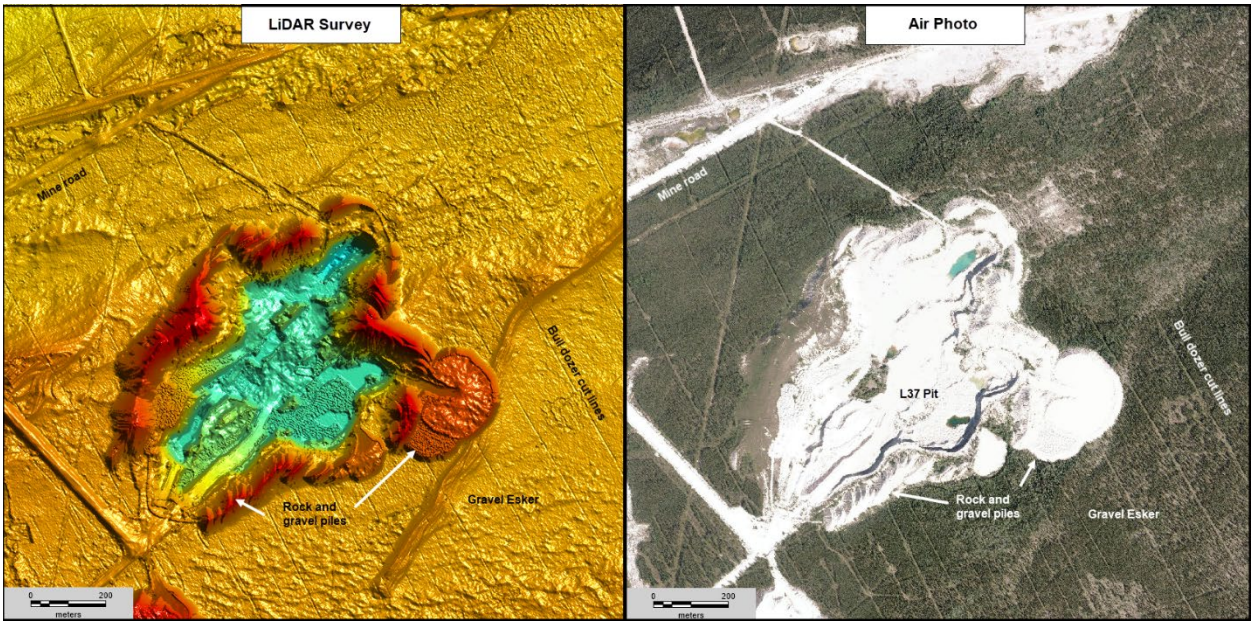


Figure 1-4: Comparison of LiDAR and Air Photo Imagery of the Historical Pine Point Mine Site

Analyses of these data indicate that the main sources of disturbance include the following:

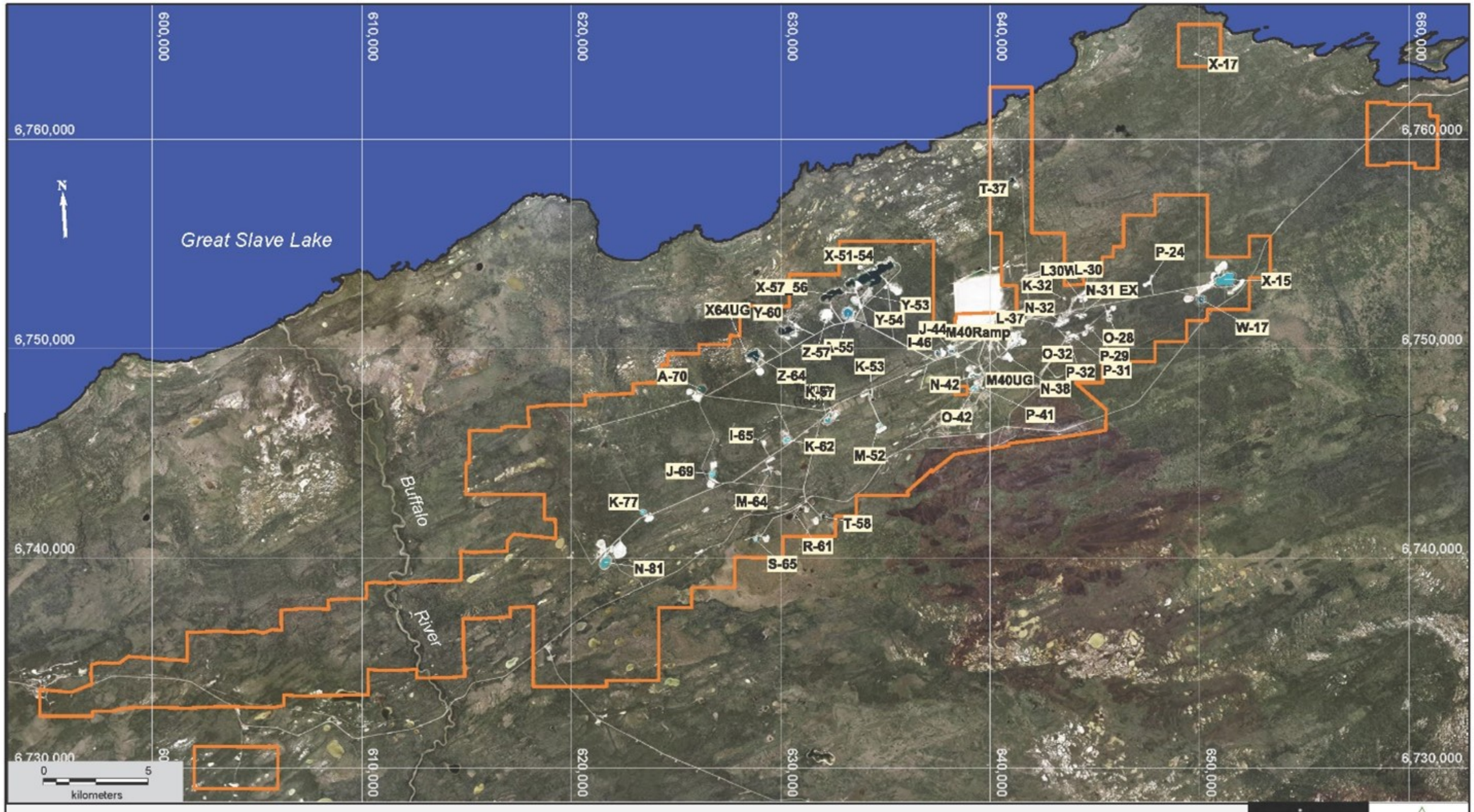
- open pits
- rock and gravel piles
- clearings and gravel pits related to mining, drill hole pads, townsite, tailings facility, core graveyard, former mill site, areas of high concentrations of drill holes, highway gravel pits
- drainage ditches
- haul roads and related mining access, bush roads, railroad right-of-way, power line, bulldozer cut lines, and highway

The area of existing disturbance is estimated in Table 1-5. Approximately 18.2% of the mineral permit area (claims and leases area) has been disturbed from the historical mining activity.

Table 1-5: Estimates of Existing Disturbance within the Mineral Permit Area (Claims and Leases Area) for the Project

Disturbance Type	Area Disturbed within Mineral Permit Area (km^2)	Percentage of Disturbance within Mineral Permit Area (%)
Open pits	5.4	1.2
Rock and gravel piles	15.5	3.3
Mine roads	6.3	1.4
Mine drainage ditches	2.7	0.6
Other disturbed areas	28.2	6.1
Cut lines	20.4	4.4
Pads	0.3	0.1
Bush roads	0.6	0.1
Railroad	0.5	0.1
Power line	1.8	0.4
Highway	2.6	0.6
Total	**84.3**	**18.2**

The mineral permit area is shown in Figure 1-5 and is calculated to be 462.2 km^2.



PPML Mineral Permits

Mineral permits: boundary

Historical Mine Name

N-81

Figure 1-5

OSISKO METALS

PINE POINT MINING LIMITED

Pine Point Project

High Resolution Air Photo

LiDAR and Orthophoto Date

NAD83 (CSRS) UTM Zone 11 | Nov 2020

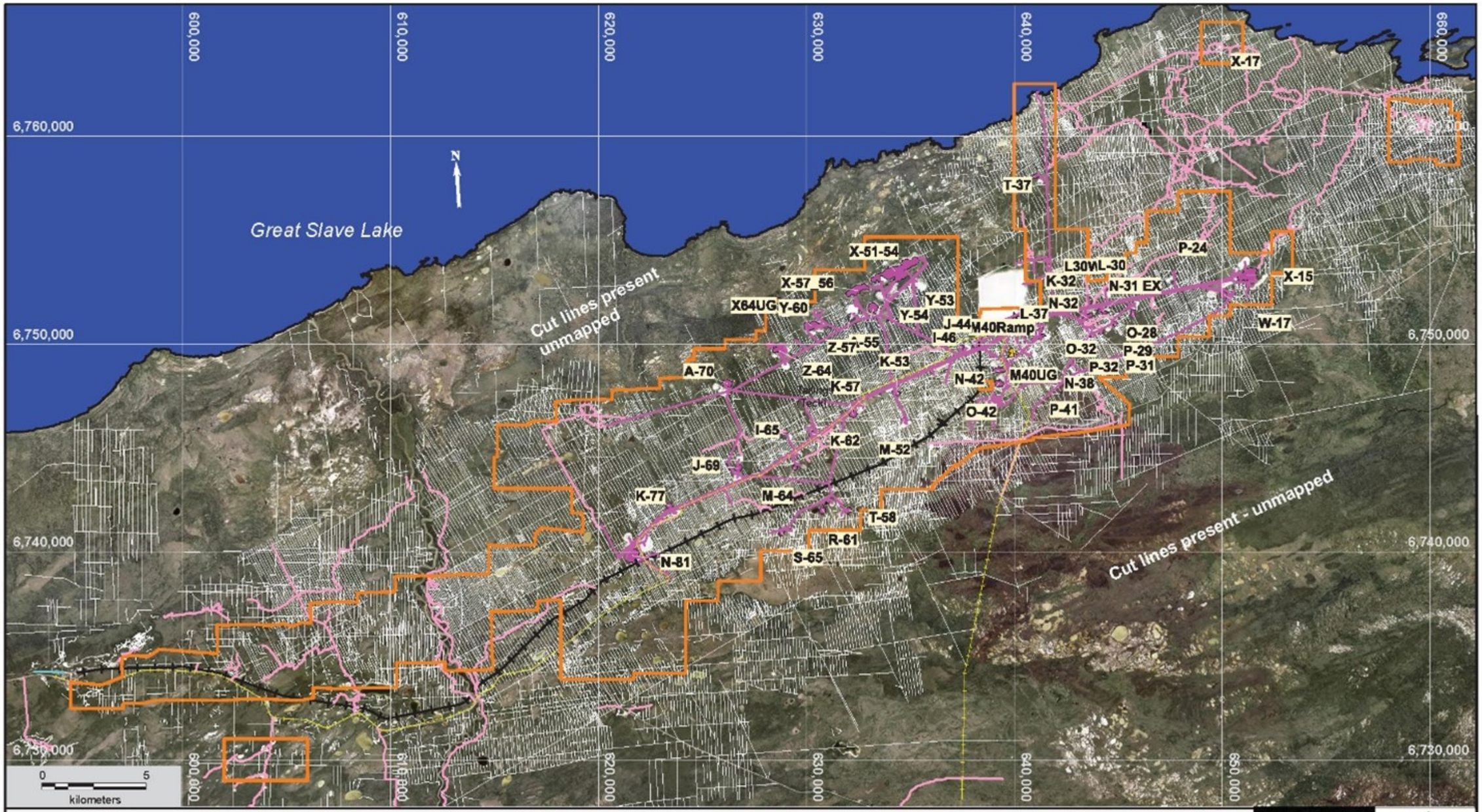
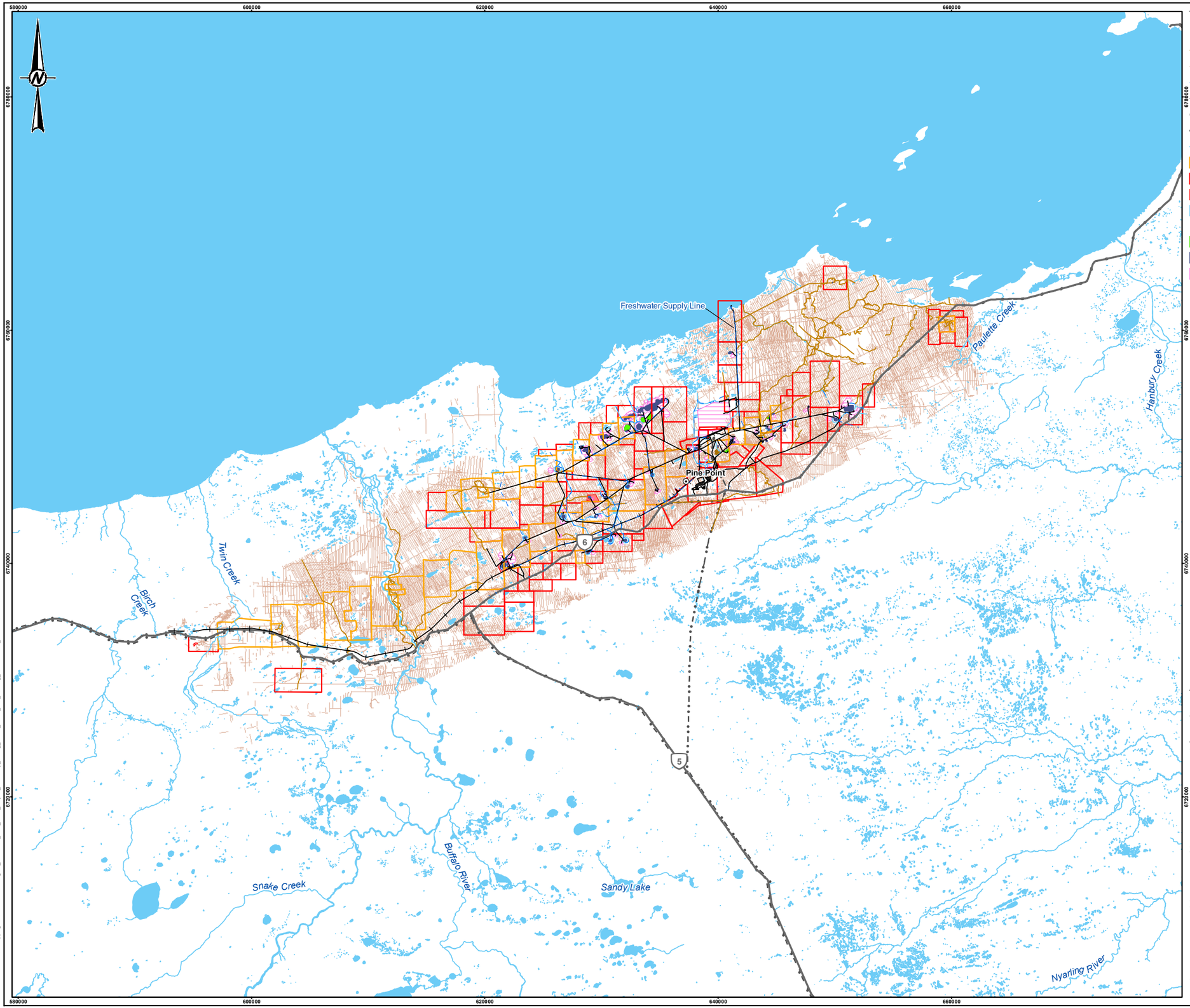

600,000
610,000
620,000
630,000
640,000
660,000
6,760,000
6,750,000
6,740,000
6,730,000
N
Great Slave Lake
Cut lines present unmapped
X-17
T-37
X-51-54
X-57_56
X64UG
Y-60
Y-53
Y-54
L30
L-30
K-32
N-31 EX
P-24
X-15
N-32
L-37
J-44
M40Ramp
I-46
O-28
W-17
Z-57
-55
K-53
O-32
P-29
P-32
P-31
A-70
Z-64
K-57
N-42
M40UG
N-38
O-42
P-41
I-65
K-62
M-52
J-69
K-77
M-64
T-58
R-61
S-65
N-81
Cut lines present - unmapped
0
5
kilometers
Survey Lines
Bulldozer cut lines (1955 - 1988)
PPML Mineral Permits
Mineral rights boundary.
Rail road bed
Primary mine haulage roads
Bush roads - drill, geophysics access
Powerline
Historical Open Pits
Historical underground mine.
N-81
Historical Mine Name
OSISKO METALS
PINE POINT MINING LIMITED
Pine Point Project
Historical Survey Lines - Regional
LiDAR and Orthophoto Date
NAD83 (CSRS) UTM Zone 11
Nov 2020

Figure 1-6



LEGEND

- FORMER PINE POINT TOWN SITE
- BUSH ROAD
- CUTLINE
- DRAINAGE DITCH
- HISTORIC RAILBED
- HIGHWAY
- TRANSMISSION LINE
- WATERCOURSE
- ACTIVE MINERAL LEASE
- ACTIVE MINERAL CLAIM
- CUTBLOCK
- WATERBODY

PINE POINT EXISTING MINING DISTURBANCE

- BACKFILLED PIT
- MINED PIT
- WASTE PILE

0 5 10
1:325,000 KILOMETRES

REFERENCE(S)

BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED. IMAGERY COPYRIGHT © ESRI AND ITS LICENSORS. USED UNDER LICENSE, ALL RIGHTS RESERVED.
PROJECTION: UTM ZONE 11N DATUM: NAD83

CLIENT
PINE POINT MINING LTD.

PROJECT
PINE POINT PROJECT

TITLE
PINE POINT PROJECT BOUNDARY, MINING LEASE AREAS, AND EXISTING DISTURBANCES

CONSULTANT
GOLDER

YYYY-MM-DD	2020-11-05
DESIGNED	JV
PREPARED	MM/PMT
REVIEWED	DP
APPROVED	DP

PROJECT NO. 19125747 CONTROL REV. 0 FIGURE 1-7

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

0 25mm

PATH: I:\2019\19125747\Mapping\Products\General\Fig1-3_19125747_Pine_Point_Project_Boundary_Mining_Lease_Areas_and_Existing_Disturbances_Rev0.mxd PRINTED ON: 2020-11-05 AT: 3:01:55 PM

1.3.2 Regulatory History

In June of 2006, Tamerlane applied to the Mackenzie Valley Land and Water Board (MVLWB) for a Land Use Permit (MV2006C0014) and Type B Water Licence (MV2006L2-0003) for the Pine Point Pilot Project. The proposed Pine Point Pilot Project included the construction and operation of an underground mining operation to extract and initially process a 1 Mt sample from a lead and zinc deposit at Tamerlane's R-190 project, east of Hay River. The proposed development involved building an underground test mine, extracting 1 Mt of lead/zinc mineralization, concentrating and separating the zinc and lead from the mineralized material, and then transporting the concentrate on Highway 5 to a load-out transfer facility south of Hay River where it would be shipped to international markets by rail.

Tamerlane was notified on June 28, 2006 that the development had been referred to the environmental assessment process. The MVEIRB then conducted an environmental assessment on Tamerlane's Pine Point Pilot Project test mine.

In February 2008, MVEIRB determined that if Tamerlane implemented the commitments listed in Appendix B of MVEIRB's Report of Environmental Assessment and Reasons for Decision, the proposed Pine Point Pilot Project test mine would not likely have any significant adverse impact on the environment or be a cause of significant public concern, and that the development should therefore proceed to the regulatory phase of approvals. No Measures were made by MVEIRB, but 11 Suggestions were provided (Appendix C of the MVEIRB Report of Environmental Assessment). The project did not begin construction at that time and in 2016 the Tamerlane assets were acquired by Darnley Bay Resources.

A history of recent exploration and associated permits and licences at the Pine Point site is provided in Table 1-6.

Table 1-6: History of Recent Exploration and Associated Permits and Licences at the Pine Point Site

Permit or Licence	Type	Owner	Activity	Status
MV2020L2-0008	Type B Water Licence	PPML	Confirmation drilling program activities	Active, expires October 8, 2022
MV2018L2-0003	Type B Water Licence	PPML	Confirmation drilling program activities	Expired
MV2018C0005	Type A Land Use Permit	PPML	Confirmation drilling program activities	Active, expires September 19, 2022
MV2017C0024 (amendment of MV2016C0023)	Type A Land Use Permit	Darnley Bay Resources Ltd.	Additional mineral exploration activities	Active, expires July 19, 2022
MV2016C0023 (renewal of MV2008C0023)	Type A Land Use Permit	Tamerlane Ventures Inc.	Drill exploration and confirmation holes	Expired
MV2012X0001	Type A Land Use Permit	Borealis Geopower	Drilling activities	Expired
MV2011C0015	Type B Water Licence	Tamerlane Ventures Inc.	Construction and operation of a lead/zinc pilot project	Expired

Table 1-6: History of Recent Exploration and Associated Permits and Licences at the Pine Point Site

Permit or Licence	Type	Owner	Activity	Status
MV2008C0023	Type A Land Use Permit	Tamerlane Ventures Inc.	Exploration activities	Expired
MV2006L2-0003	Type A Water Licence	Tamerlane Ventures Inc.	Pine Point Pilot Project	Expired
MV2006C0014	Type A Land Use Permit	Tamerlane Ventures Inc.	Construction and operation of a lead/zinc pilot project	Expired
MV2001C0084	Type A Land Use Permit	Tamerlane Ventures Inc.	Exploration and development work, including drilling	Expired

1.3.2.1 Jurisdiction

The environmental assessment process and issuance of a Land Use Permit and Water Licence for mining and milling is regulated under the *Mackenzie Valley Resource Management Act*. The *Fisheries Act*, the NWT *Lands Act* and NWT *Waters Act* also apply, as do a number of other federal and territorial regulatory instruments (Section 1.4).

1.4 Project Authorizations

PPML holds the necessary mineral leases and mineral claims that provide the fundamental mineral and mining rights for the Project. PPML controls a semi-contiguous group of 40 mineral leases and 106 mineral claims covering 46,553.48 ha in the area of the Project (Figure 1-7).

PPML has two surface leases in the R190 deposit area that were acquired in 2010 to cover the proposed mine site and a settling pond envisioned in the Tamerlane 2007 feasibility study (Figure 1-7).

The Project is not in an area of the NWT with an identified land use plan (GNWT 2020). In the southeastern NWT, the GNWT and the Government of Canada are working with the Akaitcho Dene First Nations and the Northwest Territories Métis Nation to develop an approach to land use planning that could concurrently inform negotiations for future land and resource agreements (GNWT 2019). The Project is located within the range of boreal caribou (*Rangifer tarandus caribou*); boreal caribou in the NWT are all considered part of the same population (NT1; Government of Canada and GNWT 2019). The Project will consider boreal caribou and other species at risk in planning, construction, and operations through the Wildlife Protection Plan. A Wildlife Protection Plan framework has been developed to support the submission of the Environmental Assessment (EA) Initiation Package (Section 3.9.8).

PPML currently holds a Type B Land Use Permit under authorization MV2017C0024, a Type B Water Licence (MV2020L2-0008) and a Type A Land Use Permit (MV2018C0005) from the MVLWB for drilling program activities. New applications are being submitted to the MVLWB to undertake the follow-up program recommended in the Preliminary Economic Assessment. The new applications will be for a Type A Water licence and Type A Land Use Permit to undertake this recommended follow-up work, which referred to as the Confirmation and Exploration

Program. This program includes continued work to further advance the Project design: diamond drilling for exploration, delineation, and geotechnical studies; shallow pitting to test soil strength; sampling of mineralized rock for metallurgical testing; pit water sampling to test for metallurgical processing purposes; and testing of the groundwater pumping rates and re-injection of groundwater via drillholes and deposition into pits. When approved, any existing licenses will no longer be required.

PPML will require a Type A Water Licence and Type A Land Use Permit for the Project following the Environmental Assessment process. The main licences, permits, and authorizations that are expected to be required for the Project are listed in Table 1-7.

Table 1-7: Authorizations, Permits, and Licenses Required for the Project

Authorization, Permit, or Licence	Act and/or Regulation	Permitting Board, Agency, or Organization
Type A Land Use Permit (for mine construction and operation)	*Mackenzie Valley Land Use Regulations*	MVLWB
Type A Water Licence (for Mining and Milling)	*Waters Act*/Regulations *Mackenzie Valley Resource Management Act*	MVLWB
Land Use Permit (for routine operation and maintenance)	*Mackenzie Valley Land Use Regulations*	MVLWB
Quarry Permit	*Quarrying Regulations* *Northwest Territories Lands Act*/Regulations *Northwest Territories Land Use Regulations*	GNWT-Lands
Explosives Permit	*Explosives Act*/*Explosive Regulations, 2013* *Explosives Use Act*/Regulations	Natural Resources Canada Workers' Safety and Compensation Commission
Approval to transport dangerous goods	*Transportation of Dangerous Goods Act*/Regulations	Transport Canada
Permit to Burn and Fire Preparedness Plan	*Forest Protection Act*	GNWT- Environment and Natural Resources
Fisheries Act Review / Authorization	*Fisheries Act*	Fisheries and Oceans Canada
Minor Works Order	*Canadian Navigable Waters Act*	Transport Canada
Schedule 2 Listing for Tailings Impoundment Areas	*Metal and Diamond Mining Effluent Regulations*	Environment and Climate Change Canada Fisheries and Oceans Canada
NWT Research Licence	*Scientists Act*	Aurora Research Institute
Wildlife Research Permit	*Wildlife Act*	GNWT - Environment and Natural Resources
Wildlife Management and Monitoring Plan approval	*Wildlife Act* (if the Project triggers Section 95 of the Act)	GNWT- Environment and Natural Resources
Archaeology Permit	*Archaeological Sites Act*/Regulations	GNWT- Education, Culture and Employment
Waste Disposal Approval (for any off-site waste disposal)	*Mackenzie Valley Land Use Regulations*	List land use permits for off-site disposal facilities

1.5 Description of the Developer

PPML is a 100% owned subsidiary to Osisko Metals Incorporated, which is a Canadian exploration and development company creating value with a focus on zinc mineral assets. Osisko Metals controls Canada's two premier zinc mining districts including its flagship Pine Point Project, located in the NWT, with an Inferred and Indicated Mineral Resource listed in Table 1-4.

Osisko Metal's vision is to become a leading base metal mining company in Canada. PPML and the development of the Pine Point Project are a key part of its strategy.

The Code of Ethics (Appendix A), which PPML adheres to, provides basic guidelines setting forth the ethical behavior expected from every employee. Through the Code of Ethics, PPML is committed to conducting its business in a manner that protects the environment, preserves resources and ensures sustainable development. It is continuously seeking to improve its environmental performance, in keeping with applicable law, regulations, and guidelines. Each employee is expected to be alert to environmental issues and has a responsibility to work in an environmentally responsible manner.

PPML is also committed to conducting its business responsibly with the communities in the areas where it operates, and to making a positive contribution to the well-being and development of those communities. Every employee shall reflect this commitment in their everyday dealings, and respect the different cultures and the dignity and rights of individuals in all countries where the Corporation carries out its activities.

1.6 Indigenous Traditional Knowledge, Engagement and Collaboration

1.6.1 Indigenous Traditional Knowledge

Previous studies related to Indigenous Traditional Knowledge (ITK) and traditional land and resource uses in the vicinity of the Project include ITK studies for the communities of Fort Resolution (Deninu Kųé First Nation and Fort Resolution Métis Council; Swisher 2006a) and Hay River (Hay River Métis Council and Northwest Territories Métis Nation; Swisher 2006b), and an ITK assessment for the Hay River Reserve (K'atl'odeeche First Nation; Eagle Eye Concepts 2007). These studies were conducted for Tamerlane Ventures Inc.'s Pine Point Pilot Project as part of the EA process. Information from these studies was incorporated into the baseline studies currently underway in support of the Project's environmental assessment.

Community members from Deninu Kųé First Nation, Fort Resolution Métis, and Hay River Métis have extensive familial roots in the South Slave Region and indicated that they or their family frequented the Project or broader general area (Swisher 2006a,b). Some community members began to use the area after the highway was built in the 1960s, but others have been using the area since the 1920s, which was accessed in the winter by dog team and during the summer by boat or overland by cutlines (Swisher 2006a). Hay River Métis community members indicated their historical use of the area ranges from 26 years to many generations (Swisher 2006b).

The area in the vicinity of the Project is used by the Deninu Kųé First Nation, Fort Resolution Métis, and Hay River Métis for hunting, trapping, medical plant and berry gathering, collecting firewood and also for employment activities associated with the Tamerlane 2005 Drill Program (Swisher 2006a,b). Some community members considered both groundwater and surface water in the area to be poor quality, because it is alkaline and sulphurous, and not fit for consumption (Swisher 2006a,b). Although Deninu Kųé First Nation, Fort Resolution Métis, and Hay River Métis

community members did not specifically know of anyone living in the vicinity of the Project, they had observed evidence of old prospector and hunting cabins, and it was noted that people historically used the area seasonally to hunt, and historical cabins existed (Swisher 2006a,b). Community members stated they have walked or travelled through the area or larger region in recent years, including actively snowmobiling in the South Great Slave region for traditional and work-related activities (Swisher 2006a,b).

K'atl'odeeche First Nation community members reported use of the area for hunting and harvesting resources and the community has strong economic ties with the land (Eagle Eye Concepts 2007). Caribou, moose, and waterfowl (e.g., ducks and geese) are hunted for sustenance. Elék'eh is a muskeg area on the south shore of Great Slave Lake and east of Buffalo River, and supports beaver, muskrat, and other wildlife, and is an important waterfowl nesting area. Specific moose harvesting sites were identified along the southern shore of Great Slave Lake, High Point, Birch Creek, and Twin Creek. Hunting also occurs along the Buffalo River (Eagle Eye Concepts 2007). The K'atl'odeeche First Nation also recognize themselves as stewards of their traditional lands and waters and are responsible for their protection for future generations (Eagle Eye Concepts 2007).

PPML is currently engaging with communities on the environmental assessment process regarding their preferred approach to collecting and presenting ITK. Community-specific studies undertaken as part of the baseline scope of work will be incorporated into future assessment work in consultation with communities.

1.6.2 Engagement

PPML undertook engagement from 2018 onwards and presented details of the proposed Project. During engagement, comments, concerns, and insights provided by community members were recorded and considered in Project design and in the EA Initiation Package. Table 1-8 provides a list of topics raised and how PPML has incorporated them into the design or addressed them.

The Engagement Log submitted with the Engagement and Collaboration Plan provides additional details of communication. While early consultation (prior to 2019) was focused on exploration, PPML took the approach to assume that these early concerns would also apply to the Project.

Table 1-8: Synthesis of Engagement and Considerations in Project Design and Planning

Concern	Meeting	Consideration/Accommodation
Indigenous communities need to be provided advanced notice of Project opportunities and requirements. Employment and contracting opportunities need to be kept local as much as possible	K'atl'odeeche First Nation Meeting (08/25/2020) Deninu Kųé First Nation Meeting (09/09/2020) NWT Métis Nation Meeting (08/31/ 2020)	PPML will work with communities as the Project evolves to communicate economic opportunities and associated requirements, and to facilitate the accessibility of such opportunities to Indigenous candidates and companies.
The Project must consider how to protect workers from public health risks like COVID-19	Deninu Kųé First Nation Meeting (09/09/ 2020)	PPML will follow applicable government protocols in terms of workforce management and health risk mitigation.
Will the Project result in the remediation of previously used industrial sites or the rail bed?	Deninu Kųé First Nation Meeting (09/09/ 2020)	The remediation of these sites is a responsibility of the Federal government.

Table 1-8: Synthesis of Engagement and Considerations in Project Design and Planning

Concern	Meeting	Consideration/Accommodation
Do not use water from Great Slave Lake for the processing plant	K'atl'odeeche First Nation Meeting (08/25/2020)	PPML will limit the use of water from Great Slave Lake for the processing plant by recycling water and using water from existing pits.
Concerns over legacy issues from the previous mining operation and current conditions at the site	All public meetings up to end of 2019	Work with the Government of Canada to clearly outline approach to legacy issues for PPML.
Local jobs, local workers, subcontracting opportunities	Fort Resolution Open Meeting (11/29/2017) Hay River Open Meeting (11/30/2017) Hay River Reserve (1/21/2017)	Entered into Collaboration and Exploration agreements (July 2019) to advance employment and business opportunities.
Use of existing pits for waste rock disposal	Fort Resolution Open Meeting (11/29/2017) Hay River Open Meeting (11/30/2017)	PPML will use existing open pits for waste rock, where feasible.
Surface discharge of groundwater is of concern	Fort Resolution Open Meeting (11/29/2017)	PPML does not plan to discharge any groundwater unless it meets effluent quality criteria.
Do not use Sulphur Creek as a receiving site for withdrawn groundwater	Fort Resolution Open Meeting (11/29/2017)	The Project Description does not plan for discharge to Sulphur Creek.
Caribou over-winter months near the Buffalo River in unmined lands	Fort Resolution Open Meeting (11/29/2017)	Mining proposed near the Buffalo River is limited and effects on wildlife will be managed through the Wildlife Management and Monitoring Plan.
Consider using the old Cominco system for freshwater supply from Lake to Camp	Fort Resolution Open Meeting (11/29/2017) Hay River Open Meeting (11/30/2017)	PPML has agreed to consider this point.
Use existing infrastructure	Hay River Open Meeting (11/30/2017)	PPML has designed the Project to use the existing footprint and existing infrastructure where feasible, including existing open pits.
Get into production as soon as possible. This area needs the jobs and revenue	Hay River Open Meeting (11/30/2017)	PPML has developed an aggressive schedule to meet the global zinc demand.
Conduct water quality monitoring to ensure impacts are mitigated	Hay River Open Meeting (11/30/2017)	PPML will develop a water quality monitoring program. Water quality monitoring is currently ongoing.

2 GEOLOGICAL, GEOCHEMICAL, AND GEOTECHNICAL SETTING

2.1 Geology

2.1.1 Regional Geology

The Pine Point deposits are located on the southern shore of Great Slave Lake (Figure 2-1). They form a 70 km long southwest-northeast-trending belt between Hay River and Fort Resolution in southern NWT. The area lies on the eastern margin of what is defined regionally as the Western Canada Sedimentary Basin. The Pine Point deposits exhibit all the geological, mineralogical, and geochemical attributes of Carbonate Hosted Zinc-Lead deposits.

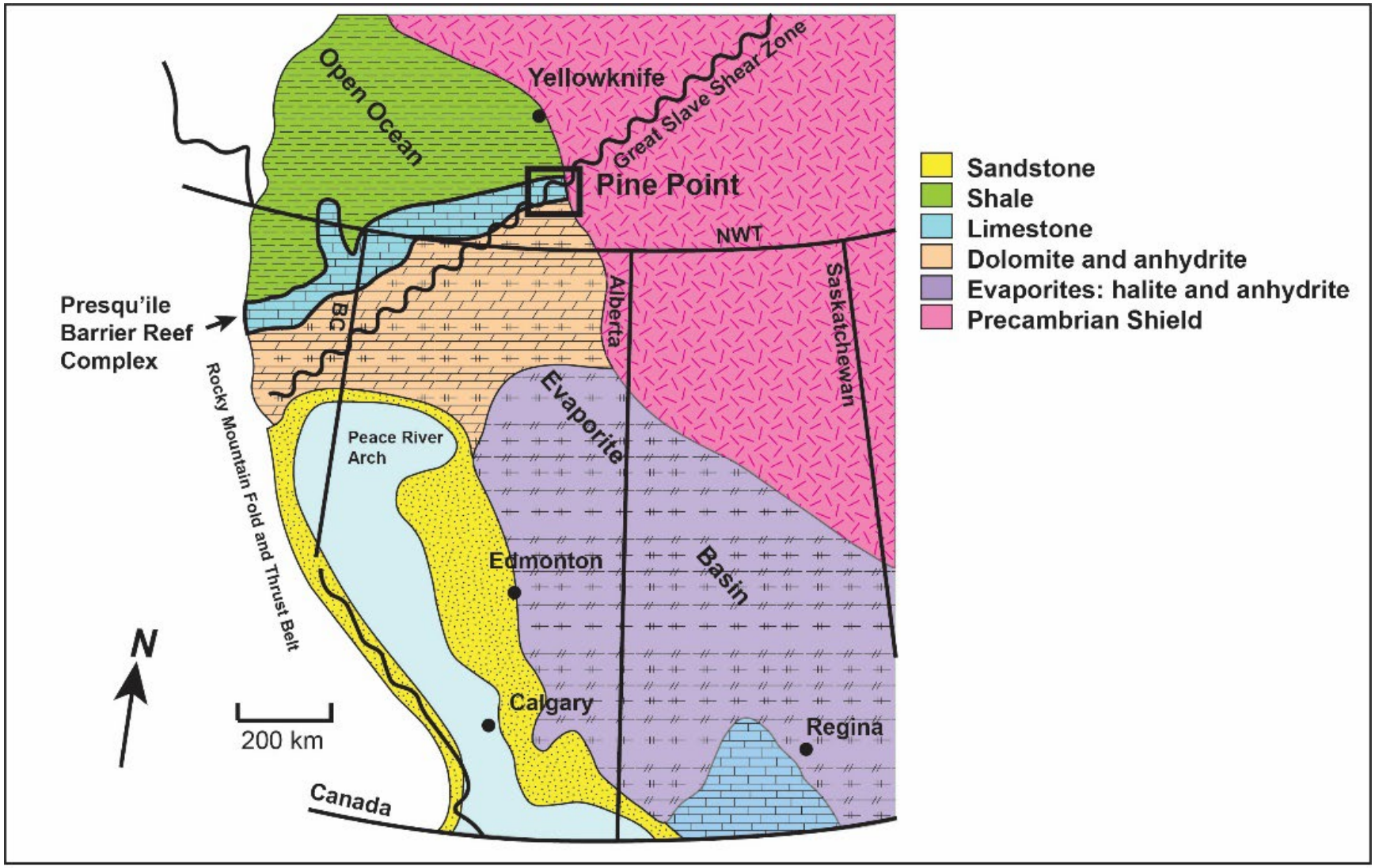


Figure 2-1: Regional Geological Setting of Pine Point

2.1.2 Project Site Geology

The Project is composed of several deposits of variable size and depth and spread across the 72 km long property. The Project is underlain by carbonate rocks and lesser shale units, which dip from 1 to 5 degrees to the southwest. These rocks are bounded to the north by marine shale and to the southeast by interbedded evaporites and carbonate rocks (Figure 2-2; Table 2-1). The entire area is covered by glacial till ranging between 10 and 40 m thick.

Table 2-1: Description of Formations and Related Rock Types

Formation Name	Marker Horizon	Protolith	Notes
Hay River (+ 15 m)		Shale	Deeper marine platform
Slave Point (50-75 m)		Limestone	Marine platform
	AMCO (1-3 m)	Blue-grey argillaceous limestone	Marine platform
Watt Mountain (7-15 m)		Green, shaley limestone	Lagoonal, restricted marine
Windy Point (10-50 m variable, on-laps reef from the north)		Limestone	Marine, reefal, time stratigraphic equivalent to upper Sulphur Point
Buffalo River 20-25 m, variable, on-laps reef from the north)		Shale	Shallow, open marine platform
Sulphur Point (0-80 m) Eroded to the north		Limestone	Reefal and marine platform
Muskeg (85-100 m, variable, on-laps reef from the south)		Interfingered dolomite and evaporite with the later becoming dominant to the south of the reef	Off-reef, restricted back-reef evaporite basin. Time stratigraphic equivalent of the Pine Point Fm and basal Sulphur Point Fm
Pine Point (40-140 m)		Dolomite and dolomitized limestone	Reefal and marine platform
	B-spongy (5-20 m)	Dolomite, vuggy	Marine bioherm, reefal?
Keg River (61-73 m)		Dolomite, locally argillaceous	Marine Platform
	E Shale (5-10 m)	Shale or shaly dolomite	Marine platform. 3-6 m below the top of Keg River Fm
Chinchaga (76 m)		Anhydrite, crystalline dolomite, quartz sandstone, dolomitic shale, halite	Restricted, back-reef basin

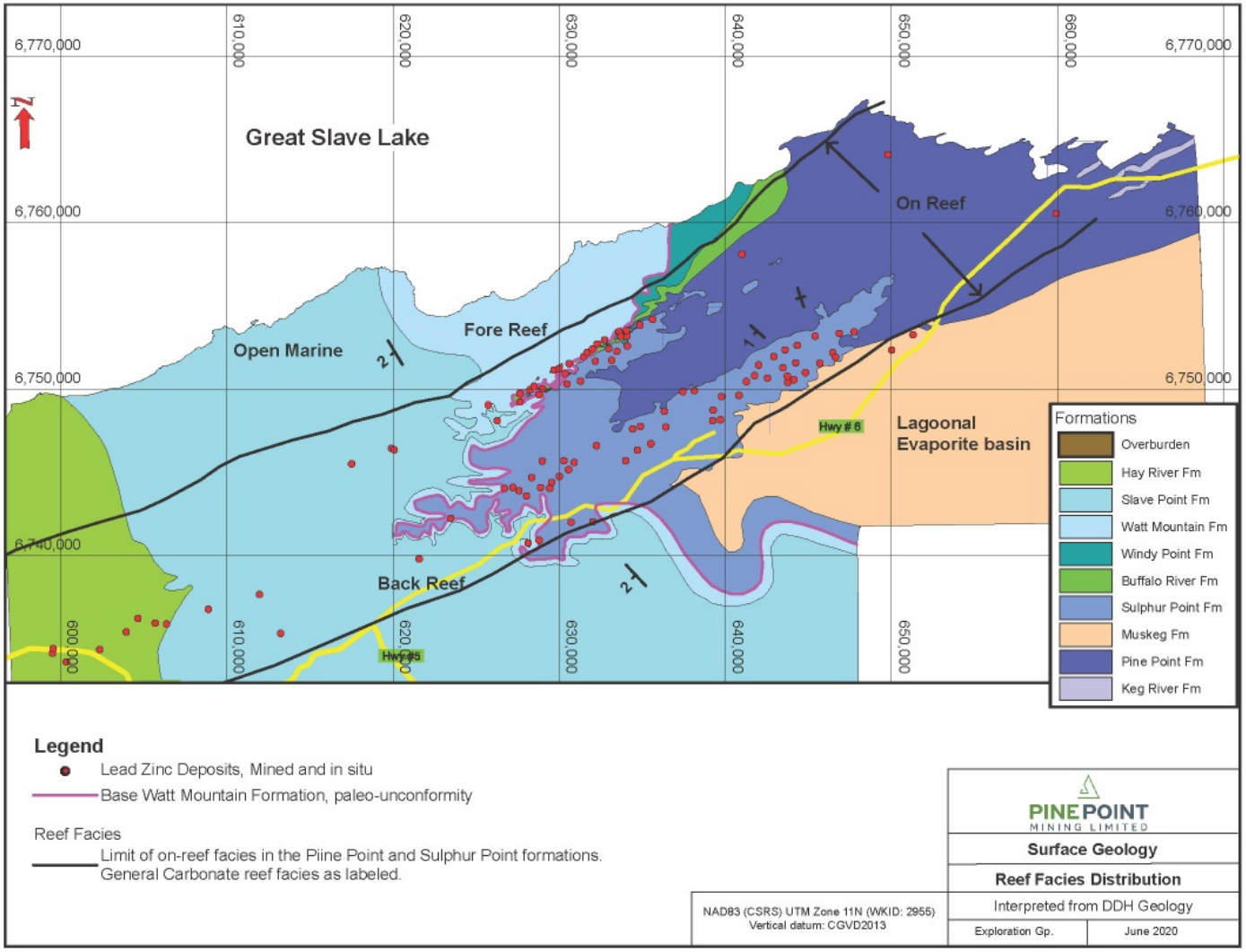
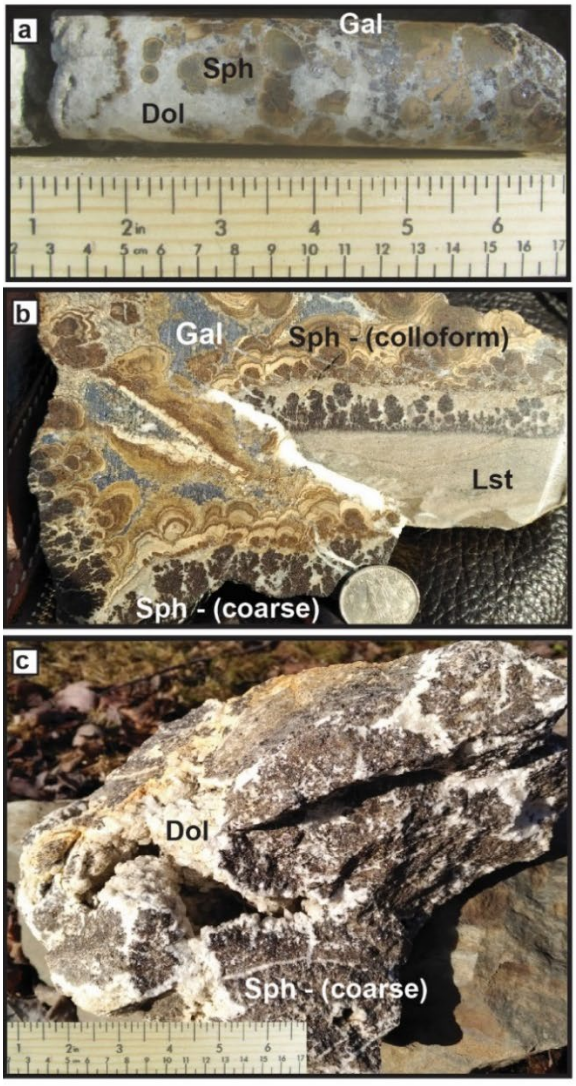


Figure 2-2: Geology in the Area of the Project

Given the extent and the variable conditions of the site, the former Cominco era mining camp has been divided into five zones: the East Mill Zone, the North Zone, the Central Zone, and the N-204 Zone all of which are mainly located east of the Buffalo River. The sixth zone is the West Zone formerly explored by the Westmin company, which is mainly located west of the Buffalo River (Figure 1-7).

The recoverable minerals at Pine Point are sphalerite (zinc sulphide) and galena (lead sulphide) (Figure 2-3), which are hosted in dolomitic limestone with minor amounts of marcasite (iron sulphide) that is locally associated with some of the deposits. The deposit types at Pine Point occur in varying shapes and thicknesses but basically fall into two categories: “Tabular” and “Prismatic” (Figure 2-4). Mineralization can be encountered anywhere in the area; however, abundances are likely below economic interest except where Tabular and Prismatic deposits are developed. Further exploration is aimed at the potential discovery of new deposits.



a) Colloform Sphalerite (brown - Sph) with coarse galena (grey - Gn). Gangue is HTD (coarse sparry dolomite: white - Dol).

b) Colloform (brown - Sph) and coarse sphalerite (purple - Sph) with coarse galena (grey - Gn). Gangue is coarse sparry dolomite (white - Dol).

c) Coarse sphalerite (purple - Sph) with HTD (coarse coarse sparry dolomite: white - Dol).

d) White hydrothermal dolomite (HTD) infiltrating orginal dolomite/limestone in the Sulphur Point Formation.

e) Lighter HTD alteration in the darker original dolomite/limestone witin the Sulphur Point Formation, L37 Pit

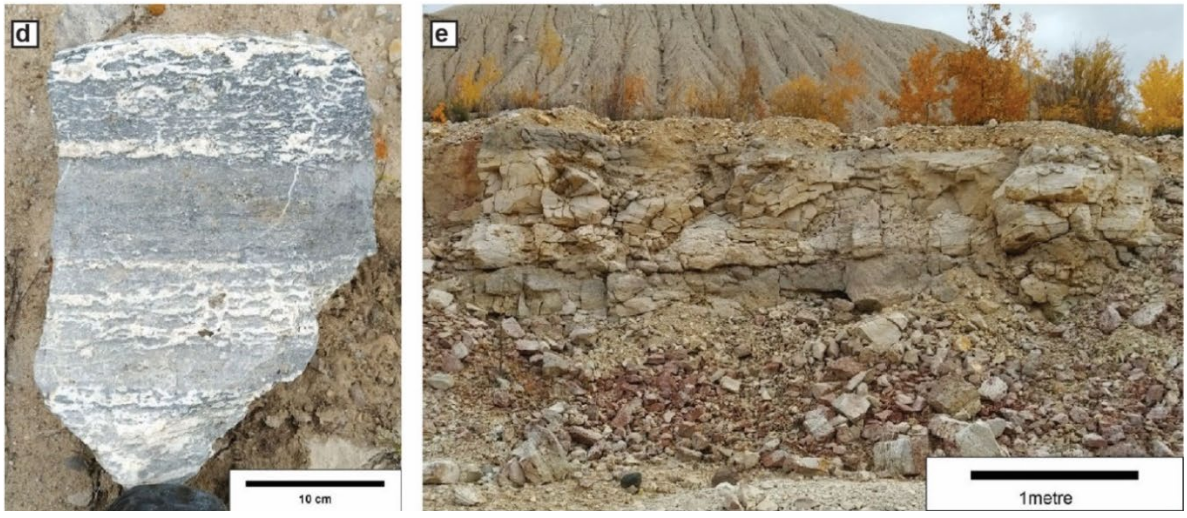


Figure 2-3: Mineralization and Alteration Styles

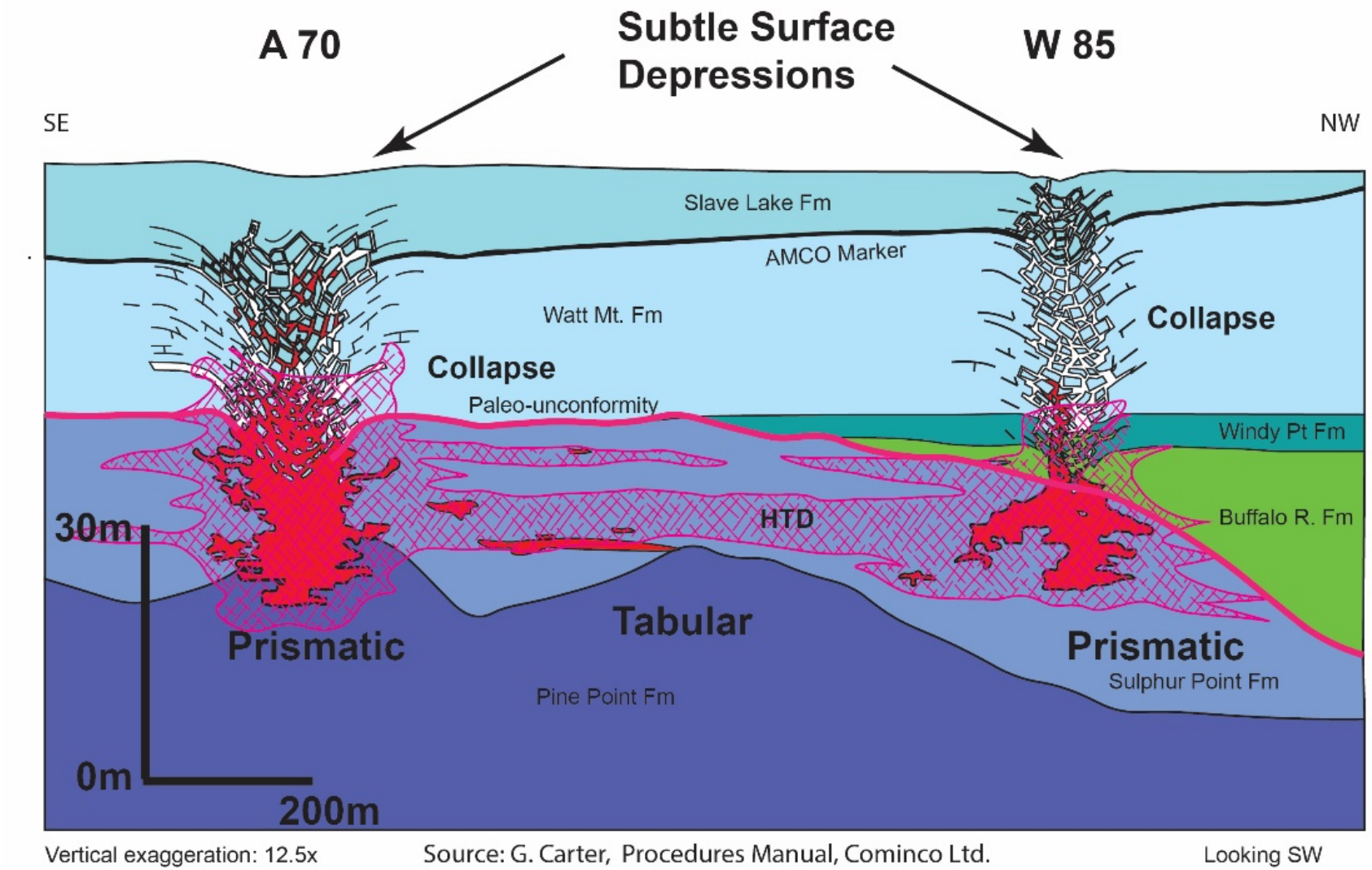


Figure 2-4: Deposit Types

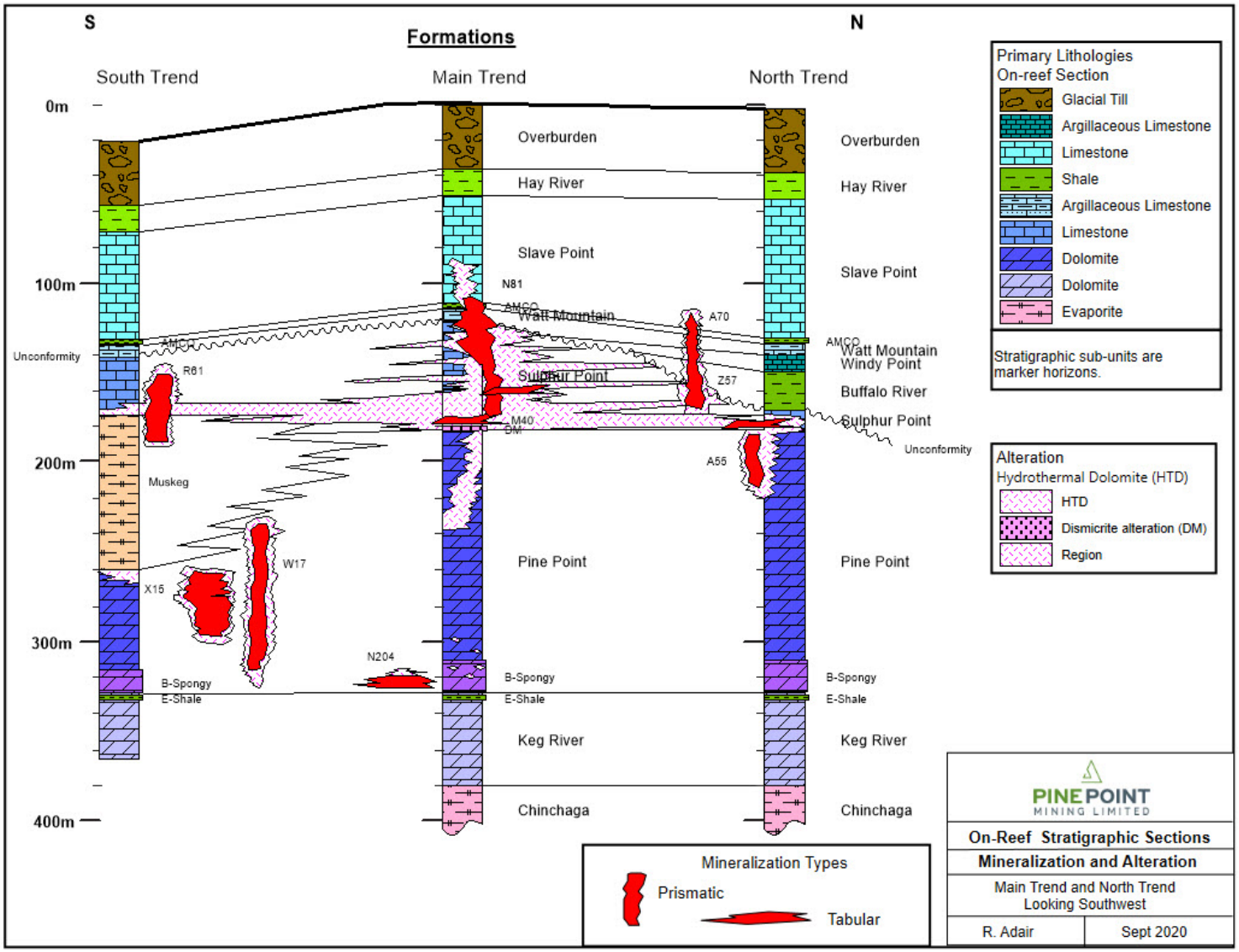


Figure 2-5: Stratigraphy, HTD Alteration, and Mineralization

Tabular deposits may extend along strike for several kilometres at varying lateral widths from 50 to 200 m wide, and usually are on average between 5 to 10 m in thickness. Prismatic deposits at Pine Point have a more vertical cylindrical morphology or shape, and often are not larger in diameter than their vertical dimension. The deposits to be mined are both Tabular and Prismatic and hosted within similar stratigraphy as those deposits previously mined by Cominco in this area.

The mineral deposits in the sector east of the Buffalo River are shallower and are anticipated to be mined mainly from surface (open-pit mining), except a few deposits in the Central Zone. The mineral deposits located west of the Buffalo River are deeper and will likely require underground mining (Figure 1-3). Mining methods will be optimized for each deposit and will vary depending on their respective conditions.

The Sulphur Point Formation has been affected, to a varying degree, by dissolution of primary carbonate rocks, followed by precipitation of sparry dolomite, calcite, and more localized sulphides within which are specific areas of higher sulphide precipitation that are now mineral deposits (Figure 2-3, Figure 2-4, and Figure 2-5). This is termed “Hydrothermal Dolomite” or HTD and is of varying intensity within the Sulphur Point Formation. This type of alteration is much more restricted to the immediate vicinity of mineralization where the latter occurs in the Pine Point, Muskeg and Slave Point Formations. HTD is characterized by high porosity.

2.1.3 Geochemical Conditions

Geochemical characterization data have been compiled for the purpose of identifying the metal leaching (ML) and acid rock drainage (ARD) potential of the mined materials (TetraTech 2018). Geochemical characterization data are available for waste rock, mineralization, tailings, overburden, and soil material. Waste rock and mineralization samples in the geochemical characterization database have been assigned to a geologic formation and include a basic lithological description. Geologic formation and lithology are presented with the analytical data results in TetraTech (2018).

Geochemical characterization data described in TetraTech (2018) were initially presented in Rescan (2011, 2012a,b). The Rescan reports detail the field programs, sample selection, and data analysis for the respective samples from borehole R190-11-GT1 and deposits X-25, P-499, O-556, Z-155, G-03, and N204. These data were collected for a 2011 geochemical characterization program conducted by Rescan as part of baseline environmental studies for the Pine Point Project and the data interpretation and analysis of the preliminary geochemical characterization results are presented in Rescan (2011, 2012a,b). pHase Geochemistry provided a draft review of these reports and compilation of available data (pHase Geochemistry 2017).

In November 2017, PPML collected and submitted an additional sixteen samples from drill core from the L-65, N-42, M-40, and EX-17 deposits. These samples were analyzed for acid-base accounting and trace element analysis. These data have not been presented in previous reports.

The following analytical tests have been conducted on samples from the Pine Point mining area. Discussion and results of these analyses are presented in the following sections. A compilation of all available data is presented TetraTech (2018) for the following analyses:

- Quantitative X-Ray Diffraction (QXRD) using the Rietveld method
- Acid-Base Accounting (ABA) analysis

- Net-Acid Generation test
- Solids trace element analyses using aqua-regia digestion with inductively coupled plasma mass spectrometry (ICP-MS) finish
- Whole rock analysis for major oxides using lithium metaborate fusion followed by X-Ray Fluorescence (XRF)
- Shake Flask Extraction (SFE) leachate analysis using a 3:1 liquid to solid ratio

These tests are static geochemical characterization tests, which measure the present composition of materials at the time of testing. The static tests typically measure chemical, physical and mineralogical properties of a sample. Each of these parameters assists in assessing the chemistry of any runoff or leachate that is in contact with the waste rock, and the ML/ARD potential of the materials. Kinetic tests have not yet been completed for materials from the Pine Point mining area.

Future test work will include confirmatory geologic review and sampling from the proposed mining areas to evaluate the consistency with the historical dataset. The historical dataset covers a wide range of lithologies across the mining area and are representative of the anticipated waste rock and mineralization mining units that are foreseen to be part of future mine development.

Future work may include assessing the historical waste rock dumps to evaluate the kinetic reaction rates. These waste rock dumps provide site-specific information on how the material has weathered and reacted to the site-specific environment over time. Static test information obtained prior to kinetic tests can be used to select the kinetic test samples and evaluate the approximate timeline of any metal leaching or the potential of significant acidic production in the waste rock materials.

2.1.3.1 Quantitative X-Ray Diffraction

A total of 22 samples from six different deposits were analyzed by Quantitative X-Ray Diffraction (QXRD) analysis. The QXRD method analyses for the relative amounts and ideal chemical formula of crystalline phases, normalized to 100%. Samples were analyzed at the University of British Columbia by quantitative phase analysis of powder samples using the Rietveld Method and X-Ray powder diffraction data.

As described in a report by pHase Geochemistry (2017), the quantitative phase analysis results indicate that all the rock samples were dominated by carbonate, specifically dolomite with lesser calcite. The QXRD data are consistent with the geologic units encountered in the mining area and correlate well with the elevated carbonate concentrations observed in the ABA data.

The artesian borehole precipitate sample from G-03 consists of secondary mineral precipitate gypsum and elemental sulphur. Sulphide mineralization consists of pyrite (FeS_2), sphalerite ((Zn,Fe)S), galena (PbS) and of varying amounts of marcasite (FeS_2) but typically ranging from trace to minor (<5%). Two samples from G-03 (G03TVI 193-203 and G03TVI 280-291) report pyrite concentrations of greater than 10.0% and 11.0%, sphalerite concentrations of 12.0% and 33.7%, galena concentrations of 2.6% and 4.5%, and marcasite of 3.1% and 10.0%. These results are consistent with ABA results for these two samples indicating elevated sulphide sulphur

content and correspondingly elevated maximum acid potential values. The ABA results for these samples are further discussed below.

2.1.3.2 Acid-Base Accounting Analysis

The potential for acid generation was tested by ABA analysis on a total of 82 samples and the results are presented in TetraTech (2018). The ABA analyses completed included determination of paste pH, total carbon, inorganic total sulphur, sulphate sulphur, sulphide sulphur, neutralization potential (NP), and fizz rating. Maximum potential acidity (MPA) values were calculated from the sulphide sulphur content. Net neutralization potential is calculated as neutralization potential minus maximum potential acidity (NP-MPA). The neutralization potential ratio (NPR) value is calculated as neutral potential divided by maximum potential acidity (NP/MPA). The $CaCO_3$ equivalent value is based on a calculation using the carbonate content and represents the Carbonate NP value.

- All samples from R-190 were analyzed using the Modified Sobek NP method. All samples from the other deposits were tested using the Standard Sobek NP method. Twelve of these other samples were also tested using the Modified Sobek NP method.
- The NPR values are based on the Modified Sobek NP for all samples except for the R-190 samples where the Standard Sobek NP is used.
- Sulphide sulphur was calculated as the difference between total sulphur and sulphate sulphur, except in the case of waste rock samples from deposit R-190. For these samples, sulphide sulphur was determined by analytical method using the HNO_3 extraction method.
- Elemental or Insoluble sulphur was measured for waste rock samples from the R-190 deposit and soil samples from the N-204 deposit.

ABA results are used to evaluate the classification of the analyzed samples as either potentially acid-generating (PAG) or as non-potentially acid generating (non-PAG). Material classification is based on the MEND Guidelines (Price 2009) as presented in Table 2-2. A sample classified as Uncertain requires additional information to evaluate ARD potential.

Table 2-2: Summary of ARD Classification based on NPR value (from Price 2009)

NPR Value	Classification
NPR <1	PAG
NPR >2	Non-PAG
1 <NPR <2	Uncertain

The analyzed samples are consistently classified as non-potentially acid generating (non-PAG), based on NPR values of greater than 2. Eighty out of the eighty-two samples are classified as non-PAG. The median NPR value for all 82 samples analyzed is 188. Figure 2-6 and Figure 2-7 present ARD classification for the sample set.

One sample, G03TVI 280-291, reports an NPR value of less than 1 (NPR= 0.42) and is classified as PAG. One sample, G03TVI 193-203, reports an NPR value of between 1 and 2 (NPR =1.92) and classifies as Uncertain. These two samples were not provided with a lithology description but

are assigned to the Watt Mountain and Slave Point formations, respectively. These two samples have considerably elevated sulphur contents when compared to the other samples in the database.

Waste rock samples from the Sulphur Point and Muskeg Formations generally report much lower values of total sulphur and sulphide sulphur. All the samples from these geologic formations came from the 2017 sampling of the L-65, N-42, M-40, and EX-17 deposits. Due to the low sulphur content, the associated maximum potential acidity value is lower than for other waste rock samples. The neutralization potentials are similar to other waste rock samples and, as a result of the above, the NPR values are generally higher than for other waste rock units.

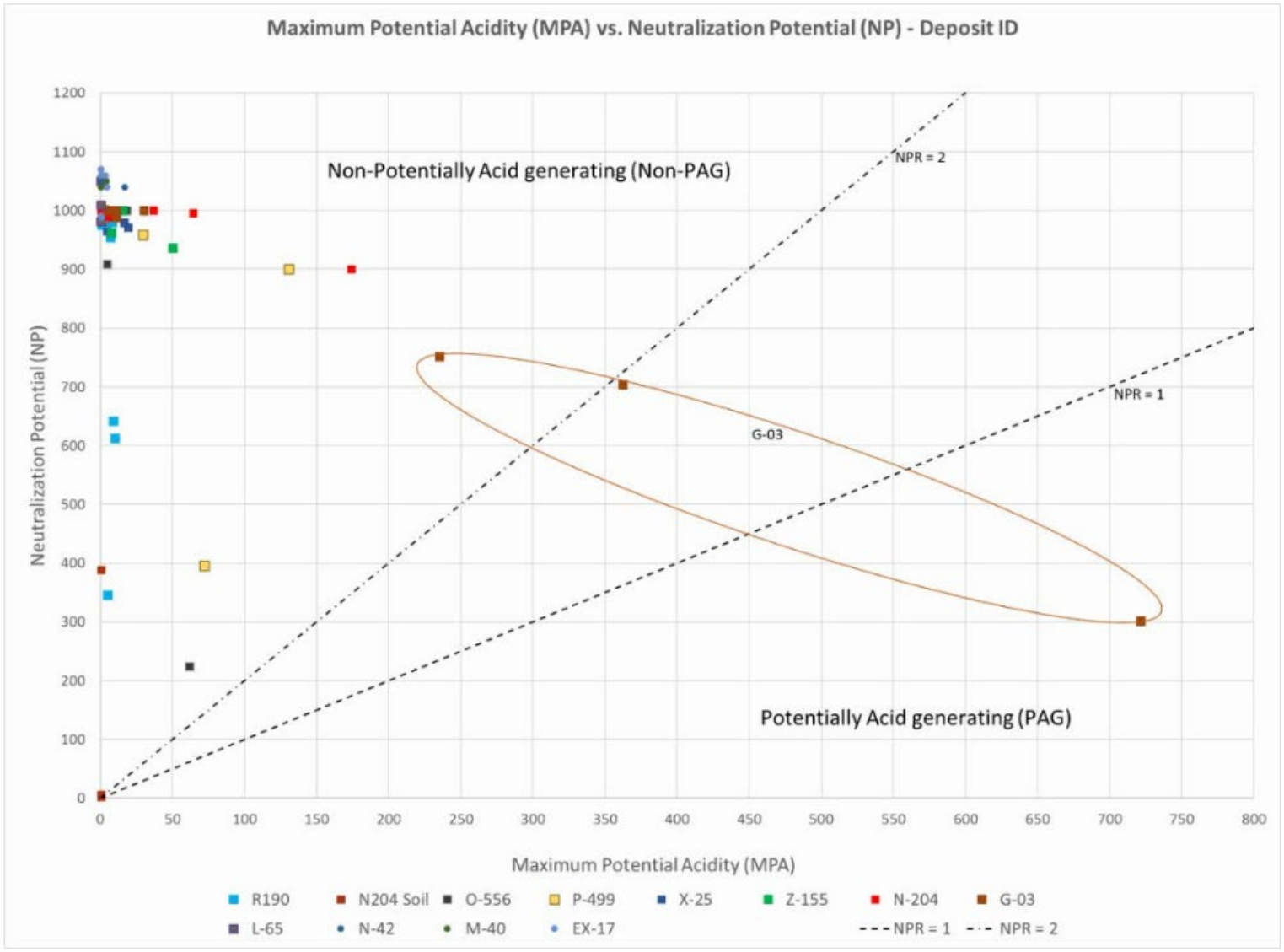


Figure 2-6: ARD Classification by Deposit ID

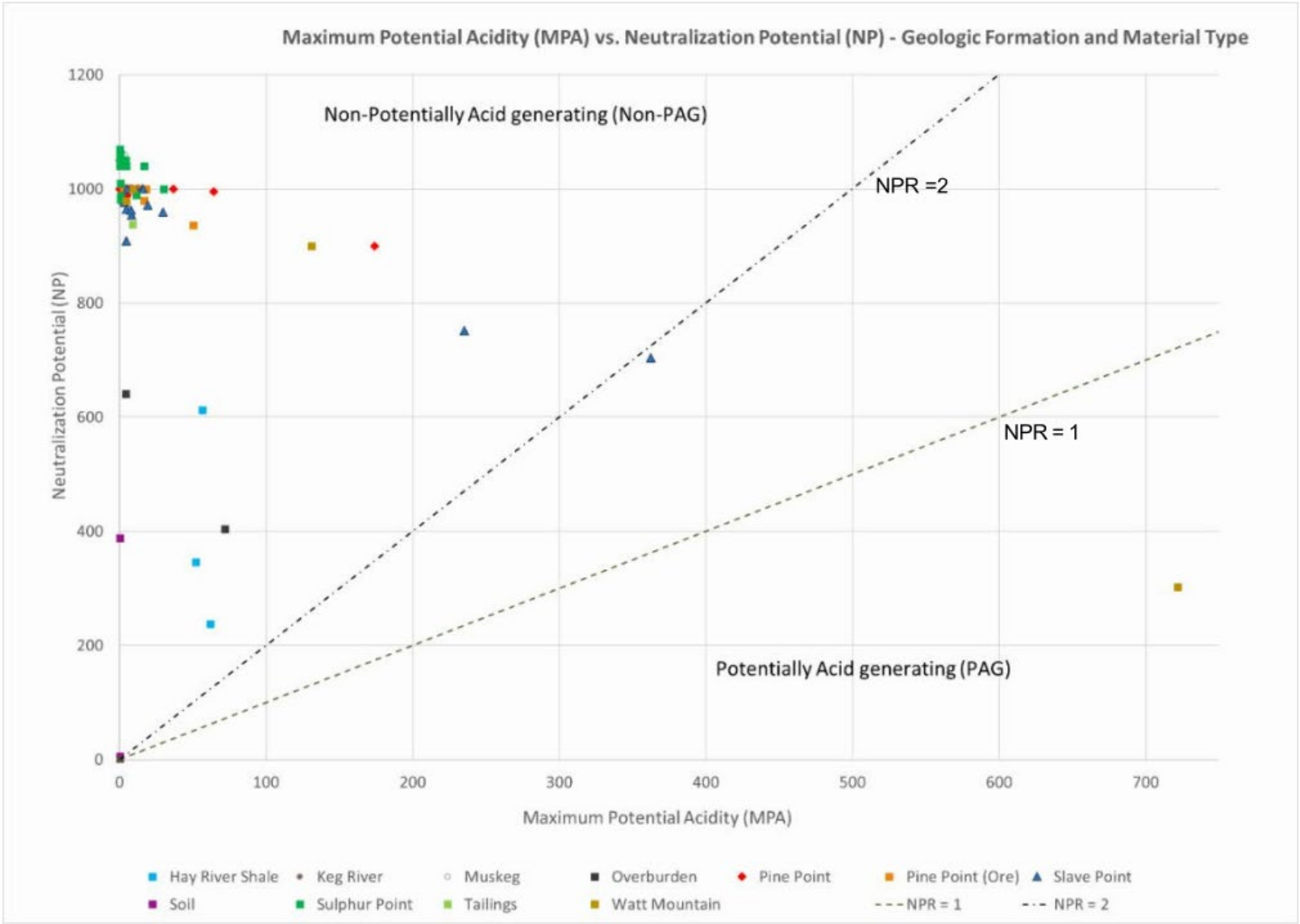


Figure 2-7: ARD Potential Classification by Geologic Formation and Material Type

The Carbonate NP value can be compared against the Sobek NP values to evaluate the contribution of carbonate minerals to the neutralization potential. The results show that the Carbonate NP values are typically 95% to 105% of the Sobek NP values. This indicates that the neutralization potential in the analyzed samples is almost entirely provided by carbonate sources, with a negligible component of neutralization influenced by other minerals such as silicates. This finding is consistent with the observed rock types and the QXRD data.

Carbonate minerals provide the most available and fastest reacting source of neutralization potential, and as such are more effective at neutralizing against acid production compared to other minerals. For classification of the analyzed samples, the NPR value calculated using the Sobek NP values is used. However, due to similarity between the two measures of neutralization potential, the NPR value calculated using the Carbonate NP would provide the sample classification.

2.1.3.3 Trace Element Analysis by ICP-MS

Trace element analysis by ICP-MS was completed on a total of 78 samples. The results are summarized in TetraTech (2018). Trace element analysis data were compared against typical element distribution values (TEDV) for carbonate rocks (Price 1997).

Price (1997) suggested that element concentrations above 10 times the typical element distribution values may provide an initial identification of significant mineral concentrations. Elevated concentrations of certain elements commonly reflect the deposit's mineralized nature and does not necessarily indicate that environmental effects will result from the exposure of these elements. Elevated concentrations do not correlate directly with increased metal leaching rate but may contribute to elevated metal loadings if the elements are susceptible to leaching.

Samples from L-165, N-42, M-40, and EX-17 were tested at Maxxam Laboratories in 2017 using the ultra-trace element analysis by aqua regia digestion and ICP-MS. The same test method was used at Acme labs for samples collected in 2011; however, there is a marked difference in measured concentrations, as described below.

Table 2-3 summarizes the number of samples from each deposit that have an element concentration exceeding the typical element distribution value by 10x or greater. As expected, concentrations of lead (Pb) and zinc (Zn) are elevated in a majority of samples. Nickel (Ni), cobalt (Co), cadmium (Cd), and sulphur (S) concentrations are also elevated in many cases. Notably, the samples collected in 2017 from the L-65, N-42, M-40, and EX-17 deposits have considerably lower metal concentrations than the other samples in the dataset. All these samples are from the Sulphur Point and Muskeg Formation, which were not sampled from the other deposits. Samples from these deposits also had lower sulphide content as noted above in the discussion of ABA results.

Table 2-3: Summary of Element Concentrations Exceeding 10x TEDV

Deposit ID	Total Number of Samples	Number of Samples with Element Concentration Exceeding 10x TEDV											
		Mo	Pb	Zn	Ni	Co	Fe	As	Sr	Cd	Ba	S	Se
R-190	10	-	1	2	4	4	-	-	-	1	-	4	-
O-556	6	-	1	2	1	1	-	-	-	2	-	1	-

Table 2-3: Summary of Element Concentrations Exceeding 10x TEDV

Deposit ID	Total Number of Samples	Number of Samples with Element Concentration Exceeding 10x TEDV											
		Mo	Pb	Zn	Ni	Co	Fe	As	Sr	Cd	Ba	S	Se
P-499	5	-	2	3	1	1	-	-	-	3	1	2	1
X-25	5	-	2	2	1	1	-	-	1	2	-	-	-
Z-155	6	-	1	4	4	1	-	-	2	4	-	1	-
N-204	22	-	18	21	11	1	-	1	-	20	2	3	2
L-65	3	-	-	-	-	-	-	-	-	-	-	-	-
N-42	3	-	-	-	1	-	-	-	-	1	-	-	-
M-40	2	-	-	-	-	-	-	-	-	-	-	-	-
EX-17	8	1	-	-	2	1	-	-	-	-	-	-	-
G-03	8	-	6	6	6	2	3	-	-	6	-	2	4
Total	**78**	**1**	**31**	**40**	**31**	**12**	**3**	**1**	**3**	**39**	**3**	**13**	**7**

2.1.3.4 Whole Rock Analysis by X-Ray Fluorescence

Whole rock analysis using X-Ray fluorescence (XRF) was completed on a total of 62 samples. The results of whole rock analysis are summarized in TetraTech (2018). Whole rock analysis is used to quantify elemental concentrations that may impact drainage chemistry. The whole rock analysis does not reveal the forms in which an element occurs in, but this information can be used in conjunction with the QXRD data for this purpose.

The whole rock analyses indicate that the sampled rocks are dominated by calcium and magnesium with minor components of silicate minerals (silica, aluminum, and iron oxides). Median values for calcium oxide for the various material types and geologic formations range from 15.5% to 33.1%. Median values for magnesium oxide for the various material types and geological formations range from 3.3% to 20.7%. Loss on ignition values are consistently elevated with median values between 18.9% and 46.6%.

The results reflect the predominant mineralogy of dolomite and calcite, with minor quartz and micas, consistent with QXRD analyses.

2.1.3.5 Shake Flask Extraction Analysis

Shake flask extraction (SFE) leach analysis was conducted on seven waste rock samples, one mineralization sample and one tailings sample. Dissolved metal results were compared against Federal Contaminated Sites Action Plan Guidance Document on Federal Interim Groundwater Quality Guidelines for Federal Contaminated Sites Tier 2 Guidelines for Residential / Parkland Land Use - coarse- and fine-grained soils. This comparison is only intended as a first pass review of potential elevated metals. Elevated concentrations of dissolved metals in the SFE analysis do not necessarily result in elevated constituents in a field setting; however, it can be used to identify which leachable constituents may be of future concern. This test work and analysis does not consider the receiving water chemistry, dilution volumes, or long-term metal dissolution for evaluating the effect of metal leaching potential on surface water receptors. Concentrations that

exceed the guideline values by an order of magnitude or greater are flagged for further consideration.

Shake flask extraction analysis results will be compared against site-specific data regarding water quality objectives, baseline water quality from surface or groundwater analysis, and environmental conditions such as proximity to surface receptors and climactic conditions.

2.2 Geotechnical Conditions

No geotechnical study is currently available for open-pit mining. The parameters used in the PEA for open pits were conservative at a 45° overall slope angle considering that the pits are shallow, but this takes into consideration the ramp and the berm widths.

A geotechnical review for the West Zone (W1 Area) was conducted in 2011-2012 by AMC Mining Consultants Canada (AMC), and provided rock mass classification, stability assessments, and ground support guidelines (AMC 2012). Underground design recommendations are based entirely on this report and most of the geotechnical information is from this review. The rock mass classification Q-RMR values indicate generally a fair to good rock mass quality overall.

There is no geotechnical information for the Central Zone underground workings.

2.2.1 Underground Rock Mass Classification

Based on the geotechnical review (AMC 2012), upper and lower bound values of Q' and Rock Mass Rating (RMR) are summarized in Table 2-4.

Table 2-4: Comparison of Rock Mass Rating Values

Rock Group	Q' Average		RMR Upper Bound (0.3 m - 1 m spacing, rating=20)		RMR Lower Bound (0.05 m - 0.3 m spacing, rating=10)	
	Q' logged	RMR^{eq}=9lnQ+44	Q_{eq}=exp[RMR-44)/9]	RMR logged	Q_{eq}=exp[RMR-44)/9]	RMR logged
Hay River Shale	4.5 (Jn-6) *fair*	57 *fair*	1.1 *poor*	45 *fair*	0.3 *very poor*	34 *poor*
Slave Point Limestone	11.5 (Jn-9) *good*	66 *good*	5.9 *fair*	60 *fair-good*	1.9 *poor*	44 *fair*
Watt Mountain Shale	4.3 (Jn=12) *fair*	57 *fair*	2.9 *poor*	54 *fair*	0.9 *very poor*	44 *fair*
Pine Point Host/Ore Body	5.9 (Jn=9) *fair*	60 *fair-good*	3.4 *poor*	55 *fair*	1.1 *poor*	45 *fair*
E-Facies	5 (Jn=6) *fair*	58 *fair*	2.4 *poor*	52 *fair*	0.8 *very poor*	42 *poor-fair*

The rock mass classification values in Table 2-4 give a general indication of the relative rock mass quality and competency that would be encountered during development drifting and mining. For example, the Slave Point Limestone Q-RMR values indicate a strong rock, with fair to good rock mass quality overall.

2.2.2 Stope Dimensions

Mineralization in the West Zone has an average height of 50 m, a length (deposit radius in the long axis) of 240 m, and a width (deposit radius in the short axis) of 120 m. To optimize the extraction of the mineralized material and reduce the number of top sills, stope sizes have been slightly modified from the AMC (2012) report. For design purposes, instead of 30 m x 10 m x 25 m

(HxWxL) stopes, lower and wider stopes were chosen with a dimension of 25 m x 15 m x 25 m. The Mathews-Potvin stability method was carried out to confirm the stability of this new stope dimension.

In Figure 2-8, it can be noted that even for the worst-case scenario (i.e., the RMR spacing rating 10), stope walls remain in the 'Stable with Support' zone. This area refers to the zone where ground support is required to provide stope stability during the stope's mine life. After blasting, the support of stope walls is provided by the mineralized material in place. Immediately after mining, the backfilling schedule will maintain control over wall dilution. This stope dimension is retained for the underground mining design in the West Zone.

2.2.3 Crown Pillar Thicknesses

A crown pillar thickness assessment was carried out in the PEA to confirm the stability of mined stope backs with the new stope dimension Table 2-5. In this assessment, the average logged value for Q was used as provided in the geotechnical review (AMC 2012).

Table 2-5: Crown Pillar Assessment – Carter method

Class	Description and Expectancy	Factor of Safety (FoS)	Maximum Scaled Span Equation (CS)(=SC)	Public Access	Maximum Scaled Span (C_s)	Years (Life Expectancy)	Crown Pillar Span (S) (m)	Span Ratio (Span/Length)	Calculated Resultant Maximum Thickness (m)
C	**Very Short Term** (Quasi Temporary Stope Crowns) *(to be monitored continuously with instruments)* *(High level of concern at closure)*	1.2	$2.74Q^{0.44}$	Actively Prevented	5.98	2-5	2	0.08	0.3
							3	0.12	0.7
							4	0.16	1.3
							5	0.20	1.9
							6	0.24	2.7
							8	0.32	4.5
							10	0.40	6.6
							15	0.60	13.0
D	**Short-Term Crown Pillar** (Semi-temporary crowns, e.g. under non-sensitive mine structure) *(to be mined out in near future)*	1.5	$2.33Q^{0.44}$	Prevented	5.09	5-10	2	0.08	0.5
							3	0.12	1.0
							4	0.16	1.8
							5	0.20	2.7
							6	0.224	3.7
							8	0.32	6.2
							10	0.40	9.1
							15	0.60	18.0

Based on this assessment, for a crown pillar with an estimated life expectancy of 5 to 10 years, the minimum thickness of the crown pillar should never drop below 18 m for a maximum hydraulic radius of 120 m. A central pillar of 20 m wide is left to limit the span of the final opening.

In general, the production time per deposit is one year on average and never exceeds two years. After mining completion, the underground mine is closed (restriction of access via signage as well as fencing is required) and no return is planned in this phase of the Project. In addition, on average, the back of the mined stopes for the West Zone is approximately 100 m below bedrock surface, with an additional 35 m of overburden. For the C1 Area, the back of the mined-out stopes is 60 m below surface, and therefore, within discussed limits.

2.2.4 Room and Pillar Stopes

To complement the longhole stoping method for the West Zone, the room and pillar method is used. It is also the main mining method for the C1 Area. The adopted dimensions of the rooms and pillars are based on standard industry practices and are summarized in Figure 2-8.

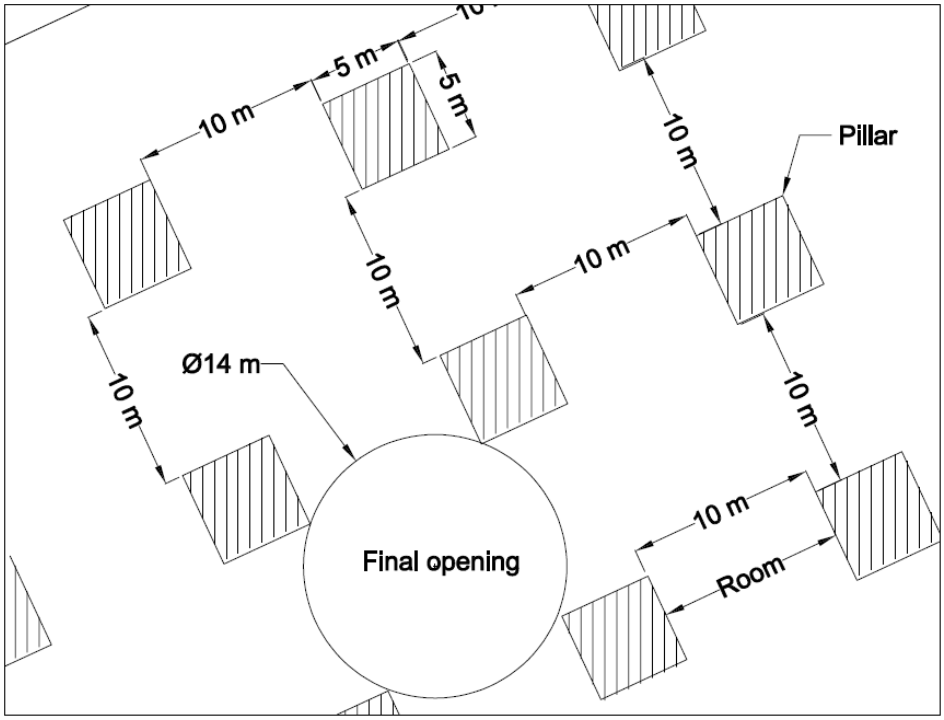


Figure 2-8: Plan View of the Room and Pillar Configuration

The height of the rooms and pillars is 5 m, and therefore, the same as that of the development levels. This allows for the use of the same equipment used in the West Zone. Mining is performed in stages. The first step is a development cut (5 m x 5 m) in the mineralized zone. During this primary development phase, the support is installed as proposed by AMC (2012). While advancing the secondary cut (also 5 m x 5 m), a secondary ground support is installed on the back to retain the rooms new span of 10 m. The proposed support consists of rebars of 3 m installed with a 1.5 m x 1.5 m pattern. This support must be installed as the development progresses. The last cut is done by retreating towards the accesses, which does not expose the workers to the final opening of 14 m in diameter.

Historically mined deposits from the Cominco era also used the room and pillar method (Figure 2-9). This method will be investigated in more detail at the next phase of the Project development.

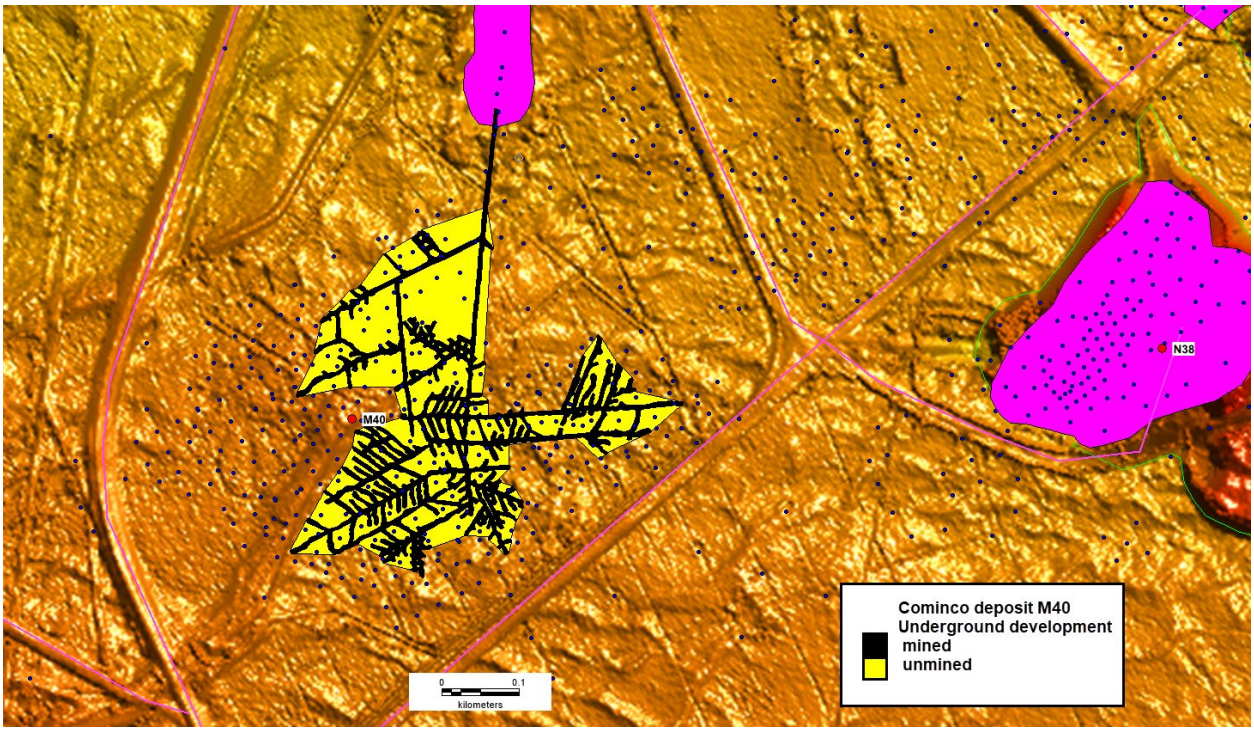


Figure 2-9: Historical Underground Mine Development from Cominco Era

2.2.5 Ground Support

In their geotechnical review, AMC (2012) provided estimates of ground support requirements for different underground excavations in the various rock units. These estimates have been evaluated and validated in the PEA. The ground support systems discussed below will be installed for both zones, regardless of the mining method used. Additional clarifications are made for the room and pillar method.

2.2.5.1 Development Headings

The NGI-Q ground support chart method was used to provide an approximation of ground support requirements for long-term development in the major lithologic units. The assumptions made are that the development headings are 5 m x 5 m, and an Excavation Support Ratio ("ESR") (permanent mine opening) of 1.6 is applied. The results are shown in Figure 2-10 and Figure 2-11. A range of ground support types have been estimated from the expected variability in ground conditions. For mine design and cost estimation purposes, an average ground support system for development drifts was decided (see Table 2-6 for excavation type versus ground support system).

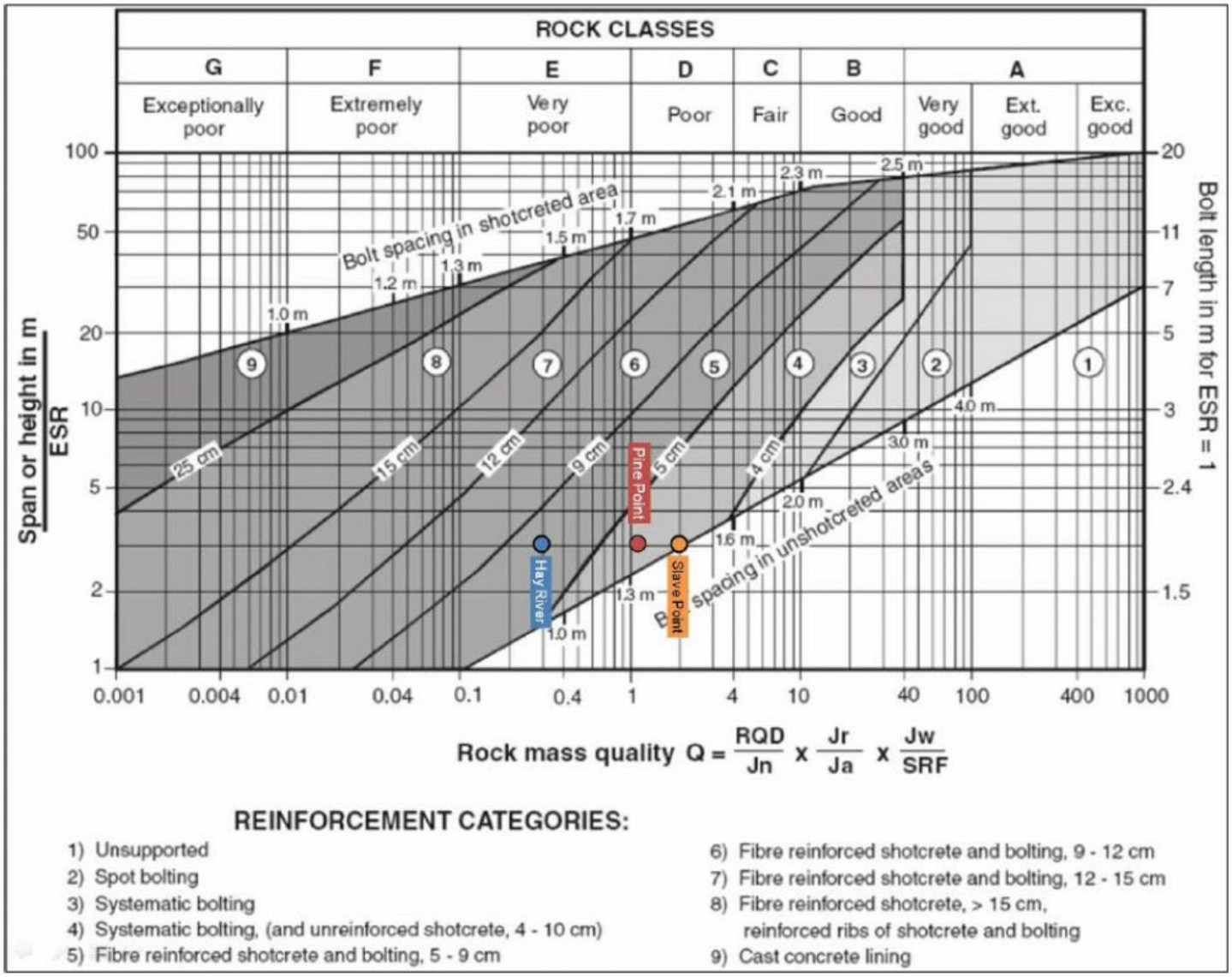


Figure 2-10: Ground Support – RMR Spacing Rating 10

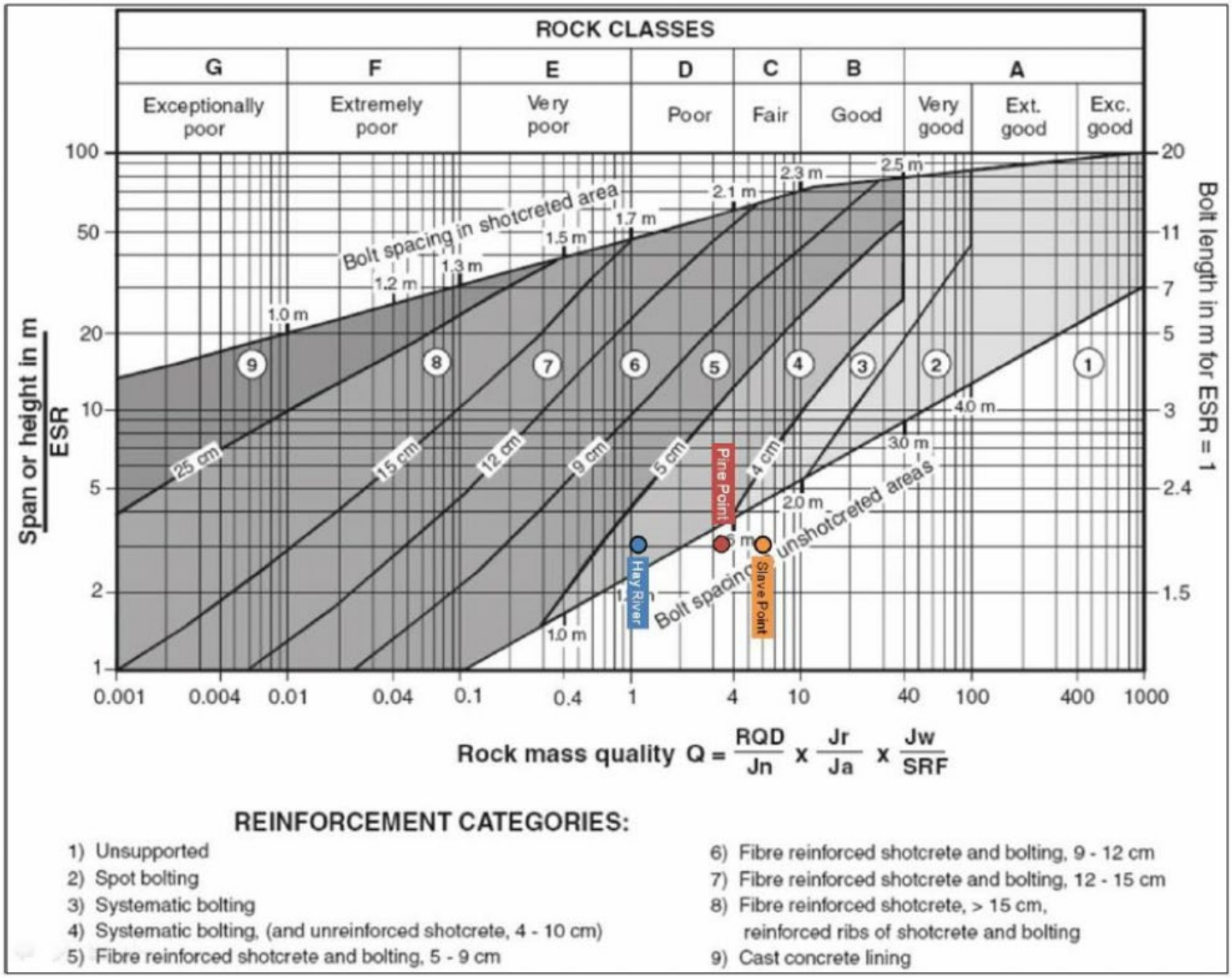


Figure 2-31: Ground Support – RMR Spacing Rating 20

Table 2-6: Excavation type versus Ground Support System

Waste Lateral Development (m)	Dimension	Ground Support
Ramp	5 m x 5 m	8' rebars pattern 1.2 x 1.2 m with mesh on roof and walls
Sublevel access	5 m x 5 m	8' rebars pattern 1.2 x 1.2 m with mesh on roof and walls
Drilling access Drift	5 m x 5 m	8' rebars pattern 1.2 x 1.2 m with mesh on roof and walls
Haulage Drift	5 m x 5 m	8' rebars pattern 1.2 x 1.2 m with mesh on roof and walls
PS Drift	5 m x 5 m	8' rebars pattern 1.2 x 1.2 m with mesh on roof and walls
Room and pillar drift	5 m x 5 m	8' rebars pattern 1.2 x 1.2 m with mesh on roof and walls
Ventilation Access	5 m x 5 m	8' rebars pattern 1.2 x 1.2 m with mesh on roof and walls
Gear Bay	5 m H x 8 m W	8' rebars pattern 1.2 x 1.2 m with mesh on roof and walls + 10' rebar pattern 1.8 x 1. 8m as back secondary support

For mine design and costing purposes, a Type 3b was selected as an average ground support system for development drifts (Figure 2-12).

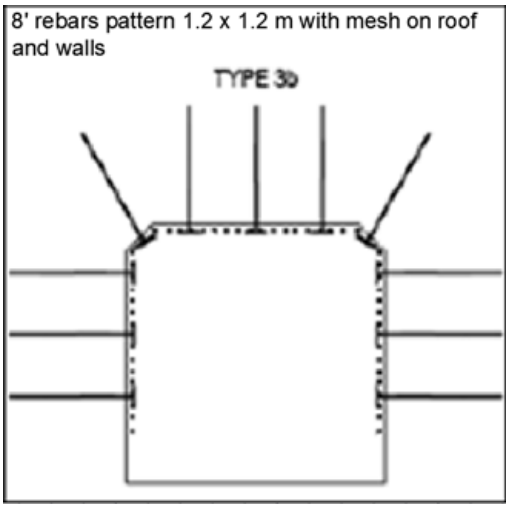


Figure 2-12: Typical Development Drift Ground Support Layouts

2.2.5.2 Sills Support

Stope entry development is generally deemed a short-term mine opening and an ESR of 2 has been applied to the ground support charts. Depending on the longevity requirements of the drifts and the ground conditions encountered, AMC (2012) recommended that planned support of stope entry excavations is achieved using both cement grout single strand cable bolts and split set or swellex bolts for surface support. Since the width of the stopes has increased from 10 m to 15 m, a re-evaluation of the secondary support at the stopes back was completed. For a width of 15 m and an RMR of 60, 9 m long double-strand cables with a pattern of 2 m x 2 m must be installed at the upper stope access (top sill). Preliminary estimates of ground support for the upper and lower stope access drifts are summarized in Table 2-7.

Table 2-7: Sills Ground Support

Stope Drift	Primary Support
Upper Stope Access	Split Sets/Swellex L-2.5m; S-1 to 1.5m c/c
Lower Stope Access	Split Sets/Swellex L=2.5m; S-1 to 1.5m c/c

2.3 Hydrogeology

A hydrogeological review was conducted in the PEA to estimate the dewatering rate required to lower the water table in the different zones of the Project. Four principal carbonate bedrock units are present beneath the overburden and Hay River Shale at the site (TetraTech 2020). These include the Slave Point Limestone, the Sulphur Point Formation (limestone with HTD), the underlying Pine Point dolomite and the underlying Keg River Formation. A highly porous alteration zone (HTD alteration) is well developed in the Sulphur Point Formation in areas of mineralization (Prismatic and Tabular styles). Channelways of HTD are present laterally in areas of Tabular mineralization and form distinct trends. The intensity of HTD in the Sulphur Point appears to drop considerably between the trends (North Trend, Main Trend, and South Trend) of mineralization. HTD is present in the Slave Point, Pine Point, Watt Mountain, and Lower Slave Lake formations and is very restricted to only the immediate area of the deposits. The presence of the HTD alteration also greatly enhances porosity and permeability. The HTD alteration zone comprises the aquifer unit. Figure 2-13 shows the HTD zone for the Main and North Trend areas as an example.

However, the East Mill Zone is considered to be drier and some of the historical pits are empty and above the top of the ambient water table. As indicated in the PEA, hydrogeological settings in the West Zone indicate high porosity and high hydraulic conductivity (1.10 E-4 m/s) except for deposit G03, which has a hydraulic conductivity slightly lower (7.41 E-4 m/s); the Central Zone has hydraulic conductivity in the same order of magnitude (1.10 E-4 m/s), and varies between 8.37 E-7 and 1.1 E-4 m/s.

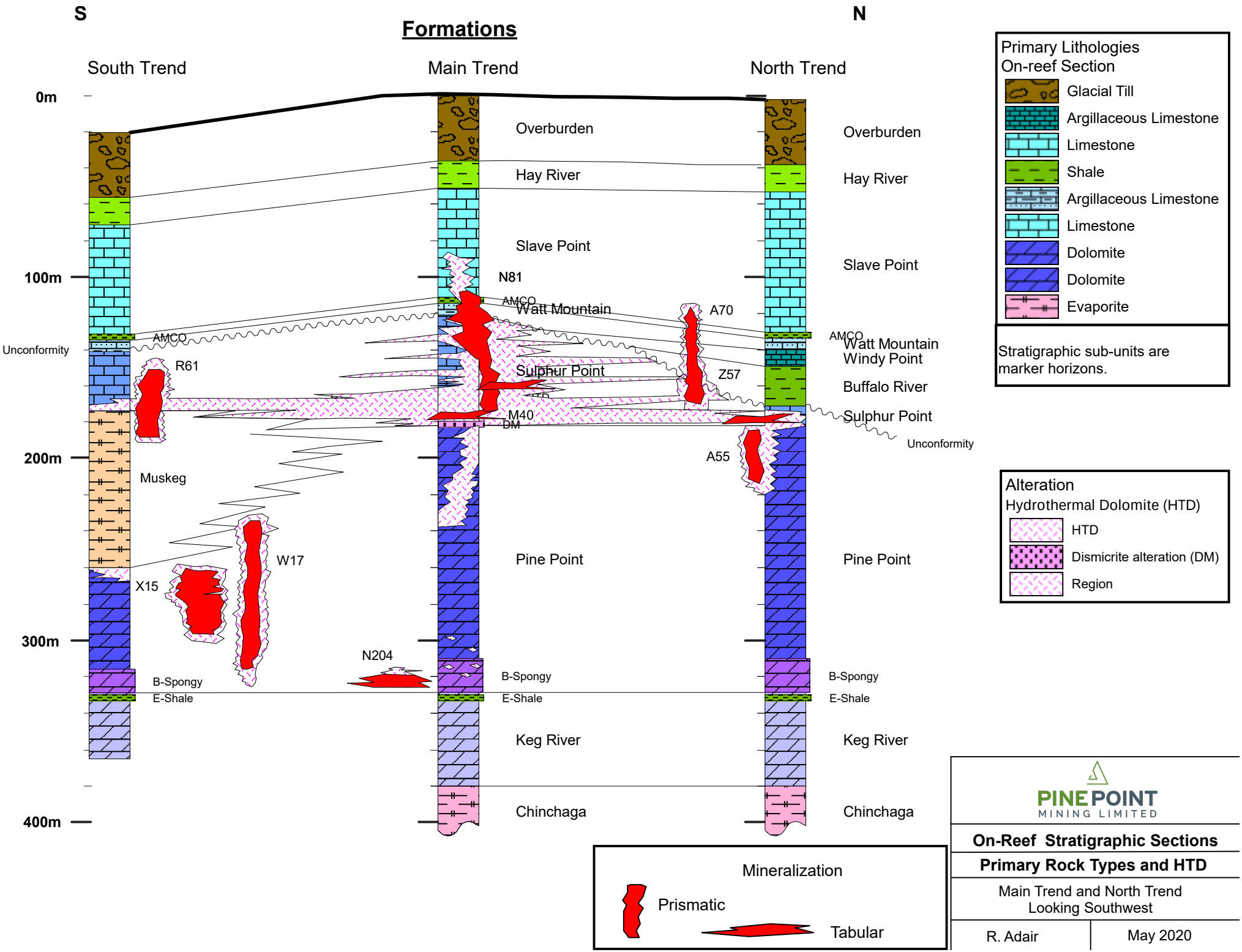


Figure 2-13: **On-reef Lithology and Stratigraphy of Main and North Trends with Schematic HTD Superimposed (Example of HTD Replacement)**

3 PROJECT COMPONENTS

3.1 Mine Plan and Schedule

The Project is to be mined both as open pits and underground workings. Two types of geological deposits (Tabular and Prismatic) are included in the mineralized material. The Tabular deposits are a rather flat layer, at shallow depth (less than 200 m), and generally thin (5 to 10 m). The Prismatic deposits have more vertical extent that could have up to 60 m thickness and are also shallow. The shape of these two types of deposits creates a series of aligned pit shells or underground workings that are generally less than 1,000 m in diameter. Some of the deposits are extensions of pits from the Cominco era that were not known or not economical at the time, while others are new discoveries.

Most of the deposits are planned to be mined as open pits and are located in the North and Main Trends (Figure 3-1). The deeper deposits with higher strip ratio are planned to be mined from underground when the grade can support this mining method and operating costs. The total mineralized material is 32.5 Mt grading 3.9% Zn and 1.48% Pb for 5.38% ZnEq for open pits, and 6.6 Mt grading 6.75% Zn and 3.34% Pb for 10.09% ZnEq for underground workings. The total combined mineralized material planned to be mined for the Project is 39.1 Mt at 4.38% Zn and 1.79% Pb for 6.17% ZnEq.

- Forty-seven deposits from four zones (East Mill, Central, North, and N204) are expected to be mined as open pits, considering the deposit's size, shape, orientation, and proximity to the surface as well as economic parameters. Drilling, blasting, loading, and hauling are used to mine the near surface mineralized material to meet the mine production schedule.
- Two zones involve underground mining methods: the West Zone (W1 Area) and the Central Zone (C1 Area). The West Zone (W1 Area) includes five underground workings mined by longhole mining methods with some stopes extracted by the room and pillar mining method (less than 10%). Three deposits from the Central Zone (C1 Area) are anticipated to be mined by underground methods due to their high strip ratio and good grades. These deposits are planned to have portal access through mined-out pits M64 (historical) and M67 (proposed).

The mining production schedule is based on a throughput of 11,250 tpd at the process plant during 10 years of operation. If additional resources are added to the mine plan, this would extend the life of mine. Indicated and Inferred Mineral Resources account for 28% and 72% of total process plant feed, respectively at this time. Further definition drilling of the Inferred Resources will increase the definition and convert these Resources to the Indicated Resource category.

Since the deposits are generally shallow, pre-stripping will be minimal. An allowance has been allocated for Year -1 but most of the stripping occurs during the first quarter of operation and it is possible to reach the Mineral Inventory deposit within a month. The first year ramp up throughput gives an average of 70% of full capacity of the mineralized material. Of the 47 pits, 20 are in operation for less than 3 months, 22 are in operation for 1 to 2 years, and 5 are in operation for more than 2 years.

Mine production is scheduled to come from open pits only in Years 1 and 2. Underground mine production supplements the open pit production feed to the plant between Years 3 and 9. The Life of Mine ("LOM") production schedule is presented in Table 3-1.

The LOM production schedule of a multi-deposit project has to take into account several aspects. The proposed schedule for the Project is a balance between the numerous deposits and their respective characteristics, considering various constraints including multiple mining methods, while aiming to optimize the plant feed. The Project has numerous specific aspects to consider, for example the West Zone deposits are high grade but require higher capital investments since they are mined from underground. Dewatering and haulage requirements would promote mining pits within “Cluster” areas, but the nearby deposits can have very variable tonnage, grades, and strip-ratios, which impacts their profitability.

The open-pit mining sequence is based on the profit margin per pit. The profit per ton was estimated for each pit based on preliminary costs including dewatering, haulage, and processing. The pits were sorted from the highest profit margin to the lowest and the sequence was developed with the following assumptions:

- 25% of the yearly production will come from the East Mill Zone, allowing access to mineralized material nearby the process plant and requiring less dewatering, as a contingency measure for the freshet.
- Preferably four clusters can be mined simultaneously, to facilitate logistics and benefit from the cumulative effects of dewatering while prioritizing pits with higher profit margins.

Generally, the pits that contain less than 1 Mt of mineralized material are mined within one year. The pits that have more than 1 Mt are mined in two to three years. The open-pit mining schedule was adjusted to be balanced with the 4,000 tpd coming from the underground operations between Years 3 to 7, and 1,500 tpd from Years 7 to 9. There will be eight pits in operation per year but less than four pits operated simultaneously. These assumptions may change as the mine plan is optimized in future studies; for example, the number of concurrent pits being mined or the number of clusters may increase or decrease.

Underground mining has been set to start in Year 3 to delay capital costs. The underground mining sequence is also based on the relative profit margin while considering the proximity (connection ramp) and underground mining methods for the production rate and reuse of equipment (West Zone completed before Central Zone).

Table 3-1: Mine Production Schedule

	Unit	LOM	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Open-pit Production												
Open pits	#		8	7	7	6	8	6	8	8	8	5
Mineralized Material	Mt	**32.6**	2.9	4.1	3.2	2.6	2.6	2.6	3.5	3.6	4.0	3.4
Zn Grade	%	**3.9**	5.0	4.9	4.6	3.8	3.5	3.7	3.2	3.8	3.2	3.2
Pb Grade	%	**1.5**	2.5	1.8	1.5	1.6	1.7	1.6	1.6	1.0	0.9	0.9
ZnEq Grade	%	**5.4**	7.6	6.8	6.1	5.4	5.2	5.3	4.8	4.9	4.1	4.1
Total Waste Rock	Mt	**167.1**	15.4	23.5	18.1	14.2	12.7	16.7	15.3	23.4	15.1	12.7
Overburden	Mt	**66.4**	5.5	9.6	9.6	7.1	6.1	6.2	7.5	9.1	3.1	2.7
Waste Rock	Mt	**100.6**	9.9	13.9	8.5	7.1	6.6	10.4	7.8	14.2	12.0	10.0
Underground Production												
Mineralized Material	Mt	**6.6**	0.0	0.0	0.9	1.5	1.5	1.5	0.6	0.5	0.1	0.0
Zn Grade	%	**6.8**	0.0	0.0	9.9	6.3	6.9	5.7	5.8	6.0	6.0	0.0
Pb Grade	%	**3.3**	0.0	0.0	5.0	4.2	2.9	3.1	2.0	1.8	1.8	0.0
ZnEq Grade	%	**10.1**	0.0	0.0	14.9	10.5	9.8	8.8	7.8	7.8	7.8	0.0
Total Production to Process Plant												
Mineralized Material to Process Plant	Mt	**39.1**	2.9	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	3.4
Zn Grade	%	**4.4**	5.0	4.9	5.9	4.7	4.7	4.4	3.6	4.1	3.3	3.2
Pb Grade	%	**1.8**	2.5	1.8	2.3	2.5	2.1	2.1	1.7	1.1	0.9	0.9
ZnEq Grade	%	**6.2**	7.6	6.8	8.1	7.2	6.8	6.5	5.2	5.2	4.2	4.1

MINING PRODUCTION SEQUENCE

- YEAR 1
- YEAR 2
- YEAR 3
- YEAR 4
- YEAR 5
- YEAR 6
- YEAR 7
- YEAR 8
- YEAR 9
- YEAR 10

NE2 AREA
X 18
X 17
N204 AREA
N204A
N204B
N204C
NE1 AREA
T37
EM AREA
N1 AREA
X55
Y53
X49
Y55
X59
X60
X61
Y62
Y65
Y56
Y58
Y57
X71
Z60
Y68
X68
L25
L26
L27
L35
L24
O27
O26
N31
N39
M40
N32
N34
N33
K51
M48
K57
K52
O53
N2 AREA
YBM
W85
C1 AREA
C2 AREA
K60
M63UG
J68
K68
M67
L65UG
M67UG
R67
C3 AREA
BIG BUFFALO RIVER
W1 AREA
G03
X25
R190
O556
P499
6
5

SCALE 1:100 000
0 2 500 5 000 7 500 10 000m

Figure 3-1
PRELIMINARY

KEY PLAN

GENERAL NOTES

LEGEND:

- PROPOSED PITS
- HISTORICAL PITS
- PROPOSED UNDERGROUND WORKINGS
- PROPOSED WASTE ROCK PILE
- PROPOSED OVERBURDEN PILE
- MINERAL SORTER REJECT
- WOODEN AREA
- WATER AREA
- WETLAND AREA
- EXISTING ROADS
- WATERCOURSES

NOTES:

1. LIDAR PROVIDED BY THE CLIENT. PRODUCED IN DECEMBER 2019.
2. UTM NAD83, ZONE 11 COORDINATE SYSTEM.
3. BASEMAP : CANVEC , 1:250000, TILE 085B, ©HER MAJESTY THE QUEEN IN RIGHT OF CANADA, AS REPRESENTED BY THE MINISTER OF NATURAL RESOURCES, 2017.

REV	DATE	DESCRIPTION	DR.	CHK	APP
ZB	2020-07-02	FOR INFORMATION	E.G.	-	S.L.
ZA	2020-06-30	FOR INFORMATION	E.G.	-	S.L.

SEAL & SIGNATURE

wsp
1600, BOULEVARD RENÉ-LÉVESQUE OUEST, 11ème ÉTAGE,
MONTRÉAL (QUÉBEC) CANADA H3H 1P9
TEL. : (514) 340-0046 | FAX. : (514) 340-1337 | WWW.WSPGROUP.COM

OSISKO METALS
PINE POINT MINING LIMITED

DESIGN :	H. LATULIPPE, Eng.	2020-07-02
DRAWN :	E. GAMSBY, tech.	2020-07-02
CHECKED :	-	-
APPROVED :	H. LATULIPPE, Eng.	2020-07-02
CLIENT :	-	
SCALE :	1:100 000	DATE

PROJECT :
PINE POINT

SUB-PROJECT :
PRELIMINARY ECONOMIC ASSESSMENT

TITLE :
MINE SURFACE FACILITIES
GENERAL ARRANGEMENT
MINE PRODUCTION SCHEDULE

DRAWING NUMBER
301-G-0110-ZB
DET. AREA - DISCIPLINE - SEQUENTIAL NO. - REVISION

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3.2 Mining

The Project is based on an updated MRE that converts 12.9 Mt to an Indicated Mineral Resource (pit constrained) and includes 37.6 Mt of Inferred Mineral Resources (underground and pit constrained). The mineral inventory will be mined at an estimated production rate of 6,000 tpd ramping up to 11,250 tpd for a life of mine that is approximately 10 years or longer. At this time, the deposits located in the East Mill, North, Central and N204 Zones, east of the Buffalo River, are mainly planned to be mined as open pits. Some of the deeper deposits, such as those located in the West Zone, west of the Buffalo River, and the Central Zone, east of the Buffalo River, will likely involve underground mining methods. The deposits are listed below in Figure 3-2 and their locations are presented in Figure 3-1.

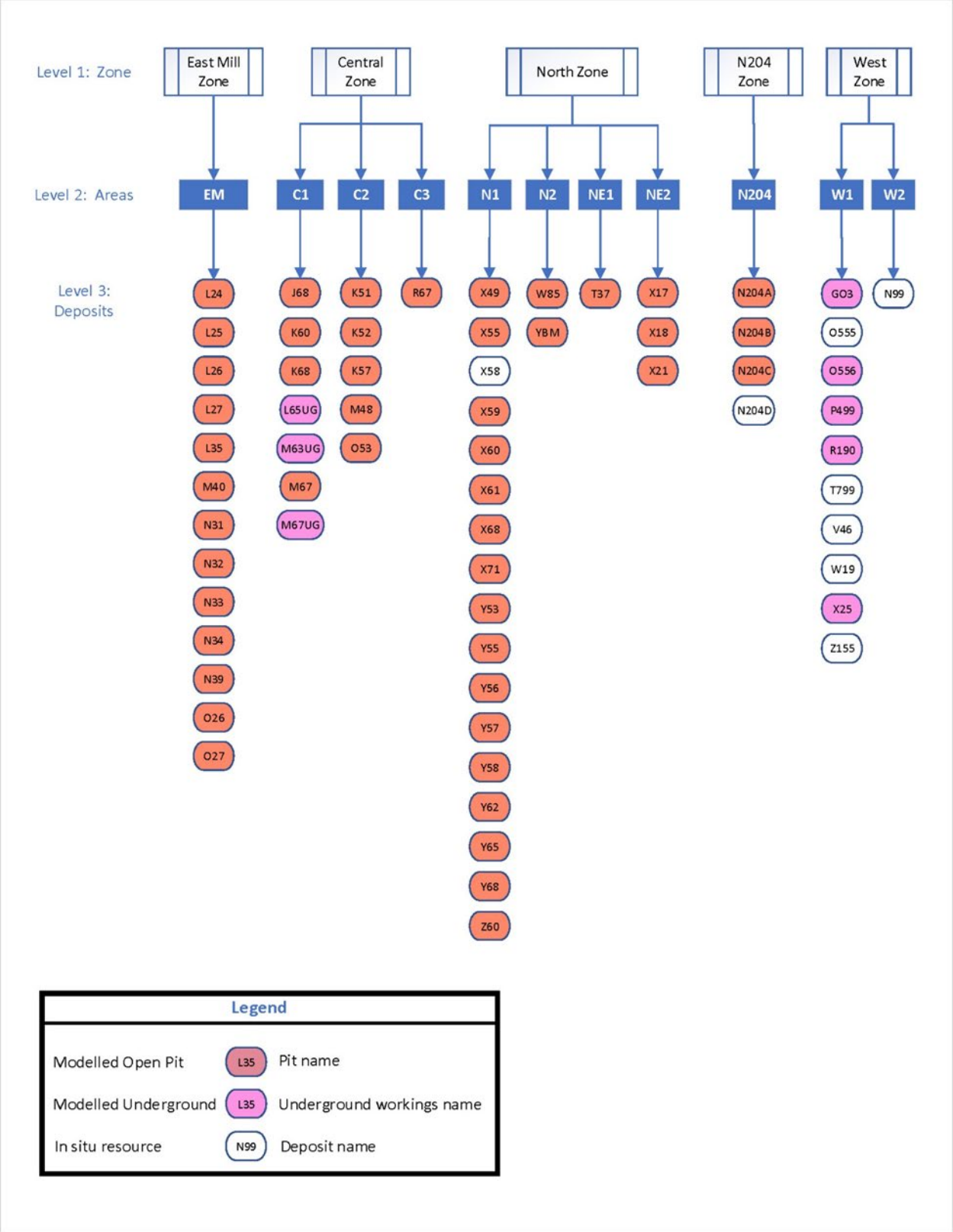

Figure 3-2: Deposit List and Locations

3.2.1 Open-Pit Mining

Most of the mineralization will be mined using open-pit mining methods. Ramps will be used to move personnel and equipment in and out of each mine, and to move mineralization and waste rock to surface. The larger pieces of mining equipment will be moved to the pits as the need arises and will generally remain in operation in the pits until no longer required, except for maintenance activities.

Open pits will be developed in stages, concurrently mining multiple pits from various zones, to provide the required material for optimized process plant operations. The site preparation work will include the stripping of overburden and placement of the material in designated overburden piles. Mineralization-bearing rock will be drilled and blasted and then transported by haul truck to the process plant.

As an alternative, when shallow and Tabular deposits are encountered, a surface miner (Figure 3-3) could be used. Each year, mineralized material will be produced from one to twelve open pits, usually located within the same zone but sometimes located in two to three different mine working areas.

Figure 3-3: Example of a Surface Miner

At full capacity, it is currently estimated that it will take 80 to 100 truck trips per day from the various sources of mineralization with a truck payload capacity of approximately 100 tonnes to haul material to the concentrator. Future trade-off studies will determine the most cost-effective truck capacity, and as such, the truck trips required.

Alternatives being considered in the Project planning stage include optimizing haulage distances and road alignments, combining open pits where possible, the use of alternative equipment and fuel for the transport fleet.

3.2.2 Underground Mining

The process of removing the economically viable mineralization from the deeper deposits will require underground mining methods. This will begin through the development of underground ramps, which will also require overburden stripping. Quantities of overburden and waste rock are expected to be considerably less than the volumes generated by open-pit mining.

Underground ramps will be used to move personnel and equipment in and out of the mines, and to move mineralization and waste rock to surface. The production period of deposits to be mined by underground methods is currently planned for Years 3 to 9 of the approximate 10-year LOM.

The deposits that are planned to be mined from underground are located in two zones: the West Zone (W1 Area), and the Central Zone (C1 Area) (Figure 3-1). For both zones, the mineralized material is accessed via a ramp and transported to surface using 45-t trucks. Waste rock material is brought to the surface and placed on a temporary stockpile near the mine portal before being used to backfill mined-out stopes after mining completion.

For the West Zone and C1 Areas, two different strategies are used to allow access to the deposits. For the West Zone, the excavation of overburden is necessary beforehand while for the C1 Area, portals would be excavated from the bottom of existing mined-out and dewatered pits and future proposed open pits.

The West Zone consists of five deposits. Three of these deposits (R190, G03, and X25) are accessed by a surface portal, while P499 and O556 are proposed to be mined at this time by a connection ramp, which is excavated from the R190 decline. For the Central Zone (C1 Area), portals are excavated from the bottom of existing pits. M67 is mined earlier in the mining schedule and from which M67UG and L65UG will be accessed. M64, which was mined during the Cominco era, will be used to access M63UG, after dewatering.

Secondary accesses are possible via ventilation raises. After the completion of decline/ramp development, ventilation raises (fresh air) are excavated in priority to create a second emergency exit before the start of production. Therefore, these raises are equipped with a manway from the surface to the bottom level of the mine.

Underground mineralized material transportation to the process plant will be carried out by a contractor. For the West Zone, the long-haul trucks are loaded at the portal and will take Highway 5 to cross the Buffalo River and then Highway 6 to the nearest haul road so that the highway is used for a limited distance. For the C1 Area, 45-t articulated trucks will transport the mineralized material.

3.3 Processing

The Project is currently being assessed based on an average mining production rate ranging between approximately 6,000 to 11,250 tpd of Run of Mine mineralization from open pit and underground operations. The mining production rate will be optimized over time, particularly if resources are added to the current resource base.

The Project includes the development of a new plant site concentrator processing facility (the "process plant") near the old Cominco process plant site location that will include pre-concentration, crushing, grinding, flotation, and dewatering circuits.

Processing pre-concentration facilities will include X-Ray Transmission (XRT) material sorters and associated crushing and screening equipment (Figure 3-4 and Figure 3-5). The advantage of using preconcentration is that it removes approximately 40% of the volume of material from the process plant feed. This reject material will not require further processing.

3.3.1 Process Plant Design

Haul trucks will transport the mineralized material to the plant site concentrator for processing into marketable zinc and lead concentrates (Figure 3-4). All of the economically viable mineralization will be sent through the pre-concentrator circuit located within the process plant between the primary crusher and the grinding circuits to sort gangue (non-mineralized rock) from mineralized material that will reduce the volume of rock to be processed in the grinding and flotation section of the process plant compared to the total mine production rate.

The process plant consists of a three-stage crushing circuit incorporating mineral sorting followed by grinding, differential flotation of lead and zinc, and dewatering of concentrate and tailings. Historical and new mined-out open pits will be used for tailings disposal.

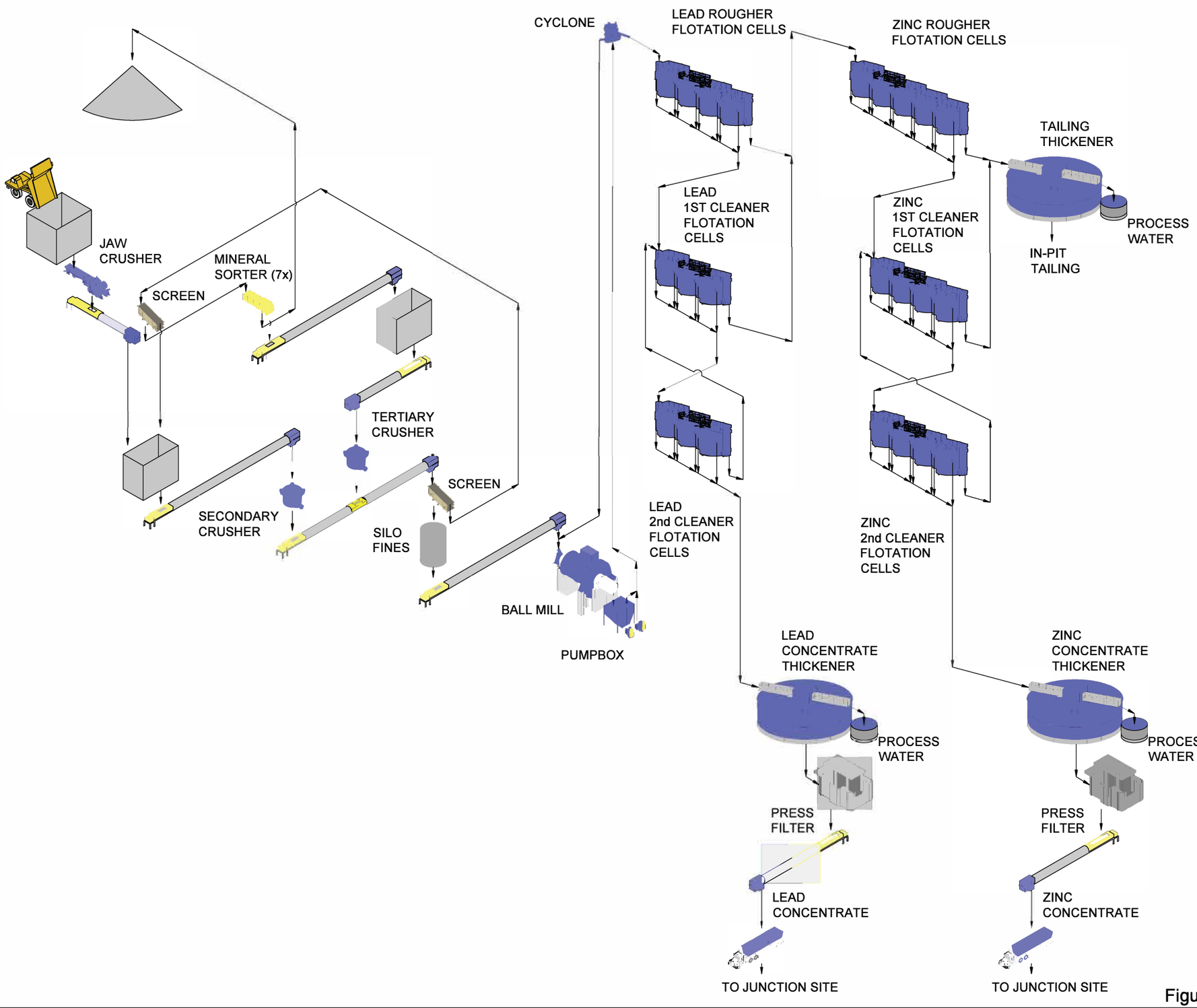

Figure 3-4

KEY PLAN

GENERAL NOTES

OSISKO METALS
FOR INFORMATION
NOT TO BE USED FOR CONSTRUCTION
DATE: 2020-06-30
BY: D. MATHIEU

REV	DATE	DESCRIPTION	DR.	CHK	APP.
ZB	2020-06-30	FOR INFORMATION	D.M.	-	-
ZA	2020-06-26	FOR INFORMATION	D.M.	-	-

SEAL & SIGNATURE

OSISKO METALS

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DRAWN :	D. MATHIEU	2020-06-22
CHECKED :		
APPROVED :		
CLIENT :	-	
SCALE :	N/A	DATE

PROJECT :
PINE POINT

SUB-PROJECT :
PRELIMINARY ECONOMIC ASSESSMENT

TITLE :
FLOWSHEET OVERALL SCHEMATIC
PROCESS FLOWSHEET
-
-

DRAWING NUMBER
600-D-0001-ZB
DET. AREA - DISCIPLINE - SEQUENTIAL NO. - REVISION

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3.3.2 Crushing and Mineral Sorting Circuit

The primary crushing circuit (Figure 3-5) located prior to the pre-concentrator circuit will consist of a primary jaw crusher and screening unit to remove the fine fraction from the crushed material that is to fine grained and not appropriate for the XRT sorting equipment. The fines will be sent directly ahead to the grinding circuit for further processing.

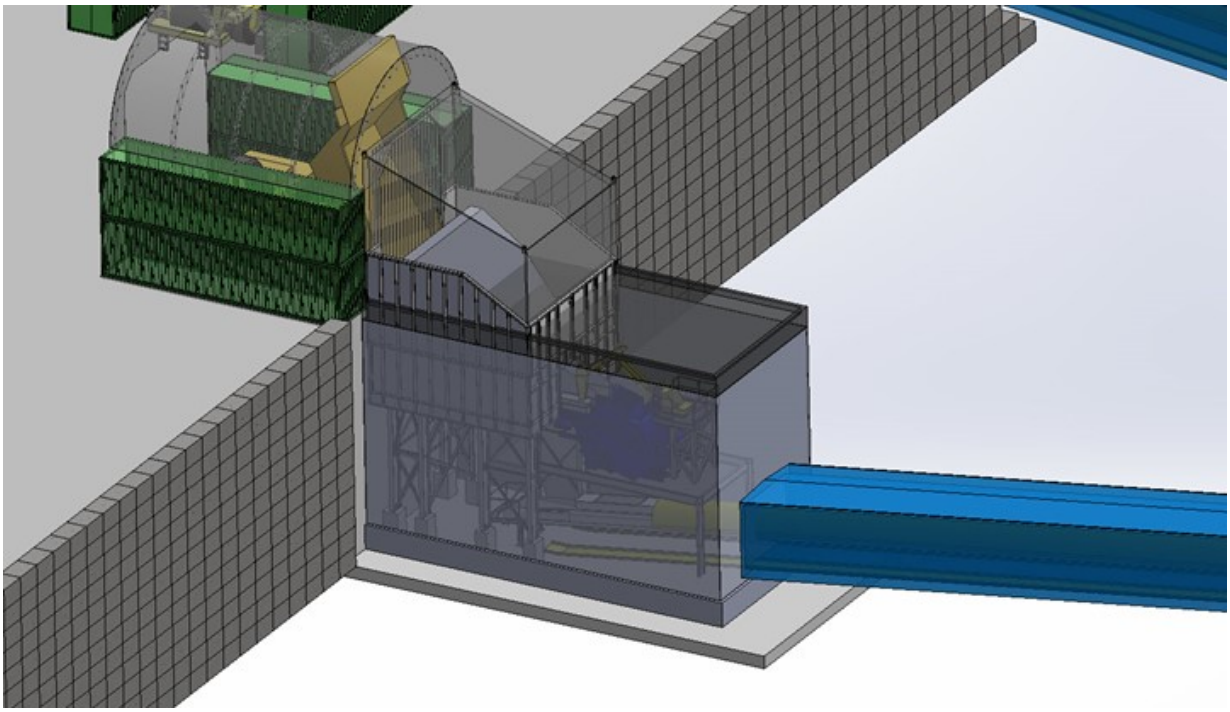


Figure 3-5: Primary Crushing Arrangement

The crushing circuit is designed to be fed 4.1 Mt of mineralized material per year. The primary crushing circuit is composed of a vibrating grizzly feeder followed by a 160 kW jaw crusher. The crusher reduces the feed size from a maximum of 500 mm to a P80 of approximately 90 mm with a 105 mm closed side setting. The crushed material is transported to the crushed mineralized material bin in the secondary crushing area via a conveyor.

The secondary crushing/screening circuit will reduce the Run of Mine material into two size fraction products: a coarse fraction of 10 to 60 mm and a fine fraction of minus 10 mm particle sizes. The coarser product will be conveyed to a surge bin that will feed the XRT material sorter circuit, whereas the fine fraction (-10 mm) will be conveyed into the concentrator surge hopper bin. The coarse mineralized fraction after XRT sorting will be re-combined with the primary crushing circuit fines as the combined process plant feed to the concentrator for processing.

Non-mineralized material rejected from the XRT sorter process (rejects) will be in the size range of 10 to 60 mm and conveyed out of the concentrator for temporary storage in a sorter reject stockpile and managed as waste rock, as per the Tailings and Waste Rock Management Plan.

Stockpiles at the process plant will be established to enable blending of mineralization to obtain a consistent grade and metallurgical properties in the feed to the concentrator. The number and location of the stockpiles near the plant will be determined in the next study phase.

Where possible, previously cleared land that was used by Cominco for industrial development will be used for infrastructure locations.

Two alternative technologies were considered for the pre-concentration process: Dense Media Separation, and XRT material sorting. Both alternatives require that the mineralization-bearing rock be crushed prior to separation. Dense Media Separation uses a water-based separation media in its processing equipment while XRT is a dry process that does not use a separation media. XRT was selected due to lower water consumption requirements.

Waste material from the XRT sorter (sorter rejects) will be transported by truck to the waste rock storage facility (WRSF) or tailings disposal area (TDA) to be deposited as cover material on these areas.

3.3.3 Grinding

Following the primary and secondary crushing and preconcentration circuits, the process plant feed will then be conveyed to the grinding circuit. The grinding circuit will consist of a single ball mill in a closed circuit with a cluster of hydro cyclones for size classification. The ball mill discharge product will be a slurry (water and solids), to be pumped to hydro cyclones. Coarse material will report to the cyclone underflow and be recirculated back to the ball mill. Fine material will report to the cyclone overflow and flow by gravity to the flotation circuit.

3.3.4 Flotation

The flotation process will separate the mineralized from non-mineralized particles and produces three products: zinc concentrate, lead concentrate, and 4,500 to 5,600 tpd of slurry tailings. Reagents, called collectors, frothers, and modifiers, are added to the grinding circuit product (slurry) before flowing into the flotation circuit which consists of flotation cells that are connected in series.

The flotation cells inject air into the slurry as it passes through the cell and the mineral particles are collected on the resulting froth bubbles, which overflow into a collection launder located at the top of each cell. Lead concentrates are first collected in the lead flotation circuit. Lead flotation circuit tails flow into the zinc flotation circuit where zinc concentrates are produced and both concentrates are filtered separately prior to transport to the trader or smelter.

After flowing through the flotation cells, the non-mineralized particles remaining in the slurry are tailings. These tailings will be pumped to a tailings thickener to remove excess water for reuse before the thickened tailings are pumped into previously mined-out open pits. The location of these pits and the pit volumes required will be refined as part of the next study. Clarified water, that is decanted from the overflow of the thickener, will be recirculated back to the grinding circuit for reuse. This recirculation will substantially reduce the Project's overall freshwater usage.

An inventory of process chemicals anticipated to be needed is provided in Table 3-2 along with their planned supply and storage methods.

Table 3-2: List of Reagent Use, Supply, and Storage

Reagent	Application	Delivery	Storage	Preparation	Estimated Consumption (tpy)
Zinc sulphate	Zinc depressant	Bags - solid	Dry warehouse	Mixing tank, water addition	873
Aero3894	Lead promoter	Totes - liquid	Dry warehouse	No preparation required	70
Copper sulphate	Lead activator	Bags - solid	Dry warehouse	Mixing tank, water addition	1,980
Aerofloat 3418A	Zinc promoter	Totes - liquid	Dry warehouse	No preparation required	37
MIBC (methyl isobutyl carbinol)	Frother	Totes - liquid	Dry warehouse	No preparation required	79
Quick lime (CaO)	pH modifier	Trucks - solid	Silo	Mixing tank, water addition	2,888
Flocculant	Flocculation of solids in thickeners	Bags solid	Dry warehouse	Eductor, mixing tank, water addition to inline mixer	175

Note: All numbers are provided for information purposes only. During actual operations, values are expected to vary.

3.3.5 Concentrate and Tailings Dewatering

Both lead and zinc concentrates will be pumped to their dedicated dewatering systems. Concentrate thickeners followed by filter feed tanks will provide enough retention time for the operation of a dedicated vertical filter press for each concentrate. The lead concentrate filter is designed to filter 76 m^3/h and the zinc concentrate filter is designed to filter 156 m^3/h of 62% solids thickened slurry. For operational flexibility, a third filter press will be installed as a stand-by for both lead and zinc concentrate filtration processes. The filtered concentrate cakes hold about 8% moisture and will be transferred by trucks.

Flotation tailings will be pumped to a 30 m diameter conventional high rate thickener. Tailings will be dewatered to 60% of solids in the underflow for disposal. Thickened tailings will be transferred to an existing or new mined-out open pit. Thickener overflow will be returned to the process plant as process water. Tailings will be managed as per the Tailings and Waste Rock Management Plan.

3.4 Waste Management Infrastructure

3.4.1 Waste Rock Storage Facilities

3.4.1.1 Reclamation Material

Reclamation material stockpiles will be located close to WRSFs and/or overburden piles and open pits to provide storage for topsoil and organics. The expected volume of reclamation material is expected to be relatively low. The reclamation material stockpiles will include mainly topsoil, peat, gravels, and small trees.

3.4.1.2 Waste Rock and Overburden Material

Mine rock will be mined using excavators or shovels. If rock is needed for on-site construction purposes (i.e., road building, pad construction, and berms), it will be crushed and screened with a mobile aggregate plant to the desired size and used as required providing that the geochemical

properties of the material are appropriate for such use. Excess Mine rock that is not required for construction will be stored on-site. As for all the Project infrastructure, WRSFs will be built, to the extent possible and practical, on disturbed areas, including mined-out pits. The WRSF location will aim at optimizing haulage distance and segregating to separate PAG material.

The volumes of the WRSFs and overburden have been calculated based on the mine plan and are listed in Table 3-3. The waste rock tonnage was converted to volume using a dry density of 2.71 t/m^3 as specified in the MRE, and a swell factor of 1.3. The overburden was converted to volume based on the assumption that it will mainly be composed of till, with a dry density of 2.0 t/m^3 (Rice et al. 2013).

Studies of ML/ARD completed to date (Rescan 2011, 2012a,b) and reviewed by TetraTech (TetraTech 2018) concluded that analyzed samples are consistently classified as non-PAG, based on NPR values of greater than 2. Eighty out of the eighty-two samples are classified as non-PAG.

Where possible, the waste rock will be backfilled in nearby historical pits or in available proposed mined-out pits. The overburden will be stockpiled separately as a major part of it will be used during reclamation. Considering the number of pits, the design and locations of the WRSFs were developed based on proximity, which limited the overall footprint and expected hauling distances. Considering the performance of existing waste rock piles at the site and in agreement with the preliminary geochemical assumptions, no improvement of the foundation for groundwater protection is deemed necessary.

The preliminary design of the WRSFs is based on typical criteria and considers the Design for Closure concept. Reshaping and reworking the waste rock material is thus limited during the active reclamation phase. The WRSFs have been designed using the following geometry; however, this may be updated in the next study:

- Maximum height: approximately 30 m
- General Slope: 2,5 H:1 V
- Lift thickness: approximately 10 m
- Berms: approximately 4 m wide berms at each lift
- Pile width and length: dependent of the site restrictions

General information on the geotechnical conditions was found in historical documents and will be confirmed with field investigations and stability studies. Observations made of existing waste rock facilities does not suggest notable issues with stability.

Site restrictions, such as historical pits and piles as well as transport infrastructure, have also been considered in the design of WRSFs. In total, 12 WRSFs and 12 overburden stockpiles have been designed. The total volume of waste rock produced over the LOM is estimated at approximately 52 Mm^3; the total overburden volume is estimated to be about 50 Mm^3. The volumes will change as the mine plans are refined during the next study; however, these volume estimates can be considered as representative of the Project. If additional resources are added to the mine plan, this will also increase the quantities of waste rock and overburden produced. Table 3-3 lists the WRSF capacities with respect to each area, as well as the list of historical and

new open pits proposed to be used for backfilling. Using 100 tonne trucks, it is currently estimated that it will take between 275 and 550 round trips per day to transport the waste rock between the open-pit mines and WRSFs. Waste rock will be managed as described in the Tailings and Waste Rock Management Plan.

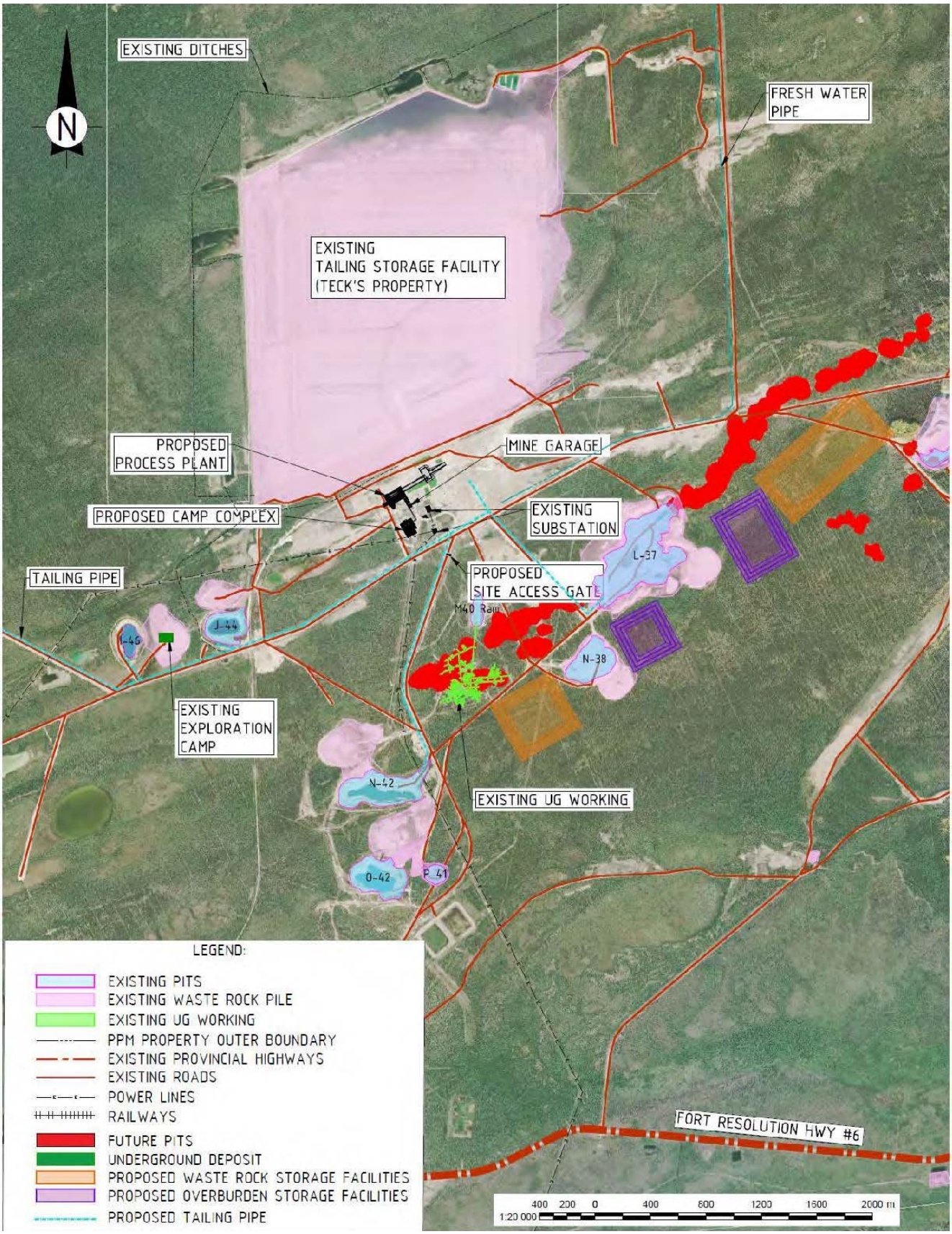
Table 3-3: Volumes of Waste Rock or Overburden Capacities in Each Pile or Pit Group

Waste Rock or Overburden Storage ID	Area	Pit Receiving Waste Rock		WRSF capacity (m^3)	Overburden stockpile capacity (m^3)
		Historical Pit	Proposed Mined-Out New Pit		
1	NE2	WRSF beside the pit.		238,904	27,208
2	N204			10,701,251	1,157,871
3	N2			4,213,922	1,643,588
4	W1			230,838	3,571,000
5	W1			84,059	2,483,000
6	W1			86,811	245,000
7	C1	I65, M64	J68, K68, M67	3,290,360	3,290,360
8	C2	NA	K51, K52	2,295,131	2,295,131
9	EM	O42, P41	N39, M40	2,040,817	2,040,817
10	EM	N/A – External only		2,747,476	2,747,476
11	N1	N/A	X59, X60, X61, Z60	7,635,277	7,635,277
12	N1	N/A	Y65	11,850,216	11,850,216
INPIT-1	NE1	T37	T37	71,078	71,078
INPIT-2	C3	S65	R67	701,841	701,841
INPIT-3	C2	M52	O53	391,703	391,703
INPIT-4	EM	X15	L26	251,861	251,861
INPIT-5	EM	O28, L30	L27, L24	1,281,062	1,281,062
INPIT-6	N1	X51-X54	NA	878,457	878,457
INPIT-7	N1	X51-X54	Y53, Y57	2,338,543	2,338,543
INPIT-8	EM	K62	K60	478,236	478,236
Totals				51,807,843	45,379,725

WRSF = Waste Rock Storage Facility

3.4.1.3 Mineral Sorter Rejects

A mineral sorter rejects pile, with a capacity of about 5 Mt (approximately 2.4 Mm^3), will be located east of the process plant (Figure 3-6). The volume may increase if additional resources are added to the mine plan. The pile is designed to have a thickness of approximately 20 m and will be used to temporarily store mineral sorter rejects before they are transferred to the TDA, available mined-out pits, or WRSF. The pile location will be refined as the process plant design advances.



PROJECT
Pine Point Project

TITLE
Process Plant Site Infrastructure Overview

PROJECT NO.		REV.	FIGURE
19125747	**B4100**	**0**	**3-6**

3.4.2 Tailings Disposal

3.4.2.1 Tailings

Mineralization-bearing material that is sent to the process plant will undergo processing including grinding and flotation. After being processed through the flotation cells, the non-mineralized particles remaining in the slurry will be separated as tailings. These tailings will be discharged into a tailings thickener to recover water for recycling and to increase the percent solids before the tailings are pumped through a pipeline for disposal into selected mined-out pits (TDAs). Clarified water, decanted from the thickener, will be recirculated back to the grinding circuit for reuse. Decanted water from the TDAs will be pumped to avoid overflow and reclaimed back as part of the overall water management system.

Survey and bathymetries conducted for the existing pits have confirmed there is sufficient available space for the entire LOM. Thickened tailings will be transported via pipeline from the concentrator to nearby TDAs. Direct transfer of tailings to TDAs has many advantages including fine ground wet material does not disperse as dust, saturated conditions reduce the potential for oxidation, and the use of previously disturbed land rather than creating new land disturbances.

A hydraulic transport system will have to be constructed for movement of tailings and reclaim water. At this point, it is expected to be above ground, with drainage points and spill containment areas located at naturally occurring low points along the route. Pipelines will follow the existing on-site road alignments where possible and will be protected by berms. Ditching will direct potential spillage to constructed containment areas. Where the pipelines will need to deviate from existing on-site roads, access roads will be built for construction and used as a service road for pipeline maintenance during operations.

Approximately 3,800 to 6,200 tonnes of thickened tailings could be produced each day. The tailings management system would need to accommodate approximately 18 Mm^3 of tailings over the LOM. The thickened tailings will be approximately 60% solids by weight when delivered to the disposal site. Tailings will be managed as described in the Tailings and Waste Rock Management Plan.

3.4.2.2 Pre-Concentration Rejects

The pre-concentration process should decrease the amount of tailings produced and would generate approximately 2,000 to 4,500 tpd of rejects comprising similar material to waste rock. This material has a size range between 10 and 60 mm and will be trucked or conveyed to a waste stockpile or to adjacent TDAs for disposal. Pre-concentration rejects will be managed as described in the Tailings and Waste Rock Management Plan.

3.4.3 Waste Management Facilities

On-site waste facilities will be provided to contain, store and treat solid wastes:

- a waste transfer sorting and storage area
- a landfill for inert solid wastes
- a landfarm for petroleum-contaminated soils (constructed as required)
- an oil-water separator for treatment of petroleum-contaminated snow/ice/water
- incinerators for combustible waste and waste oil

- burn pits for oversized, non-hazardous combustibles
- a domestic sewage treatment system

Wastes will be managed as per the Waste Management Plan. Some wastes may also be transported off-site to municipal or third-party waste management facilities, pending further Project design and discussions with the municipality.

3.4.3.1 Waste Transfer Storage Area

The waste transfer storage area will be established near the process plant/accommodation complex for the handling and temporary storage of wastes. Non-food waste products that are not incinerated or placed in the landfill immediately will be collected, sorted, and placed in designated areas within the storage area. The waste transfer storage area will include a lined pad for the collection of hazardous waste including contaminated soil and snow/ice. Hazardous material that cannot be treated on site will be returned to the suppliers or to a hazardous waste disposal facility. It will be fenced to prevent wildlife from entering and human access will be controlled.

3.4.3.2 Landfill

The active landfill will be located within a combination of completed open pits, small areas of the mine rock piles, TDAs, or overburden stockpiles. Some landfill material may be shipped off site to a licensed facility when required. The landfill will receive inert bulk waste that cannot be recycled or re-used such as conveyor belts, tires, chute liners, and building debris. Incinerator ash from the combustion of kitchen and office waste will go to the landfill.

Landfill waste will be buried to minimize exposure to wind and care will be taken to prevent the presence of wastes that could attract wildlife. The landfill in the mine rock piles will represent a single landfill in operation at any given time, which will be covered and buried as mine rock piles or overburden piles are completed. As the landfill area(s) would be in the WRSFs or overburden piles, any potential runoff and seepage from the landfill area will be contained within the Project site.

3.4.3.3 Landfarm

A landfarm for the bioremediation of hydrocarbon contaminated solids from spills may be constructed. This dyke bounded cell would be located adjacent to the fuel storage area and would consist of an arctic geo-membrane liner placed under fill material. Hydrocarbon-contaminated soils would be placed in the landfarm and spread during summer months. Any soil that has subsequently reached acceptable levels of hydrocarbon degradation would be removed and reused or transferred to the landfill. Details will be provided in the Waste Management Plan.

Arctic conditions may impede the remediation of contaminated soil through natural microbiological processes. If remediation of hydrocarbon-contaminated soils in the landfarm proves to be ineffective and no other remediation system has proved effective in northern climates, the contaminated soils will be collected and shipped to suitable licensed disposal facilities.

3.4.3.4 Incinerators

Two dual-chamber, diesel-fired incinerators will be provided for the incineration of combustible waste, including kitchen waste. The incinerators can also be used to burn waste oil. Incinerator ash will be collected in sealed, wildlife-resistant containers and, if non-hazardous, transported to the landfill. Hazardous ash will be sent to a hazardous waste disposal facility.

Each modular unit will be pre-assembled and will be housed in a pre-engineered module accessible from the accommodation complex or the waste management transfer storage area. The facility will be capable of meeting the demand of the construction workforce housed in the construction camp. The transport of waste to nearby landfill sites for disposal is also an option if required. Currently, removal of some combustible wastes to an off-site facility is also being considered to limit the amount of waste incinerated at the Project.

3.4.3.5 Domestic Sewage Treatment Plant

A sewage treatment system to handle a peak load of up to 500 people will be provided as part of initial construction. Treated domestic effluent will be discharged to the septic field or discharged to the environment, such as an unused pit or wetland, if it meets effluent criteria. If may also be shipped off-site if required. Sewage sludge will be dewatered and incinerated on-site or transported to a licensed facility.

3.5 Buildings and Infrastructure

3.5.1 Process Plant

The process plant and proposed infrastructure is expected to be sited in the same area as the historical Cominco process plant complex. Existing infrastructure from the historical operations that are planned to be reused for the Project include:

- water ponds (2) for water management once rehabilitated
- building pads for the process plant and the camp complex foundations
- open pits near the process plant to be used for tailings disposal and water management

The process plant will consist of four main areas:

- primary crusher dump building: 8.2 m wide by 18.2 m long with a height of 12 m
- crusher building: 35.4 m wide by 45 m long with a height of 41 m
- mineral sorting and screening building: 36 m wide by 36 m long with a height of 41 m
- process building: total of 176 m long with heights adapted for three sections (grinding 28 m, tailings area 19 m, concentrate filtering and load-out area 22 m). The main building will have a width of 36 m, except for the concentrate filtering and load-out area where the width will be reduced to 22 m. It will also include allocated space for the process services such as an electrical room (7 m wide by 16 m long with a height of 5 m), lab (122 m^2 surface area with a height of 5 m), mechanical shop, and HVAC.

The primary crusher building will contain the vibrating grizzly feeder with the jaw crusher. Added to this building, there will be a light shelter for truck discharge. This area will contain an overhead crane with enough capacity to lift the heaviest crusher parts. The secondary and tertiary crusher will be housed in the crusher building as well as the fine mineralized material bin.

The mineral sorting and screening building will contain the mineral sorters and the vibrating screens of the crushing circuit. Both buildings will contain an overhead crane with enough capacity to lift the heaviest equipment parts.

The reagent preparation area and concentrate thickeners will be in the process building. The tailings thickener will be outside of the process building.

3.5.2 Gate House, Parking, Weigh Scale

The gate house modular building and parking lot will be installed on the existing access road between Highway 6 and the process plant area. This area will have a gravel surface surrounded by a perimeter fence to control access to the process plant site.

All site security cameras and alarms (e.g., fire, safety shower) will be available to the gate keeper.

A 100-ton truck scale with remote monitoring system will allow to gather information on incoming delivery trucks and outcoming concentrator transportation trucks.

3.5.3 Truck Shop, Warehouse, and Laydown Area

The maintenance truck shop will include four maintenance bays and one wash bay. A central lubrication and fluid distribution and an oil recuperation system will be installed.

The warehouse will be an insulated steel frame, fabric-covered building located near the truck shop (24 m x 40 m). Another steel frame, fabric-covered building will be dedicated for emergency vehicles.

A laydown area will be constructed adjacent to the plant site to accommodate outdoor storage of equipment and supplies during construction and operations.

3.5.4 Administrative and Dry Building

As part of the camp complex, the administrative and dry building will include washroom facilities, work clothes storage, a separated men and women changing rooms and laundry facilities, if required. A dedicated ventilation and dehumidifier system will be installed to allow proper drying of clothing.

3.5.5 Camp

The workers accommodation camp will be connected to the process plant site concentrator, truck shop and administration offices. The camp will comprise dormitory rooms with central washrooms, kitchen, HVAC systems, cafeteria, entertainment areas, laundry areas, gymnasiums/fitness rooms, fire protection systems, potable water treatment plant, sewage treatment system, telecommunications systems, and an electrical substation and distribution system. It will be used during the construction phase and refurbished where necessary for the operations phase of the Project. At this stage, for operations, the camp is planned to accommodate approximately 230 to 250 workers (230 to 250 workers on rotation for a total of 456 to 550 workers). A temporary camp will provide accommodation for an additional 250 to 270 people on site per rotation during the construction phase.

Portable buildings are planned to be used while operating in more remote areas such as the W1 Area west of the Buffalo River. The Portable buildings will allow for re-location to other remote areas to meet the varying needs of the Project. The Portable buildings will consist of offices, lunchroom, mine dry, supply and storage areas. Supporting infrastructure (located near the mine portals) will be a garage (fold-away), shipping containers for storage, mine ventilation and heating system, air compressors, fuel storage and distribution area, air compressors, generators,

electrical distribution system, including a mobile substation and switching gear, for underground and surface facilities, and a communications system.

An exploration camp has been in place since 2018 that is permitted to accommodate up to 49 persons This camp is expected to remain in place to support flexibility in ongoing exploration activities.

3.5.6 Site and Access Roads

The main access to the Project site is via Highway 6. The expected traffic to and from the Project consists of the transportation of employees, shipment of concentrates, as well as transportation of equipment and supplies as required to support the construction and operations of the mine, process plant, and camp facilities. The main haul roads within the site will require rehabilitation work to suit Project needs; however, the existing 100 km of haul roads and service roads provides good access to a considerable portion of the site. New site roads are expected to required for access to some areas. The next study will determine the need and location for new onsite roads.

Construction equipment and supplies will be delivered to the site by rail or truck transport to Hay River and then by truck or barge from Hay River to the Project site. A barge may be required for some larger components because of limitations (physical dimensions and weight restrictions) of the bridges on both the Hay and Buffalo rivers.

PPML will work with the GNWT to troubleshoot “oversized” equipment delivery to the Project site. Delivery alternatives for the oversized components include specialized helicopter ferrying, winter ice road crossings of the two rivers, winter ice road from Hay River rail terminal across Great Slave Lake to the site and the use of barges on Great Slave Lake during the open water season to Dawson’s Landing. If the barge option is chosen, a haul road to the landing to facilitate overland delivery of the components to the process plant site will be constructed, to the extent, possible along existing road allowances.

3.5.7 Explosive Storage

Explosive storage for the Project will consist of the following four main components:

- bulk ammonium nitrate storage
- bulk emulsion storage and emulsion plant facility
- explosives storage magazines
- possible off-site preparation of emulsion particularly in the early and final years of operations.

Bulk ammonium nitrate and bulk emulsion for drill and blasting purposes will be shipped to site and stored in silos. Packaged explosives and explosive detonators will be stored in approved explosives magazines located on separate pads. The design of all storage facilities will meet government regulations and will be located according to required separation distances as regulated by the Explosives Regulatory Division of Natural Resources Canada. The final location of the explosive’s storage site will be determined as part of future studies. Explosives will be transported to site by trucks on an as-required basis.

3.5.8 Fuel and Hazardous Materials

The mining operation will use various hazardous materials including diesel, gasoline, lubricating and waste oil, antifreeze/glycol and propane, as required for heavy equipment operation, heating,

back-up power generation and small vehicles. The processing operation will use chemical reagents in the processing plant as described in Table 3-2. All chemicals and fuels will be brought to site by trucks and will be stored in a secured area with adequate secondary containment. The Spill Contingency Plan will document mitigation to reduce the likelihood of spills and document spill response measures. Hazardous waste will be stored on-site in a secure area and removed by a suitably licenced hazardous waste handler for proper disposal at a licenced facility (see the Waste Management Plan).

On-site fuel storage will include secondary containment as required by *Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations* (SOR/2008-197) and accompanying Code of Practice (CCME 2015). Fuel dispensing equipment for mining, process plant services, and freight vehicles will be located adjacent to the fuel tank containment area and the fueling area will drain into the containment area.

3.6 Traffic / Transportation

3.6.1 Primary Site Access

The Project site is easily accessible via Highway 6, a paved road that is maintained 365 days a year. The use of existing historic haul roads and exploration cut lines will be maximized whenever possible to minimize the need for additional ground disturbance. Waste rock from historical and proposed mining activities may be used for road construction if geochemical testing demonstrates that it can be used as construction material.

3.6.2 Employee Transportation

Workers will be transported to and from the Project site by a variety of means, including buses, small vans, and private vehicles. Transportation from local communities to the site will be available when required. Every effort will be made to recruit locally, taking advantage of the current forecasted decrease in diamond mining; however, PPML anticipates that part of the workforce may come from locations that will require flying to Hay River and then connecting with surface transport to site.

3.6.3 Concentrate Transportation

There is no zinc or lead smelter located in the NWT. Several alternatives are available for transporting the mineral concentrates to smelter facilities outside the territory. The most practical and cost-effective transportation option is to use the existing rail line transload facilities near Hay River or Enterprise communities.

Alternatives eliminated include the extension of the rail line to Pine Point and the construction of a transload facility at Polar Lake due to the cost of constructing new rail bridges over the Hay and Buffalo rivers.

Concentrates will be hauled from the site to an existing rail yard (Hay River or Enterprise) using long-haul trailer trucks on the public highway. The capacity and the condition of the existing bridges over Hay River and Buffalo River will be assessed during the next engineering study. Alternative types of long-haul equipment will be evaluated, including double trailers or single trailers. Loads will not exceed 53.5 tonnes, as per NWT regulations. It is currently estimated that there will be approximately 10 to 15 round trips per day to transport the ore concentrate to the rail yard transloading facility.

To eliminate the chance of wind-borne dispersal of concentrate along the highway corridor, alternatives available for the loading of concentrate onto the trucks at the process plant and stored at the rail yard, include:

- bagged concentrate
- bulk transport in trucks with a tarp cover, loaded at the process plant, and transferred directly to rail cars

3.7 Equipment

Mobile equipment that will be used during the construction and operation phases of the Project include:

- Pickup trucks
- Bolters
- Haul trucks (100t, 20-45t)
- Power shovels
- End dumps (LHDs)
- Excavators
- Dozers (tracked and rubber tire)
- Loaders
- Compressors
- Rock drills (diamond, rotary, percussion for underground and surface), track and skid mounted
- Water well drills, tracked and rubber tire.
- Jumbos
- Graders
- Compactors
- Skid steers
- Cranes/boom lifts various capacities
- Light towers/mobile generators

Ancillary equipment for construction and operation is expected to include:

- Welding service trucks
- Picker trucks
- Skidders
- Flat deck trailers and trucks
- Scissor neck trailer
- Personnel transport (e.g., buses)
- Rock slingers
- Cement truck
- Roll off truck
- Heat van (2T)
- Fuel trucks
- Water trucks
- Sanding trucks
- Shipping containers (storage and workshops)
- Lube service trucks
- Tire handlers
- Spare parts/service truck
- Emulsion delivery truck
- Ambulance
- Fire truck
- Pipe fusing machines
- Portable heaters
- Mobile crushing and screening plant
- Mobile pumps including sump pumps
- Mobile generators (Diesel and Compressed Natural Gas)
- Piping (various sizes and lengths)
- ATVs (winter and summer), including side-by-sides

The equipment used in many cases will be in various sizes and capacities.

3.8 Power

Power requirements to operate the pre-concentration, dewatering and concentrator facilities comprises the bulk of the electrical demand for the Project. At full capacity, the Project could use up to approximately 25 megawatts (MW) of electrical power. Some of that demand can be supplied by the current electrical production from the Taltson Hydro Dam. Additional power will be required as soon as the process plant comes online.

A local power generation strategy for the project has been developed with the goal of maintaining mining operations throughout the year. Preliminary discussions were held with the Northwest Territories Power Corporation (NTPC), the owner/operator of the Taltson facility, to gauge their interest and ability to expand capacity for the Project. The power required for the site will therefore be a combination of NTPC supplied power and local power production from compressed natural gas (CNG).

The available power from the NTPC will be mainly used for fixed installations, such as the process plant and camp, while the local power production equipment will be dedicated to mining operations (dewatering and ventilation) and will move according to pits and underground mines that are in production.

3.8.1.1 Project Power Demand

The total power demand varies over the years of operation (Table 3-4).

Table 3-4: Site Power Demand

Year		2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Area	**Description**	**Average power demand (MW)**									
200	Underground Mine	2.40	5.00	5.20	3.45	0.85	1.20	1.00	0.35		
300	Open-pit Mine	5.40	5.75	7.50	5.25	4.75	4.30	2.75	3.50	3.15	0.95
500	Site Infrastructure	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
600	Process plant	10.75	10.75	10.75	10.75	10.75	10.75	10.75	10.75	10.75	10.75
	Total power demand (MW)	**19.38**	**22.33**	**24.28**	**20.28**	**17.18**	**17.08**	**16.08**	**15.43**	**14.73**	**12.53**

3.8.1.2 NTPC Network

NTPC supplies power to South Slave region of the NWT via the Taltson Hydro Dam. The Taltson facility was brought online in 1965 to supply power to the original Cominco facilities at Pine Point, which closed in 1988, and to the town of Fort Smith, NWT. The facility now supplies power to the towns of Hay River, Fort Smith, Fort Resolution, and Enterprise. The dam complex currently has an 18.5 MW capacity with a forecasted capacity increase of 4 MW (power upgrade scheduled to be completed in 2022 at the Taltson Generation Station). Of that, 9 MW will be unused and available for PPML during the winter months (October to March) and 12 MW unused and available during the summer months (April to September). Energy cost provided by the NTPC is $0.12 per kilowatt hour (kwh) and due to the relatively low-cost energy, power supply from NTPC is favoured over on-site power generation.

3.8.1.3 On-site Power Generation

On-site power generation will be primarily required for mining operations located too far from the existing NTPC substation. After establishing the loads required for dewatering and ventilation for the open pits and underground operations, discussions were held with various suppliers to identify the best economical power supply solution.

The Project will seek to benefit from an existing CNG delivery network (virtual pipeline) for industrial clients sourced out of Alberta. This network can supply the southern area of the NWT through an existing public road network. A supply contract would be established with a local CNG provider to source, transport, and transform the natural gas on-site for local generator use.

On-site power generation will consist of two types: a stationary power plant to supplement power supply for the fixed installations, and a fleet of mobile generators to support underground and open-pit mining operations. Each of these power generation setups are intended to be under a rental contract with a local supplier, which will also include the main electrical equipment to interconnect with the local distribution network.

3.8.1.4 Stationary Power Plants

There will be two stationary power plant setups: one for the process plant and nearby dewatering activities, and another to service the five underground mines located in the West Zone of the Project. The stationary power plant located near the NTPC substation and process plant will include heat recovery to help heat adjacent infrastructure. The main purpose of this power plant will be to supply supplemental power that is unavailable from NTPC. The power plant will also provide redundancy for the network. The current load demand would require an installed power plant capacity of 3.9 MW, which would consist of three 1.3 MW modular units installed in tandem with a stationary Pressure Reduction System (PRS) to receive CNG trailer deliveries.

Another stationary power plant located near the underground mines in the W1 Area will be installed. The power plant capacity will be scaled on an annual basis according to the power needs aligned with the forecasted loads shown in Table 3-4. This plant will include up to six 1.3 MW modular units installed in tandem with a stationary PRS to receive CNG trailer deliveries. The plant will also include heat recovery systems to preheat the ventilated air for the underground mine.

3.8.1.5 Mobile Genset Fleet

A fleet of mobile gensets will be rented from the same local supplier as the stationary power plant and will be used to service the multiple open-pit mines throughout the site. As open pits will constantly be opened and closed throughout the mine life, a mobile genset fleet concept will give PPML the flexibility to relocate gensets as needed.

The fleet will consist of multiple natural gas generator packages installed on mobile trailers that can be relocated and interconnected at any required location. Depending on which pit or cluster of nearby pits are being mined, a set of mobile trailers will be locally mobilized to service nearby dewatering needs. Each mobilization will include a local electrical distribution and a trailer mounted PRS able to receive CNG transport trailers.

To minimize costs, given the fluctuating power needs over time (power demand expected between 950 to 7,500 kilowatts (kW), the quantity of rented mobile gensets will vary from month-to-month. The intent being to best match the expected power generation requirements and therefore avoid unnecessarily mobilizing too large a fleet. Generator sizes for the individual mobile

trailers will be optimized with the local supplier to identify the best fit that minimizes mobilization and demobilization efforts.

3.8.1.6 Site Distribution

As the NTPC currently owns and operates an electrical substation (138 - 12.5 kilovolts [kV]) located near the historical Pine Point infrastructure, it was agreed with NTPC that the electricity required for the site would be available at 12.5 kV from two existing main breakers. From the NTPC substation, two full capacity interconnections have been identified between the existing substation and the process plant, which will provide reliability and flexibility for maintenance.

Inside the process plant, a main electrical room including main 12.5 kV switchgears, 600 Volt (V) transformers, and motor control centres have been planned. The main switchgear will distribute power throughout the concentrator building. An allocation for electrical distribution to the camp and other service buildings has also been included. Local distribution at the underground mines and open pits will be constructed at a capacity of 12.5 kV.

The site currently has power distribution lines that are being used to serve power to nearby communities. The Project does not plan on using or modifying this infrastructure and intends to keep the Project's infrastructure independent.

3.8.1.7 Emergency Power

Critical loads, such as the concentrator, pumping stations, and camp, will include local emergency diesel power generators if the main power from NTPC is offline. The emergency system will be optimized so that the generation capacity is adequate. For mining operations additional emergency diesel power generators have not been planned at this stage.

3.9 Water and Water Management Infrastructure

The Mine Water Management Plan includes all water uses, sources, and discharges throughout construction, operation, and closure and reclamation. The infrastructure that will be required to manage the water remains to be designed, but the main components that are expected to be needed during construction and operation are described below.

Water management during closure and reclamation is described in Section 5.0 - Closure and Reclamation.

3.9.1 Construction

Water use during construction will primarily be for manufacturing concrete, dust suppression, and camp services (toilets, showers, and kitchen). Water management will also include the capture and containment of surface runoff. The existing network of drainage ditches will be used and maintained when consistent with Project activities. As needed, construction water management may also include stormwater collection ponds to manage runoff and dry sumps to provide emergency spill containment.

3.9.2 Operation

Water use during operation will include processing, production drilling, emulsion mixing, dust suppression, vehicle cleaning at the maintenance facility and camp services (toilets, showers, and kitchen). Water management during operations will include mine dewatering (open pits and underground), water in tailings, surface runoff and stormwater management. Infrastructure from construction will still be used as appropriate. As needed, there may be construction of additional stormwater ponds to manage runoff, dry sumps to provide emergency spill containment, and cut and fill to create pads for structures and laydown purposes (Figure 3-7).

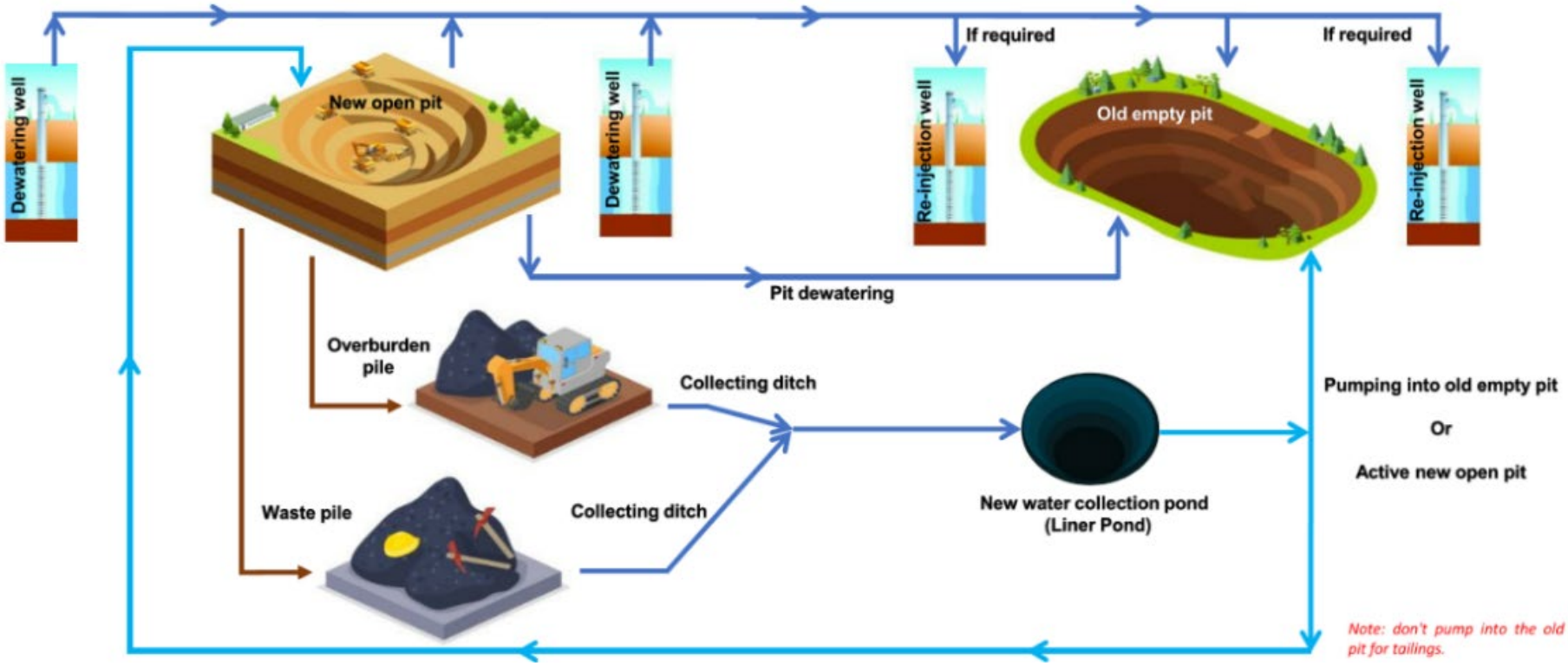


Figure 3-7: Water Management Overview

Historical open-pit capacity to store water was considered in the process of identifying preferred alternatives for water management. The mine dewatering and reclaim water systems will be constructed as the Project evolves, based on each production zone and tailings management requirements. Equipment and facilities proposed includes multiple pumps, pumping stations, injection wells, and pipelines for water recirculation and reclaim. Similar to other Project infrastructure, water management structures will be built on existing disturbed lands where possible and efforts will be made to relocate and/or re-use the existing dewatering equipment when feasible.

Re-injection wells are being evaluated as a method to dispose of groundwater that infiltrates open pits and underground mines where existing or proposed pits are not available or have insufficient capacity. The injection wells will be used to return the groundwater to the existing underground aquifer.

All sewage from the office, camp and other remote locations will be sent to a septic system or an alternative treatment plant and then discharged to the environment.

During operation, water will be stored in existing pits, which may include excess water from tailings, mine dewatering, dust suppression, and drainage systems from the vehicle and machinery maintenance facilities. As part of the ongoing design of water management for the Project, a water balance will be developed to understand how to manage the capacity of existing pits.

The maximum daily water use during operation, the water supply sources, the location of the water management infrastructure, and potential mine water discharge location(s), if required, will be evaluated and will be determined during the feasibility study design process. If operational mine water discharge is required, environmental studies will be conducted to evaluate potential effects of the discharge.

3.9.3 Mine Water

Studies are ongoing to assess the extent of mine dewatering required for both the open pit and underground operations. During mining operations, it will be necessary to manage groundwater infiltration, stormwater, and meltwater from within each operating area and have developed procedures and alternatives for managing water that does not meet environmental effluent discharge criteria.

3.9.4 Process Water

The water requirements for the process plant is divided into two main areas: freshwater and process water. Freshwater will be sourced from Great Slave Lake and used for reagent preparation, gland seal water, and stored for helping to extinguish a possible fire. The freshwater requirement for the process plant is estimated at 42 m^3/h or approximately 1,000 m^3/day.

Process water for start-up could be pumped to the process plant from historical open pits if the water quality is suitable. Sources for start-up water being evaluated include historical open pits T37, I46, and J44. To the extent practicable, once in operation, water required by the processing plant will be provided through recycling and re-use of the concentrator process water, including decant water from tailings thickener and TDAs overflow management, collected runoff, and mine water.

The process water is used throughout the process plant and is collected from thickener overflows. Effluent from the process plant that cannot be reclaimed may be pumped to historical open pits if capacity and water quality are determined to be suitable. The total amount of process water recirculating in the process plant is estimated to be 1,021 m^3/h.

Two historical ponds are located 3 km south of the former Cominco operation site. These ponds will be rehabilitated and used to store reclaim water from the TDA and runoff from the process plant site. Water from these ponds will also be used for the process plant. It is estimated that the ponds have a capacity of 40,000 m^3 each.

Reclaim water is brought back to the plant in a high-density polyethylene (HDPE) pipeline installed next to the tailings line.

3.9.5 Surface Water Runoff Management

Surface water management infrastructure at the Pine Point site includes the following:

- perimeter wells for pit water management and in-pit sumps and pumping equipment for runoff water management
- ditches and collection ponds for WRSF and overburden stockpiles
- two rehabilitated water collection ponds for storing reclaim and process water surplus

3.9.6 Waste Rock Storage Facilities and Overburden Stockpiles

Waste rock and overburden disposal strategy consists of building WRSFs and overburden stockpiles. Contact water from the WRSF and overburden stockpiles will be collected and directed to the collection ponds via a network of perimeter collection ditches.

Submersible pumps installed on floaters will be used to pump out the content of the collection ponds. Pit runoff and contact water from neighbouring WRSF or overburden stockpiles will be combined and sent to a receiving pit in the proximity. In some areas no piles are planned and runoff collected in the development of the open pits will be the only contact water to be transferred to the receiving open pit. When required, a booster pumping station will be added for water transfer to the process plant. In isolated cases where no receiving pit is available at close range, contact water will be reinjected via boreholes. Whenever possible, collection pond pumps, booster pumping stations, and piping are assumed to service the next developed area once a pond is rehabilitated. There will be no direct discharge of contact water from the WRSF and overburden stockpiles to the environment, as water collected will be directed to the nearest historical open pit.

3.9.7 Dewatering

Mine dewatering requirements and methods are also being evaluated based on past experience and studies. Dewatering methods are anticipated to be variable for each zone based on the site conditions. In contrast, the shallow open pits in the East Mill Zone area will be relatively dry except for surface water inflow.

3.9.7.1 Open Pit Dewatering

Groundwater levels are lowered using 180 m^3/h, 150 hp submersible pumps installed into multiple 400 mm diameter boreholes prior to open-pit mining. The groundwater is pumped into historical mined-out pits or wells located in the vicinity to be reinjected into the aquifer. The dewatering

requirements for each pit in terms of borehole quantities and water flows have been established by TetraTech (TetraTech 2020). For each submersible pump, HDPE piping (300 mm diameter DR11) is installed to reach the nearby booster pump station.

The centrifuge pumps are all the same models with an 1,875 m^3/h capacity and a 500 hp motor. For each booster pump, 5,000 m of HDPE piping (660 mm diameter DR17) is installed for reinjection into the aquifer far enough away to avoid repumping the same water. The number of booster pumps varies between one and three per open pit. In accordance with the mine production schedule, the submersible pumps, booster pumping stations, and piping are planned to be relocated to another pit once an open pit is no longer in operation. For the 47 open pits, 16 pumps are required. Overall, eight different pump models are being considered with motor powers ranging from 10 hp to 200 hp.

Rainwater accumulation at the bottom of the open pits will be pumped out using centrifugal diesel pumps mobile systems. Rainwater collected from adjacent operating pits is pumped to a common booster pump located on surface that transfers this water to a nearby receiving pit (either directly or combined with waste rock and overburden runoff). The pumps' head is calculated based on the pits' elevation data and approximate location of the booster pumps.

3.9.7.2 Underground Dewatering

Similar to open pits, dewatering requirements for the underground workings have been established by TetraTech (TetraTech 2020). The same pumping strategy with submersible pumps in boreholes, booster pumping stations transferring the groundwater to previously mined open-pits or reinjected into the aquifer via boreholes is used, as well as the relocation of equipment to the next deposit when a mine is no longer in operation.

However, the underground workings located West of the Buffalo River will require groundwater control (grouting) prior to dewatering. In contrast, some underground workings in the Central Area are expected to be fully or partially dewatered by drawdown from dewatering nearby open pits. The wells will be built in the same manner as for the open pits but will use 400 hp pumps.

3.9.8 Tailings and Reclaim Water Management

Tailings from the processing plant are pumped into historical and mined-out open pits (TDAs) (Figure 3-8) via HDPE pipelines. Over the life of the Project, the pipeline network will be expanded to reach the seven pits that have been identified for tailings storage (Figure 3-7). Thus, no surface tailings storage facility is required for the Project. To deposit tailings at the farthest distance from the processing plant, a booster pump station will be required.

Reclaim water is brought back to the process plant in a HDPE pipeline installed next to the tailings line. Submersible pumps (200 hp) installed on floaters are used to pump back reclaim water from TDA until pits have been fully filled. The distance between the TDA and the process plant varies from 2 km to 14 km. No booster pumps are required for the reclaim water.

Along with the piping, pumping stations will be moved to the next TDA once operations are completed in one location. Three or more reclaim water pumping stations will be required for the Project.

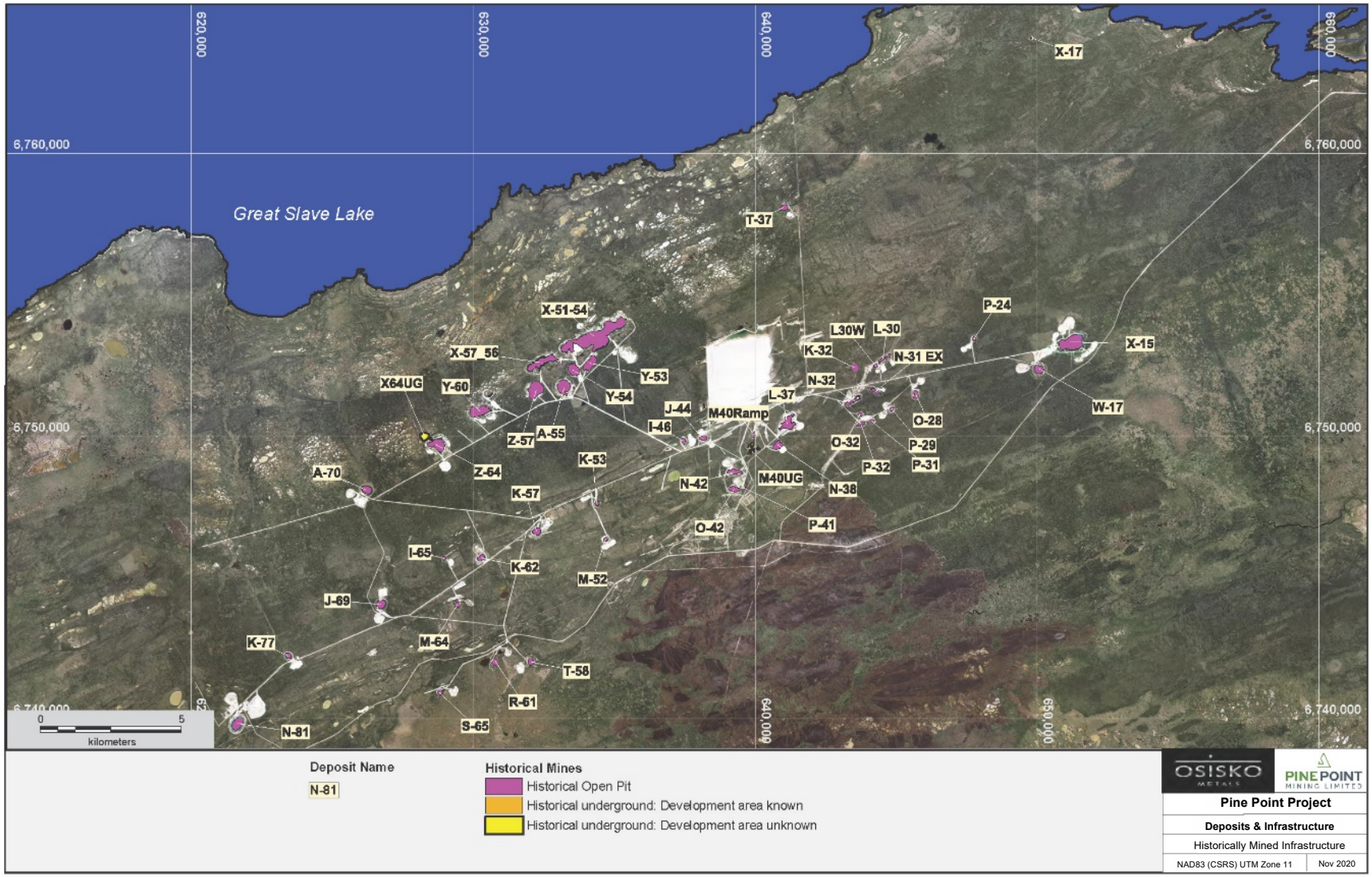


Figure 3-8: Historical and Mined-out Open Pits

3.9.9 Freshwater Requirements

The source of freshwater for non-human consumption will be investigated during field studies. The most likely source of freshwater will be Great Slave Lake, however other possible sources of freshwater include existing pits, existing water storage lagoons at the old town site, and groundwater at or near the camp. Based upon Cominco's experience, the groundwater may not be suitable for human consumption because of problems with taste, odour, and chemical content. If there are taste or human health issues due to hydrogen sulphide or other contaminants that cannot be easily managed through simple treatment to address taste and/or quality issues, then freshwater will be sourced from Great Slave Lake.

Domestic water will be required for human consumption, showers, laundry, and cooking. The total quantity needed will depend upon the capacity of the camp facility and will be further refined during the next study. The most likely source of potable water for the camp be through restoring/reusing the water system that Cominco used (i.e., piping water from Great Slave Lake into storage lagoons).

3.9.10 Water Balance

The volume of water generated by a rainfall event and/or snowmelt over the process plant site sub-watershed as well as direct precipitation on the sedimentation pond area was determined by performing a preliminary simulation with PCSWMM software. A simple mass balance was then performed to establish the relationship between inflows of water, sedimentation ponds capacity, volumes of water required to feed the process plant, and the water reclaim volume from the TDA. Assumptions using available information were made in terms of the water quality. Water quality modelling will be undertaken to support future engineering studies.

3.10 Monitoring and Management Programs and Plans

PPML has drafted environmental management and monitoring plan frameworks to support the Mackenzie Valley Environmental Impact Review Board EA Initiation Package for the Project. Updated plans will be developed during the permitting phase of the Project and will incorporate additional information based on ongoing Project design and the results of the environmental assessment, as well as relevant feedback from communities and regulators, including commitments made by PPML during the environmental assessment review process.

The frameworks were developed based on relevant guidance from regulators and administrative bodies in the NWT, including the following:

- Engagement and Consultation Policy (LWBMV 2018a)
- Engagement Guidelines for Applicants and Holders of Water Licences and Land Use Permits (LWBMV 2018b)
- Guidelines for Spill Contingency Planning (INAC 2007)
- Water and Effluent Quality Management Policy (MVLWB 2011a)
- Guidelines for Developing a Waste Management Plan (MVLWB 2011b)
- Guidelines for the Closure and Reclamation of Advanced Mineral Exploration and Mine Sites in the Northwest Territories (MVLWB and AANDC 2013)
- Wildlife Management and Monitoring Plan Guidelines (GNWT-ENR 2019).

- Guidelines for Aquatic Effects Monitoring Programs (MVLWB and GNWT 2019)
- Guidelines for Adaptive Management - a Response Framework for Aquatic Effects Monitoring (WLWB 2010)
- Draft Guidelines for Developing Baseline Water Quality Monitoring Programs in the Northwest Territories (MVLWB 2018)

Each of the plans will continue to undergo periodic review and amendment according to current circumstances and in accordance with the principles of adaptive management. Many of the plans are requirements of the Water Licence and as such, will be subject to the public review and approval process conducted by the MVLWB.

3.10.1 Engagement and Collaboration Plan

Engagement with Potentially Affected Parties (i.e., Indigenous groups and governments, communities, the territorial and federal government, regulators, and the general public) will represent a key aspect of Project planning and development. Indigenous Traditional Knowledge obtained through the engagement process will help to inform mitigations, the Project design, and the assessment of the effects from the Project.

The Engagement and Collaboration Framework describes past engagement on the Project as well as engagement activities that PPML proposes to undertake during the early engagement phase of the Project. Engagement activities beyond those proposed for the early engagement phase will be proposed and discussed with relevant Potentially Affected Parties as the Project advances following submission of the EA Initiation Package. The Engagement and Collaboration Framework describes the following:

- engagement principles and goals
- engagement to date
- identification of Potentially Affected Parties
- methods of engagement
- engagement process and milestones
- incorporation of Indigenous Traditional Knowledge
- record of engagement

The Engagement and Collaboration Framework is a living document to be updated based on feedback from communities and other stakeholders. As engagement activities unfold, planned engagement activities will be modified based on input regarding preferred methods and timing of engagement.

3.10.2 Spill Contingency Plan

The purpose of the Spill Contingency Plan is to provide policies and procedures to all site personnel in the event of an accidental release of fuel or other materials from the Project. The Spill Contingency Plan provides the protocols for personnel to follow in response to a spill. The objectives of the Spill Contingency Plan are to provide references to other approvals, relevant

standards, control plans and procedures for training, communications, investigation, corrective action, and audit that are required under the Project Agreement.

Subsequent versions of the Spill Contingency Plan will provide additional information related to the following:

- list of hazardous materials
- spill response procedures
- reporting
- equipment and resource inventory
- training and exercises

3.10.3 Erosion and Sediment Control Plan

The purpose of the Erosion and Sediment Control Plan will be to provide construction and operations personnel with principles and procedures for mitigating erosion potential from activities related to the construction and operation of the Project. Erosion and sedimentation are naturally occurring processes of loosening and transporting soil through the action of wind, water, or ice, and the subsequent transport and deposition of sediment particles. Construction and operation activities can result in increased erosion and sedimentation where soil surfaces are exposed to rainfall or snowmelt and runoff, or wind erosion and aerial sediment transport.

The Erosion and Sediment Control Plan framework outlines best management practices that will be considered and applied as appropriate during the Project, and describes inspections, maintenance, and reporting. As additional design details are available, future versions will include information on locations where the land disturbance will occur in critical areas, in relation to the need for sediment and erosion control measures, and more information on best management practices and site-specific erosion and sediment control measures.

3.10.4 Mine Water Management Plan

The overall objective of the Mine Water Management Plan will be to detail water management activities for the Project throughout all Project stages (i.e., construction, operation, closure, and post-closure). The Mine Water Management Plan framework is intended to provide a preliminary outline of approaches to managing water flow into, out from, and within the Project footprint.

The objectives of water management are to enable safe and timely mining operations at the Project, while minimizing adverse effects to the aquatic receiving environment in terms of water quantity, water quality, and aquatic life. The Mine Water Management Plan framework outlines objectives and strategies, provides definitions, and describes water management facilities.

Subsequent versions of the Mine Water Management Plan will provide additional information related to the following:

- details on water management during construction, operation, closure, and post-closure
- design of water management infrastructure
- water balance
- monitoring

- contingencies and adaptive management

3.10.5 Waste Management Plan

The waste management practices that PPML will apply during Project activities are described in Waste Management Plan, which provides policies and procedures to effectively manage waste streams. The goals of the Waste Management Plan are to:

- Identify waste streams and areas for waste reduction or reuse.
- Comply with all regulations, whether federal, territorial, or local.
- Reduce the environmental impact of operations.
- Minimize impacts on land use by other groups.
- Protect aesthetics in the camp area.
- Identify, label, store, and transport all hazardous waste and dispose of at appropriate licensed disposal facilities.

The Waste Management Plan framework outlines the waste stream hierarchy, definitions, monitoring and inspections, and training. The types of waste that may be generated during the Project can be categorized as:

- non-hazardous, non-mineral wastes
- recyclable and reusable material
- non-hazardous, combustible waste
- non-hazardous, non-combustible waste
- hazardous waste
- wastewater

As additional Project details become available, subsequent versions of the Waste Management Plan will include additional details regarding the types of wastes that will be generated by the Project and primary disposal methods.

3.10.6 Tailings and Waste Rock Management Plan

The purpose of the Tailings and Waste Rock Management Plan framework is to address the management of mined waste rock and process plant tailings to limit the generation of acidic drainage and metal leaching. The Tailings and Waste Rock Management Plan provides information on:

- country rock geology
- country rock geochemistry
- waste rock classification
- decision criteria for waste rock storage and use

- waste rock management responsibilities
- tailings disposal

Key objectives of PPML waste rock management include:

- Identifying potentially acid-generating waste rock during mining.
- Directing appropriate use and storage of waste rock types.

PPML strategies to achieve these objectives include:

- Standard Operating Procedures to provide clear identification, segregation, storage, and re-mining procedures.
- Criteria for waste rock used in construction.
- Tracking locations of potentially acid-generating waste rock.

As additional Project details become available, subsequent versions of the Tailings and Waste Rock Management Plan will include additional details regarding the geochemical characterization process, operating procedures, and disposal locations.

3.10.7 Wildlife Protection Plan

The Wildlife Protection Plan framework outlines mitigation that will be implemented to avoid and reduce the Project effects on wildlife and wildlife habitat, and the monitoring actions proposed to understand the effects of the Project on wildlife, test the predictions made during the Developer's Assessment Report, and inform adaptive management. The objectives of the Wildlife Protection Plan framework include the following:

- Document how mitigations will be applied to avoid and minimize effects of the Project construction and operation on wildlife.
- Describe how adaptive management will be applied to wildlife mitigation and monitoring.
- Form part of the engagement with communities, regulatory agencies, and other interested parties in wildlife effects mitigation and monitoring.
- Describe how PPML will meet relevant guidelines and regulatory requirements.

The Wildlife Protection Plan describes wildlife species of concern, potential effects and mitigations, monitoring, reporting, and responsibilities. The proposed monitoring for the Project is expected to include the following:

- Wildlife Sightings Monitoring.
- Wildlife Surveillance Monitoring.
- Bird Nesting and Bat Roosting Monitoring.
- Pre-clearing Monitoring.
- Wildlife Incident Reporting.

Additional information will be included in subsequent versions based on Project design information, the results of the environmental assessment, and feedback from reviewers.

3.10.8 Aquatic Effects Monitoring Program

An Aquatic Effects Monitoring Program (AEMP) is a requirement of a Type A Water Licence. The purpose of the AEMP will be to provide a systematic framework to monitor and assess environmental effects from the Project on surrounding watercourses, and to respond with appropriate actions if or when adverse effects from the Project are identified. The AEMP framework outlines the following:

- Indigenous Traditional Knowledge and engagement
- description of the aquatic environment
- problem formulation (i.e., identification of ecosystems, receptors of potential concern, potential stressors of concern, environmental pathways, preliminary impact hypotheses, and assessment endpoints and measurement indicators)
- AEMP design (monitoring components, study areas, reference areas, sampling design and frequency, and data analysis and interpretation, and quality assurance/quality control)
- methods and analysis for monitored components
- special effects studies
- Response Framework
- reporting

It is anticipated that the following core components of the AEMP will be monitored: hydrology, water quality, benthic invertebrates, and fish. These monitoring components are based on the broad categories of receptors of potential concern in the aquatic ecosystem; however, inclusion of each monitoring component, specifically the benthic invertebrate and fish health components, will be dependent on Project design and the outcome of the environmental assessment.

A Response Framework will be required to meet the requirements of the Water Licence and be approved by the MVLWB. The goal of the Response Framework is to systematically respond to monitoring results such that the potential for significant adverse effects are identified, and mitigation actions are undertaken and confirmed effective to prevent such effects from occurring.

Additional details will be provided in subsequent versions based on updated project design details, the outcome of the environmental assessment, and feedback received through the environmental assessment review process.

3.10.9 Closure and Reclamation Plan

The Closure and Reclamation Plan framework describes the conceptual plan for temporary or permanent closure of the Project. The general purpose of the Closure and Reclamation Plan framework is to demonstrate the satisfactory closure and reclamation of the Project and to describe the likely residual risks to human health and the environment. The closure goal and principles for the areas developed by the Project are reflective of the Guidelines for the Closure

and Reclamation of Advanced Mineral Exploration and Mine Sites in the Northwest Territories (MVLWB and AANDC 2013).

The Closure and Reclamation Plan framework outlines permanent closure and reclamation, progressive reclamation and temporary closure. Conceptual closure options for the Project components (open pits, underground mines, waste rock disposal areas, TDAs, water management system, and support and ancillary infrastructure) are provided under permanent closure. As Project design is advanced and feedback is received from parties, additional information related to the following will be provided in subsequent versions:

- closure objectives and criteria
- selected closure activities, rationale for selection, and associated engineering works
- predicted residual effects, uncertainties, and contingencies
- post-closure monitoring, maintenance, and reporting
- schedule of activities

4 LABOUR FORCE AND HUMAN RESOURCES

4.1 Workforce and Employment

In 2019, 25,785 people were active in the NWT labour force, representing a participation rate of 73.6% of the population aged 15 and over. Of those participating in the labour force, 10.9% are unemployed. Yellowknife's size and concentration of territorial economic and service provision activity creates an environment where participation in the labour force is high (78.9%), and unemployment is low (4.7%). In Hay River and Fort Smith, participation in the labour force (76.5% and 70.0%, respectively) and unemployment rates (6.6% and 10.2%) are in line with territorial averages, reflective of their larger size relative to the other South Slave communities and the greater abundance of economic opportunities (GNWTBS 2019).

Labour force participation rates are slightly lower, but still substantial, in Fort Resolution and Fort Providence (65.9% and 65.0%, respectively); however, the unemployment rate in both communities is high (29.7% and 30.6%, respectively). This reflects a labour market where a large portion of the population aged 15 and over is seeking work, but unable to secure employment. Participation in the labour force is lower on the Hay River Reserve (58.9%), in Dettah (58.8%), Enterprise (55%) and Łutsel K'e (54.2%). With the exception of Enterprise, the unemployment rate in each community is high, suggesting that, as is the case in the larger South Slave communities, securing employment is a challenge for those participating in the labour force due to a lack of opportunities (GNWTBS 2019). It is anticipated that the construction of the concentrator and associated infrastructure will require an average workforce of approximately 280, peaking at 500. During operations, a workforce of approximately 460 people (two shifts of 230 on rotation) will be required. The working schedules will vary depending on the positions and employment status but will likely include a combination of rotation schedules. For safety reasons with 12-hour shifts, employees will stay at the worker accommodation camp. It is anticipated that both construction and mining/processing operations will run on 12-hour shifts.

Nearby communities have labour forces experienced in construction, mining, and industrial development. The Project will benefit from this extensive experience associated with recent mineral exploration and decades of mining activity. Employment opportunities will be provided preferentially to qualified candidates from nearby communities and subsequently to current Territorial residents. It is expected that those communities with which the Project will sign an Impact Benefit Agreement will be prioritized for employment consideration and business opportunities. The Project has already entered into Collaboration Agreements with the Deninu Kųę First Nation and the Northwest Territories Métis Nation (Osisko Metals 2019), and an Exploration Agreement with the K'atl'odeeche First Nation. The Project will include local content development strategies aimed at notifying local communities of employment and business opportunities, including the educational and experience requirements for successful candidates, in advance of construction and operation.

While the hiring of local employees will be a priority, out-of-area employees will likely be required to fill some specialized positions. These employees will fly to Hay River or Fort Smith and be transported to the Project site by vehicle.

Employment opportunities at the Project will include a range of positions from entry-level (e.g., custodial, housekeeping, food service), to semi-skilled (e.g., clerical, administrative), to skilled (e.g., plumbers, welders, mechanics) and professional (e.g., engineers, scientists, planners). Most operational jobs for the Project will be accessible to candidates with a high school diploma and some level of technical or academic training.

As Project planning advances and the understanding of the associated workforce requirements evolves, the composition of the construction and operations workforce will be re-evaluated.

4.2 Training

It is expected that the Project will include programs for on-the-job training and career development for the existing workforce. Such programs will be developed in advance of construction and operation as recommended by the Socio-economic Management Plan (SEMP) that will be developed through the environmental assessment process. The SEMP will also identify the community investment priorities of the Project, which typically include investment in education programs, infrastructure and initiatives, with an aim of enhancing the local labour force's ability to take up Project employment and participate in contracting opportunities. An employee and family assistance program will be outlined in the SEMP, and will address topics such as career planning, employee counselling, family support, and transition planning. Workplace policies and programs including worker codes of conduct, workplace safety programs, and cultural awareness training programs will be developed. Benefit measures will be developed through the socio-economic assessment of the Project and will be included in the SEMP.

5 CLOSURE AND RECLAMATION

Details on closure activities are being developed as part of the design work. The design will provide for progressive reclamation and design for closure where possible. Closure activities are expected to include demolition, removal and disposal, reclamation and remediation of any infrastructure developed or used by the Project. This will include the demolition of buildings developed by PPML, removal of all temporary structures and equipment, grading any pits that may have been filled with waste rock and conducting the required post-closure environmental

monitoring related to the Project. The site will be closed in accordance with all applicable legislative requirements.

Progressive reclamation will be carried out whenever possible. Material generated from site preparation, such as the stripping of overburden and waste rock mining, will be stockpiled at locations to be used for reclamation and closure.

The Project is located on a brownfield site resulting from Cominco's historical mining, milling, and working accommodation activities. Currently, the remaining railway bed is a federally listed contaminated site (Site 00024168 - Pine Point Railbed) which is Active and listed as "high priority for action", requiring remediation/risk management. Site 00023778 - COMINCO PIT N - 32 PINE POINT is listed as "closed", requiring no historical review. The historical tailings impoundment for the Pine Point Mine is undergoing closure activities by Teck Metals, who holds a Land Use Permit (MV2019X0006) for the purposes of water treatment, site maintenance, and geotechnical and environmental investigations at the Pine Point Tailings Impoundment Area.

As such, closure and reclamation planning is only being conducted for components, facilities, and infrastructure directly associated with the Project and not for activities or monitoring associated with historical mining activities at or near the Project. Closure and reclamation planning is limited to construction camps, access roads, open pits, underground mine portals, overburden stockpiles, waste rock piles, TDAs, water management infrastructure, and plant site constructed or used as part of the Project.

A Closure and Reclamation Plan framework has been developed to support the EA Initiation Package for the Project. An updated Closure and Reclamation Plan will be developed during the permitting phase of the Project, or potentially earlier if required, based on feedback through the environmental assessment process. An updated Closure and Reclamation Plan will be submitted to the MVLWB to support the Water Licence and Land Use Permit application for the Project. PPML also expects that an Interim Closure and Reclamation Plan will be developed upon receipt of the Water Licence and Land Use Permit which will include additional details to meet the requirements of the *Guidelines for the Closure and Reclamation of Advanced Mineral Exploration and Mine Sites in the Northwest Territories* (Closure Guidelines; MVLWB and AANDC 2013) as well as engagement.

A preliminary schedule for the Project, including closure and reclamation, is provided in Section 1.1.5. Additional details on the schedule of closure and reclamation activities, including post-closure monitoring, will be developed as the Project design progresses.

5.1 Closure Goal, Principles, and Objectives

The closure goal for the Project is similar to that shown in the Closure Guidelines (MVLWB and AANDC 2013) and comprises two parts to reflect the historical disturbance that has already been experienced by the site:

> "For previously undisturbed areas, the goal is to return the affected areas of the site developed by the Project to viable and, wherever practicable, self-sustaining ecosystems that are compatible with a healthy environment and human activities. Where areas of the Project have been previously disturbed through historical mining activities, the goal is to return the areas of the site affected by the Project to at least an equivalent environmental state that they were left by the Government of Canada prior to the Project."

Closure principles for the areas developed by the Project are reflective of the Closure Guidelines and include:

- physical stability
- chemical stability
- no long-term active care
- consideration of future use

The objectives for the Closure and Reclamation Plan are to minimize the lasting environmental effects of operations to the extent practical and to allow disturbed areas to return to a similar state that existed prior to disturbance. The reclamation objectives will be developed through engagement with local communities.

Overall short-term reclamation objectives include:

- Progressively reclaim disturbed areas as soon as they are no longer required for mining activities.
- Minimize the risk and effects of water erosion and sediment transportation.
- Stabilize slopes.
- Prevent soil drifting/dust.

Overall long-term Project objectives include:

- Return disturbed areas to similar state as existed prior to the Project disturbance.
- Maintain the level of wildlife habitat.

Considering the current available geochemical information, the concepts and short- and long-term reclamation objectives are mostly pertinent to the WRSFs and TDAs of the Project.

5.2 Closure Activities

The approach to reclamation of the primary components of the Project are described below and in the Closure and Reclamation Plan Framework. Details will be further developed as mine design advances, including more details on methods, technology, equipment, infrastructure, and personnel requirements.

Progressive reclamation will be carried out where possible for facilities that have no further operational value. Opportunities for progressive reclamation will be further detailed during the next study and as an ongoing process during operations. Opportunities for progressive reclamation may exist in areas as they are mined out, such as the reclamation of the open pits, adjacent rock piles, and nearby infrastructure components. Material generated from preparation, such as the stripping of overburden and waste rock mining, will be used where possible and stockpiled at locations to facilitate reclamation.

5.2.1 Buildings and Infrastructure

The buildings, infrastructure, and equipment on the site will be dismantled and disposed of according to established procedures. Hazardous materials will be removed from buildings. Any remaining fuel and product in storage tanks will be removed prior to the tanks being dismantled. Contaminated soil will be remediated where required. The approach for the reclamation of haul roads built for the Project will be developed based on engagement with local communities.

5.2.2 Open Pits and Underground Mines

Closure options for the open pits developed for the Project may include backfilling with tailings capped by waste rock and allowing the pits to refill by natural water inflows and potentially supplemented with groundwater from nearby pits and/or diversion of surface water. Underground mine accesses will be blocked to mitigate potential risks to the safety local populations.

5.2.3 Tailings Disposal Areas

The tailings from the process plant will be deposited in historical pits, along with the mineral sorter rejects, thereby avoiding the construction of a conventional tailings management facility. Upon closure, the open pits used for tailings deposition will have been filled to ground surface with mineral sorter rejects and waste rock where necessary. The pits will be covered with stored overburden, if available, and contoured to restore the natural drainage. Measures to stabilize the surface and limit erosion will be implemented. The measures will be developed through engagement with local communities and may include revegetation.

5.2.4 Waste Rock Storage Facilities

A portion of the waste rock will be backfilled into historical or proposed mined-out pits during the operation to limit the Project's footprint and double handling. Where waste rock cannot be stored in nearby pits, the final design of the waste rock piles will be developed for the Closure and Reclamation Plan.

5.2.5 Water Management Facilities

Part of the remaining overburden material will be used to backfill waste rock and overburden water management network, such as ditches and collection ponds. Pumps and pipelines will be removed.

At the process plant site, the water management system components will be reclaimed by breaching the sedimentation ponds, removing pumps and pipelines, and dismantling any other water management infrastructure.

5.3 Monitoring and Maintenance

Monitoring for physical and chemical stability, and maintenance of the reclaimed facilities will be required after closure and post-closure until closure objectives and criteria are met. The specific schedule and program for monitoring, maintenance, and engagement will be prepared as part of the Closure and Reclamation Plan developed through the Water Licence process following completion of the environmental assessment.

The environmental monitoring programs developed during operations will be used as the basis for post-closure monitoring. Monitoring during closure will be designed to track reasonably foreseeable post-closure contamination pathways and to allow for the identification of any specific post-closure monitoring to address potential effects through adaptive management.

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Appendix A Osisko Metals Code of Ethics

Code of Ethics

May 23, 2018

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Where appropriate, the Code of Ethics of Osisko Metals Incorporated **("Osisko Metals" or the "Corporation") also applies to the directors of the Corporation and the term "employees", as well as to any third party providing goods or services to the Corporation, and the term "employees", when used herein, is, where appropriate, deemed to apply to such directors, as well as to any third party providing services or goods to the Corporation.**

SUMMARY

Osisko Metals's Code of Ethics (the "**Code**") provides basic guidelines setting forth the ethical behavior expected from every employee of the Corporation with respect to the use of Corporation time and assets, protection of confidential information, conflicts of interest, trading in Osisko Metals's securities and other matters. Every Director and employee of Osisko Metals and its affiliated entities is subject to the Code and will be requested to sign a form acknowledging that he or she understands its contents and agrees to be bound by its provisions.

In summary, all employees must:

- Follow applicable laws and regulations wherever the Corporation does business;
- Work safely, in accordance with regulatory and other industry standards;
- Treat everyone fairly and equitably: customers, suppliers, other employees, Corporation stakeholders and third parties dealing with the Corporation;
- Refrain from speaking publicly on Corporation matters, unless authorized;
- Refrain from trading on, and "tipping" others on, confidential information;
- Respect the confidential nature of the information to which they may have access and refrain from sharing same, except on a need-to-know basis;
- Always perform their duties in the best interests of the Corporation;
- Avoid conflicts of interest, both real and perceived;
- Be honest and act with integrity strictly refraining from bribery or corruption activities;
- Handle Corporation assets with care and refrain from using same and Corporation time for personal purposes;
- Respect the right of all employees to fair treatment and equal opportunity;
- Respect the right of all employees to a working environment free from discrimination or harassment of any sort;
- Act in a respectful and professional manner with other employees;
- Refrain from inappropriately influencing the political process;
- Work in an environmentally responsible manner;
- Respect the cultures and rights of communities where the Corporation operates its business;
- Ensure that all transactions are handled honestly and recorded accurately; and
- Report any violation to this Code.

INTRODUCTION

It is the Corporation's policy and objective to maintain the highest standards of ethical business behaviour. Ethical behaviour in the performance of one's duties essentially comes down to being honest and fair in one's dealings with other employees, customers, suppliers, competitors, Corporation stakeholders and the public. No one in the Corporation, from the President and Chief Executive Officer to the hourly employee, is ever expected or authorized to commit an illegal or unethical act, or to allow, direct or encourage others to do so.

The Corporation's reputation for business integrity is one of its most valued assets; it was achieved and is maintained through the efforts of its employees and their avoidance of any activity or interest that might reflect unfavourably upon the Corporation's image or reputation, or their own. Every transaction of the Corporation must be able to withstand public scrutiny without risk of causing embarrassment to the Corporation, its employees and its stakeholders.

The guidelines and principles set forth herein have been established by management of the Corporation as a code of ethics to be observed by all directors and employees of the Corporation (the "employees"). They are applicable in all jurisdictions in which the Corporation conducts business, unless the laws of those jurisdictions require otherwise.

The Code was approved by the Corporation's Board of Directors and, thus, no officer or employee has the authority to allow exceptions to its provisions. Strict adherence to the Code is a condition of employment and any breach thereof will be cause for appropriate disciplinary action, which may include dismissal.

Whereas no single booklet can define every circumstance that might be considered improper and no list of do's and don'ts will address every potential situation in which employees may find themselves, the Code cannot be construed as a comprehensive document. Therefore, above all, employees are expected to use their common sense and good judgment in observing this Code.

Each employee must be vigilant in preventing fraud, bribery and corruption. Thus, should an employee have a concern regarding the application of the Code to a particular action, situation or transaction, he or she should promptly discuss the matter with his or her immediate supervisor. If the matter is not resolved through this discussion, the employee and the immediate supervisor are expected to raise the issue with higher levels of management or with the Corporation's Chief Financial Officer.

OSISKO METALS'S CODE OF ETHICS

Each employee with executive or managerial responsibilities is responsible for communicating the expectations contained in this Code to all employees under his supervision and obtaining their undertaking as to their awareness and compliance with this Code in the attached form of undertaking.

Policies adopted by the Corporation regarding specific subject matters relating to the Code will be distributed to all employees in a timely manner.

LAWS AND REGULATIONS

Compliance with Laws and Regulations

The Corporation's operations are subject to an important number of very complex and changing laws and regulations, and its employees must comply with same as well as various rules, policies and guidelines of regulatory authorities and governmental agencies wherever it does business. Each employee is reminded that the law takes precedence in cases where there may be a conflict between the law and traditional or industry practices.

Lobbying

Communication with a member of a government or legislature (be it federal, provincial, state, municipal, local or other level) may be considered lobbying. Lobbying is regulated in many countries where the Corporation does business. Certain jurisdictions require that the Corporation or its employees be formally registered prior to engaging in such activities, and relevant employee are all expected to comply with these requirements.

Consequently, prior to engaging in any such activities, an employee must contact the Chief Executive Officer in order to ensure that the appropriate course of action is taken.

Dealing in Corporation's Securities

Securities and stock exchange laws and regulations are extremely strict regarding the use and selective disclosure of information that, if publicly disclosed, could have a significant impact on the market price or value of the Corporation's securities or affect any reasonable investor's investment decision.

Employees are prohibited from purchasing and selling Corporation shares or securities convertible into Corporation shares when they are in possession of material non public information concerning the business and affairs of the Corporation, and they are similarly prohibited from informing others about such information, except in the necessary course of business and were the other is under an obligation of confidentiality.

Fair Competition

The Corporation is committed to the principles of fair competition in the purchase and sale of products and services. All procurement decisions shall be based exclusively on normal commercial considerations, such as quality, price, availability, service, reputation and other factors bearing directly on the product, service or supplier. Customers and potential customers of the Corporation shall be provided with equal rights to make purchasing decisions based on the same competitive terms.

The Corporation will neither seek, encourage nor tolerate special favors or arrangements with suppliers or customers that impair, or give appearance of impairing, fair and unfettered commercial relationships. Under no circumstances is it acceptable to offer, give, solicit or receive any form of bribe, kickback, or inducement. In the same manner, the Corporation must avoid either the fact or the appearance of improperly influencing relationships with organizations or individuals with whom the Corporation deals in the course of its business.

Competitors' Information

From time to time, the Corporation gathers information about the industry in which it does business, including information about competitors. The Corporation is committed to gathering this information honestly and ethically; no employee should use improper means to obtain competitors' confidential business information.

DEALING WITH PUBLIC OR GOVERNMENT OFFICIALS

Anti-Bribery and Anti-Corruption

The Corporation promotes zero-tolerance against bribery and corruption and entrenches such fundamental principles in its corporate values.

Many countries, such as Canada and the United States, have passed legislation criminalizing bribery of government officials such as the *Corruption of Foreign Public Officials Act* (Canada), the *Foreign Corrupt Practices Act* (USA) and other relevant local laws in the countries where the Corporation may carry on business activities. The sanctions for violating such laws can be acute and may include individual and corporate fines, as well as imprisonment.

The Corporation is determined to ensure compliance to anti-bribery and anti-corruption laws, principles and rules. All employees shall refrain from offering, giving or receiving, directly or indirectly, anything of value (ex.: money, gifts, entertainment, employment, contracts or advantages of any kind) or any other form of improper payments to a public or government official in order to influence a government action or obtain an improper advantage and shall not knowingly participate in any form of corrupt activity.

For example, "public or government officials" may include without limitation:

- a person who holds a legislative, administrative or judicial position of a foreign state;
- a person who performs public duties or functions for a foreign state, including a person employed by a board, commission, corporation or other body or authority that is established to perform a duty or function on behalf of the foreign state, or is performing such a duty or function; or
- an official or agent of a public international organization that is formed by two or more states or governments, or by two or more such public international organizations.

Employees who have questions regarding the requirements or application of these laws must seek guidance from the Chief Financial Officer of the Corporation. In some instances, the Corporation may be subject to government investigations. While the Corporation has a policy to cooperate fully with such investigations, no employee should readily respond on behalf of the Corporation to any regulatory authority or governmental agency unless he or she has had an opportunity to consult with the Chief Financial Officer and his or her supervisor, and has received appropriate guidance in that respect.

Gifts, Hospitality and Expenses

Employees shall not, either directly or through an intermediary, offer or provide gifts, hospitality or reimbursement of travel or other expenses to a public or government official, except with the prior approval of the Chief Financial Officer or in accordance with the Corporation's Code. Employees may pay or reimburse reasonable meal expenses incurred in good faith by or on behalf of a public or government official related to the promotion, demonstration, or explanation of products or services of the Corporation or the execution or performance of a contract between the Corporation and the public official's government or agency thereof without pre-approval of the Chief Financial Officer. Any such payment or reimbursement must at all times be in compliance with the Corporation's Code, or any other related policy or guidelines.

In addition, employees must refrain from giving anything of value indirectly (for example, to a consultant, agent, intermediary, business partner or other third party) if such employee has reason to believe that it will be passed on to a government official or a private commercial partner to obtain an improper advantage. As such, all employees must take the necessary measures to:

- Ensure that the Corporation's partners, such as consultants, representatives and agents, understand and will abide by the Code and more specifically by the provisions relating to anti-bribery and anti-corruption;

- Evaluate the qualifications and reputation of the Corporation's partners (including the use of a due diligence review prior to entering into such a relationship); and

- Draft agreements and contracts that include such requirements to protect Osisko Metals. The Corporation will conduct a due diligence review on these matters prior to any decision to invest in another business – whether it is to acquire a business in whole or in part, or a joint venture arrangement.

The Chief Financial Officer is responsible for ensuring that any gift, hospitality and/or reimbursement of travel or other expenses ultimately provided to a third party, including a public or government official, is fully and accurately recorded in the Corporation's accounting records. Confirm accuracy of this statement.

Facilitating Payments

Any request for a payment to be made by or on the behalf of the Corporation, to facilitate or secure a routine transaction (*i.e.* obtain permits, licenses or work orders to which the Corporation is already entitled) are considered to be at high-risk of constituting a bribe. Therefore, the Corporation prohibits facilitating payments.

ENVIRONMENT, HEALTH AND SAFETY

Occupational Health and Safety

The Corporation is committed to ensuring a healthy working environment and safe working conditions, equipment and work sites for its employees and promoting their involvement in preventing occupational injuries.

Protection of the Environment

The Corporation is committed to conducting its business in a manner that protects the environment, preserves resources and ensures sustainable development. It is continuously seeking to improve its environmental performance, in keeping with applicable law, regulations and guidelines.

Each employee is expected to be alert to environmental issues and has a responsibility to work in an environmentally responsible manner.

PUBLIC COMMUNICATIONS AND DISCLOSURE

Media Relations and Disclosure of Information

The Chairman, President and Chief Executive Officer and the Chief Financial Officer are the only official spokespersons of the Corporation. Unless authorized by the President and Chief Executive Officer or the Chief Financial Officer, no employee may give his personal opinion, disclose confidential information or discuss matters pertaining to the Corporation to members of the news media and the public in general. Any inquiry or request for an interview must be referred to the President and Chief Executive Officer or the Chief Financial Officer.

No material undisclosed information related to the Corporation's business may be communicated to anyone until public disclosure of such information has been made to the general public, except to those who need to know said information in the necessary course of business and are under an obligation of confidentiality.

If any material information about the Corporation not yet disclosed to the public is inadvertently disclosed, employees aware of such disclosure shall contact the President and Chief Executive Officer, the Chief Financial Officer immediately so that the Corporation may promptly take corrective action.

CONFLICT OF INTEREST

Disclosure of Conflicts of Interest

In discharging their duties, employees must act honestly and in good faith with a view to the best interests of the Corporation. Employees must avoid situations involving a conflict between their personal interests and the interests of the Corporation. Actions taken and decisions made by any employee should be based on impartial and objective assessment of the facts in each situation, free from influence by gifts, favours and the like, which may adversely affect the employee's judgments.

The integrity and effectiveness of any employee is impaired when he or she has such a substantial personal interest in a transaction, or in a party to a transaction, that either his general duty of undivided loyalty to the Corporation or his independent judgment, or his decisions or actions taken on the Corporation's behalf might reasonably be expected to be adversely affected. Undisclosed interests or obligations in firms with which, or property in regards to which, the Corporation transacts business or contemplates such transactions, create at least the presumption of a conflict of interest and must be avoided. An employee who may have conflicting or potentially conflicting interests between his personal, business or other outside activities and any business interest of the Corporation in any transaction that he knows is under consideration by the Corporation, must withdraw from any discussions, decisions or assessment related to the particular subject and inform his immediate supervisor of the matter and of his conflict (or potential conflict). Employees may confront a variety of situations that represent real or potential conflicts of interest. The Corporation expects all employees to be sensitive to such possibilities and to consult their immediate supervisor or the Chief Financial Officer when ambiguous situations arise.

Outside Business Activities

Involvement or employment outside the Corporation which might reduce an employee's general duty of undivided loyalty to the Corporation, or adversely affect his independent judgment, as well as his decisions or actions taken on the Corporation's behalf, must be avoided. No conflict should exist between the private interests of employees and their official duties. To ensure that employees give their full attention to their work and their undivided loyalty to the Corporation, employees are discouraged from engaging in paid employment outside of the Corporation without the express written permission of their immediate supervisor, and, in any event, are strictly prohibited from engaging in paid employment that might conflict with the interests of the Corporation. Employees must also obtain the consent of their immediate supervisor for all professional activities (such as, for example, service in professional associations and on boards of directors) which ensue from their function or status at the Corporation or which would necessitate time or energy during the working day.

PROTECTION AND USE OF CORPORATION'S ASSETS

Corporation's Time and Assets

Employees must use Corporation's assets and resources solely for the purposes for which they are intended: any personal or other use must be avoided. Every employee has an obligation to safeguard the Corporation's assets and to exercise care in using Corporation's equipment and vehicles. Each employee must use Corporation's time solely for Corporation's purposes and not for personal purposes. Any waste, misuse, destruction or theft of Corporation's property or any improper or illegal activity must be brought to the attention of management.

Employees ceasing employment with the Corporation must return all objects, documents or data belonging to the Corporation such as computer hardware and software, databases, cellular telephones, credit cards, books, manuals, etc. and shall comply with the Corporation's guidelines and policies in that respect.

E-mail and Internet

E-mail and Internet systems are provided for business use. The use of e-mails is not entirely secure and may be susceptible to interception and creates a permanent record. Any e-mail sent may be printed by the recipient

and forwarded by the recipient to others, and is probably retained on company computer for a substantial period of time. Therefore, employees should exercise the same care, caution and etiquette in sending an e-mail message as they would in normal written business communications.

In relation to the Corporation's Internet connection, it is forbidden to download any data that is unprofessional or inappropriate for business use.

Confidential Information

Confidential information relating to the Corporation's business is a very important asset of the Corporation and must be treated accordingly.

During the course of their employment, employees may be provided with access to and knowledge of confidential information, to the extent that such information is necessary or at least useful to ensure the proper performance of their duties. Confidential information includes, but is not limited to, information not publicly disclosed about the Corporation's business, projected property acquisitions, exploration, drilling and other technical results, mining methods or techniques, production, discoveries, information relative to past, present and prospective customers and suppliers, joint ventures, financial data, marketing techniques, strategies, and business plans and personal information concerning employees of the Corporation.

Employees must preserve the confidentiality of such information and shall not at any time, both during and after their employment with the Corporation, disclose to anyone (within or outside the Corporation), any of the Corporation's confidential information, except on a need to know basis in the normal course of business. Moreover, employees shall not use such information for their, or anyone else's, personal gain. Employees shall return to the Corporation such confidential information upon request by the Corporation and, in any event, immediately after their employment termination.

The above restrictions apply not only to the Corporation's confidential information, but also to information received by the Corporation from third parties under an obligation of confidentiality.

Social Media

All directors, officers and employees of the Corporation must exercise proper care and good judgment when using social media. It is important that we do not give the improper impression that they are individually speaking on behalf of Osisko Metals when using social media, unless they are expressly authorized to do so.

Social media refers to the external online tools used to share on an ongoing basis any developments concerning the Corporation's activities. Social media tools include, but are not limited to: professional networking sites (e.g., LinkedIn), social networking sites (e.g., Facebook, Tumblr), video and photo sharing websites (e.g., YouTube), micro-blogging sites (e.g., Twitter), personal websites and blogs, forums and discussion boards (e.g.,Yahoo! Groups, GoogleGroups, Yelp).

HUMAN RESOURCES AND COMMUNITY

Employment and Equal Opportunity

The Corporation is committed to maintaining a challenging working environment in which ability and performance are recognized, free from any form of discrimination contrary to law and discrimination on the basis of personal relationships. Thus, every employee holding leadership responsibilities shall treat all other employees in a fair an equal manner and shall not allow any personal relationship with any other employee under his or her supervision compromise this principle.

The Corporation allows the employment of related persons, but in every case the procedure followed must be equitable and situations involving a conflict or a potential conflict between any employee's personal interests and the interests of the Corporation must be avoided. The following relationships between an employee and the person to whom he or she reports to may give rise to violations of this principle and must be avoided or, if they exist, be brought to the attention of the local head of the management team who shall, if appropriate, recommend specific conditions: a spouse (including common-law relation), a child or grandchild, a spouse of such child or grandchild, a sibling, a father-in-law, a mother-in-law, or any employee in the direct parent-child bloodline of another where there is a real or potential conflict of interest as a result of the relationship and the positions the employees occupy.

Respect and Integrity of the Person

The Corporation is committed to encouraging the respect of individuals, their integrity and their dignity by ensuring that the working environment and relations between employees shall be free of discrimination or harassment. Any person who believes that he is a victim of harassment may directly contact the Chief Financial Officer. The matter will be treated with discretion and diligence and in accordance with appropriate procedures.

Business and Professional Relationships

Employees must maintain professional relationships based on honesty and respect for individuals and the organization with a view to establishing lasting and equitable employment and business relationships. Employees must specifically encourage respect for others and cooperation and professionalism among colleagues.

Community Relations

The Corporation is committed to conducting its business responsibly with the communities in the areas where it operates, and to making a positive contribution to the well-being and development of said communities. Every employee shall reflect this commitment in his everyday dealings, and respect the different cultures and the dignity and rights of individuals in all countries where the Corporation carries out its activities.

CORPORATE RECORDS

Records and Reporting

The Corporation's records serve as the means and evidence of the management of the Corporation's business, as the measure of the Corporation's fulfillment of its obligations to shareholders, employees, suppliers and others, and of the Corporation's compliance with tax, financial, and other reporting requirements. Directors, officers, shareholders and other stakeholders of the Corporation cannot make informed decisions about the Corporation if its records and business information contains material errors, omissions, falsifications or misleading statements.

The Corporation is committed to maintaining adequate accounting and auditing procedures and controls to ensure that financial statements fairly present, in all material respects, the financial condition and results of operations of the Corporation in accordance with the requirements of applicable law and the International Financial Reporting Standards.

All employees involved in collecting, drafting, gathering, processing or recording such information are responsible for its integrity and shall ensure, to the best of their ability, that all entries, books, records and accounts of the Corporation accurately and fairly reflect the Corporation's operations and transactions. Accounting, financial and legal documents and records of the Corporation shall not be destroyed without the prior consent of the Chief Financial Officer.

Each employee must be vigilant in preventing fraud and dishonesty, and report immediately to his immediate supervisor any evidence of wrongdoing. No WB policy

COMPLIANCE

Employee Compliance and Reporting

All officers and managers at all levels shall maintain an "open door" policy regarding questions of business conduct as regards this Code and its applicability. Employees shall be encouraged to ask such questions in respect of any particular situation no matter how small or insignificant it may seem to be.

Each employee is encouraged to be alert to any work related activities which could be construed as a violation of the Code, should bring the matter to the attention of his or her immediate supervisor, or an (other) officer of the Corporation, as appropriate, and should take corrective action, if possible, to remediate the situation and/or prevent recurrence of the violation.

If any employee is uncertain whether an activity in which he is engaged or an activity he is witnessing could be construed as a violation of the Code, he must discuss the matter with his immediate supervisor, or an (other) officer of the Corporation, as appropriate.

Where a corporate policy provides specific complaint procedures, theses procedure will be applicable in case of violation of the policy. Otherwise, an employee who has knowledge that a violation to this Code has been committed or will be committed shall bring the matter to the attention of his immediate supervisor and, if this avenue is not appropriate or if the matter has not been corrected by the immediate supervisor, to the hierarchical supervisor of the employee's immediate supervisor and so on, up the corporate ladder, for as long as the violation has not been corrected and if necessary, as high as the President and Chief Executive Officer, as appropriate. If an employee has reasons to believe that this avenue is not appropriate, he may bring the matter to any officer of the Corporation, as appropriate.

Retaliation against any employee who honestly reports a concern about an illegal or unethical conduct will not be tolerated. Persons involved in illegal or unethical conduct, may be sanctioned even if they have reported it. It is unacceptable to file a report knowing it to be false.

Investigation and Enforcement

If any member of management receives reports of any violation of the Code, he must conduct such investigations, inform the Corporation's President and Chief Executive Officer, the Chief Financial Officer, and the head of the relevant department or division of such investigation and of its outcome, and take such other actions as he or she considers necessary to determine whether a violation has in fact occurred and shall recommend appropriate corrective and, if applicable, disciplinary action (including termination of employment) to Osisko Metals's President and Chief Executive Officer, as appropriate. Any employee who withholds information during the course of an investigation regarding a possible violation of the Code is subject to disciplinary action, including termination of employment.

Certification

Each current and new employee, director, officer and employee will be required to certify his awareness and compliance with this Code in the attached form of undertaking. Subsequently, each key director, officer and employee, as determined by management and excluding third parties, will be required to reiterate annually his or her undertaking in the attached form of renewal. Any director, officer and employee who is required to so certify and declines doing so cannot thereafter claim that he is not aware of the provisions of the Code.

REVIEW AND MONITORING

The Corporate Governance Committee shall review this Code periodically, as it deems appropriate, and propose recommended changes to the Board of Directors.

The Board of Directors, directly or through its Corporate Governance Committee, will monitor compliance to this Code.

OSISKO METALS INCORPORATED

and its affiliated entities (Pine Point Mining Limited)

UNDERTAKING TO COMPLY WITH OSISKO METALS'S CODE OF ETHICS

(For current and new employees)

I, the undersigned, hereby acknowledge having received and read a copy of the **Code of Ethics** for employees of Osisko Metals Incorporated and its affiliated entities (the "Code"), and I hereby undertake to comply with its provisions, promote the goals, measures, objectives and principles set forth therein and take all the necessary steps to ensure its application in my work environment.

I further agree that I have the responsibility to speak to my immediate supervisor, or an (other) officer of the Corporation, should I have any concerns about a possible breach, by anyone, of the Code.

Signed at _____, this _____ day of _____, 20__.

_____

Employee's signature

_____

Employee's name (print)

OSISKO METALS INCORPORATED

and its affiliated entities

UNDERTAKING TO COMPLY WITH OSISKO METALS'S CODE OF ETHICS

(Renewal Form)

I, the undersigned, hereby acknowledge having received and read a copy of the **Code of Ethics** for employees of Osisko Metals Incorporated and its affiliated entities (the "Code"), and I hereby undertake to comply with its provisions, promote the goals, measures, objectives and principles set forth therein and take all the necessary steps to ensure its application in my work environment.

I confirm that since the date of my previous undertaking to comply with the Code, I have complied with it and that:

☐ I have not been made aware of any violation to the Code; or

☐ I have not been made aware of any violation to the Code other that the violations listed in the schedule attached hereto.

I further agree that I have the responsibility to speak to my immediate supervisor, or an (other) officer of the Corporation, should I have any concerns about a possible breach, by anyone, of the Code.

_____

Date

_____

Employee's name (print)

_____

Employee's signature

_____

Location

OSISKO METALS INCORPORATED
and its affiliated entities

UNDERTAKING TO COMPLY WITH OSISKO METALS INCORPORATED'S CODE OF ETHICS

(FOR THIRD PARTY – INDIVIDUAL)

I, the undersigned, hereby acknowledge having received and read a copy of the **Code of Ethics** for employees of, and third parties providing services and goods to, Osisko Metals Incorporated and its affiliated entities (the "**Code**"), and I hereby undertake to comply with its provisions, promote the goals, measures, objectives and principles set forth therein and take all the necessary steps to ensure its application in my work environment.

I further agree that I have the responsibility to speak to an officer of Osisko Metals Incorporated, should I have any concerns about a possible breach, by anyone, of the Code.

_____
Date

_____
Name of individual (print)

_____
Individual's signature

_____
Location

OSISKO METALS INCORPORATED
and its affiliated entities

UNDERTAKING TO COMPLY WITH OSISKO METALS INCORPORATED'S CODE OF ETHICS

(FOR THIRD PARTY – BUSINESS)

_____ hereby acknowledges having received and read a copy of
(Name of business)
the **Code of Ethics** for employees of, and third parties providing services and goods to, Osisko Metals Incorporated and its affiliated entities (the "**Code**"), and hereby undertakes to comply with its provisions, promote the goals, measures, objectives and principles set forth therein and take all the necessary steps to ensure its application in its work environment.

_____ further agrees that it has the responsibility to speak to an officer of
(Name of business)
Osisko Metals Incorporated, should it have any concerns about a possible breach, by anyone, of the Code.

_____
Date

_____
Name of business (print)

_____
Signature by a duly authorized person of the business

Signed at _____, this _____ day of _____, 20__.

_____
Employee's signature

_____
Employee's name (print)

Volume 2 -

Engagement and Collaboration Framework

Engagement and Collaboration Framework for the Pine Point Project

Purpose

This framework document is provided in support of the Mackenzie Valley Environmental Impact Review Board Environmental Assessment Initiation Package for the Pine Point Project (the Project). The intent of this document is to describe how this plan relates to the Project, what information will be provided as the Project develops, and to list applicable guidelines and standards. It was developed with the available Project information. This document is not intended for approval but is provided for review purposes and will be refined as the regulatory process proceeds.

Version History

Pine Point Mining Limited is responsible for the distribution, maintenance, and updating of this document. Changes that do not affect the intent of the document will be made as required (e.g., phone numbers, names of individuals). The table below indicates the version of this document, and a summary of revisions made.

Date	Version	Section Revised	Summary of Revision	Potentially Affected Parties Comments
15 December 2020	0		First Version	

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Appendices

Abbreviations

Abbreviation	Definition
Cominco	Cominco Ltd.
COVID-19	coronavirus, 2019
DAR	Developer's Assessment Report
EA	environmental assessment
ECF	Engagement and Collaboration Framework
ITK	Indigenous Traditional Knowledge
MVEIRB	Mackenzie Valley Environmental Impact Review Board
MVLWB	Mackenzie Valley Land and Water Board
NWT	Northwest Territories
Potentially Affected Parties	Potentially Affected Parties
PPML	Pine Point Mining Limited
Project	Pine Point Project
ZnEq	zinc equivalent

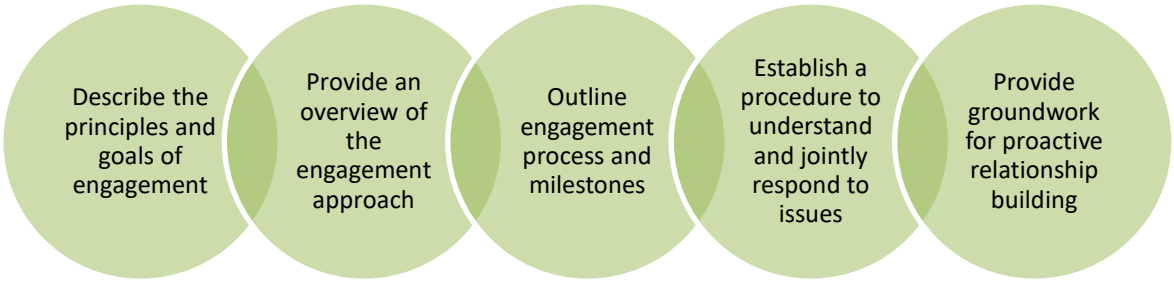
Units of Measure

Abbreviation	Definition
%	percent
tpd	tonnes per day

1 INTRODUCTION AND PURPOSE

Pine Point Mining Limited (PPML) is proposing the development of the Pine Point Project (the Project) in the South Slave Region of the Northwest Territories (NWT). The Project will fall under the jurisdiction of the Mackenzie Valley Environmental Impact Review Board (MVEIRB) and the Mackenzie Valley Land and Water Board (MVLWB) and will be developed within unsettled lands. Engagement with Potentially Affected Parties[1] will represent a key aspect of Project planning and development. Indigenous Traditional Knowledge (ITK) obtained through the engagement process will help to inform mitigations, the Project design, and the assessment of the Project's potential effects.

The MVEIRB's *Draft Environmental Assessment Initiation Guidelines for Developers of Major Projects* (MVEIRB 2018) requires that a preliminary engagement plan be submitted as part of the Environmental Assessment (EA) Initiation Package presented to Potentially Affected Parties for review in advance of the assessment and regulatory process. PPML has prepared this Engagement and Collaboration Framework (ECF) to guide engagement activities prior to the submission of the Developer's Assessment Report (DAR). The ECF will form the basis for ongoing engagement as the Project advances and will be a living document that is updated over the course of the regulatory process and the Project development. Feedback provided through the EA Initiation Package consultations will be incorporated into a refined Engagement Plan for the Project. PPML will collaborate with Indigenous groups and governments, and with communities, to determine their preferred methods of engagement. The purpose of the ECF is to:



The ECF describes engagement activities that PPML proposes to undertake during the early engagement phase of the Project as well as captures past engagement effort. The ECF does not lay out engagement activities beyond those proposed for the early engagement phase. Such activities will be proposed and discussed with relevant Potentially Affected Parties as the Project advances following submission of the EA Initiation Package. PPML recognizes the importance of collaborating with Potentially Affected Parties Potentially Affected Parties at this early stage in Project development, and will endeavor to work with Indigenous groups, communities, and other interested parties in developing to goals, approach, and desired outcomes of ongoing engagement activities.

[1] Including Indigenous groups, governments, communities, the territorial and federal government, regulators, and the general public.

PPML has entered into two separate Collaboration Agreements for the Project with the Deninu Kų́ę́ First Nation and the Northwest Territories Métis Nation to promote a cooperative and mutually respectful relationship governing the proposed exploration and development activities in the Pine Point area. The agreements reflect the intention to work with each Indigenous community regarding education and training, employment, business and contracting opportunities, information sharing, site visits, and broad outlines of topics for future agreements.

1.1 Project Description Overview

The Project is within the South Slave Region, and the traditional territories of the Akaitcho Dene First Nations, K'atl'odeeche First Nation, and the Northwest Territories Métis Nation. Of the Akaitcho Dene First Nation member nations, the Deninu Kų́ę́ First Nation is in close proximity to the Project.

The Pine Point Project is a brownfield site and the location of the historical operations managed by Cominco Ltd. (Cominco) and operated between 1964 and 1987. Information from previous studies and EAs is available to characterize the area.

The Project is currently composed of approximately 72 deposits of which 58 deposits are included in the 2020 Mineral Resource Estimate which documents a total of approximately 52.4 million tonnes of mineralized material grading 4.64% zinc and 1.83% lead (6.47% Zinc Equivalent [ZnEq]) containing approximately 5.3 billion pounds of zinc and 2.1 billion pounds of lead in situ. A total of 39.1 Mt of combined mineralized material is planned to be mined for the Project using open pit and underground mining methods. The planned processing capacity is 6,000 tonnes per day (tpd) ramping up to 11,250 tpd with an associated mine life of 10 years or longer as presented in the Preliminary Economic Assessment which also concludes there is potential for significant resource expansion and exploration potential.

The Project will consist of open pit and underground mining for lead and zinc, construction and operation of a processing mill (or “concentrator”) and pre-concentration facilities, storage and management of mineralization, waste and water, construction and operation of ancillary support facilities including a camp for workers and the transportation of zinc and lead concentrates to global markets. The Project will undergo construction, operations, closure, and post-closure phases, between late 2023 and 2037, with closure commencing in late 2037.

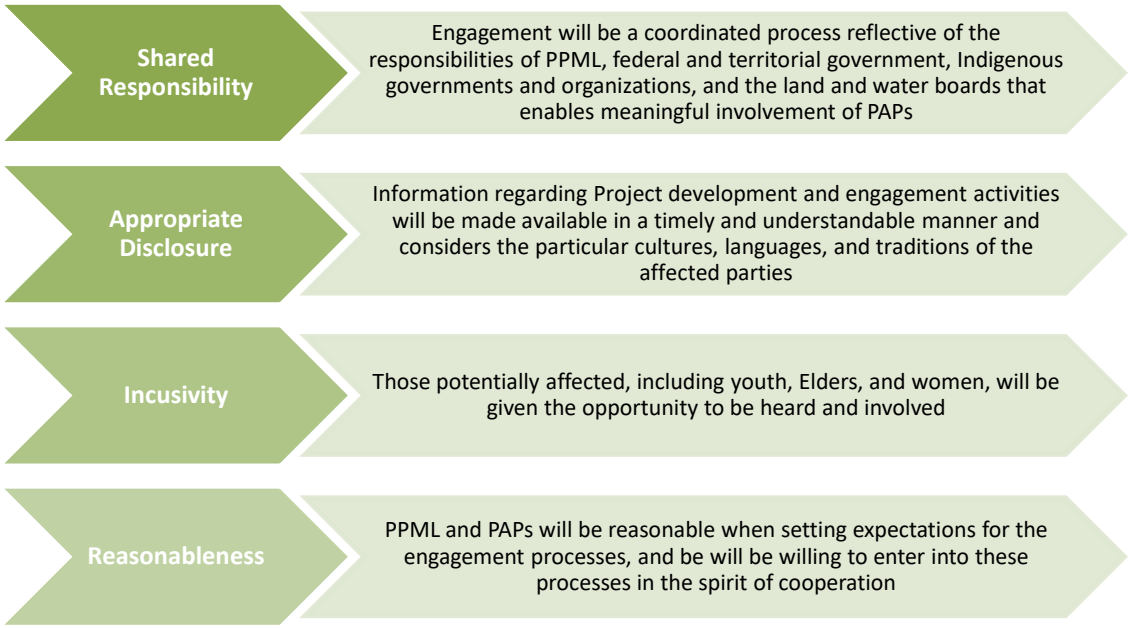
It is anticipated that the construction of the concentrator and associated infrastructure will require an average workforce of approximately 230, peaking at 500. During operations, a workforce of approximately 460 people (two shifts of 230 on rotation) will be required. The working schedules will vary depending on the positions and employment status but will likely include a combination of rotation schedules. Employees will stay at the worker accommodation camp. It is anticipated that both construction and mining/milling operations will run on 12-hour shifts, 25 hours/day, 7 days per week.

PPML will develop environmental and social management plans, which are not only industry best practice but are a requirement of the MVEIRB guidelines (MVEIRB 2018) for the EA as follows:

- Water Management Plan
- Waste Management Plan
- Spill Contingency Plan
- Erosion and Sediment Control Plan
- Aquatic Effects Monitoring Program
- Wildlife Protection Plan
- Socio-economic Management Plan
- Engagement Plan and Record of Engagement
- Tailings and Waste Rock Management Plan
- Closure and Reclamation Plan

2 PRINCIPLES AND GOALS

The Land and Water Boards of the Mackenzie Valley2 Engagement and Consultation Policy (LWBMV 2018a) provides the Guiding Principles for engagement. The engagement process for the Project will be conducted with:



Similarly, the Land and Water Boards of the Mackenzie Valley Engagement Guidelines (LWBMV 2018b) outline goals of the engagement process for varying types of development in the NWT. The goals of Project engagement activities have been informed by these guidelines:

- Explain the Project and its components, including development activities and timing.
- Facilitate timely access to the Project information in a culturally sensitive manner.

[2] Mackenzie Valley Land and Water Board (MVLWB), Sahtu Land and Water Board, Gwich'in Land and Water Board, Wek'èezhìi Land and Water Board.

- Obtain feedback from Potentially Affected Parties to identify concerns and potential impacts.
- Determine how impacts will be addressed in collaboration with Potentially Affected Parties.
- Incorporate engagement feedback, including ITK, in Project development and regulatory process.
- Identify opportunities to work collaboratively and to mutually benefit in relation to the Project.
- Build a relationship with Potentially Affected Parties to facilitate further communication and trust.

These goals will be reviewed in collaboration with communities prioritized for engagement and other Potentially Affected Parties, as appropriate, to ensure they are reflective of the desired outcomes of engagement, and how communities wish to see their input incorporated into engagement planning activities. It is anticipated that feedback from communities will be received through EA Initiation Package scoping consultations, and that this plan will be revised accordingly.

3 IDENTIFICATION OF POTENTIALLY AFFECTED PARTIES

The Engagement Guidelines (LWBMV 2018b) recommends that "*proponents focus their engagement efforts towards parties that will likely be the most directly impacted.*" This is done to focus engagement activities on those with the greatest interest in the Project and to avoid consultation fatigue. PPML has, at this time, prioritized Potentially Affected Parties for involvement based on the expected level of impact. A preliminary list of Potentially Affected Parties has been developed based on a review of previous work done to date on the Pine Point property, engagement activities to date, and Crown-Indigenous Relations and Northern Affairs Canada's NWT Land Information Related to Aboriginal Groups (CIRNAC 2018) resource. This preliminary list will be circulated to determine:

- if other Indigenous groups and governments should be included in engagement planning
- how they wish to be engaged, including approaches acceptable to the communities
- which community-specific protocols for engagement and consultation should be adhered to

The Project falls within the South Slave Region, and the traditional territories of the Akaitcho Dene First Nations, K'atl'odeeche First Nation, and the Northwest Territories Métis Nation. Of the Akaitcho Dene First Nation member nations, the Deninu Kųé First Nation is in close proximity to the Project and has to date been the most engaged. Of the Northwest Territories Métis Nation, the Hay River and Fort Resolution Métis Councils have been most engaged to date. It is proposed that these Indigenous groups be prioritized for a high level of involvement throughout the Project engagement process. Other Potentially Affected Parties have been identified for engagement based the potential for being affected by the Project, or previously asserted interest in the Project:

Indigenous Groups Prioritized for Involvement	Other Indigenous Groups with an Interest in the Project	Other Parties Informed
Deninu Kųé First Nation **K'atl'odeeche First Nation** **NWT Métis Nation** ▪ Fort Resolution Métis Council ▪ Hay River Métis Council ▪ Fort Smith Métis Council	■ West Point First Nation ■ Salt River First Nation ■ Smith's Landing First Nation ■ Yellowknives Dene First Nation ■ Łutsel K'e Dene First Nation ■ North Slave Métis Alliance	■ Business Owners (Hay River and Fort Resolution) ■ Town of Hay River ■ Hamlet of Fort Resolution ■ City of Yellowknife ■ Schools (Hay River and Fort Resolution) ■ Dehcho Land Use Planning Committee ■ NWT and Nunavut Chamber of Mines ■ Government of the Northwest Territories ■ MVEIRB ■ MVLWB

Other Interested Parties
■ Cabin Owners ■ Timberworks Inc. ■ Teck Metals ■ Avalon Advanced Metals

The list of Potentially Affected Parties identified above will be updated as the Project advances based on feedback from those engaged and other parties that self-identify throughout Project development. At this stage, it is anticipated that feedback obtained through MVEIRB's scoping consultations associated with the EA Initiation Package will result in refinement of the list of Potentially Affected Parties for engagement. A final list of Potentially Affected Parties will be presented in the refined Engagement Plan for the Project, along with their contact information and a characterization of their interests. Through preliminary engagement activities in advance of the MVEIRB EA Initiation Package scoping consultation, PPML will endeavor to obtain contact information for each Potentially Affected Party.

4 METHODS OF ENGAGEMENT

Engagement activities can be designed based on the desired outcome of engagement, the expressed preferences of Potentially Affected Parties, and the level of engagement appropriate to the party. Engagement can be classified by differing levels of involvement:

	Inform	Consult	Involve	Collaborate	Empower
Desired Outcome	Provide accessible and timely information regarding Project development	Solicit feedback regarding Project-related issues and concerns	Work with Potentially Affected Parties to consider/incorporate issues and concerns in Project decisions	Partnering with Potentially Affected Parties in the decision-making process re: aspects of the Project	Place decision-making authority in the hands of Potentially Affected Parties
	→ → → *Level of Involvement* → → →				

Adapted from the International Association of Public Participation Spectrum of Public Participation.

For each level of engagement, methods appropriate to the desired outcome can be employed. Generally, as the level of engagement increases, more complex methods of engagement involving greater levels of participation from Potentially Affected Parties is required to meet engagement goals.

	Inform	Consult	Involve	Collaborate	Empower
Example Applications	Mailouts informing Potentially Affected Parties of Project activities Emails informing the public of engagement events	Meetings with Potentially Affected Parties to present Project design information Focus groups to present info and receive comments	Community meetings or workshops to present Project info and get feedback for incorporation into Project planning	Working groups steering the decision-making process regarding community investment, IBA execution, etc.	Cooperation with the requirements of the MVEIRB charged with the decision of approving the Project
	→ →→ *Level of Participation* → → →				

Common methods of engagement are suggested in the Engagement Guidelines:

- **Written notification:** Letters, emails, and other mailouts are used to *inform* Potentially Affected Parties of Project details, to request meetings, or to provide updates to previously shared information. Information should be provided in plain language and include enough detail for the recipient to provide feedback.
- **Face-to-face meetings:** In-person or virtual communication is useful when *consulting* with Potentially Affected Parties regarding specific issues, concerns, or aspirations they may have regarding the Project, and in sharing information. Follow-up dialogue allows Potentially Affected Parties to express concerns to the developer directly, and to be *involved* in the process of resolving issues and realizing aspirations. Face-to-face meetings should be planned to identify the appropriate parties, establish a clear purpose, acknowledge that decisions are not likely to be made in the meeting, but commit to following-up on feedback received. The COVID-19 pandemic has altered the way face-to-face meetings take place, putting greater emphasis on virtual methods.
- **Community meetings:** Are informal opportunities for the broader community to be engaged, to share Project information, and to receive feedback, comments, and questions. Such meetings can be an opportunity to *inform* and *consult* the wider public regarding the Project development milestones.
- **Workshops:** Workshops provide a more formal opportunity to share technical information regarding specific, often complex topics. Workshops can *involve* participants in resolving issues and concerns and can result in concrete outcomes for incorporation into the Project planning.

PPML will employ a combination of engagement methods depending on the audience, purpose, and feedback on the preferred method of engagement of Potentially Affected Parties. In discussion with the Indigenous groups prioritized for engagement, PPML will determine the appropriate frequency and format of engagement activities as Project development advances and will amend this plan to include more detailed planning.

5 EARLY ENGAGEMENT ACTIVITIES

The Engagement Guidelines (LWBMV 2018b) stipulate that the record of engagement must include a summary of engagement activities, the parties and named representatives involved, dates of and reasons for engagement, and a discussion of whether issues raised were resolved or not. The summary should also identify how the Project was altered in response to engagement feedback. PPML has been undertaking engagement activities associated with the exploration phase of the Project since 2017. While communications to date have been focused on providing information regarding the status of the Project and discussing the potential for communities to access Project opportunities, a limited amount of feedback has been received regarding the works and activities of the mine itself. This is largely because the Project planning had not been advanced to the point where a Project Description could be presented to Potentially Affected Parties for comment and input until the Preliminary Economic Assessment (PEA) was published in July 2020. However, input from early scoping activities have included some key recommendations, some of which have been incorporated into the Project Description:

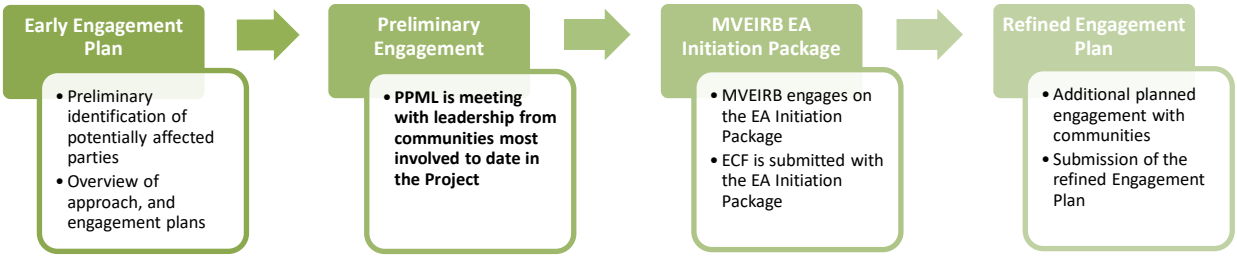
- use pits for waste rock storage and disposal
- use sump pumps in pits instead of perimeter wells
- use a liner in the tailings pits and grouting at open pits
- use an upgradient freeze wall in the Cluster Pit area
- use the previous water supply line from the Great Slave Lake
- use the old Cominco system to supply freshwater from Great Slave Lake to Camp (T-37 Road)
- decant water from in-pit tailings or move water from pit to pit if fines in tailings plug pit wall pores.
- cap and seal all holes
- plug the problematic historical Cominco open well at W-85
- avoid surface discharge of groundwater
- avoid Sulphur Creek as a receiving site for withdrawn groundwater
- avoid development near the Buffalo River as caribou overwinter here in the undisturbed lands
- widen the shoulders of the highway

While it is not possible to incorporate all input received through the Project engagement activities, PPML is committed to considering feedback received in the Project design and planning, and incorporating appropriate recommendations to the extent possible and where feasible. The recommendations above have been considered in the development of the Preliminary Economic Assessment and associated analysis of design and alternatives. The Project Description included as part of the EA Initiation Package (Volume 1) is based on the Preliminary Economic Assessment and considered engagement to date. Feedback obtained through associated MVEIRB consultation activities will be reviewed by PPML prior to future engagement to facilitate further discussion and collaboration. For a summary of engagement activities to date by each

party, please refer to Appendix A. For a comprehensive record of engagement activities to date, please refer to Appendix B.

6 ENGAGEMENT PROCESS AND MILESTONES

PPML intends to engage with the Indigenous communities prioritized for engagement to discuss the Project, the need for ITK studies, and socio-economic baseline engagement undertaken in support of the EA process. The timing of such engagement was initially planned to occur in advance of the EA Initiation Package scoping consultations. However, with the advent of the COVID-19 pandemic, the timing of such early engagement became uncertain with travel restrictions within the NWT, and to small remote communities. PPML remains committed to undertaking early engagement and has begun meeting with communities using teleconferencing. The engagement planning process at this time involves:



Once the ECF has been reviewed and commented on by communities through the MVEIRB scoping consultation, PPML will incorporate feedback into the refined Engagement Plan, resulting in a document that has been developed in collaboration with Potentially Affected Parties. As other feedback regarding valued components, potential Project effects, and proposed mitigations is incorporated into the Developers Assessment Report (DAR), the collaborative process of developing the Project will be underway in earnest. PPML will continue to integrate feedback into collaborative Project planning. As engagement advances, PPML will further define the triggers for engagement, purpose of engagement, parties involved, and the methods employed. The plan for preliminary engagement with Indigenous communities prioritized for consultation in advance of the MVEIRB consultation is presented in Table 1.

PPML has begun engaging communities regarding the Project Description and the environmental and social assessment process that is underway. Meetings have been held with the K'atl'odeeche First Nation, Northwest Territories Métis Nation, Deninu Kųé First Nation and Łutsel K'e Dene First Nation. PPML is actively engaging other communities to set up similar meetings at the time this plan was written. Key outcomes/areas of discussion have included: the need for local employment, contracting, and training opportunities; status of agreements with communities; worker safety considerations in light of COVID-19; and water management and impacts on land and continued Indigenous use.

Table 1: Preliminary Engagement Activities

Engagement Trigger	Timing of Engagement	Purpose of Engagement	Parties Engaged	Methods of Engagement
EA Initiation Package scoping consultation	Two weeks to a month prior to scoping consultation, if possible	• Introduce the formal Project engagement process. • Introduce the need for ITK studies and socio-economic baseline work in communities, and discuss ITK protocols in place. • Establish contacts for future engagement. • Discuss the need for a Project grievance mechanism and what that should look like.	• Deninu Kųę First Nation (Teleconference, September 9, 2020) • K'atl'odeeche First Nation (Teleconference, August 25, 2020) • Northwest Territories Métis Nation (Teleconference, August 31, 2020)	• written communication (invitation to meet, including purpose of meeting; follow-up emails) • follow-up calls or meetings, as appropriate
		• Introduce the engagement process • Present the results of the Preliminary Economic Assessment and Project Description • Establish contacts for future engagement	• Łutsel K'e Dene First Nation (Teleconference, August 26, 2020) • Yellowknives Dene First Nation • West Point First Nation • Smith's Landing First Nation • Salt River First Nation • North Slave Métis Alliance	• written communication (invitation to meet, including purpose of meeting; follow-up emails) • follow-up calls or meetings, as appropriate
		• Introduce the engagement process • Establish contacts for future engagement	• Town of Hay River • Hamlet of Fort Resolution • City of Yellowknife • Government of the Northwest Territories	• written communication (overview of engagement process, steps to come; follow-up emails)
		• Introduce the engagement process • Establish contacts for future engagement	• Cabin Owners • Timberworks Inc. • Teck Metals	• written communication (overview of engagement process, steps to come; follow-up emails)

Note: This table will be updated as engagement planning activities advance.

7 INCORPORATION OF INDIGENOUS TRADITIONAL KNOWLEDGE

PPML recognizes that the Indigenous peoples of the NWT have unique knowledge about the local environment through their long and close relationship with the land. ITK will play an important role in project planning and the EA process. Working collaboratively with Indigenous communities and their governments using participatory approaches and integrating ITK early in the regulatory process can help developers to identify effects and associated mitigation measures, and work towards consensus and acceptance of proposed project development activities.

PPML will endeavor to incorporate ITK as early as possible in the EA and regulatory process. ITK is often gathered using participatory tools, and can be gathered on the land through project site visit or field studies. The incorporation of ITK will be conducted in collaboration with Indigenous groups and governments, per their ITK protocols. ITK and western science can be complementary, but also have inherent differences that can make the integration of ITK into project planning challenging. In addition, some ITK may be considered confidential and limitations may exist on sharing the data in the context of EAs or regulatory decisions. The ownership of ITK and boundaries of use and storage will be clearly established between Indigenous groups and PPML pursuant to Knowledge Sharing Agreements.

8 RECORD OF ENGAGEMENT

The summary of engagement activities by party (Appendix A) and log of engagement activities to date (Appendix B) will be updated periodically as the Project advances with the results of ongoing engagement. At reporting milestones, the summary will be updated to reflect the overall evolution of engagement and relationships with Potentially Affected Parties over the life of the Project. The ECF is a living document to be updated based on feedback from parties. As engagement activities unfold, engagement planning will be modified to reflect preferred methods and timing of engagement.

Signatures from both the proponent and the engaged party on the final engagement record and engagement plan submitted to the MVEIRB (in the EA phase of the Project) and MVLWB (in the permitting phase of the Project) can assist the respective Boards in making a determination on the completeness of engagement. These signatures represent agreement on the contents of the log and record, but do not necessarily imply that the parties agree on the topics that were discussed. The MVEIRB and MVLWB will evaluate PPML's engagement activities to determine:

- Does the engagement plan reflect guidance from the MVLWB?
- Were the appropriate Indigenous organizations/governments included in engagement?
- Was communication two-way, including follow-up and response to engagement initiatives?
- Were relevant materials and information made available to allow for informed participation?
- Was engagement timely, and was the response period sufficient?
- Where community visits were not possible, what other engagement was undertaken?
- How were responses from Indigenous groups included in the engagement process and DAR?

- How have grievances been handled and responded to?
- How did the results of engagement influence Project design?

PPML will undertake engagement reporting with these questions in mind to facilitate alignment with the Boards' expectations regarding effective, meaningful engagement.

9 REFERENCES

CIRNAC (Crown-Indigenous Relations and Northern Affairs Canada). 2018. NWT land information related to Indigenous groups. Accessed March 2020. Available at https://wlwb.ca/nwt-land-information-related-indigenous-groups-arch-e-standard-maps

LWBMV (Land and Water Boards of the Mackenzie Valley). 2018a. Engagement and Consultation Policy. Accessed January 2020. Available at https://wlwb.ca/sites/default/files/mvlwb_engagement_and_consultation_policy_-_nov_25_19.pdf

LWBMV. 2018b. Engagement Guidelines for Applicants and Holders of Water Licences and Land Use Permits. Accessed January 2020. Available at https://wlwb.ca/sites/default/files/mvlwb_engagement_guidelines_for_holders_of_lups_and_wls_-_october_2_19.pdf

MVEIRB (Mackenzie Valley Environmental Impact Review Board). 2018. Draft Environmental Assessment Initiation Guidelines for Developers of Major Projects. Accessed January 2020. Available at http://reviewboard.ca/sites/default/files/news/files/mveirb-cl_and_draft_ea_initiation_guidelines_for_developers_of_major_projects_.pdf

Appendix A Engagement Summaries

Pine Point Mine - Summary of Key Engagement Activities with Potentially Affected Parties

Developer: Pine Point Mines Limited (PPML)

Affected Party: Akaitcho IMA Office

Date	Contact	Contact Initiated By	Subject / Issue / Recommendation	Response or Resolution
2020-08-19	Richard Simon	Andrew Williams	Request an opportunity to present the PEA results and upcoming permit applications	No Response as of 18 September 2020
2020-08-19	Greg Guthrie	Andrew Williams	Request an opportunity to present the PEA results and upcoming permit applications	No Response as of 18 September 2020
2020-08-19	Sarah Taylor	Andrew Williams	Request an opportunity to present the PEA results and upcoming permit applications	No Response as of 18 September 2020
2020-08-11	Stephanie Poole	Andrew Williams	Asked if emails addresses were correct for Chief Marlowe at LKDFN and for the Akaitcho Dene First Nations	Replied with new email addresses; sent emails to Richard Simon, Greg Guthrie, and Sarah Taylor.
2020-06-29	Stephanie Poole	Andrew Williams	Follow-up to email to Anne Boucher to Request an opportunity to present the PEA results and upcoming permit applications	Replied with alternate email addresses.
2020-06-26	Annie Boucher	Andrew Williams	Request an opportunity to present the PEA results and upcoming permit applications	2020-07-13 Stephanie Poole responded and had forwarded the email to the ADFN's.
2018-06-01	Screening Officer	Judy Dudley	Provided copies of Osisko Metals' Feb. 26 and April 26, 2018 news releases related to the Exploration and Winter Drilling programs at Pine Point. Provided detailed instructions on how to sign up directly to receive future news releases.	n/a
2018-02-01	Screening Officer	John Key	Notice submitted that PPML intends to file application for a new Type A LUP and Type B WL for confirmation drilling program. Provision of a map showing the affected leases. Clarification of Application duration and drilling program permitted under MV2017C0024. Request for updated contact information and how the organization wishes to be engaged over the life of the permit.	n/a

Developer: Pine Point Mines Limited (PPML)

Affected Party: Avalon Advanced Materials

Date	Contact	Contact Initiated By	Subject / Issue / Recommendation	Response or Resolution
2020-08-18	Donald Bubar	Andrew Williams	Letter notifying of intent to seek renewal of 2018 Water Licence and extension of 2018 LUP.	Reply received from Bill Mercer, informed PPML that Avalon Advanced Materials no longer has rights in the area and advised PPML that we no longer have to inform Avalon any longer
2019-12-11	Don Bubar	S Marshall for J Hussey	Letter sent describing proposed amendment of MV2017C0024 and inviting input from engagement party	No response
2018-10-23	General Office	John Key	PPML will be requesting changes to WMP for LUP MV2017C0024. The main change is to increase maximum amount of greywater on-site from 100 L/day to 5,000 L/day and discharge of greywater into a sump. Expect to have a temporary camp.	n/a
2018-02-01	Administration	John Key	Notice that PPML intends to file application for a new Type A LUP and Type B WL for confirmation drilling program. A map showing the affected leases and claims was provided. Application will be for 27 month period beginning April, 2018. Drilling to occur at same time as, and in addition to, exploration drilling program permitted under MV2017C0024. Request updated contact information to whom correspondence on this application / project should be sent. Ask how organization wishes to be engaged over the life of the permit.	n/a
2018-01-09	Donald Bubar	Jeff Hussey, President & CEO	Notification that Osisko Metals is purchasing PPML, and clarification regarding intention to reassign PPML permits and continue exploration. Contact information for J Key provided.	n/a
2018-01-09	Donald Bubar	Jeff Hussey, President & CEO	Notification that Osisko Metals is purchasing PPML, and clarification regarding intention to reassign PPML permits and continue exploration. Contact information for J Key provided.	n/a

Developer: Pine Point Mines Limited (PPML)
Affected Party: Business Owners - Hay River

Date	Contact	Contact Initiated By	Subject / Issue / Recommendation	Response or Resolution
2018-04-18	Terry Rowe	Terry Rowe	sent a copy to PPML of the letter they are submitting re: support for the confirmation drilling program permit application.	J Key replied with thanks.

Developer: Pine Point Mines Limited (PPML)
Affected Party: Cabin Owners

Date	Contact	Contact Initiated By	Subject / Issue / Recommendation	Response or Resolution
2018-02-02	Senior Administrative Officer	John Key	Sent engagement request message to cabin owners as email attachment and asked that it be posted on public notice boards. Message described proposed action in general terms and asked for contact information for future engagement.	n/a
2018-02-02	Senior Administrative Officer	John Key	Sent engagement request message to cabin owners as email attachment and asked that it be posted on public notice boards. Message described proposed action in general terms and asked for contact information for future engagement.	n/a
2018-02-02	Office of the Chief; Lands Director	John Key	Sent engagement request message to cabin owners as email attachment and asked that it be posted on public notice boards. Message described proposed action in general terms and asked for contact information for future engagement.	n/a
2018-02-02	Senior Administrative Officer	John Key	Sent engagement request message to cabin owners as email attachment and asked that it be posted on public notice boards. Message described proposed action in general terms and asked for contact information for future engagement.	n/a
2018-02-02	Office of the President	John Key	Sent engagement request message to cabin owners as email attachment and asked that it be posted on public notice boards. Message described proposed action in general terms and asked for contact information for future engagement.	n/a
2018-02-02	Office of the President	John Key	Sent engagement request message to cabin owners as email attachment and asked that it be posted on public notice boards. Message described proposed action in general terms and asked for contact information for future engagement.	Shawn, FRMC replied 2/2/18 that PPML can contact FRMC or DKFN for information about cabins. Requested a public meeting to get more information about PPML. JKey replied 2/2/18 that PPML would appreciate having the notice posted. Reminded that there was a community meeting on Nov 29, 2017 and that members from FRMC attended, and that PPML meets with President Beck on a regular basis and have taken his advice concerning distribution of information. Shawn, FRMC replied 2/2/18 that he wasn't able to attend meeting in Nov. and wishes PPML would hold another meeting.
2018-02-02	Frank Lafferty	John Key	Sent engagement request message to cabin owners as email attachment and asked that it be posted on public notice boards. Message described proposed action in general terms and asked for contact information for future engagement.	Email from Frank Lafferty received Feb. 14, 2018. He provided contact information for himself and his brother Kevin Lafferty, both of whom have cabins at the Pine Point Town Site.

Developer: Pine Point Mines Limited (PPML)
Affected Party: City of Yellowknife

Date	Contact	Contact Initiated By	Subject / Issue / Recommendation	Response or Resolution
2020-08-20	Mayor Alty, Kerry Penny (Dir, Econ Dev and Strategy)	Jeff Hussey and Andrew Williams	Presented update on the Pine Point project based on the results of PEA including the project description, upcoming permit applications and EA initiation package submission.	Questions and responses: 1. Mayor asked about employment rotations and has PPML completed a Labour Resource Study. PPML replied that at the PEA level we have not yet undertaken a Labour Resources Study. This would be addressed in later studies. 2. K Penny asked about where, when and how many employees PPML would require.as the City of YK has several infrastructure projects in the 2020's. PPML replied that apart from the high level employment numbers in the PEA we have not yet scheduled in detail employment timing and positions. PPML undertook to keep the City apprised as planning continues and timing etc. is firmed up.. 3. Has PPML presented to the YK Chamber of Commerce. PPNL has not presented to the YK Chamber, however PPML has presented to the NWT Chamber of Mines. K Penney provided a contact for the Chamber of Commerce.
2020-08-14	Brooklyn Poeschuk	Andrew Williams	Followed up on request to present PEA results and upcoming permit applications	A Williams responded and Paula Mackenzie setup meeting date for August 20, 2020
2020-06-26	Chief Lynn Alty	Andrew Williams	Request an opportunity to present the PEA results and upcoming permit applications	2020-06-29 Paula Mackenzie (Sen. Exec Asst, Admin, YK) responded and suggested meeting with the Mayor and members of the Economic Development team.

Developer: Pine Point Mines Limited (PPML)
Affected Party: Deh Cho Land Use Planning

Date	Contact	Contact Initiated By	Subject / Issue / Recommendation	Response or Resolution
2018-06-01	General Office	Judy Dudley	Provided copies of Osisko Metals' Feb. 26 and April 26, 2018 news releases related to the Exploration and Winter Drilling programs at Pine Point. Provided detailed instructions on how to sign up directly to receive future news releases.	n/a
2018-02-01	Administration	John Key	Notice submitted that PPML intends to file application for a new Type A LUP and Type B WL for confirmation drilling program. Provision of a map showing the affected leases. Clarification of Application duration and drilling program permitted under MV2017C0024. Request for updated contact information and how the organization wishes to be engaged over the life of the permit.	n/a

Developer: Pine Point Mines Limited (PPML)
Affected Party: Deninu K'ue First Nation

Date	Contact	Contact Initiated By	Subject / Issue / Recommendation	Response or Resolution
2020-09-16	Carol Ann Chaplin	Daniel Slade	Place order for core boxes with DKFN.	n/a
2020-09-09	Chief and Council	Jeff Hussey, Andrew Williams, Jesse O'Brien	Purpose: To present the results of the Preliminary Economic Assessment and the next steps for the project. Request for support from the DKFN for the upcoming project permit applications Key Outcomes: Introduction that Golder wants to work with communities to determine how they'd like to participate in socio-economic and TK studies and how these studies should be undertaken. Question if the old pits have machinery at the bottom will these be cleaned up by the Project? J Hussey responded that the cleanup of the old Pine Point mine site was now the responsibility of the GWNT and the Federal Government. DKFN expects to benefit from the Project in the DKFN's area. J Hussey responded that at this early stage in the project the main activity is drilling. clarification of project schedule provided, and discussion regarding training and associated funding available to communities. The benefits for the DKFN need to be discussed at a Joint Implementation Committee meeting. As the construction period approaches in 2023 PPML will have completed the Environmental Assessment and the Feasibility Study. PPML will be engaging closer to that time on the benefits that will be available to the DKFN. DKFN noted an arrangement with Forward Mining though Rowes Construction. DKFN concerned about how PPML will protect workers from COVID if people are coming in from outside. J Hussey noted that workers follow all the COVID-19 rules mandated by the Chief Public Health Officer and explained the camp and commuting measures in place. Discussion around how PPML would monitor contaminants such as lead and zinc, as well as contaminants from blasting. Discussion about next steps and conclusion of meeting.	PPML acknowledged they would only work with DKFN businesses or their designates when planning social baseline studies. Jeff Hussey to arrange a Joint Implementation Committee meeting. Agenda to include DKFN Members using their own equipment for work on the Project. PPML to share Covid 19 protocols for workers at the Exploration Camp.
2020-09-02	Carol Ann Chaplin	Andrew Williams	Requested to reschedule the meeting from 2 September to 9 Septmeber as some Coucillors could not attend the 2 Sep	Changed meeting invitation to 9 September.
2020-08-27	Carol Ann Chaplin	Andrew Williams	Acknowledged date for presentation to DKFN Council on September 2nd. Reiterated request for comment on the 2018 permit renewal/extension application. We will discuss the renewal/extension application at the meeting.	n/a
2020-08-26	Jeff Hussey and Andrew Williams	Carol Ann Chaplin	Changed date of meeting with Council from August 26, 2020 to September 2, 2020	PPML confirmed the change
2020-08-26	Chief Louis Balsillie	Jeff Hussey and Andrew Williams	Informed Chief Balsillie that PPML was providing information on the project to various communities in the region as required by our engagement plans. We informed the Chief of our presentation to LKDFN regarding the project and that LKDFN informed PPML that under umbrella of the Akaitcho Dene First Nations there was agreement among the ADFN regarding benefit agreements for future projects in the Akaitcho Lands.	Chief Louis acknowledged the information.
2020-08-25	Chief Louis Balsillie	Jeff Hussey and Andrew Williams	Advised Chief Louis that PPML wished to present the results of the PEA to the Chief an Council. Chief Louis queried why were we including others beside the DKFN/KFN in this consultation.	The call was terminated prematurely. PPML will try to reconnect with the Chief.
2020-08-21	Chief Louis Balsillie	Jeff Hussey	Request for opportunity to engage. Left message.	n/a
2020-08-21	Carol Ann Chaplin	Jeff Hussey	Request for opportunity to engage on Pine Point Project. Left message with band office receptionist.	n/a
2020-08-21	Jeff Hussey	Chief Louis Balsillie	Date set for meeting with Chief and Council on August 26, 2020 at 5pm. Asked that we arrange the meeting with the SAO	We sent meeting invitation to Carol Ann Chaplin (SAO) who accepted the invitation
2020-08-18	Chief Louis Balsillie	Andrew Williams	Letter notifying of intent to seek renewal of 2018 Water Licence and extension of 2018 LUP.	n/a
2020-08-13	Chief Louis Balsillie	Jeff Hussey	Requested date for PEA and permit presentation. The chief said he would contact his SAO to determine a date.	Chief called back and said he needed to review upcoming council meeting agenda and would confirm the date
2020-08-11	Chief Louis Balsillie	Jeff Hussey	The chief was busy and said he would call back	n/a
2020-08-07	Carol Ann Chaplin	Jeff Hussey	Left message requesting the Chief call back to setup up meeting with Chief Louis.	n/a
2020-06-26	Chief Louis Balsillie	Andrew Williams	Request an opportunity to present the PEA results and upcoming permit applications	n/a
2020-03-16	Carol Chaplin, SAO	Jeff Hussey	J Hussey emailed C Chaplin with update on seasonal program status; winter drill program expected to be completed in next couple of days. A small crew will remain to finish geophysics work and then to maintain camp; impact of COVID-19 on development timelines is being assessed going forward.	n/a

2020-02-07	Chief Louis Balsillie, Kevin Boucher, Stanley Beck, Frank Lafferty, Carol Chaplin, SAO	PPML	PPML (J Hussey, A Williams) provided an update on project status and plans including intention to pursue advanced exploration permitting, continuing development of mine plans and environmental baseline data collection; DKFN enquired if freeze walls were being considered. PPML responded that currently reinjection of groundwater was preferred; In response to a question about tailings, PPML would not be reusing the old tailings facility and would, where possible, deposit tailings in old pits. PPML expects to have more information to share on next permitting steps in spring 2020	n/a
2020-01-28	Carol Chaplin, SAO	Sean Marshall	Aurora Geoscience emailed DKFN SAO to inquire of meeting availability on 7 February	31 January 2020, Aurora Geosciences followed up by email; DKFN responded as being not available and requesting other dates; Aurora Geoscience replied, late March appears next opportunity for in-person meeting, will follow up when scheduling can be opened
2019-12-11	SAO Office	S Marshall for J Hussey	Letter from PPML describing proposed amendment of MV2017C0024 and inviting input from engagement party	No response
2019-12-09	Carol Chaplin, SAO	Carol Chaplin, SAO	SAO emailed J Hussey and S Marshall: Meeting request for January from Chief and Council	10 Dec 2019 Aurora Geoscience responded, offered week of 27 January 2020; 11 Dec 2019 DKFN responded, requested earlier if possible; 19 Dec 2019 Aurora Geoscience suggested conference call earlier in January; no DKFN response
2019-12-06	SAO Office	J Hussey	Share information related to proposed amendment of MV2017C0024	Meeting requested in early January; follow up requests from Aurora Geoscience (10 Dec 2019 and 19 Dec 2019) seeking input on proposed amendment not responded to
2019-11-25	SAO Office	S Marshall	Inquire on DKFN confirmation of status of Key Contracting in relation to Collaboration Agreement	SAO responded DKFN supports PPML's operations
2019-10-29	Carol Chaplin, SAO	Carol Chaplin, SAO	Request to set up a meeting between DKFN, Rowes, and PPML	n/a
2019-09-25	SAO Office	J Hussey	Confirmation of News Release content for approval regarding the Collaboration agreements by DKFN.	n/a
2019-08-26	Carol Chaplin, SAO	Carol Chaplin, SAO	Request that site visit participants also receive a tour of your camp and the core processing facility, and to include lunch on site.	The tour went well with positive feedback
2019-08-14	SAO Office	J Hussey	Sent Executed Copy of Collaboration Agreement	n/a
2019-08-07	Carol Chaplin, SAO	Carol Chaplin, SAO	Request to receive opportunities to bid on contracts such as brushing, and provision of contact information for Chief Balsillie	Provided rationale for not putting brushing contract to tender, and request for letter of support regarding aurora research licence.
2019-07-24	SAO Office	J Hussey	July 24 to Aug 15th: Request for support of Aurora Research License for Environmental baseline work	August 16th: Received DKFN latter of support for research license
2019-07-24	SAO Office	J Hussey	Request for support letter for Aurora Research Institute Research License associated to baseline environmental studies	n/a
2019-07-17	SAO Office	J Hussey	Request for meeting	n/a
2019-07-11	Carol Chaplin, SAO	Carol Chaplin, SAO	Received Signed Collaboration Agreement	n/a
2019-07-05	Carol Chaplin, SAO	Carol Chaplin, SAO	Received proposed changes to the Collaboration Agreement	n/a
2019-07-05	Carol Chaplin, SAO	Jeff Hussey	Provision of draft documentation for the proposed amendment to land use permit MV2017C0024 (Pine Point camp) and notification of preparation for advanced exploration permitting in 2020.	DKFN Chief and Council request a meeting with PPML in January, and request to know availability.
2019-06-25	Carol Chaplin, SAO	Carol Chaplin, SAO	Letter sent to Department of Lands for the amendment of the interim Land Withdrawals	n/a
2019-06-25	Carol Chaplin, SAO	Carol Chaplin, SAO	From March to the end of June there were several communications regarding the negotiation of the Collaboration Agreement regarding meetings for clarification and negotiation. This allowed for the development of an understanding and relationship building.	n/a
2019-06-24	Carol Chaplin, SAO	Carol Chaplin, SAO	Provision of confidentiality agreement and discussion of collaboration agreement	n/a
2019-05-22	SAO Office	J Hussey	Confirming meeting on Friday May 10	n/a
2019-05-22	Carol Chaplin, SAO	Carol Chaplin, SAO	Confirming meeting on Friday May 10	Confirmation that Chief and Council will attend meeting, and clarification of costs
2019-05-22	SAO Office	J Hussey	Corporate Update meeting in Fort Resolution at noon	n/a
2019-05-09	Chief Louis Balsillie	Chief Louis Balsillie	Communication regarding the location of camp accommodations and the Collaboration Agreement.	n/a
2019-05-09	Carol Chaplin, SAO		Provision of contact information for DKFN legal counsel	n/a
2019-02-08	Carol Chaplin, SAO	Carol Chaplin, SAO	Requesting a meeting for an update	n/a
2019-01-28	Rosy Bjornson	Rosy Bjornson	Request for donation for the NWT Territorial Dog Sledding Champion race held during the spring carnival March 21-24, 2019 and other related Carnival festivities.	PPML did not donate to this cause after donating $10,000 for school bus in November
2019-01-28	Kathleen Fordy for Roy Bjornson	Kathleen Fordy for Rosy Bjornson	Request for donation for a photo contest, and workshop that in Fort Resolution on March 7, 2019.	PPML did not donate to this cause after donating $10,000 for school bus in November
2019-01-18	SAO Office	PPML	New Year greetings and a request to schedule an update call with Chief Louis Balsillie	Response to reach out directly by phone

2019-01-18	SAO Office	J Hussey	Notify DKFN of temporary shut down of Pine Point drill program until after Spring breakup. Offer setup a call for next week with Chief Louis Balsillie and to also discuss a next visit that will probably only happen in April at this point	n/a
2018-12-07	n/a	Stanley Clemmer	Discuss the planned camp at Pine Point for the winter drilling program	n/a
2018-12-03	IMA Office	Judy Dudley	Provided results from the 2018 Wildlife Study as requested/required for the research permit.	n/a
2018-11-29	Carol Chaplin, SAO	Judy Dudley	Provided a summary of the 2018 Archaeology study	C Chaplin asked that Rosy's email be updated to ima@dkfn.ca
2018-11-15	Carol Chaplin, SAO	Jeff Hussey	Discussed project. DKFN asked for funding to purchase a school bus. Osisko Metals noted that school buses should be funded by the GNWT. But that this one time, Osisko Metals would donate $10,000 to the purchase.	SAO replied by email 11/22/18 with thanks. Will send an invoice.
2018-11-15	IMA Office	Judy Dudley	Provided a copy of Sept, 2018 groundwater quality monitoring data.	n/a
2018-11-12	IMA Office	Judy Dudley	Provided a copy of June, 2018 groundwater quality monitoring data.	n/a
2018-11-07	Carol Chaplin, SAO	SAO	Requested information on occupancy for new camp so they could quote the catering	Replied with camp occupancy. SAO followed up with additional questions and they were answered.
2018-11-07	Carol Chaplin, SAO	John Key	Requested update on invitation for DKFN to provide a bid for camp catering.	J Key provided same-day written answers to camp related questions sent by DKFN on Nov. 9 Nov. 9 C Chaplin forwarded a list of questions from A Harris at Rowe's Construction
2018-10-11	Senior Administrative Officer	John Key	PPML will be requesting changes to WMP for LUP MV2017C0024. The main change is to increase maximum amount of greywater on-site from 100 L/day to 5,000 L/day and discharge of greywater into a sump. Expect to have a temporary camp.	n/a
2018-10-03	Carol Chaplin, SAO	John Key	Notification that drill program was being reduced in size and fewer beds would be required at camp	Emailed back and forth to confirm number of drills and men in camp
2018-10-01	Carol Chaplin, SAO		Receipt of camp invoice	Request for further invoices not included. Further requested that invoices be corrected for date. A Lessard of Osisko Metals sent new invoicing instructions to C Chaplin.
2018-09-25	Senior Administrative Officer; IMA Office	John Key	Update on drilling programs & summer activities recently completed. Intro of staff from Osisko Metals, and presentation of the company philosophy on consultation. DKFN staff presented information on their community.	n/a
2018-09-20	Carol Chaplin, SAO	John Key	Discussed logistics for upcoming meeting on 9/25	n/a
2018-09-06	Carol Chaplin, SAO	Carol Chaplin	Further clarification on camp invoicing	n/a
2018-09-04	Carol Chaplin, SAO	Carol Chaplin	Inquiry on required September water truck services for drill program	Responded that no services were required at this time
2018-09-02	Carol Chaplin, SAO	Carol Chaplin	New directions on Camp invoicing	SAO requested further information. Osisko Metals confirmed her understanding
2018-08-31	Carol Chaplin, SAO	Carol Chaplin	Asking for clarification on invoicing for Rowe Camp	Clarified Invoicing
2018-08-17	Carol Chaplin, SAO	John Key	J Key copied on email string between Coalition and Great Slave Drilling regarding payment process. J Key replied that PPML is not part of that contractual agreement. J Key offered to talk with the owner at Great Slave Drilling on his next trip north to encourage timely payment. C Chaplin replied 8/13 that Chief has expressed concern about Great Slave Drilling's involvement in the drilling contract.	n/a
2018-08-14	Carol Chaplin, SAO	Carol Chaplin, SAO	Discussion regarding the contract to deliver core boxes, and expression of interest in having the local contractor re-instated.	J Key replied 8/15/18 that the contract award is in part performance-based. Photographs were provided to document repeated performance issues, and discussion of costs to PPML to address performance issues.
2018-08-13	Senior Administrative Officer	John Key	Replied to a request for contact information for the ProCore drilling company.	n/a
2018-07-26	Bob Overvold	John Key	Requested meeting with Chief Balsillie on July 30 to discuss the camp issue. C Chaplin replied on 7/26 that Chief asked her to notify J Key that he is not willing to meet.	n/a
2018-07-24	Senior Administrative Officer	Stanley Clemmer	Provided a pdf file of Jan - April 2018 drilling program	n/a
2018-07-23	Carol Chaplin, SAO	Carol Chaplin	Drill workers are moving from Fort Resolution to camp at km 38; DKFN is interested in the continuation of housing workers in Fort Resolution and use the Highway camp as overflow.	C Chaplin and J Key exchanged emails on 7/23 and 7/24 on this issue. C Chaplin reported that the Chief wants workers to move back to Fort Resolution to maintain the associated revenue stream. J Key responded that PPML has always understood that camp revenues will go to the Coalition to benefit the whole community. Moving workers to the km 38 camp is better for safety and achieving project efficiency goals. If that camp fills up, then PPML will ask to use the camp in Fort Resolution once again. C Chaplin replied 7/24 with discussion of whether the Fort Resolution camp is part of the Coalition agreement.
2018-07-23	Carol Chaplin, SAO	Carol Chaplin	Request for information as to why drilling workers are moving to the km 38 camp from Fort Resolution.	J Key replied that he had wanted to discuss this at the meeting on 7/20. PPML is losing out on 4 hours of drill time per drill per day by having the crews based out of Fort Resolution instead of closer. Coalition revenues from camp will not be different with the shift in workers; drilling work/revenues will improve. Info given in advance so Coalition has time to plan for the transition.
2018-07-20	Rosy Bjornson	John Key	J Key arrived to meet with C Chaplin to discuss drilling business. She was not in. J Key spoke with Rosy Bjornson about arranging a trip for the Coalition elders to visit the drill site. She promised to look into this and get back to J Key.	n/a
2018-07-06	Judy Dudley	Judy Dudley	Provide a job description for a field assistant to work on AIA study. Deadline for applications July 20.	Reminder sent on July 23 that application had passed with no responses. Requested forwarded responses by July 24 if available, otherwise position will be advertised more widely.

2018-06-14	Chief Balsillie; Tim Smith, PPML	John Key	Reviewed recently completed winter drill program. Discussed upcoming summer drill program & baseline studies. Discussed concept of having an Aboriginal Drill Company with DKFN as participant; Chief was supportive & would discuss with Council. PPML interested in staking three small parcels which are surrounded by PPML claims & leases; Chief said to go ahead and stake the claims and that he would take this to his Council for approval later.	n/a
2018-06-07	Carol Chaplin, SAO	John Key	Asked DKFN to send a letter to MVLWB comment registry asking that the Confirmation permit be issued without any further delays.	C Chaplin replied 7 June that Chief had talked with J Ho at MVLWB and was told that PPML could still drill. J Key replied that PPML could only drill under old permit (3 drills) not new permit (more drills) and this was negatively impacting PPML's program goals. C Chaplin sent PPML a copy of the letter that Chief Balsillie sent to MVLWB and the MLA on June 7 regarding support for drill program and request for prompt issuance.
2018-06-01	Senior Administrative Officer	Judy Dudley	Provided copies of Osisko Metals' Feb. 26 and April 26, 2018 news releases related to the Exploration and Winter Drilling programs at Pine Point. Provided detailed instructions on how to sign up directly to receive future news releases.	n/a
2018-05-29	Senior Administrative Officer	John Key	Provided details of meeting with FRMC on June 16 and requested confirmation that Chief Balsillie will also attend	n/a
2018-05-25	Carol Chaplin, SAO	John Key	Requested a meeting for June 16.	Meeting details confirmed by email from C Chaplin on June 5, 2016
2018-05-25	Carol Chaplin, SAO	John Key	Requested a meeting for June 16.	Meeting details confirmed by email from C Chaplin on June 5, 2016
2018-05-10	Senior Administrative Officer	Judy Dudley	Provided copy of approved Archaeological Overview Assessment	n/a
2018-05-10	Senior Administrative Officer	Judy Dudley	Provided copy of approved Archaeological Overview Assessment	n/a
2018-05-10	Carol Chaplin, SAO	Carol Chaplin, SAO	Requested information on status of payments to Great Slave Drilling. They have questions about the Coalition billing paperwork.	J Key provided confirmation that a message had been passed along to Great Slave Drilling for them to contact C Chaplin.
2018-05-09	Lisa Tudor	Judy Dudley	Advance notice that study licence application for archeology will be coming. PPML expects to hire a qualified field assistant from Fort Res to participate.	Acknowledged with thanks
2018-05-08	Carol Chaplin, SAO	Carol Chaplin, SAO	Sent copy of message from DKFN IMA to Niccole Hammer at Aurora College indicating that DKFN had no concerns re: scientific license application	n/a
2018-04-18		J Key	Chief did not show up for scheduled meeting.	n/a
2018-04-18	Carol Chaplin, SAO	John Key	Several emails exchanged re: letter of support that DKFN plans to submit re: confirmation drilling program permit application. C Chaplin provided a copy of the letter that awaits Chief's signature.	n/a
2018-04-17	Carol Chaplin, SAO	John Key	Exploration Committee meeting, Present: J Key (PPML) & C Chaplin (DKFN). Absent: T Smith (PPML) and Lisa Tudor (FRMC). JK reminded that this meeting was for the Coalition issues. JK reviewed economic opportunities that have been provided to Fort Resolution so far under DB/PPML. Discussed opportunities for coalition to provide camp services to drill program workers under new permit. J Key reminded that coalition has open opportunity to respond to RFP for pit surveying. Discussed comments that DKFN had posted to MVLWB comment registry for current application; C Chaplin said that those were posted without full approval and DKFN planned to retract them.	n/a
2018-04-17	Carol Chaplin, SAO	John Key	Provided information from Rowe Construction regarding logistics associated with Fort Resolution coalition assuming management of Construction Camp at Hwy 6 Km 38 after their road work is finished. Fort Resolution coalition has an interest in providing camp services to PPML's drilling contractors.	C Chaplin replied that they are interested in pursuing this opportunity.
2018-04-16	Carol Chaplin, SAO	John Key	Communicated that J Key is currently in Hay River. Would like to meet afternoon of April 17 with the FRMC-DKFN coalition Exploration Committee members and also meet with the Chief.	C Chaplin replied that she and Chief are available to meet.
2018-03-23	Carol Chaplin, SAO	Tim Smith	Sent notice that PPML was willing to host a 2-day Basic First Aid and a 2-week Emergency Medical Responder course in order to train and then hire local people for summer drill program. Asked for names of candidates for the training program by April 7, 2018 (2 weeks).	Carol Chaplin sent 2 names on April 10; she sent the name of another candidate on May 14.

2018-03-18	Carol Chaplin, SAO	John Key	Reminded of the request to Arthur Beck for a copy of the Timberworks pick-up truck lease sent 10-days ago, and expression of interest in taking over the lease.	Carol Chaplin replied 3/19 that she will try to get more information about this.
2018-03-09	Carol Chaplin, SAO	Carol Chaplin, SAO	Informed PPML that the Chief has been made aware of FRMC's request regarding coalition payment approach, and that this is issue for the 2 leaders to resolve.	PPML acknowledged the email.
2018-03-06	Chief and SAO	John Key	Discussed the current exploration program. Identification of Mr. Lafferty's trapline location and trapping schedule. Chief and SAO agreed to get trapline information including names and map locations. J Key asked for details about cabins; DKFN knows of 3 cabins (Kevin Lafferty, Frank Lafferty, and Les Pike). Key informed that Golder would be doing a wildlife study for PPML and asked for endorsement of the Wildlife Study license application. SAO was given the paperwork, along with a 2nd copy for FRMC. She said she would take care of this. Discussion about pick-up truck lease and possibility of Horizon North operating a drillers camp through Coalition. SAO indicated that they would assume responsibility for permitting a camp.	n/a
2018-03-06	Chief and SAO	John Key	Meeting request from PPML asked that both coalition partners be present (DKFN and FRMC) to discuss Confirmation Drilling program.	No representative from FRMC attended. The full DKFN Council reviewed the applications for the Confirmation Drilling program and they had no comments or concerns.
2018-03-02	Carol Chaplin, SAO	Carol Chaplin, SAO	Inquiry about status of payments from Osisko Metals to the Drilling Companies.	J Key replied 3/3/2018 that the payments from new owner are supposed to be paid on 3/4/18.
2018-02-26	Senior Administrative Officer	DKFN SAO	Forwarded a letter from one of their members about trapping.	n/a
2018-02-21	Eddie Lafferty	Eddie Lafferty	Expressed concern to DKFN office regarding his traps being damaged by previous drilling by a different company, and financial compensation for activities on his trapline.	DKFN Chief forwarded the letter to PPML. No map was available to show the area of concern. This issue was discussed further in March 6 meeting
2018-02-20	Senior Administrative Officer	John Key	Provided review copies of the LUP and WL applications and the supporting Plans and identified availability for discussion.	n/a
2018-02-12	Carol Chaplin, SAO	Stan Clemmer	Talk about core box production and delivery	DKFN happy with work and we have a delivery sign off system in place
2018-02-12	Carol Chaplin, SAO	Stan Clemmer	Talk about core box production and delivery	DKFN happy with work and we have a delivery sign off system in place
2018-02-09	Administrative Office	Tim Smith	Summary of drilling activity, expenditures, and labor during Fall Field season.	n/a
2018-02-01	Carol Chaplin, SAO, Chief Balsillie	John Key	Notice submitted that PPML intends to file application for a new Type A LUP and Type B WL for confirmation drilling program. Provision of a map showing the affected leases. Clarification of Application duration and drilling program permitted under MV2017C0024. Request for updated contact information and how the organization wishes to be engaged over the life of the permit.	In meeting on Feb. 1, Chief Balsillie asked that correspondence on this permit be directed to Rosie (IMA) with cc: to Carol Chapman (SAO).
2018-02-01	Chief Balsillie and C Chapman	Tim smith	Reviewed on-going activities for winter drill program. Discussion about housing drillers in fort Resolution, and providing employment for drilling assistants. Chief appointed C. Chapman to represent DKFN on Exploration Committee and will ask President Beck of FRMC to nominate someone (maybe Lisa Taylor). C Chapman suggested cost share with PPML to train Ft. Res residents to be EMT's. Chief mentioned that Band has a 3/4 ton pickup available for rent; PPML does not have current need but may in future. PPML asked for information on cabin owners.	DKFN provided the following information on Pine Point cabin owners known to them: Kevin Lafferty, Frank Lafferty, Les Pike. Eddie Lafferty has a trap line on the south side of the highway (near X15).
2018-01-20	Administrative Office	M King	Provided maps and coordinates for drill hole/drill pad locations and haul road plowing. DKFN contractor is to start on this immediately. Avoid High Voltage Power Line.	n/a
2018-01-19	Administrative Office	J Key	Authorized DKFN to contract Rowe Construction on ice road preparation ASAP. Time critical. (Rowe Construction is sub-contractor on PPML exploration project via agreement through DKFN -- DKDC is no longer going to be the prime contractor for the DKFN/FRMC coalition per instructions from DKFN)	n/a
2018-01-19	Carol Chaplin, SAO and Chief Balsillie	Carol Chaplin, SAO, for DKFN	J Key was informed that Chief Balsillie had discussed their PPML drilling agreements with Trevor Beck, President of HRMC. Chief informed Pres Beck that the DKFN/FRMC partnership would be prime contractor on all drilling done by Foraco and Great Slave Drilling and Exploration Ltd (owned by Shawn Grandguillot). If the Hay River Metis wanted their own deal with PPML, then they could work with Darryl Dean at ProCore drilling to establish a sub-contracting agreement.	J Key called C Chaplin on 1/19/2018 to ask why they had changed sub-contractors without any notice. She said it was the Chief's decision. J Key asked that the Chief call him to discuss.
2018-01-15	Arthur Beck, FRMC; Tim Smith, PPML	John Key	Shared details of Osisko Metals' potential acquisition of PPML, schedule, Osisko Metals' background and financial capacity, filing of a new application to make changes to the exploration program. Clarification that PPML will survive as owners of the permits, leases and claims.	n/a
2018-01-10	T Smith for PPML and Patty Simon of the DKFN	John Key	Shared details of Osisko Metals' potential acquisition of PPML, schedule, Osisko Metals' background and financial capacity, filing of a new application to make changes to the exploration program. Clarification that PPML will survive as owners of the permits, leases and claims.	n/a
2018-01-10	John Key, Patty Simon and Arthur Beck	T Smith	Discussed plans for the upcoming winter drill program and reviewed use of local sub-contractors. Patty Simon represented DKFN	n/a
2018-01-09	Administration	Jeff Hussey, President & CEO	Notification that Osisko Metals is purchasing PPML, and clarification regarding intention to reassign PPML permits and continue exploration. Contact information for J Key provided.	n/a
2018-01-05	Administrative Office	John Key	Provided review copy of Application to Assign MV2017C0024 from PPML to Osisko Metals.	n/a
2018-01-03	Senior Administrative Officer; Fred Spinola	John Key	Osisko Metals notification that a representative will be available to meet Jan 11 - 15 to answer questions and provide information related to acquisition of Pine Point project. Request to provide date, time and location for a meeting during those dates.	n/a

Developer: Pine Point Mines Limited (PPML)
Affected Party: Fort Providence First Nation

Date	Contact	Contact Initiated By	Subject / Issue / Recommendation	Response or Resolution
2020-08-21	Main Office	Damian Panayi	No answer at listed numbers	n/a
2020-08-20	Chief Bonnetrouge; Maggie Levavasseur	Andrew Williams	Letter notifying of intent to seek renewal of 2018 Water Licence and extension of 2018 LUP.	n/a
2020-08-20	Maggie Levavasseur	Andrew Williams	Called private number and explained who I was and that I had been calling various numbers on the web site without success. Maggie provided a new number. I also noted that Maggie had been sent some emails related to permit applications and engagement requests	Maggie provided a new number for the Fort Providence Band Office and contact name, Michael Hadley
2020-08-20	FPFN Band Office	Andrew Williams	Left message for Michael Hadley (the new Executive Director).	Left message for Michael Hadley to call back
2020-06-26	Chief Xavier Candien	Andrew Williams	Request an opportunity to present the PEA results and upcoming permit applications	n/a

Developer: Pine Point Mines Limited (PPML)
Affected Party: Fort Resolution Metis Council

Date	Contact	Contact Initiated By	Subject / Issue / Recommendation	Response or Resolution
2018-12-03	Office of the President	Judy Dudley	Provided results from the 2018 Wildlife Study as requested/required for the research permit.	n/a
2018-11-29	Environment Office	Judy Dudley	Provided a summary of the 2018 Archaeology study	n/a
2018-11-15	Environment Office	Judy Dudley	Provided a copy of Sept, 2018 groundwater quality monitoring data.	n/a
2018-11-12	Environment Office	Judy Dudley	Provided a copy of June, 2018 groundwater quality monitoring data.	n/a
2018-11-09	n/a	John Key	Notification that a camp catering quote was being requested from the Coalition via DKFN	n/a
2018-11-09	Office of the President	John Key	Sent a copy of the email trail to DKFN regarding request for bid on camp catering services. Stated that DKFN SAO has said they can't split the contract but are willing to hire FRMC workers.	J Key provided same-day written answers to camp related questions sent by DKFN on Nov. 9
2018-10-11	Office of the President	John Key	PPML will be requesting changes to WMP for LUP MV2017C0024. The main change is to increase maximum amount of greywater on-site from 100 L/day to 5,000 L/day and discharge of greywater into a sump. Expect to have a temporary camp.	n/a
2018-09-25	Arthur Beck, President; W Delorme, VP; Wilfred Beaulieu, Council; Kara Bailey, Council; Paula King, Council	John Key	Update on drilling programs & summer activities recently completed. Council members had questions about findings. Coalition agreement is expired and FRMC is not interested in renewing it. Intro of staff from Osisko Metals, and presentation of the company philosophy on consultation. President Beck presented information on their community & included a review of grievances from prior mining operations. FRMC wants to negotiate an IBA. Set date with FRMC, Northwest Territory Metis Nation and Foraco to discuss Aboriginal Drilling Company.	n/a
2018-09-21	Arthur Beck	Arthur Beck, President FRMC	Requested different meeting time for 9/25	n/a
2018-09-20	Walter Delorme, VP	John Key	Discussed logistics for upcoming meeting on 9/26	n/a
2018-08-24	Arthur Beck, FRMC; Lisa Tudor, FRMC	John Key	Discussed progress of coalition issues & fact that the agreement is expired. President Beck says FRMC wants a Coalition Board to run the agreement. L Tudor informed that she was leaving her job at FRMC. L Tudor informed that the winter 2018 drill program payments had been reconciled. Discussed possibility of having FRMC assist with removing some of the beavers at Pine Point.	n/a
2018-07-24	Lisa Tudor	Stanley Clemmer	Provided a pdf file of Jan - April 2018 drilling program	L Tudor from FRMC sent an email to Judy Dudley at PPML asking for a contact to discuss financial questions. J Dudley suggested she contact S Clemmer and cc: to J Key.
2018-07-20	Lisa Tudor	John Key	L Tudor was unaware of being the FRMC representative to the EA Committee & of what functions the EA Committee handled. She was given a list of contracts we currently had with the Coalition and an explanation of the money flow from the contractors. Said she was going to meet with C Chaplin and confirm. L Tudor was going to take her notes to the FRMC Council meeting on Monday. Discussed the beaver issue with L Tudor. She was going to talk with the GNWT Wildlife Officer in Fort Resolution and take the issue to the Council for discussion. Discussed the potential hiring of archeological study helper/helpers. She said she had one person who probably would be willing to do the 7 day a week/12 hour shifts but would get back to us. Discussed the potential of having up to 4 employees to work at the mine site to identify and log core boxes. She said she would start looking for people.	n/a

2018-07-06	Judy Dudley; Lisa Tudor	Judy Dudley	Provide a job description for a field assistant to work on AIA study. Deadline for applications July 20.	Reminder sent on July 23 that application had passed with no responses. Requested forwarded responses by July 24 if available, otherwise position will be advertised more widely. L Tudor from FRMC replied on July 24 that she would try to identify an applicant by July 25. LT notified PPML on 7/26 that FRMC had selected a person for the position. J Dudley replied 7/26 that PPML is now talking with another possible candidate and needs to receive resume and salary requirements from FRMC candidate ASAP. L Tudor replied on 7/27 and also 7/28 that their applicant is still interested, but she did not have resume or salary requirements to forward. J Dudley replied that PPML still needed resume and salary requirements.
2018-06-26	President Beck	John Key	Discussed status "Coalition Board" that FRMC wants to have formed to handle finances of coalition payments. President Beck said he would talk with Chief Balsillie to check on status. Discussed also FRMC comments submitted to PWNHC on the study license application for AIA at Pine Point; comments are in conflict with Explore Agreement. President Beck says comments were submitted in error and he will ask staff to retract them.	J Key spoke with President Beck on July 5. Chief Balsillie has refused to set up a Board to run the Coalition. President Beck asked that PPML copy FRMC on all communications. President Beck said again that he would ask staff to retract comments to PWNHC.
2018-06-14	Council; Tim Smith, PPML	John Key	Reviewed recently completed winter drill program. Discussed upcoming summer drill program & baseline studies. Discussed concept of having an Aboriginal Drill Company with FRMC as participant; Council agreed with the concept but expressed concerns that all aboriginal groups should have equal interest. PPML interested in staking three small parcels which are surrounded by PPML claims & leases; Council agreed to this.	n/a
2018-06-07	Office of the President	John Key	Asked FRMC to send a letter to MVLWB comment registry asking that the Confirmation permit be issued without any further delays.	n/a
2018-06-01	Office of the President	Judy Dudley	Provided copies of Osisko Metals' Feb. 26 and April 26, 2018 news releases related to the Exploration and Winter Drilling programs at Pine Point. Provided detailed instructions on how to sign up directly to receive future news releases.	n/a
2018-05-30	Arthur Beck	Arthur Beck	President Beck asked J Key to attend a meeting at 6 pm on June 14 to discuss the Fort Resolution Coalition Agreement.	n/a
2018-05-29	Arthur Beck	John Key	Confirmed details for meeting on June 16	n/a
2018-05-29	Arthur Beck	John Key	Confirmed details for meeting on June 17	n/a
2018-05-25	Carol Chaplin, SAO	John Key	Requested a meeting for June 16.	n/a
2018-05-24	Sherrie Strand	Sherrie Strand	Requested donation from PPML for FMRC event. J key replied 30 May 2018 that PPML will make a donation; included paperwork that FRMC will need to process first.	n/a
2018-05-10	Office of the President	Judy Dudley	Provided copy of approved Archaeological Overview Assessment	n/a
2018-05-09	Carol Chaplin, SAO	Judy Dudley	Advance notice that study licence application for archeology will be coming. PPML expects to hire a qualified field assistant from Fort Res to participate.	Acknowledged with thanks
2018-04-20	Lisa Tudor	Tim Smith	Requested information on how to secure a room at Aurora College in Fort Res. L Tudor provided contact information for Krista Kerr at Aurora College.	Matt Vincent from "62 Degrees North" was hired to conduct the training courses.
2018-04-19	Lisa Tudor	Tim Smith	Sent notice that PPML was willing to host a 2-day Basic First Aid and a 2-week Emergency Medical Responder course in order to train and then hire local people for summer drill program. Asked for names of candidates for the training program by April 27.	Lisa Tudor replied by email on April 26 with a list of 19 names of people that would attend the training.
2018-04-18	Office of the President	John Key	Forwarded email string from Rowe's Construction about possibility for PPML to use construction camp along Hwy 6. Suggested Pres. Beck speak with C Chaplin if he wants further details.	n/a
2018-04-18	Sherrie Strand; Lisa Tudor	John Key	JK reviewed the objectives of the Coalition Exploration agreement. He reviewed all of the economic benefits that have been realized in Fort Res so far. Mentioned that PPML would appreciate a letter of support for the current permit application.	J Key forwarded a copy of the letter of support that DKFN was submitting. L Tudor responded that FRMC will work on preparing a letter of support for the permit application. Sherrie Strand (Office Admin) sent a copy of a letter of support addressed to PPML.
2018-04-17	n/a	J Key	J Key stopped by the FRMC office to try to meet with staff to update them on PPML project. Someone called out from the back of the building to say that no one was around.	n/a
2018-04-17	Arthur Beck	John Key	J Key asked FRMC to prepare a letter of support for PPML's permit application.	President Beck responded via text that he was out of town but would ask his staff to prepare a letter of support.
2018-03-23	Arthur Beck, President	Tim Smith	Sent notice that PPML was willing to host a 2-day Basic First Aid and a 2-week Emergency Medical Responder course in order to train and then hire local people for summer drill program. Asked for names of candidates for the training program by April 7, 2018 (2 weeks).	n/a
2018-03-11	n/a	John Key	Requested a copy of pick-up truck lease.	n/a
2018-03-09	secretary@frmcnwt.com	Lisa Tudor	Request for copies of all correspondence sent to FRMC in regards to Pine Point site and the Exploration Agreement. Request to discuss coalition payment approach.	J Key replied that discussion of the exploration agreement was discussed face-to-face with President Beck, including the signing. There are no additional financial agreements outside of the Exploration Agreement. Advised that agreements with individual contractors would have been signed via the Coalition, therefore PPML does not have those documents. Offered to send a copy of the engagement log. Acknowledged that PPML cannot tell the Coalition how to process payments. J Key is willing to come to Fort Resolution to discuss this.

2018-03-08	Arthur Beck, President & Warren Delorme, Vice-President	John Key	Provided information regarding the application to do confirmation drilling program; provided informational poster and asked them to post. Also discussed consultant to do wildlife study. Discussed economic opportunities including drilling and medic training. Discussed future operating permit; FRMC said if technical questions are answered the community will support. Discussion about conversations with Northwest Territory Metis Nation and approach to dispersing contracts amongst the councils. Discussion about the release of withdrawn parcels of interest; Pres. Beck said he was working with Northwest Territory Metis Nation on this. PPML offered to meet again next week, but Pres. Beck declined	n/a
2018-03-06	President Beck	John Key	Left message asking for a meeting or telephone call to discuss the confirmation drilling program applications documents.	n/a
2018-02-20	Office of the President	John Key	Provided review copies of the LUP and WL applications and the supporting Plans and identified availability for discussion.	n/a
2018-02-13	Arthur Beck, President FRMC	Arthur Beck, President FRMC	Request for a summary of current drilling activity associated with the DKFN/FRMC coalition.	J Key explained that two drills were directly contracted through the Fort Res coalition, and the other was contracted through the Hay River Metis Council. Discussion about future camp service and drilling contracts.
2018-02-13	Arthur Beck	Arthur Beck	Pres. Beck asked for summary of current drilling activity that was benefiting the DKFN/FRMC coalition. J Key explained that two drills were directly contracted through the Fort Res coalition, and the other was contracted through the Hay River Metis Council (which also benefits FRMC).	J Key also reminded that PPML was purchasing fuel in Fort Resolution and that two drilling crews were staying there. Pres. Beck asked about a future camp; J Key said that there were no firm plans to have an on-site camp for the drill program. Pres Beck said FRMC was interested in providing an on-site camp and perhaps even purchasing a drill for future use.
2018-02-01	Office of the President	John Key	Notice submitted that PPML intends to file application for a new Type A LUP and Type B WL for confirmation drilling program. Provision of a map showing the affected leases. Clarification of Application duration and drilling program permitted under MV2017C0024. Request for updated contact information and how the organization wishes to be engaged over the life of the permit.	n/a
2018-01-15	Louis Balsillie and Carol Chaplin for DKFN; Tom Smith, PPML	John Key	Shared details of Osisko Metals' potential acquisition of PPML, schedule, Osisko Metals' background and financial capacity, filing of a new application to make changes to the exploration program. Clarification that PPML will survive as owners of the permits, leases and claims.	n/a
2018-01-10	T Smith for PPML and Arthur Beck, President FRMC	John Key	Shared details of Osisko Metals' potential acquisition of PPML, schedule, Osisko Metals' background and financial capacity, filing of a new application to make changes to the exploration program. Clarification that PPML will survive as owners of the permits, leases and claims.	n/a
2018-01-10	Arthur Beck, Patty Simon	T Smith	Discussed plans for the upcoming winter drill program and reviewed use of local sub-contractors. Arthur Beck represented FRMC.	n/a
2018-01-09	Administration	Jeff Hussey, President & CEO	Notification that Osisko Metals is purchasing PPML, and clarification regarding intention to reassign PPML permits and continue exploration. Contact information for J Key provided.	n/a
2018-01-05	Administrative Office	John Key	Provided review copy of Application to Assign MV2017C0024 from PPML to Osisko Metals.	n/a
2018-01-04	Shawn (last name unknown)	Shawn, FRMC	Shawn called J Key to request a meeting to discuss Osisko Metals purchase of PPML. discussion of honoraria, catering, rental of hall and equipment costs.	Follow-up email from FRMC requesting January 12 meeting and funding for honoraria, catering, and hall rental. Clarification from J Key that this would be an informal meeting not requiring honoraria or hall rental.
2018-01-03	Arthur Beck	John Key	Osisko Metals notification that a representative will be available to meet Jan 11 - 15 to answer questions and provide information related to acquisition of Pine Point project. Request to provide date, time and location for a meeting during those dates.	A Beck replied 1/3/2018 with request to meet on Jan. 12. J Key replied that this should be a joint meeting with DKFN so need confirmation that meeting on Jan. 12 works for both parties.

Developer: Pine Point Mines Limited (PPML)
Affected Party: Hamlet of Fort Resolution

Date	Contact	Contact Initiated By	Subject / Issue / Recommendation	Response or Resolution
2020-08-18	Mayor Simon; SAO Tom Beaulieu	Andrew Williams	Letter notifying of intent to seek renewal of 2018 Water Licence and extension of 2018 LUP.	Response Received from SAO Tom Beaulieu that he would provide letter to Mayor and Council at meeting next week.
2020-08-18	Tom Beaulieu	Andrew Williams	Request an opportunity to present the PEA results and upcoming permit applications	Response Received from SAO Tom Beaulieu that he would provide letter to Mayor and Council at the next meeting. Indicated the future employment would be one of the items that Council may wish to discuss as well as business opportunities, contracts and management may be other topics that Council wishes to discuss
2019-12-11	Tom Beaulieu	S Marshall for J Hussey	Letter from Jeff Hussey describing proposed amendment of MV2017C0024 and inviting input from engagement party	No response
2018-11-29	Carol Chaplin, SAO	Judy Dudley	Provided a summary of the 2018 Archaeology study	C Chaplin replied that Tausia.sao@gmail.com is no longer a valid email for the Hamlet. She cc:'ed Carolc.lands@gmail.com and louisbalsillie@gmail.com and recommended that future Hamlet email be sent to those addresses.
2018-10-23	Senior Administrative Officer	John Key	PPML will be requesting changes to WMP for LUP MV2017C0024. The main change is to increase maximum amount of greywater on-site from 100 L/day to 5,000 L/day and discharge of greywater into a sump. Expect to have a temporary camp.	n/a
2018-06-01	Senior Administrative Officer	Judy Dudley	Provided copies of Osisko Metals' Feb. 26 and April 26, 2018 news releases related to the Exploration and Winter Drilling programs at Pine Point. Provided detailed instructions on how to sign up directly to receive future news releases.	n/a
2018-02-01	Senior Administrative Officer	John Key	Notice submitted that PPML intends to file application for a new Type A LUP and Type B WL for confirmation drilling program. Provision of a map showing the affected leases. Clarification of Application duration and drilling program permitted under MV2017C0024. Request for updated contact information and how the organization wishes to be engaged over the life of the permit.	n/a
2018-01-17	Tausia Lal	Tausia Lal	Wants contact information to invoice for use of Hall on Nov. 29, 2017	J Key replied 1/17/18 that she should send invoice to him.
2018-01-09	Administration	Jeff Hussey, President & CEO	Notification that Osisko Metals is purchasing PPML, and clarification regarding intention to reassign PPML permits and continue exploration. Contact information for J Key provided.	n/a
2018-01-03	Senior Administrative Officer	John Key	Osisko Metals notification that a representative will be available to meet Jan 11 - 15 to answer questions and provide information related to acquisition of Pine Point project. Request to provide date, time and location for a meeting during those dates.	n/a

Developer: Pine Point Mines Limited (PPML)
Affected Party: Hay River Metis Council

Date	Contact	Contact Initiated By	Subject / Issue / Recommendation	Response or Resolution
2018-11-15	Office of the President	Judy Dudley	Provided a copy of Sept, 2018 groundwater quality monitoring data.	n/a
2018-11-12	Office of the President	Judy Dudley	Provided a copy of June, 2018 groundwater quality monitoring data.	n/a
2018-10-11	Office of the President	John Key	PPML will be requesting changes to WMP for LUP MV2017C0024. The main change is to increase maximum amount of greywater on-site from 100 L/day to 5,000 L/day and discharge of greywater into a sump. Expect to have a temporary camp.	n/a
2018-09-26	Trevor Beck	John Key	Update on drilling programs & summer activities recently completed. Intro of staff from Osisko Metals, and presentation of the company philosophy on consultation. President Beck presented information on their community. He suggested Osisko Metals have a community liaison officer to ensure that contracts and jobs are not all given to one community.	n/a
2018-09-20	Trevor Beck, HRMC	John Key	Discussed current drill program, future sub-contracting opportunities, Aboriginal Drill Company that Foraco is trying to put together. Agreed to meet again on 9/25 when J Key wants to introduce an Osisko Metals staff person to HRMC.	n/a
2018-07-24	Office of the President	Stanley Clemmer	Provided a pdf file of Jan - April 2018 drilling program	n/a
2018-06-15	President Beck; Tim Smith, PPML	John Key	Reviewed recently completed winter drill program. Discussed upcoming summer drill program & baseline studies. Discussed concept of having an Aboriginal Drill Company with HRMC as participant; Pres. Beck was enthusiastic. PPML interested in staking three small parcels which are surrounded by PPML claims & leases; Pres. Beck said his Council had agreed to this.	n/a

2018-06-13	President Beck	John Key	Scheduling meetings.	Another email sent on July 6, 2018 asking for a meeting on the 13th. Pres Beck confirmed availability to meet on July 13.
2018-06-01	Office of the President	Judy Dudley	Provided copies of Osisko Metals' Feb. 26 and April 26, 2018 news releases related to the Exploration and Winter Drilling programs at Pine Point. Provided detailed instructions on how to sign up directly to receive future news releases.	n/a
2018-05-25	Office of the President	John Key	Requested a meeting for June 16.	n/a
2018-05-10	Office of the President	Judy Dudley	Provided copy of approved Archaeological Overview Assessment	n/a
2018-04-16	Office of the President	John Key	Communicated that J Key is currently in Hay River. Available to meet if interested.	n/a
2018-03-28	Office of the President	John Key	Sent copies of all invoiced amounts received from drilling contractor, and acknowledged that Osisko Metals is reviewing the exploration agreement and will send a final proposal soon.	n/a
2018-03-23	Trevor Beck	Tim Smith	Sent notice that PPML was willing to host a 2-day Basic First Aid and a 2-week Emergency Medical Responder course in order to train and then hire local people for summer drill program. Asked for names of candidates for the training program by April 7, 2018 (2 weeks).	n/a
2018-03-12	Arthur Beck, President	John Key	Provided information about the application to do confirmation drilling program; provided informational poster and asked them to post. Also discussed consultant to do wildlife study. Discussed economic opportunities including: HRMC owning a drill, training local residents as medics, and camp operation. HRMC asked PPML to provide information on drilling being done by their contractor since they were not getting information from their contractor. President Beck said HRMC was not interested in training opportunities since GNWT provides funds for this. The Council wants business opportunities. Discussed future operating permit. PPML offered to meet again on March 14.	n/a
2018-03-05	Trevor Beck	T Smith	Request for a copy of an exploration agreement.	Sent clean working version of a draft exploration agreement via email following the call.
2018-03-02	Administration	John Key	Request for HRMC to provide a bid for transporting Core from Pine Point to Hay River.	n/a
2018-03-01	J Heron	John Key	Discussion regarding mineral rights within PPML's leases and claims, establishment of agreements with the Northwest Territory Metis Nation, financial benefits to communities from exploration, and previous attempts by PPML to initiate agreement negotiations with Northwest Territory Metis Nation.	n/a
2018-02-22	Trevor Beck	Trevor Beck, President HRMC	T Beck hasn't reviewed the Draft Exploration Agreement provided by PPML but wants an equitable agreement.	J Key replied that PPML believes the Draft Agreement to be fair. Willing to meet to discuss. A meeting date of March 1 was agreed to.
2018-02-20	Office of the President	John Key	Provided review copies of the LUP and WL applications and the supporting Plans and identified availability for discussion.	At meeting on March 1, 2018 President Beck stated that he had reviewed the documents and had no comments.
2018-02-01	Office of the President	John Key	Notice submitted that PPML intends to file application for a new Type A LUP and Type B WL for confirmation drilling program. Provision of a map showing the affected leases. Clarification of Application duration and drilling program permitted under MV2017C0024. Request for updated contact information and how the organization wishes to be engaged over the life of the permit.	n/a
2018-01-25	Trevor Beck	Trevor Beck	President Beck has seen advertisements out of DKFN for jobs. Wants to know if HRMC will get opportunities.	T Smith replied 1/25/2018. PPML hasn't seen the ads so not sure what they say. Reminded that the Exploration Agreement signed with the DKFN/FRMC coalition gives them contracting advantages in their area of interest, which is where winter drilling will occur. PPML understands that ProCore Drilling has formed a partnership with HRMC and that is why PPML put that Company in the bid mix; and ProCore was successful. Core Box Transportation and Water Trucking contracts have not yet been awarded; HRMC could bid on those.
2018-01-12	Tim Smith, PPML	John Key	Shared details of Osisko Metals' potential acquisition of PPML, schedule, Osisko Metals' background and financial capacity, filing of a new application to make changes to the exploration program. Clarification that PPML will survive as owners of the permits, leases and claims.	n/a
2018-01-09	Administration	Jeff Hussey, President & CEO	Notification that Osisko Metals is purchasing PPML, and clarification regarding intention to reassign PPML permits and continue exploration. Contact information for J Key provided.	n/a
2018-01-03	Trevor Beck	John Key	Osisko Metals notification that a representative will be available to meet Jan 11 - 15 to answer questions and provide information related to acquisition of Pine Point project. Request to provide date, time and location for a meeting during those dates.	Trevor Beck replied 1/9/2017 that he would like to meet Jan 12. J Key replied suggesting 10 a.m. or 1 p.m. on the 12th. T Beck confirmed 1 p.m. meeting time.

Developer: Pine Point Mines Limited (PPML)
Affected Party: Katlodeeche First Nation

Date	Contact	Contact Initiated By	Subject / Issue / Recommendation	Response or Resolution
2020-08-25	Chief Martel, Sub Chief Lamalice, Councillors R Sondfer, P Sabourin, and J Studney, R Lamalice, P Redvers, D Miller, P Riley, D Cardinal	Jeff Hussey, Andrew Williams, Jesse O'Brien	Introduction that Golder wants to work with communities to determine how they'd like to participate in socio-economic and TK studies and how these studies should be undertaken. KFN expressed concern that Osisko and PPML are paying too much attention to the Hay River Métis Government Council (which only has asserted and not recognized rights in the KFN Exploration Agreement area), the Town of Hay River (which has no rights or authorities outside of town boundaries), and Indigenous governments that have no connection at all to the Pine Point or KFN areas (such as Łutsel K'e First Nation). KFN continues to have environmental and socio-cultural concerns about the project, so mitigation of impacts on boreal caribou, fish in Ejıé Túé Dehé (Buffalo River), air and water contamination, and cultural sites in the area, particularly near Ejıé Túé Dehé, will be very important, along with appropriate management of transient workers entering Hay River or the Hay River Dene Reserve. KFN is not being adequately informed in a timely matter of all of the economic opportunities available and may be getting bypassed in favour of Hay River workers and businesses. KFN members will need advance training in order to qualify for potential job opportunities, but that training may not be available. The time and cost of engagement with Osisko / PPML in regulatory and pending IBA negotiations is not being covered so puts a strain on KFN personnel and resources. From a KFN perspective, some of the stated and implied outcomes from this session are as follows: Consistent with the KFN-PPM Exploration Agreement (EA), KFN needs to be viewed by Osisko-PPM as the primary rights holder in the EA area and treated accordingly, for activities taking place in the area but also given the transportation route through the KFN area. Osisko / PPM needs to clearly recognize that the Hay River Dene Reserve is a distinct community from the Town of Hay River and act accordingly, not lumping KFN in under the term 'Hay River'. KFN needs to be involved in the environmental assessment and regulatory process, both by being able to review licence applications in advance, but also contractually to provide environmental monitoring and traditional knowledge research services. Beginning immediately, KFN needs to be informed fully and in a timely manner of all pending opportunities for employment and contracting services, not only for those opportunities that fall explicitly under the KFN EA but also for opportunities that are open for applications or bids from all parties, not just EA parties (KFN or otherwise). KFN and Osisko / PPM need to develop a short and longer term training plan for KFN members, such that members can be prepared for opportunities when and as they arise. KFN and Osisko / PPM need to immediately begin the process of negotiating a Benefits Agreement, as contemplated in the EA, and further need to discuss funding arrangements for KFN's meaningful participation in these negotiations. The EA Implementation Committee needs to meet in the near future to review these concerns and outcomes and plan how to address	PPML is preparing follow-up notes from this meeting
2020-08-18	Peter Redvers	Andrew Williams	Letter notifying of intent to seek renewal of 2018 Water Licence and extension of 2018 LUP.	n/a
2020-08-12	Peter Redvers	Andrew Williams	Forwarded email invitation for online meeting (Teams)	Meeting invitation accepted.
2020-08-07	Peter Redvers	Jeff Hussey and Andrew Williams	Discussed potential meeting dates (Aug 25 or 27th). Peter suggested a premeeting with himself and Patrick Riley.	n/a
2020-07-07	Peter Redvers	Andrew Williams	Peter noted that Council had met on PPML's request to provide a PEA and upcoming permitting submissions; they recommended that PPML first present to the KFN Council and Environment staff. The council would decide after the presentation if a broader presentation to the community was needed.	n/a
2020-06-26	Peter Redvers	Andrew Williams	Request an opportunity to present the PEA results and upcoming permit applications	2020-06-26 P Redvers acknowledge receipt and would respond after meeting with Council.
2020-05-12	Peter Redvers	Andrew Williams	A Williams and P Redvers discussed the use of KFN personnel and equipment to assist the environmental baseline sampling program	12 May 2020 - P Redvers followed up with email to Patrick Riley indicated use of boat for May sampling and a field Assistant later in summer
2020-05-11	Peter Redvers	Andrew Williams	A Williams emailed P Redvers regarding summer environmental program area and sampling methods to be employed	12 May 2020 - P Redvers thanked A Williams for the information and requested clarity on KFN's involvement
2020-05-08	Peter Redvers	Andrew Williams	A Williams emailed P Redvers regarding summer environmental program and related work opportunities	12 May - P Redvers responded with email to KFN Patrick Riley describing opportunity and suggesting possible use of KFN boat for program and importance of KFN member participation in program; KFN to contact AGL to provide worker contact and proposal
2020-05-05	Peter Redvers	Peter Redvers	P Redvers email PPML notifying receipt of ARI Research Permit Licence for Comment and requested additional information	See Response on May 8, 2020 below.
2020-04-24	Peter Redvers	Jeff Hussey	J Hussey conference called with P Redvers and Andrew Williams regarding the request following the completion of the PEA to present the Project Description by teleconference due to COVID-19 concerns. The objective is to keep the permitting process going during the lockdown. PR mentioned that the first step would be to present to the Chief and Council. No date was planned as it is dependant on the PEA being completed.	n/a

2020-03-16	Peter Redvers	Jeff Hussey	J Hussey emailed P Redvers with update on seasonal program status; winter drill program expected to be completed in next couple of days. A small crew will remain to finish geophysics work and then to maintain camp; impact of COVID-19 on development timelines is being assessed going forward.	17 March - receipt acknowledged by PR
2020-02-07	Chief April Martel, Debbie Miller, Peter Redvers, Doug Cardinal	PPML	PPML (J Hussey, A Williams) provided an update on project status and plans including intention to pursue advanced exploration permitting, continuing development of mine plans and environmental baseline data collection; PPML expects to have more information to share on next permitting steps in spring 2020	KFN continues to be interested in economic benefits from project activities. PPML will engage with capacity requirements when next activities are planned; KFN has an agreement with Golder, who is PPML's primary environmental consultant, which should facilitate sharing of TK for research purposes; KFN raised that participating in EA process is expensive and MVEIRB's intervenor funding provides minimal resources for KFN to have capacity to participate in a timely manner. KFN asked that PPML consider how this may be addressed
2020-01-09	Peter Redvers	Peter Redvers	Correspondence to GNWT regarding KFN concerns about recording of claims in area to which KFN asserts Aboriginal Title without due consultation	N/A
2019-12-11	Peter Redvers	S Marshall for J Hussey	Letter from Jeff Hussey describing proposed amendment of MV2017C0024 and inviting input from engagement party	Reply acknowledging receipt and requesting draft spill plan when complete; draft plans and project description sent 19/20 December; no input yet received
2019-10-04	Contacted Debbie Miller CEO	J Hussey	n/a	n/a
2019-10-03	Debbie Miller CEO Peter Redvers, Larry Innes	Peter Redvers	Email to set up conference call to advance engagement, discuss collaboration agreements, exploration agreements, and next steps.	Meeting agenda received and edited, confirmed Oct 29
2019-02-09	Chief April Martel & Catherine Heron CEO	Peter Redvers	General Update and discussion surrounding Exploration Agreement	n/a
2019-01-25	Peter Redvers	Peter Redvers	Discussed leadership changes at PPML, drilling contracts, and desire to reopen engagement between KFN and PPML	n/a
2018-12-07	Ken Norn	Ken Norn	Mr. Norm wanted to know what the plans were for 2019 program in a phone call to Stanley Clemmer	n/a
2018-12-03	Peter Redvers	Judy Dudley	Provided results from the 2018 Wildlife Study as requested/required for the research permit.	P Redvers followed up 12/6/18 with question about location of wildlife cameras which J Dudley answered.
2018-11-15	Lands Office	Judy Dudley	Provided a copy of Sept, 2018 groundwater quality monitoring data.	P Redvers acknowledged receipt 11/16/2018
2018-11-12	Lands Office	Judy Dudley	Provided a copy of June, 2018 groundwater quality monitoring data.	n/a
2018-11-07	Ken Norn, Naegha Zhia	Ken Norn	Notification from K Norn that he was back at work	Receipt reply
2018-10-18	Peter Groenen	John Key	Sent P Groenen information on invoices paid to SCS Drilling	Replied receipt
2018-10-11	Peter Redvers	John Key	PPML will be requesting changes to WMP for LUP MV2017C0024. The main change is to increase maximum amount of greywater on-site from 100 L/day to 5,000 L/day and discharge of greywater into a sump. Expect to have a temporary camp.	P Redvers sent email on 10/12/2018 asking for a copy of the current WMP and references to sewage disposal.
2018-09-26	Chief Fabien	n/a	Confirmation of email address	Confirmed
2018-09-26	Chief Fabian; R Skelton, Dir Finance; C Heron, Band manager	John Key	Update on drilling programs & summer activities recently completed. Intro of staff from Osisko Metals, and presentation of the company philosophy on consultation. Chief Fabian presented KFN viewpoint on boundary of their areas of interest, economic benefits they expect to receive in future phases of project, KFN's position on Metis land claims and status information on their community. Chief informed that an election will occur in Nov. to select a new chief & that the Band is recruiting a new CEO. ATI is organizing a mining workshop in Oct. & Osisko Metals is invited to present.	n/a
2018-09-21	Ken Norn	John Key	K Norn wanted to know PPML's plans for the winter drill program and whether or not their contractor, SCS, would be asked to participate. J Key explained that the program was still being planned. J Key asked for a meeting with the Chief next week in order to introduce Osisko Metals staff coming in from Montreal. Discussion around council honoraria.	n/a
2018-09-15	Ken Norn	Ken Norn, Naegha Zhia	K Norn informed J Key expressed concern regarding behaviour of some PPML staff and drilling contractors at camp.	The PPML employee involved in the incident has left the company; the contractors involved have been instructed to keep the camp dry.
2018-08-13	Peter Groenen	Peter Groenen	Requested donation for upcoming hand games.	J Key replied that PPML had sent a donation check.
2018-08-05	Ken Norn	John Key	Discussed the drill program and performance of KFN's drill contractor, SCS. Discussion of waiving the toll fee for drilling at W-85 if another contractor drilled there as long as SCS was working elsewhere on the site. KFN agreed.	n/a
2018-08-02	Chief Fabian, Peter Groenen	John Key	KFN wanted to visit the SCS drill program which is being contracted through their business. J Key conducted the tour.	n/a
2018-07-24	Peter Redvers	Stanley Clemmer	Provided a pdf file of Jan - April 2018 drilling program	P Redvers acknowledged receipt.

2018-06-14	Peter Redvers and Ken Norn for KFN; Tim Smith, PPML	John Key	Exploration Committee Meeting: Reviewed recently completed winter drill program. Discussed upcoming summer drill program & baseline studies. Discussed concept of having an Aboriginal Drill Company with KFN as participant; Peter R said that it had promise. PPML intends to stake three small parcels at Pine Point which are surrounded by PPML claims & leases. Discussed possible open house that KFN plans to host & wishes PPML to participate. K Norn informed that KFN had a contract with a drilling company "SCS" and expected full access to the summer drilling program. J Key reminded that KFN would be invited to cover the "float" after the other drilling companies contracting through the other aboriginal groups were established. K Norn called J Key a liar and cursed him.	n/a
2018-06-05	Lands Office	John Key	Requested meeting on June 14 or 15 to discuss economic opportunities for KFN on the Exploration Drilling program. Requests the meeting to include P Redvers & K Norn (from KFN) and J Key & T Smith (from PPML).	n/a
2018-06-01	Peter Redvers; Office of the Chief	Judy Dudley	Provided copies of Osisko Metals' Feb. 26 and April 26, 2018 news releases related to the Exploration and Winter Drilling programs at Pine Point. Provided detailed instructions on how to sign up directly to receive future news releases.	n/a
2018-05-25	Peter Redvers	John Key	Requested a meeting for June 16.	P Redvers responded May 28 with suggestion that PPML book a meeting room at Ptarmigan for lunch on the 16th. J key replied on June 4 that the venue would be fine. P Redvers replied 6/6/18 that Chief Fabian, K Norn, and himself will attend mtg on June 16.
2018-05-10	Henry Tamvour (KFN), J Key (PPML), Judy Dudley (PPML)	Damian Panayi at Golder Assoc, contractor to PPML	Discussing the logistics for including a field assistant from KFN on the wildlife study. Robert Lamalice will be available to work on the project on the date specified. Cost for his work will be passed on to PPML.	n/a
2018-05-10	Lands Office	Judy Dudley	Provided copy of approved Archaeological Overview Assessment	n/a
2018-04-23	Ken Norn	John Key	Naegha Zhia is interested in bidding on upcoming drill work. He has identified a drilling company to partner with Naegha Zhia. Jkey reminded that only certain kinds of equipment may be used. PPML currently has enough drills via established relationships to initiate the summer program. No commitments can be made. PPML happy to consider valid bids based upon qualifications and price.	n/a
2018-04-19	K Norn	Tim Smith	Sent notice that PPML was willing to host a 2-day Basic First Aid and a 2-week Emergency Medical Responder course in order to train and then hire local people for summer drill program. Asked for names of candidates for the training program by April 27.	K Norn replied by email April 20 asking about location, whether or not PPML would provide training pay and meals. T Smith replied April 20 that location would be either Fort Res or Hay R; no training pay or meals would be provided. T Smith followed up by telephone on April 27 asking for names of candidates, K Norn say he had some candidates and would send that information to PPML no later than April 30. T Smith left voice mgs with K Norn on May 1 asking for details on trainee candidates. K Norn called T Smith on June 8 to ask what happened to the medic training.
2018-04-17	Peter Redvers	John Key	Exploration Committee meeting, Present: J Key (PPML) & P Redvers (KFN). Absent: T Smith (PPML) and K Norn (KFN). P Redvers kept discussion focused on PPML's arrangements with HRMC. Discussion of KFN perspective regarding Metis rights at Pine Point. J Key reminded that PPML negotiations with HRMC were confidential and he was not prepared to discuss. P Redvers said that K Norn wanted to discuss business opportunities and asked J Key to return later in the week for another meeting.	J Key replied by email on July 10, 2018 to question of Metis rights. PPML will honor exploration agreement with KFN and will try to negotiate an IBA. PPML will not ignore responsibility to consult and engage with the Metis. P Redvers responded on July 11 with thanks.
2018-03-23	Peter Redvers	Tim Smith	Sent notice that PPML was willing to host a 2-day Basic First Aid and a 2-week Emergency Medical Responder course in order to train and then hire local people for summer drill program. Asked for names of candidates for the training program by April 7, 2018 (2 weeks).	n/a
2018-03-15	Peter Redvers	John Key	Acknowledged appreciation of public acknowledgement of PPML's engagement efforts with KFN as reported in 3/14/18 article in Mining North News Brief. PPML would like to attend upcoming KFN planning conference as observers. Willing to provide information on uses / benefits of Lead and Zinc to help inform community as response to elder's comment.	P Redvers responded and asked for a copy of the article. Would like PPML to provide KFN with a brochure and slide show about zinc and lead. J Key forwarded a copy of the article 3/15/18
2018-03-05	Chief Fabian, Peter Redvers, Peter Groenen	John Key	Discussed on-going exploration program, upcoming baseline studies for the mining program, and LUP and WL application documents for confirmation drilling. Clarified that the program would be conducted on lands outside the KFN area of interest. KFN would like to be involved in wildlife study if any portion will occur within their area of interest. They want more information before responding to the Wildlife Observation Recommendation Form.	J Key provided contact information for the consultant who will lead the wildlife studies . P Redvers stated that KFN had no issues with the applications and would send a letter to that effect. KFN defers to DKFN/FRMC to make comments on the applications. No comments on current exploration drilling program.
2018-02-20	Peter Redvers	John Key	Provided review copies of the LUP and WL applications and the supporting Plans and identified availability for discussion.	P Redvers acknowledged receipt 2/25. Emails exchanged to establish meeting time to discuss.
2018-02-09	Lands Office, Ken Norn	Tim Smith	Summary of drilling activity, expenditures, and labor during Fall Field season.	n/a
2018-02-06	Peter Redvers and Ken Norn for KFN; Stan Clemmer for PPML	Tim Smith	Update on progress of winter drill program. Discussion regarding bid process and contracting. PPML provided a binder with copies of the Permit, Spill and Waste Plans, Safety & Emergency Plans, and SARA species poster. Discussed upcoming application for LUP and WL for confirmation drilling program; map of affected area provided.	n/a

2018-02-06	Peter Redvers and Ken Norn	Tim Smith	Update on progress of winter drill program. Ken Norn asked why Naegha Zhia did not have a contract. T Smith reminded that bid info was provided in December, 2017 and NZ did not bid on any of the work. T Smith reminded that they will be given opportunities to bid on new contracts that come up in future. PPML provided a binder with copies of the Permit, Spill and Waste Plans, Safety & Emergency Plans, and SARA species poster. Discussed upcoming application for LUP and WL for confirmation drilling program; map of affected area provided. A draft of the application will be provided for their review.	n/a
2018-02-01	Office of the Chief; Peter Redvers	John Key	Notice submitted that PPML intends to file application for a new Type A LUP and Type B WL for confirmation drilling program. Provision of a map showing the affected leases. Clarification of Application duration and drilling program permitted under MV2017C0024. Request for updated contact information and how the organization wishes to be engaged over the life of the permit.	P Redvers replied 2/1/18 that he will be primary contact. If drilling program will expand to KFN traditional territory they would want advance notice for deeper level of review. J Key replied 2/2/18 that the new application would occur outside KFN AOI; PPML will provide advance copy of new permit per the Exploration Agreement.
2018-01-12	T Smith for PPML, Chief Fabian, Ken Norn of Naegha Zhia, Peter Groenen and Peter Redvers for KFN	John Key	Shared details of Osisko Metals' potential acquisition of PPML, schedule, Osisko's background and financial capacity, filing of a new application to make changes to the exploration program. Clarification that PPML will survive as owners of the permits, leases and claims.	P Redvers sent email to J Key on 1/20/18 asking for confirmation that reassignment is no longer planned. P Redvers sent an email on 1/29/2018 asking for a response. J Key responded 1/29/2018 that, as explained in meeting on 1/12/18, PPML will become a wholly owned subsidiary of Osisko Metals once the sale closes. The letter had incorrect information. Acknowledged by P Redvers 1/29/18
2018-01-12	Roy Fabian, Ken Norn, Peter Groenen and Peter Redvers	Tim Smith for PPML	Discussed plans for the upcoming winter drill program and reviewed use of local sub-contractors. Discussed opportunities for the KFN in the upcoming program.	n/a
2018-01-09	Administration	Jeff Hussey, President & CEO	Notification that Osisko Metals is purchasing PPML, and clarification regarding intention to reassign PPML permits and continue exploration. Contact information for J Key provided.	n/a
2018-01-05	Chief's Office, Lands Office	John Key	Provided review copy of Application to Assign MV2017C0024 from PPML to Osisko Metals. On 1/8/2018 P Redvers sent a copy of the assignment application in which changes were made to the application form itself that state Osisko Metals has assumed PPML's obligations per the Exploration Agreement. PR also sent a draft Assignment Agreement for Osisko/PPML review and comment.	P Redvers and J Key exchanged email on 1/5/2018. PR stated that KFN would not review the application until certain conditions associated with the Exploration Agreement had been addressed. KFN will consult their lawyer. J Key reminded that KFN does not have to support the application; the review is for KFN to identify whether or not the application is correct. J Key reminded that matters associated with the exploration agreement should be handled by the exploration committee. PR replied on 1/6/2018 that KFN's attorney is going to draft a different version of the application on their behalf.
2018-01-03	Peter Redvers	John Key	Per email trail begun by PPML on Dec. 18 announcing PPML acquisition by Osisko Metals, J Key clarified that he would be representing Osisko Metals at the meeting to be held in January, 2018.	P. Redvers replied 1/3/2018 that KFN will want clarification of new business and management arrangements from the proposed change in ownership. Proposed agenda for meeting on Jan. 12 provided by P. Redvers. Discussion of funding due diligence review by KFN.

Developer: Pine Point Mines Limited (PPML)
Affected Party: Lutsel K'e Dene First Nation

Date	Contact	Contact Initiated By	Subject / Issue / Recommendation	Response or Resolution
2020-08-26	Stephanie Poole, Mervin Able, Adeline Jonasson, Ron Desjarlais	Jeff Hussey, Andrew Williams, Jesse O'Brien	Purpose: Go over the Preliminary Economic Assessment and Project Description, and introduce social baseline work. Key Feedback from LKDFN: LKDFN is Akaitcho, and the Project is in their territory, and asserts that they should benefit just as much as DKFN. LKDFN would like an IBA. Concern that LKDFN have not been targeted for engagement. LKDFN requests funding to support engagement with their communities given that they cannot invite PPML in for community meetings. LKDFN would like to conduct their own socio-economic and Traditional Land and Resource Use studies, and would like PPML to fund these. Concern re: impacts to water quality and levels in Great Slave Lake, and the risk of COVID-19 to workers.	PPML is preparing follow-up notes from this meeting
2020-08-25	Hanna Catholique	Andrew Williams	Provided updated copy of presentation for meeting on the 26th	n/a
2020-08-25	Andrew Williams	Hanna Catholique	Confirmed receipt of presentation package	n/a
2020-08-25	Hanna Catholique	Andrew Williams	PPML provided presentation and conference call in details for meeting on 26 August 2020 to LKDFN	None required
2020-08-24	Hanna Catholique	Andrew Williams	PPML confirmed the August 26th confrence call date and time.	LKDFN confiremd the date and time
2020-08-24	Hanna Catholique	Andrew Williams	Sent meeting invitation with conference call details and PDF of PPML presentation.	Hanna acknowledged receipt of the presentation PDF.
2020-08-20	Andrew Williams	Hanna Catholique	LKFN teleconference call in details.	PPML confirmed the date and time.
2020-08-19	Chief Marlowe	Andrew Williams	Request an opportunity to present the PEA results and upcoming permit applications	n/a
2020-08-19	Andrew Williams	Hanna Catholique	Notified PPML of possible meeting date for August 26th, 2020.	Confirmed the August 26th meeting date
2020-06-26	Chief Darryl Marlowe	Andrew Williams	Request an opportunity to present the PEA results and upcoming permit applications	Incorrect email address notification; resent request to new email on 19 August 2019

Developer: Pine Point Mines Limited (PPML)
Affected Party: Northwest Territories Metis Nation

Date	Contact	Contact Initiated By	Subject / Issue / Recommendation	Response or Resolution
2020-08-31	Gary Bailey, James Heron, Trevor Beck, Allan Heron, Lloyd Cardinal, Norman (last name unknown)	Jeff Hussey, Andrew Williams, Jesse O'Brien	Introduction that Golder wants to work with communities to determine how they'd like to participate in socio-economic and TK studies and how these studies should be undertaken. NWTMN is concerned that KFN doesn't have any land rights in the area. J Hussey noted that part of the project is located west of the Buffalo River and some to the east of the Buffalo River on land which KFN does have rights. NWTMN wondered why Teck and Avalon are being consulted. J Hussey noted that Teck still has rights over the Tailings Impoundment Area and Avalon did have land tenure in the past. In response to questions from NWTMN, J Hussey noted that there is no plan to reuse the railbed, the highway will be used to transport concentrates., and that the railbed is a federal responsibility. No plan to reroute the highway at his time. If future planning and design suggested that the highway needs to be rerouted, we would investigate further. Also noted that not all pits are full and PPML would not be releasing water to surface. NWTMN noted the people who would need to be on the Joint Implementation Committee (JIC) Stressed the need to establish what are the opportunities at the mine. Question regarding what contracts are going to be available and how long with they be for. J Hussey replied very little work is currently happening but PPML is ramping up at the site and PPML is keeping Jake Heron informed. The Joint Implementation Committee needs to be established to take the lead on future benefits. NWTMN noted that while the work opportunities may be small there could be room for the Métis. They would be willing to share opportunities with KFN. If there are opportunities at Hay River, please give the NWTMN an opportunity to bid for this work. Note that in the past, there was an agreement that each community (Fort Resolution and DFKN) would get a percentage of the drilling. J Hussey clarified that that agreement was not successful. NWTMN noted that their agreement includes a payment when the project is approved, and asked if that has occurred. J Hussey noted that we have not yet reached the approval stage yet, which will require a Feasibility Study to be completed and approved. It is expected that a Feasibility Study will take 8 to 12 months to complete.	Jake Heron and Jeff Hussey to arrange a date for the JIC meeting ; Send Presentation to J. Heron for the record.
2020-08-18	Jake Heron	Andrew Williams	Letter notifying of intent to seek renewal of 2018 Water Licence and extension of 2018 LUP.	n/a
2020-08-13	Jake Heron	Jeff Hussey	Followed up on date to represent PEA results. Jake suggested two presentations, the first to the Environment staff on during the NWTMN meeting on 28-29th August.	Jake will respond will a time slot to present the PEA. 28 August 2020: Jake advised that they would contact us with the time slot.
2020-08-13	Jake Heron	Jeff Hussey and Andrew Williams	Advised the NWTMN that we would be seeking an extension for MV2018L2-003 and MV2018C0005 without any changes in the scope of the work under the permits.	Acknowledged the information and noted that the IMA would receive the application.
2020-08-12	Jake Heron	Jeff Hussey	To arrange for meeting to present project post PEA	

2020-08-07	Jake Heron	Jeff Hussey and Andrew Williams	Requested dates for presentation to the NWTMN. Jake tentatively suggest August 10, 11, 12.	Meeting time was not confirmed
2020-08-06	Jake Heron	Jeff Hussey	Discussed setting a time for a presentation on the project PEA and general update.	n/a
2020-07-22	Jake Heron	Jeff Hussey	Provided general update with the completion of the PEA. Jake requested a schedule for the project	Follow-up?
2020-07-17	Trudy King	Damian Panayi at Golder Assoc, contractor to PPML	D Panayi contacted T King and left a voicemail regarding the employment opportunities associated with baseline field studies.	No response to date from T King
2020-07-15	Unknown	Damian Panayi at Golder Assoc, contractor to PPML	D Panayi contacted NWTMN regarding employment opportunities associated with baseline field studies	NWTMN provided a resume for a potential candidate
2020-07-14	Tim Heron	Damian Panayi at Golder Assoc, contractor to PPML	D Panayi contacted NWTMN regarding employment opportunities associated with baseline field studies	NWTMN provided contact information for potential candidates; Golder reached out to them
2020-07-14	Rosi (last name unknown)	Damian Panayi at Golder Assoc, contractor to PPML	D Panayi contacted NWTMN regarding employment opportunities associated with baseline field studies	NWTMN provided a resume for a potential candidate
2020-06-26	Jake Heron	Andrew Williams	Request an opportunity to present the PEA results and upcoming permit applications	2020-06-29 Jake Heron acknowledged receipt of request and would respond when all four Presidents had review the information
2020-05-05	Tim Heron	Tim Heron	T Heron contacted A Williams to discuss summer environmental program research permit application; Northwest Territory Metis Nation is interested in the program and any work opportunities that may flow from it; TH may be in the area this summer and would like to drop in for a visit	A Williams welcomed TH contacting him this summer to arrange a visit to the Project Area; AW advised TH that the program is small so employment opportunities will be limited. AW noted the interest in the program and the candidate names provided by TH. AW forwarded these names to Golder Associates.
2020-03-16	Jake Heron	Jeff Hussey	J Hussey emailed J Heron with update on seasonal program status; winter drill program expected to be completed in next couple of days. A small crew will remain to finish geophysics work and then to maintain camp; impact of COVID-19 on development timelines is being assessed going forward.	n/a
2020-02-07	President Northwest Territory Metis Nation: Garry Bailey and FRMG President: Lloyd Cardinal	PPML	PPML (J Hussey, A Williams) provided an update on project status and plans including intention to pursue advanced exploration permitting, continuing development of mine plans and environmental baseline data collection; Northwest Territory Metis Nation requested employment opportunities for summer students and general services as they have Loaders, trucks, water truck, Fuel delivery, clear cutting, and snow removal. PPML stated that the camp was about to shutdown for spring breakup and would consider services etc. when drilling campaign resumes. PPML expects to have more information to share on next permitting steps in spring 2020	n/a
2020-01-31	Jake Heron	Sean Marshall	Email to inquire of meeting availability on 7 February	J Heron requested information on proposed location; Aurora Geoscience responded Hay River in the morning; 4 Feb Aurora Geoscience called, discussed that meeting in Yellowknife could be possible with PPML, otherwise Friday afternoon is now open on south side of lake. J Heron identified an individual who had indicated interest in Metis employment on the project
2019-12-11	Jake Heron	S Marshall for J Hussey	Letter sent describing proposed amendment of MV2017C0024 and inviting input from engagement party	No response
2019-12-06	Jake Heron	J Hussey	Share information related to proposed amendment of MV2017C0024	Follow up request from Aurora Geoscience (13 Dec) seeking input on proposed amendment not responded to
2019-09-03	Tim Heron	PPML	Contacted Tim Heron regarding Research License	Received support letter
2019-06-19	Jake Heron Darwin Hanna	J Hussey	Collaboration Agreement Negotiations	Email to advise PPML that the four presidents have now endorsed the collaboration agreement, and the signed document will be returned for PPML's signature.
2019-04-21	Jake Heron, Darwin Hanna, Bob Overvold	J Hussey	Collaboration Agreement Negotiations From April to July	Several meetings held to discuss collaboration agreement
2019-04-20	Jake Heron	J Hussey	Discussions surrounding renewed interest in developing a Collaboration Agreement	Email confirming preparation activities for collaboration agreement negotiations
2018-11-12	J Heron	Jeff Hussey	Sent a copy of a discussion document and proposed additional meeting options in Hay River and/or Fort Smith Nov. 14 - 18	Not willing to meet because Osisko Metals has not agreed to fund Northwest Territory Metis Nation legal fees for document reviews. Requested permission from PPML to allow Northwest Territory Metis Nation to review the Exploration Agreements with FRMC and HRMC once those councils agree to the review as well.
2018-11-08	J Heron	Jeff Hussey	Requested a meeting for sometime Nov. 16 - 19 (in Hay River) or Nov. 20-22 (in Yellowknife)	J Hussey replied Nov. 9 and Requested a copy of draft discussion document prior to scheduling a meeting.
2018-10-25	President Bailey	John Key	PPML will be requesting changes to WMP for LUP MV2017C0024. The main change is to increase maximum amount of greywater on-site from 100 L/day to 5,000 L/day and discharge of greywater into a sump. Expect to have a temporary camp.	Automated response message received saying that the email address is now president@nwtmetis.ca but that this message would be forwarded. President Bailey responded on 10/25 that JK should contact Jake Heron to discuss the "intern measures agreement".
2018-10-19	J Heron	Jake Heron	Proposed changes to the MOU	Receipt reply

2018-10-15	J Heron	John Key	Delivery to J Heron a memo from CEO Jeff Hussey explaining the reason for the request of release of lands around Pine Point for expansion of land claims	n/a
2018-10-06	J Heron	John Key	Delivery of spreadsheet to J Heron concerning the Aboriginal Drill Company. Also attached contact information for Foraco.	J Heron requested information for clarification on timing. PPML responded with answers on 10/12/18
2018-10-01	J Heron	John Key	Delivered copy of proposed MOU between PPML and Northwest Territory Metis Nation	J Heron commented that he could not open the document. Document was resent in different format
2018-08-29	Jake Heron, consultant to Northwest Territory Metis Nation; Darwin Hanna, Northwest Territory Metis Nation Attorney; Ron ? From Northwest Territory Metis Nation; Keith Bergner, PPML attorney	John Key	Discussed Northwest Territory Metis Nation's interest in getting an Exploration Agreement for the Nation not just with the two local Councils; PPML's interest in staking additional withdrawn lands (40 parcels); possible Aboriginal drill company; Metis interested in having more than jobs and sub-contracting in projects at the site; Metis suggested that land could be transferred to a coalition of Akaitcho and Metis so that PPML could deal directly with them as the owners.	No firm decisions were made on any of the ideas discussed.
2018-07-21	5 representatives from Northwest Territory Metis Nation (including president Bailey) & 4 from PPML (Including J Hussey)	Jeff Hussey	Main purpose was to discuss land withdrawal issue. Also discussed Aboriginal Drill Company, status of exploration agreements, and developing a MOU for future interactions. President Bailey asked for funding to work on the MOU; J Hussey suggested Northwest Territory Metis Nation obtain government funds for this.	Northwest Territory Metis Nation is prepared to release claims and will discuss at their next Board meeting to get full approval. Northwest Territory Metis Nation agrees that local councils can make commitments like exploration agreements on their own. The Northwest Territory Metis Nation will work together to make sure the local councils can all participate in the drill company. PPML will produce the first draft of the MOU.
2018-06-01	Office of the President; Betty Villebrun	Judy Dudley	Provided copies of Osisko Metals' Feb. 26 and April 26, 2018 news releases related to the Exploration and Winter Drilling programs at Pine Point. Provided detailed instructions on how to sign up directly to receive future news releases.	message sent was returned as undeliverable
2018-05-10	Office of the President	Judy Dudley	Provided copy of approved Archaeological Overview Assessment	n/a
2018-05-01	Garry Bailey	Garry Bailey	9:30 p.m. call to J Key. Informed J Key that Chief Balsillie and President Beck had approved having G Bailey take over contracts for fuel hauling and storage for the PPML drilling programs. J Key indicated that PPML plans are developing and J Key would get back in touch later.	n/a
2018-03-01	Trevor Beck; J Heron	John Key	Discussion regarding mineral rights within PPML's leases and claims, establishment of agreements with the Northwest Territory Metis Nation, financial benefits to communities from exploration, and previous attempts by PPML to initiate agreement negotiations with Northwest Territory Metis Nation.	n/a
2018-02-12	Darwin Hanna	Darwin Hanna	Pine Point Project is within traditional territory of Northwest Territory Metis Nation. Please advise if PPML has legal counsel.	n/a
2018-02-01	Office of the President	John Key	Notice submitted that PPML intends to file application for a new Type A LUP and Type B WL for confirmation drilling program. Provision of a map showing the affected leases. Clarification of Application duration and drilling program permitted under MV2017C0024. Request for updated contact information and how the organization wishes to be engaged over the life of the permit.	n/a
2018-01-23	Jake Heron; Garry Bailey	John Key	Shared details of Osisko Metals' potential acquisition of PPML, schedule, Osisko Metals' background and financial capacity, filing of a new application to make changes to the exploration program. Clarification that a new LUP application requesting changes to the drill program would occur after purchase.	G Bailey expressed concern that FRMC entered into their Exploration Agreement with PPML without prior approval of Northwest Territory Metis Nation. He indicated that HRMC now wanted an Exploration Agreement too; J Key explained that this had been discussed with HRMC early on but that their focus was an IBA. Discussion of HRMC uptake of contracting opportunities. G Bailey indicated negotiations with Local Councils should include Northwest Territory Metis Nation and its attorneys, and emphasized importance of informing Northwest Territory Metis Nation; J Key and G Bailey agreed to meet formally up to three times in 2018. Discussion of funding for attorney fees and travel. Pres Bailey will propose meeting dates in future.
2018-01-09	Administration	Jeff Hussey, President & CEO	Notification that Osisko Metals is purchasing PPML, and clarification regarding intention to reassign PPML permits and continue exploration. Contact information for J Key provided.	n/a
2018-01-03	Garry Bailey	John Key	Osisko Metals notification that a representative will be available to meet Jan 11 - 15 to answer questions and provide information related to acquisition of Pine Point project. Request to provide date, time and location for a meeting during those dates.	Phone call from G Bailey on 1/3/2018 to discuss availability on 1/15/2018 to meet, and request to include Jake Heron at the meeting. Discussion and follow-up emails regarding availability on this date

Developer: Pine Point Mines Limited (PPML)
Affected Party: Northwest Territories and Nunavut Chamber of Mines

Date	Contact	Contact Initiated By	Subject / Issue / Recommendation	Response or Resolution
2020-08-18	Tom Hoefer	Andrew Williams	Letter notifying of intent to seek renewal of 2018 Water Licence and extension of 2018 LUP.	Response received from Executive Director
2019-12-11	Executive Director's office	S Marshall for J Hussey	Letter sent describing proposed amendment of MV2017C0024 and inviting input from engagement party	No response
2018-10-23	Executive Director	John Key	PPML will be requesting changes to WMP for LUP MV2017C0024. The main change is to increase maximum amount of greywater on-site from 100 L/day to 5,000 L/day and discharge of greywater into a sump. Expect to have a temporary camp.	n/a
2018-02-01	General Manager; Tom Hoefer	John Key	Notice submitted that PPML intends to file application for a new Type A LUP and Type B WL for confirmation drilling program. Provision of a map showing the affected leases. Clarification of Application duration and drilling program permitted under MV2017C0024. Request for updated contact information and how the organization wishes to be engaged over the life of the permit.	Returned as undeliverable. Another message was sent 2/1/2018 to the following email address: executivedirector@miningnorth.com 2nd message acknowledged by Tom Hoefer with thanks.
2018-01-10	Unknown	John Key	Discussed Osisko purchase of PPML Pine Point Project. Expect aggressive exploration and development program.	n/a
2018-01-09	Administration	Jeff Hussey, President & CEO	Notification that Osisko Metals is purchasing PPML, and clarification regarding intention to reassign PPML permits and continue exploration. Contact information for J Key provided.	n/a

Developer: Pine Point Mines Limited (PPML)
Affected Party: Salt River First Nation

Date	Contact	Contact Initiated By	Subject / Issue / Recommendation	Response or Resolution
2020-06-26	Chief Dave Poitras	Andrew Williams	Request an opportunity to present the PEA results and upcoming permit applications	n/a
2018-06-01	Chief Executive Officer	Judy Dudley	Provided copies of Osisko Metals' Feb. 26 and April 26, 2018 news releases related to the Exploration and Winter Drilling programs at Pine Point. Provided detailed instructions on how to sign up directly to receive future news releases.	message sent to ceo_srfn@northwestel.net was returned as undeliverable
2018-02-01	Chief Executive Officer	John Key	Notice submitted that PPML intends to file application for a new Type A LUP and Type B WL for confirmation drilling program. Provision of a map showing the affected leases. Clarification of Application duration and drilling program permitted under MV2017C0024. Request for updated contact information and how the organization wishes to be engaged over the life of the permit.	n/a

Developer: Pine Point Mines Limited (PPML)
Affected Party: Smith Landing First Nation

Date	Contact	Contact Initiated By	Subject / Issue / Recommendation	Response or Resolution
2020-06-26	Chief Gerry Cheezie	Andrew Williams	Request an opportunity to present the PEA results and upcoming permit applications	n/a
2018-06-01	Office of the Chief	Judy Dudley	Provided copies of Osisko Metals' Feb. 26 and April 26, 2018 news releases related to the Exploration and Winter Drilling programs at Pine Point. Provided detailed instructions on how to sign up directly to receive future news releases.	n/a
2018-02-01	Office of the Chief	John Key	Notice submitted that PPML intends to file application for a new Type A LUP and Type B WL for confirmation drilling program. Provision of a map showing the affected leases. Clarification of Application duration and drilling program permitted under MV2017C0024. Request for updated contact information and how the organization wishes to be engaged over the life of the permit.	n/a

Developer: Pine Point Mines Limited (PPML)
Affected Party: Teck Metals

Date	Contact	Contact Initiated By	Subject / Issue / Recommendation	Response or Resolution
2020-08-18	Michelle Unger	Andrew Williams	Letter notifying of intent to seek renewal of 2018 Water Licence and extension of 2018 LUP.	Out of Office reply
2019-12-11	Michelle Unger	S Marshall for J Hussey	Letter sent describing proposed amendment of MV2017C0024 and inviting input from engagement party	No response
2018-02-02	Michelle Unger	John Key	Notice submitted that PPML intends to file application for a new Type A LUP and Type B WL for confirmation drilling program. Provision of a map showing the affected leases. Clarification of Application duration and drilling program permitted under MV2017C0024. Request for updated contact information and how the organization wishes to be engaged over the life of the permit.	Ms. Unger replied 2/2/18 that message was received. Ms. Unger replied again on 2/12/18 pointing overlap between PPML claim and tailings facility that Teck manages. She asked if PPML planned to conduct activities in the overlapping area. J Key replied 2/16/18 that PPML has re-evaluated drill targets and determined that the claim which adjoins Teck's tailings facility will not be included in the new permit application.

Developer: Pine Point Mines Limited (PPML)
Affected Party: Timberworks Inc.

Date	Contact	Contact Initiated By	Subject / Issue / Recommendation	Response or Resolution
2020-08-19	Robert Mills	Andrew Williams	Letter notifying of intent to seek renewal of 2018 Water Licence and extension of 2018 LUP.	n/a
2019-12-11	General Manager's office	S Marshall for J Hussey	Letter sent describing proposed amendment of MV2017C0024 and inviting input from engagement party	No response
2018-10-23	General Manager	John Key	PPML will be requesting changes to WMP for LUP MV2017C0024. The main change is to increase maximum amount of greywater on-site from 100 L/day to 5,000 L/day and discharge of greywater into a sump. Expect to have a temporary camp.	n/a
2018-02-01	General Manager	John Key	Notice submitted that PPML intends to file application for a new Type A LUP and Type B WL for confirmation drilling program. Provision of a map showing the affected leases. Clarification of Application duration and drilling program permitted under MV2017C0024. Request for updated contact information and how the organization wishes to be engaged over the life of the permit.	n/a
2018-01-09	Administration	Jeff Hussey, President & CEO	Notification that Osisko Metals is purchasing PPML, and clarification regarding intention to reassign PPML permits and continue exploration. Contact information for J Key provided.	n/a

Developer: Pine Point Mines Limited (PPML)
Affected Party: Town of Fort Smith

Date	Contact	Contact Initiated By	Subject / Issue / Recommendation	Response or Resolution
2020-06-26	Mayor Lynn Napier	Andrew Williams	Request an opportunity to present the PEA results and upcoming permit applications	n/a

Developer: Pine Point Mines Limited (PPML)
Affected Party: Town of Hay River

Date	Contact	Contact Initiated By	Subject / Issue / Recommendation	Response or Resolution
2020-08-28	Stacey Barnes	Andrew Williams	Provided letter of support for extension of LUP/WL (2018 permits) and the Confirmation and Exploration Program Application	Thanks Council for their support
2020-08-27	Stacey Barnes	Andrew Williams	Follow up email regarding renewal extension application	Stacey replied that council was issuing letters of support for upcoming new permit applications and for PPML's upcoming EA Initiation Package submission.
2020-08-18	Mayor Jameson	Andrew Williams	Letter notifying of intent to seek renewal of 2018 Water Licence and extension of 2018 LUP.	n/a
2020-08-11	Stacey Barnes	Andrew Williams	Presentation update on the PEA and upcoming permitting to the Council	Questions asked and responses: 1 Has PPML contacted NTPC? Response: Yes we have been in contact with NTPC regarding the mines power requirements. Some of the power can be provided by NTPC however Taltson will not have enough capacity to meet the mines full power requirements so the mine will have to generate additional power on site. 2. What will be the nature of the workers shifts? Response: The actual shift configurations are preliminary, however we are planning on 12 hour shifts. This will required that workers are accommodated at site as driving back after a shift would be a safety concern. The rotation for the crews is still under discussion, While 2 weeks on and 2 weeks off are common in the northern mines, there are other options given the road access to the site, such as 4 days on , 3 off.
2020-07-30	Stacey Barnes	Andrew Williams	HRTC requested PPML to present via Zoom meeting on August 4 or 11th.	August 11th was agreed on for the presentation.
2020-06-26	Mayor Kandis Jameson	Andrew Williams	Request an opportunity to present the PEA results and upcoming permit applications	2020-07-30 Stacey Barnes (Hay River Council Administrator) contacted A Williams to arrange August 11, 2020 for information session with the council;
2019-12-11	Judy Goucher	S Marshall for J Hussey	Letter sent describing proposed amendment of MV2017C0024 and inviting input from engagement party	No response
2018-10-23	Senior Administrative Officer	John Key	PPML will be requesting changes to WMP for LUP MV2017C0024. The main change is to increase maximum amount of greywater on-site from 100 L/day to 5,000 L/day and discharge of greywater into a sump. Expect to have a temporary camp.	n/a
2018-07-24	Office of the Mayor	Stanley Clemmer	Provided a pdf file of Jan - April 2018 drilling program	n/a
2018-06-04	Office of the Mayor	Tim Smith	Requested letter of support for current public comment period on the Confirmation Drilling Program permit	n/a
2018-06-01	Senior Administrative Officer; Office of the Mayor	Judy Dudley	Provided copies of Osisko Metals' Feb. 26 and April 26, 2018 news releases related to the Exploration and Winter Drilling programs at Pine Point. Provided detailed instructions on how to sign up directly to receive future news releases.	n/a
2018-04-18	Stacy Barnes	John Key	Stopped by Town office. Mayor was out. Spoke with Council Administrator Stacy Barnes. J Key asked if Town would provide letter of support for permit application. S Barnes said she would raise the issue with the Town Council at their meeting on Thursday.	n/a
2018-03-06	Mayor Mapes	John Key	Discussed LUP and WL application documents as well as developing plans for mining/milling project. Mayor Mapes stated that he is aware, from prior engagement, that the confirmation drilling applications were in preparation.	The Town supports this program.
2018-02-12	Judy Goucher, SAO	Tim Smith	Requested written confirmation from Town that Town has capacity to accept and process anticipated volumes of garbage and sewage from new confirmation drilling program.	Feb. 15, 2018 received Letter confirming the Town's willingness to accept waste at the landfill and lagoon. Letter signed by Judy Goucher
2018-02-06	Mayor Mapes	Tim Smith	Reviewed proposal to apply for LUP and WL for confirmation drilling program. Mayor Mapes was supportive of the proposal and offered to provide letters of support for the applications.	n/a
2018-02-06	Unknown	Tim Smith	Reviewed activities underway with the winter drilling program. Provided a list of contractors currently working at the site.	Mayor is supportive of the program.
2018-02-01	Judy Goucher; Office of the Mayor	John Key	Notice submitted that PPML intends to file application for a new Type A LUP and Type B WL for confirmation drilling program. Provision of a map showing the affected leases. Clarification of Application duration and drilling program permitted under MV2017C0024. Request for updated contact information and how the organization wishes to be engaged over the life of the permit.	Judy Goucher replied on 2/1/18 that she should be primary contact for the Town. She will speak to Council about engagement preferences.
2018-01-12	Tim Smith, PPML	John Key	Shared details of Osisko Metals' potential acquisition of PPML, schedule, Osisko's background and financial capacity, filing of a new application to make changes to the exploration program. Clarification that PPML will survive as owners of the permits, leases and claims.	n/a
2018-01-12	Unknown	T Smith	Discussed plans for the upcoming winter drill program and reviewed use of local sub-contractors. Discussed opportunities for the HRMC in the upcoming program.	n/a
2018-01-09	Administration	Jeff Hussey, President & CEO	Notification that Osisko Metals is purchasing PPML, and clarification regarding intention to reassign PPML permits and continue exploration. Contact information for J Key provided.	n/a

Developer: Pine Point Mines Limited (PPML)
Affected Party: West Point First Nation

Date	Contact	Contact Initiated By	Subject / Issue / Recommendation	Response or Resolution
2020-09-10	Janice Switlo	Damian Panayi	Email states that West Point First Nation (WPFN) is a Dene community located in the area where through Treaty 11 the Crown has been provided with permissions to exercise partial political sovereignty. Email offers to explain this and engagement requirements more fully in a conference call with the appropriate authorities for Pine Point Mining Limited or provide a written brief directly to them. Email notes J Switlo's background details, including being former Crown Counsel for Indian and Northern Affairs, and in-house legal advisor for the GNWT for the Department of Aboriginal Affairs. Email states that PPML is not a Crown corporation. Requests that PPML obtains permission from WPFN for any new mining activity. Identifies that WPFN has not delegated authorities or decision-making to GNWT. Requests that PPML approach WPFN directly and not through GNWT. Email for requesting a forward to R Wares and J Hussey (Osisko).	Email forwarded to PPML.
2020-09-02	Wendy Ross	Andrew Williams	Wendy said that Janice Switlo would be following up on our request for engagement.	Thanked her for arranging this.
2020-08-27	Wendy Ross	Andrew Williams	Follow-up with WPFN enquiring if WPFN would like to discuss the application extension/Renewal	n/a
2020-08-21	Wendy Ross	Damian Panayi	Request for opportunity to engage on Pine Point Project.	n/a
2020-08-21	WPFN General Office	Damian Panayi	Sasah answered phone and said engagement should be through Wendy Ross. Emailed Wendy Ross.	n/a
2020-08-18	Chief Cayen	Andrew Williams	Letter notifying of intent to seek renewal of 2018 Water Licence and extension of 2018 LUP.	n/a
2020-06-26	Chief Kenneth Cayen	Andrew Williams	Request an opporutunity to present the PEA results and upcoming permit applications	n/a
2019-12-11	Kenny Cayen	S Marshall for J Hussey	Letter from Jeff Hussey describing proposed amendment of MV2017C0024 and inviting input from engagement party	No response
2019-07-24	Unknown	J Hussey	Requesting regarding License Application for Research from the Aurora Research Institute. This is associated to continuing our baseline environmental work this year in collaboration with Golder and Associates on the Pine Point project.	Received support letter
2019-04-12	Becky Cayen, Wendy Ross, Kandice Thoms	J Hussey	Corporate/Project update meeting held with Chief Becky Cayen; Wendy Ross and Kandice Thomas	n/a
2018-11-15	Lands Office	Judy Dudley	Provided a copy of Sept, 2018 groundwater quality monitoring data.	n/a
2018-11-13	General Office	Judy Dudley	Provided a copy of June, 2018 groundwater quality monitoring data.	Auto-reply that wpfn@northwestel.net is no longer valid address.
2018-10-23	Misty Ireland	John Key	PPML will be requesting changes to WMP for LUP MV2017C0024. The main change is to increase maximum amount of greywater on-site from 100 L/day to 5,000 L/day and discharge of greywater into a sump. Expect to have a temporary camp.	Misty Ireland responded on 10/26 with thanks for the update. She will forward the information to the Council.
2018-09-26	Wendy Cayen	John Key	Update on drilling programs & summer activities recently completed. Intro of staff from Osisko Metals, and presentation of the company philosophy on consultation. WPFN staff asked about timeline to begin IBA negotiations.	n/a
2018-07-24	General Office	Stanley Clemmer	Provided a pdf file of Jan - April 2018 drilling program	n/a
2018-06-01	Office of the Chief; Lands Office	Judy Dudley	Provided copies of Osisko Metals' Feb. 26 and April 26, 2018 news releases related to the Exploration and Winter Drilling programs at Pine Point. Provided detailed instructions on how to sign up directly to receive future news releases.	n/a
2018-05-10	Office of the Chief	Judy Dudley	Provided copy of approved Archaeological Overview Assessment	n/a
2018-04-27	Becky Cayen, Misty Ireland	Tim Smith	Notified that PPML was willing to host a 2-day Basic First Aid and a 2-week Emergency Medical Responder course in order to train and then hire local people for summer drill program. Asked for names of candidates for the training program.	Misty Ireland responded on May 1st with names of 7 interested people. T Smith replied that a decision had been made to postpone the Hay River session.
2018-04-18	n/a	John Key	WPFN informed that R Lafferty is no longer working for WPFN; asked for a donation to upcoming Dene council meetings. J Key provided update on recently completed winter drill program. Discussed applications for confirmation drilling program LUP and WL. J Key provided update on current thinking for Mine & Mill plan with phased development beginning with mine pit Cluster 1.	n/a
2018-04-16	Lands Office	John Key	Communicated that J Key is currently in Hay River. Available to meet in the next 3 days if interested.	Emails exchanged and meeting set for April 18.
2018-03-06	Misty Ireland	John Key	Discussion with Misty Ireland to get comments on the Draft LUP and WL documents. She had not reviewed them.	n/a
2018-02-20	Richard Lafferty	John Key	Provided review copies of the LUP and WL applications and the supporting Plans and identified availability for discussion.	Richard Lafferty replied on 3/14/2018 that WPFN had reviewed the draft applications and had no concerns. One comment is to watch water management near muskegs and marshes in protect wildlife.
2018-02-05	Chief Caen, WPFN Council, Richard Lafferty, Misty Ireland	Tim Smith	Reviewed proposal to apply for LUP and WL for confirmation drilling program. Discussed potential economic opportunities for WPFN including training for the ERT positions and a possible chauffeur service.	WPFN indicated that their preferred contact for the Permit is via email directed to Misty Ireland.
2018-02-05	Chief Caen, WPFN Council, Richard Lafferty, Misty Ireland	Tim Smith	Reviewed activities underway with the winter drilling program.	n/a

2018-02-01	Office of the Chief	John Key	Notice submitted that PPML intends to file application for a new Type A LUP and Type B WL for confirmation drilling program. Provision of a map showing the affected leases. Clarification of Application duration and drilling program permitted under MV2017C0024. Request for updated contact information and how the organization wishes to be engaged over the life of the permit.	n/a
2018-01-15	T Smith for PPML, Misty Ireland, Richard Lafferty	John Key	Shared details of Osisko Metals' potential acquisition of PPML, schedule, Osisko Metals' background and financial capacity, filing of a new application to make changes to the exploration program. Clarification that PPML will survive as owners of the permits, leases and claims.	n/a
2018-01-15	Misty Ireland, Richard Lafferty	Tim Smith	Discussed plans for the upcoming winter drill program and reviewed use of local sub-contractors. Discussed opportunities for the WPFN in the upcoming program.	n/a
2018-01-09	Administration	Jeff Hussey, President & CEO	Osisko Metals is purchasing PPML. Osisko Metals will apply to have PPML permits re-assigned; want exploration activities to continue without interruption. Questions should be directed to John Key who is representing Osisko Metals.	n/a
2018-01-03	Misty Ireland	John Key	Osisko Metals notification that a representative will be available to meet Jan 11 - 15 to answer questions and provide information related to acquisition of Pine Point project. Request to provide date, time and location for a meeting during those dates.	Misty Ireland and J Key exchanged emails 1/3/2018 to confirm meeting time. Full Council will meet with J Key on Jan 15 at 5:30

Appendix B Record of Engagement

Date	Affiliation	Contact	Contact Initiated By	Engagement Activity Type	Issue / Recommendation from Party	Proponent Response / Resolution	Materials provided
2020-09-16	Deninu K'ue First Nation	Carol Ann Chaplin	Daniel Slade	Email	Place order for core boxes with DKFN.	n/a	None
2020-09-10	West Point First Nation	Janice Switlo	Damian Panayi	Email	Email states that West Point First Nation (WPFN) is a Dene community located in the area where through Treaty 11 the Crown has been provided with permissions to exercise partial political sovereignty. Email offers to explain this and engagement requirements more fully in a conference call with the appropriate authorities for Pine Point Mining Limited or provide a written brief directly to them. Email notes J Switlo's background details, including being former Crown Counsel for Indian and Northern Affairs, and in-house legal advisor for the GNWT for the Department of Aboriginal Affairs. Email states that PPML is not a Crown corporation. Requests that PPML obtains permission from WPFN for any new mining activity. Identifies that WPFN has not delegated authorities or decision-making to GNWT. Requests that PPML approach WPFN directly and not through GNWT. Email for requesting a forward to R Wares and J Hussey (Osisko).	Email forwarded to PPML.	None
2020-09-09	Deninu K'ue First Nation	Chief and Council	Jeff Hussey, Andrew Williams, Jesse O'Brien	Teleconference	Purpose: To present the results of the Preliminary Economic Assessment and the next steps for the Project. Request for support from the DKFN for the upcoming Project permit applications. Key Outcomes: Introduction that Golder wants to work with communities to determine how they would like to participate in socio-economic and ITK studies and how these studies should be undertaken. Question if the old pits have machinery at the bottom will these be cleaned up by the Project? J Hussey responded that the cleanup of the old Pine Point mine site was now the responsibility of the GWNT and the Federal Government. DKFN expects to benefit from the Project in the DKFN's area. J Hussey responded that at this early stage in the Project, the main activity is drilling. Clarification of Project schedule provided, and discussion regarding training and associated funding available to communities. The benefits for the DKFN need to be discussed at a Joint Implementation Committee meeting. As the construction period approaches in 2023, PPML will have completed the Environmental Assessment and the Feasibility Study. PPML will be engaging closer to that time on the benefits that will be available to the DKFN. DKFN noted an arrangement with Forward Mining though Rowes Construction. DKFN concerned about how PPML will protect workers from COVID if people are coming in from outside. J Hussey noted that workers follow all the COVID-19 rules mandated by the Chief Public Health Officer and explained the camp and commuting measures in place. Discussion around how PPML would monitor contaminants such as lead and zinc, as well as contaminants from blasting. Discussion about next steps and conclusion of meeting.	PPML acknowledged they would only work with DKFN businesses or their designates when planning social baseline studies. J Hussey to arrange a Joint Implementation Committee meeting. Agenda to include DKFN Members using their own equipment for work on the Project. PPML to share COVID-19 protocols for workers at the Exploration Camp.	Presentation
2020-09-02	Deninu K'ue First Nation	Carol Ann Chaplin	Andrew Williams	Email	Requested to reschedule the meeting from 2 September to 9 September 2020 as some Councillors could not attend on 2 September.	Changed meeting invitation to 9 September 2020.	None
2020-09-02	West Point First Nation	Wendy Ross	Andrew Williams	Email	Wendy said that Janice Switlo would be following up on our request for engagement.	Thanked her for arranging this.	None
2020-08-31	Northwest Territory Metis Nation	Gary Bailey, James Heron, Trevor Beck, Allan Heron, Lloyd Cardinal, Norman (last name unknown)	Jeff Hussey, Andrew Williams, Jesse O'Brien	Teleconference	Introduction that Golder wants to work with communities to determine how they would like to participate in socio-economic and TK studies and how these studies should be undertaken. NWTMN is concerned that KFN does not have any land rights in the area. J Hussey noted that part of the Project is located west of the Buffalo River and some to the east of the Buffalo River on land which KFN does have rights. NWTMN wondered why Teck and Avalon are being consulted. J Hussey noted that Teck still has rights over the Tailings Impoundment Area and Avalon did have land tenure in the past. In response to questions from NWTMN, J Hussey noted that there is no plan to reuse the railbed, the highway will be used to transport concentrates, and that the railbed is a federal responsibility. No plan to reroute the highway at this time. If future planning and design suggested that the highway needs to be rerouted, PPML would investigate further. Also noted that not all pits are full and PPML would not be releasing water to surface. NWTMN noted the people who would need to be on the Joint Implementation Committee (JIC). Stressed the need to establish what are the opportunities at the mine. Question regarding what contracts are going to be available and how long with they be for. J Hussey replied very little work is currently happening but PPML is ramping up at the site and PPML is keeping Jake Heron informed. The Joint Implementation Committee needs to be established to take the lead on future benefits. NWTMN noted that while the work opportunities may be small there could be room for the Métis. They would be willing to share opportunities with KFN. If there are opportunities at Hay River, please give the NWTMN an opportunity to bid for this work. Note that in the past, there was an agreement that each community (Fort Resolution and DFKN) would get a percentage of the drilling. J Hussey clarified that that agreement was not successful. NWTMN noted that their agreement includes a payment when the Project is approved, and asked if that has occurred. J Hussey noted that we have not yet reached the approval stage yet, which will require a Feasibility Study to be completed and approved. It is expected that a Feasibility Study will take 8 to 12 months to complete.	Jake Heron and Jeff Hussey to arrange a date for the JIC meeting. Send Presentation to J Heron for the record.	Presentation
2020-08-28	Town of Hay River	Stacey Barnes	Andrew Williams	Email	Provided letter of support for extension of LUP/WL (2018 permits) and the Confirmation and Exploration Program Application	Thanks Council for their support	Letter
2020-08-27	Deninu K'ue First Nation	Carol Ann Chaplin	Andrew Williams	Email	Acknowledged date for presentation to DKFN Council on September 2nd. Reiterated request for comment on the 2018 permit renewal/extension application. Will discuss the renewal/extension application at the meeting.	n/a	Letter
2020-08-27	Town of Hay River	Stacey Barnes	Andrew Williams	Email	Follow up email regarding renewal extension application	Stacey replied that council was issuing letters of support for upcoming new permit applications and for PPML's upcoming EA Initiation Package submission.	None
2020-08-27	West Point First Nation	Wendy Ross	Andrew Williams	Email	Follow-up with WPFN enquiring if WPFN would like to discuss the application extension/renewal	n/a	None
2020-08-26	Deninu K'ue First Nation	Jeff Hussey and Andrew Williams	Carol Ann Chaplin	Email	Changed date of meeting with Council from 26 August 2020 to 2 September 2020	PPML confirmed the change	None
2020-08-26	Deninu K'ue First Nation	Chief Louis Balsillie	Jeff Hussey and Andrew Williams	Telephone	Informed Chief Balsillie that PPML was providing information on the Project to various communities in the region as required by our engagement plans. We informed the Chief of our presentation to LKDFN regarding the Project, and that LKDFN informed PPML that under umbrella of the Akaitcho Dene First Nations, there was agreement among the ADFN regarding benefit agreements for future projects in the Akaitcho Lands.	Chief Louis acknowledged the information.	None

Date	Affiliation	Contact	Contact Initiated By	Engagement Activity Type	Issue / Recommendation from Party	Proponent Response / Resolution	Materials provided
2020-08-26	Lutselk'e Dene First Nation	Stephanie Poole, Mervin Able, Adeline Jonasson, Ron Desjarlais	Jeff Hussey, Andrew Williams, Jesse O'Brien	Teleconference	Purpose: Go over the Preliminary Economic Assessment and Project Description, and introduce social baseline work. Key Feedback from LKDFN: LKDFN is Akaitcho, and the Project is in their territory, and asserts that they should benefit just as much as DKFN. LKDFN would like an IBA. Concern that LKDFN have not been targeted for engagement. LKDFN requests funding to support engagement with their communities given that they cannot invite PPML in for community meetings. LKDFN would like to conduct their own socio-economic and Traditional Land and Resource Use studies, and would like PPML to fund these. Concern re: impacts to water quality and levels in Great Slave Lake, and the risk of COVID-19 to workers.	PPML is preparing follow-up notes from this meeting	Presentation
2020-08-25	Lutselk'e Dene First Nation	Hanna Catholique	Andrew Williams	Email	Provided updated copy of presentation for meeting on the 26th	n/a	Presentation
2020-08-25	Lutselk'e Dene First Nation	Andrew Williams	Hanna Catholique	Email	Confirmed receipt of presentation package	n/a	None
2020-08-25	Deninu K'ue First Nation	Chief Louis Balsillie	Jeff Hussey and Andrew Williams	Telephone	Advised Chief Louis that PPML wished to present the results of the PEA to the Chief and Council. Chief Louis queried why others beside the DKFN/KFN were included in this consultation.	The call was terminated prematurely. PPML will try to reconnect with the Chief.	None
2020-08-25	K'atl'odeeche First Nation	Chief Martel, Sub Chief Lamalice, Councillors R Sondfer, P Sabourin, and J Studney, R Lamalice, P Redvers, D Miller, P Riley, D Cardinal	Jeff Hussey, Andrew Williams, Jesse O'Brien	Online Presentation	Introduction that Golder wants to work with communities to determine how they would like to participate in socio-economic and TK studies and how these studies should be undertaken. KFN expressed concern that Osisko and PPML are paying too much attention to the Hay River Métis Government Council (which only has asserted and not recognized rights in the KFN Exploration Agreement area), the Town of Hay River (which has no rights or authorities outside of town boundaries), and Indigenous governments that have no connection at all to the Pine Point or KFN areas (such as Łutsel K'e First Nation). KFN continues to have environmental and socio-cultural concerns about the project, so mitigation of impacts on boreal caribou, fish in Ejıé Túé Dehé (Buffalo River), air and water contamination, and cultural sites in the area, particularly near Ejıé Túé Dehé, will be very important, along with appropriate management of transient workers entering Hay River or the Hay River Dene Reserve. KFN is not being adequately informed in a timely matter of all of the economic opportunities available and may be getting bypassed in favour of Hay River workers and businesses. KFN members will need advance training in order to qualify for potential job opportunities, but that training may not be available. The time and cost of engagement with Osisko / PPML in regulatory and pending IBA negotiations is not being covered so puts a strain on KFN personnel and resources. From a KFN perspective, some of the stated and implied outcomes from this session are as follows: Consistent with the KFN-PPM Exploration Agreement (EA), KFN needs to be viewed by Osisko-PPML as the primary rights holder in the EA area and treated accordingly, for activities taking place in the area but also given the transportation route through the KFN area. Osisko / PPML needs to clearly recognize that the Hay River Dene Reserve is a distinct community from the Town of Hay River and act accordingly, not lumping KFN in under the term 'Hay River'. KFN needs to be involved in the environmental assessment and regulatory process, both by being able to review licence applications in advance, but also contractually to provide environmental monitoring and traditional knowledge research services. Beginning immediately, KFN needs to be informed fully and in a timely manner of all pending opportunities for employment and contracting services, not only for those opportunities that fall explicitly under the KFN EA but also for opportunities that are open for applications or bids from all parties, not just EA parties (KFN or otherwise). KFN and Osisko / PPML need to develop a short and longer term training plan for KFN members, such that members can be prepared for opportunities when and as they arise. KFN and Osisko / PPML need to immediately begin the process of negotiating a Benefits Agreement, as contemplated in the EA, and further need to discuss funding arrangements for KFN's meaningful participation in these negotiations. The EA Implementation Committee needs to meet in the near future to review these concerns and outcomes and plan how to address them.	PPML is preparing follow-up notes from this meeting	Presentation
2020-08-25	Lutselk'e Dene First Nation	Hanna Catholique	Andrew Williams	Email	PPML provided presentation and conference call in details for meeting on 26 August 2020 to LKDFN	None required	Presentation
2020-08-24	Lutselk'e Dene First Nation	Hanna Catholique	Andrew Williams	Email	PPML confirmed the 26 August conference call date and time.	LKDFN confirmed the date and time	None
2020-08-24	Lutselk'e Dene First Nation	Hanna Catholique	Andrew Williams	Email	Sent meeting invitation with conference call details and PDF of PPML presentation.	Hanna acknowledged receipt of the presentation PDF.	None
2020-08-21	Deninu K'ue First Nation	Chief Louis Balsillie	Jeff Hussey	Telephone	Request for opportunity to engage. Left message.	n/a	None
2020-08-21	Deninu K'ue First Nation	Carol Ann Chaplin	Jeff Hussey	Telephone	Request for opportunity to engage on Pine Point Project. Left message with band office receptionist.	n/a	None
2020-08-21	Deninu K'ue First Nation	Jeff Hussey	Chief Louis Balsillie	Telephone	Date set for meeting with Chief and Council on August 26, 2020 at 5pm. Asked that we arrange the meeting with the SAO	Sent meeting invitation to Carol Ann Chaplin (SAO) who accepted the invitation	Presentation
2020-08-21	West Point First Nation	Wendy Ross	Damian Panayi	Email	Request for opportunity to engage on Pine Point Project.	n/a	None
2020-08-21	West Point First Nation	WPFN General Office	Damian Panayi	Telephone Call	Sasah answered phone and said engagement should be through Wendy Ross. Emailed Wendy Ross.	n/a	None
2020-08-21	Fort Providence First Nation	Main Office	Damian Panayi	Telephone Call	No answer at listed numbers	n/a	None
2020-08-20	City of Yellowknife	Mayor Alty, Kerry Penny (Dir, Econ Dev and Strategy)	Jeff Hussey and Andrew Williams	Online Presentation	Presented update on the Pine Point Project based on the results of PEA including the Project Description, upcoming permit applications and EA initiation package submission.	Questions and responses: 1. Mayor asked about employment rotations, and has PPML completed a Labour Resource Study? PPML replied that at the PEA level we have not yet undertaken a Labour Resources Study. This would be addressed in later studies. 2. K Penny asked about where, when and how many employees PPML would require, as the City of YK has several infrastructure projects in the 2020s. PPML replied that apart from the high level employment numbers in the PEA we have not yet scheduled in detail employment timing and positions. PPML undertook to keep the City apprised as planning continues and timing etc. is firmed up. 3. Has PPML presented to the YK Chamber of Commerce? PPNL has not presented to the YK Chamber; however, PPML has presented to the NWT Chamber of Mines. K Penney provided a contact for the Chamber of Commerce.	Presentation
2020-08-20	Fort Providence First Nation	Chief Bonnetrouge; Maggie Levavasseur	Andrew Williams	Email	Letter notifying of intent to seek renewal of 2018 Water Licence and extension of 2018 LUP.	n/a	Letter

Date	Affiliation	Contact	Contact Initiated By	Engagement Activity Type	Issue / Recommendation from Party	Proponent Response / Resolution	Materials provided
2020-08-20	Fort Providence First Nation	Maggie Levavasseur	Andrew Williams	Telephone	Called private number and explained who I was and that I had been calling various numbers on the web site without success. Maggie provided a new number. I also noted that Maggie had been sent some emails related to permit applications and engagement requests.	Maggie provided a new number for the Fort Providence Band Office and contact name, Michael Hadley	None
2020-08-20	Fort Providence First Nation	FPFN Band Office	Andrew Williams	Telephone	Left message for Michael Hadley (the new Executive Director).	Left message for Michael Hadley to call back	None
2020-08-20	Lutselk'e Dene First Nation	Andrew Williams	Hanna Catholique	email	LKFN teleconference call in details.	PPML confirmed the date and time.	None
2020-08-19	Akaitcho Territory Government/DKFN	Richard Simon	Andrew Williams	Email	Request an opportunity to present the PEA results and upcoming permit applications	No Response as of 18 September 2020	Letter
2020-08-19	Akaitcho Territory Government/LKDFN	Greg Guthrie	Andrew Williams	Email	Request an opportunity to present the PEA results and upcoming permit applications	No Response as of 18 September 2020	Letter
2020-08-19	Akaitcho Territory Government/YKDFN	Sarah Taylor	Andrew Williams	Email	Request an opportunity to present the PEA results and upcoming permit applications	No Response as of 18 September 2020	Letter
2020-08-19	Lutselk'e Dene First Nation	Chief Marlowe	Andrew Williams	Email	Request an opportunity to present the PEA results and upcoming permit applications	n/a	Letter
2020-08-19	Lutselk'e Dene First Nation	Andrew Williams	Hanna Catholique	email	Notified PPML of possible meeting date for 26 August 2020.	Confirmed the 26 August meeting date	
2020-08-19	Timberworks	Robert Mills	Andrew Williams	Email	Letter notifying of intent to seek renewal of 2018 Water Licence and extension of 2018 LUP.	n/a	Letter
2020-08-18	Avalon Advanced Materials	Donald Bubar	Andrew Williams	Email	Letter notifying of intent to seek renewal of 2018 Water Licence and extension of 2018 LUP.	Reply received from Bill Mercer, informed PPML that Avalon Advanced Materials no longer has rights in the area and advised PPML that we no longer have to inform Avalon any longer	Letter
2020-08-18	Deninu K'ue First Nation	Chief Louis Balsillie	Andrew Williams	Email	Letter notifying of intent to seek renewal of 2018 Water Licence and extension of 2018 LUP.	n/a	Letter
2020-08-18	Hamlet of Fort Resolution	Mayor Simon; SAO Tom Beaulieu	Andrew Williams	Email	Letter notifying of intent to seek renewal of 2018 Water Licence and extension of 2018 LUP.	Response Received from SAO Tom Beaulieu that he would provide letter to Mayor and Council at meeting next week.	Letter
2020-08-18	Hamlet of Fort Resolution	Tom Beaulieu	Andrew Williams	Email	Request an opportunity to present the PEA results and upcoming permit applications	Response Received from SAO Tom Beaulieu that he would provide letter to Mayor and Council at the next meeting. Indicated the future employment would be one of the items that Council may wish to discuss; business opportunities, contracts and management may be other topics that Council wishes to discuss	Letter
2020-08-18	Town of Hay River	Mayor Jameson	Andrew Williams	Email	Letter notifying of intent to seek renewal of 2018 Water Licence and extension of 2018 LUP.	n/a	Letter
2020-08-18	K'atl'odeeche First Nation	Peter Redvers	Andrew Williams	Email	Letter notifying of intent to seek renewal of 2018 Water Licence and extension of 2018 LUP.	n/a	Letter
2020-08-18	NWT & Nunavut Chamber of Mines	Tom Hoefer	Andrew Williams	Email	Letter notifying of intent to seek renewal of 2018 Water Licence and extension of 2018 LUP.	Response received from Executive Director	Letter
2020-08-18	Northwest Territory Metis Nation	Jake Heron	Andrew Williams	Email	Letter notifying of intent to seek renewal of 2018 Water Licence and extension of 2018 LUP.	n/a	Letter
2020-08-18	Teck Metals Limited	Michelle Unger	Andrew Williams	Email	Letter notifying of intent to seek renewal of 2018 Water Licence and extension of 2018 LUP.	Out of Office reply	Letter
2020-08-18	West Point First Nation	Chief Cayen	Andrew Williams	Email	Letter notifying of intent to seek renewal of 2018 Water Licence and extension of 2018 LUP.	n/a	Letter
2020-08-14	City of Yellowknife	Brooklyn Poeschuk	Andrew Williams	Email	Followed up on request to present PEA results and upcoming permit applications	A Williams responded and Paula Mackenzie set up meeting date for August 20, 2020	None
2020-08-13	Deninu K'ue First Nation	Chief Louis Balsillie	Jeff Hussey	Telephone	Requested date for PEA and permit presentation. The chief said he would contact his SAO to determine a date.	Chief called back and said he needed to review upcoming council meeting agenda and would confirm the date	None
2020-08-13	Northwest Territory Metis Nation	Jake Heron	Jeff Hussey	Telephone	Followed up on date to represent PEA results. Jake suggested two presentations, the first to the Environment staff on during the NWTMN meeting on 28-29 August.	Jake will respond will a time slot to present the PEA. 28 August 2020: Jake advised that they would contact us with the time slot.	None
2020-08-13	Northwest Territory Metis Nation	Jake Heron	Jeff Hussey and Andrew Williams	Telephone	Advised the NWTMN that we would be seeking an extension for MV2018L2-003 and MV2018C0005 without any changes in the scope of the work under the permits.	Acknowledged the information and noted that the IMA would receive the application.	None
2020-08-12	K'atl'odeeche First Nation	Peter Redvers	Andrew Williams	Email	Forwarded email invitation for online meeting (Teams)	Meeting invitation accepted.	Presentation
2020-08-12	Northwest Territory Metis Nation	Jake Heron	Jeff Hussey	Telephone	To arrange for meeting to present project post PEA		None
2020-08-11	Akaitcho Territory Government	Stephanie Poole	Andrew Williams	Email	Asked if emails addresses were correct for Chief Marlowe at LKDFN and for the Akaitcho Dene First Nations	Replied with new email addresses; sent emails to Richard Simon, Greg Guthrie, and Sarah Taylor.	None
2020-08-11	Deninu K'ue First Nation	Chief Louis Balsillie	Jeff Hussey	Telephone	The chief was busy and said he would call back	n/a	None
2020-08-11	Town of Hay River	Stacey Barnes	Andrew Williams	Email	Presentation update on the PEA and upcoming permitting to the Council	Questions asked and responses: 1 Has PPML contacted NTPC? Response: Yes we have been in contact with NTPC regarding the mines power requirements. Some of the power can be provided by NTPC; however, Taltson will not have enough capacity to meet the mines' full power requirements, so the mine will have to generate additional power on site. 2. What will be the nature of the workers shifts? Response: The actual shift configurations are preliminary; however, we are planning on 12 hour shifts. This will required that workers are accommodated at site as driving back after a shift would be a safety concern. The rotation for the crews is still under discussion. While 2 weeks on and 2 weeks off are common in the northern mines, there are other options given the road access to the site, such as 4 days on, 3 off.	Presentation
2020-08-07	Deninu K'ue First Nation	Carol Ann Chaplin	Jeff Hussey	Telephone	Left message requesting the Chief call back to setup up meeting with Chief Louis.	n/a	None
2020-08-07	K'atl'odeeche First Nation	Peter Redvers	Jeff Hussey and Andrew Williams	Telephone	Discussed potential meeting dates (25 or 27 August). Peter suggested a premeeting with himself and Patrick Riley.	n/a	None
2020-08-07	Northwest Territory Metis Nation	Jake Heron	Jeff Hussey and Andrew Williams	Telephone	Requested dates for presentation to the NWTMN. Jake tentatively suggest August 10, 11, 12.	Meeting time was not confirmed	None
2020-08-06	Northwest Territory Metis Nation	Jake Heron	Jeff Hussey	Telephone	Discussed setting a time for a presentation on the Project PEA and general update.	n/a	None
2020-07-30	Town of Hay River	Stacey Barnes	Andrew Williams	Email	HRTC requested PPML to present via Zoom meeting on 4 or 11 August.	11 August was agreed on for the presentation.	None
2020-07-22	Northwest Territory Metis Nation	Jake Heron	Jeff Hussey	Telephone	Provided general update with the completion of the PEA. Jake requested a schedule for the Project	Follow-up?	None

Date	Affiliation	Contact	Contact Initiated By	Engagement Activity Type	Issue / Recommendation from Party	Proponent Response / Resolution	Materials provided
2020-07-17	Northwest Territory Metis Nation	Trudy King	Damian Panayi at Golder Assoc, contractor to PPML	Telephone	D Panayi contacted T King and left a voicemail regarding the employment opportunities associated with baseline field studies.	No response to date from T King	None
2020-07-15	Northwest Territory Metis Nation	Unknown	Damian Panayi at Golder Assoc, contractor to PPML	Unknown	D Panayi contacted NWTMN regarding employment opportunities associated with baseline field studies	NWTMN provided a resume for a potential candidate	None
2020-07-14	Northwest Territory Metis Nation	Tim Heron	Damian Panayi at Golder Assoc, contractor to PPML	phone call	D Panayi contacted NWTMN regarding employment opportunities associated with baseline field studies	NWTMN provided contact information for potential candidates; Golder reached out to them	None
2020-07-14	Northwest Territory Metis Nation	Rosi (last name unknown)	Damian Panayi at Golder Assoc, contractor to PPML	phone call	D Panayi contacted NWTMN regarding employment opportunities associated with baseline field studies	NWTMN provided a resume for a potential candidate	None
2020-07-07	K'atl'odeeche First Nation	Peter Redvers	Andrew Williams	email	Peter noted that Council had met on PPML's request to provide a PEA and upcoming permitting submissions; they recommended that PPML first present to the KFN Council and Environment staff. The council would decide after the presentation if a broader presentation to the community was needed.	n/a	None
2020-06-29	Akaitcho Dene First Nations	Stephanie Poole	Andrew Williams	Email	Follow-up to email to Anne Boucher to Request an opportunity to present the PEA results and upcoming permit applications	Replied with alternate email addresses.	None
2020-06-26	Akaitcho Territory Government	Annie Boucher	Andrew Williams	Email	Request an opportunity to present the PEA results and upcoming permit applications	2020-07-13 Stephanie Poole responded and had forwarded the email to the ADFN's.	Letter
2020-06-26	City of YK	Chief Lynn Alty	Andrew Williams	Email	Request an opportunity to present the PEA results and upcoming permit applications	2020-06-29 Paula Mackenzie (Sen. Exec Asst, Admin, YK) responded and suggested meeting with the Mayor and members of the Economic Development team.	Letter
2020-06-26	Deninu K'ue First Nation	Chief Louis Balsillie	Andrew Williams	Email	Request an opportunity to present the PEA results and upcoming permit applications	n/a	Letter
2020-06-26	Fort Providence FN	Chief Xavier Candien	Andrew Williams		Request an opportunity to present the PEA results and upcoming permit applications	n/a	Letter
2020-06-26	Town of Fort Smith	Mayor Lynn Napier	Andrew Williams	Email	Request an opportunity to present the PEA results and upcoming permit applications	n/a	Letter
2020-06-26	K'atl'odeeche First Nation	Peter Redvers	Andrew Williams	Email	Request an opportunity to present the PEA results and upcoming permit applications	2020-06-26 P Redvers acknowledge receipt and would respond after meeting with Council.	Letter
2020-06-26	Lutselk'e Dene First Nation	Chief Darryl Marlowe	Andrew Williams	Email	Request an opportunity to present the PEA results and upcoming permit applications	Incorrect email address notification; resent request to new email on 19 August 2019	Letter
2020-06-26	Northwest Territory Metis Nation	Jake Heron	Andrew Williams	Email	Request an opportunity to present the PEA results and upcoming permit applications	2020-06-29 Jake Heron acknowledged receipt of request and would respond when all four Presidents had review the information	Letter
2020-06-26	Smith Landing First Nation	Chief Gerry Cheezie	Andrew Williams	Email	Request an opportunity to present the PEA results and upcoming permit applications	n/a	Letter
2020-06-26	Salt River First Nation	Chief Dave Poitras	Andrew Williams	Email	Request an opportunity to present the PEA results and upcoming permit applications	n/a	Letter
2020-06-26	Town of Hay River	Mayor Kandis Jameson	Andrew Williams	Email	Request an opportunity to present the PEA results and upcoming permit applications	2020-07-30 Stacey Barnes (Hay River Council Administrator) contacted A Williams to arrange August 11, 2020 for information session with the council;	Presentation
2020-06-26	West Point First Nation	Chief Kenneth Cayen	Andrew Williams	Email	Request an opporutunity to present the PEA results and upcoming permit applications	n/a	Letter
2020-05-12	K'atl'odeeche First Nation	Peter Redvers	Andrew Williams	email, phone call	A Williams and P Redvers discussed the use of KFN personnel and equipment to assist the environmental baseline sampling program	12 May 2020 - P Redvers followed up with email to Patrick Riley indicated use of boat for May sampling and a field Assistant later in summer	None
2020-05-11	K'atl'odeeche First Nation	Peter Redvers	Andrew Williams	email	A Williams emailed P Redvers regarding summer environmental program area and sampling methods to be employed	12 May 2020 - P Redvers thanked A Williams for the information and requested clarity on KFN's involvement	None
2020-05-08	K'atl'odeeche First Nation	Peter Redvers	Andrew Williams	email	A Williams emailed P Redvers regarding summer environmental program and related work opportunities	12 May - P Redvers responded with email to KFN Patrick Riley describing opportunity and suggesting possible use of KFN boat for program and importance of KFN member participation in program; KFN to contact AGL to provide worker contact and proposal	None
2020-05-05	K'atl'odeeche First Nation	Peter Redvers	Peter Redvers	email	P Redvers email PPML notifying receipt of ARI Research Permit Licence for Comment and requested additional information	See Response on May 8, 2020 below.	None
2020-05-05	Northwest Territory Metis Nation	Tim Heron	Tim Heron	phone call	T Heron contacted A Williams to discuss summer environmental program research permit application; Northwest Territory Metis Nation is interested in the program and any work opportunities that may flow from it; TH may be in the area this summer and would like to drop in for a visit	A Williams welcomed TH contacting him this summer to arrange a visit to the Project Area; AW advised TH that the program is small so employment opportunities will be limited. AW noted the interest in the program and the candidate names provided by TH. AW forwarded these names to Golder Associates.	None
2020-04-24	K'atl'odeeche First Nation	Peter Redvers	Jeff Hussey	phone call	J Hussey conference called with P Redvers and Andrew Williams regarding the request following the completion of the PEA to present the Project Description by teleconference due to COVID-19 concerns. The objective is to keep the permitting process going during the lockdown. PR mentioned that the first step would be to present to the Chief and Council. No date was planned as it is dependant on the PEA being completed.	n/a	None
2020-03-16	Deninu K'ue First Nation	Carol Chaplin, SAO	Jeff Hussey	email	J Hussey emailed C Chaplin with update on seasonal program status; winter drill program expected to be completed in next couple of days. A small crew will remain to finish geophysics work and then to maintain camp; impact of COVID-19 on development timelines is being assessed going forward.	n/a	None
2020-03-16	K'atl'odeeche First Nation	Peter Redvers	Jeff Hussey	email	J Hussey emailed P Redvers with update on seasonal program status; winter drill program expected to be completed in next couple of days. A small crew will remain to finish geophysics work and then to maintain camp; impact of COVID-19 on development timelines is being assessed going forward.	17 March - receipt acknowledged by PR	None
2020-03-16	Northwest Territory Metis Nation	Jake Heron	Jeff Hussey	email	J Hussey emailed J Heron with update on seasonal program status; winter drill program expected to be completed in next couple of days. A small crew will remain to finish geophysics work and then to maintain camp; impact of COVID-19 on development timelines is being assessed going forward.	n/a	None

Date	Affiliation	Contact	Contact Initiated By	Engagement Activity Type	Issue / Recommendation from Party	Proponent Response / Resolution	Materials provided
2020-02-07	Deninu K'ue First Nation	Chief Louis Balsillie, Kevin Boucher, Stanley Beck, Frank Lafferty, Carol Chaplin, SAO	PPML	meeting	PPML (J Hussey, A Williams) provided an update on project status and plans including intention to pursue advanced exploration permitting, continuing development of mine plans and environmental baseline data collection; DKFN enquired if freeze walls were being considered. PPML responded that currently reinjection of groundwater was preferred; In response to a question about tailings, PPML would not be reusing the old tailings facility and would, where possible, deposit tailings in old pits. PPML expects to have more information to share on next permitting steps in spring 2020	n/a	None
2020-02-07	K'atl'odeeche First Nation	Chief April Martel, Debbie Miller, Peter Redvers, Doug Cardinal	PPML	meeting	PPML (J Hussey, A Williams) provided an update on project status and plans including intention to pursue advanced exploration permitting, continuing development of mine plans and environmental baseline data collection; PPML expects to have more information to share on next permitting steps in spring 2020	KFN continues to be interested in economic benefits from project activities. PPML will engage with capacity requirements when next activities are planned; KFN has an agreement with Golder, who is PPML's primary environmental consultant, which should facilitate sharing of TK for research purposes; KFN raised that participating in EA process is expensive and MVEIRB's intervenor funding provides minimal resources for KFN to have capacity to participate in a timely manner. KFN asked that PPML consider how this may be addressed	None
2020-02-07	Northwest Territory Metis Nation	President Northwest Territory Metis Nation: Garry Bailey and FRMG President: Lloyd Cardinal	PPML	meeting	PPML (J Hussey, A Williams) provided an update on project status and plans including intention to pursue advanced exploration permitting, continuing development of mine plans and environmental baseline data collection; Northwest Territory Metis Nation requested employment opportunities for summer students and general services as they have Loaders, trucks, water truck, Fuel delivery, clear cutting, and snow removal. PPML stated that the camp was about to shutdown for spring breakup and would consider services etc. when drilling campaign resumes. PPML expects to have more information to share on next permitting steps in spring 2020	n/a	None
2020-01-31	Northwest Territory Metis Nation	Jake Heron	Sean Marshall	email	Email to inquire of meeting availability on 7 February	J Heron requested information on proposed location; Aurora Geoscience responded Hay River in the morning; 4 Feb Aurora Geoscience called, discussed that meeting in Yellowknife could be possible with PPML, otherwise Friday afternoon is now open on south side of lake. J Heron identified an individual who had indicated interest in Metis employment on the project	None
2020-01-28	Deninu K'ue First Nation	Carol Chaplin, SAO	Sean Marshall	email	Aurora Geoscience emailed DKFN SAO to inquire of meeting availability on 7 February	31 January 2020, Aurora Geosciences followed up by email; DKFN responded as being not available and requesting other dates; Aurora Geoscience replied, late March appears next opportunity for in-person meeting, will follow up when scheduling can be opened	None
2020-01-09	K'atl'odeeche First Nation	Peter Redvers	Peter Redvers	email	Correspondence to GNWT regarding KFN concerns about recording of claims in area to which KFN asserts Aboriginal Title without due consultation	N/A	None
2019-12-11	Avalon Advanced Materials Inc	Don Bubar	S Marshall for J Hussey	email	Letter sent describing proposed amendment of MV2017C0024 and inviting input from engagement party	No response	Letter and map of project area and claims
2019-12-11	Deninu K'ue First Nation	SAO Office	S Marshall for J Hussey	email	Letter from PPML describing proposed amendment of MV2017C0024 and inviting input from engagement party	No response	Letter and map of project area and claims
2019-12-11	Hamlet of Fort Resolution	Tom Beaulieu	S Marshall for J Hussey	email	Letter from Jeff Hussey describing proposed amendment of MV2017C0024 and inviting input from engagement party	No response	Letter and map of project area and claims
2019-12-11	K'atl'odeeche First Nation	Peter Redvers	S Marshall for J Hussey	email	Letter from Jeff Hussey describing proposed amendment of MV2017C0024 and inviting input from engagement party	Reply acknowledging receipt and requesting draft spill plan when complete; draft plans and project description sent 19/20 December; no input yet received	Letter and map of project area and claims; draft plans and project description (19/20 Dec)
2019-12-11	Northwest Territory Metis Nation	Jake Heron	S Marshall for J Hussey	email	Letter sent describing proposed amendment of MV2017C0024 and inviting input from engagement party	No response	Letter and map of project area and claims
2019-12-11	NWT & Nunavut Chamber of Mines	Executive Director's office	S Marshall for J Hussey	email	Letter sent describing proposed amendment of MV2017C0024 and inviting input from engagement party	No response	Letter and map of project area and claims
2019-12-11	Teck Metals Limited	Michelle Unger	S Marshall for J Hussey	email	Letter sent describing proposed amendment of MV2017C0024 and inviting input from engagement party	No response	Letter and map of project area and claims
2019-12-11	Timberworks	General Manager's office	S Marshall for J Hussey	email	Letter sent describing proposed amendment of MV2017C0024 and inviting input from engagement party	No response	Letter and map of project area and claims
2019-12-11	Town of Hay River	Judy Goucher	S Marshall for J Hussey	email	Letter sent describing proposed amendment of MV2017C0024 and inviting input from engagement party	No response	Letter and map of project area and claims
2019-12-11	West Point First Nation	Kenny Cayen	S Marshall for J Hussey	email	Letter from Jeff Hussey describing proposed amendment of MV2017C0024 and inviting input from engagement party	No response	Letter and map of project area and claims
2019-12-09	Deninu K'ue First Nation	Carol Chaplin, SAO	Carol Chaplin, SAO	email	SAO emailed J Hussey and S Marshall: Meeting request for January from Chief and Council	10 Dec 2019 Aurora Geoscience responded, offered week of 27 January 2020; 11 Dec 2019 DKFN responded, requested earlier if possible; 19 Dec 2019 Aurora Geoscience suggested conference call earlier in January; no DKFN response	None

Date	Affiliation	Contact	Contact Initiated By	Engagement Activity Type	Issue / Recommendation from Party	Proponent Response / Resolution	Materials provided
2019-12-06	Deninu K'ue First Nation	SAO Office	J Hussey	email	Share information related to proposed amendment of MV2017C0024	Meeting requested in early January; follow up requests from Aurora Geoscience (10 Dec 2019 and 19 Dec 2019) seeking input on proposed amendment not responded to	Draft documents
2019-12-06	Northwest Territory Metis Nation	Jake Heron	J Hussey	email	Share information related to proposed amendment of MV2017C0024	Follow up request from Aurora Geoscience (13 Dec) seeking input on proposed amendment not responded to	Draft documents
2019-11-25	Deninu K'ue First Nation	SAO Office	S Marshall	email	Inquire on DKFN confirmation of status of Key Contracting in relation to Collaboration Agreement	SAO responded DKFN supports PPML's operations	None
2019-10-29	Deninu K'ue First Nation	Carol Chaplin, SAO	Carol Chaplin, SAO	email	Request to set up a meeting between DKFN, Rowes, and PPML	n/a	None
2019-10-04	K'atl'odeeche First Nation	Contacted Debbie Miller CEO	J Hussey	phone call	n/a	n/a	None
2019-10-03	K'atl'odeeche First Nation	Debbie Miller CEO Peter Redvers, Larry Innes	Peter Redvers	phone call	Email to set up conference call to advance engagement, discuss collaboration agreements, exploration agreements, and next steps.	Meeting agenda received and edited, confirmed Oct 29	None
2019-09-25	Deninu K'ue First Nation	SAO Office	J Hussey	email	Confirmation of News Release content for approval regarding the Collaboration agreements by DKFN.	n/a	None
2019-09-03	Northwest Territory Metis Nation	Tim Heron	PPML	email	Contacted Tim Heron regarding Research License	Received support letter	None
2019-08-26	Deninu K'ue First Nation	Carol Chaplin, SAO	Carol Chaplin, SAO	email	Request that site visit participants also receive a tour of your camp and the core processing facility, and to include lunch on site.	The tour went well with positive feedback	None
2019-08-14	Deninu K'ue First Nation	SAO Office	J Hussey	email	Sent Executed Copy of Collaboration Agreement	n/a	None
2019-08-07	Deninu K'ue First Nation	Carol Chaplin, SAO	Carol Chaplin, SAO	email	Request to receive opportunities to bid on contracts such as brushing, and provision of contact information for Chief Balsillie	Provided rationale for not putting brushing contract to tender, and request for letter of support regarding aurora research licence.	None
2019-07-24	Deninu K'ue First Nation	SAO Office	J Hussey	email	July 24 to Aug 15th: Request for support of Aurora Research License for Environmental baseline work	August 16th: Received DKFN latter of support for research license	None
2019-07-24	Deninu K'ue First Nation	SAO Office	J Hussey	email	Request for support letter for Aurora Research Institute Research License associated to baseline environmental studies	n/a	None
2019-07-24	West Point First Nation	Unknown	J Hussey	email	Requesting regarding License Application for Research from the Aurora Research Institute. This is associated to continuing our baseline environmental work this year in collaboration with Golder and Associates on the Pine Point project.	Received support letter	None
2019-07-17	Deninu K'ue First Nation	SAO Office	J Hussey	email	Request for meeting	n/a	None
2019-07-11	Deninu K'ue First Nation	Carol Chaplin, SAO	Carol Chaplin, SAO	email	Received Signed Collaboration Agreement	n/a	None
2019-07-05	Deninu K'ue First Nation	Carol Chaplin, SAO	Carol Chaplin, SAO	email	Received proposed changes to the Collaboration Agreement	n/a	None
2019-07-05	Deninu K'ue First Nation	Carol Chaplin, SAO	Jeff Hussey	email	Provision of draft documentation for the proposed amendment to land use permit MV2017C0024 (Pine Point camp) and notification of preparation for advanced exploration permitting in 2020.	DKFN Chief and Council request a meeting with PPML in January, and request to know availability.	None
2019-06-25	Deninu K'ue First Nation	Carol Chaplin, SAO	Carol Chaplin, SAO	email	Letter sent to Department of Lands for the amendment of the interim Land Withdrawals	n/a	None
2019-06-25	Deninu K'ue First Nation	Carol Chaplin, SAO	Carol Chaplin, SAO	email	From March to the end of June there were several communications regarding the negotiation of the Collaboration Agreement regarding meetings for clarification and negotiation. This allowed for the development of an understanding and relationship building.	n/a	None
2019-06-24	Deninu K'ue First Nation	Carol Chaplin, SAO	Carol Chaplin, SAO	email	Provision of confidentiality agreement and discussion of collaboration agreement	n/a	None
2019-06-19	Northwest Territory Metis Nation	Jake Heron Darwin Hanna	J Hussey	meeting	Collaboration Agreement Negotiations	Email to advise PPML that the four presidents have now endorsed the collaboration agreement, and the signed document will be returned for PPML's signature.	None
2019-05-22	Deninu K'ue First Nation	SAO Office	J Hussey	email	Confirming meeting on Friday May 10	n/a	None
2019-05-22	Deninu K'ue First Nation	Carol Chaplin, SAO	Carol Chaplin, SAO	email	Confirming meeting on Friday May 10	Confirmation that Chief and Council will attend meeting, and clarification of costs	None
2019-05-22	Deninu K'ue First Nation	SAO Office	J Hussey	email	Corporate Update meeting in Fort Resolution at noon	n/a	None
2019-05-09	Deninu K'ue First Nation	Chief Louis Balsillie	Chief Louis Balsillie	email	Communication regarding the location of camp accommodations and the Collaboration Agreement.	n/a	None
2019-05-09	Deninu K'ue First Nation	Carol Chaplin, SAO		email	Provision of contact information for DKFN legal counsel	n/a	None
2019-04-21	Northwest Territory Metis Nation	Jake Heron, Darwin Hanna, Bob Overvold	J Hussey	meeting	Collaboration Agreement Negotiations From April to July	Several meetings held to discuss collaboration agreement	None
2019-04-20	Northwest Territory Metis Nation	Jake Heron	J Hussey	Phone Call	Discussions surrounding renewed interest in developing a Collaboration Agreement	Email confirming preparation activities for collaboration agreement negotiations	None
2019-04-12	West Point First Nation	Becky Cayen, Wendy Ross, Kandice Thoms	J Hussey	meeting	Corporate/Project update meeting held with Chief Becky Cayen; Wendy Ross and Kandice Thomas	n/a	None
2019-02-09	K'atl'odeeche First Nation	Chief April Martel & Catherine Heron CEO	Peter Redvers	phone call	General Update and discussion surrounding Exploration Agreement	n/a	None
2019-02-08	Deninu K'ue First Nation	Carol Chaplin, SAO	Carol Chaplin, SAO	email	Requesting a meeting for an update	n/a	None
2019-01-28	Deninu K'ue First Nation	Rosy Bjornson	Rosy Bjornson	email	Request for donation for the NWT Territorial Dog Sledding Champion race held during the spring carnival March 21-24, 2019 and other related Carnival festivities.	PPML did not donate to this cause after donating $10,000 for school bus in November	None

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2019-01-28	Deninu K'ue First Nation	Kathleen Fordy for Roy Bjornson	Kathleen Fordy for Rosy Bjornson	email	Request for donation for a photo contest, and workshop that in Fort Resolution on March 7, 2019.	PPML did not donate to this cause after donating $10,000 for school bus in November	None
2019-01-25	K'atl'odeeche First Nation	Peter Redvers	Peter Redvers	meeting	Discussed leadership changes at PPML, drilling contracts, and desire to reopen engagement between KFN and PPML	n/a	None
2019-01-18	Deninu K'ue First Nation	SAO Office	PPML	email	New Year greetings and a request to schedule an update call with Chief Louis Balsillie	Response to reach out directly by phone	None
2019-01-18	Deninu K'ue First Nation	SAO Office	J Hussey	email	Notify DKFN of temporary shut down of Pine Point drill program until after Spring breakup. Offer setup a call for next week with Chief Louis Balsillie and to also discuss a next visit that will probably only happen in April at this point	n/a	None
2018-12-07	Deninu K'ue First Nation	n/a	Stanley Clemmer	phone call	Discuss the planned camp at Pine Point for the winter drilling program	n/a	None
2018-12-07	K'atl'odeeche First Nation	Ken Norn	Ken Norn	phone call	Mr. Norm wanted to know what the plans were for 2019 program in a phone call to Stanley Clemmer	n/a	None
2018-12-03	Deninu K'ue First Nation	IMA Office	Judy Dudley	email	Provided results from the 2018 Wildlife Study as requested/required for the research permit.	n/a	Study Results
2018-12-03	Fort Resolution Metis Council	Office of the President	Judy Dudley	email	Provided results from the 2018 Wildlife Study as requested/required for the research permit.	n/a	Study Results
2018-12-03	K'atl'odeeche First Nation	Peter Redvers	Judy Dudley	email	Provided results from the 2018 Wildlife Study as requested/required for the research permit.	P Redvers followed up 12/6/18 with question about location of wildlife cameras which J Dudley answered.	Study Results
2018-11-29	Deninu K'ue First Nation	Carol Chaplin, SAO	Judy Dudley	email	Provided a summary of the 2018 Archaeology study	C Chaplin asked that Rosy's email be updated to ima@dkfn.ca	Study Summary
2018-11-29	Fort Resolution Metis Council	Environment Office	Judy Dudley	email	Provided a summary of the 2018 Archaeology study	n/a	Study Summary
2018-11-29	Hamlet of Fort Resolution	Carol Chaplin, SAO	Judy Dudley	email	Provided a summary of the 2018 Archaeology study	C Chaplin replied that Tausia.sao@gmail.com is no longer a valid email for the Hamlet. She cc:'ed Carolc.lands@gmail.com and louisbalsillie@gmail.com and recommended that future Hamlet email be sent to those addresses.	Study Summary
2018-11-15	Deninu K'ue First Nation	Carol Chaplin, SAO	Jeff Hussey	meeting	Discussed project. DKFN asked for funding to purchase a school bus. Osisko Metals noted that school buses should be funded by the GNWT. But that this one time, Osisko Metals would donate $10,000 to the purchase.	SAO replied by email 11/22/18 with thanks. Will send an invoice.	None
2018-11-15	Deninu K'ue First Nation	IMA Office	Judy Dudley	email	Provided a copy of Sept, 2018 groundwater quality monitoring data.	n/a	Study Results
2018-11-15	Fort Resolution Metis Council	Environment Office	Judy Dudley	email	Provided a copy of Sept, 2018 groundwater quality monitoring data.	n/a	Study Results
2018-11-15	Hay River Metis Council	Office of the President	Judy Dudley	email	Provided a copy of Sept, 2018 groundwater quality monitoring data.	n/a	Study Results
2018-11-15	K'atl'odeeche First Nation	Lands Office	Judy Dudley	email	Provided a copy of Sept, 2018 groundwater quality monitoring data.	P Redvers acknowledged receipt 11/16/2018	Study Results
2018-11-15	West Point First Nation	Lands Office	Judy Dudley	email	Provided a copy of Sept, 2018 groundwater quality monitoring data.	n/a	Study Results
2018-11-13	West Point First Nation	General Office	Judy Dudley	email	Provided a copy of June, 2018 groundwater quality monitoring data.	Auto-reply that wpfn@northwestel.net is no longer valid address.	Study Results
2018-11-12	Deninu K'ue First Nation	IMA Office	Judy Dudley	email	Provided a copy of June, 2018 groundwater quality monitoring data.	n/a	Study Results
2018-11-12	Fort Resolution Metis Council	Environment Office	Judy Dudley	email	Provided a copy of June, 2018 groundwater quality monitoring data.	n/a	Study Results
2018-11-12	Hay River Metis Council	Office of the President	Judy Dudley	email	Provided a copy of June, 2018 groundwater quality monitoring data.	n/a	Study Results
2018-11-12	K'atl'odeeche First Nation	Lands Office	Judy Dudley	email	Provided a copy of June, 2018 groundwater quality monitoring data.	n/a	Study Results
2018-11-12	Northwest Territory Metis Nation	J Heron	Jeff Hussey	email	Sent a copy of a discussion document and proposed additional meeting options in Hay River and/or Fort Smith Nov. 14 - 18	Not willing to meet because Osisko Metals has not agreed to fund Northwest Territory Metis Nation legal fees for document reviews. Requested permission from PPML to allow Northwest Territory Metis Nation to review the Exploration Agreements with FRMC and HRMC once those councils agree to the review as well.	None
2018-11-09	Fort Resolution Metis Council	n/a	John Key	email	Notification that a camp catering quote was being requested from the Coalition via DKFN	n/a	None
2018-11-09	Fort Resolution Metis Council	Office of the President	John Key	email	Sent a copy of the email trail to DKFN regarding request for bid on camp catering services. Stated that DKFN SAO has said they can't split the contract but are willing to hire FRMC workers.	J Key provided same-day written answers to camp related questions sent by DKFN on Nov. 9	None
2018-11-08	Northwest Territory Metis Nation	J Heron	Jeff Hussey	email	Requested a meeting for sometime Nov. 16 - 19 (in Hay River) or Nov. 20-22 (in Yellowknife)	J Hussey replied Nov. 9 and Requested a copy of draft discussion document prior to scheduling a meeting.	None
2018-11-07	Deninu K'ue First Nation	Carol Chaplin, SAO	SAO	email	Requested information on occupancy for new camp so they could quote the catering	Replied with camp occupancy. SAO followed up with additional questions and they were answered.	None
2018-11-07	Deninu K'ue First Nation	Carol Chaplin, SAO	John Key	email	Requested update on invitation for DKFN to provide a bid for camp catering.	J Key provided same-day written answers to camp related questions sent by DKFN on Nov. 9 Nov. 9 C Chaplin forwarded a list of questions from A Harris at Rowe's Construction	None
2018-11-07	K'atl'odeeche First Nation	Ken Norn, Naegha Zhia	Ken Norn	email	Notification from K Norn that he was back at work	Receipt reply	None
2018-10-25	Northwest Territory Metis Nation	President Bailey	John Key	email	PPML will be requesting changes to WMP for LUP MV2017C0024. The main change is to increase maximum amount of greywater on-site from 100 L/day to 5,000 L/day and discharge of greywater into a sump. Expect to have a temporary camp.	Automated response message received saying that the email address is now president@nwtmetis.ca but that this message would be forwarded. President Bailey responded on 10/25 that JK should contact Jake Heron to discuss the "intern measures agreement".	None
2018-10-23	Avalon Advanced Materials	General Office	John Key	email	PPML will be requesting changes to WMP for LUP MV2017C0024. The main change is to increase maximum amount of greywater on-site from 100 L/day to 5,000 L/day and discharge of greywater into a sump. Expect to have a temporary camp.	n/a	None
2018-10-23	Hamlet of Fort Resolution	Senior Administrative Officer	John Key	email	PPML will be requesting changes to WMP for LUP MV2017C0024. The main change is to increase maximum amount of greywater on-site from 100 L/day to 5,000 L/day and discharge of greywater into a sump. Expect to have a temporary camp.	n/a	None
2018-10-23	NWT & Nunavut Chamber of Mines	Executive Director	John Key	email	PPML will be requesting changes to WMP for LUP MV2017C0024. The main change is to increase maximum amount of greywater on-site from 100 L/day to 5,000 L/day and discharge of greywater into a sump. Expect to have a temporary camp.	n/a	None
2018-10-23	Timberworks	General Manager	John Key	email	PPML will be requesting changes to WMP for LUP MV2017C0024. The main change is to increase maximum amount of greywater on-site from 100 L/day to 5,000 L/day and discharge of greywater into a sump. Expect to have a temporary camp.	n/a	None
2018-10-23	Town of Hay River	Senior Administrative Officer	John Key	email	PPML will be requesting changes to WMP for LUP MV2017C0024. The main change is to increase maximum amount of greywater on-site from 100 L/day to 5,000 L/day and discharge of greywater into a sump. Expect to have a temporary camp.	n/a	None

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2018-10-23	West Point First Nation	Misty Ireland	John Key	email	PPML will be requesting changes to WMP for LUP MV2017C0024. The main change is to increase maximum amount of greywater on-site from 100 L/day to 5,000 L/day and discharge of greywater into a sump. Expect to have a temporary camp.	Misty Ireland responded on 10/26 with thanks for the update. She will forward the information to the Council.	None
2018-10-19	Northwest Territory Metis Nation	J Heron	Jake Heron	email	Proposed changes to the MOU	Receipt reply	None
2018-10-18	K'atl'odeeche First Nation	Peter Groenen	John Key	email	Sent P Groenen information on invoices paid to SCS Drilling	Replied receipt	None
2018-10-15	Northwest Territory Metis Nation	J Heron	John Key	email	Delivery to J Heron a memo from CEO Jeff Hussey explaining the reason for the request of release of lands around Pine Point for expansion of land claims	n/a	None
2018-10-11	Deninu K'ue First Nation	Senior Administrative Officer	John Key	email	PPML will be requesting changes to WMP for LUP MV2017C0024. The main change is to increase maximum amount of greywater on-site from 100 L/day to 5,000 L/day and discharge of greywater into a sump. Expect to have a temporary camp.	n/a	None
2018-10-11	Fort Resolution Metis Council	Office of the President	John Key	email	PPML will be requesting changes to WMP for LUP MV2017C0024. The main change is to increase maximum amount of greywater on-site from 100 L/day to 5,000 L/day and discharge of greywater into a sump. Expect to have a temporary camp.	n/a	None
2018-10-11	Hay River Metis Council	Office of the President	John Key	email	PPML will be requesting changes to WMP for LUP MV2017C0024. The main change is to increase maximum amount of greywater on-site from 100 L/day to 5,000 L/day and discharge of greywater into a sump. Expect to have a temporary camp.	n/a	None
2018-10-11	K'atl'odeeche First Nation	Peter Redvers	John Key	email	PPML will be requesting changes to WMP for LUP MV2017C0024. The main change is to increase maximum amount of greywater on-site from 100 L/day to 5,000 L/day and discharge of greywater into a sump. Expect to have a temporary camp.	P Redvers sent email on 10/12/2018 asking for a copy of the current WMP and references to sewage disposal.	None
2018-10-06	Northwest Territory Metis Nation	J Heron	John Key	email	Delivery of spreadsheet to J Heron concerning the Aboriginal Drill Company. Also attached contact information for Foraco.	J Heron requested information for clarification on timing. PPML responded with answers on 10/12/18	None
2018-10-03	Deninu K'ue First Nation	Carol Chaplin, SAO	John Key	email	Notification that drill program was being reduced in size and fewer beds would be required at camp	Emailed back and forth to confirm number of drills and men in camp	None
2018-10-01	Deninu K'ue First Nation	Carol Chaplin, SAO		email	Receipt of camp invoice	Request for further invoices not included. Further requested that invoices be corrected for date. A Lessard of Osisko Metals sent new invoicing instructions to C Chaplin.	None
2018-10-01	Northwest Territory Metis Nation	J Heron	John Key	email	Delivered copy of proposed MOU between PPML and Northwest Territory Metis Nation	J Heron commented that he could not open the document. Document was resent in different format	None
2018-09-26	K'atl'odeeche First Nation	Chief Fabien	n/a	email	Confirmation of email address	Confirmed	None
2018-09-26	Hay River Metis Council	Trevor Beck	John Key	meeting	Update on drilling programs & summer activities recently completed. Intro of staff from Osisko Metals, and presentation of the company philosophy on consultation. President Beck presented information on their community. He suggested Osisko Metals have a community liaison officer to ensure that contracts and jobs are not all given to one community.	n/a	None
2018-09-26	K'atl'odeeche First Nation	Chief Fabian; R Skelton, Dir Finance; C Heron, Band manager	John Key	meeting	Update on drilling programs & summer activities recently completed. Intro of staff from Osisko Metals, and presentation of the company philosophy on consultation. Chief Fabian presented KFN viewpoint on boundary of their areas of interest, economic benefits they expect to receive in future phases of project, KFN's position on Metis land claims and status information on their community. Chief informed that an election will occur in Nov. to select a new chief & that the Band is recruiting a new CEO. ATI is organizing a mining workshop in Oct. & Osisko Metals is invited to present.	n/a	None
2018-09-26	West Point First Nation	Wendy Cayen	John Key	meeting	Update on drilling programs & summer activities recently completed. Intro of staff from Osisko Metals, and presentation of the company philosophy on consultation. WPFN staff asked about timeline to begin IBA negotiations.	n/a	None
2018-09-25	Deninu K'ue First Nation	Senior Administrative Officer; IMA Office	John Key	meeting	Update on drilling programs & summer activities recently completed. Intro of staff from Osisko Metals, and presentation of the company philosophy on consultation. DKFN staff presented information on their community.	n/a	None
2018-09-25	Fort Resolution Metis Council	Arthur Beck, President; W Delorme, VP; Wilfred Beaulieu, Council; Kara Bailey, Council; Paula King, Council	John Key	meeting	Update on drilling programs & summer activities recently completed. Council members had questions about findings. Coalition agreement is expired and FRMC is not interested in renewing it. Intro of staff from Osisko Metals, and presentation of the company philosophy on consultation. President Beck presented information on their community & included a review of grievances from prior mining operations. FRMC wants to negotiate an IBA. Set date with FRMC, Northwest Territory Metis Nation and Foraco to discuss Aboriginal Drilling Company.	n/a	None
2018-09-21	Fort Resolution Metis Council	Arthur Beck	Arthur Beck, President FRMC	phone call	Requested different meeting time for 9/25	n/a	None
2018-09-21	K'atl'odeeche First Nation	Ken Norn	John Key	meeting	K Norn wanted to know PPML's plans for the winter drill program and whether or not their contractor, SCS, would be asked to participate. J Key explained that the program was still being planned. J Key asked for a meeting with the Chief next week in order to introduce Osisko Metals staff coming in from Montreal. Discussion around council honoraria.	n/a	None
2018-09-20	Deninu K'ue First Nation	Carol Chaplin, SAO	John Key	phone call	Discussed logistics for upcoming meeting on 9/25	n/a	None
2018-09-20	Fort Resolution Metis Council	Walter Delorme, VP	John Key	meeting	Discussed logistics for upcoming meeting on 9/26	n/a	None
2018-09-20	Hay River Metis Council	Trevor Beck, HRMC	John Key	meeting	Discussed current drill program, future sub-contracting opportunities, Aboriginal Drill Company that Foraco is trying to put together. Agreed to meet again on 9/25 when J Key wants to introduce an Osisko Metals staff person to HRMC.	n/a	None
2018-09-15	K'atl'odeeche First Nation	Ken Norn	Ken Norn, Naegha Zhia	phone call	K Norn informed J Key expressed concern regarding behaviour of some PPML staff and drilling contractors at camp.	The PPML employee involved in the incident has left the company; the contractors involved have been instructed to keep the camp dry.	None
2018-09-06	Deninu K'ue First Nation	Carol Chaplin, SAO	Carol Chaplin	email	Further clarification on camp invoicing	n/a	None
2018-09-04	Deninu K'ue First Nation	Carol Chaplin, SAO	Carol Chaplin	email	Inquiry on required September water truck services for drill program	Responded that no services were required at this time	None
2018-09-02	Deninu K'ue First Nation	Carol Chaplin, SAO	Carol Chaplin	email	New directions on Camp invoicing	SAO requested further information. Osisko Metals confirmed her understanding	None
2018-08-31	Deninu K'ue First Nation	Carol Chaplin, SAO	Carol Chaplin	email	Asking for clarification on invoicing for Rowe Camp	Clarified Invoicing	None

Date	Affiliation	Contact	Contact Initiated By	Engagement Activity Type	Issue / Recommendation from Party	Proponent Response / Resolution	Materials provided
2018-08-29	Northwest Territory Metis Nation	Jake Heron, consultant to Northwest Territory Metis Nation; Darwin Hanna, Northwest Territory Metis Nation Attorney; Ron ? From Northwest Territory Metis Nation; Keith Bergner, PPML attorney	John Key	meeting	Discussed Northwest Territory Metis Nation's interest in getting an Exploration Agreement for the Nation not just with the two local Councils; PPML's interest in staking additional withdrawn lands (40 parcels); possible Aboriginal drill company; Metis interested in having more than jobs and sub-contracting in projects at the site; Metis suggested that land could be transferred to a coalition of Akaitcho and Metis so that PPML could deal directly with them as the owners.	No firm decisions were made on any of the ideas discussed.	None
2018-08-24	Fort Resolution Metis Council	Arthur Beck, FRMC; Lisa Tudor, FRMC	John Key	meeting	Discussed progress of coalition issues & fact that the agreement is expired. President Beck says FRMC wants a Coalition Board to run the agreement. L Tudor informed that she was leaving her job at FRMC. L Tudor informed that the winter 2018 drill program payments had been reconciled. Discussed possibility of having FRMC assist with removing some of the beavers at Pine Point.	n/a	None
2018-08-17	Deninu K'ue First Nation	Carol Chaplin, SAO	John Key	email	J Key copied on email string between Coalition and Great Slave Drilling regarding payment process. J Key replied that PPML is not part of that contractual agreement. J Key offered to talk with the owner at Great Slave Drilling on his next trip north to encourage timely payment. C Chaplin replied 8/13 that Chief has expressed concern about Great Slave Drilling's involvement in the drilling contract.	n/a	None
2018-08-14	Deninu K'ue First Nation	Carol Chaplin, SAO	Carol Chaplin, SAO	email	Discussion regarding the contract to deliver core boxes, and expression of interest in having the local contractor re-instated.	J Key replied 8/15/18 that the contract award is in part performance-based. Photographs were provided to document repeated performance issues, and discussion of costs to PPML to address performance issues.	None
2018-08-13	Deninu K'ue First Nation	Senior Administrative Officer	John Key	email	Replied to a request for contact information for the ProCore drilling company.	n/a	None
2018-08-13	K'atl'odeeche First Nation	Peter Groenen	Peter Groenen	email	Requested donation for upcoming hand games.	J Key replied that PPML had sent a donation check.	None
2018-08-05	K'atl'odeeche First Nation	Ken Norn	John Key	meeting	Discussed the drill program and performance of KFN's drill contractor, SCS. Discussion of waiving the toll fee for drilling at W-85 if another contractor drilled there as long as SCS was working elsewhere on the site. KFN agreed.	n/a	None
2018-08-02	K'atl'odeeche First Nation	Chief Fabian, Peter Groenen	John Key	meeting	KFN wanted to visit the SCS drill program which is being contracted through their business. J Key conducted the tour.	n/a	None
2018-07-26	Deninu K'ue First Nation	Bob Overvold	John Key	email	Requested meeting with Chief Balsillie on July 30 to discuss the camp issue. C Chaplin replied on 7/26 that Chief asked her to notify J Key that he is not willing to meet.	n/a	None
2018-07-24	Deninu K'ue First Nation	Senior Administrative Officer	Stanley Clemmer	email	Provided a pdf file of Jan - April 2018 drilling program	n/a	None
2018-07-24	Fort Resolution Metis Council	Lisa Tudor	Stanley Clemmer	email	Provided a pdf file of Jan - April 2018 drilling program	L Tudor from FRMC sent an email to Judy Dudley at PPML asking for a contact to discuss financial questions. J Dudley suggested she contact S Clemmer and cc: to J Key.	None
2018-07-24	Hay River Metis Council	Office of the President	Stanley Clemmer	email	Provided a pdf file of Jan - April 2018 drilling program	n/a	None
2018-07-24	K'atl'odeeche First Nation	Peter Redvers	Stanley Clemmer	email	Provided a pdf file of Jan - April 2018 drilling program	P Redvers acknowledged receipt.	None
2018-07-24	Town of Hay River	Office of the Mayor	Stanley Clemmer	email	Provided a pdf file of Jan - April 2018 drilling program	n/a	None
2018-07-24	West Point First Nation	General Office	Stanley Clemmer	email	Provided a pdf file of Jan - April 2018 drilling program	n/a	None
2018-07-23	Deninu K'ue First Nation	Carol Chaplin, SAO	Carol Chaplin	email	Drill workers are moving from Fort Resolution to camp at km 38; DKFN is interested in the continuation of housing workers in Fort Resolution and use the Highway camp as overflow.	C Chaplin and J Key exchanged emails on 7/23 and 7/24 on this issue. C Chaplin reported that the Chief wants workers to move back to Fort Resolution to maintain the associated revenue stream. J Key responded that PPML has always understood that camp revenues will go to the Coalition to benefit the whole community. Moving workers to the km 38 camp is better for safety and achieving project efficiency goals. If that camp fills up, then PPML will ask to use the camp in Fort Resolution once again. C Chaplin replied 7/24 with discussion of whether the Fort Resolution camp is part of the Coalition agreement.	None
2018-07-23	Deninu K'ue First Nation	Carol Chaplin, SAO	Carol Chaplin	email	Request for information as to why drilling workers are moving to the km 38 camp from Fort Resolution.	J Key replied that he had wanted to discuss this at the meeting on 7/20. PPML is losing out on 4 hours of drill time per drill per day by having the crews based out of Fort Resolution instead of closer. Coalition revenues from camp will not be different with the shift in workers; drilling work/revenues will improve. Info given in advance so Coalition has time to plan for the transition.	None
2018-07-21	Northwest Territory Metis Nation	5 representatives from Northwest Territory Metis Nation (including president Bailey) & 4 from PPML (Including J Hussey)	Jeff Hussey	meeting	Main purpose was to discuss land withdrawal issue. Also discussed Aboriginal Drill Company, status of exploration agreements, and developing a MOU for future interactions. President Bailey asked for funding to work on the MOU; J Hussey suggested Northwest Territory Metis Nation obtain government funds for this.	Northwest Territory Metis Nation is prepared to release claims and will discuss at their next Board meeting to get full approval. Northwest Territory Metis Nation agrees that local councils can make commitments like exploration agreements on their own. The Northwest Territory Metis Nation will work together to make sure the local councils can all participate in the drill company. PPML will produce the first draft of the MOU.	None
2018-07-20	Deninu K'ue First Nation	Rosy Bjornson	John Key	meeting	J Key arrived to meet with C Chaplin to discuss drilling business. She was not in. J Key spoke with Rosy Bjornson about arranging a trip for the Coalition elders to visit the drill site. She promised to look into this and get back to J Key.	n/a	None
2018-07-20	Fort Resolution Metis Council	Lisa Tudor	John Key	meeting	L Tudor was unaware of being the FRMC representative to the EA Committee & of what functions the EA Committee handled. She was given a list of contracts we currently had with the Coalition and an explanation of the money flow from the contractors. Said she was going to meet with C Chaplin and confirm. L Tudor was going to take her notes to the FRMC Council meeting on Monday. Discussed the beaver issue with L Tudor. She was going to talk with the GNWT Wildlife Officer in Fort Resolution and take the issue to the Council for discussion. Discussed the potential hiring of archeological study helper/helpers. She said she had one person who probably would be willing to do the 7 day a week/12 hour shifts but would get back to us. Discussed the potential of having up to 4 employees to work at the mine site to identify and log core boxes. She said she would start looking for people.	n/a	None

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2018-07-06	Deninu K'ue First Nation	Judy Dudley	Judy Dudley	email	Provide a job description for a field assistant to work on AIA study. Deadline for applications July 20.	Reminder sent on July 23 that application had passed with no responses. Requested forwarded responses by July 24 if available, otherwise position will be advertised more widely.	None
2018-07-06	Fort Resolution Metis Council	Judy Dudley; Lisa Tudor	Judy Dudley	email	Provide a job description for a field assistant to work on AIA study. Deadline for applications July 20.	Reminder sent on July 23 that application had passed with no responses. Requested forwarded responses by July 24 if available, otherwise position will be advertised more widely. L Tudor from FRMC replied on July 24 that she would try to identify an applicant by July 25. LT notified PPML on 7/26 that FRMC had selected a person for the position. J Dudley replied 7/26 that PPML is now talking with another possible candidate and needs to receive resume and salary requirements from FRMC candidate ASAP. L Tudor replied on 7/27 and also 7/28 that their applicant is still interested, but she did not have resume or salary requirements to forward. J Dudley replied that PPML still needed resume and salary requirements.	None
2018-06-26	Fort Resolution Metis Council	President Beck	John Key	telephone	Discussed status "Coalition Board" that FRMC wants to have formed to handle finances of coalition payments. President Beck said he would talk with Chief Balsillie to check on status. Discussed also FRMC comments submitted to PWNHC on the study license application for AIA at Pine Point; comments are in conflict with Explore Agreement. President Beck says comments were submitted in error and he will ask staff to retract them.	J Key spoke with President Beck on July 5. Chief Balsillie has refused to set up a Board to run the Coalition. President Beck asked that PPML copy FRMC on all communications. President Beck said again that he would ask staff to retract comments to PWNHC.	None
2018-06-15	Hay River Metis Council	President Beck; Tim Smith, PPML	John Key	meeting	Reviewed recently completed winter drill program. Discussed upcoming summer drill program & baseline studies. Discussed concept of having an Aboriginal Drill Company with HRMC as participant; Pres. Beck was enthusiastic. PPML interested in staking three small parcels which are surrounded by PPML claims & leases; Pres. Beck said his Council had agreed to this.	n/a	None
2018-06-14	Deninu K'ue First Nation	Chief Balsillie; Tim Smith, PPML	John Key	meeting	Reviewed recently completed winter drill program. Discussed upcoming summer drill program & baseline studies. Discussed concept of having an Aboriginal Drill Company with DKFN as participant; Chief was supportive & would discuss with Council. PPML interested in staking three small parcels which are surrounded by PPML claims & leases; Chief said to go ahead and stake the claims and that he would take this to his Council for approval later.	n/a	None
2018-06-14	Fort Resolution Metis Council	Council; Tim Smith, PPML	John Key	meeting	Reviewed recently completed winter drill program. Discussed upcoming summer drill program & baseline studies. Discussed concept of having an Aboriginal Drill Company with FRMC as participant; Council agreed with the concept but expressed concerns that all aboriginal groups should have equal interest. PPML interested in staking three small parcels which are surrounded by PPML claims & leases; Council agreed to this.	n/a	None
2018-06-14	K'atl'odeeche First Nation	Peter Redvers and Ken Norn for KFN; Tim Smith, PPML	John Key	meeting	Exploration Committee Meeting: Reviewed recently completed winter drill program. Discussed upcoming summer drill program & baseline studies. Discussed concept of having an Aboriginal Drill Company with KFN as participant; Peter R said that it had promise. PPML intends to stake three small parcels at Pine Point which are surrounded by PPML claims & leases. Discussed possible open house that KFN plans to host & wishes PPML to participate. K Norn informed that KFN had a contract with a drilling company "SCS" and expected full access to the summer drilling program. J Key reminded that KFN would be invited to cover the "float" after the other drilling companies contracting through the other aboriginal groups were established. K Norn called J Key a liar and cursed him.	n/a	None
2018-06-13	Hay River Metis Council	President Beck	John Key	email	Scheduling meetings.	Another email sent on July 6, 2018 asking for a meeting on the 13th. Pres Beck confirmed availability to meet on July 13.	None
2018-06-07	Deninu K'ue First Nation	Carol Chaplin, SAO	John Key	email	Asked DKFN to send a letter to MVLWB comment registry asking that the Confirmation permit be issued without any further delays.	C Chaplin replied 7 June that Chief had talked with J Ho at MVLWB and was told that PPML could still drill. J Key replied that PPML could only drill under old permit (3 drills) not new permit (more drills) and this was negatively impacting PPML's program goals. C Chaplin sent PPML a copy of the letter that Chief Balsillie sent to MVLWB and the MLA on June 7 regarding support for drill program and request for prompt issuance.	None
2018-06-07	Fort Resolution Metis Council	Office of the President	John Key	email	Asked FRMC to send a letter to MVLWB comment registry asking that the Confirmation permit be issued without any further delays.	n/a	None
2018-06-05	K'atl'odeeche First Nation	Lands Office	John Key	email	Requested meeting on June 14 or 15 to discuss economic opportunities for KFN on the Exploration Drilling program. Requests the meeting to include P Redvers & K Norn (from KFN) and J Key & T Smith (from PPML).	n/a	None
2018-06-04	Town of Hay River	Office of the Mayor	Tim Smith	email	Requested letter of support for current public comment period on the Confirmation Drilling Program permit	n/a	None
2018-06-01	Akaitcho IMA Office	Screening Officer	Judy Dudley	email	Provided copies of Osisko Metals' Feb. 26 and April 26, 2018 news releases related to the Exploration and Winter Drilling programs at Pine Point. Provided detailed instructions on how to sign up directly to receive future news releases.	n/a	None
2018-06-01	Deh Cho Land Use Planning	General Office	Judy Dudley	email	Provided copies of Osisko Metals' Feb. 26 and April 26, 2018 news releases related to the Exploration and Winter Drilling programs at Pine Point. Provided detailed instructions on how to sign up directly to receive future news releases.	n/a	None
2018-06-01	Deninu K'ue First Nation	Senior Administrative Officer	Judy Dudley	email	Provided copies of Osisko Metals' Feb. 26 and April 26, 2018 news releases related to the Exploration and Winter Drilling programs at Pine Point. Provided detailed instructions on how to sign up directly to receive future news releases.	n/a	None
2018-06-01	Fort Resolution Metis Council	Office of the President	Judy Dudley	email	Provided copies of Osisko Metals' Feb. 26 and April 26, 2018 news releases related to the Exploration and Winter Drilling programs at Pine Point. Provided detailed instructions on how to sign up directly to receive future news releases.	n/a	None
2018-06-01	Hamlet of Fort Resolution	Senior Administrative Officer	Judy Dudley	email	Provided copies of Osisko Metals' Feb. 26 and April 26, 2018 news releases related to the Exploration and Winter Drilling programs at Pine Point. Provided detailed instructions on how to sign up directly to receive future news releases.	n/a	None
2018-06-01	Hay River Metis Council	Office of the President	Judy Dudley	email	Provided copies of Osisko Metals' Feb. 26 and April 26, 2018 news releases related to the Exploration and Winter Drilling programs at Pine Point. Provided detailed instructions on how to sign up directly to receive future news releases.	n/a	None

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2018-06-01	K'atl'odeeche First Nation	Peter Redvers; Office of the Chief	Judy Dudley	email	Provided copies of Osisko Metals' Feb. 26 and April 26, 2018 news releases related to the Exploration and Winter Drilling programs at Pine Point. Provided detailed instructions on how to sign up directly to receive future news releases.	n/a	None
2018-06-01	Northwest Territory Metis Nation	Office of the President; Betty Villebrun	Judy Dudley	email	Provided copies of Osisko Metals' Feb. 26 and April 26, 2018 news releases related to the Exploration and Winter Drilling programs at Pine Point. Provided detailed instructions on how to sign up directly to receive future news releases.	message sent was returned as undeliverable	None
2018-06-01	Salt River First Nation	Chief Executive Officer	Judy Dudley	email	Provided copies of Osisko Metals' Feb. 26 and April 26, 2018 news releases related to the Exploration and Winter Drilling programs at Pine Point. Provided detailed instructions on how to sign up directly to receive future news releases.	message sent to ceo_srfn@northwestel.net was returned as undeliverable	None
2018-06-01	Smith Landing First Nation	Office of the Chief	Judy Dudley	email	Provided copies of Osisko Metals' Feb. 26 and April 26, 2018 news releases related to the Exploration and Winter Drilling programs at Pine Point. Provided detailed instructions on how to sign up directly to receive future news releases.	n/a	None
2018-06-01	Town of Hay River	Senior Administrative Officer; Office of the Mayor	Judy Dudley	email	Provided copies of Osisko Metals' Feb. 26 and April 26, 2018 news releases related to the Exploration and Winter Drilling programs at Pine Point. Provided detailed instructions on how to sign up directly to receive future news releases.	n/a	None
2018-06-01	West Point First Nation	Office of the Chief; Lands Office	Judy Dudley	email	Provided copies of Osisko Metals' Feb. 26 and April 26, 2018 news releases related to the Exploration and Winter Drilling programs at Pine Point. Provided detailed instructions on how to sign up directly to receive future news releases.	n/a	None
2018-05-30	Fort Resolution Metis Council	Arthur Beck	Arthur Beck	phone call	President Beck asked J Key to attend a meeting at 6 pm on June 14 to discuss the Fort Resolution Coalition Agreement.	n/a	None
2018-05-29	Deninu K'ue First Nation	Senior Administrative Officer	John Key	email	Provided details of meeting with FRMC on June 16 and requested confirmation that Chief Balsillie will also attend	n/a	None
2018-05-29	Fort Resolution Metis Council	Arthur Beck	John Key	phone call	Confirmed details for meeting on June 16	n/a	None
2018-05-29	Fort Resolution Metis Council	Arthur Beck	John Key	phone call	Confirmed details for meeting on June 17	n/a	None
2018-05-25	Deninu K'ue First Nation	Carol Chaplin, SAO	John Key	email	Requested a meeting for June 16.	Meeting details confirmed by email from C Chaplin on June 5, 2016	None
2018-05-25	Deninu K'ue First Nation	Carol Chaplin, SAO	John Key	email	Requested a meeting for June 16.	Meeting details confirmed by email from C Chaplin on June 5, 2016	None
2018-05-25	Fort Resolution Metis Council	Carol Chaplin, SAO	John Key	email	Requested a meeting for June 16.	n/a	None
2018-05-25	Hay River Metis Council	Office of the President	John Key	email	Requested a meeting for June 16.	n/a	None
2018-05-25	K'atl'odeeche First Nation	Peter Redvers	John Key	email	Requested a meeting for June 16.	P Redvers responded May 28 with suggestion that PPML book a meeting room at Ptarmigan for lunch on the 16th. J key replied on June 4 that the venue would be fine. P Redvers replied 6/6/18 that Chief Fabian, K Norn, and himself will attend mtg on June 16.	None
2018-05-24	Fort Resolution Metis Council	Sherrie Strand	Sherrie Strand	email	Requested donation from PPML for FMRC event. J key replied 30 May 2018 that PPML will make a donation; included paperwork that FRMC will need to process first.	n/a	None
2018-05-10	Deninu K'ue First Nation	Senior Administrative Officer	Judy Dudley	email	Provided copy of approved Archaeological Overview Assessment	n/a	None
2018-05-10	Deninu K'ue First Nation	Senior Administrative Officer	Judy Dudley	email	Provided copy of approved Archaeological Overview Assessment	n/a	None
2018-05-10	Deninu K'ue First Nation	Carol Chaplin, SAO	Carol Chaplin, SAO	email	Requested information on status of payments to Great Slave Drilling. They have questions about the Coalition billing paperwork.	J Key provided confirmation that a message had been passed along to Great Slave Drilling for them to contact C Chaplin.	None
2018-05-10	Fort Resolution Metis Council	Office of the President	Judy Dudley	email	Provided copy of approved Archaeological Overview Assessment	n/a	None
2018-05-10	Hay River Metis Council	Office of the President	Judy Dudley	email	Provided copy of approved Archaeological Overview Assessment	n/a	None
2018-05-10	K'atl'odeeche First Nation	Henry Tamvour (KFN), J Key (PPML), Judy Dudley (PPML)	Damian Panayi at Golder Assoc, contractor to PPML	email	Discussing the logistics for including a field assistant from KFN on the wildlife study. Robert Lamalice will be available to work on the project on the date specified. Cost for his work will be passed on to PPML.	n/a	None
2018-05-10	K'atl'odeeche First Nation	Lands Office	Judy Dudley	email	Provided copy of approved Archaeological Overview Assessment	n/a	None
2018-05-10	Northwest Territory Metis Nation	Office of the President	Judy Dudley	email	Provided copy of approved Archaeological Overview Assessment	n/a	None
2018-05-10	West Point First Nation	Office of the Chief	Judy Dudley	email	Provided copy of approved Archaeological Overview Assessment	n/a	None
2018-05-09	Deninu K'ue First Nation	Lisa Tudor	Judy Dudley	email	Advance notice that study licence application for archeology will be coming. PPML expects to hire a qualified field assistant from Fort Res to participate.	Acknowledged with thanks	None
2018-05-09	Fort Resolution Metis Council	Carol Chaplin, SAO	Judy Dudley	email	Advance notice that study licence application for archeology will be coming. PPML expects to hire a qualified field assistant from Fort Res to participate.	Acknowledged with thanks	None
2018-05-08	Deninu K'ue First Nation	Carol Chaplin, SAO	Carol Chaplin, SAO	email	Sent copy of message from DKFN IMA to Niccole Hammer at Aurora College indicating that DKFN had no concerns re: scientific license application	n/a	None
2018-05-01	Northwest Territory Metis Nation	Garry Bailey	Garry Bailey	phone call	9:30 p.m. call to J Key. Informed J Key that Chief Balsillie and President Beck had approved having G Bailey take over contracts for fuel hauling and storage for the PPML drilling programs. J Key indicated that PPML plans are developing and J Key would get back in touch later.	n/a	None
2018-04-27	West Point First Nation	Becky Cayen, Misty Ireland	Tim Smith	email; phone	Notified that PPML was willing to host a 2-day Basic First Aid and a 2-week Emergency Medical Responder course in order to train and then hire local people for summer drill program. Asked for names of candidates for the training program.	Misty Ireland responded on May 1st with names of 7 interested people. T Smith replied that a decision had been made to postpone the Hay River session.	None
2018-04-23	K'atl'odeeche First Nation	Ken Norn	John Key	meeting	Naegha Zhia is interested in bidding on upcoming drill work. He has identified a drilling company to partner with Naegha Zhia. Jkey reminded that only certain kinds of equipment may be used. PPML currently has enough drills via established relationships to initiate the summer program. No commitments can be made. PPML happy to consider valid bids based upon qualifications and price.	n/a	None
2018-04-20	Fort Resolution Metis Council	Lisa Tudor	Tim Smith	email	Requested information on how to secure a room at Aurora College in Fort Res. L Tudor provided contact information for Krista Kerr at Aurora College.	Matt Vincent from "62 Degrees North" was hired to conduct the training courses.	None

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2018-04-19	Fort Resolution Metis Council	Lisa Tudor	Tim Smith	email	Sent notice that PPML was willing to host a 2-day Basic First Aid and a 2-week Emergency Medical Responder course in order to train and then hire local people for summer drill program. Asked for names of candidates for the training program by April 27.	Lisa Tudor replied by email on April 26 with a list of 19 names of people that would attend the training.	None
2018-04-19	K'atl'odeeche First Nation	K Norn	Tim Smith	email; phone	Sent notice that PPML was willing to host a 2-day Basic First Aid and a 2-week Emergency Medical Responder course in order to train and then hire local people for summer drill program. Asked for names of candidates for the training program by April 27.	K Norn replied by email April 20 asking about location, whether or not PPML would provide training pay and meals. T Smith replied April 20 that location would be either Fort Res or Hay R; no training pay or meals would be provided. T Smith followed up by telephone on April 27 asking for names of candidates, K Norn say he had some candidates and would send that information to PPML no later than April 30. T Smith left voice mgs with K Norn on May 1 asking for details on trainee candidates. K Norn called T Smith on June 8 to ask what happened to the medic training.	None
2018-04-18	Business Owners - Hay River	Terry Rowe	Terry Rowe	email	sent a copy to PPML of the letter they are submitting re: support for the confirmation drilling program permit application.	J Key replied with thanks.	None
2018-04-18	Deninu K'ue First Nation		J Key	meeting	Chief did not show up for scheduled meeting.	n/a	None
2018-04-18	Deninu K'ue First Nation	Carol Chaplin, SAO	John Key	email	Several emails exchanged re: letter of support that DKFN plans to submit re: confirmation drilling program permit application. C Chaplin provided a copy of the letter that awaits Chief's signature.	n/a	None
2018-04-18	Fort Resolution Metis Council	Office of the President	John Key	email	Forwarded email string from Rowe's Construction about possibility for PPML to use construction camp along Hwy 6. Suggested Pres. Beck speak with C Chaplin if he wants further details.	n/a	None
2018-04-18	Fort Resolution Metis Council	Sherrie Strand; Lisa Tudor	John Key	email	JK reviewed the objectives of the Coalition Exploration agreement. He reviewed all of the economic benefits that have been realized in Fort Res so far. Mentioned that PPML would appreciate a letter of support for the current permit application.	J Key forwarded a copy of the letter of support that DKFN was submitting. L Tudor responded that FRMC will work on preparing a letter of support for the permit application. Sherrie Strand (Office Admin) sent a copy of a letter of support addressed to PPML.	None
2018-04-18	Town of Hay River	Stacy Barnes	John Key	meeting	Stopped by Town office. Mayor was out. Spoke with Council Administrator Stacy Barnes. J Key asked if Town would provide letter of support for permit application. S Barnes said she would raise the issue with the Town Council at their meeting on Thursday.	n/a	None
2018-04-18	West Point First Nation	n/a	John Key	meeting	WPFN informed that R Lafferty is no longer working for WPFN; asked for a donation to upcoming Dene council meetings. J Key provided update on recently completed winter drill program. Discussed applications for confirmation drilling program LUP and WL. J Key provided update on current thinking for Mine & Mill plan with phased development beginning with mine pit Cluster 1.	n/a	None
2018-04-17	Deninu K'ue First Nation	Carol Chaplin, SAO	John Key	meeting	Exploration Committee meeting, Present: J Key (PPML) & C Chaplin (DKFN). Absent: T Smith (PPML) and Lisa Tudor (FRMC). JK reminded that this meeting was for the Coalition issues. JK reviewed economic opportunities that have been provided to Fort Resolution so far under DB/PPML. Discussed opportunities for coalition to provide camp services to drill program workers under new permit. J Key reminded that coalition has open opportunity to respond to RFP for pit surveying. Discussed comments that DKFN had posted to MVLWB comment registry for current application; C Chaplin said that those were posted without full approval and DKFN planned to retract them.	n/a	None
2018-04-17	Deninu K'ue First Nation	Carol Chaplin, SAO	John Key	email	Provided information from Rowe Construction regarding logistics associated with Fort Resolution coalition assuming management of Construction Camp at Hwy 6 Km 38 after their road work is finished. Fort Resolution coalition has an interest in providing camp services to PPML's drilling contractors.	C Chaplin replied that they are interested in pursuing this opportunity.	None
2018-04-17	Fort Resolution Metis Council	n/a	J Key	meeting	J Key stopped by the FRMC office to try to meet with staff to update them on PPML project. Someone called out from the back of the building to say that no one was around.	n/a	None
2018-04-17	Fort Resolution Metis Council	Arthur Beck	John Key	text message	J Key asked FRMC to prepare a letter of support for PPML's permit application.	President Beck responded via text that he was out of town but would ask his staff to prepare a letter of support.	None
2018-04-17	K'atl'odeeche First Nation	Peter Redvers	John Key	meeting	Exploration Committee meeting, Present: J Key (PPML) & P Redvers (KFN). Absent: T Smith (PPML) and K Norn (KFN). P Redvers kept discussion focused on PPML's arrangements with HRMC. Discussion of KFN perspective regarding Metis rights at Pine Point. J Key reminded that PPML negotiations with HRMC were confidential and he was not prepared to discuss. P Redvers said that K Norn wanted to discuss business opportunities and asked J Key to return later in the week for another meeting.	J Key replied by email on July 10, 2018 to question of Metis rights. PPML will honor exploration agreement with KFN and will try to negotiate an IBA. PPML will not ignore responsibility to consult and engage with the Metis. P Redvers responded on July 11 with thanks.	None
2018-04-16	Deninu K'ue First Nation	Carol Chaplin, SAO	John Key	email	Communicated that J Key is currently in Hay River. Would like to meet afternoon of April 17 with the FRMC-DKFN coalition Exploration Committee members and also meet with the Chief.	C Chaplin replied that she and Chief are available to meet.	None
2018-04-16	Hay River Metis Council	Office of the President	John Key	email	Communicated that J Key is currently in Hay River. Available to meet if interested.	n/a	None
2018-04-16	West Point First Nation	Lands Office	John Key	email	Communicated that J Key is currently in Hay River. Available to meet in the next 3 days if interested.	Emails exchanged and meeting set for April 18.	None
2018-03-28	Hay River Metis Council	Office of the President	John Key	email	Sent copies of all invoiced amounts received from drilling contractor, and acknowledged that Osisko Metals is reviewing the exploration agreement and will send a final proposal soon.	n/a	None
2018-03-23	Deninu K'ue First Nation	Carol Chaplin, SAO	Tim Smith	email	Sent notice that PPML was willing to host a 2-day Basic First Aid and a 2-week Emergency Medical Responder course in order to train and then hire local people for summer drill program. Asked for names of candidates for the training program by April 7, 2018 (2 weeks).	Carol Chaplin sent 2 names on April 10; she sent the name of another candidate on May 14.	None
2018-03-23	Fort Resolution Metis Council	Arthur Beck, President	Tim Smith	email	Sent notice that PPML was willing to host a 2-day Basic First Aid and a 2-week Emergency Medical Responder course in order to train and then hire local people for summer drill program. Asked for names of candidates for the training program by April 7, 2018 (2 weeks).	n/a	None
2018-03-23	Hay River Metis Council	Trevor Beck	Tim Smith	email	Sent notice that PPML was willing to host a 2-day Basic First Aid and a 2-week Emergency Medical Responder course in order to train and then hire local people for summer drill program. Asked for names of candidates for the training program by April 7, 2018 (2 weeks).	n/a	None
2018-03-23	K'atl'odeeche First Nation	Peter Redvers	Tim Smith	email	Sent notice that PPML was willing to host a 2-day Basic First Aid and a 2-week Emergency Medical Responder course in order to train and then hire local people for summer drill program. Asked for names of candidates for the training program by April 7, 2018 (2 weeks).	n/a	None
2018-03-18	Deninu K'ue First Nation	Carol Chaplin, SAO	John Key	email	Reminded of the request to Arthur Beck for a copy of the Timberworks pick-up truck lease sent 10-days ago, and expression of interest in taking over the lease.	Carol Chaplin replied 3/19 that she will try to get more information about this.	None

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2018-03-15	K'atl'odeeche First Nation	Peter Redvers	John Key	email	Acknowledged appreciation of public acknowledgement of PPML's engagement efforts with KFN as reported in 3/14/18 article in Mining North News Brief. PPML would like to attend upcoming KFN planning conference as observers. Willing to provide information on uses / benefits of Lead and Zinc to help inform community as response to elder's comment.	P Redvers responded and asked for a copy of the article. Would like PPML to provide KFN with a brochure and slide show about zinc and lead. J Key forwarded a copy of the article 3/15/18	None
2018-03-12	Hay River Metis Council	Arthur Beck, President	John Key	meeting	Provided information about the application to do confirmation drilling program; provided informational poster and asked them to post. Also discussed consultant to do wildlife study. Discussed economic opportunities including: HRMC owning a drill, training local residents as medics, and camp operation. HRMC asked PPML to provide information on drilling being done by their contractor since they were not getting information from their contractor. President Beck said HRMC was not interested in training opportunities since GNWT provides funds for this. The Council wants business opportunities. Discussed future operating permit. PPML offered to meet again on March 14.	n/a	Poster summarizing new application provided.
2018-03-11	Fort Resolution Metis Council	n/a	John Key	email	Requested a copy of pick-up truck lease.	n/a	None
2018-03-09	Deninu K'ue First Nation	Carol Chaplin, SAO	Carol Chaplin, SAO	email	Informed PPML that the Chief has been made aware of FRMC's request regarding coalition payment approach, and that this is issue for the 2 leaders to resolve.	PPML acknowledged the email.	None
2018-03-09	Fort Resolution Metis Council	secretary@frmcnwt.com	Lisa Tudor	email	Request for copies of all correspondence sent to FRMC in regards to Pine Point site and the Exploration Agreement. Request to discuss coalition payment approach.	J Key replied that discussion of the exploration agreement was discussed face-to-face with President Beck, including the signing. There are no additional financial agreements outside of the Exploration Agreement. Advised that agreements with individual contractors would have been signed via the Coalition, therefore PPML does not have those documents. Offered to send a copy of the engagement log. Acknowledged that PPML cannot tell the Coalition how to process payments. J Key is willing to come to Fort Resolution to discuss this.	None
2018-03-08	Fort Resolution Metis Council	Arthur Beck, President & Warren Delorme, Vice-President	John Key	meeting	Provided information regarding the application to do confirmation drilling program; provided informational poster and asked them to post. Also discussed consultant to do wildlife study. Discussed economic opportunities including drilling and medic training. Discussed future operating permit; FRMC said if technical questions are answered the community will support. Discussion about conversations with Northwest Territory Metis Nation and approach to dispersing contracts amongst the councils. Discussion about the release of withdrawn parcels of interest; Pres. Beck said he was working with Northwest Territory Metis Nation on this. PPML offered to meet again next week, but Pres. Beck declined	n/a	Poster summarizing new application provided.
2018-03-06	Deninu K'ue First Nation	Chief and SAO	John Key	meeting	Discussed the current exploration program. Identification of Mr. Lafferty's trapline location and trapping schedule. Chief and SAO agreed to get trapline information including names and map locations. J Key asked for details about cabins; DKFN knows of 3 cabins (Kevin Lafferty, Frank Lafferty, and Les Pike). Key informed that Golder would be doing a wildlife study for PPML and asked for endorsement of the Wildlife Study license application. SAO was given the paperwork, along with a 2nd copy for FRMC. She said she would take care of this. Discussion about pick-up truck lease and possibility of Horizon North operating a drillers camp through Coalition. SAO indicated that they would assume responsibility for permitting a camp.	n/a	None
2018-03-06	Deninu K'ue First Nation	Chief and SAO	John Key	meeting	Meeting request from PPML asked that both coalition partners be present (DKFN and FRMC) to discuss Confirmation Drilling program.	No representative from FRMC attended. The full DKFN Council reviewed the applications for the Confirmation Drilling program and they had no comments or concerns.	Poster summarizing new application provided. Asked that it be posted and 2nd copy be given to FRMC for them to post. SAO agreed to do this.
2018-03-06	Fort Resolution Metis Council	President Beck	John Key	phone call	Left message asking for a meeting or telephone call to discuss the confirmation drilling program applications documents.	n/a	None
2018-03-06	Town of Hay River	Mayor Mapes	John Key	meeting	Discussed LUP and WL application documents as well as developing plans for mining/milling project. Mayor Mapes stated that he is aware, from prior engagement, that the confirmation drilling applications were in preparation.	The Town supports this program.	Poster summarizing new application provided to mayor. Asked that it be posted.
2018-03-06	West Point First Nation	Misty Ireland	John Key	phone call	Discussion with Misty Ireland to get comments on the Draft LUP and WL documents. She had not reviewed them.	n/a	None
2018-03-05	Hay River Metis Council	Trevor Beck	T Smith	phone call	Request for a copy of an exploration agreement.	Sent clean working version of a draft exploration agreement via email following the call.	None
2018-03-05	K'atl'odeeche First Nation	Chief Fabian, Peter Redvers, Peter Groenen	John Key	meeting	Discussed on-going exploration program, upcoming baseline studies for the mining program, and LUP and WL application documents for confirmation drilling. Clarified that the program would be conducted on lands outside the KFN area of interest. KFN would like to be involved in wildlife study if any portion will occur within their area of interest. They want more information before responding to the Wildlife Observation Recommendation Form.	J Key provided contact information for the consultant who will lead the wildlife studies . P Redvers stated that KFN had no issues with the applications and would send a letter to that effect. KFN defers to DKFN/FRMC to make comments on the applications. No comments on current exploration drilling program.	Poster summarizing new application provided to KFN. Asked that it be posted.
2018-03-02	Deninu K'ue First Nation	Carol Chaplin, SAO	Carol Chaplin, SAO	email	Inquiry about status of payments from Osisko Metals to the Drilling Companies.	J Key replied 3/3/2018 that the payments from new owner are supposed to be paid on 3/4/18.	None
2018-03-02	Hay River Metis Council	Administration	John Key	email	Request for HRMC to provide a bid for transporting Core from Pine Point to Hay River.	n/a	None
2018-03-01	Hay River Metis Council	J Heron	John Key	meeting	Discussion regarding mineral rights within PPML's leases and claims, establishment of agreements with the Northwest Territory Metis Nation, financial benefits to communities from exploration, and previous attempts by PPML to initiate agreement negotiations with Northwest Territory Metis Nation.	n/a	None

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2018-03-01	Northwest Territory Metis Nation	Trevor Beck; J Heron	John Key	meeting	Discussion regarding mineral rights within PPML's leases and claims, establishment of agreements with the Northwest Territory Metis Nation, financial benefits to communities from exploration, and previous attempts by PPML to initiate agreement negotiations with Northwest Territory Metis Nation.	n/a	None
2018-02-26	Deninu K'ue First Nation	Senior Administrative Officer	DKFN SAO	email	Forwarded a letter from one of their members about trapping.	n/a	None
2018-02-22	Hay River Metis Council	Trevor Beck	Trevor Beck, President HRMC	email	T Beck hasn't reviewed the Draft Exploration Agreement provided by PPML but wants an equitable agreement.	J Key replied that PPML believes the Draft Agreement to be fair. Willing to meet to discuss. A meeting date of March 1 was agreed to.	None
2018-02-21	Deninu K'ue First Nation	Eddie Lafferty	Eddie Lafferty	letter	Expressed concern to DKFN office regarding his traps being damaged by previous drilling by a different company, and financial compensation for activities on his trapline.	DKFN Chief forwarded the letter to PPML. No map was available to show the area of concern. This issue was discussed further in March 6 meeting	None
2018-02-20	Deninu K'ue First Nation	Senior Administrative Officer	John Key	email	Provided review copies of the LUP and WL applications and the supporting Plans and identified availability for discussion.	n/a	None
2018-02-20	Fort Resolution Metis Council	Office of the President	John Key	email	Provided review copies of the LUP and WL applications and the supporting Plans and identified availability for discussion.	n/a	None
2018-02-20	Hay River Metis Council	Office of the President	John Key	email	Provided review copies of the LUP and WL applications and the supporting Plans and identified availability for discussion.	At meeting on March 1, 2018 President Beck stated that he had reviewed the documents and had no comments.	None
2018-02-20	K'atl'odeeche First Nation	Peter Redvers	John Key	email	Provided review copies of the LUP and WL applications and the supporting Plans and identified availability for discussion.	P Redvers acknowledged receipt 2/25. Emails exchanged to establish meeting time to discuss.	None
2018-02-20	West Point First Nation	Richard Lafferty	John Key	email	Provided review copies of the LUP and WL applications and the supporting Plans and identified availability for discussion.	Richard Lafferty replied on 3/14/2018 that WPFN had reviewed the draft applications and had no concerns. One comment is to watch water management near muskegs and marshes in protect wildlife.	None
2018-02-13	Fort Resolution Metis Council	Arthur Beck, President FRMC	Arthur Beck, President FRMC	phone call	Request for a summary of current drilling activity associated with the DKFN/FRMC coalition.	J Key explained that two drills were directly contracted through the Fort Res coalition, and the other was contracted through the Hay River Metis Council. Discussion about future camp service and drilling contracts.	None
2018-02-13	Fort Resolution Metis Council	Arthur Beck	Arthur Beck	phone call	Pres. Beck asked for summary of current drilling activity that was benefiting the DKFN/FRMC coalition. J Key explained that two drills were directly contracted through the Fort Res coalition, and the other was contracted through the Hay River Metis Council (which also benefits FRMC).	J Key also reminded that PPML was purchasing fuel in Fort Resolution and that two drilling crews were staying there. Pres. Beck asked about a future camp; J Key said that there were no firm plans to have an on-site camp for the drill program. Pres Beck said FRMC was interested in providing an on-site camp and perhaps even purchasing a drill for future use.	No
2018-02-12	Deninu K'ue First Nation	Carol Chaplin, SAO	Stan Clemmer	meeting	Talk about core box production and delivery	DKFN happy with work and we have a delivery sign off system in place	None
2018-02-12	Deninu K'ue First Nation	Carol Chaplin, SAO	Stan Clemmer	meeting	Talk about core box production and delivery	DKFN happy with work and we have a delivery sign off system in place	No
2018-02-12	Northwest Territory Metis Nation	Darwin Hanna	Darwin Hanna	email	Pine Point Project is within traditional territory of Northwest Territory Metis Nation. Please advise if PPML has legal counsel.	n/a	No
2018-02-12	Town of Hay River	Judy Goucher, SAO	Tim Smith	email	Requested written confirmation from Town that Town has capacity to accept and process anticipated volumes of garbage and sewage from new confirmation drilling program.	Feb. 15, 2018 received Letter confirming the Town's willingness to accept waste at the landfill and lagoon. Letter signed by Judy Goucher	None
2018-02-09	Deninu K'ue First Nation	Administrative Office	Tim Smith	email	Summary of drilling activity, expenditures, and labor during Fall Field season.	n/a	No
2018-02-09	K'atl'odeeche First Nation	Lands Office, Ken Norn	Tim Smith	email	Summary of drilling activity, expenditures, and labor during Fall Field season.	n/a	No
2018-02-06	K'atl'odeeche First Nation	Peter Redvers and Ken Norn for KFN; Stan Clemmer for PPML	Tim Smith	committee meeting	Update on progress of winter drill program. Discussion regarding bid process and contracting. PPML provided a binder with copies of the Permit, Spill and Waste Plans, Safety & Emergency Plans, and SARA species poster. Discussed upcoming application for LUP and WL for confirmation drilling program; map of affected area provided.	n/a	None
2018-02-06	K'atl'odeeche First Nation	Peter Redvers and Ken Norn	Tim Smith	committee meeting	Update on progress of winter drill program. Ken Norn asked why Naegha Zhia did not have a contract. T Smith reminded that bid info was provided in December, 2017 and NZ did not bid on any of the work. T Smith reminded that they will be given opportunities to bid on new contracts that come up in future. PPML provided a binder with copies of the Permit, Spill and Waste Plans, Safety & Emergency Plans, and SARA species poster. Discussed upcoming application for LUP and WL for confirmation drilling program; map of affected area provided. A draft of the application will be provided for their review.	n/a	Yes
2018-02-06	Town of Hay River	Mayor Mapes	Tim Smith	meeting	Reviewed proposal to apply for LUP and WL for confirmation drilling program. Mayor Mapes was supportive of the proposal and offered to provide letters of support for the applications.	n/a	None
2018-02-06	Town of Hay River	Unknown	Tim Smith	meeting	Reviewed activities underway with the winter drilling program. Provided a list of contractors currently working at the site.	Mayor is supportive of the program.	No
2018-02-05	West Point First Nation	Chief Caen, WPFN Council, Richard Lafferty, Misty Ireland	Tim Smith	meeting	Reviewed proposal to apply for LUP and WL for confirmation drilling program. Discussed potential economic opportunities for WPFN including training for the ERT positions and a possible chauffeur service.	WPFN indicated that their preferred contact for the Permit is via email directed to Misty Ireland.	None
2018-02-05	West Point First Nation	Chief Caen, WPFN Council, Richard Lafferty, Misty Ireland	Tim Smith	meeting	Reviewed activities underway with the winter drilling program.	n/a	No
2018-02-02	Cabin Owners	Senior Administrative Officer	John Key	public notice	Sent engagement request message to cabin owners as email attachment and asked that it be posted on public notice boards. Message described proposed action in general terms and asked for contact information for future engagement.	n/a	None
2018-02-02	Cabin Owners	Senior Administrative Officer	John Key	public notice	Sent engagement request message to cabin owners as email attachment and asked that it be posted on public notice boards. Message described proposed action in general terms and asked for contact information for future engagement.	n/a	None
2018-02-02	Cabin Owners	Office of the Chief; Lands Director	John Key	public notice	Sent engagement request message to cabin owners as email attachment and asked that it be posted on public notice boards. Message described proposed action in general terms and asked for contact information for future engagement.	n/a	None
2018-02-02	Cabin Owners	Senior Administrative Officer	John Key	public notice	Sent engagement request message to cabin owners as email attachment and asked that it be posted on public notice boards. Message described proposed action in general terms and asked for contact information for future engagement.	n/a	None

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2018-02-02	Cabin Owners	Office of the President	John Key	public notice	Sent engagement request message to cabin owners as email attachment and asked that it be posted on public notice boards. Message described proposed action in general terms and asked for contact information for future engagement.	n/a	None
2018-02-02	Cabin Owners	Office of the President	John Key	public notice	Sent engagement request message to cabin owners as email attachment and asked that it be posted on public notice boards. Message described proposed action in general terms and asked for contact information for future engagement.	Shawn, FRMC replied 2/2/18 that PPML can contact FRMC or DKFN for information about cabins. Requested a public meeting to get more information about PPML. JKey replied 2/2/18 that PPML would appreciate having the notice posted. Reminded that there was a community meeting on Nov 29, 2017 and that members from FRMC attended, and that PPML meets with President Beck on a regular basis and have taken his advice concerning distribution of information. Shawn, FRMC replied 2/2/18 that he wasn't able to attend meeting in Nov. and wishes PPML would hold another meeting.	None
2018-02-02	Cabin Owners	Frank Lafferty	John Key	public notice	Sent engagement request message to cabin owners as email attachment and asked that it be posted on public notice boards. Message described proposed action in general terms and asked for contact information for future engagement.	Email from Frank Lafferty received Feb. 14, 2018. He provided contact information for himself and his brother Kevin Lafferty, both of whom have cabins at the Pine Point Town Site.	None
2018-02-02	Teck Metals	Michelle Unger	John Key	email	Notice submitted that PPML intends to file application for a new Type A LUP and Type B WL for confirmation drilling program. Provision of a map showing the affected leases. Clarification of Application duration and drilling program permitted under MV2017C0024. Request for updated contact information and how the organization wishes to be engaged over the life of the permit.	Ms. Unger replied 2/2/18 that message was received. Ms. Unger replied again on 2/12/18 pointing overlap between PPML claim and tailings facility that Teck manages. She asked if PPML planned to conduct activities in the overlapping area. J Key replied 2/16/18 that PPML has re-evaluated drill targets and determined that the claim which adjoins Teck's tailings facility will not be included in the new permit application.	None
2018-02-01	Akaitcho IMA Office	Screening Officer	John Key	email	Notice submitted that PPML intends to file application for a new Type A LUP and Type B WL for confirmation drilling program. Provision of a map showing the affected leases. Clarification of Application duration and drilling program permitted under MV2017C0024. Request for updated contact information and how the organization wishes to be engaged over the life of the permit.	n/a	None
2018-02-01	Avalon Advanced Materials	Administration	John Key	email	Notice that PPML intends to file application for a new Type A LUP and Type B WL for confirmation drilling program. A map showing the affected leases and claims was provided. Application will be for 27 month period beginning April, 2018. Drilling to occur at same time as, and in addition to, exploration drilling program permitted under MV2017C0024. Request updated contact information to whom correspondence on this application / project should be sent. Ask how organization wishes to be engaged over the life of the permit.	n/a	None
2018-02-01	Deh Cho Land Use Planning	Administration	John Key	email	Notice submitted that PPML intends to file application for a new Type A LUP and Type B WL for confirmation drilling program. Provision of a map showing the affected leases. Clarification of Application duration and drilling program permitted under MV2017C0024. Request for updated contact information and how the organization wishes to be engaged over the life of the permit.	n/a	None
2018-02-01	Deninu K'ue First Nation	Carol Chaplin, SAO, Chief Balsillie	John Key	email	Notice submitted that PPML intends to file application for a new Type A LUP and Type B WL for confirmation drilling program. Provision of a map showing the affected leases. Clarification of Application duration and drilling program permitted under MV2017C0024. Request for updated contact information and how the organization wishes to be engaged over the life of the permit.	In meeting on Feb. 1, Chief Balsillie asked that correspondence on this permit be directed to Rosie (IMA) with cc: to Carol Chapman (SAO).	None
2018-02-01	Deninu K'ue First Nation	Chief Balsillie and C Chapman	Tim smith	meeting	Reviewed on-going activities for winter drill program. Discussion about housing drillers in fort Resolution, and providing employment for drilling assistants. Chief appointed C. Chapman to represent DKFN on Exploration Committee and will ask President Beck of FRMC to nominate someone (maybe Lisa Taylor). C Chapman suggested cost share with PPML to train Ft. Res residents to be EMT's. Chief mentioned that Band has a 3/4 ton pickup available for rent; PPML does not have current need but may in future. PPML asked for information on cabin owners.	DKFN provided the following information on Pine Point cabin owners known to them: Kevin Lafferty, Frank Lafferty, Les Pike. Eddie Lafferty has a trap line on the south side of the highway (near X15).	None
2018-02-01	Fort Resolution Metis Council	Office of the President	John Key	email	Notice submitted that PPML intends to file application for a new Type A LUP and Type B WL for confirmation drilling program. Provision of a map showing the affected leases. Clarification of Application duration and drilling program permitted under MV2017C0024. Request for updated contact information and how the organization wishes to be engaged over the life of the permit.	n/a	None
2018-02-01	Hamlet of Fort Resolution	Senior Administrative Officer	John Key	email	Notice submitted that PPML intends to file application for a new Type A LUP and Type B WL for confirmation drilling program. Provision of a map showing the affected leases. Clarification of Application duration and drilling program permitted under MV2017C0024. Request for updated contact information and how the organization wishes to be engaged over the life of the permit.	n/a	None
2018-02-01	Hay River Metis Council	Office of the President	John Key	email	Notice submitted that PPML intends to file application for a new Type A LUP and Type B WL for confirmation drilling program. Provision of a map showing the affected leases. Clarification of Application duration and drilling program permitted under MV2017C0024. Request for updated contact information and how the organization wishes to be engaged over the life of the permit.	n/a	None
2018-02-01	K'atl'odeeche First Nation	Office of the Chief; Peter Redvers	John Key	email	Notice submitted that PPML intends to file application for a new Type A LUP and Type B WL for confirmation drilling program. Provision of a map showing the affected leases. Clarification of Application duration and drilling program permitted under MV2017C0024. Request for updated contact information and how the organization wishes to be engaged over the life of the permit.	P Redvers replied 2/1/18 that he will be primary contact. If drilling program will expand to KFN traditional territory they would want advance notice for deeper level of review. J Key replied 2/2/18 that the new application would occur outside KFN AOI; PPML will provide advance copy of new permit per the Exploration Agreement.	None
2018-02-01	Northwest Territory Metis Nation	Office of the President	John Key	email	Notice submitted that PPML intends to file application for a new Type A LUP and Type B WL for confirmation drilling program. Provision of a map showing the affected leases. Clarification of Application duration and drilling program permitted under MV2017C0024. Request for updated contact information and how the organization wishes to be engaged over the life of the permit.	n/a	None
2018-02-01	NWT & Nunavut Chamber of Mines	General Manager; Tom Hoefer	John Key	email	Notice submitted that PPML intends to file application for a new Type A LUP and Type B WL for confirmation drilling program. Provision of a map showing the affected leases. Clarification of Application duration and drilling program permitted under MV2017C0024. Request for updated contact information and how the organization wishes to be engaged over the life of the permit.	Returned as undeliverable. Another message was sent 2/1/2018 to the following email address: executivedirector@miningnorth.com 2nd message acknowledged by Tom Hoefer with thanks.	None

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2018-02-01	Salt River First Nation	Chief Executive Officer	John Key	email	Notice submitted that PPML intends to file application for a new Type A LUP and Type B WL for confirmation drilling program. Provision of a map showing the affected leases. Clarification of Application duration and drilling program permitted under MV2017C0024. Request for updated contact information and how the organization wishes to be engaged over the life of the permit.	n/a	None
2018-02-01	Smith Landing First Nation	Office of the Chief	John Key	email	Notice submitted that PPML intends to file application for a new Type A LUP and Type B WL for confirmation drilling program. Provision of a map showing the affected leases. Clarification of Application duration and drilling program permitted under MV2017C0024. Request for updated contact information and how the organization wishes to be engaged over the life of the permit.	n/a	None
2018-02-01	Timberworks Inc.	General Manager	John Key	email	Notice submitted that PPML intends to file application for a new Type A LUP and Type B WL for confirmation drilling program. Provision of a map showing the affected leases. Clarification of Application duration and drilling program permitted under MV2017C0024. Request for updated contact information and how the organization wishes to be engaged over the life of the permit.	n/a	None
2018-02-01	Town of Hay River	Judy Goucher; Office of the Mayor	John Key	email	Notice submitted that PPML intends to file application for a new Type A LUP and Type B WL for confirmation drilling program. Provision of a map showing the affected leases. Clarification of Application duration and drilling program permitted under MV2017C0024. Request for updated contact information and how the organization wishes to be engaged over the life of the permit.	Judy Goucher replied on 2/1/18 that she should be primary contact for the Town. She will speak to Council about engagement preferences.	None
2018-02-01	West Point First Nation	Office of the Chief	John Key	email	Notice submitted that PPML intends to file application for a new Type A LUP and Type B WL for confirmation drilling program. Provision of a map showing the affected leases. Clarification of Application duration and drilling program permitted under MV2017C0024. Request for updated contact information and how the organization wishes to be engaged over the life of the permit.	n/a	None
2018-01-25	Hay River Metis Council	Trevor Beck	Trevor Beck	email	President Beck has seen advertisements out of DKFN for jobs. Wants to know if HRMC will get opportunities.	T Smith replied 1/25/2018. PPML hasn't seen the ads so not sure what they say. Reminded that the Exploration Agreement signed with the DKFN/FRMC coalition gives them contracting advantages in their area of interest, which is where winter drilling will occur. PPML understands that ProCore Drilling has formed a partnership with HRMC and that is why PPML put that Company in the bid mix; and ProCore was successful. Core Box Transportation and Water Trucking contracts have not yet been awarded; HRMC could bid on those.	No
2018-01-23	Northwest Territory Metis Nation	Jake Heron; Garry Bailey	John Key	meeting	Shared details of Osisko Metals' potential acquisition of PPML, schedule, Osisko Metals' background and financial capacity, filing of a new application to make changes to the exploration program. Clarification that a new LUP application requesting changes to the drill program would occur after purchase.	G Bailey expressed concern that FRMC entered into their Exploration Agreement with PPML without prior approval of Northwest Territory Metis Nation. He indicated that HRMC now wanted an Exploration Agreement too; J Key explained that this had been discussed with HRMC early on but that their focus was an IBA. Discussion of HRMC uptake of contracting opportunities. G Bailey indicated negotiations with Local Councils should include Northwest Territory Metis Nation and its attorneys, and emphasized importance of informing Northwest Territory Metis Nation; J Key and G Bailey agreed to meet formally up to three times in 2018. Discussion of funding for attorney fees and travel. Pres Bailey will propose meeting dates in future.	None
2018-01-20	Deninu K'ue First Nation	Administrative Office	M King	email	Provided maps and coordinates for drill hole/drill pad locations and haul road plowing. DKFN contractor is to start on this immediately. Avoid High Voltage Power Line.	n/a	Yes
2018-01-19	Deninu K'ue First Nation	Administrative Office	J Key	email	Authorized DKFN to contract Rowe Construction on ice road preparation ASAP. Time critical. (Rowe Construction is sub-contractor on PPML exploration project via agreement through DKFN -- DKDC is no longer going to be the prime contractor for the DKFN/FRMC coalition per instructions from DKFN)	n/a	No
2018-01-19	Deninu K'ue First Nation	Carol Chaplin, SAO and Chief Balsillie	Carol Chaplin, SAO, for DKFN	email	J Key was informed that Chief Balsillie had discussed their PPML drilling agreements with Trevor Beck, President of HRMC. Chief informed Pres Beck that the DKFN/FRMC partnership would be prime contractor on all drilling done by Foraco and Great Slave Drilling and Exploration Ltd (owned by Shawn Grandguillot). If the Hay River Metis wanted their own deal with PPML, then they could work with Darryl Dean at ProCore drilling to establish a sub-contracting agreement.	J Key called C Chaplin on 1/19/2018 to ask why they had changed sub-contractors without any notice. She said it was the Chief's decision. J Key asked that the Chief call him to discuss.	No
2018-01-17	Hamlet of Fort Resolution	Tausia Lal	Tausia Lal	email	Wants contact information to invoice for use of Hall on Nov. 29, 2017	J Key replied 1/17/18 that she should send invoice to him.	No
2018-01-15	Deninu K'ue First Nation	Arthur Beck, FRMC; Tim Smith, PPML	John Key	meeting	Shared details of Osisko Metals' potential acquisition of PPML, schedule, Osisko Metals' background and financial capacity, filing of a new application to make changes to the exploration program. Clarification that PPML will survive as owners of the permits, leases and claims.	n/a	None
2018-01-15	Fort Resolution Metis Council	Louis Balsillie and Carol Chaplin for DKFN; Tom Smith, PPML	John Key	meeting	Shared details of Osisko Metals' potential acquisition of PPML, schedule, Osisko Metals' background and financial capacity, filing of a new application to make changes to the exploration program. Clarification that PPML will survive as owners of the permits, leases and claims.	n/a	None
2018-01-15	West Point First Nation	T Smith for PPML, Misty Ireland, Richard Lafferty	John Key	meeting	Shared details of Osisko Metals' potential acquisition of PPML, schedule, Osisko Metals' background and financial capacity, filing of a new application to make changes to the exploration program. Clarification that PPML will survive as owners of the permits, leases and claims.	n/a	None
2018-01-15	West Point First Nation	Misty Ireland, Richard Lafferty	Tim Smith	meeting	Discussed plans for the upcoming winter drill program and reviewed use of local sub-contractors. Discussed opportunities for the WPFN in the upcoming program.	n/a	No
2018-01-12	Hay River Metis Council	Tim Smith, PPML	John Key	meeting	Shared details of Osisko Metals' potential acquisition of PPML, schedule, Osisko Metals' background and financial capacity, filing of a new application to make changes to the exploration program. Clarification that PPML will survive as owners of the permits, leases and claims.	n/a	None
2018-01-12	K'atl'odeeche First Nation	T Smith for PPML, Chief Fabian, Ken Norn of Naegha Zhia, Peter Groenen and Peter Redvers for KFN	John Key	meeting	Shared details of Osisko Metals' potential acquisition of PPML, schedule, Osisko's background and financial capacity, filing of a new application to make changes to the exploration program. Clarification that PPML will survive as owners of the permits, leases and claims.	P Redvers sent email to J Key on 1/20/18 asking for confirmation that reassignment is no longer planned. P Redvers sent an email on 1/29/2018 asking for a response. J Key responded 1/29/2018 that, as explained in meeting on 1/12/18, PPML will become a wholly owned subsidiary of Osisko Metals once the sale closes. The letter had incorrect information. Acknowledged by P Redvers 1/29/18	None

Date	Affiliation	Contact	Contact Initiated By	Engagement Activity Type	Issue / Recommendation from Party	Proponent Response / Resolution	Materials provided
2018-01-12	K'atl'odeeche First Nation	Roy Fabian, Ken Norn, Peter Groenen and Peter Redvers	Tim Smith for PPML	meeting	Discussed plans for the upcoming winter drill program and reviewed use of local sub-contractors. Discussed opportunities for the KFN in the upcoming program.	n/a	No
2018-01-12	Town of Hay River	Tim Smith, PPML	John Key	meeting	Shared details of Osisko Metals' potential acquisition of PPML, schedule, Osisko's background and financial capacity, filing of a new application to make changes to the exploration program. Clarification that PPML will survive as owners of the permits, leases and claims.	n/a	None
2018-01-12	Town of Hay River	Unknown	T Smith	meeting	Discussed plans for the upcoming winter drill program and reviewed use of local sub-contractors. Discussed opportunities for the HRMC in the upcoming program.	n/a	No
2018-01-10	Deninu K'ue First Nation	T Smith for PPML and Patty Simon of the DKFN	John Key	meeting	Shared details of Osisko Metals' potential acquisition of PPML, schedule, Osisko Metals' background and financial capacity, filing of a new application to make changes to the exploration program. Clarification that PPML will survive as owners of the permits, leases and claims.	n/a	None
2018-01-10	Deninu K'ue First Nation	John Key, Patty Simon and Arthur Beck	T Smith	meeting	Discussed plans for the upcoming winter drill program and reviewed use of local sub-contractors. Patty Simon represented DKFN	n/a	No
2018-01-10	Fort Resolution Metis Council	T Smith for PPML and Arthur Beck, President FRMC	John Key	meeting	Shared details of Osisko Metals' potential acquisition of PPML, schedule, Osisko Metals' background and financial capacity, filing of a new application to make changes to the exploration program. Clarification that PPML will survive as owners of the permits, leases and claims.	n/a	None
2018-01-10	Fort Resolution Metis Council	Arthur Beck, Patty Simon	T Smith	meeting	Discussed plans for the upcoming winter drill program and reviewed use of local sub-contractors. Arthur Beck represented FRMC.	n/a	No
2018-01-10	NWT & Nunavut Chamber of Mines	Unknown	John Key	meeting	Discussed Osisko purchase of PPML Pine Point Project. Expect aggressive exploration and development program.	n/a	None
2018-01-09	Avalon Advanced Materials	Donald Bubar	Jeff Hussey, President & CEO	letter	Notification that Osisko Metals is purchasing PPML, and clarification regarding intention to reassign PPML permits and continue exploration. Contact information for J Key provided.	n/a	None
2018-01-09	Avalon Advanced Materials	Donald Bubar	Jeff Hussey, President & CEO	letter	Notification that Osisko Metals is purchasing PPML, and clarification regarding intention to reassign PPML permits and continue exploration. Contact information for J Key provided.	n/a	None
2018-01-09	Deninu K'ue First Nation	Administration	Jeff Hussey, President & CEO	letter	Notification that Osisko Metals is purchasing PPML, and clarification regarding intention to reassign PPML permits and continue exploration. Contact information for J Key provided.	n/a	None
2018-01-09	Fort Resolution Metis Council	Administration	Jeff Hussey, President & CEO	letter	Notification that Osisko Metals is purchasing PPML, and clarification regarding intention to reassign PPML permits and continue exploration. Contact information for J Key provided.	n/a	None
2018-01-09	Hamlet of Fort Resolution	Administration	Jeff Hussey, President & CEO	letter	Notification that Osisko Metals is purchasing PPML, and clarification regarding intention to reassign PPML permits and continue exploration. Contact information for J Key provided.	n/a	None
2018-01-09	Hay River Metis Council	Administration	Jeff Hussey, President & CEO	letter	Notification that Osisko Metals is purchasing PPML, and clarification regarding intention to reassign PPML permits and continue exploration. Contact information for J Key provided.	n/a	None
2018-01-09	K'atl'odeeche First Nation	Administration	Jeff Hussey, President & CEO	letter	Notification that Osisko Metals is purchasing PPML, and clarification regarding intention to reassign PPML permits and continue exploration. Contact information for J Key provided.	n/a	None
2018-01-09	Northwest Territory Metis Nation	Administration	Jeff Hussey, President & CEO	letter	Notification that Osisko Metals is purchasing PPML, and clarification regarding intention to reassign PPML permits and continue exploration. Contact information for J Key provided.	n/a	None
2018-01-09	NWT & Nunavut Chamber of Mines	Administration	Jeff Hussey, President & CEO	letter	Notification that Osisko Metals is purchasing PPML, and clarification regarding intention to reassign PPML permits and continue exploration. Contact information for J Key provided.	n/a	None
2018-01-09	Timberworks Inc.	Administration	Jeff Hussey, President & CEO	letter	Notification that Osisko Metals is purchasing PPML, and clarification regarding intention to reassign PPML permits and continue exploration. Contact information for J Key provided.	n/a	None
2018-01-09	Town of Hay River	Administration	Jeff Hussey, President & CEO	letter	Notification that Osisko Metals is purchasing PPML, and clarification regarding intention to reassign PPML permits and continue exploration. Contact information for J Key provided.	n/a	None
2018-01-09	West Point First Nation	Administration	Jeff Hussey, President & CEO	letter	Osisko Metals is purchasing PPML. Osisko Metals will apply to have PPML permits re-assigned; want exploration activities to continue without interruption. Questions should be directed to John Key who is representing Osisko Metals.	n/a	None
2018-01-05	Deninu K'ue First Nation	Administrative Office	John Key	email	Provided review copy of Application to Assign MV2017C0024 from PPML to Osisko Metals.	n/a	Yes
2018-01-05	Fort Resolution Metis Council	Administrative Office	John Key	email	Provided review copy of Application to Assign MV2017C0024 from PPML to Osisko Metals.	n/a	Yes
2018-01-05	K'atl'odeeche First Nation	Chief's Office, Lands Office	John Key	email	Provided review copy of Application to Assign MV2017C0024 from PPML to Osisko Metals. On 1/8/2018 P Redvers sent a copy of the assignment application in which changes were made to the application form itself that state Osisko Metals has assumed PPML's obligations per the Exploration Agreement. PR also sent a draft Assignment Agreement for Osisko/PPML review and comment.	P Redvers and J Key exchanged email on 1/5/2018. PR stated that KFN would not review the application until certain conditions associated with the Exploration Agreement had been addressed. KFN will consult their lawyer. J Key reminded that KFN does not have to support the application; the review is for KFN to identify whether or not the application is correct. J Key reminded that matters associated with the exploration agreement should be handled by the exploration committee. PR replied on 1/6/2018 that KFN's attorney is going to draft a different version of the application on their behalf.	Yes
2018-01-04	Fort Resolution Metis Council	Shawn (last name unknown)	Shawn, FRMC	phone call	Shawn called J Key to request a meeting to discuss Osisko Metals purchase of PPML. discussion of honoraria, catering, rental of hall and equipment costs.	Follow-up email from FRMC requesting January 12 meeting and funding for honoraria, catering, and hall rental. Clarification from J Key that this would be an informal meeting not requiring honoraria or hall rental.	None
2018-01-03	Deninu K'ue First Nation	Senior Administrative Officer; Fred Spinola	John Key	email	Osisko Metals notification that a representative will be available to meet Jan 11 - 15 to answer questions and provide information related to acquisition of Pine Point project. Request to provide date, time and location for a meeting during those dates.	n/a	None
2018-01-03	Fort Resolution Metis Council	Arthur Beck	John Key	email	Osisko Metals notification that a representative will be available to meet Jan 11 - 15 to answer questions and provide information related to acquisition of Pine Point project. Request to provide date, time and location for a meeting during those dates.	A Beck replied 1/3/2018 with request to meet on Jan. 12. J Key replied that this should be a joint meeting with DKFN so need confirmation that meeting on Jan. 12 works for both parties.	None
2018-01-03	Hamlet of Fort Resolution	Senior Administrative Officer	John Key	email	Osisko Metals notification that a representative will be available to meet Jan 11 - 15 to answer questions and provide information related to acquisition of Pine Point project. Request to provide date, time and location for a meeting during those dates.	n/a	None

Date	Affiliation	Contact	Contact Initiated By	Engagement Activity Type	Issue / Recommendation from Party	Proponent Response / Resolution	Materials provided
2018-01-03	Hay River Metis Council	Trevor Beck	John Key	email	Osisko Metals notification that a representative will be available to meet Jan 11 - 15 to answer questions and provide information related to acquisition of Pine Point project. Request to provide date, time and location for a meeting during those dates.	Trevor Beck replied 1/9/2017 that he would like to meet Jan 12. J Key replied suggesting 10 a.m. or 1 p.m. on the 12th. T Beck confirmed 1 p.m. meeting time.	None
2018-01-03	K'atl'odeeche First Nation	Peter Redvers	John Key	email	Per email trail begun by PPML on Dec. 18 announcing PPML acquisition by Osisko Metals, J Key clarified that he would be representing Osisko Metals at the meeting to be held in January, 2018.	P. Redvers replied 1/3/2018 that KFN will want clarification of new business and management arrangements from the proposed change in ownership. Proposed agenda for meeting on Jan. 12 provided by P. Redvers. Discussion of funding due diligence review by KFN.	None
2018-01-03	Northwest Territory Metis Nation	Garry Bailey	John Key	email; phone	Osisko Metals notification that a representative will be available to meet Jan 11 - 15 to answer questions and provide information related to acquisition of Pine Point project. Request to provide date, time and location for a meeting during those dates.	Phone call from G Bailey on 1/3/2018 to discuss availability on 1/15/2018 to meet, and request to include Jake Heron at the meeting. Discussion and follow-up emails regarding availability on this date	None
2018-01-03	West Point First Nation	Misty Ireland	John Key	email	Osisko Metals notification that a representative will be available to meet Jan 11 - 15 to answer questions and provide information related to acquisition of Pine Point project. Request to provide date, time and location for a meeting during those dates.	Misty Ireland and J Key exchanged emails 1/3/2018 to confirm meeting time. Full Council will meet with J Key on Jan 15 at 5:30	None

Volume 2 -

Spill Contingency Plan Framework

PINE POINT
MINING LIMITED

Spill Contingency Plan Framework
for the
Pine Point Project

Purpose

This framework document is provided in support of the Mackenzie Valley Environmental Impact Review Board Environmental Assessment Initiation Package for the Pine Point Project (Project). The intent of this document is to describe how this environmental management plan relates to the Project, what information will be provided as the Project develops and to list applicable guidelines and standards. It was developed with the available Project information. This document is not intended for approval but is provided for review purposes and will be refined as the regulatory process proceeds.

Version History

Pine Point Mining Limited is responsible for the distribution, maintenance, and updating of this document. Changes that do not affect the intent of the document will be made as required (e.g., phone numbers, names of individuals). The table below indicates the version of this document, and a summary of revisions made.

Revision #	Section(s) Revised	Description of Revision	Issue Date
0	-	Framework version for MVEIRB EA Initiation Package	15 December 2020

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Abbreviations

Abbreviation	Definition
EA	Environmental Assessment
GNWT	Government of the Northwest Territories
GNWT-ENR	Government of the Northwest Territories, Environment and Natural Resources
NWT	Northwest Territories
Osisko Metals	Osisko Metals Incorporated
PPE	personal protective equipment
PPML	Pine Point Mining Limited
PVC	polyvinyl chloride
TDG	Transportation of Dangerous Goods
Project	Pine Point Project
WHMIS	Workplace Hazardous Material Information System
MVLWB	Mackenzie Valley Land and Water Board

Units of Measure

Unit of Measure	Definition
m	metre
km	kilometre
L	litre

1 Introduction

1.1 Background

Pine Point Mining Limited (PPML) is the sole proponent of the Pine Point Project (Project) and is a 100% owned subsidiary of Osisko Metals Incorporated (Osisko Metals). Pine Point is a brownfield site and the location of the historical Pine Point Mine managed by Cominco Ltd. (Cominco), operated between 1964 and 1988. In February 2018, Osisko Metals acquired PPML and became owner of the Project. PPML is proposing to re-open the Pine Point Mine site to mine mineralized material and produce concentrates of zinc and lead for shipment to independent smelters worldwide.

1.2 Purpose

The Spill Contingency Plan Framework is a requirement of the Environmental Assessment (EA) Initiation Package (MVEIRB 2018). It is intended to provide a preliminary outline of approaches to preventing and managing accidental release of toxic substances. The Spill Contingency Plan Framework is meant to provide a basis for PPML to engage with regulatory agencies and Indigenous communities and elicit feedback on planned water management activities and facilities for the Project. A complete Spill Contingency Plan will be submitted to the Mackenzie Valley Land and Water Board (MVLWB) for approval following the EA, and will incorporate feedback obtained through the EA.

This Spill Contingency Plan Framework has been developed for the Project in accordance with the Guidelines for Spill Contingency Planning prepared by Crown-Indigenous Relations and Northern Affairs Canada (INAC 2007) and the *Spill Contingency Planning and Reporting Regulations* issued under the *Environmental Protection Act*. The Spill Contingency Plan provides the protocols for personnel to follow in response to a spill. All persons involved with the Project will read and be familiar with the Spill Contingency Plan. To be effective, all personnel must be familiar with their responsibilities and steps to take in the event of a spill, prior to any spill or emergency.

This plan identifies key spill response personnel and their roles and responsibilities as well as the equipment and other resources available to respond to a spill. The spill response procedures are designed to minimize potential health and safety hazards and environmental damage, and to facilitate clean-up efforts. The plan has been prepared to direct responsible persons to the information required in responding to a spill.

1.3 Project Contact

Primary Pine Point Mining Limited Contact	Andrew Williams
Title	Environmental Manager
Address	1100 Avenue des Canadiens-de-Montréal, Bureau 300
City	Montreal
Province	Québec
Postal Code	H3B 2S2
Telephone	416-209-2056
Email	acwilliams@live.ca

1.4 Roles and Responsibilities

The Environmental Manager will be ultimately responsible for the success of this plan and approves all relevant policies and documents, auditing, action planning and the verification process. The Environmental Manager is responsible for the implementation of this plan including overall management of the plan, internal reporting, compliance, and adaptive management.

Other relevant personnel will be responsible for the effectiveness of this Plan by completing required training and supporting the implementation of and compliance to this Plan, as appropriate to their roles, as set out by this Plan.

1.5 Distribution List

The distribution list for the Spill Contingency Plan is shown in Table 1; this table will be completed with the relevant contact information for the Spill Contingency Plan that will be developed during the permitting phase of the Project.

Table 1: Distribution List

Name	Contact Method	Position/Organization
-To be determined-		Project Supervisor
		Public Relations
		Camp Manager
		Inspector, Government of Northwest Territories (GNWT) - Lands
		GNWT – Environment and Natural Resources (GNWT-ENR), Water Resources
		Environmental Protection, Environment and Climate Change Canada
		Area Manager, Fisheries and Oceans Canada
		Environmental Protection Division, GNWT
		Mackenzie Valley Land and Water Board (MVLWB)
		Applicable PPML Employees/Contractors

1.6 Legislation and Guidelines

There are several pieces of territorial and federal legislation that apply to the Spill Contingency Plan objectives for the Project. Regulatory bodies that are expected to have jurisdiction over the Project once approved include:

- Fisheries and Oceans Canada
- Environment and Climate Change Canada
- Transport Canada
- Government of the Northwest Territories - Environment and Natural Resources (GNWT-ENR)
- MVLWB

Applicable environmental legislation and guidelines include:

- *Fisheries Act*
- *Transportation of Dangerous Goods Act* and Regulations
- Northwest Territories *Environmental Protection Act* and regulations (including the *Spill Contingency Planning and Reporting Regulations*)
- Northwest Territories *Water Act* and Regulations
- Guidelines for Spill Contingency Planning (INAC 2007)

1.7 Project Details

The Project is located in the South Slave Mining District, south of Great Slave Lake in the Northwest Territories (NWT), approximately 175 km directly south of Yellowknife, 75 km east of Hay River, and 53 km southwest of Fort Resolution (Figure 1). It is located on a brownfield site resulting from Cominco's historical mining and milling operations and includes the historical town of Pine Point and associated working accommodations. The closest major transportation hubs are Yellowknife and Hay River. Access to the Project is presently via all-weather Highways 5 and 6.

The Project will consist of open pit and underground mining for mineralized materials, construction and operation of up to three pre-concentration plants, construction and operation of a processing mill (or "concentrator"), storage and management of processed mineralized and waste materials, water management, construction and operation of ancillary support facilities including a camp for workers, and the shipping of zinc and lead concentrates to global markets. Further details are provided in the Project Description (Volume 1).

Maps indicating the Project footprint, infrastructure, storage locations of each hazardous material, probable spill locations and direction of flow on land and in water, catchment basins, locations of all response equipment, topography, approved disposal sites, and any other important on- or off-site features will be included in Appendix A when these details have been finalized.

LEGEND

- FORMER PINE POINT TOWN SITE
- POPULATED PLACE
- ALL-SEASON ROAD
- PARK/PROTECTED AREA
- WATERBODY
- GENERAL PROJECT LOCATION

0 25 50

1:1,250,000 KILOMETERS

REFERENCE(S)

1. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
2. PARKS AND PROTECTED AREAS OBTAINED FROM CONSERVATION AREAS REPORTING AND TRACKING SYSTEM (CARTS), CANADIAN COUNCIL ON ECOLOGICAL AREAS, 2017.

PROJECTION: ALBERS CONIC EQUAL AREA

CLIENT
PINE POINT MINING LTD.

PROJECT
PINE POINT PROJECT

CONSULTANT
GOLDER

YYYY-MM-DD	2020-10-07
DESIGNED	DC
PREPARED	BW / MM / JE
REVIEWED	DP
APPROVED	DP

TITLE
PROJECT LOCATION

PROJECT NO.	CONTROL	REV.	FIGURE
19125747		0	1

1.8 List of Hazardous Materials

Safety Data Sheets that describe the physical and chemical characteristics of all liquid chemicals that will be used and stored on-site, will be provided in Appendix B.

1.9 Preventative Measures

Several preventative measures will be implemented as outlined below. Additional measures will be outlined in subsequent versions of the plan once additional Project details and locations are available.

Fuel storage and refuelling areas will be located at a minimum 150 m away of the high-water mark of any waterbody. Site personnel will conduct daily inspections of fuel storage and refuelling areas to check for, and immediately repair leaks or damage to containers, as well as monitor for stained or discoloured soils as an indication of potential leaks. Regular maintenance and oil checks of all motorized equipment will also be completed to avoid preventable leaks. Drip trays will be placed under all vehicles and equipment not in use for two hours or longer.

The following measures will be implemented during the Project:

- Training will be provided to site staff who will be responsible for handling, transferring, and dispensing fuel at the site. Safe practices include, but are not limited to, constant attendance during fuelling, using absorbent material, and awareness of pump or emergency shut-off location. Training records will be maintained at site by the Site Coordinator.
- Full-sized spill kits (described in Section 4.1), fire extinguishers, and extra sorbent matting and other similar materials will be stored and readily available at each fuel storage site.
- Any fuel drums to be shipped to site will be labelled with PPML's name in accordance with Land Use Permit conditions.
- The fittings and connection points of all drums in use (i.e., those connected to stationary heating units or generator systems) will be closed with appropriate Teflon tape, and will be wrapped with absorbent pads, and buckets will be placed under the connection for secondary containment.
- Secondary containment or an impermeable surface liner (e.g., drip pans and fold-a-tanks) will be placed under all containers and vehicle fuel tank inlet and outlet points, hose connections, and hose ends during fuel and hazardous substance transfers. Secondary containment will be of adequate size and volume to contain and hold fluids for the purpose of preventing spills.
- Transfer operations will be attended by trained personnel at all times.
- At auxiliary site(s), drums of fuel for drills will be stored on a secondary containment or in a double walled tank. Absorbent materials will be present should a spill occur.

At all times, the operators will maintain a storage tank designated for the collection of used oil and provisions made to provide containment in the event of an overflow or spill during liquid transfer to the drum.

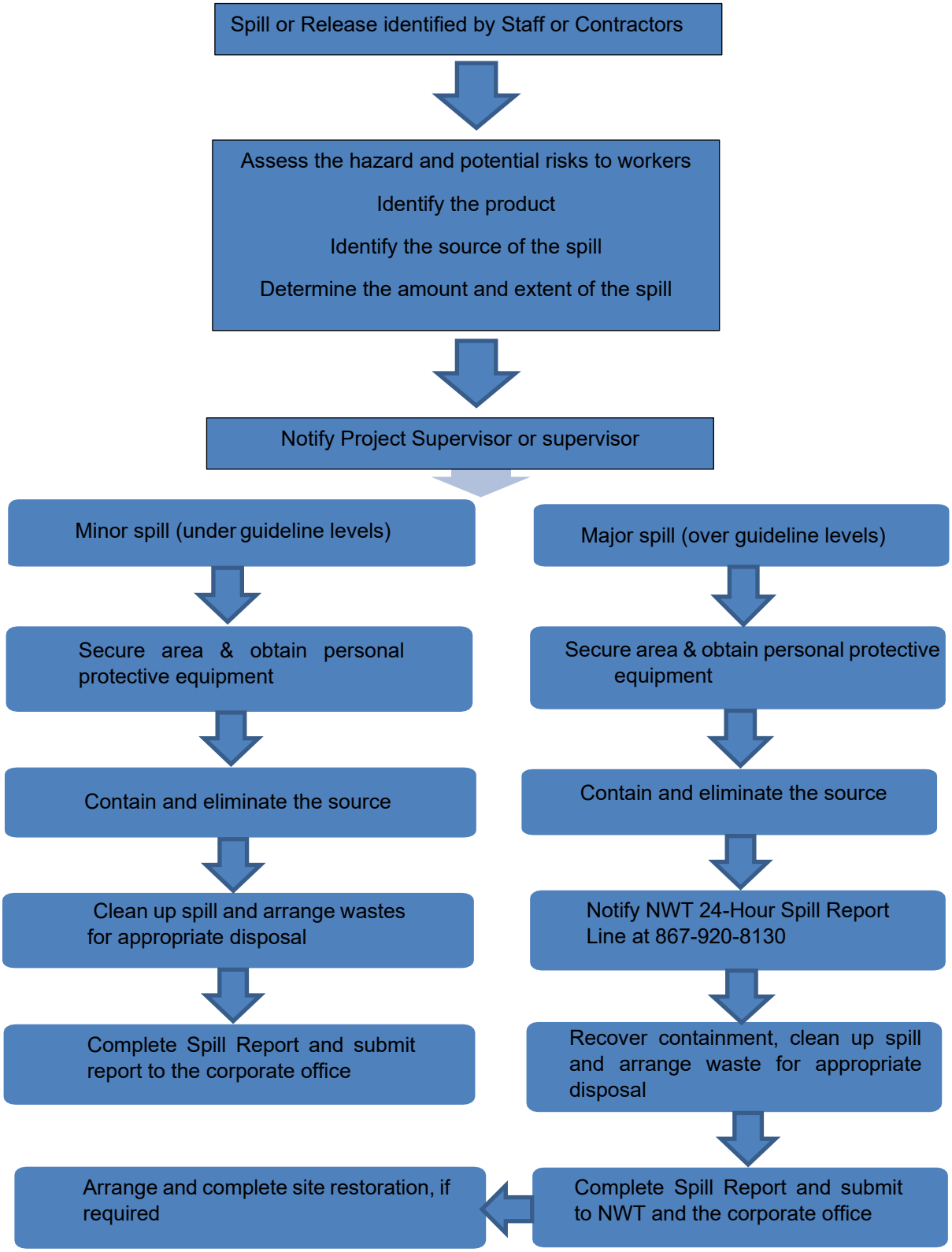
1.10 Access to Copies of the Spill Contingency Plan

Copies of this Spill Contingency Plan are available at PPML's head office in Montreal, Quebec. Copies are available upon request from Andrew Williams, Environmental Manager, who can be contacted at 416-209-2056. Any revisions to the document are identified at the beginning of this document. Copies of the Spill Contingency Plan are kept on-site in the Field Office and will be made readily accessible to all personnel on-site and will be reviewed with all personnel regularly.

2 Response Organization

Basic steps to take in the event of a spill are outlined in Figure 2. This chart provides a general framework for response, with detailed descriptions actions to take at each stage of the emergency outlined further outlined in Section 3.0. A quick and effective response to a spill situation can greatly reduce any associated negative impacts.

Figure 2: Basic Steps to Take in the Event of a Spill



3 Spill Action Plans

3.1 Potential Discharge Events – Worst Case Scenario

The types of potential Project-related spill events, including associated discharge volumes and worst-case scenarios, will be outlined in Table 2.

Table 2: Potential Discharge Event:

Material	Potential Discharge	Discharge Volume, () indicates worst case volumes	Direction of Potential Discharge	Environmental Impacts
-To be determined-				

3.2 Spill Response Procedures

This section describes the cleanup response and protocols to follow in the event of a fuel or oil spill. The uncontrolled discharge of fuel and oil into groundwater, surface water, or soil is prohibited by territorial and federal laws. It is imperative that actions be taken to respond to a spill once it has occurred. In the event of a spill, the Project has defined a spill response procedure as described below.

Prompt response to a spill is the best means of minimizing impact to the environment and, in particular, preventing a discharge from reaching waterbodies. In the event of a spill of a petroleum product, the employee first becoming aware of the spill will assume the role of temporary spill coordinator until he/she can notify the Project Supervisor. If the temporary spill coordinator is unable to notify the Project Supervisor or their supervisor, then he/she will assume the responsibility of implementing the emergency spill response procedures provided that he/she has been trained on the means of protecting the health and safety of spill response personnel and on the implementation of this Spill Contingency Plan. The spill coordinator will assess the hazard, secure spill response materials and personal protective equipment (PPE), contain the spill to the extent possible, and eliminate the spill source to the extent possible as outlined below.

3.3 Assess Hazard

Upon notification of a spill, the spill coordinator will determine the hazard potential of the spill. The spill coordinator will determine at least the following factors:

- the substance spilled and its hazard potential
- the amount of the spill and the extent of spreading
- the source of the leakage and spill

If a spill occurs, where appropriate, the spill coordinator will consult with the camp provided emergency responders to determine the potential hazard to employees from the substance spilled. If a spill is determined to be of such a magnitude that it cannot be safely and effectively controlled by site personnel, then the spill coordinator will promptly notify the outside emergency response agency to implement control and clean-up. A list of emergency contacts is included in Section 4.2.

3.4 Secure Spill Response and Personal Protective Equipment

Upon determining the hazard potential for the planned response action, the spill coordinator will direct those who will respond to the spill to obtain the appropriate response equipment and PPE. Employees will not be issued spill response equipment or PPE without having been trained on its proper use and limitations. The spill coordinator will also ensure the removal of all sources of ignition from the area when dealing with hydrocarbon spills.

3.5 Contain and Eliminate Spill Source

Upon obtaining the proper spill response tools and PPE, the spill coordinator and any spill responder(s) will first attempt to contain the spill to prevent its entry into a ditch or conveyance that eventually discharges to a waterbody. The speed and direction of the spill will be assessed, and appropriate containment used to hinder this movement. Examples of equipment and media that can be used to contain spills include dikes and berms, sand and oil absorbent materials such as kitty litter, straw bales, and absorbent pillows and booms.

At the same time as containment is being performed or as soon as possible after containment, the spill responder(s) will attempt to seal or otherwise stop the source of the spill, if it is safe to do so. Common methods of eliminating a spill source include closing valves, use of a leak stopping compound for pinhole leaks, drum over-packs, and deactivating pumps. The spill response priority at this stage is to:

- protect human health
- protect the environment
- protect equipment

In the event contractor assistance is required for cleanup, the spill coordinator or alternate will arrange for timely cleanup with an outside contractor.

3.6 Notification and Reporting

The NWT-Nunavut Spill report form is provided in Appendix C. The Project Supervisor will determine if a spill is reportable in accordance with the criteria listed in Appendix D. In the event of a reportable spill, the Project Supervisor shall notify the NWT 24-Hour Spill Report Line (see Section 4.2 for contact information). Before reporting, the following information should be known regarding the spill:

- date and time of the spill
- location of spill
- direction the spill is moving
- name and phone number of the person close to the location of the spill
- type of contaminant spilled, and quantity spilled
- cause of the spill
- whether the spill is continuing or is stopped

- description of the existing containment
- actions taken to recover, clean, and dispose of the spilled contaminant
- name, address, and phone number of the person reporting the spill
- name of person in charge of management or control at the time of the spill

The Spill Report (Appendix C) must be completed and faxed or emailed to the NWT 24-Hour Spill Report Line. This form requires details about the time, material and quantity released.

It is expected that as per Water Licence conditions, a detailed report on each spill and unauthorized discharge, including descriptions of root causes, response actions and any changes to procedures to prevent similar occurrences in the future will be provided to the MVLWB within 30 days.

The NWT 24-Hour Spill Report Line must be notified of a spill immediately if either of the following occurs:

- The spill exceeds one of the volumes listed, by chemical type, within the immediately reportable quantities table in Appendix D.
- The spill is near or reaches a waterbody, is near or into a designated sensitive environment or sensitive wildlife habitat, poses imminent threat to human health or safety, poses imminent threat to a listed species at risk or its critical habitat, or is uncontrollable.

If notification is required, it will be done by only the Project Supervisor, who has been trained on how and when to notify external agencies by telephone. A record of that telephone report must be made, including the name of the person contacted at the NWT 24-Hour Spill Report Line as well as any direction received from the regulator during the telephone call.

Copies of spill reports submitted to regulatory agencies need to be forwarded to Andrew Williams.

If the spill is not reportable, the spill coordinator must still complete the spill report form and forward to Andrew Williams, PPML Environmental Manager, without contacting external agencies. Spill records will be compiled and reviewed to establish patterns in spill events, if any, and to determine if further preventive actions should be taken.

3.7 Spill-Related Waste Disposal

Wastes resulting from a minor spill response will be contained in impervious bags, drums, or buckets. Any free-standing liquid will be collected by using absorbents or pumped into marked storage containers. Contaminated soil, ice, or snow will be excavated and stored in marked containers. Tools such as cans, shovels, or rakes may be used to collect the contaminated material. Following any clean-up, any tools or equipment used will be properly washed and decontaminated or replaced if this is not possible.

All hydrocarbon waste, be it hydrocarbon-impacted soils or waste oil, will be transferred to the onsite landfarm or shipped to a registered hazardous waste receiving facility for proper disposal.

3.8 Site Restoration

If a reportable spill should occur, PPML will communicate with GNWT-ENR and other government agencies on any required site restoration activities. Where required, PPML will conduct site-specific studies to assess the extent of soil and groundwater impact and develop a remediation program considering contamination excavation and removal or in place treatment/bioremediation, as appropriate to the nature of the impact. Site investigation and remediation work will be completed in consultation with any assigned agency representatives, as required.

4 Equipment and Resource Inventory

4.1 On-site Spill Response Equipment

Hand tools will be kept on site to aid in the mitigation of hazardous materials spills. Mobile equipment will also be available for emergency use and to respond to spill incidents. PPML and its contractors will maintain spill kits on-site.

Spill kits are expected to contain the following types of items:

- (1) 16 gauge open-top drum with bolting ring and gasket (205 L)
- (1) package of 10 disposable polyethylene bags (5 mil; mil is plastic thickness, 5 mil = 0.005 inch)
- (1) shovel (spark proof)
- (4) 5 inch x 10 foot absorbent booms
- (1) 10 pound bag of absorbent particulate
- (1) bail of 17 inch x 19 inch = sorbent sheets (100 sheets)
- (2) PVC oil resistant gloves
- (2) respirators
- (2) pairs splash protective goggles

4.2 Off-site Resource Inventory

Depending on the severity of the spill, the off-site resources presented in Table 3 could be contacted. Based on the remote location of the sites, these resources will not likely be able to arrive on-site immediately following contact.

Table 3: Off-site Resources

Contact	Phone Number
-To be determined-	

5 Training and Exercises

5.1 Introduction

PPML is responsible for providing a qualified supervisor and training site workers in spill response. Any persons involved in the handling and shipping of hazardous materials will receive Transportation of Dangerous Goods (TDG) training and will maintain a valid TDG certificate.

5.2 Training

PPML has established spill response and spill awareness orientations to be completed by staff at the Project site. All individuals entering the site must complete spill awareness training at the point of arrival to the site. The Project Supervisor designate conducts an orientation session that provides an overview of the locations of spill response equipment (as outlined in Figure 2) and who to contact on-site in the event of a spill. Key site staff have basic first aid training as well as WHMIS.

In addition to the information provided during the spill awareness training session, spill responders are instructed on step by step methods to identify, assess, and respond to spill situations. This training includes a review of how to use absorbent and other spill response equipment and how to properly dispose of contaminated spill response equipment. A mock spill exercise will be used to familiarize spill responders with the equipment available and the steps to take during typical spill situations that may occur on the Site.

5.3 Mock Exercises

Inspectors and other relevant regulators will be notified of planned upcoming mock spill exercises so that regulators have the option of observing the onsite exercise. Mock exercises must be held, at minimum, annually and a record of the exercise retained. The exercise record must detail, at minimum, a description of the exercise scenario tested, time, date, names of participants, outcome of the exercise, lessons learned and, if applicable, corrective actions to be taken as a result of the exercise.

5.4 Schedule and Record Keeping

The training session and exercises will be held prior to the start of construction as part of a worker orientation seminar. Follow up training sessions for new and current employees will occur on a suitably recurring schedule so that returning individuals receive a refresher while new individuals become familiar with onsite spill prevention and response measures.

PPML will keep records of all individuals who attend the training session and exercises, as well as copies of their training certificates (e.g., first aid and WHMIS).

6 Media and Public Enquiries

6.1 General Policy on Public Relations

All enquiries are to be directed to the Project Supervisor.

Environmental incidents such as spills often attract local interest and media attention. Employees will not make any statements on behalf of PPML to the media or to the public.

Employees will respond fully to any request from local authorities or emergency workers that will help to control the spill and its damage. Employees will refer all other requests for information to the Project Supervisor. This may include questions from reporters, environmental agencies, or people and property owners affected by a spill. When probing questions are asked, it is important that the response is polite and professional; for example:

“I’m sorry. I don’t have the authority to answer that question. Please contact _____. His/her phone number is _____.”

NWT Spill Reports are available for the public to view upon request by contacting the NWT Spill Line or by viewing the GNWT Hazardous Materials Spill Database online at http://apps.enr.gov.nt.ca/app/spills/epd_spills/asp/login.asp.

7 References

Acts and Regulations Cited

Environmental Protection Act. RSNWT 1988, c E-7. Available at https://www.justice.gov.nt.ca/en/files/legislation/environmental-protection/environmental-protection.a.pdf

Fisheries Act. RSC 1985, c F-14. Last amended 28 August 2019. Available at https://laws-lois.justice.gc.ca/eng/acts/f-14/

Spill Contingency Planning and Reporting Regulations. R-068-93 under the *Environmental Protection Act*. Available at https://www.justice.gov.nt.ca/en/files/legislation/environmental-protection/environmental-protection.r2.pdf

Transportation of Dangerous Goods Act, 1992. SC 1992, c 34. Last amended 28 August 2019. Available at https://laws-lois.justice.gc.ca/eng/acts/t-19.01/

Transportation of Dangerous Goods Act. RSNWT 1988, c 81 (Supp.). Last amended 2018. Available at https://www.justice.gov.nt.ca/en/files/legislation/transportation-of-dangerous-goods/transportation-of-dangerous-goods.a.pdf?t1601922340664

Waters Act. SNWT 2014, c 18. Last amended 31 August 2016. Available at https://www.justice.gov.nt.ca/en/files/legislation/waters/waters.a.pdf

Literature Cited

INAC (Indian and Northern Affairs Canada). 2007. Guidelines for Spill Contingency Planning. Water Resources Division, INAC, Yellowknife, NT. http://www.enr.gov.nt.ca/sites/enr/files/guidelines_for_spill_contingency_planning_2007.pdf

MVEIRB (Mackenzie Valley Environmental Impact Review Board). 2018. Draft EA Initiation Guidelines for Developers of Major Projects. Accessed March 2020. Available at http://reviewboard.ca/file/1132/download?token=c5tFrEqL

Appendix A Project Maps

Will be provided in final version

Appendix B Safety Data Sheets

Will be provided in final version

Appendix C NT-NU Spill Report Form

NT-NU SPILL REPORT

OIL, GASOLINE, CHEMICALS AND OTHER HAZARDOUS MATERIALS

NT-NU 24-HOUR SPILL REPORT LINE
TEL: (867) 920-8130
FAX: (867) 873-6924
EMAIL: spills@gov.nt.ca

REPORT LINE USE ONLY

A	REPORT DATE: MONTH – DAY – YEAR	REPORT TIME	☐ ORIGINAL SPILL REPORT, OR ☐ UPDATE # _____ TO THE ORIGINAL SPILL REPORT	REPORT NUMBER ____-_____
B	OCCURRENCE DATE: MONTH – DAY – YEAR	OCCURRENCE TIME		

C	LAND USE PERMIT NUMBER (IF APPLICABLE)	WATER LICENCE NUMBER (IF APPLICABLE)
D	GEOGRAPHIC PLACE NAME OR DISTANCE AND DIRECTION FROM NAMED LOCATION	REGION ☐ NWT ☐ NUNAVUT ☐ ADJACENT JURISDICTION OR OCEAN
E	LATITUDE DEGREES MINUTES SECONDS	LONGITUDE DEGREES MINUTES SECONDS

F	RESPONSIBLE PARTY OR VESSEL NAME	RESPONSIBLE PARTY ADDRESS OR OFFICE LOCATION	
G	ANY CONTRACTOR INVOLVED	CONTRACTOR ADDRESS OR OFFICE LOCATION	
H	PRODUCT SPILLED	QUANTITY IN LITRES, KILOGRAMS OR CUBIC METRES	U.N. NUMBER
	SECOND PRODUCT SPILLED (IF APPLICABLE)	QUANTITY IN LITRES, KILOGRAMS OR CUBIC METRES	U.N. NUMBER
I	SPILL SOURCE	SPILL CAUSE	AREA OF CONTAMINATION IN SQUARE METRES
J	FACTORS AFFECTING SPILL OR RECOVERY	DESCRIBE ANY ASSISTANCE REQUIRED	HAZARDS TO PERSONS, PROPERTY OR ENVIRONMENT
K	ADDITIONAL INFORMATION, COMMENTS, ACTIONS PROPOSED OR TAKEN TO CONTAIN, RECOVER OR DISPOSE OF SPILLED PRODUCT AND CONTAMINATED MATERIALS		

L	REPORTED TO SPILL LINE BY	POSITION	EMPLOYER	LOCATION CALLING FROM	TELEPHONE
M	ANY ALTERNATE CONTACT	POSITION	EMPLOYER	ALTERNATE CONTACT LOCATION	ALTERNATE TELEPHONE

REPORT LINE USE ONLY

N	RECEIVED AT SPILL LINE BY	POSITION STATION OPERATOR	EMPLOYER	LOCATION CALLED YELLOWKNIFE, NT	REPORT LINE NUMBER (867) 920-8130

LEAD AGENCY ☐ EC ☐ CCG ☐ GNWT ☐ GN ☐ ILA ☐ INAC ☐ NEB ☐ TC

SIGNIFICANCE ☐ MINOR ☐ MAJOR ☐ UNKNOWN

FILE STATUS ☐ OPEN ☐ CLOSED

AGENCY	CONTACT NAME	CONTACT TIME	REMARKS
LEAD AGENCY			
FIRST SUPPORT AGENCY			
SECOND SUPPORT AGENCY			
THIRD SUPPORT AGENCY			

Appendix D Immediately Reportable Spill Quantities

MVLWB / GNWT

Operation and Maintenance Plan Templates for Municipal Water Licences: Spill Contingency Plan

November 10, 2015

Mackenzie Valley Land and Water Board

SAHTU LAND & WATER BOARD

GWICH'IN LAND AND WATER BOARD

Wek'èezhìı Land and Water Board

Northwest Territories

Operation & Maintenance Plan Template – Spill Contingency Plan

If you have any questions about this document, please contact your regional Manager of Community Infrastructure Planning.

1. Site & Systems Description

Community: _____

Which facilities do these plans cover? Include only facilities where the community would be responsible for responding to a spill. (Check all that apply.)

☐ Water Treatment Plant (WTP)

☐ Solid Waste Facility (SWF)

☐ Wastewater Treatment System (WWTS), specify type:

○ Mechanical Plant ○ Natural Lake Lagoon ○ Engineered Lagoon ○ Exfiltration System

☐ Bulk Fuel Storage Facility

☐ Community Garage

☐ Swimming Pool

☐ Landfarm at separate location from SWF

☐ Other (specify): _____

Attach a map showing the **location of each facility** (multiple facilities can be shown on one map, or you can use separate maps). Include any additional community fuel storage locations, such as an airport fuel facility. Show the **municipal boundaries** on each map. Show the **location of fuel and other hazardous materials** stored at each site. If applicable, show the location of the **fuel and pump for a seasonal reservoir fill**.

☐ Map(s) attached

2. Spill Contingency Plan (SCP)

2.1 SCP – Introduction

What is the Effective Date of the Spill Contingency Plan? _____ (yyyy/mm/dd)

This Spill Contingency Plan is effective from the date shown above until such time that an updated contingency plan is in place. Updated plans should include a list of all revision dates and a brief summary of the changes made to the plan. In the event of a spill during a period of review this plan shall take precedence. This plan applies to all operations and activities conducted within the municipal boundaries of . This Spill Contingency Plan was developed to comply with the Environmental Protection Act. R.R.N.W.T. 1990,c.

2.2 SCP – Revisions

The Spill Contingency Plan should be updated annually, at a minimum, to reflect changes such as fuel storage locations, new hazardous materials on site, new construction and new personnel and contact information. **Use the following table to record a summary of revisions each year.** Add new pages as needed.

Date of Revision (yyyy/mm/dd)	Title, Section Number, or Page Number of Revised Sections	Summary of Changes

2.3 SCP – Purpose

The purpose of this plan is to outline response actions for potential spills of any size, including a worst case scenario, for the . The plan identifies key response personnel and their roles and responsibilities in the event of a spill, as well as the equipment and other resources available to respond to a spill. It details spill response procedures that will minimize potential health and safety hazards, environmental damage, and clean-up efforts. The plan has been prepared to ensure quick access to all the information required in responding to a spill.

It is the policy of the :

- To comply with existing regulations
- To provide such protection of the environment as it is technically feasible and economically practical
- To cooperate with other groups on the protection of the environment
- To keep employees, government officials, and the general public informed

2.4 SCP – Contact Information & Responsibilities

An **immediately reportable spill** is defined as a release of a substance that is likely to be an imminent environmental or human health hazard or meets or exceeds the volumes shown in the attached table. These spills **must be reported** to the NWT 24-hour Spill Report Line at (867) 920-8130.

NWT 24-Hour Spill Line: 867-920-8130

Provide contact information for spill response personnel. Where possible, provide additional phone numbers to ensure contacts can be reached 24 hours a day in the event of a spill.

Band Manager:

Name:	
Phone:	
Second phone:	

Senior Administrative Officer (SAO):

Name:	
Phone:	
Second phone:	

Maintenance Foreman:

Name:

Phone:

Second phone:

Works Foreman:

Name:

Phone:

Second phone:

Additional copies of the Spill Contingency Plan may be obtained by contacting:

Name:

Position: (normally SAO or Band Manager)

Phone:

Email:

Fax:

Media inquiries should be directed to:

Name:

Position:

Phone:

Email:

Fax:

Who is responsible for activating the Spill Contingency Plan at each facility in the event of a spill?

	Name	Job Title	24-hour telephone number(s)
WTP			
WWTS			
SWF			
Bulk Fuel Storage Facility			
Community Garage			
Other			
Other			

2.5 SCP – Off-Site Resources

Off-site resources for assistance in the event of a spill are listed below. Assistance from outside the community may not be able to reach the site until at least the next business day.

- NWT 24-Hour spill line ..... (867) 920-8130
- GNWT Environmental Protection Division ..... (867) 873-7654
- ENR Inspector ..... CHOOSE REGION (867) xxx-xxxx
- AANDC Northwest Territories Region ..... (867) 669-2440
- Environment Canada (Emergency) Yellowknife ..... (867) 669-4725
- GNWT Environmental Health Officer ..... (867) 669-8979
- RCMP (Yellowknife) ..... (867) 669-1111
- Stanton Territorial Health Authority ..... (867) 669-4111
- Dehcho Health & Social Services Authority ..... (867) 695-3815
- Medivac (Yellowknife) ..... (867) 669-4115
- Great Slave Helicopters (Yellowknife) ..... (867) 873-2081
- Matrix Helicopters (Yellowknife)..... (867) 766-3134
- Trinity Helicopters (Yellowknife)..... (867) 669-7031
- Remote Helicopters (Hay River) ..... (867) 874-6999
- Thebacha Helicopters (Fort Smith) ..... (867) 872-4354
- Air Tindi (Yellowknife) ..... (867) 669-8218 or 669-8200
- Arctic Sunwest Charters (Yellowknife) ..... (867) 873-4464

2.6 SCP – Emergency Phone & Radio Locations

Where are Emergency telephones and/or radios located?

- ☐ Water Treatment Plant
- ☐ Wastewater Treatment System
- ☐ Solid Waste Facility
- ☐ Bulk Fuel Storage Facility
- ☐ Community Garage
- ☐ Community's main office
- ☐ Other (specify):

2.7 SCP – Distribution & Storage of Spill Contingency Plan

A copy of this Spill Contingency Plan should be kept on site at each facility at all times and at the Community's main office. Indicate which locations have a copy of the Spill Contingency Plan (check all that apply):

- ☐ Water Treatment Plant
- ☐ Wastewater Treatment System
- ☐ Solid Waste Facility
- ☐ Bulk Fuel Storage Facility
- ☐ Community's main office
- ☐ Other (specify):

Which offices have received a copy of the Spill Contingency Plan as part of the formal distribution of the plan? Choose the applicable office from each menu. The address and contact information will automatically be filled in below.

Choose **Regional Land and Water Board**:	Choose Regional Land and Water Board
Choose **Municipal and Community Affairs** (MACA) regional office:	Choose MACA Regional Office
Choose **Public Works and Services** (PWS) office:	Choose PWS Regional Office
Choose **Health & Social Services Authority**:	Choose Health & Social Services Authority

Formal distribution of the Spill Contingency Plan has been made to the following offices:

No Water Board Selected

No MACA Office Selected

No PWS Office Selected

No HSSA Office Selected

2.8 SCP – Community Environmental Policy

The is committed to operating in an environmentally sensitive manner, and complying with requirements of the No Water Board Selected .

2.9 SCP – Potential Spill Materials Inventory

In this section, you will create a **Potential Spill Materials Inventory** by listing the hazardous materials stored at each site that could lead to a spill.

The following tables list hazardous materials on-site for each facility that may pose a spill risk, the type of storage container, the average and maximum quantities stored and their storage location. Tables are provided for the most common facilities. Use the two "Other Location" tables at the end of the section to add additional facilities such as a community pool, landfarm (other than one that is part of the Solid Waste Facility), or other facilities with chemical storage. Do not include sewage or fuel tanks installed at individual buildings or households.

Materials commonly found at each type of facility have been listed as a starting point. Skip any materials that are not used at your facility. Add any additional materials at the end of the list for each facility.

Water Treatment Plant (Do not list small quantities of reagents or calibration standards used for in-plant water testing.)

Material	Type of Storage Container	Quantity Normally Onsite (L/drums/gallons)	Maximum Quantity Onsite (L/drums/gallons)	Storage Location and Uses
Sodium Hypochlorite (liquid) and/or household bleach				
Sodium Hypochlorite (powder)				
Sodium Hydroxide (Caustic Soda)				
Vita-D-Chlor (Ascorbic Acid)				
Diesel or heating fuel				
Aluminium sulfate or alum				
Coagulant-aid polymer				

Wastewater Treatment System

Material	Type of Storage Container or Containment	Quantity Normally Onsite (L/drums/gallons)	Maximum Quantity Onsite (L/drums/gallons)	Storage Location and Uses
Sewage or wastewater				
Diesel or heating fuel				

Solid Waste Facility (For additional information on the hazardous waste materials listed in this section, please refer to the "Hazardous waste information" pages appended to this document.)

Material	Type of Storage Container	Quantity Normally Onsite (L/drums/gallons)	Maximum Quantity Onsite (L/drums/gallons)	Storage Location and Uses
Diesel or heating fuel				
Household Hazardous Waste				
Asbestos				

Lead-acid Batteries				
Antifreeze or glycol				
Hydrocarbon-contaminated soil, snow, or water				
Mercury				
Oily Debris				
Halocarbons or Refrigerants				
Paint				
Propane Tanks				
Residue Fuel Tanks, Heating Oil Tanks, Drums				
Used oil				
Waste fuel				
Vehicles				

Bulk Fuel Storage Facility (If the community has additional fuel storage at the airport or elsewhere, add additional lines for the second location. For example, if you have diesel stored at two separate facilities, you will have two lines in the table for diesel.)

Material	**Type of Storage Container**	**Quantity Normally Onsite (L/drums/gallons)**	**Maximum Quantity Onsite (L/drums/gallons)**	**Storage Location and Uses**
Gasoline				
Diesel or LSDL fuel				
Jet-A				
Propane				

Community Garage

Material	Type of Storage Container	Quantity Normally Onsite (L/drums/gallons)	Maximum Quantity Onsite (L/drums/gallons)	Storage Location and Uses
Diesel or heating fuel				
Glycol or antifreeze				
Engine oil				
Transmission fluid				
Brake fluid				

Other Location 1 (specify):

Material	Type of Storage Container	Quantity Normally Onsite (L/drums/gallons)	Maximum Quantity Onsite (L/drums/gallons)	Storage Location and Uses

Other Location 2 (specify):

Material	Type of Storage Container	Quantity Normally Onsite (L/drums/gallons)	Maximum Quantity Onsite (L/drums/gallons)	Storage Location and Uses

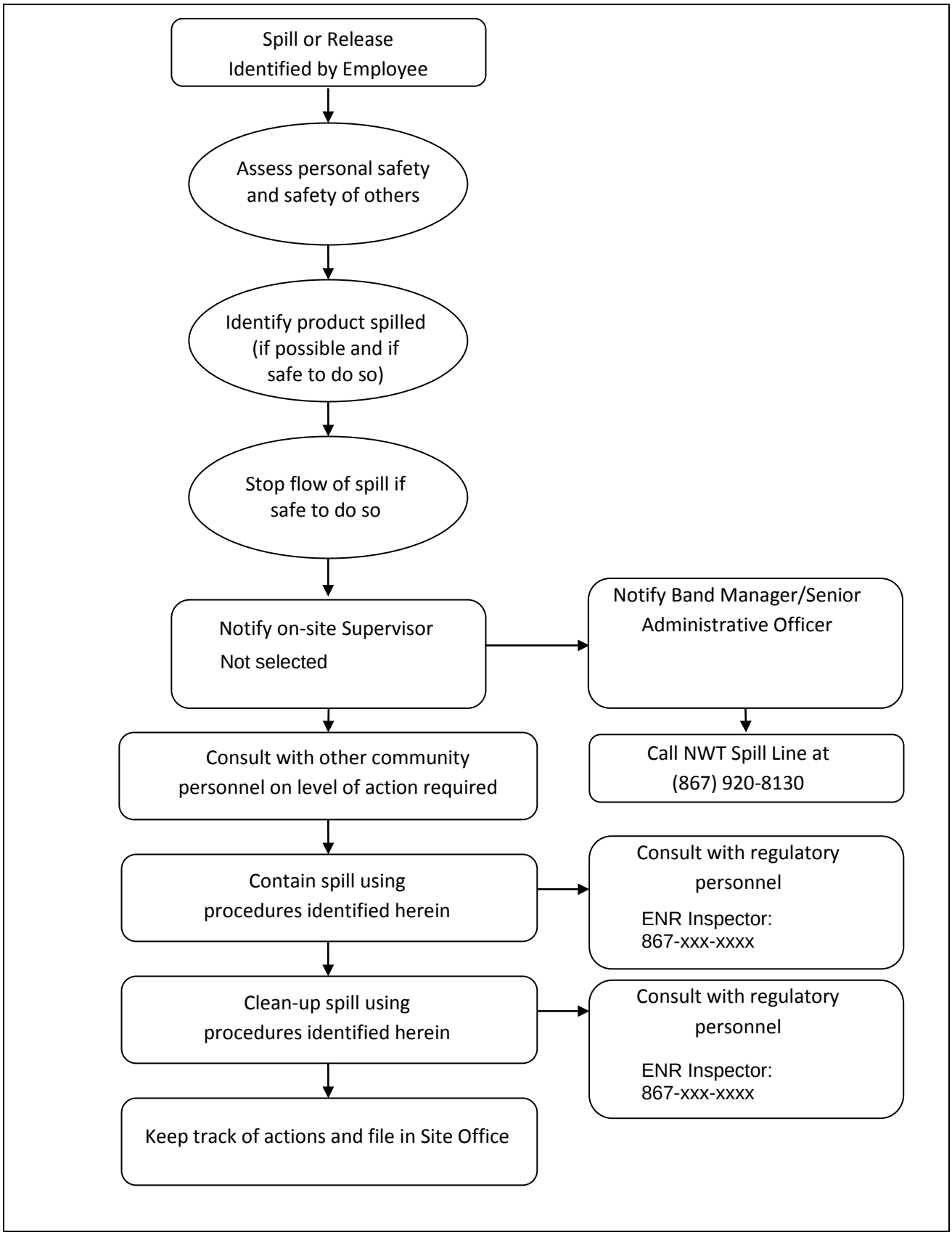
2.10 SCP – Response Flowchart

The flow chart on the following page identifies the response organization and the chain of command for responding to a spill or release.

Choose site supervisor for flowchart

If Other, name:

If Other, phone:


Spill or Release Identified by Employee
Assess personal safety and safety of others
Identify product spilled (if possible and if safe to do so)
Stop flow of spill if safe to do so
Notify on-site Supervisor Not selected
Notify Band Manager/Senior Administrative Officer
Consult with other community personnel on level of action required
Call NWT Spill Line at (867) 920-8130
Contain spill using procedures identified herein
Consult with regulatory personnel ENR Inspector: 867-xxx-xxxx
Clean-up spill using procedures identified herein
Consult with regulatory personnel ENR Inspector: 867-xxx-xxxx
Keep track of actions and file in Site Office

2.11 SCP – Action Plan

Reservoir Fill Operation and Flammable Liquids

Is there a seasonally-filled water reservoir in the community?

○ Yes ○ No

If yes, which fuels, oils and chemicals are used in the filling operation? Indicate the maximum quantity stored on or adjacent to the ice, in Litres. (If no, skip this section.)

☐ Diesel fuel	Max quantity **on ice**:		Litres
☐ Engine oil	Max quantity:		Litres
☐ Gasoline	Max quantity:		Litres
☐ Antifreeze	Max quantity:		Litres
☐ Automatic Transmission Fluid	Max quantity:		Litres
☐ Other (specify):	Max quantity:		Litres

Where is the reservoir refill pump located?

Distance from reservoir: ____ m

Direction from reservoir: Choose dire of reservoir

currently conducts seasonal reservoir fills. The location of the reservoir refill pump is approximately m of the reservoir. The quantity of fuel on the ice at any one time shall be limited to 205 litres in the pumps fuel tank and fuel that is in a mobile tidy tank that will only be on the ice during refueling. Fuel will be transferred from a tidy tank that is situated in the back of a truck into the tank required to operate the pump as required.

During seasonal pumping operations, the fluids listed above will be stored in close proximity to the Mackenzie River. No storage or staging of fluids other than those listed above is a part of the operation; the amount of fuel on the ice at any given time will be minimized. This will significantly reduce the size of a potential spill. All other flammable liquid spills within municipal boundaries and of municipal responsibility will be dealt with in the same manner.

Defensive Position- Reservoir Fill Operation Only

- Retain Sufficient Spill Recovery supplies onsite during pumping operations.
- Train on site personnel in spill containment and clean up.
- Provide communications during operations.
- Storage of fluids not exceeding the amounts listed above.

- Ensure that the ice is able to support the types of vehicles and equipment used in the filling operation. The GNWT Department of Transportation has published "A Field Guide To Ice Construction Safety", which is a good reference for working on ice and provides guidance on determining a safe thickness of ice for a given load. The following paragraph is from the Field Guide, Section 3.4.

  "The ability of ice to support a load is dependent on a number of factors, including ice thickness, the pressure of the water below the ice as deflection develops, the way the ice formed initially, snow cover, vehicle speed and the kinds of load placed on the ice cover. The strength is different for sea and freshwater ice and is affected by the presence of cracks and sudden or extreme temperature changes. It should also be remembered that ice thickness can vary considerably from place to place and until a margin of safety is achieved, extreme caution must be exercised."

  The Field Guide is available on DOT's website and should be used as guidance to determine if the ice thickness is sufficient for reservoir filling activities. People in the community who are familiar with the source waterbody should also provide information on site-specific dangers such as known areas of thin ice, which can't be predicted in a general guideline. Additional caution is needed when working with vibrating loads such as pumps, which can cause damage to the ice. If possible, these loads should be kept on shore. If this is not possible, the ice may need to be thicker, and should be monitored for damage such as cracks that may weaken it. The Field Guide provides information on cracked ice.

Response Strategy

In the event of a spill:

- Be alert and consider safety first. If possible, identify the product spilled and the source of the spill.
- Assess the fire and safety hazard to human life; warn people in and around the spill area to vacate the area if necessary
- Shut off the source of the spill, if safe to do so.
- Shut off all machinery or equipment, for example: lights, motors, furnaces, truck engines that may cause sparks, etc. to start a fire, no smoking.
- Tend to the injured, if any.
- Secure the area by not letting any vehicles or persons enter the area.
- Use good judgment to safely stop the spill product from spreading, if possible, by creating a barrier to keep the area of spill from getting larger
- Notify the SAO / Acting SAO that a spill has occurred. The SAO will follow these steps:
  Step 1: Activate the Spill Recovery Plan.
  Step 2: Consult with on-site staff and determine appropriate level of response.
  Step 3: Notify all relevant government departments using the 24-hour Spill Line.
  Step 4: Deploy appropriate staff resources, including Rubber Tire Loader, Municipal Works staff, Spill Containment Kit located as listed in section 2.13.
  Step 5: Commence spill containment and collection activities.
  Step 6: See that the contaminated materials are disposed within the solid waste disposal area.
  Step 7: Complete spill report.

Sewage Spills

The main source for a sewage spill in would be the sewage truck and/or sewage holding tanks in a home or community building. The maximum size of a sewage spill is most likely limited to the capacity of the sewage truck.

Response Strategy

In the event of a spill:

- Be alert and consider safety first. If possible, identify the product spilled and the source of the spill.
- Shut off the source of the spill, if safe to do so.
- Tend to the injured, if any.
- Secure the area by not letting any vehicles or persons enter the area.
- Use good judgment to safely stop the spill product from spreading, if possible, by creating a barrier to keep the area of spill from getting larger
- Notify the SAO / Acting SAO that a spill has occurred. The SAO will follow these steps:
  Step 1: Activate the Spill Recovery Plan.
  Step 2: Consult with on-site staff and determine appropriate level of response.
  Step 3: Notify all relevant government departments using the 24-hour Spill Line.
  Step 4: Deploy appropriate staff resources, including Rubber Tire Loader, Municipal Works staff, Spill Containment Kit located as listed in section 2.13.
  Step 5: Commence spill containment and collection activities preferably using the backup sewage truck. Use of the municipal loader is preferred for the creation of a containment berm and the collection of contaminated soil. The spill contact area is to be treated with lime and covered with soil.
  Step 6: See that the contaminated materials are disposed of within the solid waste disposal area.
  Step 7: Complete Spill Report.

General Community Operations

On a daily basis the community conducts operations that have the potential to be a small spill situation. Reporting for these spills will be in accordance with the Environmental Protection Act and the volumes outlined in the list of Immediately Reportable Spill Quantities appended to this document.

Defensive Spill Position

General community operations include:

- Retain sufficient supplies (sorbent) in community-owned vehicles and potential spill locations to contain potential spill volumes. Such as motor oil generated from servicing vehicles, gasoline and diesel from the fuelling of equipment.
- Using Storage tanks that meet the fire code and Fire Marshal's recommendations (Dyked tanks or double-walled).
- Training personnel in safe, sensible operational procedures.
- Retain minimum economic volumes of chlorine and other chemicals in the community's

possession to reduce the size of a potential spill.

- Retain Safety Data Sheets (SDS) for all chemicals in use.

Response Strategy

The response strategy would be the same as the Reservoir Fill Operation and Flammable Liquids section above, incorporating the information from the appropriate SDS.

Note: Specific chemicals have specific spill containment requirements; the SDS for these chemicals identify the procedure for its collection.

Attach SDS (or MSDS) for all chemicals, fuels, and oils used in community operations.

☐ SDS attached.

Hazardous Material Spills On-site

Indicate which of the following materials are generated or stored in your community (check all that apply):

☐ Gasoline

☐ Diesel

☐ Waste Oil and Miscellaneous Oils and Grease

☐ Sewage

Potential Environmental Impacts of Spill

Generally, for the hazardous materials discussed below, environmental impacts are lower during the winter, as snow is a natural sorbent and ice forms a barrier lining for eliminating soil or water contamination. Spills can be more readily recovered when identified and reported.

Gasoline:

Environmental Impacts:

- Harmful to wildlife and aquatic life
- Not readily biodegradable
- Has potential to bioaccumulate in environment
- Volatilizes easily
- Runoff into water bodies must be avoided

Worst Case Scenario: Fuel truck spill and contents pour onto ground and surrounding environment.

Diesel:

Environmental Impacts:

- Harmful to wildlife and aquatic life
- Not readily biodegradable
- Has potential to bioaccumulate in environment
- Burns slowly, more readily contained than volatile fuels
- Runoff into water bodies must be avoided

Worst Case Scenario: Fuel truck spill and contents pour onto ground and surrounding environment.

Waste Oil and Miscellaneous Oils and Grease:

Environmental Impacts:

- Harmful to wildlife and aquatic life
- Not readily biodegradable
- Has potential to bioaccumulate in environment
- Runoff into water bodies must be avoided

Worst Case Scenario: All oil and waste oil containers simultaneously spill and contents pour onto ground and surrounding environment.

Sewage:

Environmental Impacts:

- Human health hazard and unsightly appearance
- High nutrient concentrations could negatively impact water bodies and runoff into water bodies must be avoided

Worst Case Scenario: All oil and waste oil containers simultaneously spill and contents pour onto ground and surrounding environment.

Procedures for Initial Actions

The following list of actions should be followed by the first person on the scene:

- Ensure safety of all personnel
- Identify the product spilled
- Assess the hazards and risks to persons in the vicinity of the spill
- Remove all sources of ignition
- If possible, without further assistance, control the danger to human life
- If it is safe to do so, and if possible, stop the spill (i.e. shut off pump, replace cap, tip drum upward, etc.)
- Gather information on the status of the situation, including:
  - Estimated size of spill
  - Estimated migration route
- Contact on site Supervisor.

Spill Reporting Procedures

Spills should be reported immediately to the onsite Supervisor, who will notify the SAO and Band Manager. Together they will determine if the spill is to be reported to the NWT 24-Hour Spill Line at 867-920-8130, based on the volumes in the Immediately Reportable Spill Quantities table at the end of this document.

Copies of the Spill Report form are available in each spill kit and at the end of this document. The form will be filled out by the onsite Foreman (or designate), and faxed or emailed to the NWT Spill Line. Contact information is as follows:

NWT 24-Hour Spill Line
Phone: (867) 920-8130
Fax: (867) 873-6924
Email: spills@gov.nt.ca

Procedures for the Protection of Human Health and Safety

Following a spill, the health and safety of workers as well as the general public is a priority. Actions taken will depend on the type of spill.

- In the event of a chemical spill: Restrict public access to the spill area. Workers involved in the clean-up of the spill should wear personal protective equipment (PPE).
- In the event of a flammable or combustible material spill: Disconnect electrical equipment, evacuate adjacent buildings and restrict public access to the spill area. Only spark-arresting equipment should be used during clean-up of the spill. PPE should also be worn by workers involved in the clean-up.
- In the event of a sewage spill: Restrict public access (including pets and animals) to the spill area.

Procedures for Containing and Controlling Spills

General procedures noted below will be used to contain and control all spills. Specific procedures for spills on land, water, snow and ice follow.

- First anticipate what will be affected by the spill.
- Assess direction and speed of spill, and any factors that could affect these (water, wind and slope).
- Determine best location for containing spill, avoiding any water bodies.

Containment of Spills on Land:
Dykes and trenches can be constructed to contain spills on land. Soil surrounding the spill area can be dug out, and piled up, to create a barrier for the spill. A plastic tarp can be placed at the base of the dyke, so that the pooled material can be removed with sorbent materials. Conversely, trenches can be excavated to permafrost, which will provide a natural containment of the spill. Once the material is contained, it can be pumped out, or removed by using sorbent materials. If the spill is moving very slowly, such structures

may not be necessary and the material can be removed before migrating away from the spill location.

Containment of Spills on Water:
Spills on water are considered the most serious types of spills, as there is often no containment of the spilled material and water quality and aquatic life are negatively impacted. Booms, weirs, sediment curtains and fencing can be installed to contain the spill. Booms are designed to float, and are made of absorbent material to soak up the spilled fuel. They are deployed from the shore or a boat, to create a circle around the spill or to contain a spill from migrating further into the receiving water bodies. Weirs are installed across creeks/drainages, to prevent further migration. Plywood or other materials found onsite can be used. Barriers made of fence or netting can be used as well, with sorbent material placed at the base of the barrier. Once contained, the fuel can be removed by absorbent materials, pumped out or allowed to volatilize.

Containment of Spills on Snow:
Snow acts as a natural sorbent for spilled fuel. Impacted snow is easily visible, and can be shoveled into empty drums or barrels for proper disposal. If the spill is migrating down a hill, a snow dyke can be constructed to contain the spill. A plastic tarp can be placed at the base of the dyke, where spilled fuel is expected to pool. The collected fuel and impacted snow can be removed with absorbent materials, pumped out, or shoveled into barrels for disposal.

Containment of Spills on Ice:
Ice is considered impermeable to fuel, so these spills are generally easy to clean up. Small spills can be cleaned up by placing absorbent materials on top of the ice. Impacted snow and slush can then be removed by shovels, and placed in barrels for disposal. For larger spills, dykes of snow and trenches can be constructed to contain the spill. Pooled fuel can then be removed by absorbent materials or pumped out. Impacted snow and slush can be shoveled into barrels for disposal.

Worst Case Scenarios:
Worst case scenarios include a dyke or trench overflowing and a large spill on water that cannot be contained with materials available in the community. In the first case, a trench or collection pit could be constructed downstream to collect the fuel. In the second case, an emergency response team would need to be called, with appropriate equipment to deal with the spill.

Procedures for Transferring, Storing and Managing Spill Related Wastes

Spills are generally cleaned up starting at the outer limit of the spill, and working towards the point of the spill. Sorbent materials and hand tools such as cans and shovels are used for smaller spills. Larger spills can be contained with the use of a pump and/or heavy equipment.

Spill wastes include used absorbent materials and containers of impacted water and snow. Sorbent materials should be placed in plastic bags for proper disposal. The containers of impacted water and snow should be sealed and stored until disposal at an approved facility can be arranged. For most of the containment procedures, spilled petroleum products and materials used for containment will be placed into empty waste oil containers and sealed for proper disposal at an approved disposal facility.

Following a spill, all used materials need to be properly washed and/or replaced.

Procedures for Restoring Affected Areas

Once a spill has been contained, community personnel will consult with the Inspector assigned to the file to determine the level of clean-up required. The Inspector may request that a site specific study be conducted, to ensure appropriate clean-up levels are met.

After clean-up has been completed, the community should follow up with the NWT 24-hour Spill Line to ensure that the spill report file has been closed. Closure of the spill file provides evidence that the spill was cleaned up to the regulator's satisfaction. This will help prevent the spill from being considered an environmental liability for the community in the event of a change of ownership, refinancing, or closure of the site. A copy of the spill report marked "Closed" can be provided on request for the community's files. The Spill Line also keeps copies of these reports on file.

2.12 SCP – Resource Inventory

In this section, you will create a **Resource Inventory** by identifying the supplies and equipment available for spill response at each facility.

What earth-moving and other equipment is available in the community for spill cleanup (for any or all facilities)? (Check all that apply, list any additional equipment.)

☐ Loader ☐ Excavator ☐ Backhoe ☐ Bobcat

☐ Bulldozer ☐ Dump truck ☐ Fuel truck

☐ Shovels or other hand tools

☐ Other (specify): _____

Which facilities have spill kits? (Check all that apply.) Indicate where the spill kit is stored at each facility. Give enough detail for a person to find the spill kit if they don't know where it is. How many litres of spilled oil/fuel are the spill kits designed to contain and collect?

☐ Water Treatment Plant Location: _____ Volume: _____ L

☐ Wastewater Treatment System Location: _____ Volume: _____ L

☐ Solid Waste Facility Location: _____ Volume: _____ L

☐ Bulk Fuel Storage Facility Location: _____ Volume: _____ L

☐ Community Garage Location: _____ Volume: _____ L

☐ Other (specify): _____

Additional volumes will be accommodated with the use of absorbent products that will be maintained in inventory in sufficient quantities.

What is included in the spill kit for each facility? Check all materials that apply for each facility. (The typical quantity is shown for information only and all kits should have sufficient material for expected spill volumes at each site.)

Item	Typical Quantity	Qty at WTP	Qty at WWTS	Qty at SWF	Qty at Bulk Fuel Storage Facility	Qty at Community Garage	Other (specify):	Other (specify):
Tyvek splash suits	4	☐	☐	☐	☐	☐	☐	☐
Chemical master gloves	4	☐	☐	☐	☐	☐	☐	☐
Large bags with ties for temporary use	10	☐	☐	☐	☐	☐	☐	☐
Oil-only booms (5 in by 10 ft)	2	☐	☐	☐	☐	☐	☐	☐
Oil-only mats (6 in x 20 in)	50	☐	☐	☐	☐	☐	☐	☐
Sorbent socks	5	☐	☐	☐	☐	☐	☐	☐
Sorbent pads	10	☐	☐	☐	☐	☐	☐	☐
Large tarps	2	☐	☐	☐	☐	☐	☐	☐
Duct tape (roll)	1	☐	☐	☐	☐	☐	☐	☐
Utility knife	1	☐	☐	☐	☐	☐	☐	☐

Field notebook and pencil	1	☐	☐	☐	☐	☐	☐	☐
Rake	1	☐	☐	☐	☐	☐	☐	☐
Pick axe	1	☐	☐	☐	☐	☐	☐	☐
Aluminum scoop shovels	3	☐	☐	☐	☐	☐	☐	☐
Instruction binder	1	☐	☐	☐	☐	☐	☐	☐
Copies of the NWT Spill Report form to be completed in the event of a spill	1 or more	☐	☐	☐	☐	☐	☐	☐

2.13 SCP – Training

The Department of Environment and Natural Resources schedules a few training sessions each year for spill contingency. Selected members from the community works department can attend these training sessions. Once key personnel have the fundamental information, training sessions will be conducted as a part of the normal operation of the community.

Training will be conducted on an as-needed basis.

Where are training records kept? ☐

For each facility, indicate the training items that are done. (Check all that apply.)

Training	**WTP**	**WWTS**	**SWF**	**Bulk Fuel Storage Facility**
All individuals working at the facility are required to participate in an orientation session.	☐	☐	☐	☐
During the orientation, all locations of the Spill Contingency Plan and spill kits are indicated.	☐	☐	☐	☐
During the orientation, an overview of the Spill Contingency Plan is provided.	☐	☐	☐	☐

Specific training sessions, including mock spill exercises, are scheduled for individuals directly involved with handling hazardous materials.	☐	☐	☐	☐
All facility operators are required to have their basic first aid training, as well as WHMIS training, before working on the site.	☐	☐	☐	☐
A spreadsheet is kept by the Band Manager or Senior Administrative Officer at the Community head office indicating the training undertaken by the facility operator, and expiry dates for specific training.	☐	☐	☐	☐

Hazardous waste information

Asbestos: Exposed asbestos fibres from construction and demolition debris present a risk to human health. The risks to human health are lowered to safe levels when asbestos is properly packaged according to the conditions set by the Worker Safety and Compensation Commission. Once this has taken place, a hole must be dug in advance of acceptance and the asbestos needs to be buried immediately. The location needs to be documented to prevent future disturbance. Further details can be found in ENR's document *Guideline for the Management of Waste Asbestos* (attached).

Lead-acid batteries are commonly found in vehicles. Both the lead and the acid are contaminants. Batteries in good condition can be stacked on pallets and banded or shrink-wrapped for transportation when enough have been collected to make shipping worthwhile. Store broken batteries in a pail or other container to prevent spills and avoid contact with battery acid. Further details can be found in ENR's document *Guideline for the Management of Waste Batteries* (attached).

Glycols: Waste antifreeze (Ethylene Glycol) is generated from vehicle maintenance. Propylene glycol is more common to the industrial/commercial sector where it is used for heating larger buildings. Glycols can be stored in pails or drums until the quantity warrants shipping. Further details can be found in ENR's document *Guideline for the Management of Waste Antifreeze* (attached).

Hydrocarbon-contaminated soil, snow, and water that result from spills or contaminated sites are managed as a hazardous waste in the NWT. Hydrocarbons include diesel, heating oil, gasoline, and other petroleum products. Communities wanting to store or treat contaminated soil, snow, or water may need to amend their water licence. Contact ENR for guidance on developing appropriate facilities.

Mercury is a severely toxic contaminant. Disposal needs to be reduced to levels as low as reasonably achievable. Thermostats, thermometers, mercury switches and fluorescent lamps all contain mercury. They can be safely stored in clearly marked pails. Drum-top crushing equipment can be used to remove the mercury from fluorescent bulbs. Other types of mercury-containing lights (i.e. street lamps or high intensity discharge lamps from the industrial/commercial sector) require specialized disposal methods and usually need to be transported to southern receiving facilities. For further information, see ENR's document *Guide to Recycling Mercury-Containing Lamps* (attached).

Oily debris can consist of rags, sorbent material, or containers used to store or clean up oil. These materials are contaminants that cannot be added to a typical soil treatment facility, but need to be kept segregated from other waste.

Ozone depleting substances (ODS), also referred to as halocarbons, are chemicals mainly used in air conditioning and refrigeration equipment. The release of these substances depletes the ozone layer and is prohibited. Refrigerants need to be recovered by a trained technician prior to disposal of items containing refrigerants, including refrigerators, freezers and vehicles. Specific training is required for anyone servicing equipment containing ODSs and halocarbon alternatives. For more information, see ENR's document *Environmental Guideline for Ozone Depleting Substances (ODS's) and Halocarbon Alternatives* (attached).

Paint: Paint can contain a number of hazardous chemicals, including lead. Whenever possible, paint should be used rather than disposed of. If it can't be used, the disposal method depends on the type of paint (check the label). Oil-based paint should be stored in approved 205 litre drums, ready for shipping. Latex paints can be landfilled after they are completely dried out (they can be spread out on a board or sheet to dry). Industrial/commercial paints usually need specialized treatment methods and should not be collected at the community SWF. Check ENR's document *Guideline for the Management of Waste Lead and Lead Paint* (attached) for more information.

Propane tanks and aerosol cans are regulated as a dangerous good and are a potential explosion hazard at all times. Propane tanks can be returned to the retailer or supplier for safe storage and transport. Trained staff can safely evacuate the propane gas, making the tanks safe for scrap metal. Large propane tanks and other compressed gas canisters from the industrial/commercial sector should not be collected at the community SWF.

Residue Fuel Tanks / Heating Oil Tanks / Residue Drums: Fuel storage tanks and drums often contain residue (e.g. sludge at the bottom), or may still contain flammable vapours. Tanks must be properly emptied prior to disposal as scrap metal. Empty drums need to be stored on their sides to prevent water from accumulating.

Used oil can be used as feedstock for a used oil furnace if the testing and other conditions in the *Used Oil and Waste Fuel Management Regulations Plain Language Guide* (attached) are met. Used oil can be stored in clearly labelled good quality tanks or drums. Do not let drums or pails be contaminated with glycol or solvents. Do not accept excessive volumes from the industrial/commercial sector.

Waste Fuel: Residents generate waste fuel from the use of gas-powered equipment and need a local disposal option. Waste fuel from residents can be bulked into UN-approved steel drums at Household Hazardous Waste collection events, or on a daily basis. The decision to accept waste fuel from residents on a daily basis requires appropriate screening methods to screen out incompatible materials from residents and excessive volumes of fuel or solvents from the industrial/commercial/institutional sector.

Vehicles: End-of-life vehicles contain antifreeze, batteries, fuel, mercury switches and other lubricating fluids that are considered hazardous waste and need to be removed. Once the hazardous materials are removed, the rest of the vehicle can be treated as scrap metal. Refrigerants from air conditioning systems will need to be removed by a trained technician.

Immediately Reportable Spill Quantities

TDG Class	Substance for NWT 24 Hour Spill Line	Immediately Reportable Quantities
1	Explosives	Any amount
2.3	Compressed gas (toxic)	
2.4	Compressed gas (corrosive)	
6.2	Infectious substances	
7	Radioactive	
None	Unknown substance	
2.1	Compressed gas (flammable)	Any amount of gas from containers with a capacity greater than 100 L
2.2	Compressed gas (non-corrosive, non-flammable)	
3.1	Flammable liquids	> 100 L
3.2		
3.3		
4.1	Flammable solids	> 25 kg
4.2	Spontaneously combustible solids	
4.3	Water reactant	
5.1	Oxidizing substance	> 50 L or 50 kg
9.1	Miscellaneous products or substances excluding PCB mixtures	
5.2	Organic peroxides	> 1 L or 1 kg
9.2	Environmentally hazardous	
6.1	Poisonous substances	> 5 L or 5 kg
8	Corrosive substances	
9.3	Dangerous wastes	
9.1	PCB mixtures of 5 or more ppm	> 0.5 L or 0.5 kg
None	Other contaminants (e.g., crude oil, drilling fluid, produced water, waste or spent chemicals, used or waste oil, vehicle fluids, waste water, etc.)	> 100 L or 100 kg
None	Sour natural gas (i.e., contains H2S), sweet natural gas	Uncontrolled release or sustained flow of 10 min or more

Note: In addition, all releases of harmful substances, regardless of quantity, are to be reported to the NWT spill line if the release is near or into a water body, is near or into a designated sensitive environment or sensitive wildlife habitat, poses imminent threat to human health or safety, poses imminent threat to a listed species at risk or its critical habitat, or is uncontrollable.

Source: AANDC, *Guidelines for Spill Contingency Planning*. April 2007

NT-NU SPILL REPORT

OIL, GASOLINE, CHEMICALS AND OTHER HAZARDOUS MATERIALS

NT-NU 24-HOUR SPILL REPORT LINE
Tel: (867) 920-8130 • Fax: (867) 873-6924 • Email: spills@gov.nt.ca

REPORT LINE USE ONLY

A	Report Date: MM DD YY	Report Time:	☐ Original Spill Report **OR** ☐ Update # _____ to the Original Spill Report	**Report Number:**
B	Occurrence Date: MM DD YY	Occurrence Time:		
C	Land Use Permit Number (if applicable):		Water Licence Number (if applicable):	
D	Geographic Place Name or Distance and Direction from the Named Location:		Region: ☐ NT ☐ Nunavut ☐ Adjacent Jurisdiction or Ocean	
E	Latitude: _____ Degrees _____ Minutes _____ Seconds		Longitude: _____ Degrees _____ Minutes _____ Seconds	
F	Responsible Party or Vessel Name:		Responsible Party Address or Office Location:	
G	Any Contractor Involved:		Contractor Address or Office Location:	
H	Product Spilled: ☐ Potential Spill	Quantity in Litres, Kilograms or Cubic Metres:	U.N. Number:	
I	Spill Source:	Spill Cause:	Area of Contamination in Square Metres:	
J	Factors Affecting Spill or Recovery:	Describe Any Assistance Required:	Hazards to Persons, Property or Environment:	
K	Additional Information, Comments, Actions Proposed or Taken to Contain, Recover or Dispose of Spilled Product and Contaminated Materials:			

L	Reported to Spill Line by:	Position:	Employer:	Location Calling From:	Telephone:
M	Any Alternate Contact:	Position:	Employer:	Alternate Contact Location:	Alternate Telephone:

REPORT LINE USE ONLY

N	Received at Spill Line by:	Position:	Employer:	Location Called:	Report Line Number:

Lead Agency: ☐ EC ☐ CCG/TCMSS ☐ GNWT ☐ GN ☐ ILA ☐ AANDC ☐ NEB ☐ Other: _____

Significance: ☐ Minor ☐ Major ☐ Unknown

File Status: ☐ Open ☐ Closed

Agency:	**Contact Name:**	**Contact Name:**	**Remarks:**
Lead Agency:			
First Support Agency:			
Second Support Agency:			
Third Support Agency:			

The Mackenzie Valley Land and Water Board

www.mvlwb.com

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Yellowknife, NT X1A 2P6

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Volume 2 -

Erosion and Sediment Control Plan Framework

PINE POINT
MINING LIMITED

Erosion and Sediment Control Plan Framework
for the
Pine Point Project

Purpose

This framework document is provided in support of the Mackenzie Valley Environmental Impact Review Board Environmental Assessment Initiation Package for the Pine Point Project (Project). The intent of this document is to describe how this environmental management plan relates to the Project, what information will be provided as the Project develops and to list applicable guidelines and standards. It was developed with the available Project information. This document is not intended for approval but is provided for review purposes and will be refined as the regulatory process proceeds.

Version History

Pine Point Mining Limited is responsible for the distribution, maintenance, and updating of this document. Changes that do not affect the intent of the document will be made as required (e.g., phone numbers, names of individuals). The table below indicates the version of this document, and a summary of revisions made.

Revision #	Section(s) Revised	Description of Revision	Issue Date
0	-	Framework version for MVEIRB EA Initiation Package	15 December 2020

Table of Contents

Tables

Figures

Appendices

Abbreviations

Abbreviation	Definition
BMPs	Best Management Practices
Cominco	Cominco Ltd.
EA	Environmental Assessment
ESCP	Erosion and Sediment Control Plan
PPML	Pine Point Mining Limited
Osisko Metals	Osisko Metals Incorporated
Project	Pine Point Project

Units of Measure

Units	Definition
%	percent
km	kilometre
m	metre

1 INTRODUCTION

1.1 Background

Pine Point Mining Limited (PPML) is the sole proponent of the Pine Point Project (Project) and is a 100% owned subsidiary of Osisko Metals Incorporated (Osisko Metals). Pine Point is a brownfield site and the location of the historical Pine Point Mine managed by Cominco Ltd. (Cominco), operated between 1964 and 1988. In February 2018, Osisko Metals acquired PPML and became owner of the Project. PPML is proposing to re-open the Pine Point Mine site to mine mineralized material and produce concentrates of zinc and lead for shipment to independent smelters worldwide

1.2 Purpose

The Erosion and Sediment Control Plan (ESCP) Framework is a requirement of the Environmental Assessment (EA) Initiation Package (MVEIRB 2018). It is intended to provide a preliminary outline of approaches to managing the release of sediments to watercourses. The ESCP Framework is meant to provide a basis for PPML to engage with regulatory agencies and Indigenous communities and elicit feedback on planned sediment and erosion control practices for the Project. A complete ESCP will be submitted to the Mackenzie Valley Land and Water Board for approval following the EA, and will incorporate feedback obtained through the EA.

Erosion and sedimentation are naturally occurring processes of loosening and transporting soil through the action of wind, water, or ice, and the subsequent transport and deposition of sediment particles. Construction activities can result in increased erosion and sedimentation where soil surfaces are exposed to rainfall or snowmelt and runoff, or wind erosion and aerial sediment transport.

1.3 Project Contact

Primary Pine Point Mining Limited Contact	Andrew Williams
Title	Environmental Manager
Address	1100 Avenue des Canadiens-de-Montréal, Bureau 300
City	Montreal
Province	Québec
Postal Code	H3B 2S2
Telephone	416-209-2056
Email	acwilliams@live.ca

1.4 Roles and Responsibilities

The Environmental Manager will be ultimately responsible for the success of this plan and approves all relevant policies and documents, auditing, action planning and the verification process. The Environmental Manager is responsible for the implementation of this plan including overall management of the plan, internal reporting, compliance, and adaptive management.

Other relevant personnel will be responsible for the effectiveness of this Plan by completing required training and supporting the implementation of and compliance to this Plan, as appropriate to their roles, as set out by this Plan.

1.5 Project Details

The Project is located in the South Slave Mining District, south of Great Slave Lake in the Northwest Territories (NWT), approximately 175 km directly south of Yellowknife, 75 km east of Hay River, and 53 km southwest of Fort Resolution (Figure 1). It is located on a brownfield site resulting from Cominco's historical mining and milling operations and includes the historical town of Pine Point and associated working accommodations. The closest major transportation hubs are Yellowknife and Hay River. Access to the Project is presently via all-weather Highways 5 and 6.

The Project will consist of open pit and underground mining for mineralized materials, construction and operation of up to three pre-concentration plants, construction and operation of a processing mill (or "concentrator"), storage and management of processed mineralized and waste materials, water management, construction and operation of ancillary support facilities including a camp for workers, and the shipping of zinc and lead concentrates to global markets. Further details are provided in the Project Description (Volume 1).

Maps indicating the Project footprint, infrastructure, storage locations of each hazardous material, probable spill locations and direction of flow on land and in water, catchment basins, locations of all response equipment, topography, approved disposal sites, and any other important on- or off-site features will be included when these details have been finalized.

LEGEND

- FORMER PINE POINT TOWN SITE
- POPULATED PLACE
- ALL-SEASON ROAD
- PARK/PROTECTED AREA
- WATERBODY
- GENERAL PROJECT LOCATION

0 25 50

1:1,250,000 KILOMETERS

REFERENCE(S)

1. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
2. PARKS AND PROTECTED AREAS OBTAINED FROM CONSERVATION AREAS REPORTING AND TRACKING SYSTEM (CARTS), CANADIAN COUNCIL ON ECOLOGICAL AREAS, 2017.

PROJECTION: ALBERS CONIC EQUAL AREA

CLIENT
PINE POINT MINING LTD.

PROJECT
PINE POINT PROJECT

CONSULTANT
GOLDER

YYYY-MM-DD	2020-10-07
DESIGNED	DC
PREPARED	BW / MM / JE
REVIEWED	DP
APPROVED	DP

TITLE
PROJECT LOCATION

PROJECT NO.	CONTROL	REV.	FIGURE
19125747		0	1

2 BEST MANAGEMENT PRACTICES SELECTION AND DESIGN

This section of the ESCP will outline the main Best Management Practices (BMPs) that will be considered and applied as appropriate during the Project. BMPs that may be relevant to the Project are outlined in the sections below.

2.1 Critical Areas

This section of the ESCP will describe the proposed land disturbances and construction activities associated with the Project. Where possible, information will be provided on locations where the land disturbance will occur in critical areas, in relation to the need for sediment and erosion control measures. Areas of disturbance on slopes, in areas of sand and fine-grained soils, and near waterbodies may be defined as critical areas.

2.2 Procedural Best Management Practices

Procedural BMPs are non-structural methods or procedures that can reduce erosion and sediment transport at a construction site. These include site management and scheduling practices that may use structural erosion or sediment control BMPs to achieve their goals. Commonly used procedural BMPs are provided in the following sections.

2.3 Site Management

Site management refers to the housekeeping and mitigation that will reduce the likelihood of erosion and sediment transport. Site management strategies include:

- **Project Footprint Minimization** – Construction boundaries will be carefully demarcated to restrict vegetation removal and soil disturbance to active development sites. No vegetation will be removed and no machinery will be permitted outside of these locations.
- **Exposed Soil Minimization** – By minimizing the total disturbed soil area and the disturbed soil area at any time, the erosion potential is reduced, and the quantity of sediment control measures is reduced. Note that tree cutting and removal is not equated with soil disturbance; this activity can be done with minimal disturbance of the understory.
- **Site Access Management** – The site should be accessible from only a limited number of points. Main access roads should be maintained to minimize the tracking of material off site.

2.4 Stockpile Management

Stockpiles of rock, topsoil, or other materials that may cause seepage or erosion should not be located within 100 m of waterbodies (i.e., lakes, ponds, or watercourses). However, should there be layout constraints that limit the placement of stockpiles and minimum setback distances that are not practical, mitigation, such as silt fence or diversion berms around the stockpile, will be used for stockpiles located where risks of sedimentation are posed. Stockpiles of material susceptible to wind erosion should be protected where reasonable to do so.

2.5 Structural Best Management Practices

Structural BMPs are methods that can reduce erosion and sediment transport at a construction site. These BMPs require the construction and physical implementation of a design to mitigate erosion or sediment. Commonly used structural BMPs are provided in the following sections.

2.6 Surface Water Management BMPs

Water management BMPs include on site and off site measures, focusing on surface water management.

- **Use of Existing Drainage** – Existing watercourses tend to be well-vegetated and have natural rates of erosion. Discharges from the construction site containing levels of sediment that meet water quality discharge criteria should be conveyed to existing, undisturbed watercourses.
- A**ppropriate Design of Drainage Channels** – Drainage channels will be designed and approved by a registered professional engineer to ensure appropriate depths, slopes, cross-sections, and linings (armoured or vegetated).
- **Flow Isolation** – Clean water drainage from upstream areas should be diverted around the construction site, where there is a possibility of erosion and wherever practical, to reduce the quantity of water that must be managed on site. This can be achieved using the water management system.
- **Diversion around Construction Site** – Strategically placed diversion ditches can help direct water movement on site by reducing the total amount of water and reducing its interaction with erosion prone sites.

2.7 Erosion Control BMPs

Erosion control BMPs are intended for application to exposed soils/sediments where there is a need to reduce the potential for erosion due to wind, rain splash, or flowing water. Preventing erosion at the source reduces the amount of sediment that needs to be managed by downstream sediment control measures. Erosion can be controlled by protecting surfaces from runoff (exposed surface protection), or by reducing the quantity or velocity of flow (runoff control).

- **Riparian Zone Preservation** – Watercourse erosion potential is considerably reduced by preserving natural vegetation, to reduce runoff velocity and enhance infiltration.
- **Slope Texturing/Grading** – The accumulation of water and its movement over a large soil surface can cause erosion which can be exaggerated by a topography promoting high runoff velocity. Recontouring methods and roughening up the surface area can help to reduce the risk of erosion. Recontouring the soil surface can reduce erosion by shortening the length and decreasing the angle of the slope. Texturing of slopes, either by roughening the surface, tracking the surface, or installing grooves or benches, reduces the runoff velocity, traps sediment, and increases the infiltration of water into the soil.
- **Energy Dissipater** – Rock riprap, gabions, or sandbags can be installed at areas such as culvert outlets or drop structures to reduce flow velocities and protect against erosion. Dissipaters with high flow rates should be designed by a qualified professional.

- **Mulching** – Application of organic material or other normally biodegradable substances as a protection layer to the soil surface to minimize raindrop/runoff erosion, conserve a desirable soil moisture property for plant growth, and to promote seed germination and plant growth.
- **Prevention of Rut Development** – Depending on the characteristics of soil and moisture content, and prior to the establishment of engineered roads, temporary trails may be utilized. Prevention of the formation of ruts can reduce the potential for water channelling which increases water energy and potential for erosion. Actions like corduroy road construction can limit this impact prior to engineered road construction in some cases.

2.8 Sediment Control BMPs

Sediment control BMPs are intended for application to flowing water where the risk assessment indicates the need to retain mobilized sediment. It is advisable to install sediment control measures within the construction site, close to the sediment source; this reduces the quantity of water that must be managed and reduces the consequences of a failure. Sediment control can be accomplished by filtering or settling sediment-laden runoff water.

- **Natural vegetation** – Runoff can be slowed through surface vegetation and trapped by infiltration or by settling as the flow velocity reduces within the vegetation.
- **Silt fencing** – A permeable fabric barrier installed vertically on support posts typically along contours to capture and filter sediment laden sheet flow runoff. It causes water to pond allowing sediment to settle out as water filters through fabric. It also entraps and minimizes coarse sediment from sheet flow or overland flow from entering waterbodies. It serves as a perimeter control for sediment transport and deposition. Alternative barriers of equivalent performance may also be used.
- **Runoff Ponds/Sediment Traps** – Low height dam enclosure for impoundment of sediment laden runoff, sedimentation of silt size particles, and release of treated runoff. They can be constructed by excavating a pond or building embankments above the original ground surface. Sediment traps can be used at the outlet of diversion ditches and at the outlet of any structure that carries sediment-laden runoff, promoting settlement of sediment prior to releasing water into downstream watercourses.

2.8.1 Dust Suppression

Water will be applied to specific locations as necessary during dry periods to increase soil cohesion.

3 INSPECTIONS, MAINTENANCE, AND REPORTING

An inspection program is required to quickly identify and correct any erosion and sediment control hazards and to ensure that structural BMPs are working as intended. This will be completed through a system of inspections, maintenance, and reporting. Additional details regarding inspections, maintenance, and reporting will be provided in subsequent versions of the ESCP when additional Project details are available.

3.1 Inspections

During construction, inspections will be done during periods of snow melt including freshet, as well as after significant precipitation events. Compliance with BMPs will also be evaluated during inspections. All inspections will be documented using a field form (see Appendix A for an example) and a photo log. If an erosion and sediment control measure is observed to be inadequate for the task it was designed to achieve, the measure will be adjusted or replaced. If changes are made due to inadequate performance of a measure, the changes will be brought to the attention of the Lands Inspector. Any non-conformance with the ESCP that is identified as a result of an inspection will result in the development of a corrective and/or preventive action plan.

3.2 Maintenance

Maintenance requirements for the erosion and sediment control measures are broken down by BMP type and shown with the associated inspection requirements in Table 1. The inspection for each BMP type is to occur before forecasted significant precipitation events and after significant runoff events.

Table 1: Erosion and Sediment Control Maintenance Requirements

BMP	Inspection/Maintenance Requirement
Silt Fence, checkdams, sediment traps	• Sediment shall be removed once upstream sediment accumulates to a depth 1/3 height of the silt fence • Inspect staking and if keyed into soil correctly • If damage is discovered, it shall be repaired as soon as possible
Perimeter and diversion berms	• If damage is discovered, it shall be repaired as soon as possible
Flow dissipaters	• Inspect for evidence of scouring, accumulation of sediment • If damage is discovered, it shall be repaired as soon as possible
Erosion control blankets	• Inspect staking and if there are any voids underneath • If damage is discovered, it shall be repaired as soon as possible
Slope Protection and Stockpiles	• Inspect for evidence of scouring, gullies or channeling • If damage is discovered, it shall be repaired as soon as possible

3.3 Reporting

An annual performance report and any changes to the ESCP will be included in the Water Licence Annual Report to the Mackenzie Valley Land and Water Board.

4 ADAPTIVE MANAGEMENT

Adaptive management is a structured, iterative process of decision making in the face of uncertainty, with an aim to reducing uncertainty over time via system monitoring. The policies and recommended mitigation measures described in this ESCP framework have been developed based on other northern mining project BMPs and will be further detailed in subsequent versions of the plan as additional Project details are available. A review process is required to ensure effectiveness and to incrementally improve performance of BMPs and site-specific erosion and sediment control measures. The ESCP is a living document, hence site conditions and lessons learned during implementation of erosion and sediment control measures at the Project site will be incorporated in subsequent versions of the ESCP.

5 REFERENCES

MVEIRB (Mackenzie Valley Environmental Impact Review Board). 2018. Draft EA Initiation Guidelines for Developers of Major Projects. Accessed March 2020. Available at http://reviewboard.ca/file/1132/download?token=c5tFrEqL

Appendix A Example Erosion and Sediment Control Inspection Form

INSPECTION AND MAINTENANCE FORM

Construction Site Location: ______________________ Contractors on Site: ______________

Heavy Equipment on Site: ______________________ Construction Activities on Site: ______________

Date: ______________________ Current Weather: ______________

Date of Last Inspection: ______________________ mm of rain in last 24hr: ______________

Type of Measure (BMP)	Location on Site	General Condition	General Performance	Maintenance Required	Type of Maintenance Required	Site Manager Notified	Date Repairs to be Completed By
		Poor / Fair / Good	Poor / Fair / Good	Y / N		Y / N	
		Poor / Fair / Good	Poor / Fair / Good	Y / N		Y / N	
		Poor / Fair / Good	Poor / Fair / Good	Y / N		Y / N	
		Poor / Fair / Good	Poor / Fair / Good	Y / N		Y / N	
		Poor / Fair / Good	Poor / Fair / Good	Y / N		Y / N	
		Poor / Fair / Good	Poor / Fair / Good	Y / N		Y / N	
		Poor / Fair / Good	Poor / Fair / Good	Y / N		Y / N	
		Poor / Fair / Good	Poor / Fair / Good	Y / N		Y / N	
		Poor / Fair / Good	Poor / Fair / Good	Y / N		Y / N	
		Poor / Fair / Good	Poor / Fair / Good	Y / N		Y / N	
		Poor / Fair / Good	Poor / Fair / Good	Y / N		Y / N	
		Poor / Fair / Good	Poor / Fair / Good	Y / N		Y / N	
		Poor / Fair / Good	Poor / Fair / Good	Y / N		Y / N	
		Poor / Fair / Good	Poor / Fair / Good	Y / N		Y / N	
		Poor / Fair / Good	Poor / Fair / Good	Y / N		Y / N	
		Poor / Fair / Good	Poor / Fair / Good	Y / N		Y / N	

Notes:

Inspector's Name: Inspector's Signature:

Volume 2 -

Mine Water Management Plan Framework

PINE POINT
MINING LIMITED

Mine Water Management Plan Framework
for the
Pine Point Project

Purpose

This framework document is provided in support of the Mackenzie Valley Environmental Impact Review Board Environmental Assessment Initiation Package for the Pine Point Project (Project). The intent of this document is to describe how this environmental management plan relates to the Project, what information will be provided as the Project develops and to list applicable guidelines and standards. It was developed with the available Project information. This document is not intended for approval but is provided for review purposes and will be refined as the regulatory process proceeds.

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Revision #	Section(s) Revised	Description of Revision	Issue Date
0	-	Framework version for MVEIRB EA Initiation Package	15 December 2020

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Abbreviations

Abbreviation	Definition
AEMP	Aquatic Effects Monitoring Program
EA	environmental assessment
Cominco	Cominco Ltd.
MVLWB	Mackenzie Valley Land and Water Board
NWT	Northwest Territories
PPML	Pine Point Mining Limited
SNP	Surveillance Network Program
Project	Pine Point Project
MWMP	Mine Water Management Plan

Units of Measure

Units	Definition
%	percent
km	kilometre

1 Introduction

1.1 Background

Pine Point Mining Limited (PPML) is the sole proponent of the Pine Point Project (Project) and is a 100% owned subsidiary of Osisko Metals Incorporated (Osisko Metals). Pine Point is a brownfield site and the location of the historical Pine Point Mine managed by Cominco Ltd. (Cominco), operated between 1964 and 1988. In February 2018, Osisko Metals acquired PPML and became owner of the Project. PPML is proposing to re-open the Pine Point Mine site to mine mineralized material and produce concentrates of zinc and lead for shipment to independent smelters worldwide.

1.2 Purpose

The Mine Water Management Plan (MWMP) Framework is a requirement of the Environmental Assessment (EA) Initiation Package (MVEIRB 2018). It is intended to provide a preliminary outline of approaches to managing water flow into, out from and within the Project footprint. The MWMP Framework is meant to provide a basis for PPML to engage with regulatory agencies and Indigenous communities and elicit feedback on planned water management activities and facilities for the Project. A complete MWMP will be submitted to the Mackenzie Valley Land and Water Board for approval following the EA, and will incorporate feedback obtained through the EA.

1.3 Objectives

The objective of the MWMP Framework is to provide an initial high-level outline of the MWMP for the Project to allow for engagement as part of the EA process and prior to applying for the Water Licence.

The overall objective of the MWMP will be to detail water management activities for the Project throughout all Project stages (i.e., construction, operations, closure, and post-closure). The MWMP will provide the necessary data to inform all stakeholders of the water management activities occurring related to the Project, and is one of the management plans that will be employed to make decisions on reducing the magnitude, frequency, and extent of effects on the environment.

1.4 Project Contacts

Primary Pine Point Mining Limited Contact	Andrew Williams
Title	Environmental Manager
Address	1100 Avenue des Canadiens-de-Montréal, Bureau 300
City	Montreal
Province	Québec
Postal Code	H3B 2S2
Telephone	416-209-2056
Email	acwilliams@live.ca

1.5 Roles and Responsibilities

The Environmental Manager will be ultimately responsible for the success of this plan and approves all relevant policies and documents, auditing, action planning and the verification process. The Environmental Manager is responsible for the implementation of this plan including overall management of the plan, internal reporting, compliance, and adaptive management.

Other relevant personnel will be responsible for the effectiveness of this Plan by completing required training and supporting the implementation of and compliance to this Plan, as appropriate to their roles, as set out by this Plan.

1.6 Project Details

The Project is located in the South Slave Mining District, south of Great Slave Lake in the Northwest Territories (NWT), approximately 175 km directly south of Yellowknife, 75 km east of Hay River, and 53 km southwest of Fort Resolution (Figure 1). It is located on a brownfield site resulting from Cominco's historical mining and milling operations and includes the historical town of Pine Point and associated working accommodations. The closest major transportation hubs are Yellowknife and Hay River. Access to the Project is presently via all-weather Highways 5 and 6.

The Project will consist of open pit and underground mining for mineralized materials, construction and operation of up to three pre-concentration plants, construction and operation of a processing mill (or "concentrator"), storage and management of processed mineralized and waste materials, water management, construction and operation of ancillary support facilities including a camp for workers, and the shipping of zinc and lead concentrates to global markets. Further details are provided in the Project Description (Volume 1).

Maps indicating the Project footprint, infrastructure, storage locations of each hazardous material, probable spill locations and direction of flow on land and in water, catchment basins, locations of all response equipment, topography, approved disposal sites, and any other important on- or off-site features will be included when these details have been finalized.

LEGEND

- FORMER PINE POINT TOWN SITE
- POPULATED PLACE
- ALL-SEASON ROAD
- PARK/PROTECTED AREA
- WATERBODY
- GENERAL PROJECT LOCATION

0 25 50

1:1,250,000 KILOMETERS

REFERENCE(S)

1. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
2. PARKS AND PROTECTED AREAS OBTAINED FROM CONSERVATION AREAS REPORTING AND TRACKING SYSTEM (CARTS), CANADIAN COUNCIL ON ECOLOGICAL AREAS, 2017.

PROJECTION: ALBERS CONIC EQUAL AREA

CLIENT
PINE POINT MINING LTD.

PROJECT
PINE POINT PROJECT

CONSULTANT
GOLDER

YYYY-MM-DD	2020-10-07
DESIGNED	DC
PREPARED	BW / MM / JE
REVIEWED	DP
APPROVED	DP

TITLE
PROJECT LOCATION

PROJECT NO.	CONTROL	REV.	FIGURE
19125747		0	1

2 Water Management Approach

This section describes water management terminology, objectives and strategies of water management, proposed water management facilities, and the proposed water management approach through the different stages of the Project.

2.1 Definitions

Mine water will need to be managed and monitored on site. The following main sources of mine water are identified:

- Surface mine water:
  - Runoff from Project areas collected in diversions, drainage ditches, and sumps.
  - Runoff and seepage from waste rock storage facilities, overburden piles, tailings disposal areas, and other stockpiles or bermed storage cells.
- Open pit mine water:
  - Groundwater inflow and runoff into open pits.
- Underground mine water:
  - Groundwater inflow and runoff into the underground mining areas.

Process water is water used in processing of mineralized material, including crushing, pre-concentrating, and milling, and is the liquid component of slurry. Process water will be recovered for reuse in processing of mineralized material from tailings thickening ponds as much as practical. Tailings will be deposited in a disposal areas as a slurry.

Natural runoff is runoff water from natural catchments. Natural runoff will be diverted away from the Project area where practical.

Discharge is direct or indirect release of any mine water or waste to a surface water receiving environment (i.e., typically a watercourse or waterbody).

Dewatering is the removal of some or all water from a water source.

2.2 Water Management Objectives and Strategies

The objectives of water management are to enable safe and timely mining operations at the Project, while minimizing adverse effects to the aquatic receiving environment in terms of water quantity, water quality, and aquatic life. The MWMP will be compliant with the Project's Water Licence and will provide the appropriate safeguards in respect to the Project's use and discharge of water.

The following strategies are planned to achieve the objectives:

- To the extent practicable, minimize the quantity of water used for construction and operational purposes.
- To the extent practicable, minimize the quantity of mine water through management and monitoring.
- To the extent practicable, manage potential acid-generation and metals leaching of stored run of mine or waste material and associated runoff.
- To the extent practicable, intercept and divert runoff from natural catchments away from the Project.
- If required, plan for the discharge of mine water to meet regulatory requirements and be protective of the aquatic receiving environment.
- Use experience and data from operations at the historical Cominco mine and other similar open pit and underground mines to develop sound management plans.
- Implement monitoring plans throughout the various states of mine development to allow for development of adaptive management strategies, as required.

2.3 Water Management Facilities

The Project is located on a brownfield site that contains some former infrastructure (i.e., roads) and water management facilities (i.e., drainage ditches and open pits) that may be used for the Project, although additional water management facilities may be required during the construction, operations, and closure phases of the Project. The locations, specifics, and design criteria of water management facilities for the Project are being evaluated and will be determined during the design process. Once developed, this section will present the following:

- water management design basis
- a description of the main water management facilities
- considerations for potential changes in hydrologic conditions
- additional water management considerations for future stages of design

The following facilities are currently planned to be used for water management during all phases of the Project:

- **Existing Open Pits** – Water will be stored in existing pits, which may include excess water from tailings, mine dewatering, dust suppression, and drainage systems from the vehicle and machinery maintenance facilities.
- **Septic System or Sewage Treatment** – All sewage and greywater from offices, camp services, and other domestic sources will be transferred to a septic system or sewage treatment, designed to meet all regulatory requirements.
- **Potable Water Treatment Plant** – Potable water will be needed for camp services and human consumption during all stages of the mine.

- **Re-injection Wells** – These wells are currently being evaluated as an alternative underground disposal method for groundwater withdrawn from the vicinity of open pits and underground mining areas. This groundwater will be pumped into re-injection wells and returned to the existing underground aquifer from which it originated.
- **Drainage Ditches** – The existing network of drainage ditches will be used when possible and maintained, modified or expanded, as required.
- **Pumping and Pipeline Systems** – Where required, pumps and pipelines will be installed for the purposes of water transfer for water management.
- **Water Management Ponds or Sumps** – Where required, water management ponds or sumps will be constructed to manage and store water for treatment or transfer.
- **Water Storage Lagoons** – Where required, water storage lagoons will be used as an alternative temporary storage location prior to treatment when mine water does not meet water quality discharge criteria for direct discharge to the environment.
- **Dry Sumps** – Where required, dry sumps will be constructed to provide emergency water storage.
- **Outfall** –If mine water discharge is required, an engineered outfall will be employed to mitigate scour and erosion when discharging into the surface water receiving environment.

The location and specifications of these water management facilities are being evaluated and will be determined during the design process.

2.4 Water Management Stages

The mine development plan for the Project is comprised of the following stages. Some stages may overlap (i.e., progressive reclamation and closure) whenever practical.

- **Construction** – when activities are mainly focused on the construction of infrastructure needed for production mining and processing and associated water management facilities.
- **Operations** – when activities are mainly focused on open pit and underground mining to produce mineral concentrates.
- **Closure** – occurs following completion of mining, when activities are mainly focused on reclaiming the areas affected by the Project, including the open pits and underground mine areas that were used for the Project.
- **Post-closure** – is the period after closure, when activities are mainly focused on monitoring, as required.

Currently, the duration of each development stage and the planned water management activities, including timing of construction of water management facilities, specific facility type, and location, are under evaluation.

3 Water Balance

Once mine development studies and planning has progressed (i.e., expected pit and underground dewatering and seepage, timing and concurrence of mining activities, planned milling throughput, and the number of workers on site during different development stages) and additional local hydrological and hydrometeorological data have been collected, a water balance model will be developed to inform the design of proposed water management infrastructure over the life of the mine from construction, operations, into closure. The water balance will determine the capacity of existing pits, and whether an operational mine water discharge will be required.

For preliminary discussion, the following water uses and sources of water that may be discharged have been identified and are presented without quantities in Table 1.

Table 1: Preliminary List of Potential Water Demands and Water to be Released/Discharged

Water Demand	Stage of Mine		
	Construction	Operations	Closure/Post-closure
Dust Suppressant	✓	✓	✓
Camp Facilities	✓	✓	✓
Vehicle Maintenance and Washing	✓	✓	✓
Concrete Mixing	✓	✓	✓
Emulsion Mixing	-	✓	-
Milling	-	✓	-
Water that may be Discharged	**Construction**	**Operations**	**Closure/Post-closure**
Camp Facilities	✓	✓	✓
Vehicle Maintenance and Washing	✓	✓	✓
Surface Mine Water	✓	✓	✓
Open-Pit Mine Water	✓	✓	-
Underground Mine Water	✓	✓	-
Process Water	✓	✓	-
Surface Water Runoff	✓	✓	✓
Waste Rock Storage Facilities	✓	✓	✓

4 Water Quality

A site water quality model will be developed based the final design of water management facilities and with additional water quality data to be collected. The water quality model will be developed to project water quality concentrations at relevant discharge sources during the life of the mine, particularly for operations when there is the potential for mine-related discharges into the receiving environment.

5 Mine Water Monitoring and Adaptive Management

The water balance and water quality models described in the previous sections will be based on data from field investigations conducted to date and from the experience of other northern projects in similar environments. Water quantity and quality monitoring during construction and operations will verify the modelled water quantity and quality predictions and compare against adaptive management thresholds, and assess the performance of the adaptive management strategies.

This section provides a summary of the proposed mine water monitoring, a brief summary of the proposed conceptual receiving environment monitoring program and aquatic response framework, and a description of possible adaptive management concepts. Details of the monitoring plans related to water management (e.g., the Aquatic Effects Monitoring Program [AEMP] and associated response framework and Surveillance Network Program [SNP]) will be finalized through the permitting process.

5.1 Mine Water Monitoring

Monitoring stations will be established to monitor the water quantity and quality of the mine water at the site associated with Project activities. This monitoring is generally associated with the SNP. The objective of this monitoring is to verify assumptions made in the development of the site water balance and water quality models, the EA, and to trigger targeted adaptive management strategies where required to meet environmental protection objectives. Data collected as part of this monitoring program are made available through the Mackenzie Valley Land and Water Board (MVLWB).

The monitoring would be initiated at the construction stage of the Project and will continue through closure and post-closure. Specific details of the program will differ across the Project phases to best reflect current mine activities and potential effects. Once additional details are available, this section will provide a summary of the key components of the monitoring program for the Water Licence review process.

5.1.1 Construction

During construction, site monitoring would consist of SNP monitoring, as well as regular inspection of the performance of diversions of natural runoff, road culverts, and erosion and sediment control features that will be installed as part of the implementation of best management practices. Inspections during freshet and other high runoff events will also be completed. Inspections of water management facility performance will continue throughout the construction phase. Some monitoring specific to construction activities will be carried out. The details of this monitoring will be developed as more detailed design information is available and finalized during the regulatory process.

5.1.2 Operations

During the operations stage, mine water monitoring under the SNP will be an important part of overall mine water management for the Project. The details of this monitoring will be developed as detailed design information becomes available and finalized during the regulatory process.

5.1.3 Closure

During closure, SNP monitoring, monitoring specific to Project closure activities, such as, back-flooding, sediment and erosion control measures, removal of facilities, reclamation activities and other closure procedures, will be carried out. The details of this monitoring will be developed as detailed design information becomes available and finalized during the regulatory process

5.1.4 Post-Closure

Monitoring for physical and chemical stability and maintenance of the facilities reclaimed for the Project will be required after closure and into post-closure until closure objectives and criteria are satisfactorily demonstrated. The schedule and program for monitoring and maintenance will be developed through the Interim Closure and Reclamation Plan to be developed in the regulatory process. The post-closure monitoring program will use the monitoring programs from the operations and closure stages of the proposed Project as a basis and will be adapted to meet post-closure needs. The details of this monitoring will be developed as detailed design information becomes available and finalized during the regulatory process.

5.2 Receiving Environment Monitoring Program and Aquatic Response Framework

Monitoring will be conducted in the aquatic receiving environment downstream of the proposed Pine Point Mine as per the AEMP that will be conducted under the Water Licence for the Project. This will be a seasonal program that is reported on annually, as per the established practice as defined by the MVLWB. An aquatic response framework will also be developed to allow for an adaptive management approach.

Depending on final Project design and the outcome of the EA, it is anticipated that the AEMP will include the monitoring components of hydrology, water quality, and fish health. Locations of monitoring in the aquatic receiving environment and reference areas will be determined during the AEMP design process and will be part of a separate monitoring plan. An AEMP framework is provided in Volume 2.

5.3 Adaptive Management

Throughout all phases of the mine life, PPML is committed to implementing effective adaptive management strategies, where applicable. Data collected as part of the monitoring program will be used to assess the need for adaptive management. Adaptive management strategies may involve improvement or modifications of environmental management plans (such as the MWMP), or temporary use of the contingency allowances included in the design of water management facilities.

The water management structures will be designed to provide for contingency (e.g., minimum operational freeboard for water retaining structures, and safety factor included in the design of the pumping systems), which allows accommodating unexpected hydrologic and operational conditions, as required. Potential adaptive management measures range in scale from construction of additional diversion structures, increasing pumping capacity, increasing water treatment capacity, increasing mine water storage capacity to implementing adjustments to the water management strategies.

Further details on the adaptive management measures applied to specific water management facilities will be developed during the design process. Adaptive management measures will also include water quantity, water quality, and other strategies related to changing water conditions on site.

6 References

MVLWB and AANDC (Mackenzie Valley Land and Water Board and Aboriginal Affairs and Northern Development Canada). 2013. Guidelines for the Closure and Reclamation of Advanced Mineral Exploration and Mine Sites in the Northwest Territories. Accessed March 2020. Available at https://mvlwb.com/sites/default/files/documents/wg/WLWB_5363_Guidelines_Closure_Reclamation_WR.pdf

MVEIRB (Mackenzie Valley Environmental Impact Review Board). 2018. Draft EA Initiation Guidelines for Developers of Major Projects. Accessed March 2020. Available at http://reviewboard.ca/file/1132/download?token=c5tFrEqL

Appendix A Project Maps

Maps will be provided in a subsequent version showing planned water management infrastructure at various development stages.

Volume 2 -

Waste Management Plan Framework

PINE POINT
MINING LIMITED

Waste Management Plan Framework
for the
Pine Point Project

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0	-	Framework version for MVEIRB EA Initiation Package	15 December 2020

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Figures

Appendices

Abbreviations

Abbreviation	Definition
Cominco	Cominco Ltd.
GNWT-ENR	Government of the Northwest Territories, Environment and Natural Resources
MVLWB	Mackenzie Valley Land and Water Board
NWT	Northwest Territories
Osisko Metals	Osisko Metals Incorporated
PPML	Pine Point Mining Limited
Project	Pine Point Project
TDG	Transportation of Dangerous Goods

Units of Measure

Unit of Measure	Definition
%	percent
km	kilometre
L	litre

1 Introduction

1.1 Background

Pine Point Mining Limited (PPML) is the sole proponent of the Pine Point Project (Project) and is a 100% owned subsidiary of Osisko Metals Incorporated (Osisko Metals). Pine Point is a brownfield site and the location of the historical Pine Point Mine managed by Cominco Ltd. (Cominco), which was operated between 1964 and 1988. In February 2018, Osisko Metals acquired PPML and became owner of the Project. PPML is proposing to re-open the Pine Point Mine site to mine mineralized material and produce concentrates of zinc and lead for shipment to independent smelters worldwide

1.2 Purpose

The Waste Management Plan Framework is a requirement of the Environmental Assessment (EA) Initiation Package (MVEIRB 2018). It is intended to provide a preliminary outline of approaches to managing Project waste. The Waste Management Plan Framework is meant to provide a basis for PPML to engage with regulatory agencies and Indigenous communities and elicit feedback on planned waste management activities and facilities for the Project. A final Waste Management Plan will be submitted to the Mackenzie Valley Land and Water Board for approval following the EA, and will incorporate feedback obtained through the EA.

The goals of this Waste Management Plan Framework are to:

- Identify waste streams and areas for waste reduction or reuse.
- Comply with all regulations, whether federal, territorial, or local.
- Reduce the environmental impact of operations.
- Minimize impacts on land use by other groups.
- Protect aesthetics in the camp area.
- Identify, label, store and transport all hazardous waste and dispose of at appropriate licensed disposal facilities.
- Meet PPML Environmental Policy commitments.

PPML will comply with applicable territorial and federal legislation. The relevant major acts, regulations and guidelines include:

Territorial

- *Environmental Protection Act*
- *Used Oil and Waste Fuel Management Regulations*
- *Transportation of Dangerous Goods Act*
- *Waste Reduction and Recovery Act*
- *Waters Act* and *Regulations*
- *Guidelines for Developing a Waste Management Plan* (MVLWB 2011)

- *Guidelines for Ambient Air Quality Standards in the Northwest Territories* (GNWT-ENR 2014)
- *Guideline for the Design, Operation, Monitoring, Maintenance and Closure of Petroleum Hydrocarbon-Contaminated Soil Treatment Facilities in the Northwest Territories* (LWBMV 2020)
- *Guideline for Hazardous Waste Management* (GNWT-ENR 2017)
- *Guideline for the Management of Waste Batteries* (GNWT-ENR 1998a)
- *Guideline for the Management of Waste Antifreeze* (GNWT-ENR 1998b)
- *Guideline for the Management of Waste Solvents* (GNWT-ENR 1998c)
- *Guideline for the Management of Waste Paint* (GNWT-ENR 1998d)

Federal

- *Transportation of Dangerous Goods Act*
- *Canadian Environmental Protection Act*
- *Mackenzie Valley Resource Management Act*

This Waste Management Plan framework has been developed to support the EA Initiation Package to be submitted to the Mackenzie Valley Environmental Impact Review Board. An updated Waste Management Plan for the Project will be developed during the permitting phase of the Project, or earlier if required, once additional Project details are available, and will incorporate relevant feedback and commitments made by PPML during the environmental assessment review process.

1.3 Project Contact

Primary Pine Point Mining Limited Contact	Andrew Williams
Title	Environmental Manager
Address	1100 Avenue des Canadiens-de-Montréal, Bureau 300
City	Montreal
Province	Québec
Postal Code	H3B 2S2
Telephone	416-209-2056
Email	acwilliams@live.ca

1.4 Roles and Responsibilities

The Environmental Manager will be ultimately responsible for the success of this plan and approves all relevant policies and documents, auditing, action planning and the verification process. The Environmental Manager is responsible for the implementation of this plan including overall management of the plan, internal reporting, compliance, and adaptive management.

Other relevant personnel will be responsible for the effectiveness of this Plan by completing required training and supporting the implementation of and compliance to this Plan, as appropriate to their roles, as set out by this Plan.

1.5 Project Details

The Project is located in the South Slave Mining District, south of Great Slave Lake in the Northwest Territories (NWT), approximately 175 km directly south of Yellowknife, 75 km east of Hay River, and 53 km southwest of Fort Resolution (Figure 1). It is located on a brownfield site resulting from Cominco's historical mining and milling operations and includes the historical town of Pine Point and associated working accommodations. The closest major transportation hubs are Yellowknife and Hay River. Access to the Project is presently via all-weather Highways 5 and 6.

The Project will consist of open pit and underground mining for zinc and lead, construction and operation of up to three pre-concentration plants, construction and operation of a processing mill (or "concentrator"), storage and management of processed mineralized materials and waste materials, water management, construction and operation of ancillary support facilities including a camp for workers, and the shipping of zinc and lead concentrates to global markets. Further details are provided in the Project Description (Volume 1).

Maps indicating the Project footprint, infrastructure, storage locations of each hazardous material, probable spill locations and direction of flow on land and in water, catchment basins, locations of all response equipment, topography, approved disposal sites, and any other important on- or off-site features will be included in subsequent versions of the Waste Management Plan when these details have been finalized.

2 Waste Stream Hierarchy

A waste management hierarchy is useful in identifying what waste management strategies are more desirable. The methods and definitions are based on the *Guidelines for Developing a Waste Management Plan* (MVLWB 2011). In order of preference (from the most preferable to the least), the options to be considered for each type of waste or potential waste generated by the Project are:

- **Source Reduction** – Elimination or decrease of the volume, mass, and toxicity of waste generated.
- **Reuse** – Reuse of a product more than once for the same or different purpose, either on or off site.
- **Recycle/Recovery** – Materials otherwise destined for disposal are collected, processed, and remanufactured whether on or off site. For this Project, recyclables (e.g., beverage containers, tin cans, plastics, and glass) will be collected and handed into an appropriate recycling facility.
- **Treatment** – Method to reduce the volume, mass, and/or toxicity prior to disposal.
- **Release to the Receiving Environment** – Least desirable option, often involving landfilling or other storage and containment options.

LEGEND

- FORMER PINE POINT TOWN SITE
- POPULATED PLACE
- ALL-SEASON ROAD
- PARK/PROTECTED AREA
- WATERBODY
- GENERAL PROJECT LOCATION

0 25 50

1:1,250,000 KILOMETERS

REFERENCE(S)

1. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
2. PARKS AND PROTECTED AREAS OBTAINED FROM CONSERVATION AREAS REPORTING AND TRACKING SYSTEM (CARTS), CANADIAN COUNCIL ON ECOLOGICAL AREAS, 2017.

PROJECTION: ALBERS CONIC EQUAL AREA

CLIENT
PINE POINT MINING LTD.

PROJECT
PINE POINT PROJECT

CONSULTANT
GOLDER

YYYY-MM-DD	2020-10-07
DESIGNED	DC
PREPARED	BW / MM / JE
REVIEWED	DP
APPROVED	DP

TITLE
PROJECT LOCATION

PROJECT NO.	CONTROL	REV.	FIGURE
19125747		0	1

3 Definitions

Under the authority of the *Environmental Protection Act*, the Government of the Northwest Territories, Environment and Natural Resources (GNWT-ENR) has produced a series of Environmental Guidelines for the management of specific hazardous wastes commonly produced by NWT industries. The Environmental Guidelines for the management of waste solvents, hydrocarbons, batteries, antifreeze, asbestos, paint, and ozone depleting substances have been referred to during the preparation of this plan.

The *Guideline for Hazardous Waste Management* (GNWT-ENR 2017) in the NWT provides definitions of terms used in the *Environmental Protection Act* and Environmental Guidelines and describes the principles of acceptable waste management practice. The following definitions are particularly important to this document.

Hazardous Waste: A contaminant which is no longer used for its original purpose and is intended for recycling, treatment, disposal, or storage and is:

- a dangerous good according to the *Transportation of Dangerous Goods Regulations* (TDG Regulations)
- leachable waste
- hazardous to the aquatic environment
- waste containing dioxins and furans
- contaminated soil/snow/water from a contaminated site
- drilling waste
- listed waste
- any other waste deemed hazardous

Hazardous waste does not include a material that is:

- authorized for on-site disposal by the applicable regulator for the specific activity in which the hazardous waste was generated
- household hazardous waste being transported to a municipal collection depot
- included in Class 1, Explosives or Class 7, radioactive materials of TDG Regulations
- exempted as a small quantity
- an empty container
- goods that are defective, surplus, or otherwise not usable for their intended purpose and that are in the process of being returned directly to a manufacturer or supplier

Empty Container: A container from which all:

- Hazardous waste has been emptied, to the greatest extent possible, using regular handling procedures. Its contents shall not exceed 0.1 percent (%) of the container's original capacity or 0.2 litres (L), whichever is less. This does not include toxic gas in Class 2.3 of the TDG Regulations or containers which previously came in direct contact with:
    - Substances in Class 6.1 Packing Group I materials of the TDG Regulations.
    - Severely toxic contaminants.
- Flammable vapours have been reduced to less than twenty percent (20%) of the lower explosive limit for the material by purging, venting, or by the introduction of an inert material.

Small Quantity: Hazardous waste that is generated in any month is not greater than the amount in column II of Schedule V corresponding to the type of hazardous waste, or the aggregate quantity accumulated at any one time is not greater than the amount in column II of Schedule V (GNWT-ENR 2017) corresponding to the type of hazardous waste.

Schedule V: Small Quantity Threshold for Types of Hazardous Waste

Column I: Hazardous Waste Types	Column II: Amount
1. All hazardous waste unless otherwise specified	5 Kg or L
2. Dangerous Goods Class 6.1 (Packing Group 1)	1 kg or L
3. Waste batteries	50 kg
4. Contaminated snow/water	20 kg or L
5. Contaminated Soil	500 kg
6. Waste Glycol	20 L
7. Incinerator ash	20 Kg
8. Waste paint	20 kg or L
9. Used Oil	20 L
10. Leachable waste containing severely Toxic Contaminants	1 kg or L
11. Severely Toxic Contaminants in pure form	n/a hazardous waste in any quantity

4 Identification of Waste Types

Waste stream management involves the appropriate identification, segregation, and handling of different waste streams. The types of waste that may be generated during the Project can be categorized as:

- non-hazardous, non-mineral wastes
- recyclable and reusable material
- non-hazardous, combustible waste
- non-hazardous, non-combustible waste

- hazardous waste
- wastewater

A summary of the types of waste is provided below. As additional Project details become available, subsequent versions of the Waste Management Plan will include additional details regarding the types of wastes that will be generated by the Project and primary disposal methods.

4.1 Non-Hazardous, Non-Mineral Wastes

Non-hazardous, non-mineral wastes generated during construction will primarily include domestic wastes, vegetation from clearing operations, bulky metals (vehicles, equipment), and rubber products (tires). Disposal method to be included.

4.2 Recyclable and Reusable Material

All material appropriate for recycling (i.e., beverage containers, tin cans, plastics, and glass) will be identified, segregated, bagged, and shipped to an appropriate recycling facility.

Some select items can be sent back to the manufacturer for recycling or reuse. Large, reusable containers such as drums and metal parts from heavy equipment that can be sent back to the supplier for reconditioning and reuse.

4.3 Non-Hazardous, Combustible Waste

Clean wood waste, which is not painted and is not pressure treated can be incinerated on site. In addition to clean wood waste, food waste, paper and cardboard can also be incinerated. Should incineration of waste occur, the make and model of the incinerator and the standard operating procedure including training requirements and record keeping will be appended to this plan. Any ash generated from incineration of waste will be sampled and tested for leachable metals as well as dioxins and furans to confirm the absence of contaminants prior to disposal in solid waste facilities in the NWT.

4.4 Non-Hazardous, Non-combustible Waste

Food waste, combustible attractants and clean wood waste and cardboard will likely be incinerated on-site. Waste material which cannot be incinerated or recycled / reused will be identified, segregated, packaged and may be shipped off site for disposal or, if inert, can be placed in the landfill on site.

4.5 Hazardous Waste

The mining operation will use various hazardous materials including diesel, gasoline, lubricating and waste oil, antifreeze/glycol and propane, as required for heavy equipment operation, heating, back-up power generation, and small vehicles. All chemicals and fuels will be brought to site by trucks and will be stored in a secured area with adequate secondary containment. The Spill Contingency Plan will document mitigation to reduce the likelihood of spills and document spill response measures. Hazardous waste will be stored on-site in a secure area and removed by a suitably licenced hazardous waste handler for proper disposal at a licenced facility.

The GNWT-ENR defines hazardous waste in Schedule V of the *Guideline for Hazardous Waste Management* (GNWT-ENR 2017). This includes, among others, waste batteries, waste paint, waste glycol, incinerator ash, and used oil above certain quantities.

Based on the GNWT-ENR (2017) guidelines, on-site materials which are considered hazardous waste are:

- diesel and gasoline
- waste paint and solvents
- antifreeze, glycol, and propane
- lubricating and waste oil

These materials will be stored and transported in accordance with the above-mentioned guidelines and standard practice.

4.6 Waste Water

Sewage from the office, camp, and other potential locations will be sent to a treatment facility. Treated domestic effluent will be discharged to the septic field or may be discharged to a waterbody if it meets effluent criteria. This will be further described in an updated version of the plan during the permitting phase of the Project, or earlier if required, once additional Project details are available.

5 Waste Management Facilities

Various wastes will be generated during the construction and operation of the Project. It is essential that these wastes are handled, stored, and managed in a safe and environmentally responsible manner. Waste management facilities will be constructed to meet guidelines. Some wastes may also be transported off-site to municipal or third-party waste management facilities. A summary of the primary waste management facilities is provided below.

5.1 Waste Transfer Storage Area

The waste transfer storage area will be established near the process plant/accommodation complex for the handling and temporary storage of wastes and recyclables. Non-food waste products that are not incinerated or placed in the landfill immediately will be collected, sorted, and placed in designated areas within the storage area. The waste transfer storage area will include a lined and enclosed pad for the collection and subsequent return of hazardous waste to suppliers or to a hazardous waste disposal facility. It will be fenced to prevent wildlife from entering and human access will be controlled.

5.2 Landfill

The active landfill will be located within a combination of completed open pits, small areas of the mine rock piles, tailings disposal areas, or overburden stockpiles. Some landfill material may be shipped off site to a licensed facility when required. The landfill will receive inert bulk waste that cannot be recycled or re-used such as conveyor belts, tires, chute liners, and building debris. Incinerator ash from the combustion of kitchen and office waste will go to the landfill.

Landfill waste will be buried to minimize exposure to wind and care will be taken to prevent the presence of wastes that could attract wildlife. The landfill in the mine rock piles will represent a single landfill in operation at any given time, which will be covered and buried as mine rock piles or overburden piles are completed. As the landfill area(s) would be in the waste rock storage facilities or overburden piles, any potential runoff and seepage from the landfill area will be contained within the Project site.

5.3 Landfarm

A landfarm for the bioremediation of hydrocarbon contaminated solids from spills may be constructed, following the applicable guidelines (LWBMV 2020). This dyke bounded cell would be located adjacent to the fuel storage area and would consist of an arctic geo-membrane liner placed under fill material. Hydrocarbon-contaminated soils would be placed in the landfarm and spread during summer months. Any soil that has subsequently reached acceptable levels of hydrocarbon degradation would be removed and reused or transferred to the landfill.

Arctic conditions may impede the remediation of contaminated soil through natural microbiological processes. If remediation of hydrocarbon-contaminated soils in the landfarm proves to be ineffective and no other remediation system has proved effective in northern climates, the contaminated soils will be collected and shipped to suitable licensed disposal facilities.

5.4 Incinerators

Two dual-chamber, diesel-fired incinerators will be provided for the incineration of combustible waste, including kitchen waste. The incinerators can also be used to burn waste oil. Incinerator ash will be collected in sealed, wildlife-resistant containers, and transported to the landfill.

Each modular unit will be pre-assembled and will be housed in a pre-engineered module accessible from the accommodation complex or the waste management transfer storage area. The facility will be capable of meeting the demand of the construction workforce housed in the construction camp. The transport of waste to nearby landfill sites for disposal is also an option if required. Currently, removal of some combustible wastes to an off-site facility is also being considered to limit the amount of waste incinerated at the Project.

5.5 Domestic Sewage Treatment System

A sewage treatment system to handle a peak load of up to 500 people will be provided as part of initial construction. Treated domestic effluent will be discharged to the septic field, other treatment system or discharged to the aquatic environment if it meets effluent criteria. If may also be shipped off-site if required. Sewage sludge will be dewatered and incinerated on-site or transported to a licensed facility.

5.6 Monitoring, Inspections, Maintenance, and Reporting

An inspection program will be required for all waste storage areas at the Project to identify any non-compliances and to confirm any applied Best Management Practices are working as intended. Inspections must verify that:

- Secondary containment is in place and adequate (i.e., no debris / water build-up present limiting containment).
- Waste containers are labelled as to their contents and date.
- Waste storage areas housekeeping is adequate.
- Waste is not stockpiled and is being regularly transported off site for disposal.
- There are no signs of leaks or spills.
- There is no evidence of wildlife being attracted to waste storage areas.
- Landfill site is monitored and inspected.

Inspections will be documented, and records retained. Where non-conformances are noted during inspection, corrective action must be taken, and a record of completion retained.

6 Training

PPML will be responsible for providing training to all employees and contractors. A training session on the Waste Management Plan will be held for all employees and contractors involved in environmental monitoring. The training session will review the Plan and include information on:

- individuals' roles and responsibilities
- identification of the various types of waste
- instructions on how waste streams are separated and managed

TDG Regulation training will be provided to any employees responsible for the coordination of hazardous waste (i.e., dangerous goods) shipments off-site. Only TDG trained employees will prepare, review, and sign waste manifests, in accordance with regulatory requirements.

7 References

Acts and Regulations Cited

Territorial

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MVEIRB (Mackenzie Valley Environmental Impact Review Board). 2018. Draft EA Initiation Guidelines for Developers of Major Projects. Accessed March 2020. Available at http://reviewboard.ca/file/1132/download?token=c5tFrEqL

Appendix A Project Maps

To be provided in final Waste Management Plan.

Appendix B: Schematic of Temporary Waste Storage at Camp Location

To be provided in final Waste Management Plan.

Appendix C: Additional Information

To be provided in final Waste Management Plan.

1) Waste management log form
2) Sewage management system (manufacturer, operating procedure, draft log)
3) Additional waste management facility approvals and/or hazardous waste operators

Volume 2 -

Tailings and Waste Rock Management Plan Framework

PINE POINT
MINING LIMITED

Tailings and Waste Rock Management Plan Framework
for the
Pine Point Project

Purpose

This framework document is provided in support of the Mackenzie Valley Environmental Impact Review Board Environmental Assessment Initiation Package for the Pine Point Project (Project). The intent of this document is to describe how this environmental management plan relates to the Project, what information will be provided as the Project develops, and to list applicable guidelines and standards. It was developed with the available Project information. This document is not intended for approval but is provided for review purposes and will be refined as the regulatory process proceeds.

Version History

Pine Point Mining Limited is responsible for the distribution, maintenance, and updating of this document. Changes that do not affect the intent of the document will be made as required (e.g., phone numbers, names of individuals). The table below indicates the version of this document, and a summary of revisions made.

Revision #	Section(s) Revised	Description of Revision	Issue Date
0	-	Framework version for MVEIRB EA Initiation Package	15 December 2020

Table of Contents

Tables

Figures

Abbreviations

Abbreviation	Definition
ABA	Acid-Base Accounting
Cominco	Cominco Ltd.
EA	Environmental Assessment
HSE	Health, Safety, and Environment
Osisko Metals	Osisko Metals Incorporated
PPML	Pine Point Mining Limited
Project	Pine Point Project
TDA	tailings disposal area
TWRMP	Tailings and Waste Rock Management Plan

Units of Measure

Units	Definition
%	percent
km	kilometre
m	metre

1 Introduction

1.1 Background

Pine Point Mining Limited (PPML) is the sole proponent of the Pine Point Project (Project) and is a 100% owned subsidiary of Osisko Metals Incorporated (Osisko Metals). Pine Point is a brownfield site and the location of the historical Pine Point Mine managed by Cominco Ltd. (Cominco), operated between 1964 and 1988. In February 2018, Osisko Metals acquired PPML and became owner of the Project. PPML is proposing to re-open the Pine Point Mine site to mine mineralized material and produce concentrates of zinc and lead for shipment to independent smelters worldwide.

1.2 Purpose

The Tailings and Waste Rock Management Plan (TWRMP) Framework is a requirement of the Environmental Assessment (EA) Initiation Package (MVEIRB 2018). It is intended to provide a preliminary outline of approaches to managing Project tailings and mine rock. The TWRMP Framework is meant to provide a basis for PPML to engage with regulatory agencies and Indigenous communities and elicit feedback on planned waste management activities and facilities for the Project. A complete TWRMP will be submitted to the Mackenzie Valley Land and Water Board for approval following the EA, and will incorporate feedback obtained through the EA.

The purpose of the TWRMP is to address the management of mined waste rock and tailings to limit the generation of acidic drainage and metal leaching. Physical stability of placed waste rock and management of waste rock from historical mining is not within the scope of this plan.

The TWRMP provides information on:

- country rock geology
- country rock geochemistry
- waste rock classification
- decision criteria for waste rock storage and use
- waste rock management responsibilities
- tailings disposal

Key objectives of PPML waste rock management include:

- Identifying potentially acid-generating waste rock during mining.
- Directing appropriate use and storage of waste rock types.

PPML strategies to achieve these objectives include:

- Standard Operating Procedures to provide clear identification, segregation, storage, and re-mining procedures.
- Criteria for waste rock used in construction.
- Tracking locations of potentially acid-generating waste rock.

1.3 Project Contact

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Province	Québec
Postal Code	H3B 2S2
Telephone	416-209-2056
Email	acwilliams@live.ca

1.4 Roles and Responsibilities

The Environmental Manager will be ultimately responsible for the success of this plan and approves all relevant policies and documents, auditing, action planning and the verification process. The Environmental Manager is responsible for the implementation of this plan including overall management of the plan, internal reporting, compliance, and adaptive management.

Other relevant personnel will be responsible for the effectiveness of this Plan by completing required training and supporting the implementation of and compliance to this Plan, as appropriate to their roles, as set out by this Plan.

1.5 Project Details

The Project is located in the South Slave Mining District, south of Great Slave Lake in the Northwest Territories, approximately 175 km directly south of Yellowknife, 75 km east of Hay River, and 53 km southwest of Fort Resolution (Figure 1). It is located on a brownfield site resulting from Cominco's historical mining and milling operations and includes the historical town of Pine Point and associated working accommodations. The closest major transportation hubs are Yellowknife and Hay River. Access to the Project is presently via all-weather Highways 5 and 6. Further details are provided in the Project Description (Volume 1, Section 1.0).

The Project will consist of open pit and underground mining for zinc and lead, construction and operation of up to three pre-concentration plants, construction and operation of a processing mill (or "concentrator"), storage and management of processed mineralized materials and waste materials, water management, construction and operation of ancillary support facilities including a camp for workers, and the shipping of zinc and lead concentrates to global markets. Further details are provided in the Project Description (Volume 1).

Maps indicating the Project footprint, infrastructure, storage locations of each hazardous material, probable spill locations and direction of flow on land and in water, catchment basins, locations of all response equipment, topography, approved disposal sites, and any other important on- or off-site features will be included when these details have been finalized.

LEGEND

- FORMER PINE POINT TOWN SITE
- POPULATED PLACE
- ALL-SEASON ROAD
- PARK/PROTECTED AREA
- WATERBODY
- GENERAL PROJECT LOCATION

0 25 50

1:1,250,000 KILOMETERS

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PROJECTION: ALBERS CONIC EQUAL AREA

CLIENT
PINE POINT MINING LTD.

PROJECT
PINE POINT PROJECT

CONSULTANT
GOLDER

YYYY-MM-DD	2020-10-07
DESIGNED	DC
PREPARED	BW / MM / JE
REVIEWED	DP
APPROVED	DP

TITLE
PROJECT LOCATION

PROJECT NO.	CONTROL	REV.	FIGURE
19125747		0	1

2 Description of Pine Point Geology and Rock Types

2.1 Pine Point Rock Geology

The Project is divided into six zones: the East Mill Zone, the North Zone, the North-East Zone, the Central Zone, and the N-204 Zone all of which are mainly located east of the Buffalo River. The West Zone is located west of the Buffalo River.

The recoverable minerals at Pine Point are sphalerite (zinc sulphide) and galena (lead sulphide), which are hosted in dolomitic limestone with minor amounts of marcasite (iron sulphide) that is locally associated with some of the deposits. The deposits occur in varying shapes and thicknesses but basically fall into two categories: Tabular and Prismatic.

Tabular deposits may extend along strike for several kilometres at varying lateral widths from 50 to 200 m wide, and usually between 5 to 10 m in thickness. Prismatic deposits have a more vertical cylindrical morphology or shape, and often are not larger in diameter than their vertical dimension. The deposits to be mined are both tabular and prismatic and hosted within similar stratigraphy as those deposits previously mined by Cominco in this area.

The mineral deposits in the sector east of the Buffalo River are shallower and are anticipated to be mined mainly from surface (open-pit mining). The mineral deposits located west of the Buffalo River are deeper and will likely require underground mining. Mining methods will be optimized for each deposit and will vary depending on their respective conditions. Mine dewatering requirements and methods are also being evaluated based on past experience and studies. Dewatering methods are anticipated to be variable for each zone based on the site conditions. In contrast, the shallow open pits in the East Mill Zone area will be relatively dry except for surface water inflow.

The potential for acid generation was tested by acid-base accounting (ABA) analysis on a total of 82 samples and the results are presented in TetraTech (2018). The ABA analyses completed included determination of paste pH, total carbon, inorganic total sulphur, sulphate sulphur, sulphide sulphur, neutralization potential (NP), and fizz rating. The analyzed samples are consistently classified as non-potentially acid generating.

2.2 Pine Point Waste Rock Type Classification

Waste rock classifications based on total sulphur content will be developed to segregate potentially acid-generating waste rock, from non-acid generating rock (Table 1).

Table 1: Pine Point Waste Rock Type Classification

Waste Rock Classification	Criteria (total sulphur in wt%)	Description
-To be determined-		

2.3 Waste Rock Segregation Operating Procedures

The procedure for segregating waste rock may be as follows:

- Visually inspect the development face.
- Identify the waste rock type where the rock contains acid-generating potential more than 10% (combined amount).
- Identify the waste rock type where the rock contains acid-generating potential less than 10% (combined amount).
- Clearly delineate the muck piles (blasted rock from the development face) as into the two types using spray paint and/or stakes.
- Haul the muck to the appropriate location of the temporary storage location based on the type of rock.

Further details on waste rock segregation will be developed as the Project design advances. Standard Operating Procedures for segregation of waste rock will provide detailed descriptions for specific tasks.

3 Tailings and Waste Rock Distribution

3.1 Waste Rock Storage Facilities

For open-pit mining, mine ramps will be advanced progressively through the operating life of the mine using drill and blasting techniques. The mining process will generate waste rock. Waste rock will be deposited into historical mined open pits where feasible or in waste rock storage facilities adjacent to the deposits being mined. Nearly all this waste will be dolomitized limestone.

Waste rock will be mined using excavators and/or shovels. If rock is needed for on-site construction purposes (i.e., road building, pad construction, and berms), it will be crushed to the desired size and used as required, providing that the geochemical properties of the material are appropriate for such use. Excess waste rock that is not required for construction will be stored on-site. Waste rock will either be disposed of onto constructed waste rock storage facilities, or where possible, into historical open pits.

Waste rock in excess of available proximal open pit space will be placed in waste rock storage facilities designed for stability adjacent to active open pits and underground mines.

3.2 Overburden

To the extent possible and practical, infrastructure will be built on disturbed sites. Prior to the development of the surface and the underground mining operations, overburden will be removed to expose the rock to be excavated from the open pits and the underground portals.

The stripping operation for the open pits and underground operations will produce approximately 85-105 Mt or more of overburden. Overburden disposal locations will aim at optimizing haulage distance and a best effort segregation will be made to segregate topsoil and gravel in separate stockpiles for re-use and reclamation.

3.3 Tailings Disposal Areas

Mineralization-bearing material that is sent to the mill will undergo processing including grinding and flotation. After being processed through the flotation cells, the non-sulphide particles remaining in the slurry will be separated as tailings. These tailings will be discharged into a tailings thickener to recover water for recycling and to increase the percent solids before being pumped through a pipeline for disposal into selected mined-out pits (tailings disposal areas; TDAs). Multiple locations are being evaluated for suitability as TDAs. Clarified water, decanted from the thickener will be recirculated back to the grinding circuit for reuse. Decanted water from the TDAs will be pumped to avoid overflow and reclaimed back as part of the overall water management system.

Multiple locations are being evaluated for suitability as TDAs. Survey and bathymetries conducted for the existing pits have confirmed there is sufficient available space for the entire life of mine. Thickened tailings will be transported via pipeline from the concentrator to nearby TDAs. Direct transfer of tailings to TDAs has many advantages including fine ground wet material does not disperse as dust, saturated conditions reduce the potential for oxidation, and the use of previously disturbed land rather than creating new land disturbances.

A hydraulic transport system will have to be constructed for movement of tailings and reclaim water. At this point, it is expected to be above ground, with drainage points and spill containment areas located at naturally occurring low points along the route. Pipelines will follow the existing on-site road alignments where possible and will be protected as necessary by berms. Ditching will direct potential spillage to constructed containment areas. Where the pipelines will need to deviate from existing on-site roads, access roads will be built for construction and used as a service road for pipeline maintenance during operations.

Approximately 3,800 to 6,200 tonnes of thickened tailings could be produced each day. The tailings management system would need to accommodate approximately 18 Mm^3 of tailings over the life of mine. The thickened tailings will be approximately 60% solids by weight when delivered to the disposal site.

Approximately 3,800 to 6,200 tonnes of thickened tailings could be produced each day. The tailings management system would need to accommodate approximately 18 Mm^3 of tailings over the LOM. The thickened tailings will be approximately 60% solids by weight when delivered to the disposal site. Tailings will be managed as described in the Tailings and Waste Rock Management Plan.

3.4 Permanent Waste Rock Storage Facilities

Preliminary locations for waste rock storage facilities and overburden stockpiles have been identified in Section 3.4.1.2 of the Project Description (Volume 1). Preliminary waste rock storage facility locations were established based on proximity, which limited the overall footprint and haulage distances. Site restrictions, such as historical pits and piles as well as transport infrastructure, have also been considered.

The permanent storage location(s) for waste rock and overburden from the open pits and underground mines will be further refined in future iterations of this Plan, as additional Project design details are available (i.e., as part of the Developer's Assessment Report submission or Water Licence/Land Use Permit application).

3.5 Temporary Waste Rock Storage Facilities

Proposed temporary waste rock storage facilities will be defined in future iterations of this Plan, as additional Project details are available (i.e., as part of the Developer's Assessment Report submission or Water Licence/Land Use Permit application)

3.6 Waste Rock for Construction

Waste rock used for construction will be non-metal leaching and non-acid generating. Geochemical characterization will confirm which waste rock will be used for construction.

3.7 Seepage Predictions

Predictions of seepage water chemistry will be submitted as part of effluent quality criteria predictions, as required, in the Type A Water Licence application.

4 Tailings and Waste Rock Management Responsibilities

PPML groups with waste rock management responsibilities include health, safety, and environment (HSE), surface mining, mine technical services, and underground operations.

Waste rock management responsibilities of an HSE group include:

- first point of contact for regulators with issues related to this plan or related plans
- geochemical criteria
- waste rock field testing and effluent predictions
- external reporting of waste rock movement in accordance with Water Licence requirements, i.e., Annual Type A Water Licence reporting

Waste rock management responsibilities of a surface mining group include:

- preparing and distributing open pit mining plans
- mining and hauling waste rock on surface
- surveying the waste rock storage facilities
- surface construction activities

Waste rock management responsibilities of mine technical services include:

- delineation of potentially acid-generating waste rock from non-acid generating rock
- periodic inspections of the mine dig face
- waste rock inspections for stability and seepage

Waste rock management responsibilities of an underground operations group include:

- recording and hauling underground waste rock to the appropriate temporary storage locations

5 References

MVEIRB (Mackenzie Valley Environmental Impact Review Board). 2018. Draft EA Initiation Guidelines for Developers of Major Projects. Accessed March 2020. Available at http://reviewboard.ca/file/1132/download?token=c5tFrEqL

TetraTech. 2018. Summary of Geochemical Characterization Data for the Pine Point Project, NWT by TetraTech Canada Inc, Vancouver, British Columbia

Volume 2 -

Closure and Reclamation Plan Framework

Closure and Reclamation Plan Framework

for the

Pine Point Project

Purpose

This framework document is provided in support of the Mackenzie Valley Environmental Impact Review Board Environmental Assessment Initiation Package for the Pine Point Project (the Project). The intent of this document is to describe how this environmental management plan relates to the Project, what information will be provided as the Project develops, and to list applicable guidelines and standards. It was developed with the available Project information. This document is not intended for approval but is provided for review purposes and will be refined as the regulatory process proceeds.

Version History

Pine Point Mining Limited is responsible for the distribution, maintenance, and updating of this document. Changes that do not affect the intent of the document will be made as required (e.g., phone numbers, names of individuals). The table below indicates the version of this document, and a summary of revisions made.

Revision #	Section(s) Revised	Description of Revision	Issue Date
0	-	Framework version for MVEIRB Initiation Package	15 December 2020

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Tables

Figures

APPENDICES

Abbreviations

Abbreviation	Definition
Cominco	Cominco Ltd.
CRP	Closure and Reclamation Plan
ICRP	Interim Closure and Reclamation Plan
NTPC	Northwest Territories Power Corporation
NWT	Northwest Territories
PPML	Pine Point Mining Limited
Project	Pine Point Project
WRSF	waste rock storage facility
ZnEq	zinc equivalent

Units of Measure

Unit of Measure	Definition
%	percent
km	kilometre
ha	hectare
Mt	million tonnes
tpd	tonnes per day

1 INTRODUCTION

This Closure and Reclamation Plan (CRP) framework has been developed by Pine Point Mining Limited (PPML) for the proposed Pine Point Project (Project). The Project is located on a brownfield site resulting from the Cominco Ltd. (Cominco) historical mining and milling activities. It is located in the Northwest Territories (NWT) within the South Slave Mining District, south of Great Slave Lake, approximately 175 km directly south of Yellowknife.

The CRP framework has been developed to support the Mackenzie Valley Environmental Impact Review Board Environmental Assessment (EA) Initiation Package for the Project. An updated CRP will be developed during the permitting phase of the Project, or potentially earlier if required, based on feedback through the EA process. The CRP that will be developed to support the Water Licence and Land Use Permit application will be submitted to the Mackenzie Valley Land and Water Board for review and approval. The CRP for permitting will incorporate relevant feedback and commitments made by PPML during the EA review process.

In addition, following the permitting phase of the Project, and upon receipt of the Water Licence and Land Use Permit, PPML will prepare an Interim Closure and Reclamation Plan (ICRP) that will include additional details to meet the requirements of the *Guidelines for the Closure and Reclamation of Advanced Mineral Exploration and Mine Sites in the Northwest Territories* (Closure Guidelines; MVLWB and AANDC 2013).

1.1 Purpose and Scope

The CRP framework describes the conceptual plan for temporary or permanent closure of the Project. The general purpose of this CRP framework is to demonstrate the satisfactory closure and reclamation of the mine and to describe the likely residual risks to human health and the environment.

This CRP framework details closure plans for the Project only and does not include activities or monitoring associated with historical mining activities at or near the Project, outside of developments directly associated with the Project. Closure and reclamation planning is limited to construction camps, access roads, open pits, underground mine portals, overburden stockpiles, waste rock piles, tailings disposal areas, water management infrastructure and plant site constructed or used as part of this Project.

1.2 Closure Goal and Principles

The closure goal for the Project is similar to that shown in the Closure Guidelines (MVLWB and AANDC 2013) and comprises two parts to reflect the historical disturbance that has already been experienced by the site:

> "For previously undisturbed areas, the goal is to return the affected areas of the site developed by the Project to viable and, wherever practicable, self-sustaining ecosystems that are compatible with a healthy environment and human activities. Where areas of the Project have been previously disturbed through historical mining activities, the goal is to return the areas of the site affected by the Project to an equivalent environmental state that they were left by the Government of Canada prior to the Project."

Closure principles for the areas developed by the Project are reflective of the Closure Guidelines and include:

- physical stability
- chemical stability
- no long-term active care
- consideration of future use

1.3 Closure and Reclamation Planning Team

PPML is a 100% owned subsidiary to Osisko Metals Incorporated. The PPML Project supervisor will ultimately be responsible for the success of the CRP during construction and operations and will approve relevant policies and documents, auditing, action planning, and the verification process. The PPML Project supervisor will be responsible for the implementation of the CRP including overall management of the plan, internal reporting, compliance and adaptive management. Other relevant personnel will also be responsible for the effectiveness of the CRP through completing required training, supporting implementation and remaining compliant with the CRP, as appropriate to their roles, as set out by the CRP.

Project Contact

Primary Pine Point Mining Limited Contact	Andrew Williams
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Address	1100 Avenue des Canadiens-de-Montréal, Bureau 300
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Email	acwilliams@live.ca

1.4 Engagement

The CRP will be refined based on engagement conducted throughout the EA process and future CRPs will continue to be influenced and guided by engagement with parties. Future engagement regarding the Project will be conducted according to the Engagement and Collaboration Framework (Volume 2).

1.5 Regulatory Instruments for Closure and Reclamation

Closure of the Project may be subject to the federal and territorial legislation outlined in Table 1. An updated list will be included in future versions of the CRP during the permitting phase of the Project.

Table 1: Federal and Territorial Acts and Regulations Relevant to Closure and Reclamation

Federal	Territorial
• *Fisheries Act* • *Arctic Waters Pollution Prevention Act* and Regulations • *Mackenzie Valley Resource Management Act* and Regulations • *Canadian Environmental Protection Act, 1999* and Regulations • *Canadian Navigable Waters Act* • *Explosives Act* and Regulations • *Transportation of Dangerous Goods Act* and Regulations • *Canada Wildlife Act* • *Species at Risk Act*	• *Commissioner's Lands Act* and Regulations • *Environmental Protection Act* and Regulations • *Environmental Rights Act* and Regulations • *Waters Act* and Regulations • *Northwest Territories Lands Act* and Regulations • *Safety Act* and Regulations • *Mine Health and Safety Act* and Regulations • *Scientists Act* and Regulations • *Archaeological Sites Act* and Regulations • *Wildlife Act* • *Explosives Use Act* and Regulations • *Species at Risk (NWT) Act*

The CRP framework has been developed in consideration of applicable territorial guidelines, including:

- *Guidelines for the Closure and Reclamation of Advanced Mineral Exploration and Mine Sites in the Northwest Territories* (MVLWB and AANDC 2013)
- *Northern Land Use Guidelines: Camp and Support Facilities* (GNWT-Lands 2015a)
- *Northern Land Use Guidelines: Access Roads and Trails* (GNWT-Lands 2015b)
- *Northern Land Use Guidelines: Pits & Quarries* (GNWT-Lands 2015c)

2 PROJECT ENVIRONMENT

A description of the existing environment is provided in the Description of Existing Environment for Pine Point Project (Volume 3, Section 3.0) and will be summarized here in future versions of the CRP (i.e., Atmospheric Environment, Physical [Terrestrial] Environment, Chemical Environment, and Biological Environment).

3 PROJECT DESCRIPTION

The Project is composed of mining deposits using open pit and underground mining methods totalling approximately 39.1 million tonnes (Mt) of mineralized material. The planned processing capacity is 6,000 tonnes per day (tpd) ramping up to 11,250 tpd with an associated mine life of 10 years or longer. The Project will consist of open-pit and underground mining for zinc and lead, construction and operation of a processing mill (or "concentrator"), storage and management of

processed mineralized material and waste materials, water management, construction and operation of ancillary support facilities including a camp for workers, and the transportation of zinc and lead concentrates to established ports in Canada for global markets.

3.1 Location and Access

The Project is located in the South Slave Mining District, south of Great Slave Lake in the Northwest Territories, approximately 175 km directly south of Yellowknife, 75 km east of Hay River, and 53 km southwest of Fort Resolution (Figure 1). It is located on a brownfield site resulting from Cominco's historical mining and milling operations and includes the historical town of Pine Point and associated working accommodations. The closest major transportation hubs are Yellowknife and Hay River. Access to the Project is presently via all-weather Highways 5 and 6. Further details are provided in the Project Description (Volume 1, Section 1.0).

The mineral claims and mining leases that comprise the Project encompass a total of 46,553 ha including 106 mineral claims, 40 mining leases, and four surface leases.

3.2 Project History

The first Pine Point lead-zinc deposit was discovered in 1898 by prospectors heading to the Klondike gold rush. Cominco began exploration at Pine Point in 1929, with test-pitting, drilling, and shaft sinking. In 1948, Cominco began major exploration work. In the early 1960s, Cominco advanced the project to construction, which included a railroad, hydroelectric dam, and a town where up to 2,000 people could live.

Cominco commenced large-scale mine production in 1964 based on a resource estimate of 21.5 Mt of identified mineralized material averaging 7.2% zinc and 4% lead. The mine eventually ramped up to a production rate of 10,000 tpd. The historical operation was an assemblage of 50 separate open pits and 2 underground deposits, lying along a 70 km trend. Cominco operated the historical mine between 1964 and 1987, producing 64 Mt of mineralized material grading 7.0% zinc and 3.1% lead from 52 deposits. This historical production illustrates that the mine is composed of several small deposits rather than one or a few large ones. The list of historical deposits illustrates that deposits varied between 49,000 tonnes and 17,500,000 tonnes of mineralized material, with an average of 1,300,000 tonnes of mineralized material. Grades during the Cominco era ranged from 4% to 21% zinc equivalent (ZnEq), with an average of 9.9% ZnEq. The Cominco concentrator eventually processed at a level of 10,000 tpd. The mining operation closed in 1987 and Cominco left significant lower grade mineral resources in the ground.

In the 2000s, the Project was purchased by Tamerlane Ventures Ltd. with the intent to mine the existing resource; however, due to poor metal prices, the Project did not proceed. Darnley Resources Bay Ltd. purchased the property in 2016 and continued with exploration. The Project was acquired by PPML in February 2018.

LEGEND

- FORMER PINE POINT TOWN SITE
- POPULATED PLACE
- ALL-SEASON ROAD
- PARK/PROTECTED AREA
- WATERBODY
- GENERAL PROJECT LOCATION

0 25 50

1:1,250,000 KILOMETERS

REFERENCE(S)

1. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
2. PARKS AND PROTECTED AREAS OBTAINED FROM CONSERVATION AREAS REPORTING AND TRACKING SYSTEM (CARTS), CANADIAN COUNCIL ON ECOLOGICAL AREAS, 2017.

PROJECTION: ALBERS CONIC EQUAL AREA

CLIENT
PINE POINT MINING LTD.

PROJECT
PINE POINT PROJECT

CONSULTANT
GOLDER

YYYY-MM-DD	2020-10-07
DESIGNED	DC
PREPARED	BW / MM / JE
REVIEWED	DP
APPROVED	DP

TITLE
PROJECT LOCATION

PROJECT NO.	CONTROL	REV.	FIGURE
19125747		0	1

3.3 Project Geology

A discussion of the site geology can be found in of the Description of Existing Environment for Pine Point Project (Volume 3, Section 3.0). A summary will be included here in future versions of the CRP.

3.4 Project Summary

Processing facilities, the worker camp, and ancillary support structures will be located on previously disturbed land wherever practicable. It is expected that, where possible, historical open pits will be used to contain waste rock, tailings, and wastewater from future mining activities, thus minimizing new disturbance due to the Project.

The Project is divided into six zones. Appendix A (Project Mapbook) currently shows general locations for the Project. As the CRP evolves, maps will be developed to show what the site will look like following closure.

- East of Buffalo River:
  - East Mill Zone
  - North Zone
  - Central Zone
  - North-East Zone
  - N204 Zone
- West of Buffalo River:
  - West Zone

The main components of the Project are anticipated to include:

- **Open pits.** It is currently expected that 47 deposits from four zones (East Mill, Central, North, and N204) east of the Buffalo River will be mined as open pits, considering the deposit's size, shape, orientation, and proximity to the surface as well as economic parameters. A total of 32.5 Mt of mineralized material is expected to be mined via open pits.
- **Underground mines.** The West Zone (W1 Area) includes five underground workings mined by longhole methods with some stopes mined by the room and pillar method (less than 10%). Three deposits from the Central Zone (C1 Area) are anticipated to be mined by underground methods given their high strip ratio and good grades for a total of 6.6 Mt of mineralized material.
- **Waste rock and overburden disposal areas.** Waste rock and overburden will be stored in surface stockpiles, adjacent to the new open pits or underground mines. Waste rock will also be placed in nearby exhausted open pits in some cases. Waste rock and overburden that will not be used for infrastructure development or progressive reclamation and closure will be placed in piles adjacent to the pits, or in some cases, the waste rock will be placed in nearby

exhausted open pits. The total volume of waste rock produced over the life of mine is estimated at approximately 52 Mm^3. Nearly all this waste will be dolomitized limestone. The total overburden volume is estimated to be about 50 Mm^3, for excavation with topsoil separated for reclamation activities.

- **Tailings disposal areas.** Tailings disposal areas will be located within historical mined-out pits and new open pits after the completion of mining.
- **Water management system.** The water management system could include diversion and drainage ditches for surface water management, pumping stations, water supply, pumping and injection wells to manage subsurface water, sedimentation and polishing ponds, and other associated infrastructure.
- **Process plant**. Inclusive of pre-concentrator, crusher, grinding and flotation plant, thickeners, external conveyors, stockpiles, workshops, laydown areas and other installations necessary to operate the process plant.
- **Power generation and distribution facility**. Including transmission lines for power distribution, substations, and compressed natural gas and diesel generation plants.
- **Workers accommodation camp.** The camp is planned to accommodate approximately 230 to 250 workers during operations and peaking at 500 workers during construction
- **Support and ancillary infrastructure.** An explosives storage area, petroleum storage and distribution area, warehouses, a truck shop, administration offices, a mine “dry”, and other support facilities and improvements to historical linear infrastructure, including access and haul roads, as well as power and communication lines, if necessary.

A site plan for the Project will be included in future versions of the CRP.

4 PERMANENT CLOSURE AND RECLAMATION

4.1 Definition of Permanent Closure

The following is the definition of permanent closure applied in this CRP framework:

> “Permanent closure is the final closure of a mine site with no foreseeable intent by the existing proponent to return to either active exploration or mining.”

4.2 Permanent Closure and Reclamation Requirements

Closure planning is ongoing in accordance with the Closure Guidelines (MVLWB and AANDC 2013), Closure Planning is closely tied with mine planning. Closure activities for Project developments may include:

- demolition and removal of buildings, infrastructure, and mobile equipment
- removal of hazardous materials
- remediation of spills and contamination
- creation of stable long-term structures

- development of closure drainage features
- site contouring and decompaction
- placement of salvaged topsoil, where required to support revegetation activities
- revegetation of selected areas
- monitoring and maintenance of reclaimed landforms
- water quality monitoring

The CRP framework does not include the reclamation of historical mining components, which will not be used by the proponent from the historical operations unless explicitly stated herein.

Conceptual closure options for the Project components are provided below. Detailed closure options, objectives, and criteria for the Project components will continue to be advanced with additional details to be provided in future versions of the CRP, taking into account further Project design details and feedback received from potentially affected parties. Future versions of the CRP will also include discussion of the following for each Project component:

- selected closure activities and rationale for selection
- engineering works associated with selected closure activities
- predicted residual effects
- uncertainties
- post-closure monitoring, maintenance, and reporting
- contingencies

4.2.1 Open Pits

Approximately 47 open pits are proposed to be constructed east of Buffalo River as part of the Project. Pits are planned to be mined using conventional open-pit mining techniques. Mineralized rock will be drilled and blasted and then collected using large shovels and trucks. Open pits will be developed in stages to provide the required material for optimized mill operations. Each year, mineralized material will be produced from one to twelve open pits, usually located within the same zone but sometimes located in two or more different mine working areas. As the Project is located on a historical brownfield site, some of the pit locations have already been disturbed through previous mining activities. In some instances, pits will be located on undisturbed areas.

Closure options for the open pits developed for the Project may include:

- backfilling of some pits with tailings capped by waste rock
- creation of pit lakes by allowing the pits to refill by natural water inflows and potentially supplemented with groundwater from nearby pits and/or diversion of surface water
- isolation of pits through the use of berms, fences, or some other mechanism

Reclamation options and selected activities for the pits that may have waste rock redeposited as part of Project activities are discussed in Section 4.2.3.

4.2.2 Underground Mines

The process of removing the economically viable mineralization from the deeper deposits will require underground mining methods. This will begin through the development of underground ramps, which will also require overburden stripping. Deposits that are planned to be mined from underground are located in two zones: the West Zone (W1 Area), and the Central Zone (C1 Area).

In addition to closing off the surface openings, other closure options for the underground mines may include the following:

- allowing to fill with groundwater
- backfilling with waste rock

4.2.3 Waste Rock Storage Facilities

It is currently anticipated that a total of 52 Mm^3 of waste rock and 50 Mm^3 of overburden will be generated over the duration of the Project. Where possible, the waste rock will be placed in nearby historical pits or in available proposed mined out pits. Where not possible, waste rock will be deposited in waste rock storage facilities (WRSFs). Closure activities for WRSFs will take into consideration the geochemical properties of the waste rock. Overburden will be stockpiled separately as a major part of it will be used during reclamation.

For WRSFs, options for closure activities may include:

- grading and contouring
- leaving waste as deposited
- capping with borrow material
- covering with an engineered cover of locally available materials
- seeding or revegetation of selected areas

For waste rock that has been used to partly or completely fill a historical pit, options for closure activities may include:

- leaving waste rock as deposited
- capping with borrow material
- covering with an engineered cover of locally available materials

4.2.4 Tailings Disposal Areas

Mineralized rock that is sent to the mill will undergo processing including grinding and flotation. After being processed through the flotation cells, the non-mineralized particles remaining in the slurry will be separated as tailings. These tailings will be discharged into a tailings thickener to recover water for recycling and to increase the percent solids before being pumped through a

pipeline for disposal into existing flooded pits, which will act as a tailings disposal area. Multiple locations are being evaluated for suitability as disposal areas. The tailings will fill the pits to a few metres below the bedrock surface.

Upon closure, the open pits used for tailings deposition will have been filled to ground surface with mineral sorter rejects and waste rock where necessary. The pits will be covered with stored overburden, if available, and contoured to restore the natural drainage.

This cover will limit direct access by terrestrial wildlife. Monitoring will occur and mitigations implemented as required to address the potential for acid rock drainage or any other water quality issues, and additional management measures will be implemented if there is found to be a concern.

4.2.5 Water Management System

Water management systems for the Project will include infrastructure to:

- manage surface water runoff at the Project
- dewater the pits and underground
- manage and process water by placing into nearby exhausted pits or reinjecting back into the aquifer
- produce potable water
- manage and process sewage
- supply, store, process (if required), and distribute potable water

Options for closure activities related to water management systems developed or used for the Project include:

- operation and maintenance of surface water management infrastructure during active closure
- decommissioning and removal of surface water management infrastructure, such as wells, pumping stations, pipelines, culverts / drainage channels, and sedimentation ponds
- decommissioning and removal of potable water treatment plant and sewage treatment system
- backfilling of ditches and collection ponds using overburden material
- restoration of natural drainage paths to the extent practical

4.2.6 Support and Ancillary Infrastructure

Support and ancillary infrastructure that will be developed for the Project includes explosive and fuel storage, buildings for administration, camp, maintenance facilities, warehouse facilities, landfills, and linear infrastructure such as roads, water pipelines, tailings transportation pipeline, and powerlines.

The power required for the site will be a combination of Northwest Territories Power Corporation (NTPC) supplied power and local power production from compressed natural gas. Critical loads, such as the concentrator, pumping stations, and camp, will include local emergency diesel power generators if the main power from NTPC is offline.

Closure options for the support and ancillary infrastructure developed or used for the Project include the following activities or alternative closure options that may be agreed upon during engagement with parties:

- removal and proper disposal of hazardous materials
- demolition of buildings developed for the Project, and removal and appropriate disposal of materials
- removal of temporary structures and equipment used for the Project
- removal of linear infrastructure such as power lines, pipelines, and roads developed as part of the Project
- remediation of contaminated soil where required
- scarifying (e.g., recontouring and decompaction) and potential revegetation with native species in targeted disturbed areas
- covering of landfill facilities and other closure actions where applicable as recommended in guidelines (GNWT 2003, 2017; ECCC 2017).

5 PROGRESSIVE RECLAMATION

5.1 Definition of Progressive Reclamation

Progressive reclamation is defined as:

> "Progressive reclamation takes place prior to permanent closure to reclaim components and/or decommission facilities that no longer serve a purpose. These activities can be completed during operations with the available resources to reduce future reclamation costs, minimize the duration of environmental exposure, and enhance environmental protection. Progressive reclamation may shorten the time for achieving closure objectives and may provide valuable experience on the effectiveness of certain measures that might be implemented during permanent closure." (MVLWB and AANDC 2013).

5.2 Opportunities for Progressive Reclamation

Progressive reclamation will be carried out whenever possible. At this point in time, opportunities for progressive reclamation cannot be specifically identified; however, opportunities for progressive reclamation may exist in areas as they are mined out, such as the reclamation of the open pits, adjacent rock piles and other infrastructure components in the vicinity. These opportunities will be identified and developed in subsequent versions of the CRP (i.e., potentially in the CRP developed for permitting, or in the ICRP developed following receipt of the Water Licence for the Project).

5.3 Completed Progressive Reclamation

Once the mine is operational, this section of the CRP will include documentation of the progressive reclamation conducted to date.

6 TEMPORARY CLOSURE

In the event of temporary closure of the Project, mine components will placed under care and maintenance, whereby components are maintained as necessary to protect humans, wildlife, and the environment. Relevant environmental, access, and security monitoring, together with ongoing management and reporting, will be continued under temporary closure conditions.

6.1 Temporary Closure Goal and Closure Objectives

Temporary closure goals and objectives will be provided in future versions of the CRP.

6.2 Temporary Closure Activities

The following activities will be implemented during times of temporary closure:

- Secure and restrict access to the Project, including buildings and other structures to authorized personnel only.
- Guard or block openings and post warning signs.
- Continue physical, chemical, and biological treatment, as well as monitoring programs according to water licences, land use permits, and land lease conditions to maintain compliance.
- Secure waste management systems.
- Conduct an inventory of chemicals and reagents, petroleum products, and other hazardous materials and secure appropriately or remove if required.
- Record fluid levels in fuel tanks and monitor regularly for leaks or remove from the Project.
- Store hazardous waste at an approved on-site waste management facility prior to shipping for off-site disposal to an appropriately registered receiving facility.
- Relocate explosives to the main powder magazine and secure, dispose of, or remove from the Project.
- Stabilize WRSFs, overburden stockpiles, tailings disposal areas, wastewater, and other containment structures as necessary, and maintain in an appropriate manner (including regular geotechnical inspections).
- Inspect drainage ditches and spillways and maintain regularly (e.g., seasonally depending on snow and ice accumulation and melting) during the closure period and include as part of geotechnical inspections.
- Inspect facilities and infrastructure regularly.

- Keep the security deposit up-to-date.

Updates to activities undertaken during temporary closure will be provided in future versions of the CRP.

6.3 Temporary Closure Monitoring, Maintenance, and Reporting

Once the mine is operational, this section of the CRP will document monitoring, maintenance, and reporting undertaken during temporary closure.

6.4 Temporary Closure Contingency Program

Contingency actions during temporary closure will be guided by the concept of adaptive management and geared toward supporting the temporary closure activities discussed in Section 6.1. Details regarding contingency actions that may be undertaken during temporary closure will be provided in future versions of the CRP.

6.5 Temporary Closure Schedule

Future updates to this section will include:

- A description of the anticipated sequence of events that may lead to a temporary closure.
- Descriptions of temporary closure activities for each Project component.
- Charts or tables if the nature of activities is complex.
- For planned temporary closure, an estimate of how long the closure will last and the approximate end date of the closure period.

7 INTEGRATED SCHEDULE OF ACTIVITIES

The preliminary life of mine schedule for the open pits can be viewed in the Project Description (Volume 1, Section 1.0). It is currently expected that the Project will enter into active closure in 2037. Additional details regarding the operational and closure schedule will be provided in future versions of the CRP.

8 POST-CLOSURE SITE ASSESSMENT

Future versions of the CRP will include a description of how residual environmental impacts of the Project will be assessed once closure activities have been completed.

9 FINANCIAL SECURITY

Once the Project is in the permitting phase, future updates to the CRP will include:

- An estimate of total liability associated with permanent closure of the Project, including post-closure monitoring programs and activities.
- A breakdown of costs associated with each component.

10 REFERENCES

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Appendix A Project Mapbook

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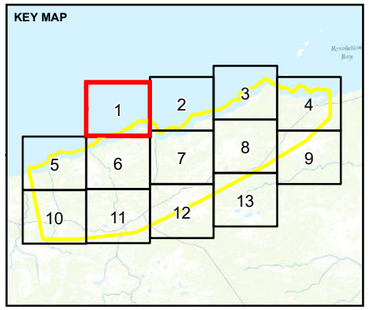
LEGEND

- CONTOUR
- CUTLINE
- WATERBODY
- WETLAND

KEY MAP



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CLIENT
PINE POINT MINING LTD.

PROJECT
PINE POINT PROJECT

TITLE
EXISTING DISTURBANCES

CONSULTANT
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YYYY-MM-DD	2020-12-15
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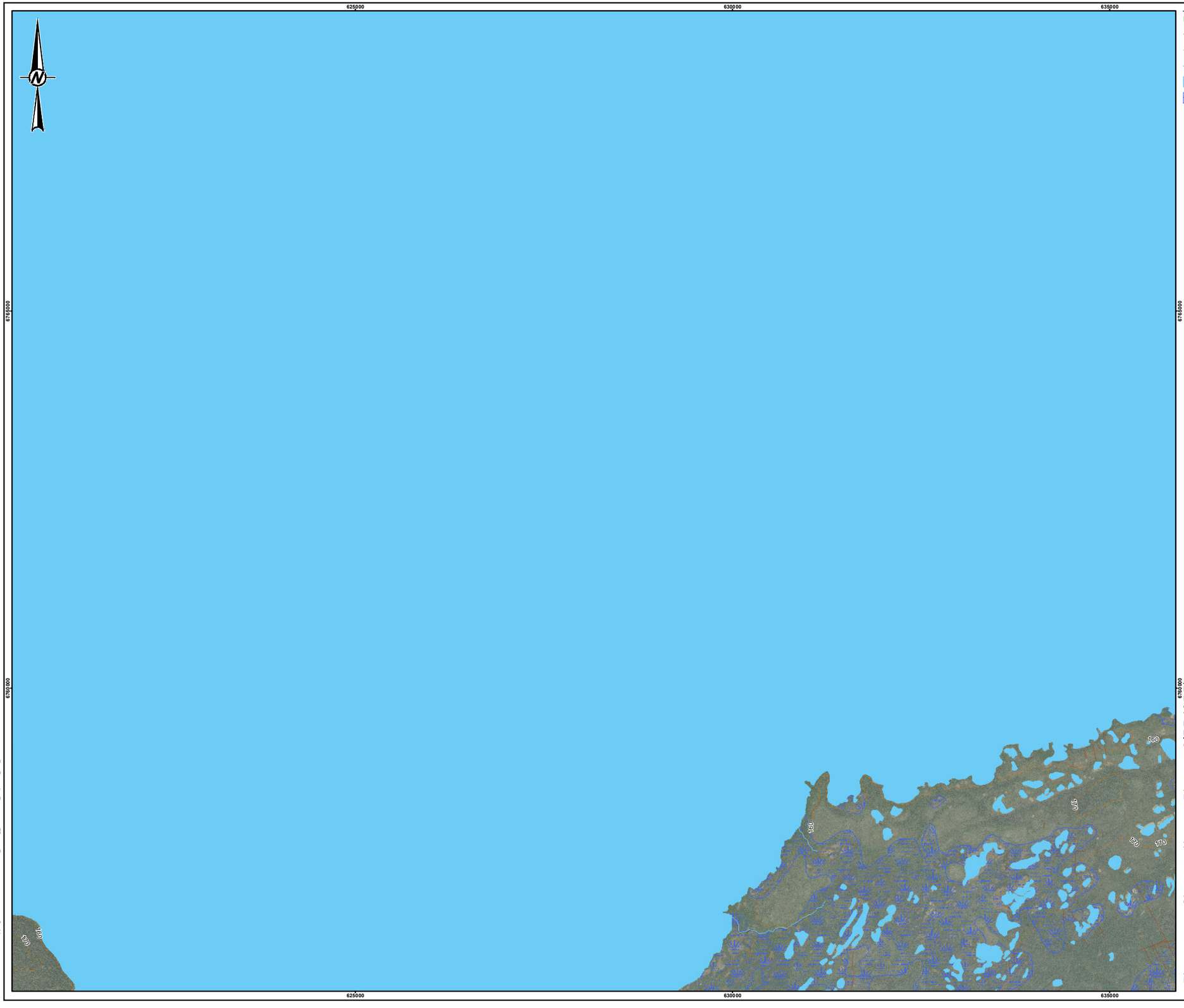
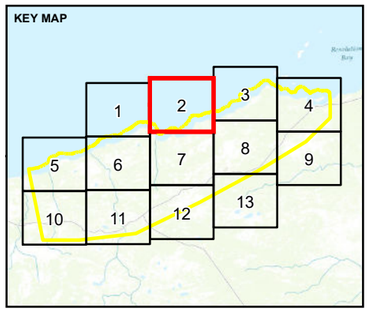


LEGEND

- CONTOUR
- CUTLINE
- WATERCOURSE
- WATERBODY
- WETLAND

KEY MAP



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CLIENT
PINE POINT MINING LTD.

PROJECT
PINE POINT PROJECT

TITLE
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CONSULTANT
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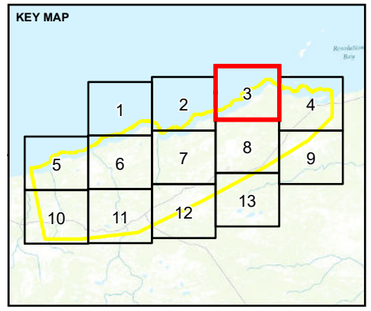
LEGEND

- BUSH ROAD
- CONTOUR
- CUTLINE
- DRAINAGE DITCH
- WATERCOURSE
- ACTIVE MINERAL CLAIM
- WATERBODY
- WETLAND
- MINED PIT

KEY MAP



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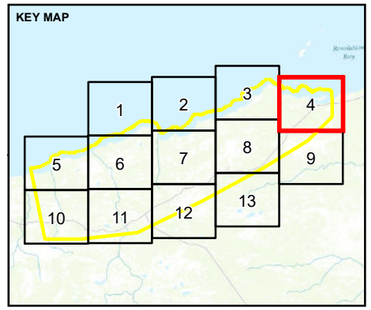
LEGEND

- BUSH ROAD
- CONTOUR
- CUTLINE
- HIGHWAY
- ROAD
- TRANSMISSION LINE
- WATERCOURSE
- ACTIVE MINERAL CLAIM
- ACTIVE MINERAL LEASE
- WATERBODY
- WETLAND

EXISTING DISTURBANCE

- ROAD MAINTENANCE

KEY MAP



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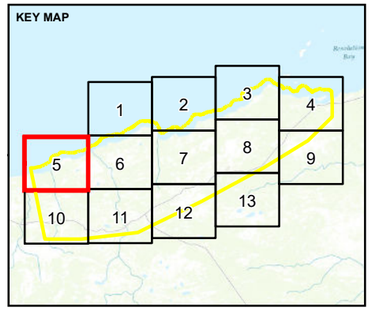
LEGEND

- CONTOUR
- WATERCOURSE
- WATERBODY
- WETLAND

KEY MAP



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LEGEND

- BUSH ROAD
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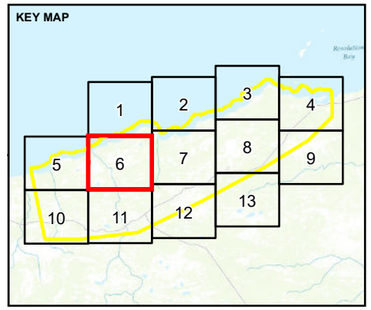
- ACTIVE MINERAL CLAIM
- ACTIVE MINERAL LEASE
- WATERBODY
- WETLAND

KEY MAP



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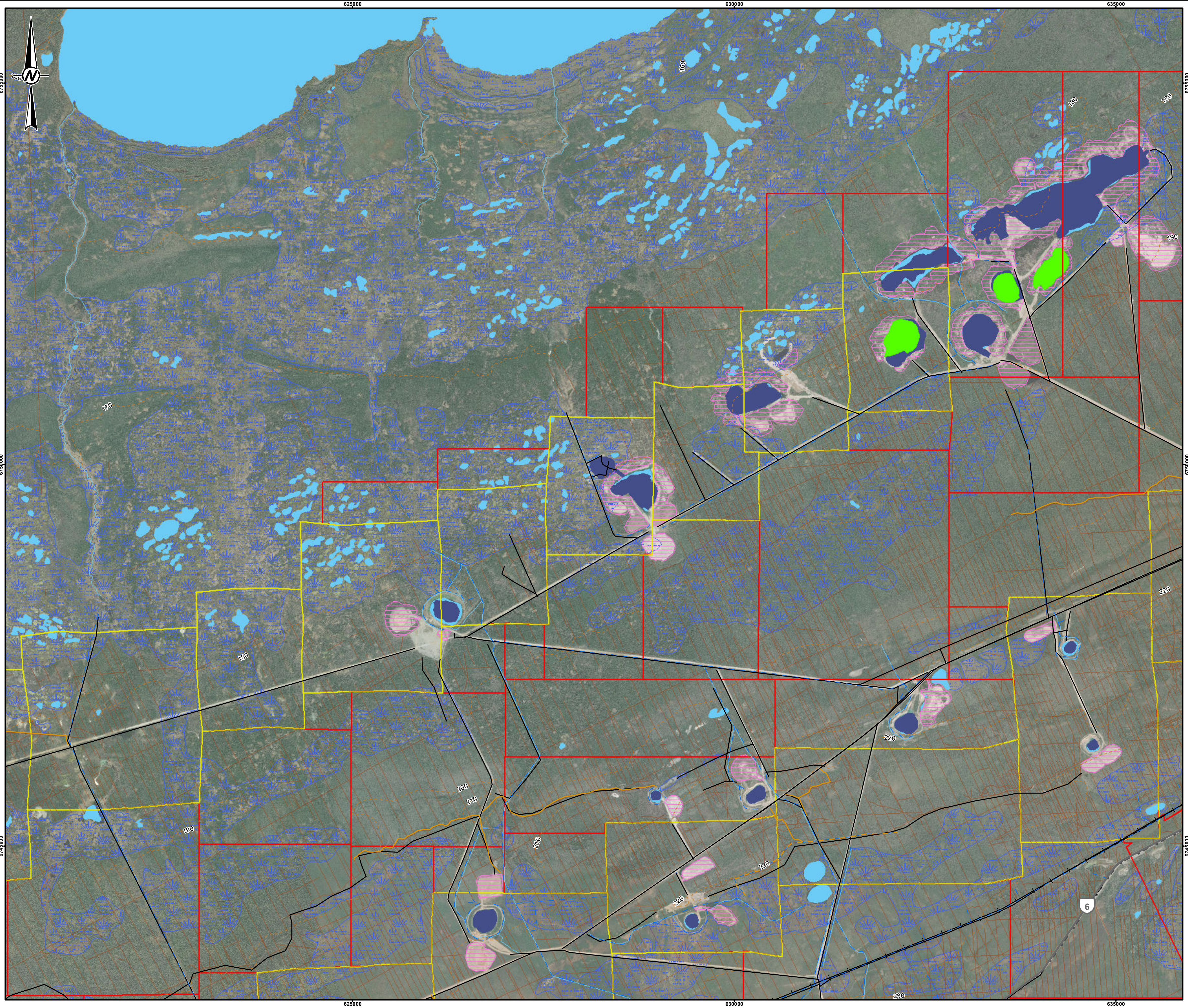

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- CUTLINE
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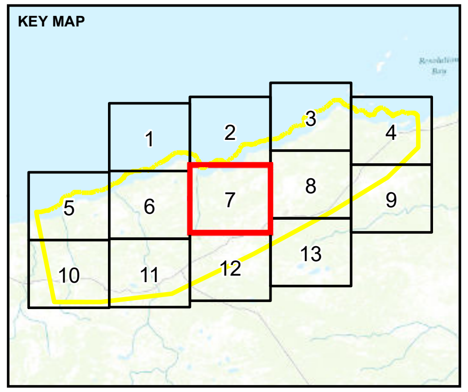
- HIGHWAY
- ROAD
- TRANSMISSION LINE
- WATERCOURSE
- ACTIVE MINERAL CLAIM
- ACTIVE MINERAL LEASE
- WATERBODY
- WETLAND
- BACKFILLED PIT
- MINED PIT
- WASTE PILE



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PROJECT
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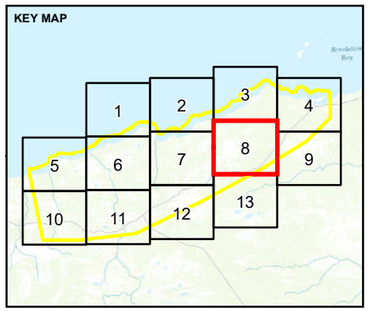
LEGEND

- BUSH ROAD
- CONTOUR
- CUTLINE
- DRAINAGE DITCH
- EXISTING RAILBED
- HIGHWAY
- ROAD
- TRANSMISSION LINE
- WATERCOURSE
- ACTIVE MINERAL CLAIM
- ACTIVE MINERAL LEASE
- WATERBODY
- WETLAND

EXISTING DISTURBANCE

- ROAD MAINTENANCE
- SETTLEMENT
- WELL SITE
- BACKFILLED PIT
- MINED PIT
- WASTE PILE

KEY MAP



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PINE POINT MINING LTD.

PROJECT
PINE POINT PROJECT

TITLE
EXISTING DISTURBANCES

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GOLDER

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N
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Hanbury Creek
200
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180

LEGEND

- BUSH ROAD
- CONTOUR
- CUTLINE
- DRAINAGE DITCH
- HIGHWAY
- ROAD
- TRANSMISSION LINE
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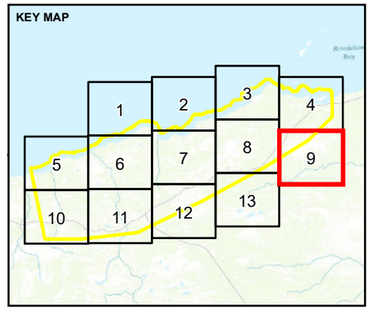
- ACTIVE MINERAL CLAIM
- WATERBODY
- WETLAND
- MINED PIT
- WASTE PILE

KEY MAP



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Birch Creek

5

LEGEND

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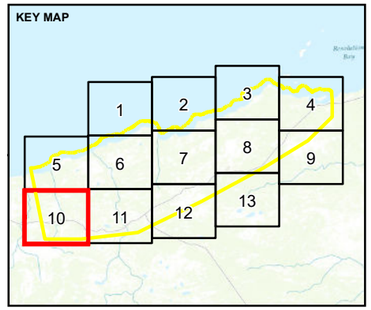
- CONTOUR
- CUTLINE
- EXISTING RAILBED
- HIGHWAY
- ROAD
- TRANSMISSION LINE
- WATERCOURSE
- ACTIVE MINERAL CLAIM
- ACTIVE MINERAL LEASE
- WATERBODY
- WETLAND

EXISTING DISTURBANCE

- SETTLEMENT
- UNKNOWN
- WELL SITE

KEY MAP



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PROJECTION: UTM ZONE 11N DATUM: NAD83

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PROJECT
PINE POINT PROJECT

TITLE
EXISTING DISTURBANCES

CONSULTANT
GOLDER

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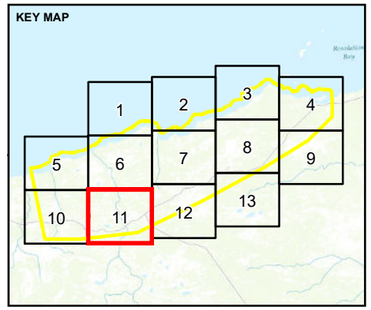
LEGEND

- BUSH ROAD
- CONTOUR
- CUTLINE
- DRAINAGE DITCH
- EXISTING RAILBED
- HIGHWAY
- ROAD
- TRANSMISSION LINE
- WATERCOURSE
- ACTIVE MINERAL CLAIM
- ACTIVE MINERAL LEASE
- WATERBODY
- WETLAND

EXISTING DISTURBANCE

- UNKNOWN

KEY MAP



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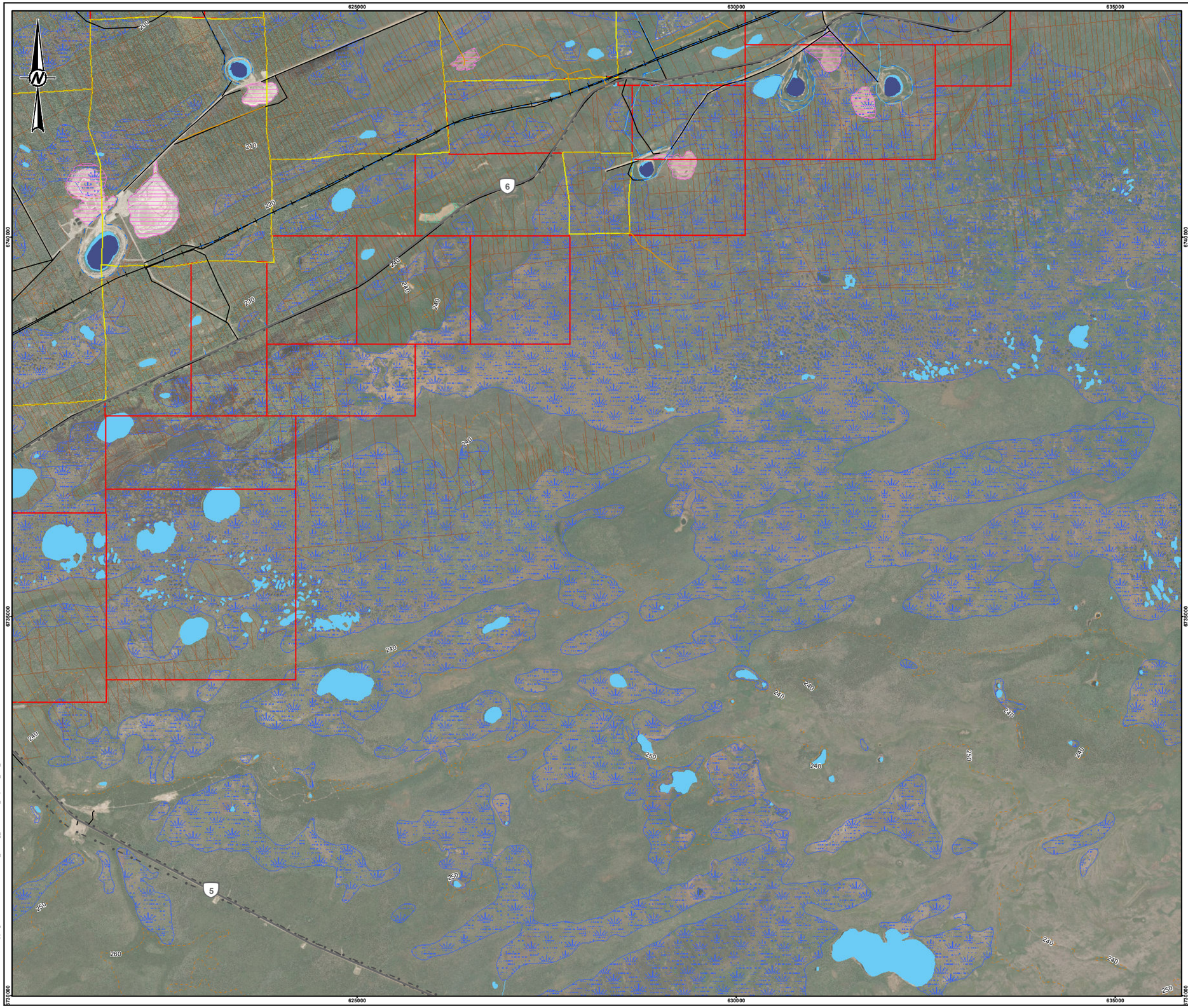


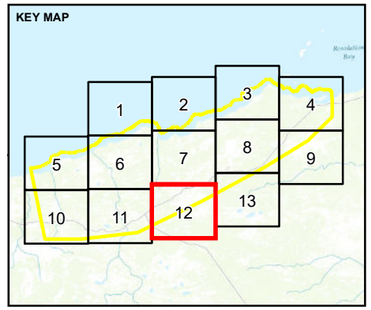
LEGEND

- BUSH ROAD
- CONTOUR
- CUTLINE
- DRAINAGE DITCH
- EXISTING RAILBED
- HIGHWAY
- ROAD
- TRANSMISSION LINE
- WATERCOURSE
- ACTIVE MINERAL CLAIM
- ACTIVE MINERAL LEASE
- WATERBODY
- WETLAND

EXISTING DISTURBANCE

- ROAD MAINTENANCE
- MINED PIT
- WASTE PILE

KEY MAP



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PROJECTION: UTM ZONE 11N DATUM: NAD83

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Hanbury Creek
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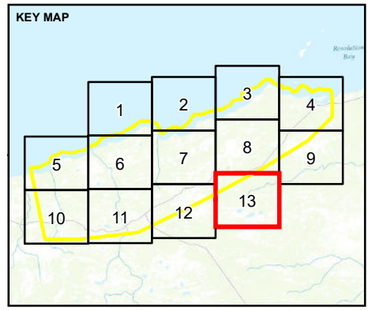
LEGEND

- BUSH ROAD
- CONTOUR
- CUTLINE
- DRAINAGE DITCH
- EXISTING RAILBED
- HIGHWAY
- TRANSMISSION LINE
- WATERCOURSE
- ACTIVE MINERAL CLAIM
- WATERBODY
- WETLAND

KEY MAP



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PROJECTION: UTM ZONE 11N DATUM: NAD83

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Volume 2 -

Wildlife Protection Plan Framework

Wildlife Protection Plan Framework

for the

Pine Point Project

Purpose

This framework document is provided in support of the Mackenzie Valley Environmental Impact Review Board Initiation Package for the Pine Point Project (Project). The intent of this document is to describe how this environmental management and monitoring plan relates to the Project, what information will be provided as the Project develops and to list applicable guidelines and standards. It was developed with the available Project information. This document is not intended for approval but is provided for review purposes and will be refined as the regulatory process proceeds.

Version History

The Pine Point Mining Limited is responsible for the distribution, maintenance, and updating of this document. Changes that do not affect the intent of the document will be made as required (e.g., phone numbers, names of individuals). The table below indicates the version of this document, and a summary of revisions made.

Revision #	Section(s) Revised	Description of Revision	Issue Date
0	-	Framework version for MVEIRB Initiation Package	15 December 2020

Table of Contents

Tables

Figures

Appendices

Abbreviations

Abbreviation	Definition
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
EA	environmental assessment
ECCC	Environment and Climate Change Canada
GNWT	Government of the Northwest Territories
GNWT-ENR	Government of the Northwest Territories, Environment and Natural Resources
NWT	Northwest Territories
PPML	Pine Point Mining Limited
Project	Pine Point Project

Units of Measure

Abbreviation	Definition
°C	degrees Celsius
m	metre
mm	millimetre

1 INTRODUCTION

Pine Point Mining Limited (PPML) is proposing to construct and operate the Pine Point Project (Project), which is located in the South Slave Mining District, south of Great Slave Lake in the Northwest Territories (NWT), approximately 175 km directly south of Yellowknife, 75 km east of Hay River, and 53 km southwest of Fort Resolution. It is located on a brownfield site resulting from Cominco Ltd.'s historical mining and milling operations (Figure 1). The construction and operation of the Project can affect wildlife and wildlife habitat in several ways, including habitat degradation and functional habitat loss due to noise or other sensory disturbances, dust, accidental spills of toxic or hazardous substances, injury or mortality due to vehicle collisions, and wildlife attraction to construction camps.

This Wildlife Protection Plan Framework outlines mitigation that will be implemented to reduce the Project effects on wildlife and wildlife habitat, and the monitoring actions proposed to understand the effects of the Project on wildlife, test the predictions made during the Developer's Assessment Report, and inform adaptive management.

This Wildlife Protection Plan Framework has been developed as a component of the Environmental Assessment (EA) Initiation Package for the Project (MVEIRB 2018). The Wildlife Protection Plan for the Project will be updated once the EA process is complete, or earlier if required, and will incorporate relevant feedback and commitments made by PPML during the EA review process.

1.1 Project Description

The Project will consist of open pit and underground mining for zinc and lead, construction and operation of a processing mill (or "concentrator") and pre-concentration facilities, storage and management of processed mineralized material and waste materials, water management, construction and operation of ancillary support facilities including a camp for workers and the transportation of zinc and lead concentrates to global markets.

The closest major transportation hubs are Yellowknife and Hay River. Access to the Project is presently via all-weather Highways 5 and 6. Further details are provided in the Project Description (Volume 1, Section 1.0).

The Project is located at the edge of the Boreal Plains and Taiga Plains Ecozones, and within the Slave River and Hay River Lowland Ecoregions. The area is characterized by short, cool summers and long, cold winters. The winter months are typically the driest with the most precipitation usually occurring in August. Conditions are wet in low-lying poorly drained areas that retard organic matter decomposition, and peatlands of varying thickness occur over extensive areas as patterned and horizontal fens, treed bogs, and peat plateaus (the latter on permanently frozen organic soils) (ECG 2009). On better-drained upland sites, the interplay of parent materials and active processes such as fire and alluvial deposition results in a mix of deciduous, mixed-wood, and coniferous forests (ECG 2009). Broad-scale vegetation includes mixed-wood, deciduous, and coniferous forest fens with black spruce, larch, and dwarf birch; sedges and mosses are widespread, and peat plateaus (complexes of open, stunted black spruce – lichen forest and wet sedge – moss-dominated collapse scars) are common (ECG 2009).

LEGEND

- FORMER PINE POINT TOWN SITE
- POPULATED PLACE
- ALL-SEASON ROAD
- PARK/PROTECTED AREA
- WATERBODY
- GENERAL PROJECT LOCATION

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REFERENCE(S)

1. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
2. PARKS AND PROTECTED AREAS OBTAINED FROM CONSERVATION AREAS REPORTING AND TRACKING SYSTEM (CARTS), CANADIAN COUNCIL ON ECOLOGICAL AREAS, 2017.

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2 OBJECTIVES

The objectives of this Wildlife Protection Plan framework include the following:

- Document how mitigations will be applied to avoid or minimize effects of the Project construction and operation on wildlife.
- Describe how adaptive management will be applied to wildlife mitigation and monitoring.
- Form part of the engagement with communities, regulatory agencies, and interested parties on wildlife effects mitigation and monitoring.
- Describe how PPML will meet relevant guidelines and regulatory requirements.

3 STATUTORY REQUIREMENTS AND GUIDELINES

Several federal and territorial acts and regulations apply to wildlife in relation to the Project (Table 1; Appendix A). Other guidelines and documents that were considered in the preparation of this document include the following:

- Wildlife and Monitoring Plan Guidelines (GNWT-ENR 2018).
- Northern Land Use Guidelines: Camp and Support Facilities (GNWT-Lands 2015a).
- Northern Land Use Guidelines: Pits and Quarries (GNWT-Lands 2015b).
- Northern Land Use Guidelines: Access Roads and Trails (GNWT-Lands 2015c).
- Forest Fire Prevention and Suppression Guidelines for Industrial Activities (GNWT 2001).
- Pine Point Project Environmental Management and Monitoring Plan Frameworks.

Table 1: Concordance Table for Conformity of the Wildlife Protection Plan to Federal and Territorial Acts, Regulations, and Guidelines

Legislation/Regulation	Requirements	Section in the Wildlife Protection Plan	Responsible Regulatory Agency
Species at Risk Act and Species at Risk (NWT) Act	Adhere to requirements of all applicable Regulations or Recovery Plans that may be developed over the duration of the Project.	Section 2.0	ECCC-CWS GNWT
NWT *Wildlife Act* Section 95(1)	A developer or other person or body may be required, in accordance with the regulations, to prepare a wildlife mitigation and monitoring plan for approval by the Minister, and to adhere to the approved plan, if the Minister is satisfied that a development, proposed development, or other activity is likely to: (a) result in a significant disturbance to big game or other prescribed wildlife (b) substantially alter, damage or destroy habitat (c) pose a threat of serious harm to wildlife or habitat, or (d) significantly contribute to cumulative impacts on a large number of big game or other prescribed wildlife, or on habitat	Entire document	GNWT-ENR
NWT *Wildlife Act* Section 95(1)	A wildlife mitigation and monitoring plan must include: (a) a description of potential disturbance to big game and other prescribed wildlife, potential harm to wildlife and potential impacts on habitat (b) a description of measures to be implemented for the mitigation of potential impacts (c) the process for monitoring impacts and assessing whether mitigative measures are effective, and (d) other prescribed requirements	Section 2.0 Section 3.0	GNWT-ENR
Migratory Birds Convention Act, 1994 and Migratory Birds Regulations	The taking of nests or eggs of migratory game or insectivorous or nongame birds shall be prohibited, except for scientific or propagating purposes under such laws or regulations as the High Contracting Powers may severally deem appropriate.	Section 2.0	ECCC-CWS
Mackenzie Valley Land Use Regulations	Land use permits may include provisions for the protection of wildlife habitat.	Entire document	Mackenzie Valley Land and Water Board GNWT-Lands

ECCC-CWS = Environment and Climate Change Canada, Canadian Wildlife Service; GNWT = Government of the Northwest Territories; GNWT-ENR = Government of the Northwest Territories, Environment and Natural Resources; GNWT-Lands = Government of the Northwest Territories, Department of Lands;. See Appendix A for details on relevant sections of the legislation/regulations.

4 SPECIES OF CONCERN

The intent of the federal *Species at Risk Act* and the *Species at Risk (NWT) Act* is to protect species at risk from becoming extirpated or extinct as a result of human activity. While the former was enacted by the Government of Canada, the latter was enacted by the Government of the Northwest Territories (GNWT) and applies only to wild animals and plants managed by the GNWT. For example, species managed by the federal *Migratory Birds Convention Act, 1994* are not covered by the *Species at Risk (NWT) Act*. For the purposes of this Wildlife Protection Plan framework, species may be of concern as a result of either their federal, territorial, or Committee on Status of Endangered Wildlife in Canada (COSEWIC) status. As the *Species at Risk (NWT) Act* is implemented, it is expected that the NWT Species at Risk Committee will make further assessments and the Conference of Management Authorities will prepare the List of Species at Risk, providing legal protection for these species. This could lead to changes to species of concern for the Project.

Species of concern were identified that are known to be or are expected to be in the area of the historical operations and could potentially interact with the Project (Table 2). Environment and Climate Change Canada (ECCC) has issued Species at Risk Recovery Plans for seven of the species of concern: caribou (boreal population) (*Rangifer tarandus caribou*), wood bison (*Bison bison athabascae*), little brown myotis (*Myotis lucifugus*), northern myotis (*Myotis septentrionalis*), common nighthawk (*Chordeiles minor*), olive-sided flycatcher (*Contopus cooperi*), and whooping crane (*Grus americana*) (Environment Canada 2007, 2016a,b; ECCC 2016, 2018a,b, 2019). Critical habitat has been defined for caribou (boreal population) (SOR/2019-188).

ECCC has also issued Species at Risk Management Plans for three of the species of concern: rusty blackbird (*Euphagus carolinus*), yellow rail (*Coturnicops noveboracensis*), and northern leopard frog (*Lithobates pipiens*) (Environment Canada 2013, 2015).

Table 2: Wildlife Species of Concern that may Interact with the Project

Species	NWT Species at Risk Committee Status[a]	Federal *Species at Risk Act* Schedule 1 Status[b]	Committee on the Status of Endangered Wildlife in Canada Status[c]	Observed at Pine Point?
Caribou (boreal population)	Threatened	Threatened	Threatened	Yes
Wood bison	Threatened	Threatened	Special Concern	Yes
Wolverine	Not at Risk	Special Concern	Special Concern	Yes
Little brown myotis	Special Concern	Endangered	Endangered	Yes
Northern myotis	Special Concern	Endangered	Endangered	Yes
Short-eared owl	Not applicable	Special Concern	Special Concern	No
Whooping crane	Not applicable	Endangered	Endangered	Yes
Bank swallow	Not applicable	Threatened	Threatened	Yes
Barn swallow	Not applicable	Threatened	Threatened	No
Common nighthawk	Not applicable	Threatened	Threatened	Yes
Horned grebe (western population)	Not applicable	Special Concern	Special Concern	Yes
Olive-sided flycatcher	Not applicable	Threatened	Threatened	Yes
Rusty blackbird	Not assessed	Special Concern	Special Concern	Yes

Table 2: Wildlife Species of Concern that may Interact with the Project

Species	NWT Species at Risk Committee Status[a]	Federal *Species at Risk Act* Schedule 1 Status[b]	Committee on the Status of Endangered Wildlife in Canada Status[c]	Observed at Pine Point?
Yellow rail	Not applicable	Special Concern	Special Concern	No
Gypsy cuckoo bumble bee	Data Deficient	Endangered	Endangered	No
Yellow-banded bumble bee	Not at Risk	Special Concern	Special Concern	No
Northern leopard frog	Threatened	Special Concern	Special Concern	No

(a) GNWT (2018)

(b) Government of Canada (2019)

(c) COSEWIC (2019)

5 POTENTIAL EFFECTS AND MITIGATION

A preliminary list of potential effects to wildlife from the Project is presented in Table 3. Main concerns to wildlife are the following:

- direct habitat loss
- indirect habitat loss
- wildlife mortality or injury

Direct habitat loss refers to the disturbance and immediate loss of wildlife habitat within the Project physical footprint, for example, from placement of open mine pits or access roads.

Indirect habitat loss describes changes to wildlife movement and behaviour due to Project activities (such as the noise from mining equipment, odours, and human presence). Indirect habitat loss can occur even where vegetation and other habitat features remain intact. These changes are typically negative, causing wildlife avoidance, but can also be positive for species that are attracted to camps.

Wildlife mortality or injury can result from collisions with vehicles or removal of problem wildlife to protect worker safety.

Mitigation, design features, policies, and procedures or guidelines that are expected to be followed to avoid, minimize, or offset potential effects of the Project are also presented in Table 3. The mitigation considers current practices at the Ekati and Gahcho Kué diamond mines and along the Tłı̨chǫ All-Season Road and are considered to be effective (De Beers 2014; DDEC 2016; GNWT 2019).

Table 3: Potential Project-Wildlife Interactions and Mitigation during Project Construction and Operation

Project Component	Potential Effects Pathways	Mitigation
Construction: Site preparation Infrastructure development Operations: Pit development Fleet movement Mineralized material processing Waste disposal Water management	Direct habitat loss and fragmentation from the Project footprint of new open pits and related infrastructure (e.g., road crossings, water intakes).	• Location of Project on a brownfield site reduces the potential for additional habitat loss and linear developments.
	Construction activities leading to air emissions (including dust), which may affect vegetation communities and thereby alter the abundance, distribution, survival, and reproduction of wildlife.	• Best management practices to control fugitive particulate emissions from mine components and from fuel handling and storage. • Regular road inspections to determine if dust suppression needs to be applied and if dust suppression is being implemented effectively. • Enforcement of speed limits and maintenance of the road surface to suppress dust production.
	Vegetation clearing leading to destruction of migratory bird nests.	• Vegetation clearing outside of critical (nesting) periods for migratory birds.
	Sensory disturbance leading to changes in wildlife habitat quality and survival and reproduction.	• Use of conventional and best-practice methods to suppress noise on components and equipment, including regular maintenance where required.
	Increased traffic leading to collisions with wildlife.	• Providing wildlife with right-of-way on Project roads.
	Wetland hydrology and functional changes due to water management activities, which may alter the abundance, distribution, and survival and reproduction of wildlife.	• Best management practices for erosion and sediment control (e.g., ground cover, silt fences or curtains, and runoff management) where needed. • Where practical, use of natural drainage patterns to reduce ditches and diversion berms. • Adherence to the Water Management Plan, which describes facilities for containment and management, discharge (if required), and monitoring during construction and operations. • Maximizing use of historical infrastructure such as former open pits, where practicable.
	Hazardous substance spills leading to changes to health or mortality of individual animals.	• Adherence to the Spill Contingency Plan and spills prevention. • Immediate reporting of spills of reportable quantities to the 24-hour spill line according to the NWT *Spill Contingency Planning and Reporting Regulations*.
	Improved access leading to increased predation or harvesting of wildlife.	• Maximizing use of historical infrastructure such as roads, where practicable. • Provision of employees with wildlife awareness training and development and enforcement of a “no harassment, hunting, trapping, harvesting, or fishing policy” for employees and contractors.
	Attraction to camps leading to problem wildlife and injury or mortality to individual animals.	• Prohibition of littering and feeding of wildlife. • Adherence to the Waste Management Plan.

NWT = Northwest Territories

6 MONITORING

The proposed monitoring for the Project is expected to include the following:

- wildlife sightings monitoring
- wildlife surveillance monitoring
- bird nesting and bat roosting monitoring
- pre-clearing monitoring
- wildlife incident reporting

Details of the monitoring are described below. Work instructions and data sheets are provided in the appendices indicated below.

6.1 Wildlife Sightings Monitoring

Wildlife sighting records provide a simple means for all staff to contribute to tracking wildlife activity at the Project. The value of the data is limited as it is not systematically collected and contains repeated observations, but it can provide an indication of the potential for wildlife incidents or problem wildlife and areas of concern at the Project.

6.1.1 Methods

Wildlife sighting records will be posted at the Project camp and work areas for staff to record observations of wildlife. All staff will be encouraged to add observations to the log, including the species, number, location, and date of the observation. Environmental monitors will check the logs weekly for evidence of problem wildlife or problem areas that may pose a risk to wildlife. Observations of wildlife may be called in by radio and entered into the Wildlife Sightings Log by the environmental monitors. The environmental manager will report any important observations to the mine manager.

6.1.2 Supporting Documentation

- Wildlife Sighting Procedure and Form (Appendix B).

6.2 Wildlife Surveillance Monitoring

Environmental monitors will complete systematic surveys of the Project camp and waste management areas to document wildlife activity.

6.2.1 Methods

Environmental monitors will undertake systematic tours of the Project camp and waste management areas to record all wildlife observations or recent wildlife sign (e.g., tracks and scat). Surveys of these areas will be completed at least once per week. Any wildlife concerns that come to light during the survey should immediately be brought to the attention of the environmental manager so that appropriate action can be taken.

6.2.2 Supporting Documentation

- Wildlife Surveillance Monitoring Procedure and Form (Appendix B).

6.3 Bird Nesting and Bat Roosting Monitoring

Clearing of vegetation will generally be scheduled to occur outside of migratory bird breeding and bat maternity seasons (May 1 to August 20). However, there may be instances where vegetation removal is required during this period because of schedule changes or unforeseen circumstances. In these cases, non-intrusive pre-clearing surveys are required, which will be developed on a case-by-case basis.

6.3.1 Methods

Environmental monitors will undertake systematic monitoring within high use areas of the Project to detect bird nesting activity and potential bat maternity roosts. Environmental monitors will document avian nests and nesting behaviour, as well as potential little brown myotis and northern myotis maternal roosting sites. The surveillance monitoring survey will include high use areas of the Project where there is risk of birds or bats nesting or finding shelter. This will include buildings that are frequently used, and stockpiles of supplies, sand and soil, as well as mobile and stationary equipment that has potential to be used during the migratory bird nesting and bat roosting season (1 May to 20 August).

Surveys in these areas will occur at least once per week during the migratory bird nesting and bat maternity roosting season and more frequently in particular areas if nests or roosts are found or nesting or roosting activity is observed.

6.3.2 Supporting Documentation

- Bird Nesting/Bat Roosting Activity Monitoring Procedure and Form (Appendix B).

6.4 Pre-Clearing Monitoring

Pre-clearing surveys will be completed to detect large mammals and raptor nests ahead of clearing activities. Raptor nests will be avoided by 500 m year-round, where possible, and clearing activities will be completed as quickly as possible to limit chances for large mammals to be present in the areas to be cleared.

6.4.1 Methods

Environmental monitors will travel (by foot, all-terrain vehicle, snow machine, or truck) the area to be cleared, plus a 500 m buffer. Any large mammals (e.g., caribou, moose, bison, bears, and wolves) or sign and raptor nests observed will be documented and reported to the environmental manager.

6.4.2 Supporting Documentation

- Pre-clearing Wildlife Survey Procedure and Form (Appendix B).

6.5 Wildlife Incident Reporting

Wildlife incidents refer to a range of possible occurrences at the Project, including:

- human-wildlife interactions that present a risk to either people or animals
- wildlife-caused damage to property or delay in operations
- wildlife deterrent actions (including audible or chemical deterrents; see Appendix B)
- wildlife injury or mortality
- wildlife found dead, even if from natural causes
- birds nesting on Project infrastructure or equipment

PPML will document all such incidents and make recommendations to prevent future incidents or escalation of problems, and report to the Government of the Northwest Territories, Environment and Natural Resources (GNWT-ENR).

6.5.1 Methods

Documentation of wildlife incidents will include photographs, names of people involved, the nature of the incident, and supporting information, such as the time, date, location, and follow-up actions. Encounters with black bears will follow the guidance provided in the Safety in Grizzly Bear and Black Bear Country brochure (Appendix C). All incidents will require follow-up to determine what can be done to prevent a similar incident from occurring in the future.

6.5.2 Supporting Documentation

- Wildlife Incident Procedures and Form (Appendix B).
- Safety in Grizzly and Black Bear Country (Appendix C).

7 REPORTING

Once the Project is approved and in construction, PPML will report progress and implementation of the Wildlife Protection Plan in the Wildlife Protection Plan Annual Report, documenting activities in the previous year. PPML will review the Wildlife Protection Plan annually to reflect changes in mine operations or as directed by the Mackenzie Valley Land and Water Board and GNWT-ENR. The Wildlife Protection Plan Annual Report will include, but not be limited to, the following information:

- occurrences of human-wildlife interactions, and incidents, accidents, injuries, or mortalities involving wildlife
- records of disturbances to wildlife habitat that were not predicted
- observations of recreational and traditional or non-traditional harvesting activities near the Project
- a discussion of the effectiveness of the mitigation outlined in the Wildlife Protection Plan

- any updates or recommended changes to the Wildlife Protection Plan

A mitigation audit of mitigation listed in the Wildlife Protection Plan will be undertaken annually during the Project construction and operation to document instances of adaptive management and the success of mitigation. The mitigation audit will investigate the following:

- Is all mitigation being implemented?
- How successful is the mitigation?
- Has new mitigation has been implemented in response to new issues?
- Is some mitigation redundant?

The results of the mitigation audit will be included in the Wildlife Protection Plan Annual Report, and the Wildlife Protection Plan will be revised, if necessary, to reflect lessons learned.

8 ROLES AND RESPONSIBILITIES

The following individuals are responsible to maintain and implement the Wildlife Protection Plan. Contact information is provided in Appendix D.

The PPML mine manager will:

- approve the Wildlife Protection Plan

The PPML environmental manager will:

- prepare updates of the Wildlife Protection Plan
- prepare the Wildlife Protection Plan Annual Report
- contact GNWT-ENR or other regulatory agency in the case of wildlife emergencies
- ensure that all staff are trained in the Wildlife Protection Plan processes
- ensure that the Wildlife Sightings Record is maintained and observations are transcribed to a database
- review all Wildlife Incident Reports and provide completed reports to the mine manager

All site staff will:

- follow the mitigation and procedures described in the Wildlife Protection Plan
- document all wildlife sightings in the Wildlife Sightings Record
- report any wildlife incidents to the environmental manager

9 REFERENCES

Acts and Regulations

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Appendices

Appendix A: Statutory Requirements

Appendix B: Protocols and Datasheets

Appendix C: Safety in Grizzly and Black Bear Country

Appendix D: Project Contact Information

Appendix A Statutory Requirements

Statutory Requirements for Wildlife in the NWT

July 2019

Government of
Northwest Territories

DISCLAIMER

This document is provided as an aide to developers drafting WMMPs to highlight those sections of the Northwest Territories *Wildlife Act* and *Species at Risk (NWT) Act* that most commonly apply to development activities. This is not an exhaustive list and other sections of these Acts may apply. The developer is responsible for familiarizing themselves with these Acts and current regulations.

The developer is also responsible for ensuring their activities comply with relevant federal legislation, including the Migratory Birds Regulations under the *Migratory Birds Convention Act* and the federal *Species at Risk Act*.

Wildlife Act

Topic	Section of *Wildlife Act*	Notes
Birds and nests	**51.** (1) Subject to section 17, no person shall, unless authorized by a licence or permit to do so, destroy, disturb or take (a) an egg of a bird; (b) the nest of a bird when the nest is occupied by a bird or its egg; or (c) the nest of a prescribed bird.	s. 5.3 and Schedule B of the Wildlife General Regulations sets out prescribed birds to include raptors from the following families: • Falconiformes • Strigiformes • Accipitriformes 51. (1) (c) of the NWT *Wildlife Act* does not specify the nest has to be active and applies year round.
Wildlife abodes	**51.**(2) Subject to section 17, no person shall, unless authorized by a licence or permit to do so, break into, destroy or damage a den, beaver dam or lodge, muskrat push-up or hibernaculum.	As per s. 5.4 (1) and (2) of the Wildlife General Regulations, this applies to naturally-occurring bats roosts. This section applies to any occupied or unoccupied den, beaver dam or lodge, muskrat push-up or hibernaculum.
Disturbance and harassment	**52.** Subject to section 17, no person shall, unless authorized by a licence or permit to do so, (a) engage in an activity that is likely to result in a significant disturbance to big game or other prescribed wildlife; or (b) unnecessarily chase, fatigue, disturb, torment or otherwise harass game or other prescribed wildlife.	"big game" means species of wildlife prescribed as big game, or an individual of a species of big game; Schedule A – Part 1 of the Wildlife General Regulations, sets out the species prescribed as big game, and Schedule B sets out prescribed wildlife for the purpose of paragraphs 52 (a) and (b) of the Wildlife Act.
Chasing Wildlife	55. Notwithstanding any other provision of this Act or the regulations, a person may chase wildlife away from a dwelling place, camp, work site, municipality or unincorporated community, or its immediate vicinity, if doing so is necessary to prevent injury or death to a person or damage to property.	"wildlife" means (a) all species of vertebrates and invertebrates found wild in nature in the Northwest Territories, and individuals of those species, except (i) fish as defined in section 2 of the *Fisheries Act* (Canada), and (ii) other prescribed species and subspecies, (b) species of wildlife referred to in paragraph (a) that are domesticated or held in captivity, and individuals of those species, and (c) prescribed species or subspecies of vertebrates and invertebrates, and individuals of those species or subspecies.

Defence of life and property	**56.** (1) Notwithstanding any other provision of this Act or the regulations but subject to subsection (4), a person may harvest and consume wildlife or take and consume the eggs of birds if it is necessary to prevent starvation of a person. (2) Notwithstanding any other provision of this Act or the regulations but subject to subsection (4), a person may kill wildlife if it is necessary to prevent injury or death to a person. (3) Notwithstanding any other provision of this Act or the regulations but subject to subsection (4) and any regulations specified as applying in respect of this section, a person may kill wildlife if it is necessary to prevent damage to property. (4) Subsections (1), (2) and (3) do not provide a defence to a contravention of this Act or the regulations for a person who resorts to harvesting or killing wildlife as a result of his or her mismanagement.	
Reporting	**57.** Subject to the regulations, a person shall, as soon as is practicable, report the harvest or kill of big game or other prescribed wildlife to an officer, if (a) under section 56, the person harvested big game or other prescribed wildlife to prevent starvation, or killed big game or other prescribed wildlife to prevent injury or death to a person or damage to property; and (b) the harvest or kill would, but for subsection 56(1), (2) or (3), be a contravention of this Act or the regulations.	Section 7 of the Wildlife General Regulations describes what information must be included in the report.
Accidental kill or wounding	**58.** A person who, with a motorized vehicle, accidentally kills or seriously wounds big game or other prescribed wildlife on a highway as defined in section 1 of the *Motor Vehicles Act*, shall report the event to an officer within the time fixed in the regulations.	Sub-section 8(1) of the Wildlife General Regulations specifies that any person who accidentally kills or seriously wounds big game or other prescribed wildlife with a motorized vehicle on a highway must report the event to an officer within 24 hours after the incident.
Feeding wildlife	**65.** (1) Subject to subsection (2), no person shall intentionally feed big game, fur-bearers or other prescribed wildlife. (2) Subsection (1) does not apply in respect of a person feeding wildlife lawfully kept in captivity or in circumstances permitted by the regulations.	Schedule A – Part 2 of the Wildlife General Regulations sets out the species prescribed as fur-bearers

Wildlife Attractants	**66.** (1) No person shall deposit, place or leave in, on or about land or premises food, food waste or another substance if there is a reasonable likelihood that it could attract big game or other prescribed wildlife to the land or premises and endanger a person, a domestic animal or wildlife. (2) Subsection (1) does not apply in respect of (a) the drying or caching of meat, pelts or hides, except in a manner contrary to regulations respecting the treatment, caching and identification of wildlife and parts of wildlife left temporarily on the land; (b) a person lawfully harvesting fur-bearers with bait; or (c) other persons and circumstances exempted by the regulations.	
Damage to habitat	**93.** (1) No person shall substantially alter, damage or destroy habitat. (2) A person who establishes that he or she acted with legal justification in altering, damaging or destroying habitat shall not be convicted of an offence under subsection (1).	"habitat" means the area or type of site where a species or an individual of a species of wildlife naturally occurs or on which it depends, directly or indirectly, to carry out its life processes;
Requirement for Wildlife Management and Monitoring Plan	**95.** (1) A developer or other person or body may be required, in accordance with the regulations, to prepare a wildlife management and monitoring plan for approval by the Minister, and to adhere to the approved plan, if the Minister is satisfied that a development, proposed development, or other activity is likely to (a) result in a significant disturbance to big game or other prescribed wildlife; (b) substantially alter, damage or destroy habitat; (c) pose a threat of serious harm to wildlife or habitat; or (d) significantly contribute to cumulative impacts on a large number of big game or other prescribed wildlife, or on habitat	Regulations.13.1-13.3 of the Wildlife General Regulations define prescribed species as territorially managed wildlife (not migratory birds or fish) assessed or legally listed as species at risk under federal or NWT legislation. Information on species at risk in the NWT can be found at the NWT Species at Risk website. Please consult the WMMP Guidelines www.enr.gov.nt.ca/en/services/legislation-and-regulations for information about when a WMMP is required and how to develop a WMMP.
Contents of the Wildlife Management and Monitoring Plan	**95**. (2) A wildlife management and monitoring plan must include (a) a description of potential disturbance to big game and other prescribed wildlife, potential harm to wildlife and potential	

	impacts on habitat; (b) a description of measures to be implemented for the mitigation of potential impacts; (c) the process for monitoring impacts and assessing whether mitigative measures are effective; and (d) other prescribed requirements.	

Species at Risk (NWT) Act

Topic	Section of the Act or Regulations	Notes
Designated Habitat	**80.** No person shall destroy any part of designated habitat.	
Species conservation	**151.** (1) The Commissioner, on the recommendation of the Minister, may make regulations respecting the conservation of pre-listed species or listed species, including but not limited to (a) requiring the doing of things that may conserve the species; (b) prohibiting activities that may adversely affect the species; (d) imposing prohibitions against (i) killing, harming, harassing, capturing or taking an individual of a species,	For up-to-date information on Regulations and Permits issued under the Act go to nwtspeciesatrisk.ca/en/Regulations
Habitat conservation	**152.** The Commissioner, on the recommendation of the Minister, may make regulations respecting the conservation of habitat of pre-listed species or listed species or the area in which the habitat is located or the surrounding area, including but not limited to (a) requiring the doing of things that may conserve the habitat or area; (b) prohibiting activities that may adversely affect the habitat or area; (c) imposing prohibitions against damaging or destroying the habitat or area; (d) controlling, restricting or prohibiting any use of, access to, or activity in the habitat or area; and (e) controlling, restricting or prohibiting the release of any substances in or into the habitat or area.	For up-to-date information on Regulations and Permits issued under the Act go to nwtspeciesatrisk.ca/en/Regulations

Designating habitat	**153.** (1) The Commissioner, on the recommendation of the Minister, may, by regulation, designate habitat, or a component or combination of components of habitat, of a pre-listed species or a listed species.	For up-to-date information on Regulations and Permits issued under the Act go to nwtspeciesatrisk.ca/en/Regulations
Designated habitat	**154.** The Commissioner, on the recommendation of the Minister, may make regulations respecting the conservation of designated habitat or the area in which designated habitat is located or the surrounding area, including but not limited to (a) requiring the doing of things that may conserve the designated habitat or area; (b) prohibiting activities that may adversely affect the designated habitat or area; (c) imposing prohibitions against damaging the designated habitat or area; (d) controlling, restricting or prohibiting any use of, access to, or activity in the designated habitat or area; and (e) controlling, restricting or prohibiting the release of any substances in or into the designated habitat or area.	For up-to-date information on Regulations and Permits issued under the Act go to nwtspeciesatrisk.ca/en/Regulations

Appendix B Protocols and Datasheets

Wildlife Sightings Procedure

Purpose

The purpose of this procedure is to describe the management of the wildlife sightings that are observed during the construction and operation phases of the Project.

Responsibility

All staff are responsible for reporting wildlife sightings. PPML staff are responsible for collecting the log sheets weekly and entering them into a database. PPML staff are also responsible for entering wildlife observations reported by radio into the log sheets.

Procedure

1) Wildlife sighting logs will be posted on various bulletin boards in camps and work areas for Project staff to record observations of wildlife.

2) Project staff will be made aware of which species are a priority to report.

3) All Project staff will be encouraged to add observations to the log, including the species, number, location, and date of the observation.

4) PPML staff will check the logs weekly for evidence of problem wildlife or problem areas that may pose a risk to wildlife.

5) Observations of wildlife may be called in by radio and entered into the Wildlife Sightings Log by PPML staff.

Equipment Requirements

None. Data sheets to be posted for use by all Project staff.

Reporting

Observations relevant to human or wildlife safety, such as observations of bears, caribou, moose, bison, species at risk, roosting bats, or nesting birds, will be included in the internal Weekly Report. Copies of all Wildlife Sightings Logs will be provided in the internal Weekly Report. All information including surveys and monitoring will be summarized in the Annual Report.

WILDLIFE SIGHTINGS LOG

Date	Time	Species	Number	Location (km marker, or coordinates)	Notes (any behavioural response or reactions?)	Name	Company

Wildlife Surveillance Monitoring Procedure

Purpose

To prevent wildlife incidents through systematically documenting wildlife activity.

Responsibility

PPML staff are responsible for completing surveys of the camp and waste management areas for evidence of wildlife presence and entering them into a database.

Procedure

PPML staff will undertake systematic tours of the Project camp and waste management areas to record all wildlife observations or recent wildlife sign (e.g., tracks and scat). Surveys will be completed at least once per week. Observers will travel to defined Project locations, and record the following at each location:

1) Time upon arrival at location / monitoring site.
2) Location or monitoring site.
3) Presence of wildlife or wildlife sign (Yes or No).
4) Species or sign observed.
5) Number of individuals.
6) Wildlife activity.
7) Photo number (if photo taken).
8) Any relevant comments about the observation, or relevant information from people working at the location.
9) Observations of any birds nesting or mammals denning adjacent to the cleared right of way or access roads.
10) Any relevant comments about improper storage or segregation of wastes or other wildlife attractants, any evidence of wildlife gaining access to wastes or attractants, and any reports of dangerous wildlife interactions from people working at the location.
11) Wildlife sign (such as tracks or scat) or observations of wildlife from Project staff working in the area (in the additional comments section on the reverse side of the data sheet). Photos of sign and wildlife should be taken where possible to help in identification of species after completion of the survey.
12) Photo number on the data sheet and download and file the photos by date.
13) If no wildlife is observed, no sign seen, and no reports of wildlife from staff, then an “N” should be recorded on the data sheet and in the database for that monitoring site or location.

Locations for Systematic Monitoring

The following areas / sites should be visited at least once a week:

- camp (entire perimeter)
- waste management areas (entire perimeter)

Equipment Requirements

- truck
- binoculars
- datasheets
- field guide for birds
- global positioning system (GPS)
- project map
- digital camera

Reporting

Any wildlife concerns that are observed during the survey should immediately be brought to the attention of the environmental manager so that appropriate action can be taken. Any wildlife incidents observed or reported during this survey should be reported in the Wildlife Incident Report Form (see separate form). Observations relevant to human or wildlife safety, such as observations of bears, caribou, moose, species at risk, roosting bats, or nesting birds, will be included in the internal Weekly Report. All information including surveys and monitoring will be summarized in the Annual Report.

WILDLIFE SURVEILLANCE MONITORING FORM

Observers:_____ Date:_____ Page :_____of: _____

Wildlife Observed or Wildlife Sign

Time	Location	Wildlife Present? (Y/N)	Species Or Sign	Number	Activity	Photo #	Observations from people working at the location / other comments

Record any additional comments on reverse page

Bird Nesting and Bat Roosting Activity Procedure

Purpose

To purpose of this procedure is to detect and mitigate impacts to active bird nests and bat roosting sites from vegetation clearing and other Project activities.

Responsibility

PPML staff are responsible for completing the surveys and entering the results into a database.

Procedure

Systematic Monitoring

PPML staff will undertake systematic monitoring of Project buildings, stationary equipment, and active exploration sites to detect bird nesting activity and potential bat roosts. PPML staff will document avian nests and nesting behaviour, as well as potential little brown myotis and northern myotis maternal roosting sites. The surveillance monitoring survey will include high use areas of the Project where there is risk of birds or bats nesting or finding shelter. This will include buildings that are frequently used, and stockpiles of supplies, sand and soil, as well as mobile and stationary equipment that has potential to be used during the migratory bird nesting and bat roosting season (May 1 to August 20).

Surveys in these areas will occur at least once per week during the migratory bird nesting and bat roosting season and more frequently in particular areas if nests or roosts are found or nesting or roosting activity is observed.

Observers will travel to defined Project locations and record the following at each location:

1) Time upon arrival at location / monitoring site.
2) Time upon arrival at location / monitoring site.
3) Location or monitoring site.
4) Presence of bird nesting behaviour, active bird nests, or bat roosting sites.
5) Number of individuals.
6) Photo number (if photo taken).
7) Any relevant comments about the observation, or relevant information from people working at the location.
8) Any reports of sign or observations of species from Project staff working in the area (in the additional comments section on the reverse side of the data sheet).
9) If no nests, nesting behaviour or roosting sites are observed, no sign seen, and no reports of wildlife from staff, then an “N” should be recorded on the data sheet and in the database for that monitoring site / location.
10) Monitoring will initiate May 1 and continue at least until August 20 (or until all identified nests are inactive), and focus on areas where scheduled construction activities are expected during the migratory bird nesting season.

11) In particular, incidental observations of avian species at risk should be documented. These species include the following:

    a) Bank swallow

    b) Barn swallow

    c) Common nighthawk

    d) Olive-sided flycatcher

    e) Canada warbler

    f) Rusty blackbird

    g) Evening grosbeak

    h) Horned grebe

    i) Yellow rail

    j) Whooping crane

Pre-Vegetation Clearing

Clearing of vegetation will generally be scheduled to occur outside of migratory bird breeding season (May 1 to August 20). However, there may be instances where vegetation removal is required during this period due to schedule changes or unforeseen circumstances. In these cases, non-intrusive pre-clearing surveys are required. These will be developed on a case-by-case basis.

PPML staff will determine an appropriate setback distance for each nest on a case-by-case basis according to the following two factors (ECCC 2019a):

1) Alert distance - the distance at which the bird adopts an alert posture or emits alarm calls

    a) Birds usually perceive humans as potential predators. They may leave their nests in response to being approached, or abort nesting because of stressful situations.

2) Flush distance - the distance at which a bird takes flight or moves away from a threat, performs distraction displays (such as feigning a broken wing or sitting down on a non-nesting site to draw attention away from the nest), or actively defends the nest

A higher minimum setback distance may be required in some circumstances, such as the following (ECCC 2019a):

- Removal of vegetation and/or soil disturbance.
- Drilling, loud noise, vibration.
- Regular approach by humans or vehicles.
- Noise exceeding 10 decibels (db) above ambient noise levels in the natural environment.
- Noise greater than about 50 db.
- Most waterfowl nests compared to nests of songbirds and other small birds.

- Presence of sensitive species or species at risk.

Survey Locations

Systematic Monitoring

The following areas / sites should be visited at least once a week:

- camp (entire perimeter and buildings)
- waste management areas (entire perimeter and buildings)
- heavy equipment that has been stationary for more than two days and will be used during the migratory bird nesting and bat roosting season
- waterbodies within 100 m of camp
- stream crossing locations

Pre-Vegetation Clearing

- All greenfield areas that will be cleared of vegetation during the migratory bird nesting period, plus a minimum 30 m buffer around the area to be cleared, should be searched PPML staff as soon as possible before clearing is to take place. The exact buffer to be searched will be determined by the environmental manager on a case-by-case basis.

Equipment Requirements

- truck
- binoculars
- datasheets
- field guide for birds
- GPS
- project map
- digital camera

Reporting

Any bird nesting or bat roosting observed during the survey should immediately be brought to the attention of the environmental manager. The environmental manager will determine an appropriate setback distance for each nest on a case-by-case basis according to the factors outlined above. If a species at risk is found, the environmental manager will email Environment and Climate Change Canada (ECCC) to determine an appropriate course of action. Details of all nests identified, and associated mitigation that was implemented to limit effects on nesting birds will be included in the internal Weekly Reports.

All observations of nesting or roosting activity or risk of nesting or roosting on active Project infrastructure should be included in the internal Weekly Report. All information including surveys and monitoring will be summarized in the Annual Report.

BIRD NESTING/ BAT ROOSTING ACTIVITY MONITORING FORM

Observers:_____ Date: _____ Page: _____of: _____

Location:_____

Wildlife Observed or Wildlife Sign

Time	Location	Species Observed	Photo #	Nesting/Roosting Behaviour Observed	Nest/Roost Observed (describe)

Record any additional comments on reverse page

Pre-Clearing Survey Procedure

Purpose

The purpose of this procedure is to detect large mammals and raptor nests ahead of the vegetation clearing activities in greenfield areas.

Responsibility

PPML staff are responsible for completing the surveys and entering them into a database. Surveys will be overseen by the environmental manager.

Procedure

1) PPML staff will travel survey (by foot, ATV, or snow machine) the entire area that will be cleared, plus a 500 metre (m) buffer around the area to be cleared. PPML staff should aim to survey areas to be cleared just prior to the vegetation clearing.

2) PPML staff will travel at no more than 10 kilometres per hour (km/h) looking for wildlife and fresh wildlife sign.

3) Any large mammals (caribou, moose, bison, bears, wolves) or sign and raptor nests observed in or within 500 m of the area to be cleared will be documented and reported to the environmental manager.

4) For each day of surveys, the following information will be recorded using the datasheet provided:

   - start and finish coordinates
   - observer names
   - wildlife or wildlife sign observed.

5) Communications with the environmental manager and any follow up actions will also be documented.

Mitigation Options for Large Mammals

If large mammal is observed within 500 m of an area that will be cleared of vegetation, activities within 500 m of the animal will cease until the animal moves beyond 500 m from activities.

Mitigation Options for Raptor Nests

If an unoccupied raptor nest is found within 500 m of an area that will be cleared of vegetation during winter, the following mitigation options will be evaluated by GNWT-ENR and PPML (in decreasing order of preference):

- If feasible, adjust the area required for greenfield clearing to avoid the raptor nest by 500 m;
- Reduce the size of the exclusion zone, but maintain a vegetated buffer around the raptor nest. Leave the tree supporting the raptor nest standing, if safety permits.
- If the tree supporting the nest is directly within an area that must be cleared, and the mitigations listed above are not feasible, obtain a permit from GNWT-ENR to destroy the raptor nest.

If vegetation clearing in greenfield areas is required during the raptor breeding period, the area to be cleared, plus a 500 m buffer, will be searched to locate active raptor nests. The environmental manager will be notified immediately if an active raptor nest is found within 500 m of the area to be cleared. The environmental manager will email GNWT-ENR to determine an appropriate course of action. Through consultation with GNWT-ENR nests, will be protected by a buffer that protects the nest while allowing activities to continue and will be monitored. Details of nests identified and associated mitigation will be included in the internal Weekly Reports.

Equipment Requirements

- Datasheets
- GPS
- Project map
- Transect lines
- Digital camera

Reporting

Observations of large mammals or fresh sign and active and inactive raptor nests will be reported immediately to the environmental manager. Survey effort and a summary of results will be included in the internal Weekly Report. All information including surveys and monitoring will be summarized in the Annual Report.

PRE-CLEARING WILDLIFE SURVEY

Date: _____Start time:_____ End time:_____

Observer(s): _____

Feature (circle one): Project Area Access Road Site Road

Start location (UTM): _____ End location:_____

Wildlife and Wildlife Sign Observations

Time	Species	Observation (visual, tracks, other sign)	Location (UTM)	Comments

Document follow-up actions resulting from any wildlife observations

Wildlife Incidental Reporting Procedure

Purpose

The following procedure is intended as a guideline to identify wildlife that requires immediate reporting and sampling (if necessary). GNWT-ENR encourages all those conducting activities on the land or residents to record and report all instances of injury or possibility of disease in wildlife. The Project will document all such incidents to prevent future incidents or escalation of problems, and report to GNWT-ENR and ECCC, as applicable.

Responsibility

All Project personnel are responsible for recording wildlife incidents on the Project site.

As per Section 57 of the *Wildlife Act*, any defense of life and property kills must be reported to GNWT-ENR without delay. All reasonable efforts must be made ensure to avoid spoiling of the hide and other valuable parts. These should be turned over to an GNWT-ENR Officer to avoid any wastage.

As per Section 58 of the *Wildlife Act*, and sub-section 8(1) of the Wildlife General Regulations, any person who accidentally kills or seriously wounds big game or other prescribed wildlife with a motorized vehicle on a highway must report the event to an officer within 24 hours after the incident.

Procedure

Report wildlife incidents within the Project footprint when:

- Wildlife is injured or killed due to collision with a Project vehicle.
- Wildlife is suspected of being diseased.
- Wildlife is found dead or injured.
- There is the potential for human/wildlife conflict such as an occupied bird nest or wolf or bear den.
- Wildlife is deterred from camp or other work area.
- An animal is killed to protect worker safety.
- Property is destroyed by wildlife.

Complete the Wildlife Incident Record Form, providing information such as:

- Behaviour and movements.
- Loss of life or property.
- Reason for attraction to area.
- Estimation of how long the animal was dead.
- Any other animals seen in the area.

Collect photographs:

- Add photo name/label.
- Show general area.
- In case of mortality, photograph the animal (one from each side, head, and tail), including anything unusual and any obvious injuries or marks.

Equipment Requirements

- Data sheets to be posted for all Project staff use.
- In case of mortality, digital camera.

Reporting

PPML staff should report all incidents immediately to the environmental manager. When the Wildlife Incident Report is complete, the environmental manager is to contact:

1) GNWT-ENR North Slave Emergency number at (867) 873 - 7181 (24 Hours), Fax: (867) 873 – 6230.
2) ECCC at ec.dalfnort-wednorth.ec@canada.ca

All Incident Reports will be included in the internal Weekly Reports.

Occurrence Date/Time:

Date Reported:

WILDLIFE INCIDENT RECORD

MAIN CONTACT INFORMATION			
NAME: **ADDRESS:** **PHONE NUMBER:**			
Location of Complaint: (coordinates, km marker, lake, camp)			
Details Taken by:			
Location of Incident (coordinates, km marker, lake, camp):			
Type of Incident:	□ Encounter □ Nuisance □ Wildlife Mortality □ Wildlife Injured □ Defensive □ Other:		
Species:	□ Black Bear □ Bison □ Fox □ Wolverine □ Wolf □ Caribou □ Moose □ Bird □ Other:		
Sex:	□ Male	**AGE CLASS:**	□ Adult
	□ Female		□ Juvenile
	□ Unknown		□ Cub
			□ Unknown

Details of Incident: (movement, behaviour, reason for attraction, property damage, vehicle collision, etc.)	

Details of Action Taken: (reporting, deterrence type, disposal, removal of attractant, etc.)	
DATE: mm/dd/yy	

Was the incident resolved?	□ Yes	□ No
Has Environment & Natural Resources been contacted? **Contact Name:** **Date/Time Reported:**	□ Yes	□ No

Appendix C Safety in Grizzly and Black Bear Country

2014

Bear Occurrence Procedures Manual

Photo by Dean Cluff/ENR

Environment & Natural Resources

Northwest Territories Environment and Natural Resources

Bear Occurrence Procedures Manual

Implementation of these procedures will allow ENR a greater ability to provide advice and assistance in preventing harm to humans, bear(s) or property. In addition, it will provide guidance on safely deterring bears that find themselves in areas of development, tourism camps or cabins with the aim of preventing habituation and unnecessary destruction.

Report any incidents such as sightings, encounters, injuries and/or mortalities to the ENR. The GNWT Phone Directory can be found at http://rdirectory.gov.nt.ca/rDirectory.aspx Regional contacts are listed below:

North Slave Region

Wildlife Emergency	(867) 873 - 9238 (24 Hours)
Yellowknife	(867) 873 - 9238
Fax:	(867) 873 - 6230

South Slave Region

Wildlife Emergency	(867) 872 - 0400 (24 Hours)
Fort Smith	(867) 872 - 6400
Fax:	(867) 872 - 4250

Inuvik Region

Wildlife Emergency	(867) 678 - 0289 (24 Hours)
Inuvik	(867) 678 - 6650
Fax:	(867) 678 - 6659

Sahtu Region

Wildlife Emergency	(867) 587 - 2422 (24 Hours)
Norman Wells	(867) 587 - 3500
Fax:	(867) 587 - 3516

Deh Cho Region

Wildlife Emergency	(867) 695 - 7433 (24 Hours)
Fort Simpson	(867) 695 - 7450
Fax:	(867) 695 - 2381

BEAR AWARENESS TRAINING

ENR supports the NWT Mine Health and Safety Regulations (s.15.05), which requires that all field personnel involved in mineral exploration undertake bear-safety training. However, human/wildlife incident prevention is a key component to the training.

Training of personnel in preventing and responding to wildlife incidents can reduce the likelihood of injury to personnel and wildlife. Therefore, all field personnel working on the project must receive bear awareness training, preferably from a professional trainer.

The training should include:

1. Recognizing the causes of human/wildlife conflicts;
2. How to prevent and respond to bear incidents;
3. Proper storage, transfer and disposal of camp waste; and
4. Proper use and safe application of deterrents.

INCIDENT PREVENTION

Refer to the ***Camp Waste and Wildlife Attraction Guideline.*** This resource provides guidance on how to minimize or prevent attraction from bears to your camp, cabin or work site.

OCCURRENCE RESPONSE

Small scale exploration and tourism camps should develop and implement Bear Incident Standard Operating Procedures (SOPs) that can be used in the field. The SOPs will allow all members on site to have knowledge of how to minimize or prevent any loss of life or property if there is a bear within the vicinity of your camp area or work site. SOPs may include such things as:

a) Response team
b) Equipment
c) Action level
d) Emergencies
e) Reporting Requirement

1. SIGHTING - Bear in the general vicinity (>1km)

1. If it is within sight of your camp/cabin and it is safe to do so, use a ***Wildlife Sightings Log*** to record and report information regarding your observations.
2. Continue to monitor, if necessary.

2. ENCOUNTER - Bear In Camp (<1km)

1. If safe to do so; take a quick note of the location, direction of travel and general behaviour of the bear(s).
2. Sound the bear alarm.
3. If necessary, phone the ENR Regional contacts listed above for guidance on necessary next steps to ensure human/wildlife safety and protection of property.
4. If necessary, stay indoors or in your vehicle. **DO NOT APPROACH THE BEAR.**
5. Keep all doors and windows closed.

6. If necessary and safe to do so; continue to monitor the behaviour and movement until either the bear leaves on its own, deterrence is successful or response personnel arrive.
7. If possible, start deterrence procedures.
8. Report status of bear encounter to the ENR Regional contacts listed above when safe to do so.

3. Injury

1. Any injuries a bear may have obtained from direct or indirect contact with the camp or persons must be reported to the appropriate ENR Regional contact listed above.

4. Mortality

1. A bear may be destroyed if human life is in danger or destruction of property is imminent.
2. Under the NWT Wildlife Act, mortalities must be reported to the appropriate ENR Regional contact listed as soon as is practicable. In some cases, the responsible party may be asked to:

    a) Skin the bear leaving the claws and head attached.
    b) Preserve the hide by freezing and/or salting it and store it in a cool place. Turn in the hide, the skull, evidence of sex and any other biological samples requested when filing the report to the nearest ENR Regional office or to an ENR Renewable Resource Officer.

If or when possible, the attached ***Bear Occurrence Checklist*** should be completed prior to calling ENR. It is critical that as much information as possible be provided in order for ENR to provide appropriate advice and guidance.

DENNING BEARS

A. For exploration camps, if a bear is located in, at or near a den site, work in the area must halt. All employees should safely retreat from the area and report the incident to the Site Supervisor and/or Wildlife Monitor and the appropriate ENR Regional contact listed above for further advice and assistance.

B. For cabin owners, if a bear is located in, at or near a den site, safely retreat from the area and report the incident to the appropriate ENR Regional contact listed above for further advice and assistance.

C. Staff from ENR will be required to assess the den site and may implement measures to ensure both human safety and that the bear(s) remain undisturbed. This may include the establishment of a buffer zone of at least 300 meters around the den.

D. Work inside the buffer zone may not be permitted until after den emergence.

Office Use Only
File#:

Environment & Natural Resources (ENR)
Bear Occurrence Checklist

- Fill out or check all that apply

1. **Complainant Details:**				
Name, job title and affiliation:				
Contact information:				
Location of complainant: *(coordinates, lake or property name)*				
Other on-site contact information: *(wildlife monitors/site supervisors)*				
2. **Bear Occurrence Details:**				
Date/Time:		**Location:** *(coordinates, lake or property name)*		
Type of bear occurrence:	□ sighting	□ encounter	□ injury	□ mortality *Ear tag/tattoo #*
	□ Other, explain:			
Number of bears:		**# of cubs**		
Type:	□ black	□ grizzly	□ unknown	
Sex :	□ male	□ female	□ unknown	
Age Class:	□ cub (<1)	□ juvenile	□ adult	□ unknown
Behaviour:	□ fearful	□ not fearful	□ aggressive	□ other
General Observations	□ moving toward site	□ moving away from site	□ at site	
Other observations: *(i.e. walking, resting, eating, mortality, injury, den site, number of cubs, etc.)*				
Has bear(s) been involved in a previous incident:	□ No □ Yes	**If yes, explain:**		
Did the bear obtain a reward	□ No □ Yes	**If yes, explain:**		
Any property damage or loss of life:	□ No □ Yes	**If yes, explain:**		

3. **Detection/Deterrent:**				
Detection system on site:	□ Alarm	□ Dog	□ Motion detector	□ Other:
Deterrence on site:	□ Bear boards	□ Auditory *(Yelling/Flares/Alarm/Horn/Bell/ Whistle/Cracker shells)*	□ Projectile *(Rubber Bullets/Firearms)*	
	□ Electric Fence	□ Chased *(Dog, vehicle)*	□ Other:	
Was deterrence used:	□ No □ Yes	**Explain:**		
Was the deterrence successful:	□ No □ Yes	**Explain:**		
Present status of bear with dates:	□ at large	□ captured	□ deterred	□ other

4. Additional Comments	

Appendix D Project Contact Information

Appendix D: Project Contact Information

Andrew Williams
Environmental Manager
Pine Point Mining Limited
1100 Avenue des Canadien-de-Montreal
Bureau 300
Montreal, OC, H3B 2S2
Phone: 416-209-2056
Email: acwilliams@live.ca

Volume 2 -

Aquatic Effects Monitoring Program Design Plan Framework

Aquatic Effects Monitoring Program Design Plan Framework for the Pine Point Project

Purpose

This framework document is provided in support of the Mackenzie Valley Environmental Impact Review Board (MVEIRB) Environmental Assessment Initiation Package for the Pine Point Project (Project). The intent of this document is to describe how this environmental mitigation and monitoring plan relates to the Project, what information will be provided as the Project develops and to list applicable guidelines and standards. It was developed with the available Project information. This document is not intended for approval but is provided for review purposes and will be refined as the regulatory process proceeds.

Version History

The Pine Point Mining Limited is responsible for the distribution, maintenance, and updating of this document. Changes that do not affect the intent of the document will be made as required (e.g., phone numbers, names of individuals). The table below indicates the version of this document, and a summary of revisions made.

Revision #	Section(s) Revised	Description of Revision	Issue Date
0	-	Framework version for MVEIRB Initiation Package	15 December 2020

Table of Contents

Figures

Abbreviations

Abbreviation	Definition
AEMP	Aquatic Effects Monitoring Program
AEMP Framework	Aquatic Effects Monitoring Program Design Plan Framework
Beak	Beak Consultants Ltd.
CCME	Canadian Council of the Ministry of Environment
Cominco	Cominco Ltd.
EA	environmental assessment
EBA	EBA Engineering Consultants Ltd.
EEM	Environmental Effects Monitoring
GNWT	Government of the Northwest Territories
Golder	Golder Associates Ltd.
ITK	Indigenous Traditional Knowledge
MVLWB	Mackenzie Valley Land and Water Board
NWT	Northwest Territories
QA	quality assurance
QC	quality control
PPML	Pine Point Mining Limited
the historical mine	Historical Pine Point Mine
Project	Pine Point Project
VCs	valued components

Units of Measure

Units	Definition
%	percent
ºC	degrees Celsius
km	kilometre
km^2	square kilometre
km^3	cubic kilometre
masl	metres above sea level
m	metre
m^3/s	cubic metres per second

1 INTRODUCTION

1.1 Background

Pine Point Mining Limited (PPML) is the sole proponent of the Pine Point Project (Project) and is a 100% owned subsidiary of Osisko Metals Incorporated. PPML acquired the Project in February 2018 with the objective of redeveloping a mine at the Pine Point property, which is a brownfield site resulting from historical mining and milling activities by Cominco Ltd (Cominco). PPML is proposing to mine mineralized material and produce concentrates of lead and zinc for shipment to independent smelters worldwide. The Project will consist of open pit and underground mining for zinc and lead.

1.2 Purpose and Scope

An Aquatic Effects Monitoring Program (AEMP) is a requirement of a Type A Water Licence. The purpose of the AEMP will be to provide a systematic framework to monitor and assess environmental effects from the Project on surrounding watercourses, and to respond with appropriate actions if, or when adverse effects from the Project are identified.

This AEMP Design Plan Framework (AEMP Framework) was developed to support the Mackenzie Valley Environmental Impact Review Board Environmental Assessment (EA) Initiation Package for the Project. It is intended to provide a preliminary outline of approaches to monitoring, data analysis, and the Response Framework for the AEMP. This AEMP Framework is based on guidance provided in the *Guidelines for Aquatic Effects Monitoring Programs* (MVLWB/GNWT 2019). The AEMP Framework is meant to provide a basis for PPML to engage with regulatory agencies and Indigenous communities and elicit feedback on the planned aquatic effects monitoring activities associated with the Project. An updated, conceptual AEMP Design Plan for the Project will be developed during the permitting phase of the Project (i.e., for water licencing) or potentially earlier, if required, based on feedback through the EA process. The conceptual AEMP Design Plan will incorporate the feedback received on this AEMP Framework, as well advancement in the Project design and water balance studies. A final AEMP Design Plan will be submitted to the Mackenzie Valley Land and Water Board (MVLWB) for approval prior to commencement of monitoring activities.

1.3 Document Organization

The content of this AEMP Framework follows the *Guidelines for Aquatic Effects Monitoring Programs* (MVLWB/GNWT 2019). To meet the EA requirements (MVEIRB 2018) and provide appropriate supporting information, this document is organized as follows:

- Section 2 – Project Description: briefly describes the Project.
- Section 3 – Description of the Environment: briefly describes the environmental setting around the Project, including traditional uses and a description of the relevant environmental components that could be affected by the Project.
- Section 4 – Problem Formulation: describes the issues that may need to be tracked throughout the monitoring program and provides a conceptual site model which identifies and describes potential pathways of exposure.

- Section 5 – AEMP Design: provides a framework for the conceptual study design, which includes a brief description of the study area and a preliminary sampling design (i.e., provides options for the where, when, and how).
- Section 6 – Methods and Analysis: describes an overview of component-specific details related to the sampling design for consideration in the conceptual AEMP design (i.e., field methods and data analysis approach).
- Section 7 – Special Studies: describes the purpose of special studies that may be conducted as part of the AEMP.
- Section 8 – Response Framework: describes the purpose of AEMP Response Framework, which will be developed for the AEMP Study Design.
- Section 9 – AEMP Reporting: describes the AEMP reporting system.
- Section 10 – References: provides the list of references.

1.4 Objectives

The objective of the AEMP will be to assess mine-related effects on watercourses in the area surrounding the Project in a scientifically defensible manner. The AEMP will provide the necessary data to inform adaptive management of potential aquatic effects resulting from operation of the proposed Pine Point Mine. The AEMP is one of the monitoring programs and management plans that will be employed to make decisions on reducing the magnitude, frequency, and extent of effects on the environment.

The objective of the AEMP Framework is to provide an initial high-level outline of the AEMP for the Project to allow for engagement on the AEMP Framework prior to developing the AEMP Design Plan for the Water Licence.

1.5 Aquatic Effect Monitoring Program Team and Accountability

1.5.1 Corporate Contact Information

Primary Pine Point Mining Limited Contact	Andrew Williams
Title	Environmental Manager
Address	1100 Avenue des Canadiens-de-Montréal, Bureau 300
City	Montreal
Province	Québec
Postal Code	H3B 2S2
Telephone	416-209-2056
Email	acwilliams@live.ca

1.5.2 Consultant Contact Information

Golder Associates Ltd. (Golder) will support PPML in developing and implementing the AEMP for the Project. Key contacts for this AEMP Framework are:

Damian Panayi
Project Director
Golder Associates Ltd.
4905 48 St. #9, Yellowknife, NWT, X1A 3S3
damian_panayi@golder.com
867-873-6319

Lasha Young
Project Manager
Golder Associates Ltd.
16820 107 Ave, Edmonton, AB, T5P 4C3
lasha_young@golder.com
780-930-2885

1.6 Traditional Knowledge and Engagement

Indigenous Traditional Knowledge (ITK), also known as Indigenous Knowledge, is sought for use in environmental monitoring programs by involving Indigenous communities in program planning and implementation and providing opportunities for community members to share ITK with those involved in the program.

PPML will complete a thorough engagement process throughout the EA process and leading up the Water Licence application to gather input from stakeholders on the EA and documents to be submitted to support the Water Licence. PPML has identified a number of Indigenous communities, municipal, territorial, and federal government agencies, and other interested organizations as parties to be engaged as part of the process. These parties, and the details of the planned engagement activities, are presented in the Engagement and Collaboration Framework for the Project (Volume 2).

1.7 Regulatory Instruments for AEMP

Following the EA process, the Project will enter the permitting phase of the Project. A Type A Water Licence for Mining and Milling will be required for the Project and will be applied for after approval of the EA. The Water Licence is required prior to beginning construction to ensure that the construction, operation, and closure and reclamation of the Project complies with the *Mackenzie Valley Resource Management Act* and the *Waters Act*. Other permits and authorizations relevant to the Project will also be applied for and would require approval to be granted prior to construction and operation (i.e., an Aurora Research Institute Scientific Research Licence and a Fisheries and Oceans Canada *Fisheries Act* Authorization).

2 PROJECT DESCRIPTION

The Project is located in the Northwest Territories (NWT) within the South Slave Mining District, south of Great Slave Lake, approximately 175 km directly south of Yellowknife, 75 km east of Hay River, and 53 km southwest of Fort Resolution (Figure 1). The closest major transportation hubs are Yellowknife and Hay River. Access to the Project is presently via all-weather Highways 5 and 6.

A description of the Project, including a summary of the site history and Project components and alternatives is provided in the Project Description (Volume 1). The Project will consist of open pit and underground mining for lead and zinc, construction and operation of a processing mill (or "concentrator") and pre-concentration facilities, storage and management of mineralization waste and water, construction and operation of ancillary support facilities including a camp for workers, and the transportation of zinc and lead concentrates to global markets. As much as possible, the construction of processing facilities, the camp, and ancillary support structures will be located on previously disturbed land.

The Project includes underground mines in the areas west of the Buffalo River and open-pit mining in the sector east of the Buffalo River. The area surrounding the Project includes approximately 50 existing open pits, which were developed during previous mining activity. Existing open pits will be used to manage waste rock generated from future mining and from pre-concentration (rejects). Tailings and mine water will also be stored in the existing open pits. Water stored in existing pits during operation may include excess water from tailings, mine dewatering, dust suppression, and drainage systems from the vehicle and machinery maintenance facilities.

The use of the existing open pits for water storage is currently the preferred approach for the management of mine water on site; however, direct discharge to the aquatic receiving environment may be used as an alternative, if required. As part of the ongoing design of water management for the Project, a water balance will be developed to understand the capacity of existing pits, and the need for mine water discharge will be determined; if required, potential discharge location(s) will be selected.

Sewage and domestic wastewater from the camp and other facilities will be sent to a septic system or, as an alternative, to a sewage treatment plant and then discharged to the environment. Surface water runoff for the site will be managed using ditches and collection ponds, and potentially other infrastructure.

Water use for the project will include water requirements related to the mine process and for domestic water use. The quantity of water needed will be evaluated as part of ongoing design of water management for the Project. It is anticipated that water will be withdrawn from Great Slave Lake using infrastructure previously developed by Cominco.

The conceptual project timeline for the permitting, construction, and operational stages are presented in the Project Description (Volume 1, Section 1.0).

LEGEND

- FORMER PINE POINT TOWN SITE
- POPULATED PLACE
- ALL-SEASON ROAD
- PARK/PROTECTED AREA
- WATERBODY
- GENERAL PROJECT LOCATION

0 25 50

1:1,250,000 KILOMETERS

REFERENCE(S)

1. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
2. PARKS AND PROTECTED AREAS OBTAINED FROM CONSERVATION AREAS REPORTING AND TRACKING SYSTEM (CARTS), CANADIAN COUNCIL ON ECOLOGICAL AREAS, 2017.

PROJECTION: ALBERS CONIC EQUAL AREA

CLIENT
PINE POINT MINING LTD.

PROJECT
PINE POINT PROJECT

CONSULTANT
GOLDER

YYYY-MM-DD	2020-10-07
DESIGNED	DC
PREPARED	BW / MM / JE
REVIEWED	DP
APPROVED	DP

TITLE
PROJECT LOCATION

PROJECT NO.	CONTROL	REV.	FIGURE
19125747		0	1

3 DESCRIPTION OF THE ENVIRONMENT

3.1 General Setting

The Project is located at the edge of the Boreal Plains and Taiga Plains Ecozones, and within the Slave River and Hay River Lowland Ecoregions. These ecoregions are classified as having a sub-humid, mid-boreal ecoclimate (Environment Canada 2000, as cited in EBA 2005a). The area is characterized by short, cool summers and long, cold winters. The average monthly temperatures in 2019 at the closest monitoring stations (Hay River Airport) ranged from a minimum of -22.7°C in February to maximum of 15.5°C in July. The winter months are typically the driest with the most precipitation usually occurring in August.

The two nearest drainages in the area of the Project are the Buffalo River and Twin Creek. These watercourses flow north into Great Slave Lake. Figure 2 illustrates the location of these waterbodies.

The Project is located in an area of sporadic discontinuous permafrost with generally subdued topography, which suggests that between 10% and 50% of the land area is underlain by permafrost, and the ground ice content in the upper 10 to 20 m of the ground is low. The vegetation in the surrounding area is characterized by medium to tall, closed stands of jack pine and trembling aspen. White and black spruce dominate older stands of forest. Poorly drained fens and bogs in this region are covered with low, open stands of larch, black spruce, and ericaceous shrubs (Environment Canada 2000, as cited in EBA 2005a). Wildfires have been a common occurrence in the region.

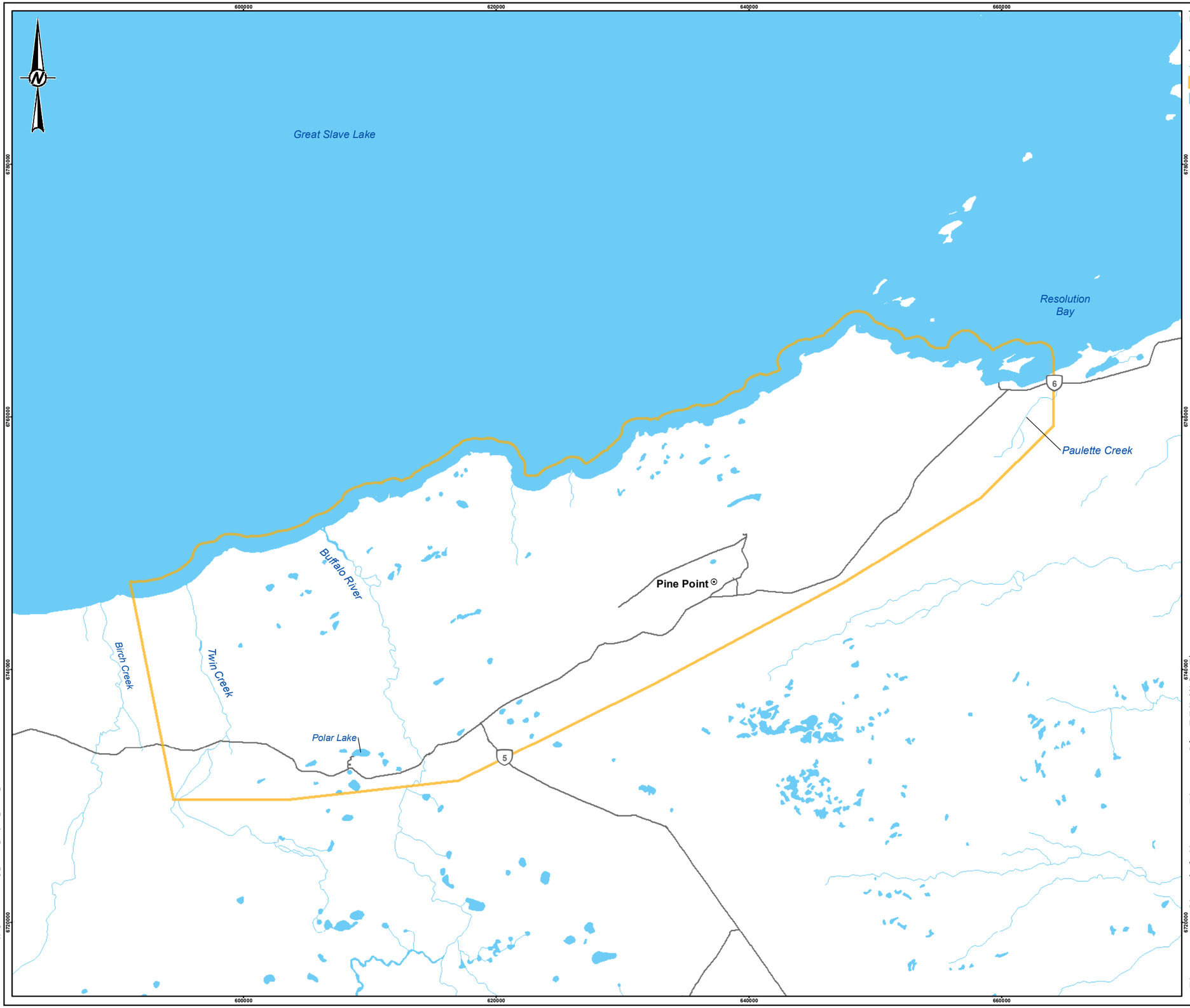
Hunting, fishing, and trapping activities occur in the vicinity of the Project. Wildlife identified as being present and/or harvested include caribou, moose, wood bison, lynx, wolf, otter, black bear, rabbit, porcupine, ptarmigan, ruffed grouse, and waterbirds. Fishing for subsistence, recreational and commercial purposes also occurs in the vicinity of the Project.

3.2 Existing Conditions

The environmental components that could be affected by the Project and that are relevant to the AEMP include, surface water quantity, water quality, and fish and fish habitat. A brief summary of existing environmental conditions pertaining to these components is included below; additional details are provided in the Existing Environment for the Pine Point Project (Golder 2020a).

3.2.1 Surface Water Quantity

As indicated above, the two main drainages located in the immediate area of the Project are the Buffalo River and Twin Creek. Twin Creek is a small stream that drains several small lakes and wetlands approximately 20 km to the south of the Highway 5 northward into Great Slave Lake. The drainage area of Twin Creek at the mouth of Great Slave Lake is approximately 220 km^2. The overall length of Twin Creek is approximately 45 km, with a typical seasonal water flow and higher flows occurring during spring snow melt (EBA 2005b). The stream channel is often undefined and flows through sphagnum bogs (EBA 2005b). After turning into a large, open, almost treeless, and swampy area, the stream re-emerges as a defined creek channel before reaching Great Slave Lake (Beak 1980).



LEGEND

- FORMER PINE POINT TOWN SITE
- ALL-SEASON ROAD
- WATERCOURSE
- GENERAL PROJECT LOCATION
- WATERBODY

0 7.5 15

1:300,000 KILOMETRES

REFERENCE(S)

1. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
2. PARKS AND PROTECTED AREAS OBTAINED FROM CONSERVATION AREAS REPORTING AND TRACKING SYSTEM (CARTS), CANADIAN COUNCIL ON ECOLOGICAL AREAS, 2017.
3. POTENTIAL EFFLUENT DISCHARGE LOCATIONS PROVIDED BY ANDRÉE DROLET, PPML, BY EMAIL ON 27 JUNE 2019.

PROJECTION: UTM ZONE 11 DATUM: NAD 83

CLIENT

PINE POINT MINING LTD.

PROJECT

PINE POINT PROJECT

TITLE

WATERCOURSES AND WATERBODIES IN THE AREA SURROUNDING THE PROJECT

CONSULTANT

GOLDER

YYYY-MM-DD	2020-12-15
DESIGNED	SB
PREPARED	MM
REVIEWED	KM
APPROVED	KM

PROJECT NO.	PHASE	REV.	FIGURE
19125747	6000	0	2

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Buffalo River is a large river originating from Buffalo Lake located in the southernmost portion of the NWT. It receives drainage from many other small lakes and wetlands upstream (south) and northward towards Great Slave Lake. The total drainage area of the Buffalo River where it empties into Great Slave Lake is approximately 18,400 km^2. The overall length of Buffalo River is approximately 155 km. Water flows strongly and is generally turbid. The river has a mud bottom, with gravel and cobbles present in faster flowing areas. Buffalo River water flows year-round with higher levels of flow occurring during the annual spring melt. The Buffalo River is moderately incised into the surrounding terrain. Based on discharge records from 1969 to 1990, it has a mean annual flow of 49 m^3/s, with a mean maximum daily flow of 187 m^3/s during May or June.

Great Slave Lake is the final receptor of the drainages from Twin Creek and the Buffalo River systems. Great Slave Lake is the second largest lake in the NWT (after Great Bear Lake), the deepest lake in North America (616 m), and the sixth largest lake in the world. It is 456 km long, 19 to 109 km wide, and covers an area of 28,400 km^2 with an approximate lake volume of 2,090 km^3. At Hay River (Station 070B002), the mean lake level is 156.63 meters above sea level (masl) with normal seasonal variations between 156.34 and 156.96 masl, and the highest levels occurring in mid-summer (WSC 2020).

3.2.2 Water Quality

Water quality in the general area surrounding the Project has been investigated by various parties over the last 30 years, including Environment and Climate Change Canada, previous mine operators, BC Research, Beak, EBA Engineering Consultants Ltd. (EBA), and Golder. Recent baseline data collection for the Project occurred in 2019 and 2020.

The Buffalo River is slightly alkaline with high water hardness. High turbidity and total suspended solids concentrations were characteristic of the Buffalo River, particularly during September and October, with corresponding high metals concentrations. As a result, total aluminum, cadmium, chromium, copper, and iron concentrations were consistently above Canadian Council of the Ministry of Environment (CCME) guidelines (EBA 2005b; Rescan 2012a; Tamerlane 2007; Golder 2020b). Aluminum is typically associated with the limestones, dolomites, sandstones, and shales that occur in the LSA, while elevated iron concentrations are commonly linked to the mafic minerals that occur across the region (EBA 2005b). The concentrations of all major ions and other metals were below CCME guidelines. Buffalo River can be characterized as eutrophic based on elevated total phosphorus concentrations (0.028 to 0.13 mg/L; CCME 2004); however, these levels are attributed to the elevated total suspended solids in the river.

In general, Twin Creek was slightly alkaline with very hard water, particularly in September. Low turbidity and total suspended solids concentrations were measured in Twin Creek, with low major ion and metal concentrations that were typically below CCME guidelines. Twin Creek is also an oligotrophic watercourse and as noted for Birch Creek, total fluoride concentrations were above the interim CCME guidelines; all other major ions and metal concentrations were below CCME guidelines.

3.2.3 Fish and Fish Habitat

Studies on the aquatic life of the major watercourses and waterbodies in the vicinity of the Project have occurred since the early 1970s by various parties including BC Research (1977), Beak (1980), EBA (2005b, 2006), Rescan (2012b), and Fisheries and Oceans Canada (2013).

Fish habitat assessments were completed in 2005 at six sites on the Buffalo River (EBA 2005b). Fish habitat in the Buffalo River was predominantly run habitat with some riffles and rapids. Bed substrates consisted mostly of gravel, with some fines and cobble. There was minimal cover for fish but when cover was present, it consisted of boulders, depth, or large organic debris. No instream overhead vegetation was observed.

Fish habitat assessments were completed in 2005 at nine locations in Twin Creek (EBA 2005b) and at five locations in 2011 (Rescan 2012b). The upstream reaches of Twin Creek flowed through a bog/wetland or underground channels and no visible channel was observed. The lower reaches of Twin Creek were low gradient. Fish habitat in Twin Creek consisted predominantly of pools with water depths of 0.5 to 1 m, with some runs and riffles. Bed substrates consisted mostly of fines with some cobble and gravel with cover for fish provided by instream and overhead vegetation (EBA 2005b; Rescan 2012b). Potential barriers to fish movement (e.g., debris piles) were observed at several reaches in Twin Creek.

Benthic invertebrates were sampled in Twin Creek, and the Buffalo River in 2011. The benthic invertebrate community in Twin Creek was dominated by aquatic insects and chironomids (Rescan 2012a). The Buffalo River had higher total abundances of benthic invertebrates than Twin Creek and consisted of chironomids, true bugs (i.e., Hemiptera), gastropods, bivalve molluscs, and oligochaete worms (Rescan 2012a). Freshwater mussel shells were also observed at the Buffalo River during fish baseline studies in 2005 (EBA 2005b).

The Buffalo River and Twin Creek are both fish bearing waterbodies with connectivity to Great Slave Lake. A total of 34 fish species occur in Great Slave lake. Many of these species have also been documented in the Buffalo River and Twin Creek. In the Buffalo River, Burbot, Inconnu, Lake Whitefish, Northern Pike, Goldeye, and Walleye have been recorded (Beak 1980; Evans et al. 1998; Stewart 1999; Tamerlane 2007). The mouth of the Buffalo River has also been known as a key area for fishing of Inconnu, Lake Whitefish, and Lake Trout by residents of Fort Resolution during the open water season (Beak 1980; Stewart 1999).

White Sucker, Longnose Sucker, Northern Pike, and Brook Stickleback are known or likely to occur in Twin Creek (EBA 2005b; Tamerlane 2007). ITK interviews indicated that although Twin Creek is not used as a traditional harvesting area, Walleye, Sucker species (Catostomidae), and Stickleback species (Gasterostidae) were present. Lake Trout and Northern Pike were identified to potentially be present (Tamerlane 2007). Fish sampling was completed in 2011 at three watercourses (Twin Creek and two unnamed creeks) and 23 waterbodies (i.e., lakes, ponds, wetlands). Brook Stickleback were captured at one location in Twin Creek and one shallow pond located within the historical Pine Point mine footprint (Rescan 2012b).

3.3 Traditional Land Use

The Project is located within the traditional territories of the Akaitcho Dene First Nation, K'atl'odeeche First Nation, and the Northwest Territories Métis Nation. Traditional uses in the area include use of the water and land for hunting and harvesting. In particular, the local water is used for drinking and harvesting fish. Traditional land uses include hunting and gathering; caribou, in particular, are a highly valued resource (Treaty 8 Tribal Council 2020).

Potential effects on traditional land uses will be addressed as part of the Wildlife Protection Plan, and effects on traditional water uses will be addressed as part of the AEMP. Where available, further discussion of relevant ITK and information regarding traditional water use in the area will be integrated into future iterations of the AEMP Design Plan.

3.4 Nearby Facilities

There are two major gold mining operations located on the northern shore of Great Slave Lake near the city of Yellowknife, which are currently in remediation: Giant Mine and Con Mine. These operations, although in remediation, may still contribute to legacy contamination and cumulative effects in Great Slave Lake. These mines are located approximately 160 km north of the Project.

Giant Mine began operating in 1948 and continued producing gold until 1999. The gold produced at this site was bound in arsenopyrite ore and consequently had to be roasted at extremely high temperatures. This process released toxic dust and arsenic trioxide waste into the surrounding environment, including the waters of Yellowknife Bay in Great Slave Lake. Giant Mine was officially abandoned in 2005. The Giant Mine Remediation Project is responsible for the remediation of the site (INAC 2018).

Con Mine, the first gold mine in the NWT, opened in 1938. The mine operated until the late 1990s, and officially closed in 2003. The site is now owned by Newmont Mining Corporation and is under remediation (Silke 2012).

4 PROBLEM FORMULATION

Conceptual site models illustrate potential linkages between stressors of potential concern, exposure pathways, and receptors of potential concern. A preliminary conceptual site model was developed for the AEMP Framework to assist with communicating the potential effects of the Project on the structure and function of the ecological components in the area surrounding the Project. The conceptual site model for the AEMP involves the identification of potential stressors to the aquatic ecosystem; these stressors will be modified and refined as the Project develops.

4.1 Aquatic Ecosystems in the Area Surrounding the Project

A simple model illustrating a typical aquatic food-web in the area of the Project is presented in Figure 3. For lake environments, the base of the food-web is comprised of phytoplankton in the water column and periphyton on shoreline rocks, which use nutrients and light to produce carbon for growth and provide food to benthic invertebrates and zooplankton. Zooplankton feed on phytoplankton, while benthic invertebrates feed on periphyton and decaying organic material (dead plankton or sloughed-off periphyton) that settle onto the sediments. Fish feed on zooplankton and benthic invertebrates, and larger predatory fish feed on smaller fish.

The riverine environment is similar to the lake environment, although plankton play a smaller role and periphyton and benthic invertebrates play a larger role in the flowing water ecosystem of the streams. Wildlife and waterfowl also use water and biota in lakes and streams as drinking water and as a food source.

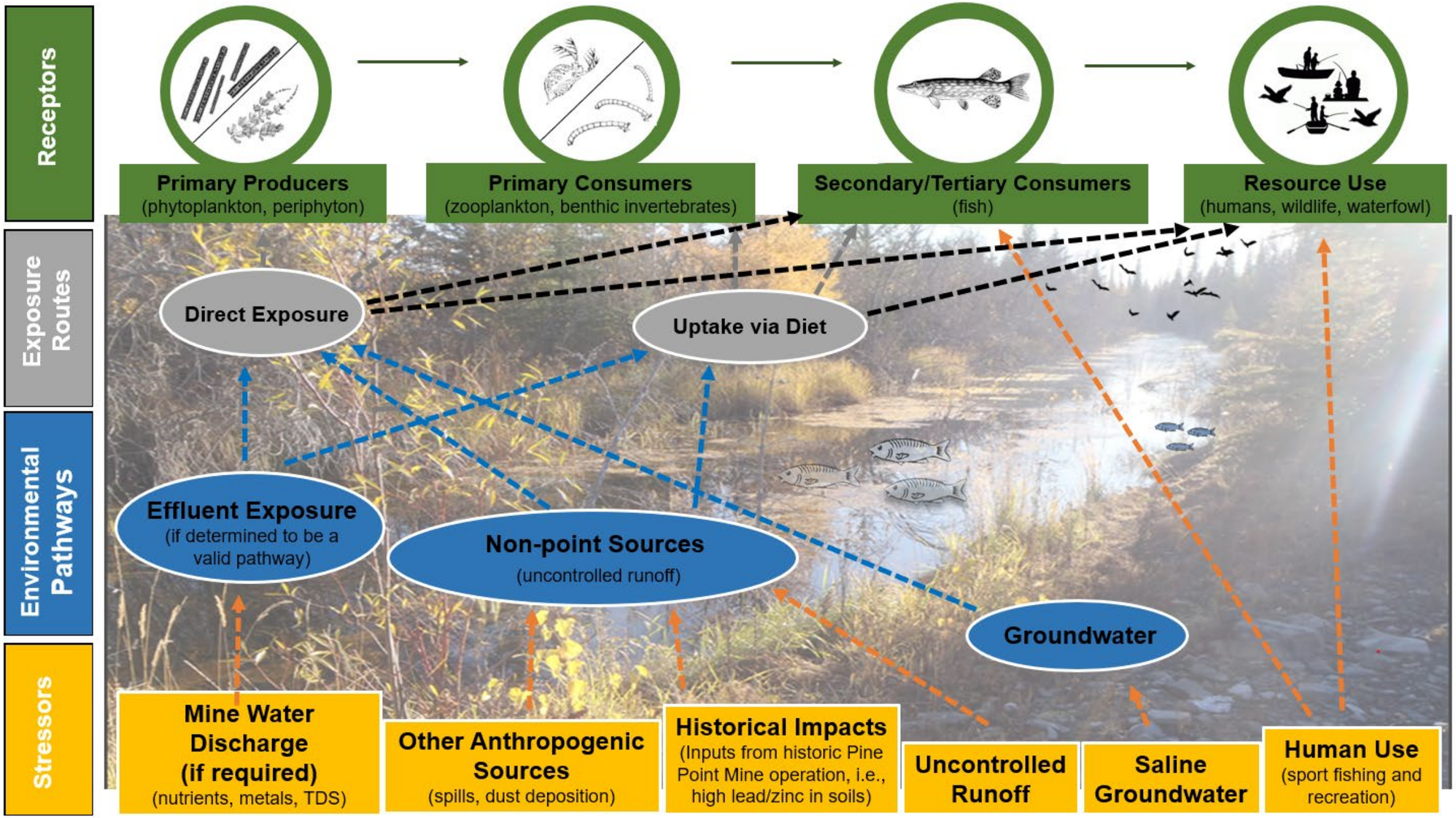

Figure 3: Preliminary Conceptual Site Model for the Aquatic Environment in the Area Surrounding the Project

4.2 Receptors of Potential Concern

The biological receptors identified in the preliminary conceptual site model (Figure 3) include:

- Primary producers: macrophytes, periphyton, and phytoplankton communities.
- Primary consumers: zooplankton and benthic invertebrate communities.
- Secondary/tertiary consumers: fish.
- Resource use: humans, wildlife, and birds.

These broad categories are considered as receptors of potential concern in the aquatic ecosystem; however, the decision of which receptors will be included in the AEMP, particularly with regard to primary producers and consumers, will be determined based on the outcomes of the EA and once additional Project design details are available.

4.3 Potential Stressors of Concern

The potential stressors of concern identified in the preliminary conceptual site model (Figure 3) are based on the mine components and activities identified in the Project Description (Volume 1, Section 3.0) that are the primary sources of stress to aquatic ecosystems. The primary exposure routes for biological receptors include the release of mine-affected water to the surface water environment (if required for the Project) and runoff from historic mine facilities. Other potential stressors include uncontrolled mine runoff (i.e., spills and leaching from flooded lands) and human resource use (i.e., sport fishing and recreation).

These potential stressors could affect biological receptors in the aquatic ecosystem; however, the stressors considered in the AEMP will be confirmed based on the outcomes of the EA and once additional Project design details are available.

4.4 Environmental Pathways

The pathways by which Project-related sources and stressors may influence the aquatic ecosystem are both direct and indirect. Direct pathways involve a direct influence on a receptor, for example, direct toxicity to fish may occur as a result of elevated concentrations of an ion or a metal in the downstream environment. Indirect pathways often include several levels of receptors; for example, mining activities may result in an increase in nutrient concentrations and primary productivity in downstream environments, which in turn may reduce dissolved oxygen concentrations and the capacity of a waterbody to support aquatic life (e.g., invertebrates and fish).

The potential pathways relevant to the AEMP are:

- Direct contact of aquatic organisms with mine-affected water (i.e., total dissolved solids and associated ions and metals).
- Reduction in the quality of aquatic habitat through eutrophication associated with increased nutrient concentrations.

Alteration of the quantity and quality of habitat from changes to water levels and flows is not currently expected to be a key effects pathway for the EA, and consequently the AEMP.

4.5 Preliminary Impact Hypotheses

Impact hypotheses are specific and testable questions that are used to help focus the AEMP on the key pathways of concern for downstream aquatic ecosystems. The Project-specific impact hypotheses will be developed for the AEMP based on information gathered during the EA process and will be informed based on the results of engagement and through additional collection of ITK.

4.6 Assessment Endpoints and Measurement Indicators

Assessment endpoints are the ultimate properties of valued components (VCs) that should be protected or developed for use by future human generations. Assessment endpoints are formal narrative expressions of the environmental values to be protected (Suter 1993; Suter et al. 2000). Considerations in the selection of assessment endpoints include ecological relevance, policy goals, future land use, societal values, susceptibility to substances of potential concern, and the ability to define the endpoint in operational terms. At a minimum, assessment endpoints include an ecological component and a property (attribute) of that ecological component to be evaluated.

Measurement indicators represent physical and biological attributes of the aquatic environments that can be measured and used to characterize changes to VCs. An overarching objective of AEMPs is the collection of monitoring data to support the protection of VCs. Measurement indicators will be used to monitor for changes in the environment, and thus effects on traditional water use. The VCs, assessment endpoints, and measurement indicators that will be used in the AEMP will be identified during the EA process and during development of the AEMP Design Plan.

5 AQUATIC EFFECTS MONITORING PROGRAM DESIGN

5.1 Monitoring Components

The following core components of the AEMP will be considered for monitoring, depending on Project design and the outcome of the EA:

- surface water quantity
- water quality
- benthic invertebrates
- fish health

These monitoring components are based on the broad categories of receptors of potential concern in the aquatic ecosystem listed in Section 4.2; however, the monitoring components ultimately included in the AEMP, in particular, the benthic invertebrate and fish components, will be dependent on the Project design and water management plan (i.e., if mine water discharge is required), as well as the outcome of the EA.

5.2 Study Areas

The predicted zone of influence of the Project, includes the Project footprint and surrounding areas that may be disturbed by mining activities, including the potential for mine water discharge. The predicted zone of influence applicable to the AEMP Framework is likely to include the Buffalo River and Twin Creek, as the two main watercourses which may have Project-related effects. The predicted zone of influence and associated study areas will be further refined in subsequent versions of the AEMP Design Plan, once additional Project details are known. Information on existing conditions for these two watercourses is provided in Section 3.0.

Great Slave Lake is the final receptor of the drainages from the Twin Creek and the Buffalo River systems (Figure 3). If Project effects are observed in Twin Creek or the Buffalo River, as part of regular AEMP monitoring, water quality sampling may be considered along the southern shoreline of Great Slave Lake. However, due to the size of the lake and expected mixing within shoreline areas, Project effects are likely to be non-measurable in Great Slave Lake.

There are other watercourses flowing into the southern portion of Great Slave Lake (i.e., Little Buffalo River, Paulette Creek); however, only Twin Creek and Buffalo River are currently considered likely to experience Project-related effects (Figure 2). There are also many small shallow lakes scattered throughout the region between the Project site and Great Slave Lake (Figure 2); however, most of these lakes have no visible drainage.

5.3 Reference Area Selection

In the Metal Mining Environmental Effects Monitoring Technical Guidance Document (Environment Canada 2012), a reference area is defined as “water frequented by fish that is not exposed to effluent and that has fish habitat that, as far as is practicable, is most similar to that of the exposure area”. Inclusion of reference areas in monitoring programs allow comparisons to evaluate differences in monitored watercourses relative to background conditions, as well as tracking of regional trends unrelated to the effects of the Project being monitored.

Birch Creek is identified as a possible reference location for Twin Creek and Buffalo River because it is outside the zone of influence of the Project (Figure 2). It has been used as a reference area for previous aquatic studies for the site. Information regarding habitat conditions in Birch Creek is available in the Existing Environment for the Pine Point Project (Golder 2020a). However, the selection of a suitable reference location will be determined following additional studies and engagement; specifically, ITK input will be sought during the selection of a reference location for Twin Creek and Buffalo River.

5.4 Sampling Design and Frequency

The sampling design used for the AEMP will be determined during development of the conceptual AEMP Design Plan and will incorporate information from ongoing baseline data collection and the EA process. The number of stations and specific locations of each station will be determined based on the Project Description submitted with the Water Licence application and an understanding of the potential effects from the Project. Not all watercourses may necessarily be sampled for all components. The study design will take into consideration the potential for Project effects on individual components and study area. The number of stations to be sampled

(i.e., sample size) will be determined based on the results of a power analysis that will be completed for the AEMP once additional information is available, as per guidance provided in *Guidelines for Aquatic Effects Monitoring Programs* (MVLWB/GNWT 2019).

Monitoring frequency may initially be annual for surface water quantity and quality but may be reduced based on monitoring results. If benthic invertebrates and fish are included in the AEMP Design Plan, a sampling frequency of every three to five years is recommended. This approach follows that used by other AEMPs in the NWT. It is also consistent with the requirements of the federal *Metal and Diamond Mining Effluent Regulations* Environmental Effects Monitoring (EEM) program, which employs annual water and toxicological sampling paired with a tiered, three-year cycle for biological sampling (Environment Canada 2012). The AEMP re-evaluation process will be used to determine schedule and frequency on an ongoing basis.

Surface water quantity and quality sampling may initially occur seasonally, with programs recommended for spring (freshet), summer (July), fall (September), and winter (under-ice cover conditions). Hydrology monitoring may also include the use of continuous data loggers to collect year-round water-level and temperature data.

If deemed necessary based on the outcome of the EA, the benthic invertebrate sampling program is recommended to occur concurrently with the fall water quality program, during the period of peak benthic invertebrate productivity, following the approach used by other AEMPs in the NWT (Golder 2014; De Beers 2016). Similarly, the decision of whether a fish sampling program will be included in the AEMP will depend on the outcome of the EA. If required, the timing of the fish sampling program will depend on which target species are selected for monitoring and the timing of spawning.

5.5 Data Analysis and Interpretation

The primary objectives of the AEMP data analysis and interpretation for each component will be to inform the AEMP Response Framework through the Action Levels (Section 8.0), and to provide input to the overall integration of the results of individual monitoring components. The details of the AEMP sampling design will be partly determined by the requirements of the AEMP Response Framework, which has yet to be developed (Section 8.0); however, analysis and interpretation of the AEMP data are expected to focus on guideline and threshold comparisons, and temporal and spatial analyses.

5.6 Quality Assurance and Quality Control

Quality assurance (QA) refers to plans or programs encompassing internal and external management and technical practices designed to ensure that data of known quality are collected, and that such collections match the intended use of those data (Environment Canada 2012). Quality control (QC) is an internal aspect of quality assurance. It includes the techniques used to measure and assess data quality and the remedial actions to be taken when QC assessment criteria are not met. The QA/QC procedures ensure that field sampling, laboratory analyses, data entry, data analysis, and report preparation produce technically sound and scientifically defensible results.

The QA/QC procedures will govern all aspects of the AEMP, including the field methods, laboratory analysis, data management and analysis, and reporting. Field QA/QC procedures pertain to the maintenance and operation of equipment and instrumentation, sampling methods, sample handling, and shipping. Laboratory QA/QC procedures incorporate protocols developed by analytical laboratories. Office QA/QC procedures include validation of field measurements and analytical results provided by analytical laboratories. Results from the QC assessments will be used to adjust, the program to improve data quality, when necessary.

5.7 Integration with Other Monitoring Programs

The AEMP is one of the environmental monitoring programs associated with the Project. The AEMP will incorporate information from other management and monitoring programs, where applicable.

6 METHODS AND ANALYSIS

6.1 Surface Water Quantity

6.1.1 Objectives and Scope

The surface water quantity component will evaluate short- and long-term changes to surface water quantity in the watercourses influenced by the Project, evaluate predictions made in the EA, and assess the efficacy of impact mitigation strategies proposed in the mine plan. The specific objectives for the surface water quantity component of the AEMP will be developed following the EA and prior to water licencing.

6.1.2 Field Methods

Field methods will follow standard hydrological monitoring methods (Terzi et al. 1994; WMO 2010) and may include continuous water level data collection (i.e., automated stations which record stream water level), discharge, current velocity measurements, and hydrometric surveys (i.e., levelling surveys and/or channel geometry surveys to define channel-geometry of the gauged stream section). Specific field methods will be determined following completion of the EA.

6.1.3 Data Analysis

Standard hydrologic indices will be calculated including annual runoff, mean annual discharge, peak flows, and low flows.

6.1.4 Quality Assurance Quality Control

Field QA/QC procedures for the surface water quantity component pertain to the maintenance and operation of equipment and instrumentation, and field survey methods. The office QA/QC procedures for the surface water quantity component will include validation of field measurements and results.

6.2 Water Quality

6.2.1 Objectives and Scope

The water quality component will evaluate short- and long-term changes to surface water quality in the watercourses influenced by the Project, evaluate predictions made in the EA, and assess the efficacy of impact mitigation strategies proposed in the mine plan to minimize the water quality effects of the Project. The specific objectives for the water quality component of the AEMP will be developed following the EA and prior to water licencing.

6.2.2 Field Methods

6.2.2.1 Sample Collection

Physico-chemical water column field measurements of dissolved oxygen, pH, water temperature, and conductivity will be collected annually at each AEMP station in the watercourses. A target parameter list for water quality samples, along with the desired analytical methods/instrumentation, and target detection limits will be determined based on the outcomes of the EA, accepted laboratory standards, and experience gained from other AEMPs.

Water will be sampled according to standard water quality methods (Environment Canada 1983, 2012; APHA 2012). These methods represent accepted procedures for collecting water samples, collecting field measurements, recording field notes, calibrating instruments, and maintaining QA/QC functions.

6.2.3 Data Analysis

Water quality data will be compared to various guidelines, which include protection of aquatic life, protection of water for wildlife consumption, and protection of source for drinking water (as applicable) and potentially to site-specific benchmarks.

6.2.4 Quality Assurance and Quality Control

Field QA/QC procedures for the water quality component pertain to the maintenance and operation of equipment and instrumentation, sampling methods, sample handling, and shipping. Water samples will be submitted only to laboratories accredited by the Canadian Association for Laboratory Accreditation. Laboratory QA/QC procedures incorporate protocols developed by analytical laboratories, while the office QA/QC procedures include validation of field measurements and analytical results provided by the analytical laboratories.

Quality control samples will also be used to detect and reduce systematic and random errors that may occur during field sampling and laboratory procedures. The QC samples may consist of field, equipment and travel blanks and duplicate samples, based on Environment and Climate Change Canada's recommendations (Environment Canada 1983, 2012). All QC samples will be collected in the same manner as water samples, conforming to standard sampling methods.

6.3 Benthic Invertebrate Community

6.3.1 Objectives

A benthic invertebrate community survey will be included in the AEMP, if deemed necessary based on the outcome of the EA. The benthic invertebrate component, which may include periphyton sampling in the watercourses, will evaluate short- and long-term changes to the benthic invertebrate community in the watercourses surrounding the Project and evaluate predictions made in the EA. The specific objectives for the benthic invertebrate habitat component of the AEMP will be developed following the EA.

6.3.2 Field Methods

Benthic invertebrate samples will be collected in watercourses in the Project area. Supporting periphyton samples (as chlorophyll *a* or ash-free dry mass) will be collected in the watercourses potentially affected by the Project. A benthic invertebrate sampling device appropriate for the habitat conditions will be used to collect benthic invertebrate samples from the watercourses in the Project area. A Surber sampler or Hess sampler may be used for erosional habitats, whereas an Ekman grab may be used for depositional habitats. Benthic invertebrate samples will be collected at a frequency of once every three years, as per EEM standards (Environment Canada 2012) during the fall. Samples will be submitted to a qualified taxonomist for taxonomic composition (to the lowest practical taxonomic level) and density.

6.3.3 Data Analysis

Benthic invertebrate community data will be qualitatively reviewed based on density and taxonomic results. The data analysis will focus on evaluating responses in indicators such as benthic invertebrate density, richness, diversity and community composition.

6.3.4 Quality Assurance and Quality Control

Quality assurance and quality control procedures will be applied during all aspects of the benthic invertebrate component to verify that the data collected are of acceptable quality. Replicate samples will be submitted to the taxonomist and a proportion of the samples will be re-counted by the taxonomist to verify counting efficiency.

6.4 Fish Health

6.4.1 Objectives

A fish health survey will be included in the AEMP, if deemed necessary based on the outcome of the EA. The fish health component would evaluate short- and long-term changes in fish health in the watercourses influenced by the Project and will evaluate predictions made in the EA. It is anticipated that the main objective of the fish health component will be to determine whether stressors such as the mine water discharge (if required), or surface runoff from the mine site, are having a significant effect on the growth, reproduction, survival, and condition of fish in the watercourses downstream of the Project. The specific objectives for the fish health component of the AEMP will be developed following the EA and will consider the potential for effects on indicators of fish health.

6.4.2 Field Methods

Fish present in the watercourses will be sampled using a combination of methods, which may include minnow trapping, backpack electrofishing, or the use of nets (e.g., trap nets or fyke nets), as appropriate. A single species, potentially Ninespine or Brook Stickleback, may be chosen as a target species for the fish health assessment. Non-lethal and/or lethal surveys may be employed depending on the specific objectives of the monitoring, which will be defined during development of the conceptual AEMP Design Plan. The target sample size would be 20 males and 20 females, consistent with EEM guidance.

6.4.3 Data Analysis

Catch-per-unit-effort will be used as an estimate of relative abundance of fish (Ricker 1975). Length-frequency distributions will be used to describe the fish community data, as well as condition factor. If a lethal fish survey is used, a number of fish health endpoints will be calculated (e.g., age, size-at-age, relative gonad size, relative liver size, and fecundity) and compared between the exposure and reference areas to identify whether an effect has occurred on the fish population as per EEM guidelines (Environment Canada 2012).

6.4.4 Quality Assurance and Quality Control

Field staff will be knowledgeable of fish health survey requirements and fish identification and will be trained to be proficient in standardized procedures, data recording, and equipment operations applicable to the field sampling. The office QA/QC procedures for the fish health component will include validation of field measurements and results.

7 SPECIAL EFFECTS STUDIES

Special studies are not core components of the AEMP, but rather consist of targeted studies or research activities that support the overall objectives of the AEMP. Special effect studies may be identified as a requirement of a Water Licence or as part of the response to an exceedance of an Action Level in the Response Framework (Section 8.0). These studies may be initiated on an “as needed” basis to address potential data gaps, investigate new sampling and analytical methods, and other topics that require additional investigation to support effects monitoring, or to integrate ITK.

No specific special studies have been identified within this AEMP Framework. Special studies may be identified based on ongoing engagement and initial findings of the AEMP and would be completed during the implementation of the AEMP.

8 RESPONSE FRAMEWORK

The MVLWB defines a Response Framework as a “systematic approach to responding to the results of a monitoring program through adaptive management actions” (MVLWB/GNWT 2019). The goal of the Response Framework is to systematically respond to monitoring results such that the potential for significant adverse effects are identified and mitigation actions are undertaken and confirmed effective to prevent such effects from occurring. This is accomplished by implementing appropriate mitigation at predefined Action Levels, which are triggered before a significant adverse effect could occur.

8.1 Significance Threshold

Significance thresholds are the levels of change in monitored components of the aquatic ecosystem that, if exceeded, would result in significant adverse effects to the environment. Significance thresholds represent the “no-go zone”, such that management actions and adaptive management are used to prevent a significance threshold from being reached. Significance thresholds will be developed for the AEMP Design Plan and will be based on information provided in the EA and through engagement activities.

8.2 Action Levels and Responses

The MVLWB defines an Action Level as “a predetermined change, to a monitored parameter or other qualitative or quantitative measure, that requires the Licensee to take appropriate actions…”. In a Response Framework, Action Levels are set to trigger management actions to ensure that Project-related effects on the aquatic receiving environment remain within an acceptable range or are otherwise minimized to the extent practical. Action Levels range from Low, Medium, and High, with each new level initiating a new set of management actions. Action Levels will be developed for each Impact Hypothesis and for relevant measurement indicators in the AEMP Design Plan.

The AEMP Response Framework will provide suggested types of actions (e.g., mitigation and design changes) to be taken if an Action Level is exceeded. If an Action Level requiring response is exceeded (i.e., Moderate or High), an MVLWB-approved AEMP Response Plan will be implemented, which may include additional monitoring and possibly management responses (e.g., changes to mitigation), as appropriate. Exact responses detailed in a Response Plan will depend on the component affected, the likely cause of the effect, and the type and magnitude of effect.

9 AQUATIC EFFECTS MONITORING PROGRAM REPORTING

Reporting for the AEMP involves four types of documents: AEMP Design Plans, AEMP Annual Reports, Aquatic Effects Re-evaluation Reports, and AEMP Response Plans. These documents represent different chronological events over the AEMP life. First, the AEMP Design Plan, provided as a framework here, is generated to describe how aquatic effects monitoring in the Project area is proposed to take place; this document is typically updated over the life of the Project to incorporate changes to the mine plan and lessons learned from the earlier monitoring results. Next, monitoring is summarized yearly in the Annual Report. After several years of data have been collected (specified by the MVLWB), an Aquatic Effects Re-evaluation Report is prepared. If, along the way, impacts to the aquatic environment are identified (e.g., if a Moderate or High Action Level is triggered), then an AEMP Response Plan is generated.

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REPORT

Existing Environment for Pine Point Project

Pine Point Project

Submitted to:

Pine Point Mining Limited

Submitted by:

Golder Associates Ltd.

16820 107 Avenue, Edmonton, Alberta, T5P 4C3, Canada

+1 780 483 3499

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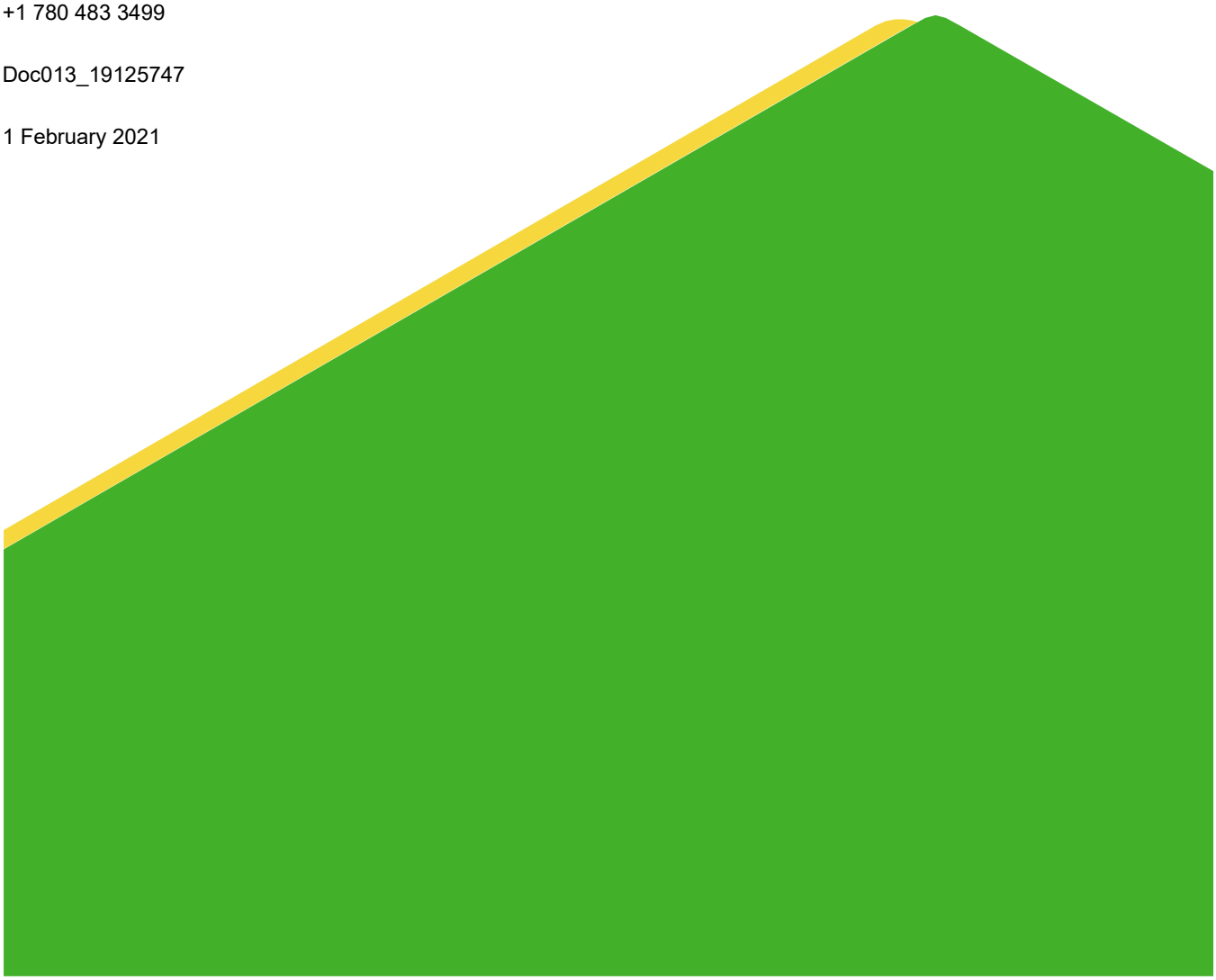
1 February 2021



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Abbreviations and Units of Measure

Abbreviation	Definition
AAQS	Ambient Air Quality Standards
ABA	Acid Base Accounting
ARU	Autonomous Recording Unit
ASTt	Arctic Small Tool Tradition
BP	years before present
Ca^{2+}	calcium
CCME	Canadian Council of Ministers of the Environment
Cl^{-}	chloride anions
Cominco	Cominco Ltd.
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
EA	environmental assessment
ECCC	Environment and Climate Change Canada
GIS	Geographic Information System
GNWT	Government of Northwest Territories
Hwy	Highway
ITK	Indigenous Traditional Knowledge
K^{+}	potassium
LSA	local study area
MBCA	Migratory Birds Convention Act
Mg^{2+}	magnesium
MVEIRB	Mackenzie Valley Environmental Impact Review Board
NH_3, NH^{4+}	ammonia
NHN	National Hydrographic Network
NO^2	nitrogen dioxide
NO^{3-}	nitrate
non-PAG	non-potentially acid-generating
NPR	neutralization potential ratio
NWT	Northwest Territories
O^3	ozone
PAG	potentially acid-generating
PPML	Pine Point Mining Limited
Project	Pine Point Project
RSA	regional study area
SARA	*Species at Risk Act*
SO^2	sulphur dioxide
SO_4^{2-}	sulphate
spp.	multiple species
STIs	sexually transmitted infections
Tamerlane	Tamerlane Ventures Inc.
TLRU	traditional land and resource use
TSS	total suspended solids

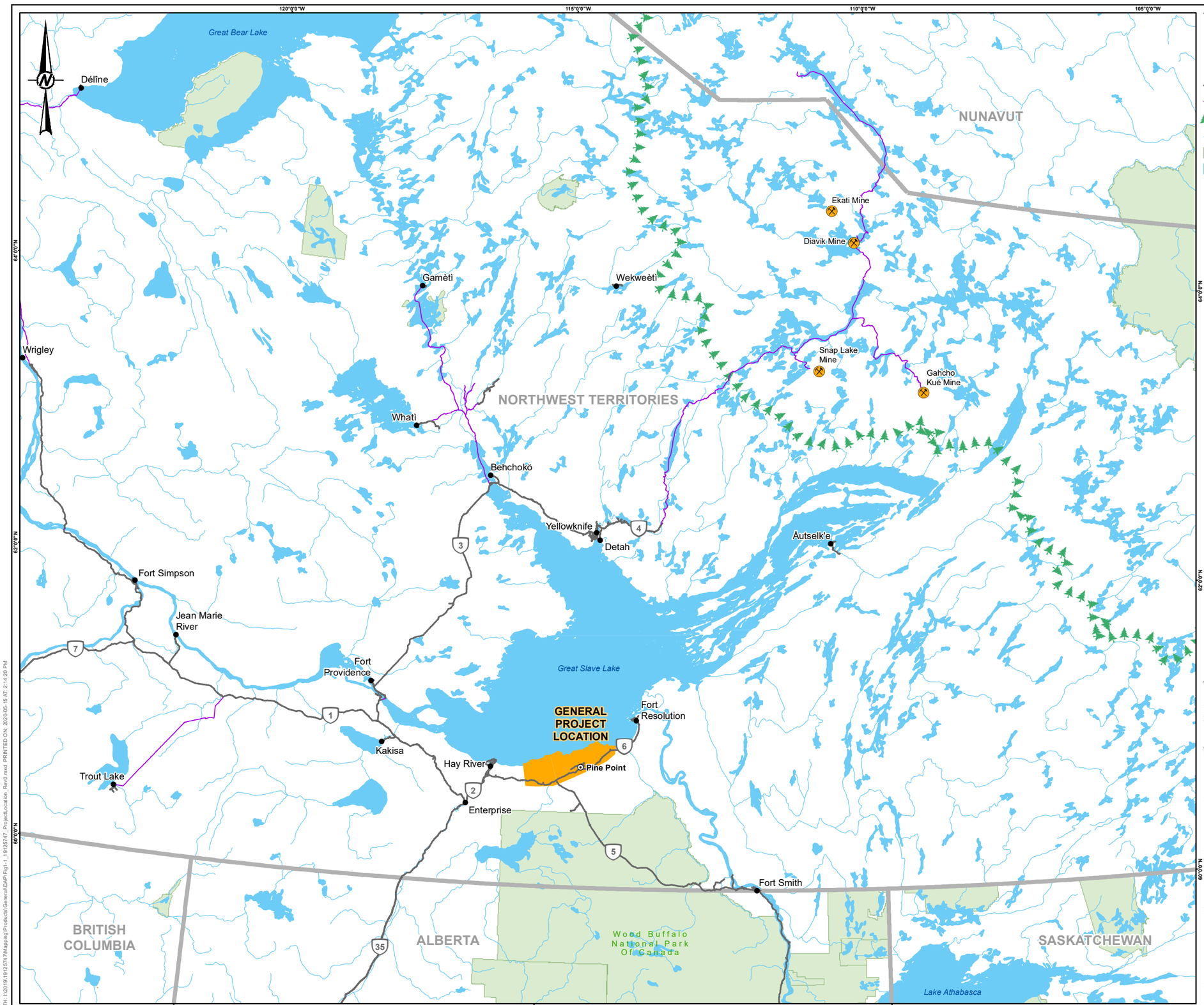
Units	Definition
%	percent
<	less than
>	more than
°C	degree Celsius
µg/m^3	micrograms per cubic metre
cm	centimetre
dBA	A-weighted decibels
ha	hectare
km	kilometre
km/h	kilometres per hour
km^2	square kilometre
km^3	cubic kilometre
Leq,24	24-hour average noise levels
Leq,day	average daytime noise levels
Leq,night	average nighttime noise levels
m	metre
m/s	metres per second
m^3	cubic metre
m^3/s	cubic metres per second
Ma	million years ago
masl	metres above sea level
mg/dm^2/d	milligrams per square decimetres per day
mg/L	milligrams per litre
mm	millimetre
ppb	parts per billion

1.0 INTRODUCTION

1.1 Overview

This document fulfills the requirement to provide a description of existing environmental conditions, as a component of the Environmental Assessment (EA) Initiation Package for the Pine Point Mining Limited (PPML or “the developer”) Pine Point Project (Project), as outlined in the Mackenzie Valley Environmental Impact Review Board (MVEIRB) *Draft Environmental Assessment Initiation Guidelines for Developers of Major Projects* (MVEIRB 2018). The Project is located in the Northwest Territories (NWT) within the South Slave Mining District, approximately 175 km south of Yellowknife, 75 km east of Hay River, and 53 km southwest of Fort Resolution near the historical Pine Point town site (Figure 1-1 and Figure 1-2). Most of the anticipated Project infrastructure and facilities are located on a brownfield site associated with historical mining activity by Cominco Ltd. (Cominco). The Project will consist of open pit and underground mining for lead and zinc, construction and operation of a processing mill (or "concentrator"), and pre-concentration facilities, storage and management of processed mineralized material and waste materials, water management, construction and operation of ancillary support facilities including a camp for workers and the transportation of zinc and lead concentrates to global markets.

The summary of existing environmental conditions for the Project includes a preliminary description of: 1) the biophysical environment, which includes components such as air, soils, surface water, fish, and wildlife; and 2) the human environment, which includes components such as socio-economics, traditional land and resource use, and community well-being. Consistent with MVEIRB guidance (MVEIRB 2018), the description of the existing environment is intended to support understanding how the Project may interact with the environment, and how the potential effects to biophysical and human components can be mitigated as part of the EA Initiation Package. The existing environment section for the EA Initiation Package is intended to be an introduction to the more comprehensive characterization of existing environmental conditions that will be completed for each biophysical and human component in the Developer’s Assessment Report for the Project. In the Developer’s Assessment Report, the existing environment will provide context for analyzing effects from the Project and other developments on biophysical and human components, after applying mitigation and enhancement policies and actions.



LEGEND

- FORMER PINE POINT TOWN SITE
- POPULATED PLACE
- EXISTING MINE
- ALL-SEASON ROAD
- WINTER ROAD
- TREELINE
- WATERCOURSE
- PARK/PROTECTED AREA
- WATERBODY
- GENERAL PROJECT LOCATION

0 50 100

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2. PARKS AND PROTECTED AREAS OBTAINED FROM CONSERVATION AREAS REPORTING AND TRACKING SYSTEM (CARTS), CANADIAN COUNCIL ON ECOLOGICAL AREAS, 2017.

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CLIENT
PINE POINT MINING LTD.

PROJECT
PINE POINT PROJECT

TITLE
LOCATION OF PROJECT

CONSULTANT
GOLDER

YYYY-MM-DD	2020-05-15
DESIGNED	DC
PREPARED	BW
REVIEWED	LY
APPROVED	LY

PROJECT NO.	PHASE	REV.	FIGURE
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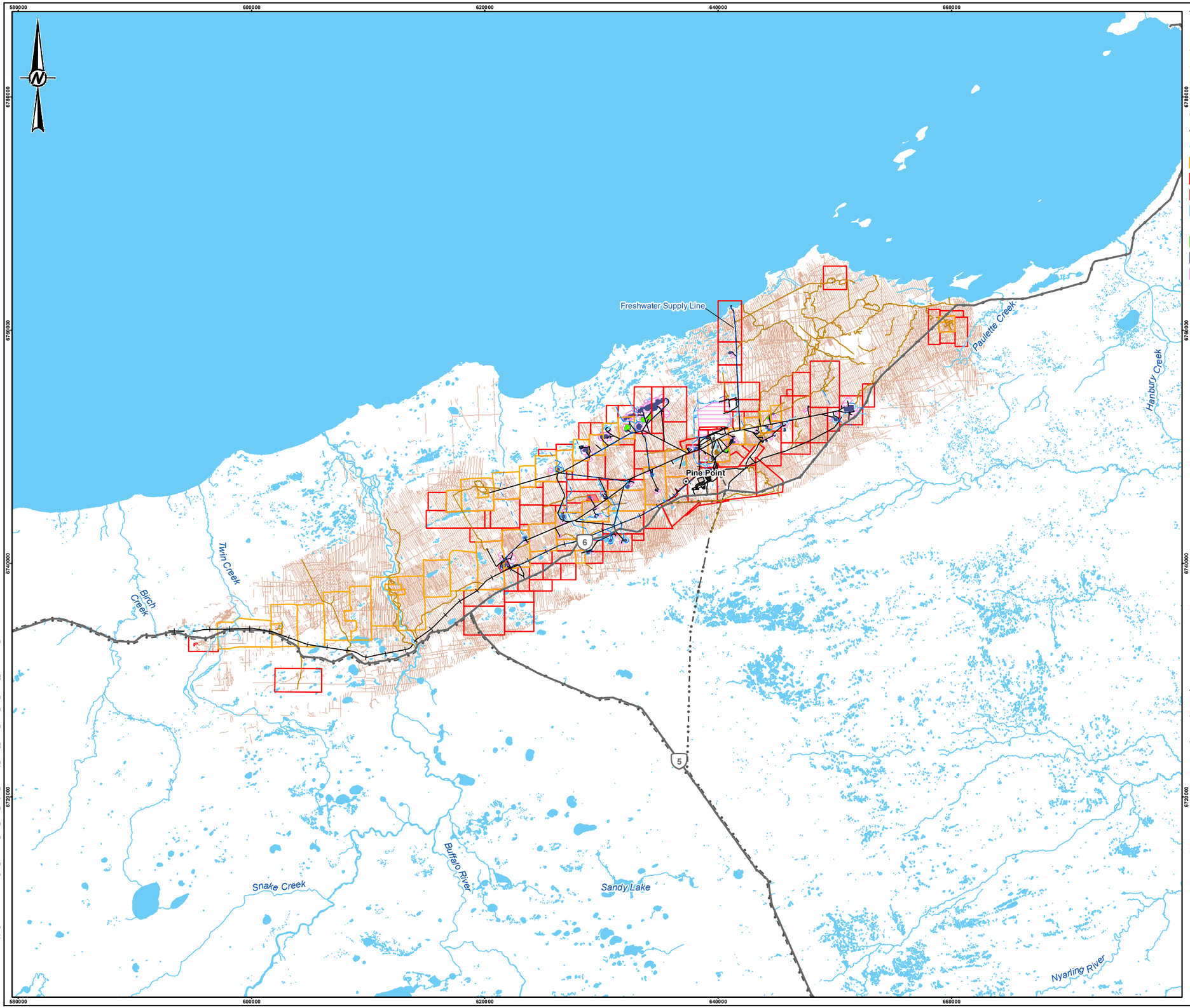

LEGEND

- FORMER PINE POINT TOWN SITE
- BUSH ROAD
- CUTLINE
- DRAINAGE DITCH
- HISTORIC RAILBED
- HIGHWAY
- TRANSMISSION LINE
- WATERCOURSE
- ACTIVE MINERAL LEASE
- ACTIVE MINERAL CLAIM
- CUTBLOCK
- WATERBODY

PINE POINT EXISTING MINING DISTURBANCE

- BACKFILLED PIT
- MINED PIT
- WASTE PILE

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1:325,000 KILOMETRES

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CLIENT
PINE POINT MINING LTD.

PROJECT
PINE POINT PROJECT

TITLE
PINE POINT PROJECT BOUNDARY, MINING LEASE AREAS, AND EXISTING DISTURBANCES

CONSULTANT
GOLDER

YYYY-MM-DD	2020-11-05
DESIGNED	JV
PREPARED	MM/PMT
REVIEWED	DP
APPROVED	DP

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1.2 Background

The Pine Point lead-zinc deposit was first discovered in 1898 by prospectors heading to the Klondike gold rush. Prospectors learned of the presence of minerals in the area from the local Indigenous population (Locock et al. 2006). Cominco began exploration at Pine Point in 1929, with test-pitting, drilling, and shaft sinking. In 1948, Cominco began major exploration work. Cominco proceeded with construction in the early 1960s and historical operation ran between 1964 and 1987 producing 64 million tonnes grading 7.0% zinc + 3.1% lead from 52 deposits. The historic Pine Point Mine was an assemblage of 50 separate open pits and two underground deposits, distributed along a 70 km trend. The mining operation closed in 1987 and Cominco left substantial lower grade mineral resources in the ground at the site. Restoration of the mine was completed in 1991.

In the 2000s, the Pine Point property was purchased by Tamerlane Ventures Inc. (Tamerlane) with the intent to mine the existing resource. Tamerlane conducted additional exploration activities at the site and initiated regulatory applications to pursue longer-term development of the site. Tamerlane applied to the Mackenzie Valley Land and Water Board for a Land Use Permit (MV2006C0014) and Type B Water Licence (MV2006L2-0003) for the Pine Point Pilot Project in June 2006. Prior to the completion of the preliminary screening conducted by MVEIRB, Environment and Climate Change Canada (ECCC, formerly Environment Canada) referred the development to EA on the basis that the development “might have significant adverse impacts on the environment”. ECCC cited a number of potential impacts and uncertainties related to the proposed development (MVEIRB 2008).

Tamerlane submitted its final Developer’s Assessment Report for the Pine Point Pilot Project to MVEIRB in April 2007. In February 2008, MVEIRB determined that the development could proceed to the regulatory phase of approvals, provided that the commitments per the MVEIRB’s Tamerlane Pine Point Pilot Project Report of Environmental Assessment and Reasons for Decision (MVEIRB 2008) were implemented; however, the Pine Point Pilot Project did not proceed due to low metal prices. Darnley Resources Bay Ltd. purchased the property in 2016 and continued with exploration. The property was acquired by PPML in February 2018. As described above and on Figure 1-2, the Project is predominantly located on previously developed land and is primarily a brownfield site.

2.0 APPROACH

In this report, baseline conditions are similar to existing environmental conditions, and comprise the current physical, chemical, biological, social, economic, and cultural setting in which the Project is located, and where Project effects might be expected to occur. As a result of past mining activities and the brownfield nature of the site, existing conditions do not necessarily reflect historical background conditions (i.e., before any industrial development occurred). Rather, existing conditions represent the outcome of historical and current environmental and socio-economic pressures or factors that have shaped the observed condition of biophysical, social, economic, and cultural components of the surrounding environment. Environmental and socio-economic pressures can be natural (e.g., weather, wildfire, predation, and disease) and human-related (e.g., previous mining development, remediation activities, fishing, and hunting). In the context of the proposed Project, existing conditions are characterized by recent environmental data collected in support of the Project, as well as information collected as part of previous activities at the Pine Point property.

Spatial boundaries for the existing environment were designed to approximate or be captured by the proposed study areas defined for components of the biophysical and human environments in Sections 4.2 of the Developer’s Assessment Proposal included in the EA Initiation Package (Volume 5). In general, spatial scales consisted of a local study area (LSA) and a regional study area (RSA). The spatial boundaries of the local and regional study areas for assessing effects from the Project and other previous and reasonably foreseeable

developments on each component will be finalized in the Developer's Assessment Report following feedback from communities and regulators on the Developer's Assessment Proposal. Data collected in the anticipated physical footprint and immediate vicinity of the Project (i.e., LSA) will be subsequently used in the Developer's Assessment Report to provide fine-scale measures of environmental conditions and predict the direct and indirect changes from the Project on components of the biophysical and human environments (e.g., changes to terrestrial and aquatic habitat from the physical Project footprint or from dust and air emissions). Data collected at larger scales, such as the RSA, will be used to measure broader-scale environmental conditions and provide regional context for the effects of the Project.

The description of the existing environment draws on data and information obtained from previous environmental and socio-economic studies completed within the study areas, as well as from publicly available information, and data and reports related to the regulatory process undertaken by Tamerlane for the Pine Point Pilot Project. Previous studies include:

- Studies completed by EBA Engineering Consultants Ltd. (EBA) on behalf of Tamerlane in 2005-2006 (EBA 2005a,b,c, 2006a,b,c,d).
- Indigenous Traditional Knowledge (ITK) study reports conducted in October 2006 with the cooperation of Indigenous groups (Swisher 2006a,b).
- The EA of the Pine Point Pilot Project by Tamerlane in 2007 (Environmental Assessment EA0607-002 and Water Licence MV2006L2-0003), in the area known as the West Zone.

Much of the information presented in these studies remains relevant for describing historical trends that have influenced existing conditions. This information was used along with data obtained from more recent baseline studies and from desktop sources (e.g., published material and environmental databases), to develop a preliminary summary of the existing environment for the Project. Recent studies include additional baseline investigations completed by Tamerlane following the approval of the Pine Point Pilot Project and reconnaissance level field surveys completed by PPML for the current Project in 2018 and 2019. Recent studies include:

- Studies completed by Rescan Environmental Services Ltd. (Rescan) on behalf of Tamerlane in 2011 (Rescan 2012a-n).
- Reconnaissance level field studies completed by Golder Associates Ltd. (Golder) on behalf of PPML in 2018 and 2019 (Golder 2018a, 2019a,b,c).

Section 3.0 provides a summary of historical and recent environmental data for the Project**.** A baseline study plan (Appendix C) was developed based on the results of a gap analysis completed of previous environmental data for the Project, and other publicly available information (Golder 2019d). The purpose of the gap analysis was to identify environmental data gaps or missing information, and provide recommendations for additional data collection that may be required to support the EA.

Summaries of existing environmental conditions are provided for biophysical and human environmental components that may or may not be considered in the Developer's Assessment Report. The Developer's Assessment Report will focus on specific intermediate and valued components that have been selected following feedback on the Developer's Assessment Proposal, community and regulatory engagement, and other selection criteria (e.g., sensitivity of a component to Project effects and presence in study areas) (Volume 5). Valued components represent physical, biological, cultural, social and economic properties of the environment that are either legally, politically, publicly or professionally recognized as ecologically and socially important to a particular region, community or by society as a whole.

3.0 DESCRIPTION OF EXISTING ENVIRONMENT

3.1 Spatial Boundaries

The study areas for collection of baseline data and preliminary descriptions of existing environmental conditions for biophysical and human components are defined in the following sections. These study areas may be refined in the Developer's Assessment Report based on updated Project information and the outcomes of feedback on the EA Initiation Package and engagement planned for the Project.

3.1.1 Geological Setting and Resources

Geological setting and resources have been included as it is a required component of the existing environment summary (MVEIRB 2018). The spatial boundary used in the existing environment summary for geology and resources is the same as the terrestrial RSA defined in Section 3.1.4.

3.1.2 Air Quality, Noise, and Climate

Details related to the location and size of existing and new facilities and infrastructure for the Project (i.e., physical Project footprint) are currently being developed through the design process, and as such, cannot be included in the EA Initiation Package. These Project Description details are expected to be available for the Developer's Assessment Report and the LSA for air quality would likely include a 10 km area beyond the Project footprint. The RSA for air quality will be defined to evaluate predicted Project emission concentrations to approximately 10% of the affiliated air quality standard. For example, if the nitrogen dioxide (NO_2) 1-hour standard is 213 parts per billion (ppb), the study area would be defined to enclose the 21 ppb predicted air quality prediction contour. The RSA for air quality will be defined once initial results of the modelling to support the effects assessment for air quality components are available. Existing climate data will be summarized in an assumed RSA that includes meteorological stations at the Project, historic Pine Point town site, Hay River, and Fort Resolution.

Similarly, once further details on the Project Description are available, the LSA for the noise component would include the anticipated Project footprint plus a 1.5 km buffer. The RSA for the noise component would likely include the anticipated Project footprint plus a 5 km buffer.

Study area boundaries have not been defined for climate because greenhouse gas emissions associated with climate change need to be considered in a global context. The greenhouse gas emissions directly associated with the Project will be calculated and considered in the context of published regional, territorial, and national totals.

3.1.3 Groundwater Quantity and Quality, Surface Water Quantity and Quality, and Fish and Fish Habitat

A single LSA and RSA were defined for aquatic resource components, which includes groundwater quantity and quality, surface water quantity and quality, and fish and fish habitat. The aquatic LSA includes all active mineral claims, existing bush roads, cutlines, historic railbed, waste rock piles, and backfilled and mined pits (Figure 3-1). The western and eastern boundaries of the LSA are defined by the western boundary of the Twin Creek watershed and the eastern boundary of the Paulette Creek watershed, respectively. The northern extent of the LSA includes a 10-m buffer north of the shoreline of Great Slave Lake and the outlets of the Twin Creek, Buffalo River, and Paulette Creek. The southern extent of the LSA includes Highway 6, connecting the western and eastern boundaries.

The aquatic RSA includes the LSA plus Birch Creek, which is located 5 km to the west of the LSA (Figure 3-1). The RSA boundary extends 2 km into Great Slave Lake and provides broader context for characterizing baseline conditions and capturing the maximum potential effects from the Project.

3.1.4 Terrain and Soils, Vegetation, and Wildlife

For existing conditions of the EA Initiation Package, a single LSA and RSA was defined for terrestrial environment components, which includes terrain and soils, vegetation, and wildlife. The terrestrial LSA includes the anticipated maximum extent of the Project footprint, plus a 500 m buffer (Figure 3-2). All active mineral claims, existing bush roads, cutlines, historic railbed, waste rock piles, and backfilled and mined pits are included in the LSA. The terrestrial RSA includes the LSA and is similar to the RSA for groundwater, hydrology, and surface water quality due to the ecological relationships among aquatic and soil and vegetation ecosystems, and wildlife habitats (e.g., wetland structure and function) (Figure 3-2). The RSA provides broader context for characterizing baseline conditions such as the presence of previous and existing developments, and natural disturbances (e.g., wildfire).

3.1.5 Heritage Resources

The LSA for the heritage resources component will include the Project footprint or areas of existing and future direct ground disturbance that could affect heritage resources. The RSA will include the area extending from Hay River in the west to Slave River in the east, and the shore of Great Slave Lake in the north to the Alberta border in the south. The RSA provides context for documented heritage resources in the LSA.

3.1.6 Traditional Land and Resource Use

The Project is located on the asserted territories of the Deh Cho and Akaitcho First Nations, and is within the traditional territories of the Deninu Kue First Nation, K'atl'odeeche First Nation, and Northwest Territory Métis Nation. The Hay River Métis Council and the Fort Resolution Métis Council were initially engaged separately; however, more recently, engagement has been through the Northwest Territory Métis Nation. Existing conditions for traditional land and resource use (TLRU) of these groups includes hunting and trapping, fishing, use of water, and plants and berry gathering. Therefore, study areas for TLRU correspond to those defined for aquatic (Section 3.1.3) and terrestrial (Section 3.1.4) disciplines. Consideration is also given to the noise study area (Section 3.1.2) when discussing effects on the experience of Indigenous land users. The TLRU component does not use a polygon-based study area for documenting existing conditions related to travel, access, and the use of the land for cultural and spiritual practices, as such practices are fluid and not confined to a single jurisdiction or spatial boundary. Areas of use for these purposes may overlap and change over time. overlap and change over time.

3.1.7 Socio-economics

As indicated in Section 3.1.6, the Project is within the traditional territories of the Deninu Kue First Nation, K'atl'odeeche First Nation, and Northwest Territory Métis Nation. The proponent has established agreements with these groups' respective communities as a means for securing local benefits. Agreements address both benefit capture and mitigation of adverse effects. The potential for employment with the Project, and the qualifications required to access employment opportunities, will be of key interest to these groups, and to communities within the South Slave Region. While Hay River, Hay River Dene 1 (K'atl'odeeche First Nation), and Fort Resolution are the closest communities to the Project, other communities in the region and the City of Yellowknife may also be impacted by the Project to varying degrees. Based on the factors above, the socio-economic LSA focuses on the following communities (Figure 3-3):

Communities Prioritized by PPML for Involvement and Closest to the Project (i.e., focal communities)

- Fort Resolution (South Slave community, Deninu Kųé First Nation, Northwest Territory Métis Nation [Fort Resolution Métis Council])
- Hay River Dene 1 (K'atl'odeeche First Nation)
- Hay River (South Slave community, Northwest Territory Métis Nation [Hay River Métis Council Government])

Other Communities for Inclusion

- Enterprise (South Slave community)
- Fort Providence (South Slave community)
- Fort Smith (South Slave community, Northwest Territory Métis Nation [Fort Smith Métis Council])
- Kakisa (South Slave community)
- Dettah (Akaitcho Dene [Yellowknives Dene First Nation])
- Łutsel K’e (Akaitcho Dene [Łutsel K'e Dene First Nation])
- Yellowknife (major population, economic and service hub)
- West Point First Nation (located within Hay River)

The socio-economic RSA is the NWT (Figure 3-3). Regional-level effects are largely related to broader economic changes such as Project-driven contributions to territorial Gross Domestic Product, labour force conditions, government revenues, industry and commercial activity, and population change.

3.1.8 Non-Traditional Land and Resource Use

Non-traditional land and resource use include non-Indigenous hunting, fishing, outfitting, tourism, recreation, and industrial and resource extraction opportunities. Therefore, the study areas for non-traditional land and resource use correspond to the local and regional study areas defined for aquatic and terrestrial disciplines (Sections 3.1.3 and 3.1.4) (i.e., the study areas within which resources accessed by land users are assessed). Consideration is also given to the noise study area (Section 3.1.2) when discussing effects on the experience of commercial and recreational land users.

580000 600000 620000 640000 660000

6780000 6760000 6740000 6720000

Freshwater Supply Line
Pine Point
Paulette Creek
Hanbury Creek
Twin Creek
Birch Creek
Snake Creek
Buffalo River
Sandy Lake
Nyarling River
6
5

LEGEND

- FORMER PINE POINT TOWN SITE
- BUSH ROAD
- CUTLINE
- DRAINAGE DITCH
- HISTORIC RAILBED
- HIGHWAY
- MINE ROAD
- TRANSMISSION LINE
- WATERCOURSE
- CUTBLOCK
- LOCAL STUDY AREA -
- REGIONAL STUDY AREA -
- WATERBODY

PINE POINT EXISTING MINING DISTURBANCE

- BACKFILLED PIT
- MINED PIT
- WASTE PILE

WATERSHEDS

- BIRCH CREEK
- BUFFALO RIVER
- BUFFALO RIVER AT HIGHWAY 5
- LITTLE BUFFALO RIVER
- LITTLE BUFFALO RIVER AT HWY 6
- PAULETTE CREEK
- PAULETTE CREEK AT HIGHWAY 6
- TWIN CREEK
- TWIN CREEK AT HIGHWAY 5

KEY MAP

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REFERENCE(S)

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PROJECTION: UTM ZONE 11N DATUM: NAD83

CLIENT
PINE POINT MINING LTD.

PROJECT
PINE POINT PROJECT

TITLE
GROUNDWATER QUANTITY AND QUALITY, SURFACE WATER QUANTITY AND QUALITY, AND FISH AND FISH HABITAT LOCAL AND REGIONAL STUDY AREAS

CONSULTANT
GOLDER

YYYY-MM-DD	2020-12-15
DESIGNED	JV
PREPARED	MM/PMT
REVIEWED	JV
APPROVED	JV

PROJECT NO.	CONTROL	REV.	FIGURE
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6780000 6760000 6740000 6720000

Freshwater Supply Line
Pine Point
Paulette Creek
Hanbury Creek
Twin Creek
Birch Creek
Snake Creek
Buffalo River
Sandy Lake
Nyarling River
6
5

LEGEND

- FORMER PINE POINT TOWN SITE
- BUSH ROAD
- CUTLINE
- DRAINAGE DITCH
- HISTORIC RAILBED
- HIGHWAY
- MINE ROAD
- TRANSMISSION LINE
- WATERCOURSE
- CUTBLOCK
- LOCAL STUDY AREA - TERRESTRIAL
- REGIONAL STUDY AREA - TERRESTRIAL
- WATERBODY

PINE POINT EXISTING MINING DISTURBANCE

- BACKFILLED PIT
- MINED PIT
- WASTE PILE

KEY MAP

0 5 10
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PROJECTION: UTM ZONE 11N DATUM: NAD83

CLIENT
PINE POINT MINING LTD.

PROJECT
PINE POINT PROJECT

TITLE
TERRAIN AND SOILS, VEGETATION, AND WILDLIFE LOCAL AND REGIONAL STUDY AREAS

CONSULTANT
GOLDER

YYYY-MM-DD	2020-12-15
DESIGNED	JV
PREPARED	MM/PMT
REVIEWED	JV
APPROVED	JV

PROJECT NO. 19125747 CONTROL REV. 0 FIGURE 3-2

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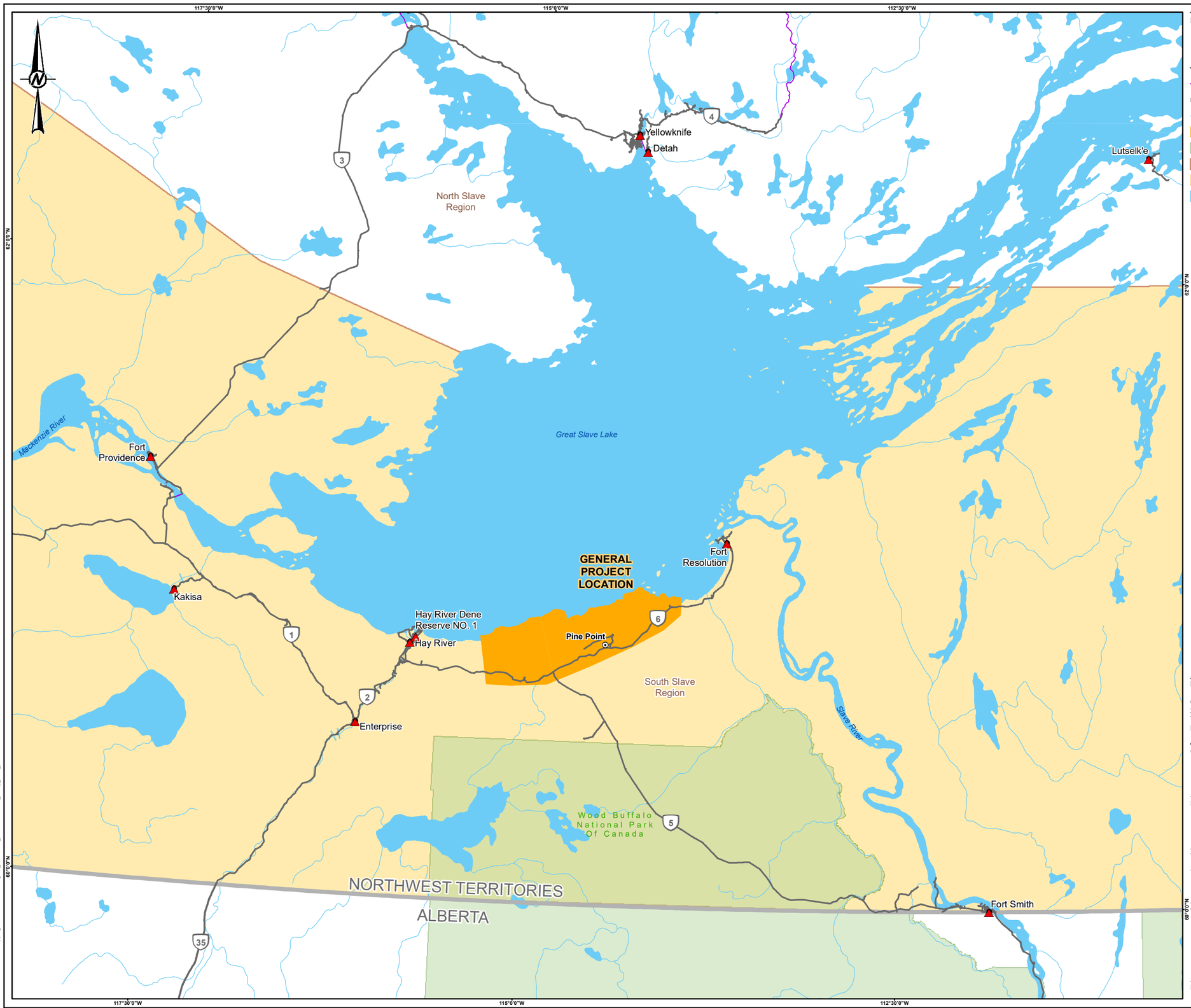

LEGEND

- FORMER PINE POINT TOWN SITE
- SOCIO-ECONOMIC STUDY AREA COMMUNITY
- ALL-SEASON ROAD
- WINTER ROAD
- TERRITORIAL/PROVINCIAL BOUNDARY
- WATERCOURSE
- GENERAL PROJECT LOCATION
- PARK / PROTECTED AREA
- REGIONAL BOUNDARY
- SOUTH SLAVE REGION
- WATERBODY

0 25 50
1:1,375,000 KILOMETRES

REFERENCE(S)

1. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
2. PARKS AND PROTECTED AREAS OBTAINED FROM CONSERVATION AREAS REPORTING AND TRACKING SYSTEM (CARTS), CANADIAN COUNCIL ON ECOLOGICAL AREAS, 2017.

PROJECTION: ALBERS CONIC EQUAL AREA

CLIENT
PINE POINT MINING LTD.

PROJECT
PINE POINT PROJECT

TITLE
SOCIO-ECONOMIC LOCAL STUDY AREA COMMUNITIES

CONSULTANT
GOLDER

YYYY-MM-DD	2020-12-15
DESIGNED	JO
PREPARED	MM
REVIEWED	JV
APPROVED	JV

PROJECT NO. 19125747 | PHASE | REV. 0 | FIGURE 3-3

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3.2 General Setting

The Project is located at the edge of the Boreal Plains and Taiga Plains Ecozones, and within the Slave River and Hay River Lowland Ecoregions. These ecoregions are classified as having a sub-humid, mid-boreal ecoclimate (Environment Canada 2000, as cited in EBA 2005b). The area is characterized by short, cool summers and long, cold winters. The average monthly temperatures in 2019 at the closest monitoring station (Hay River Airport) ranged from a minimum of -22.7°C in February to a maximum of 15.5°C in July. The winter months are typically the driest with the most precipitation usually occurring in August.

The two nearest drainages to the site are the Buffalo River and Twin Creek, located towards the western edge of the Project. These watercourses flow north into Great Slave Lake, which is situated immediately north of the Project boundary (Figure 1-2) and north of the mining lease areas. The water quality of Twin Creek and Buffalo River, and in Great Slave Lake is typical of natural background values for this area of the NWT, with concentrations of most parameters below the federal water quality guidelines for the protection of aquatic life and drinking water (CCME 1999; Health Canada 2006). Fish species that occur in the Buffalo River include Inconnu, Whitefish, Northern Pike, Walleye, and Burbot.

The Project is located in an area of sporadic discontinuous permafrost with generally subdued topography, which suggests that between 10% and 50% of the land area is underlain by permafrost, and the ground ice content in the upper 10 to 20 m of the ground (% by volume of visible ice) is low (<10%) (NRC 1995). Permafrost has not been intersected by any recent core drilling in the area; however, it was detected at one location during a soil/vegetation reconnaissance survey in 2019. The vegetation in the surrounding area is characterized by medium to tall, closed stands of jack pine and trembling aspen. White and black spruce dominate older stands of forest. Poorly drained fens and bogs in this region are covered with low, open stands of larch, black spruce, and ericaceous shrubs (Environment Canada 2000, as cited in EBA 2005b). Wildfires have been a common occurrence in the South Slave Region.

Moose, boreal caribou, and occasionally wood bison are the main ungulates found in the region where the Project is located, although none of these species are considered common. Hunting and trapping activities occur in the vicinity of the Project. Wildlife identified as being present and harvested include caribou, lynx, wolf, otter, black bear, rabbit, porcupine, ptarmigan, ruffed grouse, and waterbirds. Migratory songbirds typical of the boreal forest are also present in the area. The south shore of Great Slave Lake is considered to be an important concentration site for waterbirds during their annual migrations.

3.3 Biophysical Environment

3.3.1 Geological Setting and Resources

3.3.1.1 Bedrock Geology

The Project is located within the northern part of the Interior Plains, a low relief area between the Canadian Shield and the western Cordillera (Fulton 1989). The plains are underlain by flat-lying sedimentary bedrock, which is poorly consolidated or even unconsolidated in some areas (Fulton 1989). The sedimentary rocks in the area of the Project were deposited in a marine environment during the Givetian stage (387 to 283 million years ago [Ma]); one of two stages within the middle Devonian period (393 to 382 Ma).

The mineralized zinc and lead ore bodies that are of interest for the Project are part of the Pine Point barrier complex, which formed due to a gentle arching (emergence) of marine sediments (the underlying Keg River Formation) that initiated the formation of a carbonate shoal (Rhodes et al. 1984). The Pine Point Formation (also known as the Pine Point Group [Skall 1975]) lies conformably above the Keg River Formation and although the

Pine Point Formation was deposited as limestones, it has been dolomitized (i.e., dolomite has been formed due to the replacement of calcium ions by magnesium ions). The dolomite in this area is also known as the Presqu'ile Barrier Formation (Rhodes et al. 1984) (i.e., the Presqui'ile Barrier Reef Complex [PPML 2020]). Karst activity within the barrier complex caused the dissolution of minerals within the rocks resulting in subsidence and collapse, and the formation of a karst network of chimney like karst structures, thicker tabular karst, sinkholes, and caves (Rhodes et al. 1984) as well as intermittent creeks and natural springs (Dames & Moore 1976). Mineralization (galena, sphalerite, marcasite, and pyrite) within the karst network occurred as replacement of internal sediments and breccia fragments within the karst network (Rhodes et al. 1984).

The bedrock geology in the Pine Point area is described in the *Summary Report on the Geology of Pine Point Based on Drilling Conducted between 2017 and 2020 by Pine Point Mining Limited* (PPML 2020). The mineralization was the result of metal bearing brines mixing with sulphur-rich fluids and hydrocarbons under hydrostatic pressure (PPML 2020). Zinc, lead, and iron sulphides are mainly precipitated through sulphur from dissolved anhydrite/gypsum and/or reaction of hydrogen sulphide gas and/or bitumen dissolved with basinal fluids, or present within the host rock (PPML 2020). Mixing of these fluids resulted in a self-reinforcing chemical reaction that hydrothermally precipitated the zinc and lead sulphides (i.e., sphalerite and galena). Calcite is the last precipitated mineral and generally forms a permeability barrier (PPML 2020). The karst network within the barrier complex is a major control of mineralized material deposition (Rhodes et al. 1984), and therefore, the most intense centers of mineralization coincide with the best developed karst (Skall 1975).

Three other formations overlie the Pine Point Formation. There is a sharp contact between the Pine Point Formation and the overlying Watt Mountain Formation (shales, sandstones, limestone breccia), which in turn is disconformably overlain by the Slave Point Formation (limestone, dolomite and shale). Finally, the Hay River Formation (shale and minor sandstone) unconformably overlies the Slave Point Formation (Skall 1975).

3.3.1.2 Seismic Hazard

According to Natural Resources Canada (NRC 2006), the area including and surrounding the Project is geologically stable, of low seismic risk and with no natural landslides suggestive of seismic (earthquake) hazard. Based on LiDAR data from 2018 and 2019, the banks of the Buffalo River are the only area where visible landslides occurred. The Buffalo River meanders across the landscape eroding the material on the outside bends of the river resulting in failure of the banks in these areas.

The Canada Seismicity Map from Energy, Mines and Resources Canada plots significant earthquake locations for the years 1568 through 1991. Two relatively small events have been recorded in the region and both occurred to the west of the Project. No earthquake of Richter Magnitude M6 or greater has occurred within 1,000 km of the Project in recorded history.

The Indigenous Traditional Knowledge (ITK) interviews conducted in October 2006 indicated that none of the study participants had any specific knowledge of earthquakes in the South Slave area. However, several of the participants in the Fort Resolution ITK interviews noted that slight tremors had been felt in Fort Smith – once in the 1970s and once in the 1980s on Christmas Eve. According to the participants, the epicentre was in the Mackenzie Mountains (Tamerlane 2006a,b).

3.3.1.3 Geochemistry

Geochemical characterization data were compiled for the purpose of identifying the metal leaching (ML) and acid rock drainage (ARD) potential of the mined materials (TetraTech 2018). Geochemical characterization data are available for waste rock, mineralization, tailings, overburden, and soil material. Geochemical characterization data

described in TetraTech (2018) were initially presented in Rescan (2011, 2012a,b). These data were collected for a 2011 geochemical characterization program conducted by Rescan as part of baseline environmental studies for the Pine Point Project and the data interpretation and analysis of the preliminary geochemical characterization results are presented in Rescan (2011, 2012a,b). pHase Geochemistry provided a draft review of these reports and compilation of available data (pHase Geochemistry 2017). In November 2017, PPML collected and submitted an additional sixteen samples from drill core from the L-65, N-42, M-40, and EX-17 deposits. These samples were analyzed for Acid Base Accounting (ABA) and trace element analysis.

The following analyses were completed and reported in TetraTech (2018): quantitative X-ray diffraction using the Rietveld method; ABA analysis; Net-Acid Generation test; solids trace element analyses using aqua-regia digestion with inductively coupled plasma mass spectrometry finish; whole rock analysis for major oxides using lithium metaborate fusion followed by X-Ray Fluorescence; and Shake Flask Extraction leachate analysis using a 3:1 liquid to solid ratio.

The potential for acid generation was tested by ABA analysis on a total of 82 samples and the results are presented in TetraTech (2018). ABA results are used to evaluate the classification of the analyzed samples as either potentially acid-generating (PAG) or as non-potentially acid generating (non-PAG). Material classification is based on the Mine Environment Neutral Drainage Guidelines (Price 2009). The analyzed samples are consistently classified as non-PAG, based on neutralization potential ratio (NPR) values of greater than 2. Eighty out of the eighty-two samples are classified as non-PAG. One sample reports an NPR value of less than 1 and is classified as PAG. One sample reports an NPR value of between 1 and 2 and classifies as Uncertain. These two samples were not provided with a lithology description but are assigned to the Watt Mountain and Slave Point formations, respectively. These two samples have significantly elevated sulphur contents when compared to the other samples in the database.

Waste rock samples from the Sulphur Point and Muskeg Formations generally report much lower values of total sulphur and sulphide sulphur. All the samples from these geologic formations came from the 2017 sampling of the L-65, N-42, M-40, and EX-17 deposits. Due to the low sulphur content, the associated maximum potential acidity value is lower than for other waste rock samples. The neutralization potentials are similar to other waste rock samples and, as a result of the above, the NPR values are generally higher than for other waste rock units.

The neutralization potential in the analyzed samples is almost entirely provided by carbonate sources, with an insignificant component of neutralization influenced by other minerals such as silicates. This finding is consistent with the observed rock types and the quantitative X-ray diffraction data. Carbonate minerals provide the most available and fastest reacting source of neutralization potential, and as such are more effective at neutralizing against acid production compared to other minerals.

The whole rock analyses indicate that the sampled rocks are dominated by calcium and magnesium with minor components of silicate minerals (silica, aluminum, and iron oxides). The results reflect the predominant mineralogy of dolomite and calcite, with minor quartz and micas, consistent with quantitative X-ray diffraction analyses. Additional details regarding geochemistry can be found in Section 2.1.3 of the Project Description.

3.3.2 Air Quality, Noise, and Climate

3.3.2.1 Meteorology and Climate

Historic weather and climate data for the air quality RSA (Section 3.1.2) are available from the former Pine Point weather station (Climate ID: 2203101) and the surrounding operating weather stations:

- Hay River Airport (Climate ID: 2202401)
- Fort Resolution Airport (Climate ID: 2202010)

The former Pine Point weather station was located within the historic Pine Point townsite from November 1975 to April 1988. The Hay River Airport station is located approximately 75 km west of the historic Pine Point townsite, while the Fort Resolution Airport station is approximately 50 km northeast. The Hay River Airport station began recording data in September of 2014, but a previous iteration of the station located at the same site was operated from 1953 to September 2014. Similarly, the current version of the Fort Resolution Airport station began recording at the end of December 2014 replacing the previous station that began recording in 1954 to 2014. Additionally, a meteorological station at the Project was installed by Golder and Aurora Geosciences Ltd. in October 2019, the data from which will be provided in the Developers Assessment Report. Table 3-1 summarizes the locations and the data available from these stations.

Table 3-1: Meteorological Stations in the Regional Study Area

Station Name	UTM (NAD83)			Elevation (masl)	Meteorological Parameters Monitored	Climate Normals Data Available	Station Operator	Data Source
	Easting (m)	Northing (m)	Zone					
Pine Point	642996	6750807	11	224	■ Temperature ■ Precipitation	N/D	ECCC	ECCC 2019a
Hay River Airport	566163	6745549	11	164.9	■ Temperature ■ Precipitation ■ Wind ■ Humidity ■ Pressure ■ Visibility	■ 1961-1990 ■ 1971-2000 ■ 1981-2010	ECCC	ECCC 2019a,b
Fort Resolution Airport	355380	6795905	12	160.6	■ Temperature ■ Humidity ■ Wind ■ Pressure ■ Visibility	N/D	Nav Canada	ECCC 2019c
Pine Point Project	639672	6750617	11	219	■ Temperature ■ Rain ■ Wind ■ Solar Radiation	N/D	Aurora Geosciences Ltd.	N/A

ECCC = Environment and Climate Change Canada; masl = metres above sea level; N/A = not applicable; N/D = data not available; NAD83 = North American 1983 datum; UTM = Universal Transverse Mercator.

3.3.2.2 Temperature

Figure 3-4 presents a summary of average monthly temperatures from the weather stations within the RSA compared with ECCC's 1981-2010 climate normals at the Hay River Airport and the historical average from 1976-1987 at the historical Pine Point station. The average monthly temperatures in 2019 at the Hay River Airport station ranged from a minimum of -22.7°C in February to maximum of 15.5°C in July. The minimum average monthly temperature in 2019 at the Fort Resolution Airport was -25.3°C in February and the maximum was 15.1°C in July. Average monthly temperatures at Hay River and Fort Resolution were similar throughout 2019, although Fort Resolution was slightly cooler for most months. In comparison to the Hay River 1981-2010 climate normals and the Pine Point 1976-1987 historical average, 2019 temperatures at both stations were relatively normal with the exception of March, which was atypically warm in Hay River.

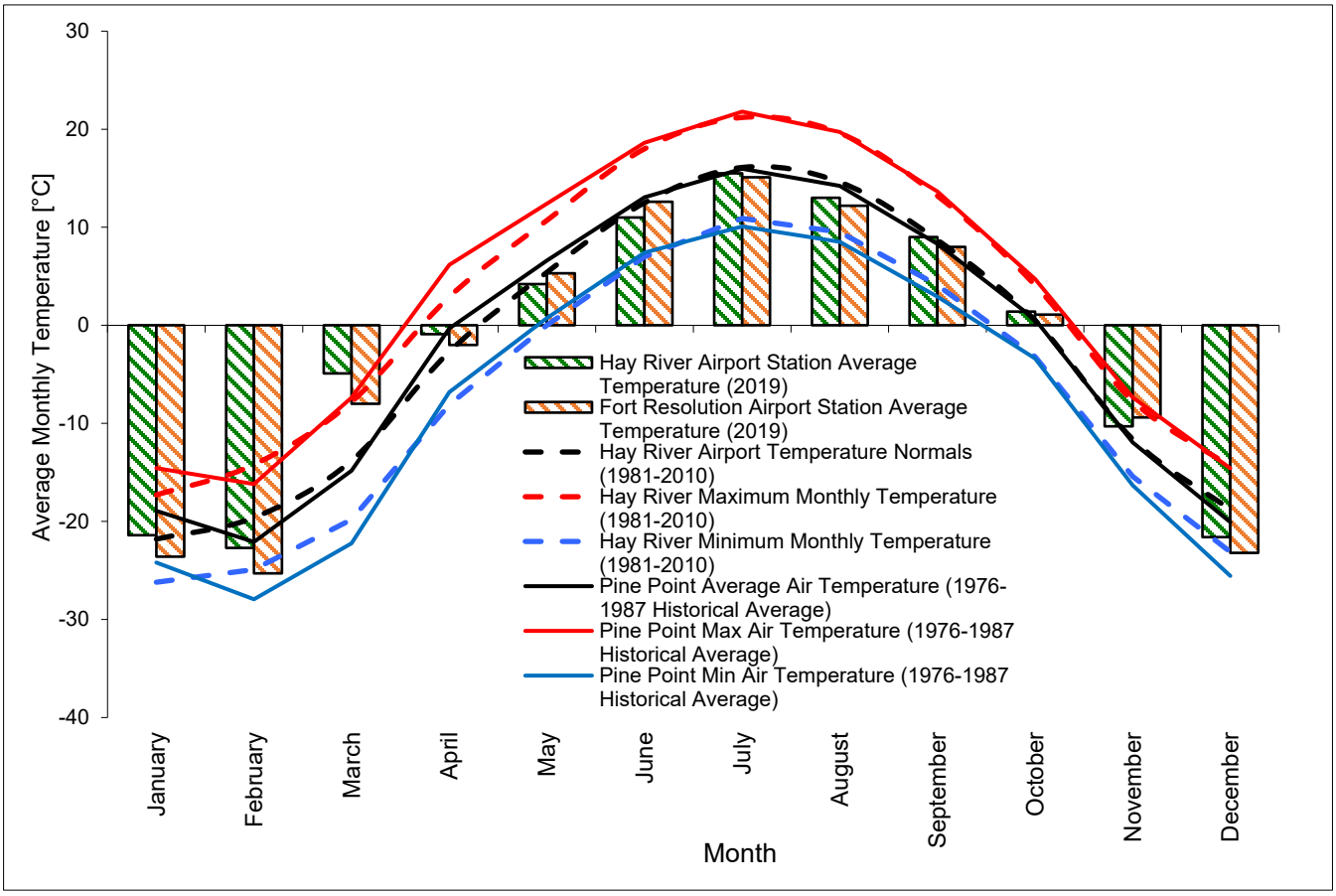


Figure 3-4: Average Monthly Temperatures in the Regional Study Area

3.3.2.3 Precipitation

Total monthly precipitation at Hay River is compared with the latest Hay River climate normals and the Pine Point historical average in Figure 3-5. The weather station at Fort Resolution does not record precipitation. As indicated in Figure 3-5, the winter months are typically the driest with the most precipitation usually occurring in August. The year 2019 was considerably drier than usual at Hay River especially in January, February, March, and August. In total, 228.5 mm of precipitation was recorded at the Hay River station in 2019 in comparison with the 1981-2010 climate normals of 336.4 mm and the Pine Point historical average of 313.5 mm.

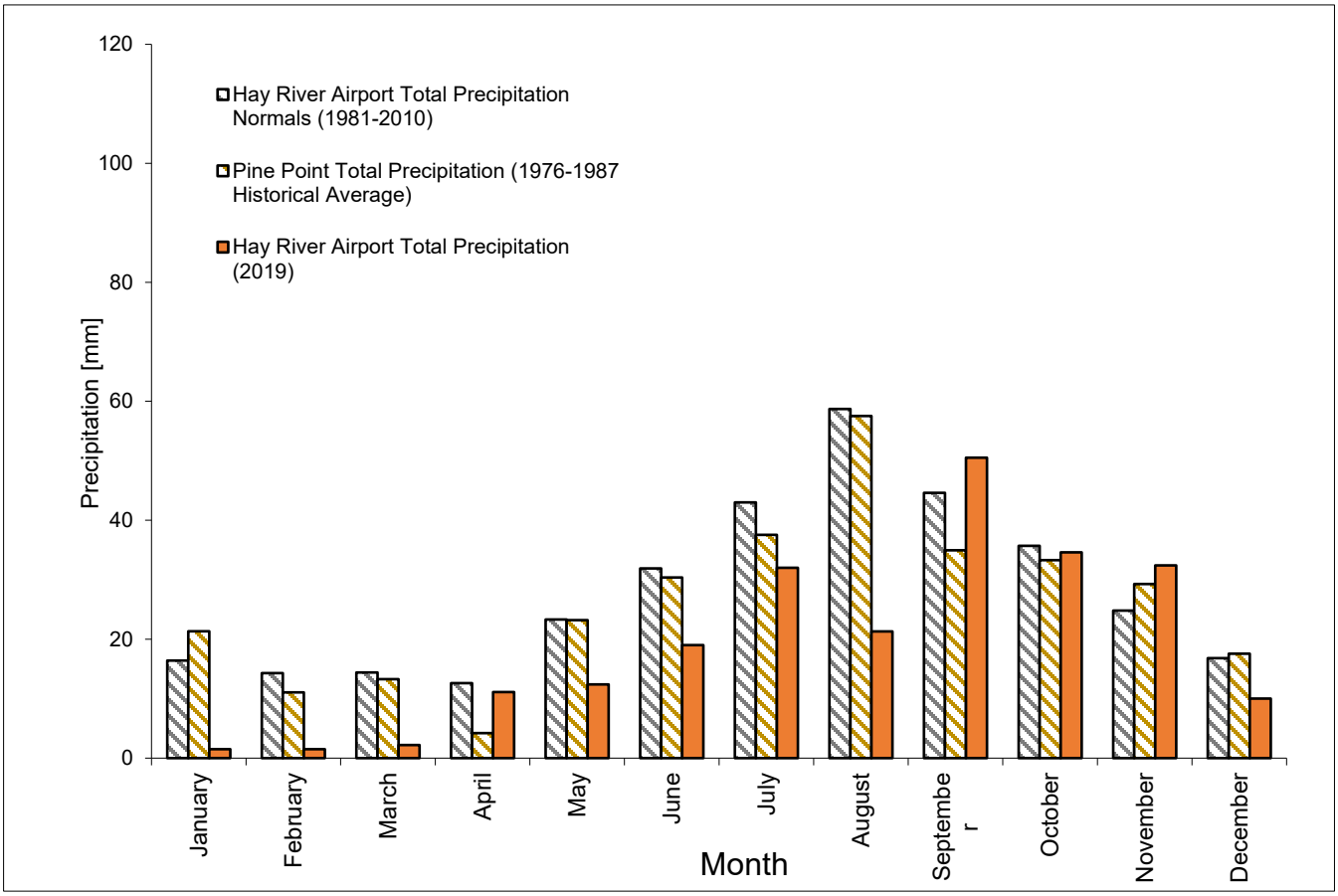


Figure 3-5: Monthly Precipitation in 2019 in Comparison with Historical Averages and Normals

3.3.2.4 Wind

Figure 3-6 and Figure 3-7 summarize the wind distribution in 2019 and during the winter and summer months using a wind rose at the Hay River and Fort Resolution weather stations. Wind flow in the wind roses is presented from the direction shown. In 2019, annual wind was predominantly from the east at Hay River with other major winds occurring from the northwest and south. In the winter months (November through March), winds were mostly from the northwest and south, whereas in the summer months (June through September), winds were mainly from the east and northeast. Annual winds in 2019 at Fort Resolution were largely from the north-northwest, and north, with other winds occurring from the south-southeast and southeast. The 2019 summer months at the Fort Resolution station were dominated by northerly winds. In the winter months, winds were more evenly distributed with the predominant wind occurring from the south-southeast and northwest, north-northwest.

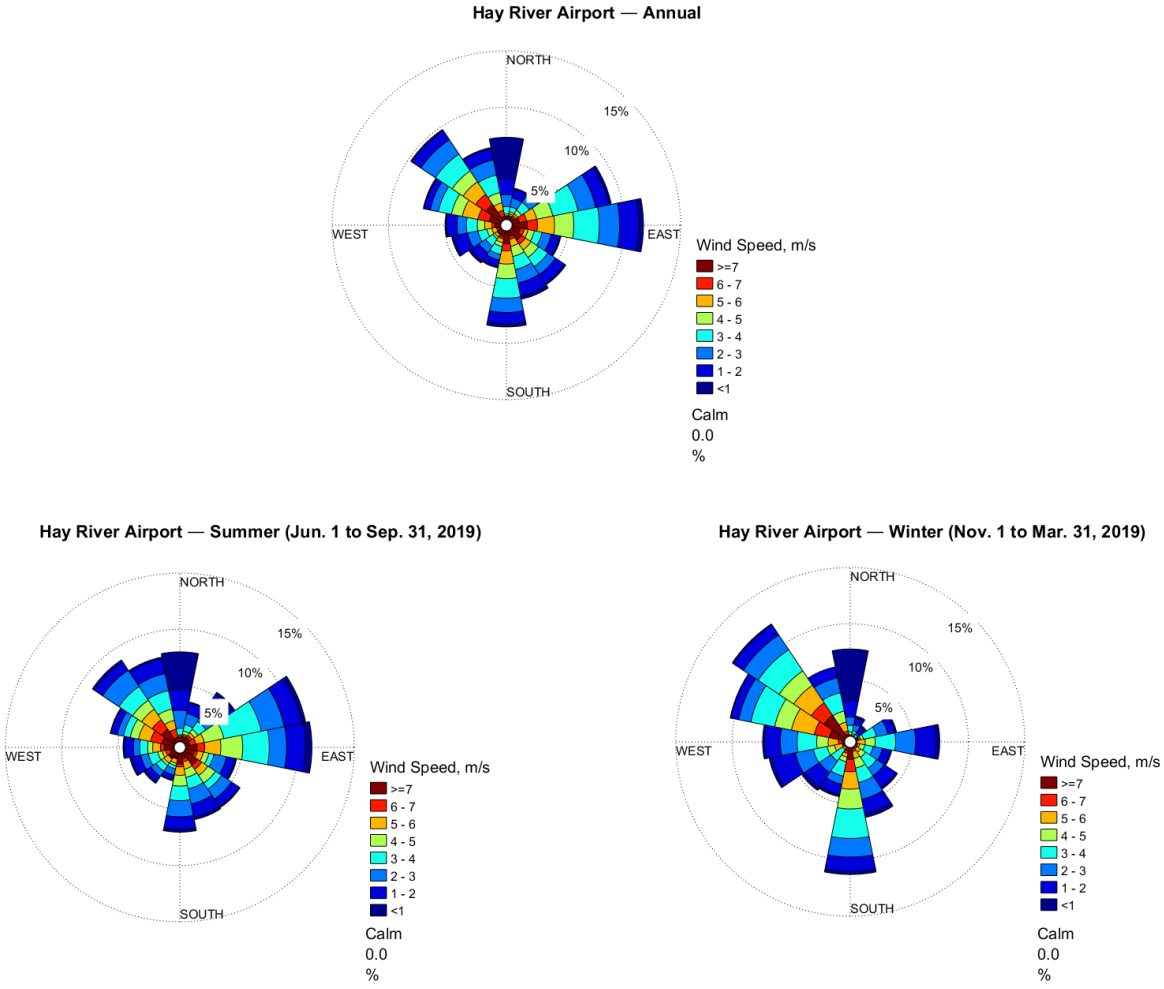


Figure 3-6: 2019 Hay River Airport Wind Roses

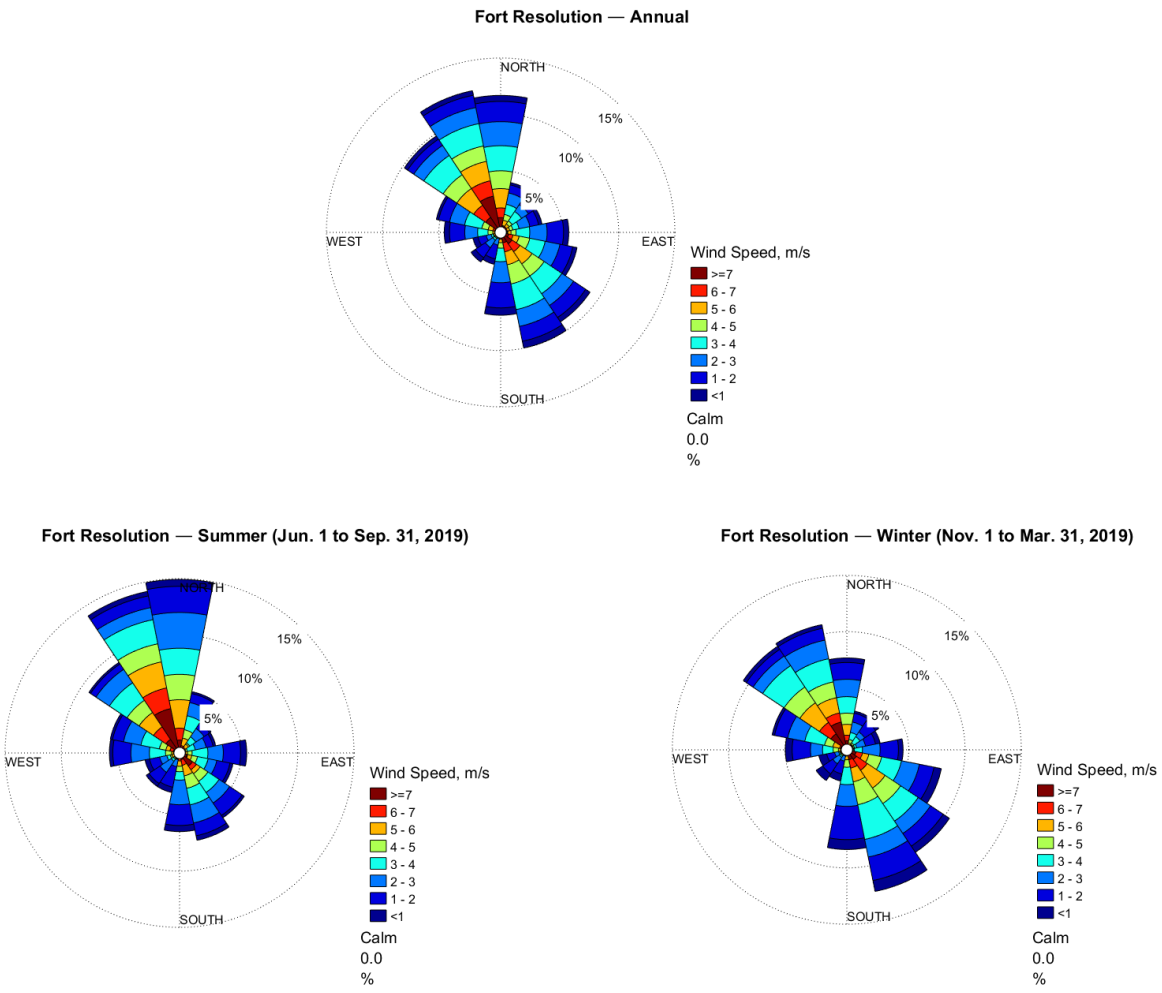


Figure 3-7: 2019 Fort Resolution Airport Wind Roses

Table 3-2 compares the wind speed observed at the Hay River Airport in 2019 with the Hay River 1981-2010 climate normals. Since ECCC reports wind direction in their climate normals using an 8-point compass (ECCC 2019b), the directions summarized in Table 3-2 are also presented based on an 8-point compass versus the wind roses, which are 16-point. Average wind speeds throughout the year, as observed at the Hay River station, range from 10.7 km/h in February to 23.7 km/h in October. In comparison to the climate normals, average wind speed in 2019 was similar during most months apart from September and October, which were much higher compared to the climate normals.

Table 3-2: 2019 Hay River Average Wind Speed and Predominant Wind Direction in Comparison with Climate Normals

Month	Average Wind Speed (km/h)		Predominant Wind Direction[(a)]	
	1981-2010 Hay River Airport Climate Normals	2019 Hay River Airport	1981-2010 Hay River Airport Climate Normals	2019 Hay River Airport
January	11.2	12.8	W	NW
February	11.4	10.7	NW	S
March	11.8	13.3	NW	NW
April	13.1	11.4	E	E
May	13.6	14.7	E	E
June	11.8	12.0	E	NW
July	11.2	12.1	E	NW
August	11.5	12.5	S	NW
September	13.2	19.9	S	E
October	13.5	23.7	S	E
November	13	15.3	W	NW
December	11.4	10.9	W	NW
Average	12.2		E	

(a) Wind directions based off an eight-point compass

3.3.2.5 Humidity

Relative humidity readings in 2019 from the stations located in the RSA are compared to the 1981-2010 Hay River climate normals in Figure 3-8. The former station located at the historic Pine Point townsite did not record humidity. The 2019 measurements from Hay River and Fort Resolution stations were similar to the Hay River climate normals.

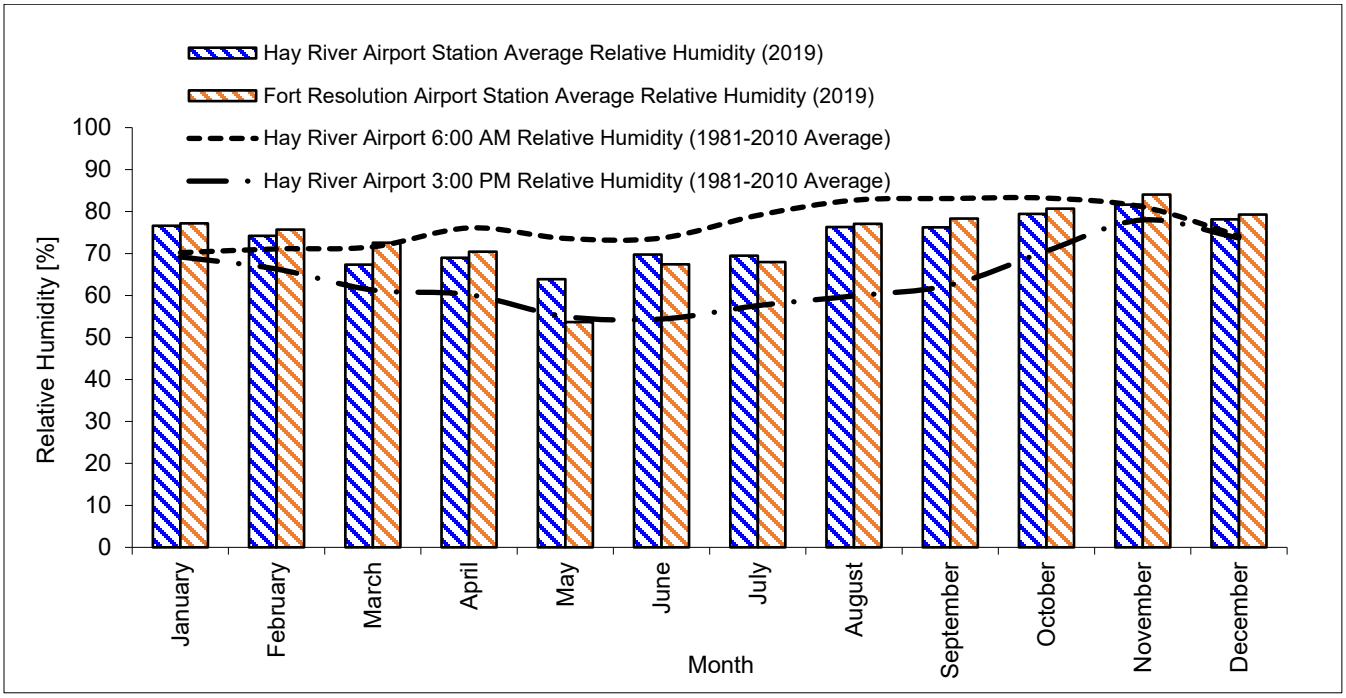


Figure 3-8: 2019 Relative Humidity in the Regional Study Area

3.3.2.6 Air Quality

Continuous air monitoring data are available from the NWT Air Quality Monitoring Network station located in Fort Smith and ECCC's National Air Pollution Surveillance station located in Yellowknife (GNWT 2020a). Background acid deposition data are available from the Canadian Air and Precipitation Monitoring Network's stations located at Snare Rapids and Wood Buffalo National Park (ECCC 2018a). Results from both stations are considered to be representative of background conditions (ECCC 2018a) in the LSA and region (Section 3.1.2). Previously, acid deposition was also monitored at a station near Hay River by the Canadian Network for Sampling Precipitation from 1979 to 1985 and is publicly accessible online (ECCC 2018b). In addition, two baseline air quality monitoring studies in the region were completed in 2011 (Rescan 2012c,d). The results of these studies are considered representative of the existing environment, as there have been no new developments in the region since the completion of the studies.

The baseline air quality studies consisted of dustfall monitoring and passive air sampling (Rescan 2012c,d). Dustfall monitoring was undertaken at seven locations, five of which were located close to the Project and the other two were located near the intersection of Highways 2 and 5, south of Hay River. Dustfall monitoring was conducted from July to October of 2011. At each dustfall monitoring station, two dustfall containers were placed on top of two-metre tall poles. One container's contents were analyzed for total particulate, soluble particulate, insoluble particulate, sulphate (SO_4^{2-}), nitrate (NO_3^-), ammonia (NH_3 and NH_4^+), and chloride anions (Cl^-). The other container's contents were analyzed for total metals and base cations (Mg^{2+}, Ca^{2+}, K^+). Passive air samples of sulphur dioxide (SO_2), nitrogen dioxide (NO_2), and ozone (O_3) were also collected monthly at three locations near the Project site from July to October of 2011 using a Passive Air Sampling System (PASS). Table 3-3 presents the locations of the dustfall and passive air sampling stations.

Table 3-3: Dustfall and Passive Air Sampling Locations

Dustfall Sample Location ID	PASS Sample Location ID	UTM (NAD83, Zone 11)		Study
		Easting (m)	Northing (m)	
DF-1	—	607729	6734415	Rescan 2012c
DF-2	PASS 1	602446	6733882	Rescan 2012c
DF-3	PASS 2	659585	6760609	Rescan 2012d
DF-4	PASS 3	612995	6735336	Rescan 2012c
DF-5	—	602278	6734305	Rescan 2012c
DF-6	—	562322	6737288	Rescan 2012c
DF-7	—	562553	6737260	Rescan 2012c

NAD83 = North American 1983 datum; PASS = Passive Air Sampling System; UTM = Universal Transverse Mercator.

Averaged results of total dustfall, NO_3^-, and SO_4^{2-} deposition from the 2011 dustfall studies are summarized in Table 3-4. No published dustfall criteria exist in the NWT, but total dustfall results were well below the Alberta Ambient Air Quality Guidelines of 1.77 milligrams per square decimetres per day (mg/dm^2/d) and 5.27 mg/dm^2/d (averaged over 30 days) dustfall criteria for residential and commercial areas, respectively (AEP 2019). The results are indicative of baseline levels for an area with minimal disturbance to air quality.

Table 3-4: 2011 Total Dustfall, Nitrate, and Sulphate Deposition Results

Substance	Average Deposition Rate (mg/dm^2/d)						
	DF-01	DF-02	DF-03	DF-04	DF-05	DF-06	DF-07
Total Dustfall	0.28	0.28	0.27	0.16	0.28	0.28	0.47
NO_3^-	0.0036	0.0016	0.0010	0.0010	0.0017	0.0013	0.0012
SO_4^{2-}	0.0049	0.0073	0.0036	0.0044	0.0050	0.0054	0.0050

mg/dm^2/d = milligrams per squared decimetres per day.

The Government of the Northwest Territories (GNWT) Ambient Air Quality Standards (AAQS [GNWT 2014]), are summarized in Table 3-5 and passive air sampling results from the 2011 studies are presented in Table 3-6. The passive air sampling results are presented as the average monthly concentrations, and since the AAQS are for 1-hour, 8-hour, 24-hour and annual timeframes, the sampling results can only be compared with the annual AAQS. All results were well below the relevant annual AAQSs.

Table 3-5: GNWT Ambient Air Quality Standards

Substance	NWT Ambient Air Quality Standard (µg/m^3)[a]			
	1-hr average	8-hr average	24-hr average	Annual Mean
CO	15,000	6,000	—	—
$PM_{2.5}$	—	—	28	10[c]
O_3	—	126[b]	—	—
NO_2	400	—	200	60[c]
SO_2	450	—	150	30[c]
TSP	—	—	120	60[d]

(a) Source: GNWT 2014
(b) Rolling average
(c) Arithmetic mean
(d) Geometric mean
"—" = No AAQS exists for this averaging period.
CO = carbon monoxide; NO_2 = nitrogen dioxide; µg/m^3 = micrograms per cubic metre; O_3 = ozone; $PM_{2.5}$ = fine particulate matter; SO_2 = sulphur dioxide; TSP = total suspended particulate.

Table 3-6: 2011 Passive Air Sampling Results

Substance	Average Monthly Concentration (µg/m^3)[a]		
	PASS 1[a]	PASS 2[b]	PASS 3[a]
NO_2	0.09	0.09	0.21
O_3	33.52	30.23	27.83
SO_2	0.52	0.36	0.65

(a) Average of four monthly sample results
(b) Source: Rescan 2012c
(c) Source: Rescan 2012d
NO_2 = nitrogen dioxide; O_3 = ozone; SO_2 = sulphur dioxide; PASS = Passive Air Sampling System.

A summary of the continuous carbon monoxide (CO), fine particulate matter ($PM_{2.5}$), O_3, NO_2, and SO_2 monitored data from the most recent five-year period (2015 to 2019) from the Yellowknife and Fort Smith stations is presented in Appendix A. No exceedances of CO, NO_2, O_3, or SO_2 AAQS were measured at either station from 2015 to 2019. There were exceedances measured for the $PM_{2.5}$ 24-hour AAQS. The exceedances in 2015 and 2016 were attributed to forest fire smoke in the GNWT air quality reports (GNWT 2017a, 2018a). All exceedances in 2017, 2018, and 2019 occurred in spring or summer and were likely caused by wildfire smoke or dust from dry gravel roads.

Figure 3-9 summarizes the 8-hr CO concentrations recorded at both stations in 2019. The maximum 8-hr CO concentration of 3,021 µg/m^3 during the 2015-2019 time period was recorded at the Yellowknife station in 2019. This maximum is still much lower than the CO AAQS of 6,000 µg/m^3 for the 8-hr averaging period. The 5-year average at Fort Smith was 179 µg/m^3 of CO averaged over eight hours, whereas the Yellowknife station 5-year average was higher at 282 µg/m^3.

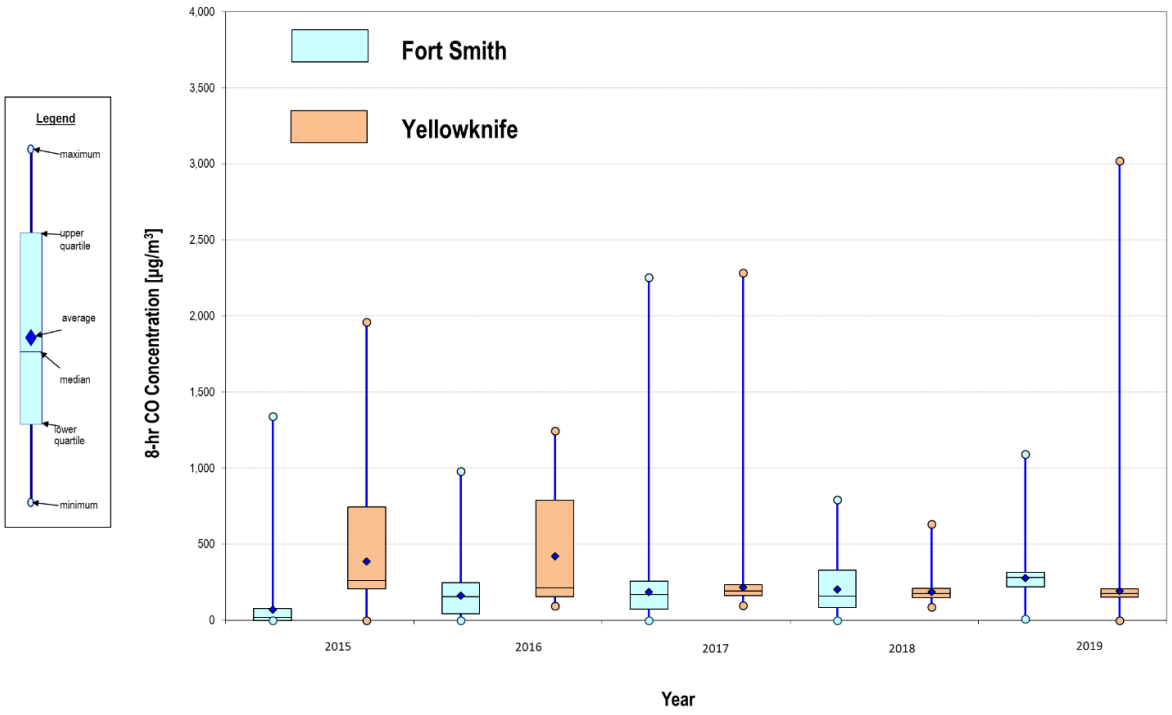


Figure 3-9: Box Plot of the 8-h CO Concentrations Recorded from 2015-2019

The 24-hour averaged NO_2 concentrations recorded during the 2015-2019 time period are presented in Figure 3-10. Maximum concentrations recorded at both stations were much lower than the 24-hr NO_2 AAQS of 200 µg/m^3. From 2015 through 2019, the Fort Smith station averaged 2.9 µg/m^3 of NO_2 over 24 hours, and the Yellowknife station averaged 4.7 µg/m^3.

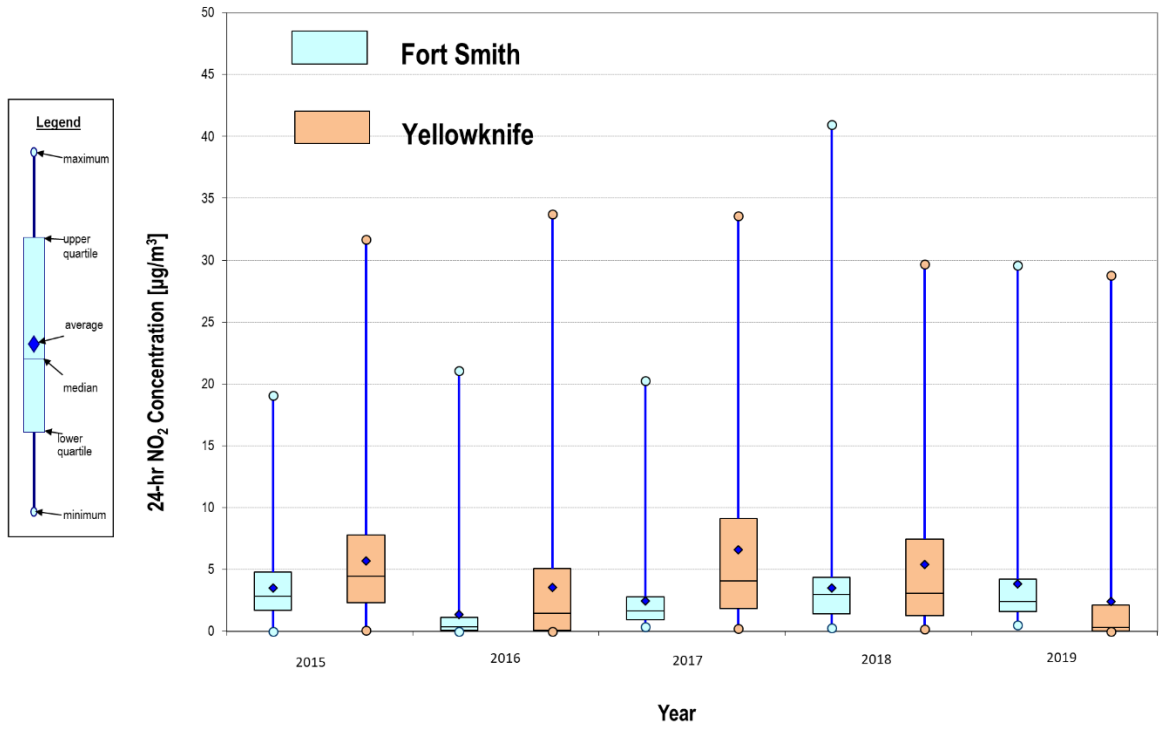


Figure 3-10: Box Plot of the 24-h NO_2 Concentrations Recorded from 2015-2019

The 8-hr rolling average of hourly O_3 concentrations measured at the Fort Smith and Yellowknife stations from 2015 through 2019 are compared with the AAQS in Figure 3-11. Ozone concentrations at both stations varied minimally year to year, with Fort Smith and Yellowknife 8-hour rolling average concentrations of 56.0 µg/m^3 and 56.9 µg/m^3, respectively.

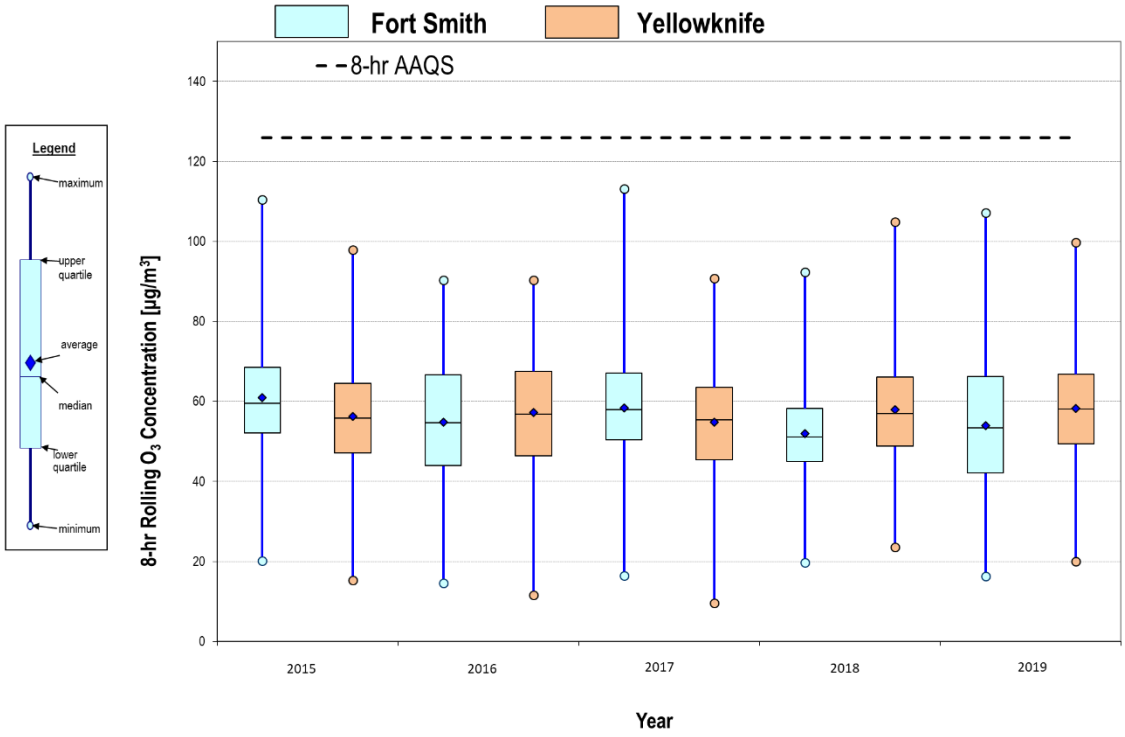


Figure 3-11: Box Plot of the 8-h Rolling Average O3 Concentrations Recorded in 2015-2019

The 24-hr $PM_{2.5}$ concentrations at the Fort Smith and Yellowknife stations are presented in Figure 3-12. Concentrations of $PM_{2.5}$ are greatly affected by wildfire smoke and road dust in the summer months as evident by the large variation in maximum values recorded versus the 75th percentiles. Typically 24-hr $PM_{2.5}$ concentrations at both stations were well below the AAQS, with 2015 through 2019 averages of 7.1 µg/m^3 and 5.7 µg/m^3 at Fort Smith and Yellowknife, respectively.

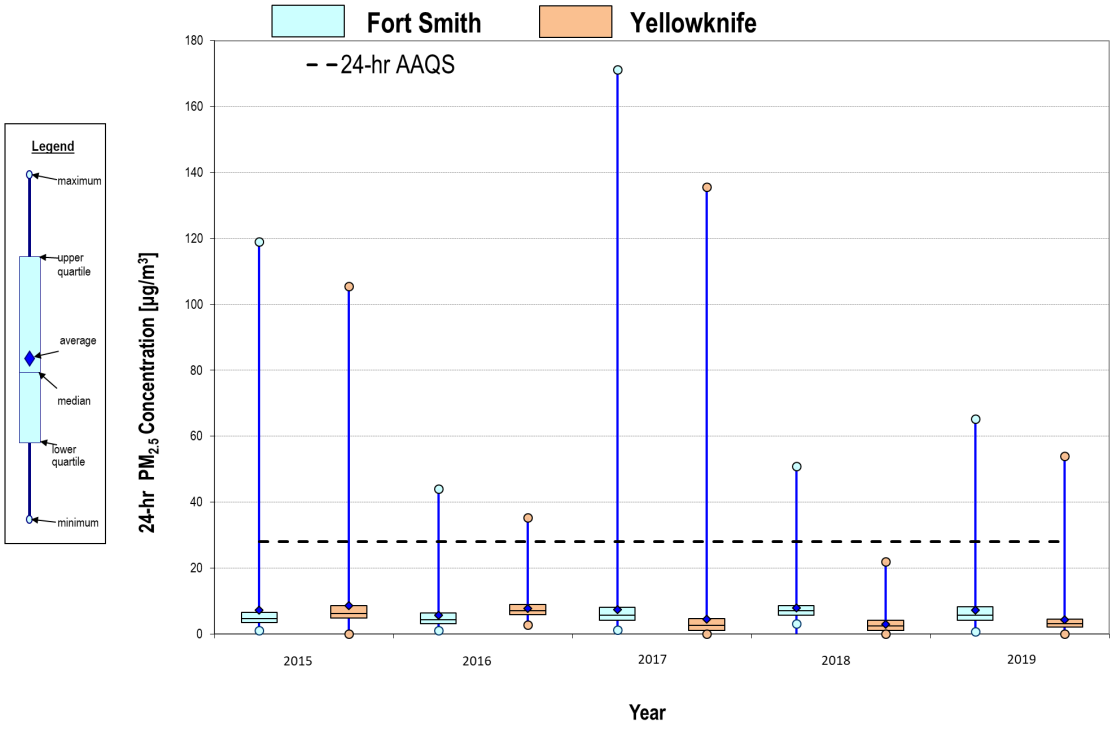


Figure 3-12: Box Plot of the 24-h $PM_{2.5}$ Concentrations Recorded in 2015-2019

Figure 3-13 presents the 24-hour concentrations of SO_2 from 2015 through 2019 recorded at the Fort Smith and Yellowknife stations. Measurements were well below the 24-hour SO_2 AAQS of 150 µg/m^3, with the maximum value of 19.0 µg/m^3 at Fort Smith in 2019. On average, Fort Smith and Yellowknife 24-hour SO_2 concentrations were less than 1 µg/m^3.

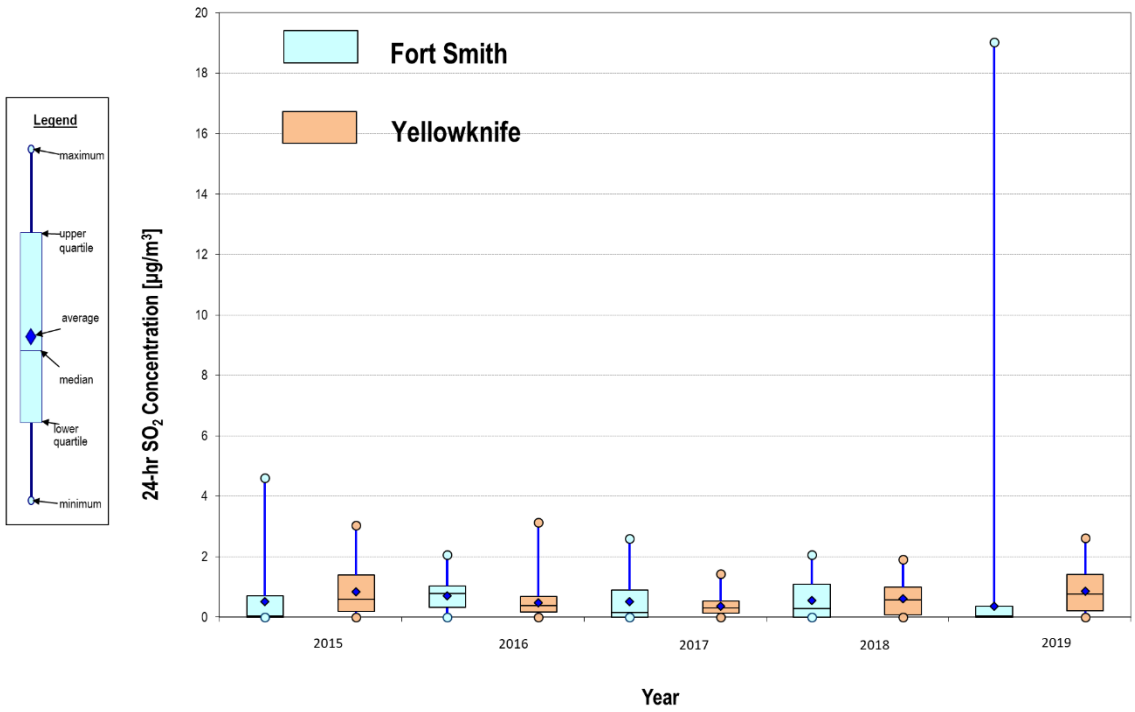


Figure 3-13: Box Plot of the 24-h SO_2 Concentrations Recorded from 2015-2019

3.3.2.7 Noise

A baseline noise survey was completed in the noise RSA in July and December 2011 (Rescan 2012c,d; Section 3.1.2). There have been no new developments in the RSA since 2011; therefore, the results of the 2011 survey provides representative information on noise levels for the existing environment.

The baseline noise survey measured noise levels at four monitoring stations in the RSA (S1, S2, S3, and S4). To characterize seasonal variability, noise levels were measured twice at each monitoring station: once during the summer with relatively low wind (July 2011), and once during the winter with relatively high wind (December 2011). To characterize daily variability, noise levels were measured for a period of approximately 24 hours at each monitoring station. All noise measurements were collected using Type I integrating sound level meters. Table 3-7 describes the noise monitoring stations and measurement periods captured during the baseline noise survey.

Table 3-7: Baseline Noise Monitoring Stations in the Regional Study Area

Baseline Noise Monitoring Station	Universal Transverse Mercator Coordinates (NAD83, Zone 11)		Description	Measurement Periods
	Easting (m)	Northing (m)		
S1	600004	6734214	The sound level meter was installed approximately 300 m south of Highway 5, in a grassy location with a row of young deciduous trees between the sound level meter and the highway.	19 to 20 July 2011; 6 to 7 December 2011
S2	607159	6735888	The sound level meter was installed at the intersection of two cut lines in a relatively flat grassy area, with no nearby sources of industrial noise.	19 to 20 July 2011; 6 to 7 December 2011
S3	659585	6760609	The sound level meter was installed approximately 500 m south of Highway 6, in a small cut block.	20 to 21 July 2011; 6 to 7 December 2011
S4	613469	6734287	The sound level meter was installed approximately 250 m east of the Buffalo River in a forest clearing along an access road.	20 to 21 July 2011; 6 to 7 December 2011

NAD83 = North American 1983 datum;

For each monitoring station and measurement period, Table 3-8 presents average daytime noise levels ($L_{eq,day}$), where daytime is defined as the period from 7:00 a.m. to 10:00 p.m., average nighttime noise levels ($L_{eq,night}$), where nighttime is defined as the period from 10:00 p.m. to 7:00 a.m., and 24-hour average noise levels ($L_{eq,24}$). All noise levels are expressed in A-weighted decibels (dBA), which is a logarithmic unit that reflects the sensitivity of the human auditory system. Table 3-8 also identifies noise sources that were audible during the survey and contributed to the measured noise levels.

Table 3-8: Baseline Noise Levels in the Regional Study Area

Baseline Noise Monitoring Station	Measurement Period	Baseline Noise Levels (dBA)			Audible Noise Sources
		Daytime ($L_{eq,day}$)	Nighttime ($L_{eq,night}$)	24-Hour ($L_{eq,24}$)	
S1	July 2011	43	37	41	highway traffic; birds; wind
	December 2011	51	53	51	
S2	July 2011	24	30	28	wildlife; wind
	December 2011	51	51	51	
S3	July 2011	29	32	30	highway traffic; wildlife; wind; rain/thunder[(a)]
	December 2011	53	54	53	
S4	July 2011	43	25	41	birds; wind; rain/thunder[(a)]
	December 2011	49	51	50	

(a) Rain and thunder were only audible during the July 2011 measurement period.

At each monitoring station, baseline noise levels were higher during the December measurement period than the July measurement period. Elevated noise levels during the December period are primarily the result of high wind speeds. As a result, baseline measurements from July 2011 are generally representative of the existing environment during periods of low to moderate wind, and baseline measurements from December 2011 are generally representative of the existing environment during periods of high wind.

3.3.3 Groundwater Quantity and Quality

Regional Hydrogeology

Regional groundwater occurs in both an unconfined aquifer in the overburden, as well as in a confined bedrock aquifer. The average depth to groundwater ranges from 1 to 18 m below ground surface (Tamerlane 2007). The groundwater recharge areas are from local topographic highs such as the Caribou Mountains located 200 km south of the Pine Point property, and to a lesser extent, Cameron Hills to the north, where groundwater flow is distributed radially. Durston (1979) and Stevenson (1984) postulated that a perched groundwater flow system exists within the Caribou Mountain uplands, which re-charges the lower Slave Point Formation. The groundwater flow in the overburden aquifer varies with topographic relief, but flows generally towards the northeast (Brown et al. 1981).

The groundwater in the bedrock aquifer generally flows towards the north and northeast, and discharges along lowlands adjacent to the western margin of the Canadian Shield, including the Hay River valley to the northwest and the Little Buffalo River and Slave River valleys to the northeast, and the south side of Great Slave Lake comprises a lowland area, which is considered a major regional groundwater discharge area (Tamerlane 2007). Discharge areas are evident through the presence of surface water features such as swamps and alkali flats, and springs discharging mineralized and sulphurous groundwater. High specific conductivity readings have also been observed along Slave River, Salt River, Little Buffalo River, Buffalo River, and along Great Slave Lake between Fish Point and Presqu'ile Point. Groundwater discharge is also evident through the presence of swampy areas and sulphurous springs throughout the northern sections of the LSA (EBA 2011).

Site Hydrogeology

The bedrock units that represent the most productive aquifers are within the Sulphur Point Formation and the Pine Point Formation, consisting of highly porous, well fractured dolomite. According to Stevenson (1984), the aquifer is laterally confined by the Buffalo River shales to the north and the Muskeg evaporites to the south. Overlying clay till overburden and the Watt Mountain Formation limestones of generally low permeability act to confine the aquifer on top while the Chinchaga Formation evaporites underlying the Pine Point and Keg River formations form an effective vertical barrier below the aquifer. The hydraulic continuity is thought to be more predominant along the northeast-southwest trend of the Presqu'ile Barrier Reef Complex due to karstification, solution channelling, and jointing characteristics (GTC 1983).

Local groundwater recharge to the bedrock aquifer at the Pine Point site is likely to be variable and largely controlled by the overburden geology. High rates of recharge are expected in areas where sinkholes are present, but in general, recharge will be limited by the presence of till overburden. Several small ponds were observed in boggy areas that were several metres above the regional water table, indicating that recharge is relatively slow through the till. Local surface water/groundwater flows through the till, then downwards through fractured bedrock towards the water table. Groundwater within the saturated bedrock is expected to flow anisotropically along solution channels, bedding planes, and fractured zones (Brown et al. 1981) (i.e., there is a preferred direction of groundwater movement along these features as compared to across them). Several seepage points observed in historical pit walls indicate that there is some lateral flow within the unsaturated bedrock. Groundwater discharges locally towards the north to northeast, and springs discharging mineralized and sulphurous groundwater have been also observed along the south shore of Great Slave Lake (GTC 1983; Stevenson 1983), and sulphurous springs and artesian boreholes along the banks of the Buffalo River have been reported (GTC 1983; EBA 2005a). One participant in the Hay River ITK interviews indicated that he was aware of "artesian wells" in the Pine Point area (Tamerlane 2006b).

The permeability and porosity of the Presqu'ile aquifer is very high with hydraulic conductivity values on the order of 10^{-4} to 10^{-3} m/s (Stevenson 1983; GTC 1983). Based on work completed by Stevenson (1983), the water table in the LSA slopes northwards towards Great Slave Lake. Local gradients range from about 0.4% northwards along the north part of the area and about 0.25% westward along the south portion.

Interpretation of the bedrock groundwater potentiometric[1] contours in relation to the topography indicates that the depth of groundwater is up to 30 m below the ground surface along the northeastward trending ridge in the east-central part of the LSA. In the northwest portion of the LSA, the potentiometric surface is higher than the ground surface. High water levels have resulted in groundwater discharge as springs along the incised Buffalo River channel and other small tributary channels in the area.

Although the Presqu'ile aquifer has a high permeability, groundwater flow through it is likely to be relatively slow due to the low hydraulic gradient in the RSA. Due to the high porosity, the storativity of the aquifer is high. It is estimated that about 1 billion m^3 of water was removed during mining activities from 1968 to 1984. According to Stevenson (1984), this water was produced from storage within the aquifer (16%), recharge from local precipitation (76%), with the remainder from the regional groundwater flow.

Groundwater Quality

Sampling at the Pine Point site has consistently shown that the physical and chemical properties of the groundwater are consistent with the limestone, dolomite, sandstone, and shale, and evaporite formations regionally. Three basic types of groundwater have been reported in the RSA through previous studies, namely a calcium bicarbonate water found locally in glacial drifts, sulphur water commonly found in springs along the south shore of Great Slave Lake, and saline water described from groundwater contact with the Devonian evaporite layers. The chemistry of most groundwater samples collected in the RSA over the previous 30 years reflects mixing of these three groundwater types, although it should be noted that groundwater deeper than 25 m was not tested in previous studies (Tamerlane 2007).

Indigenous Traditional Knowledge suggests that groundwater in the area is poor, and described it as alkaline, sulphurous, and non-potable (Tamerlane 2007). Some people indicated that baseline groundwater quality had been non-potable prior to the start of mining activities, and others indicated that mining activities had worsened groundwater quality.

3.3.4 Surface Water Quantity

The landscape within and surrounding the aquatics RSA is largely composed of boreal forest, interspersed with extensive lakes and wetlands (Section 3.1.3). Rivers are generally associated with snowmelt, with peak flows dominated by snowmelt floods in the spring. Where present, permafrost acts as a barrier to deep groundwater recharge, which increases surface runoff and decreases sub-surface flow.

[1] Potentiometric surface is the theoretical level to which water in a confined aquifer will rise to and equalize in a well.

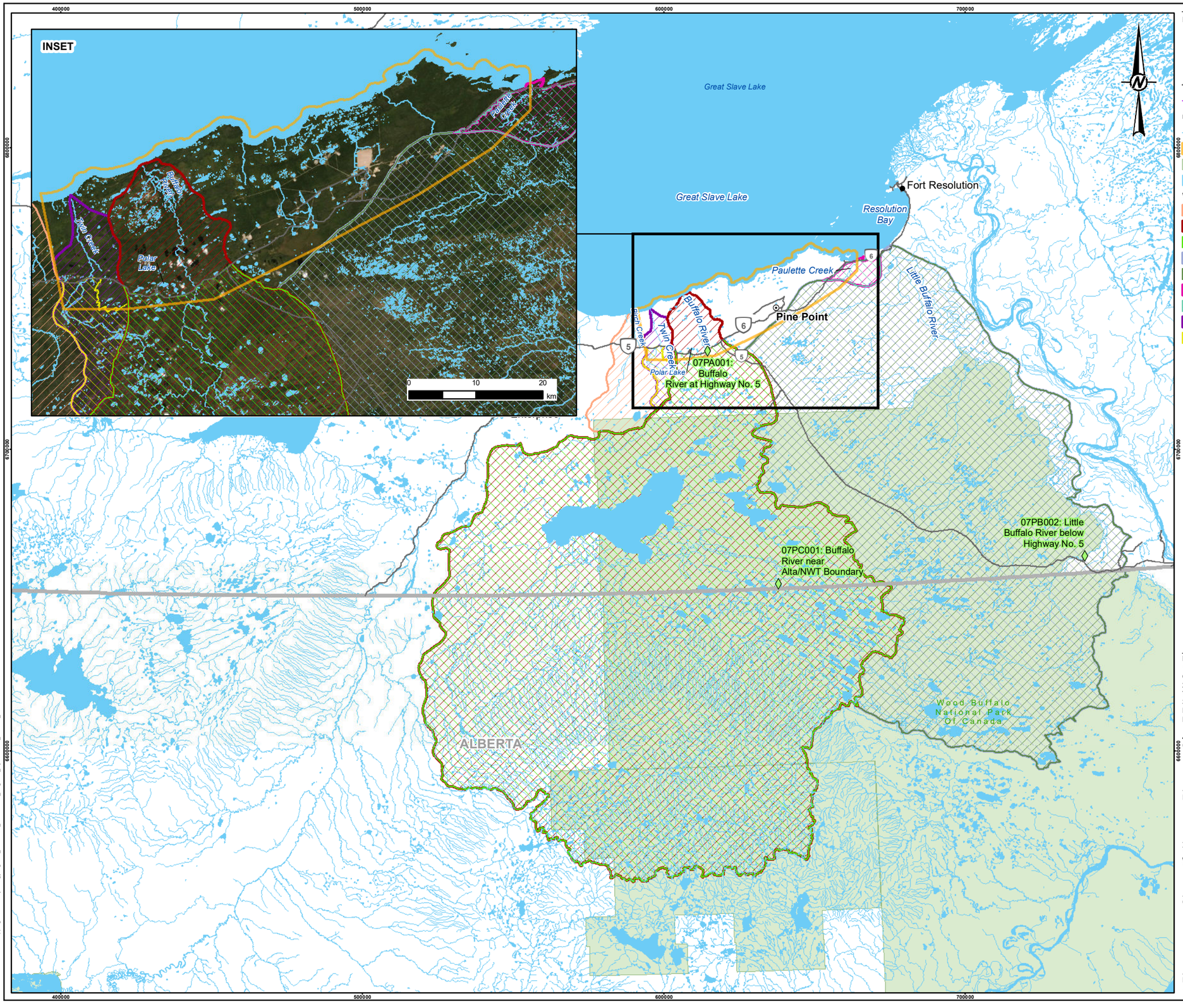
The local area around the Project is flat to gently sloping. A considerable area is covered by poorly drained muskeg up to 3 m deep in some areas (Beak 1980). Elevations range from approximately 262 m in the southwest part of the LSA to 156 m in the northeast (LSI 2018, 2019). Swamp, muskeg, and low gravel ridges are the main topographic features with several small lakes and numerous potholes (Beak 1980). Overall, the land gently slopes in a northeast direction toward the southern shore of Great Slave Lake.

The two main drainages located within the LSA are the Buffalo River and Twin Creek. Birch Creek, Paulette Creek and the Little Buffalo River are outside of the LSA, but within the RSA. All of the main watercourses in the RSA flow north into Great Slave Lake (Figure 3-14).

Watercourses

Watercourses are presented in order of location from west to east across the RSA and surrounding area: Birch Creek, Twin Creek, Buffalo River, Paulette Creek, and Little Buffalo River (see Figure 3-14). Each of these watercourses flow north, eventually draining into Great Slave Lake.

Boundaries for the Birch Creek watershed were adopted from the National Hydrographic Network (NHN) geospatial data (NRC 2020) and no further delineation was completed. Birch Creek drains several wetlands to the south of the Highway 5 northward into Great Slave Lake. The drainage area of Birch Creek at the mouth of Great Slave Lake is approximately 526 km^2.



LEGEND

- FORMER PINE POINT TOWN SITE
- HYDROMETRIC STATION - ENVIRONMENT CANADA
- POPULATED PLACE
- ALL-SEASON ROAD
- WINTER ROAD
- TERRITORIAL/PROVINCIAL BOUNDARY
- WATERCOURSE
- GENERAL PROJECT LOCATION
- PARK/PROTECTED AREA
- WATERBODY

WATERSHEDS

- BIRCH CREEK
- BUFFALO RIVER
- BUFFALO RIVER AT HIGHWAY 5
- LITTLE BUFFALO RIVER
- LITTLE BUFFALO RIVER AT HWY 6
- PAULETTE CREEK
- PAULETTE CREEK AT HIGHWAY 6
- TWIN CREEK
- TWIN CREEK AT HIGHWAY 5

REFERENCE(S)

1. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
2. PARKS AND PROTECTED AREAS OBTAINED FROM CONSERVATION AREAS REPORTING AND TRACKING SYSTEM (CARTS), CANADIAN COUNCIL ON ECOLOGICAL AREAS, 2017.
3. POTENTIAL EFFLUENT DISCHARGE LOCATIONS PROVIDED BY ANDRÉE DROLET, PPML, BY EMAIL ON 27 JUNE 2019.

PROJECTION: UTM ZONE 11 DATUM: NAD 83

CLIENT
PINE POINT MINING LTD.

PROJECT
PINE POINT PROJECT

TITLE
WATERSHEDS AND REGIONAL HYDROMETRIC STATIONS

CONSULTANT
GOLDER

YYYY-MM-DD	2020-12-15
DESIGNED	SB
PREPARED	MM
REVIEWED	JV
APPROVED	JV

PROJECT NO.	PHASE	REV.	FIGURE
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Twin Creek is located approximately 10 km to the east of Birch Creek within the LSA. Twin Creek is a small stream that drains several small lakes and wetlands to the south of the Highway 5 northward into Great Slave Lake. The drainage area for Twin Creek was delineated by a Geographic Information System (GIS) analysis using Green-Kenue software (CHC 2012) based on LiDAR collected in 2018 (LSI 2018) and 2019 (LSI 2019) supplemented with data from the Arctic digital elevation model (Porter et al. 2018). Boundaries with some adjacent watersheds (Birch Creek and Buffalo River watersheds) were also informed by NHN geospatial data (NRC 2020). Twin Creek originates approximately 20 km south of Highway 5 (Figure 3-14), and at Highway 5, drains an area of approximately 121 km^2. The drainage area of Twin Creek at the mouth of Great Slave Lake is approximately 220 km^2. The overall length of Twin Creek is approximately 45 km, with a typical seasonal water flow and higher flows occurring during spring snow melt (EBA 2005a). According to satellite imagery, maps, and onsite field studies, the stream channel is often undefined and flows through sphagnum bogs (EBA 2005a). After turning into a large, open, almost treeless, and swampy area, the stream re-emerges as a defined creek channel before reaching Great Slave Lake (Beak 1980).

Buffalo River is a large river originating from Buffalo Lake located in the southernmost portion of the NWT. It receives drainage from many other small lakes and wetlands upstream (south) and northward towards Great Slave Lake (Figure 3-14). The total drainage area of the Buffalo River at Highway 5 is about 18,100 km^2 and where the Buffalo River empties into Great Slave Lake, the total drainage area is approximately 18,400 km^2. The NHN geospatial data (NRC 2020) were used as the reference for the Buffalo River watershed as it extends far beyond the extent of available digital elevation model data and south of the Alberta – NWT border. Boundaries for the Buffalo River watershed were adopted from NHN geospatial data (NRC 2020) and no further delineation was completed. The overall length of Buffalo River is approximately 155 km. From the Highway 5 bridge to the mouth of the river, it is approximately 100 m wide and moderately incised at the highway bridge, which is approximately 19 km from the confluence with Great Slave Lake (Beak 1980). Water flows strongly and is generally turbid. The river has a mud bottom, with gravel and cobbles present in faster flowing areas (EBA 2005a; Beak 1980). Buffalo River water flows year-round with higher levels of flow occurring during the annual spring melt. The Buffalo River is moderately incised into the surrounding terrain. Based on discharge records from 1969 to 1990, it has a mean annual flow of 49 m^3/s, with a mean maximum daily flow of 187 m^3/s during May or June (WSC 2020).

The drainage area for Paulette Creek was delineated by a GIS analysis using Green-Kenue software (CHC 2012) based on LiDAR collected in 2018 (LSI 2018) and 2019 (LSI 2019) supplemented with data from the Arctic digital elevation model (Porter et al. 2018). Boundaries with some adjacent watersheds (Little Buffalo River watershed) were also informed by NHN geospatial data (NRC 2020). Paulette Creek originates 11 km southwest of Highway 6 that drains an area dominated by swamp and muskeg. Paulette Creek empties into Great Slave Lake approximately 1.6 km downstream of the highway. The Paulette Creek drainage area at Highway 6 is 79 km^2 and 81.4 km^2 where it empties into Great Slave Lake.

The Little Buffalo River is a large river originating in northern Alberta and flowing through the southernmost portion of the NWT. It receives drainage from many other small lakes and wetlands upstream (south) and northward towards Great Slave Lake (Figure 3-14). Boundaries for the Buffalo River watershed were adopted from NHN geospatial data (NRC 2020) and no further delineation was completed. The total drainage area of the Little Buffalo River at Highway 6 is about 12,700 km^2. The Little Buffalo River empties into Great Slave Lake approximately 2 km north of the Highway 6 crossing with negligible gains to drainage area downstream of Highway 6.

Waterbodies

Polar Lake is located approximately 2.9 km to the west of the LSA and about 0.8 km north of Highway 5 (Beak 1980). It is a shallow lake with no major surface feed streams or outlet drainages (Figure 3-14). It is approximately 1.6 km long, 0.6 km wide, and has a surface area of about 0.73 km^2. The lake may receive groundwater sources (Beak 1980). The estimated lake level of Polar Lake at the time of contour mapping conducted for Western Mines in the summer of 1979 was 214.6 metres above sea level (masl) (Beak 1980).

Great Slave Lake is the final receptor of the drainages from Twin Creek and the Buffalo River systems (Figure 3-14). Historical data available on lake levels at the Water Survey of Canada recording station at Hay River (Station 070B002) indicate that the mean lake level is 156.63 masl with normal seasonal variations between 156.34 and 156.96 masl, with the highest levels occurring in mid-summer (WSC 2020).

Great Slave Lake is the second largest lake in the NWT (after Great Bear Lake), the deepest lake in North America (616 m), and the sixth largest lake in the world. It is 456 km long, 19 to 109 km wide, and covers an area of 28,400 km^2 with an approximate lake volume of 2,090 km^3.

The southern shoreline area of Great Slave Lake between the mouths of Twin Creek and the Buffalo River is relatively regular in shape and has little terrestrial vegetation. The beach and nearshore area along the shoreline generally consist of fine sand and silt. Localized patches of emergent vegetation occur along the shoreline to about 10 m offshore in the lake. The nearshore lake water is often murky due to the regular suspension of shallow sediments (EBA 2007).

Regional Hydrometric Monitoring

Limited long-term hydrometric monitoring is available for the region, as none of the regional stations are currently active. Calculation of water yields was possible for three stations: the Buffalo River at Highway 5 (WSC Station 07PA001), the Buffalo River near the provincial – territorial border, and the Little Buffalo River below Highway 5. The Buffalo River at Highway 5 was selected as being representative of regional conditions due to the proximity to the Project as well as the length and completeness of the record. Comparing annual basin yields in Table 3-9 should be done with caution as not all the monitored years had complete data records and not all the periods of record overlap. Generally, the average annual water yield in the Little Buffalo River watershed is less than the Buffalo River watershed.

Table 3-9: Regional Water Survey of Canada Hydrometric Stations (WSC 2020)

Station Number	Station Name	Distance to Project and Direction	Watershed Area (km^2)[(a)]	Period of Record	Published Record Length[(b)] (years)	Record Length Suitable for Regional Analysis[(c)] (years)	Average Annual Basin Yield (mm)
07PA001	Buffalo River at Highway 5	28 km SW	18,100	1969 to 1990	22	22	84
07PB002	Little Buffalo River Below Highway 5	130 km SE	3,330	1966 to 1994	30	28	29
07PC001	Buffalo River Near Alberta/NWT Border	91 km S	4,350	1987 to 1994	8	6	172

(a) The watershed area published by WSC is 18,500 km^2. However, geospatial analysis for the Project based on the NHN geospatial data determined that the watershed area reporting to the Buffalo River at Highway 5 was 18,100 km^2.

(b) Full calendar years only.

(c) In some years, gaps were filled using a recession constant, or by linearly interpolating during short periods or during winter and were suitable for analysis. In some years, gaps were large or occurred during the open-water season and gaps were not able to be accurately filled.

High Level Water Balance

A high-level water balance, typical of conditions in the region has been estimated for the Buffalo River watershed draining to Highway 5 and is summarized in Table 3-10. The Buffalo River watershed at Highway 5 consists of 7% water surface and 93% land surface. There is annual net precipitation in excess of 84 mm water equivalent, which leaves the watershed as surface runoff. The primary inflow and source of runoff is snowmelt released in early spring.

The total evaporative losses from land and lake surfaces (lake evaporation and land evapotranspiration) in the watershed upstream of Highway 5 is 244 mm or approximately 230% of pre-snowmelt precipitation. When combined with the sublimation of snow, the total loss to the atmosphere is 269 mm or roughly 80% of total annual precipitation.

Table 3-10: Regional Representative Watershed (Buffalo River at Highway 5), Mean Annual Water Balance for Natural Conditions

Component	Magnitude (mm)	Comment
Total precipitation	336	1981 to 2010 Climate Normal Value for Hay River A
Rainfall	205	Estimated mean annual value for 1981 to 2010[(a)]
Snowfall as SWE	131	Estimated mean annual value for 1981 to 2010[(a)]
Sublimation Losses	25	Estimated mean annual value for 1981 to 2010[(b)]
Spring SWE	106	mean annual value accounting for losses due to sublimation
Net precipitation input	311	rainfall + spring SWE
Surface runoff	84	estimated mean annual value from Buffalo River at Highway 5 (Station 07PA001) (WSC 2020)
Lake evaporation at 330 mm	23	7% of Buffalo River watershed is lake surface[(c)]
Evapotranspiration at 237 mm	220	93% of Buffalo River watershed is land surface[(d)]
Net watershed output	328	surface runoff + lake evaporation + evapotranspiration

(a) Precipitation phase was partitioned based on air temperature using the Pipes and Quick (1977) method.

(b) Sublimation loss is calculated using the methods detailed by Kuchment and Gelfan (1996) based on meteorological inputs from ERAI (ECWMF 2020) for the period 1981 to 2010.

(c) Total evaporation loss from lake surfaces = (330 mm) x (0.07) = 23 mm. Evaporation is calculated using the methods documented by Priestley and Taylor (1972) based on meteorological inputs from ERAI (ECWMF 2020) for the period 1981 to 2010.

(d) Total evapotranspiration loss from land surfaces = (237 mm) x (0.93) = 220 mm. Evapotranspiration is calculated using the methods detailed by Granger and Gray (1989) based on meteorological inputs from ERAI (ECWMF 2020) for the period 1981 to 2010.

SWE = snow water equivalent.

3.3.5 Surface Water Quality

This section provides an overview of the general surface water quality and cultural uses of major watercourses and waterbodies located within and surrounding the aquatics RSA (Section 3.1.3). A review of the topography, vegetation, and hydrography as it relates to surface water drainage was detailed in Section 3.3.4, along with the physical characteristics of major watercourses and waterbodies located within the RSA. A review of the aquatic life present in select watercourses and waterbodies within the RSA is provided in Section 3.3.6.

Additional details on water quality studies completed to date within the region of the Project are presented in Appendix B, Table B1, and a summary of available water quality data is presented in Appendix B, Table B2 (watercourses) and Table B3 (waterbodies). All data are presumed to represent surface water quality, which has been collected during the open-water season (May to October).

Watercourses

Watercourses are presented in order of their location from west to east across the RSA and surrounding area: Birch Creek, Twin Creek, Buffalo River and Paulette Creek (Figure 3-14). Each of these watercourses flow north during the open-water season, eventually draining into Great Slave Lake. Based on a review of field data collected to date and historical long-term hydrometric monitoring data available for the region, it has been assumed that these watercourses partially or completely freeze periodically during winter.

Birch Creek is located 5 km to the west of the Project and was chosen as a reference station for a previous aquatic resources baseline study (Rescan 2012g). This creek was found to be slightly alkaline (pH >8) with very hard water (hardness >180 mg/L; hardness classification according to McNeely et al. 1979), particularly in August and September. The water is characterized as clear with low turbidity conditions and low total suspended solids (TSS) measurements. Birch Creek can be described as an oligotrophic watercourse (i.e., total phosphorus concentrations were less than 0.0010 mg/L; CCME 2004). Major ions and metal concentrations measured in Birch Creek were typically below guidelines, with total fluoride concentrations above the interim Canadian Council of Ministers of the Environment (CCME) guideline (0.12 mg/L; CCME 1999). Fluoride concentrations in Birch Creek were consistent with those measured in other small streams within the vicinity (Rescan 2012g).

Twin Creek is located approximately 10 km to the east of Birch Creek within the LSA. The water quality of Twin Creek has been assessed in several studies, including a historical study conducted in the late 1970s (Beak 1980; EBA 2005a; Rescan 2012f,g; Golder 2020). In general, Twin Creek was slightly alkaline with very hard water, particularly in September. Low turbidity and TSS concentrations were measured in Twin Creek, with low major ion and metal concentrations that were typically below CCME guidelines. Twin Creek is also an oligotrophic watercourse and as noted for Birch Creek, total fluoride concentrations were above the interim CCME guidelines; all other major ions and metal concentrations were below CCME guidelines. In general, the water quality in Twin Creek was consistent with the reported water quality in Birch Creek (EBA 2005a; Tamerlane 2007; Golder 2020).

Buffalo River, located approximately 18 km to the east of Twin Creek along Highway 5, is the largest watercourse that flows through the LSA. The water quality of Buffalo River has been assessed in several studies (Beak 1980; EBA 2005a; Rescan 2012g; Golder 2020). Overall, the Buffalo River was slightly alkaline with water hardness that is slightly lower than in Birch and Twin creeks (i.e., 121 to 180 mg/L). High turbidity and TSS concentrations were characteristic of the Buffalo River, particularly during September and October, with corresponding high metals concentrations measured during all sampling events. As a result, total aluminum, cadmium, chromium, copper, and iron concentrations were consistently above CCME guidelines (EBA 2005a; Rescan 2012g; Tamerlane 2007; Golder 2020). Aluminum is typically associated with the limestones, dolomites, sandstones, and shales that occur in the LSA, while elevated iron concentrations are commonly linked to the mafic minerals that occur across the region (EBA 2005a). The concentrations of all major ions and other metals were below CCME guidelines. Buffalo River can be characterized as eutrophic based on elevated total phosphorus concentrations (0.028 to 0.13 mg/L; CCME 2004); however, these levels are attributed to the elevated TSS in the river.

Paulette Creek is located southeast of Highway 6. Two studies investigating the water quality of Paulette Creek has been completed to date (Rescan 2012f; Golder 2020). Five stations along the creek were sampled in 2012, and one station was sampled in 2019. Paulette Creek was slightly alkaline with very hard water. Turbidity and TSS concentrations in Paulette Creek were low, and consistent with concentrations in Twin and Birch creeks. Metal concentrations were generally low and below CCME guidelines, with total cadmium and fluoride measured above CCME guidelines.

Waterbodies

There are numerous shallow lakes and ponds distributed throughout the LSA and RSA that comprise the wetland environment located along the southern shore of Great Slave Lake. Polar Lake is located approximately 2.9 km to the west of the LSA and about 0.8 km north of Highway 5. Water sampling conducted to date on Polar Lake was completed on 11 September 1979 (Beak 1980). This study classified Polar Lake as an ultra-oligotrophic waterbody. The water had a slightly basic pH with very hard water conditions, and low metal concentrations. Turbidity and TSS were not measured during this study.

Great Slave Lake is the receiving environment for all major watercourses within the region. The water quality of Great Slave Lake in the area adjacent to the Project has been assessed in several recent studies (EBA 2005a; Rescan 2012g; Golder 2020), which were limited to fall conditions (August to October). Samples from these studies indicated that waters were slightly alkaline, very soft to moderately soft, and eutrophic. High turbidity values and TSS concentrations were measured, with high variability between stations. As a consequence of the high TSS concentrations, metals concentrations were elevated with total aluminum concentrations above the CCME guideline at all stations, and total cadmium, chromium, copper, and iron were above CCME guidelines at some stations. The fluoride concentration was measured above the interim CCME guideline at one station only. Inflows from the highly turbid Buffalo River appear to contribute to the high turbidity and metal concentrations measured in Great Slave Lake (Rescan 2012g; Golder 2020).

Cultural Uses of Watercourses and Waterbodies

Many communities are located near to the Project, including Hay River, approximately 75 km to the west of the Project and Fort Resolution, approximately 53 km to the northeast of the Project, on Resolution Bay of Great Slave Lake. Information has been gathered on the cultural uses of major watercourses and waterbodies in the region, yet little is known about the cultural uses of smaller watercourses (e.g., creeks) located within the LSA. Great Slave Lake is known to be important traditional and commercial fishing area (Evans et al. 1998; Richardson et al. 2001; Rescan 2012g).

Pit Data Summary

Water quality was sampled in flooded pits in the LSA during field programs conducted in 2005, 2017, and 2018; a total of 14 mine pits, one tailings pond, and one natural waterbody were sampled in the sampling programs (EBA 2005a; PPML unpublished data; Maskwa 2018).

Physico-chemical sampling profiles were only conducted at five pits in 2018. pH ranged from 8.0 to 8.3, indicating all pits sampled were alkaline and within the CCME water quality guideline for the protection of aquatic life (CCME 1999). Dissolved oxygen measurements were above the lower bound CCME water quality guideline of 6.5 mg/L (CCME 1999). Specific conductivity ranged from 613 to 2,326 microsiemens per centimetre. Distinct thermoclines were noted at approximately 3 m depth in all pits sampled in 2018.

Based on water quality data from all sampled locations, the waters were clear, with low total suspended solids concentrations and turbidity. Total dissolved solids concentrations were between 468 and 2,570 mg/L. Major ions were dominated by sulphate, calcium, and bicarbonate. Fluoride ranged from 0.32 to 1.2 mg/L and exceeded the interim chronic guideline of 0.12 mg/L (CCME 1999) in all pits/years sampled. Hardness ranged from 315 to 1,810 mg/L, which characterized water from all pits as very hard (McNeely et al. 1979). Concentrations of total and dissolved metals were generally below water quality guidelines for the protection of freshwater aquatic life (CCME 1999). Water quality guideline exceedances for protection of aquatic life were measured for total aluminium, cadmium, copper, iron, lead, thallium, uranium, and dissolved zinc concentrations at one or more pits.

In general, metals that occasionally exceeded guidelines consistently between the pit and surface water stations in recent and historic data included total aluminum, cadmium, copper, iron, and dissolved zinc (Beak 1980; Evans et al. 1998; EBA 2005a, Rescan 2012f,g; Golder 2020), whereas guideline exceedances specific to the pit stations included total lead, thallium, and uranium concentrations (EBA 2005a; Rescan 2012g; Golder 2020).

3.3.6 Fish and Fish Habitat

The Slave River, Little Buffalo River, Paulette Creek, Buffalo River, Twin Creek, Birch Creek, Sandy River, and Hay River flow into the southern portion of Great Slave Lake. Twin Creek, the Buffalo River, and Paulette Creek are the primary watercourses near the predicted zone of influence of the Project, which could affect fish and fish habitat (Figure 3-14; Section 3.1.3). A large number of small, shallow lakes with no visible drainages are also present within the LSA (Beak 1980). Water is currently present throughout the historical decommissioned Pine Point mine area through a series of flooded and connected channels and pits.

Previous studies have been undertaken in the LSA, since the early 1970s (Tamerlane 2007). Many of these studies investigated concerns raised by the community of Fort Resolution related to the operation and decommissioning of the historical Pine Point mine. Concerns were centred around the possibility of contamination of the water, sediment, and fish in the Resolute Bay area by the historical mine (Evans et al. 1998).

3.3.6.1 Fish Habitat

Great Slave Lake

Great Slave Lake is the receiving environment for all primary watercourses in the region. Great Slave Lake is downstream from the historical Pine Point mine site and is the final receiving waterbody for the Buffalo River and Twin Creek drainages. Great Slave Lake is the second largest lake in the NWT, covering an area of 28,400 km^2, and deepest in North America at 616 m. It has an approximate volume of 2,090 km^3 (Tamerlane 2007). The nearshore area of Great Slave Lake between Twin Creek and Buffalo River consists of fine silt and sand, with patches of emergent vegetation. The nearshore water is turbid due to regular wave action and resulting suspension of sediments (Tamerlane 2007).

Twin Creek

Twin Creek is a poorly defined, low gradient (i.e., 0.1%) small stream that drains several small lakes and wetlands to the south of the RSA northward into Great Slave Lake (EBA 2005a; Rescan 2012e). It has typical seasonal water flow, with higher flows occurring during spring snow melt (Beak 1980; EBA 2005a). According to satellite imagery, maps, and onsite field studies, the stream channel is often undefined and travels through sphagnum bogs (EBA 2005a). After turning into a large, open, almost treeless, and swampy area, the stream re-emerges as a defined creek channel before reaching Great Slave Lake (Beak 1980).

Fish habitat assessments were completed in 2005 at nine locations in Twin Creek (EBA 2005a) and at five locations in 2011 (Rescan 2012e). The upstream reaches of Twin Creek flowed through a bog/wetland or underground channels and no visible channel was observed. The lower reaches of Twin Creek were low gradient (0.1%) (Rescan 2012e). Twin Creek had bankfull widths that ranged from 3 to 50 m, with the widest and slowest-flowing sections meandering through wetlands (EBA 2005a). Fish habitat in Twin Creek consisted predominantly of pools with water depths of 0.5 to 1 m, with some runs and riffles. Bed substrates consisted mostly of fines with some cobble (EBA 2005a; Rescan 2012e) and gravel with cover for fish provided by instream and overhead vegetation (EBA 2005a; Rescan 2012e). Potential barriers to fish movement (e.g., debris piles) were observed at several reaches in Twin Creek. Suitable habitat in Twin Creek was observed for Brook Stickleback (*Culaea inconstans*), Northern Pike (*Esox lucius*), White Sucker (*Catostomus commersonii*), and Longnose Sucker (*Catostomus catostomus*).

Buffalo River

The Buffalo River is a large river that originates from Buffalo Lake and receives drainage from many other small lakes and wetlands upstream (south) and as it flows northward towards Great Slave Lake. Water flows are strong and generally turbid. The river has a mud bottom, with gravel and cobbles present in faster flowing areas (EBA 2005a; Beak 1980). The Buffalo River flows year-round with higher levels of flow occurring during the annual spring melt.

Fish habitat assessments were completed in 2005 at six sites in the Buffalo River (EBA 2005a). The Buffalo River had bankfull widths that ranged from 50 to 204 m. Fish habitat in the Buffalo River was predominantly run habitat with some riffles and rapids. Bed substrates consisted mostly of gravel, with some fines and cobble. There was minimal cover for fish (less than 5% at most sites), but when cover was present, it consisted of boulders, depth, or large organic debris. No instream overhead vegetation was observed. Suitable habitat in the Buffalo River was observed for Inconnu (*Stenodus leucichthys*), Walleye (*Sander vitreus*), Northern Pike, Burbot (*Lota lota*), and Whitefish species (EBA 2005a; Tamerlane 2007).

Other Watercourses and Waterbodies

In addition to Twin Creek and the Buffalo River, fish habitat assessments were also completed in 2011 at eight additional unnamed watercourses in the LSA (Rescan 2012e). These small watercourses typically had low gradients (less than 1%) with wetted widths between 0.2 and 4.9 m. Bankfull depths were typically less than 0.5 m (range was 0.25 to 5.6 m) (Rescan 2012e). Cover for fish was sparse (less than 30%) and provided primarily by substrate (e.g., boulders) and instream vegetation. Riparian vegetation was less than 3% at nearly all of the watercourse sites sampled. Barriers to fish movement were observed at four watercourses and included boulder gardens, beaver dams, and underground flow (Rescan 2012e).

A total of 44 waterbodies (e.g., ponds, wetlands, and quarries) were assessed in 2011 (Rescan 2012e). Waterbodies typically had organic substrates and were located in marsh/bog terrain. Many of the waterbodies assessed for fish habitat were ephemeral and were dry at the time of sampling (i.e., July) (Rescan 2012e).

Fish and fish habitat assessments at Paulette Creek were completed on 18 May 2017 (Golder 2018b) and 18 May 2018 (Golder 2019c). Paulette Creek had wetted widths ranging from 8.4 to 70 m. Habitat was composed of flats, runs, and riffles with bed substrates of cobble, gravel, boulder, and fines. Suitable spawning habitat (i.e., riffle) and egg incubation sites (i.e., gravel, cobble, and boulder mix) were identified for White Sucker and Longnose Sucker.

A fish site reconnaissance survey was completed on 2 October 2019 (Golder 2019b). A number of old mining pits were characterized at the historical Pine Point mine off available access roads. Most of the pits were full of water at the time of the visit with riparian vegetation extending to the shoreline of a pit lake/pond. The diversion ditches and constructed channels around the pits and through the mine area were also typically full of water. The riparian zones of most channels were vegetated, with signs of recent use by beaver, including beaver dams. Depths of the channels were visually estimated to be less than 1.5 m. Channels were also stagnant with very little moving water observed at the time of the reconnaissance survey. Forage fish (i.e., Brook Stickleback) and potential habitat for forage fish were observed throughout the historical Pine Point mine based on the presence of water throughout the area and the high connectivity of the constructed channels.

Lower Trophic Communities

Benthic invertebrates were sampled in Paulette Creek, Twin Creek, and the Buffalo River in 2011 (Rescan 2012f,g). The benthic invertebrate community in Paulette Creek was dominated by amphipods (e.g., Hyalelidae and Gammaridae) and chironomids (e.g., Diptera) (Rescan 2012f). The benthic invertebrate community in Twin Creek was dominated by aquatic insects and chironomids (Rescan 2012g). The Buffalo River had higher total abundances of benthic invertebrates than Twin Creek and consisted of chironomids, true bugs (i.e., Hemiptera), gastropods, bivalve molluscs, and oligochaete worms (Rescan 2012g). Freshwater mussel shells were also observed at the Buffalo River during fish baseline studies in 2005 (EBA 2005a).

3.3.6.2 Fish Community

A total of 34 species of fish have been documented in Great Slave Lake (Scott and Crossman 1973; Rawson, 1951 [in Beak 1980]; Richardson et al. 2001; Reist et al. 2016), some of which have been documented in watercourses in the LSA (Table 3-11). However, few fish-bearing waterbodies are present in the vicinity of the Project. Paulette Creek, Twin Creek, Buffalo River, and Great Slave Lake are the only confirmed fish-bearing waterbodies (Beak 1980; MVEIRB 2008; Golder 2018b). There is potential for a documented fish species from Great Slave Lake to also potentially occupy Twin Creek, Buffalo River, and Paulette Creek. The potential for fish presence in the watercourses (Table 3-11) considered the historical capture of a fish from previous studies (e.g., Beak 1980; EBA 2005a; Rescan 2012e), as well as the presence of preferred habitat for feeding, rearing, overwintering, or spawning (Scott and Crossman 1998). If the preferred habitat was present in the watercourse, the fish species was considered to potentially be present.

White Sucker, Longnose Sucker, Northern Pike, and Brook Stickleback are known or likely to occur in Twin Creek (EBA 2005a; Tamerlane 2007). ITK interviews indicated that although Twin Creek is not used as a traditional harvesting area, Walleye, Sucker species (Catostomidae), and Stickleback species (Gasterostidae) were present. Lake Trout and Northern Pike were identified to potentially be present (Tamerlane 2007). Fish sampling was completed in 2011 at three watercourses (Twin Creek and two unnamed creeks) and 23 waterbodies (i.e., lakes, ponds, wetlands). Brook Stickleback were captured at one location in Twin Creek and one shallow pond located within the historical Pine Point mine footprint (Rescan 2012e).

In the Buffalo River, Burbot, Inconnu, Lake Whitefish, Northern Pike, Goldeye, and Walleye have been recorded (Beak 1980; Evans et al. 1998; Stewart 1999; Tamerlane 2007). The mouth of the Buffalo River has also been known as a key area for fishing of Inconnu, Lake Whitefish, and Lake Trout by residents of Fort Resolution during the open water season (Beak 1980; Stewart 1999).

Field investigations in Paulette Creek were completed in 2017 and 2018 and Longnose Sucker, White Sucker, Northern Pike, and Walleye were observed or captured (Golder 2018b, 2019c). Potential for Brook Stickleback in other waterbodies on the historical Pine Point mine site was also observed during a site reconnaissance visit in October 2019 due to the connectivity of the constructed channels in the mine area (Golder 2019b).

Polar Lake was historically stocked in the 1970s with Brook Trout (*Salvelinus fontinalis*) and Rainbow Trout (*Oncorhynchus mykiss*). As recent as 2007, Polar Lake was stocked with Arctic Char (*Salvelinus alpinus*) but is not used for traditional harvesting (Tamerlane 2007).

Table 3-11: Fish Species Documented in Great Slave Lake with Potential to be Present in Twin Creek, Buffalo River, and Paulette Creek

Fish Documented in Great Slave Lake[a]			Potentially Present in Twin Creek	Potentially Present in Buffalo River	Potentially Present in Paulette Creek	Potentially Present in LSA[c]
Family	Common Name	Scientific Name				
Catostomidae	Longnose Sucker	*Catostomus catostomus*	Yes*	Yes	Yes*	Yes
	White Sucker	*Catostomus commersonii*	Yes*	Yes	Yes*	Yes
Cottidae [b]	Deepwater Sculpin	*Myoxocephalus thompsonii*	No	No	No	No
	Slimy Sculpin	*Cottus cognatus*	Yes	Yes	Yes	Yes
	Spoonhead Sculpin	*Cottus ricei*	No	Yes	Yes	Yes
Cyprinidae	Emerald Shiner	*Notropis atherinoides*	No	Yes	Yes	Yes
	Fathead Minnow	*Pimephales promelas*	Yes	Yes	Yes	Yes
	Finescale Dace	*Chrosomus neogaeus*	Yes	No	No	Yes
	Flathead Chub	*Platygobio gracilis*	No	Yes	Yes	Yes
	Lake Chub	*Couesius plumbeus*	No	No	No	No
	Longnose Dace	*Rhinichthys cataractae*	No	Yes	Yes	Yes
	Peamouth	*Mylochelius caurinus*	Yes	Yes	Yes	Yes
	Northern Pearl Dace	*Margariscus nachtrebi*	Yes	Yes	Yes	Yes
	Spottail Shiner	*Notropis hudsonius*	No	No	Yes	No
Esocidae	Northern Pike	*Esox lucius*	Yes	Yes*	Yes	Yes
Gadidae	Burbot	*Lota lota*	Yes	Yes*	Yes	Yes
Gasterosteidae	Brook Stickleback	*Culaea inconstans*	Yes*	Yes	Yes	Yes
	Ninespine Stickelback	*Pungitius pungitius*	Yes*	Yes	Yes	Yes
Hiodontidae	Goldeye	*Hiodon tergisus*	No	Yes*	No	Yes
Percidae	Walleye	*Sander vitreus*	Yes*	Yes*	Yes	Yes
	Yellow Perch	*Perca flavescens*	No	Yes	Yes	Yes
Percopsidae	Trout-perch	*Percopsis omiscomaycus*	No	No	No	No
Petromyzontidae	Arctic Lamprey	*Lethenteron camtschaticum*	No	No	No	No

Table 3-11: Fish Species Documented in Great Slave Lake with Potential to be Present in Twin Creek, Buffalo River, and Paulette Creek

Fish Documented in Great Slave Lake[a]			Potentially Present in Twin Creek	Potentially Present in Buffalo River	Potentially Present in Paulette Creek	Potentially Present in LSA[c]
Family	Common Name	Scientific Name				
Salmonidae	Arctic Grayling	*Thymallus arcticus*	No	No	No	No
	Chum Salmon	*Oncorhynchus keta*	No	No	No	No
	Cisco	*Coregonus artedi*	No	No	No	No
	Inconnu	*Stenodus leucichthys*	No	Yes*	No	Yes
	Lake Trout	*Salvelinus namaycush*	No[d]	No	No	No
	Lake Whitefish	*Coregonus clupeaformis*	No	Yes*	Yes	Yes
	Least Cisco	*Corgeonus sardinella*	No	No	No	No
	Rainbow Trout	*Oncorhynchus mykiss*	No	No	No	No
	Round Whitefish	*Prosopium cylindraceum*	No	No	No	No
	Sockeye Salmon	*Oncorhynchus nerka*	No	No	No	No
	Shortjaw Cisco	*Coregonus zenithicus*	No	No	No	No

Note:

Fish potential in the watercourses was based either on the historical capture of a fish from a previous study (e.g., Beak 1980; EBA 2005a; Rescan 2012e) or the presence of preferred habitat for feeding, rearing, overwintering, or spawning (Scott and Crossman 1998).

(a) Reist et al. (2016), Richardson et al. (2001), Scott and Crossman (1998), Golder (2019a), Rescan (2012a), Rawson 1951 (in Beak [1980], Evans et al. (1998) and Stewart (1999).

(b) Arctic Sculpin (*Myoxocephalus scorpioides*) and Shorthorn Sculpin (*Myoxocephalus scorpius*) reported in the catch in Zhu et al. (2017)

(c) LSA includes Twin Creek, Buffalo River, and Paulette Creek.

(d) Although ITK interviews stated the potential presence of Lake Trout, previous habitat assessments suggest a lack of suitable habitat for Lake Trout (i.e., cold lakes and occasionally large watercourses with bankfull widths greater than 5 m) in Twin Creek.

* = presence confirmed from historical capture or ITK interviews

3.3.6.3 Species of Concern

Inconnu (Upper Mackenzie River and Great Slave Lake populations) have been classified as Sensitive by the NWT Species at Risk Infobase (GNWT 2020b). However, Inconnu have not been classified federally by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and are not listed on Schedule 1 of the *Species at Risk Act* (SARA) (Government of Canada 2019a).

Shortjaw Cisco (*Coregonus zenithicus*) have been documented in Great Slave Lake and are classified as Threatened by COSEWIC but are not listed on Schedule 1 of SARA (Government of Canada 2019a). Shortjaw Cisco are found in deep (greater than 50 m), cool lakes (Scott and Crossman 1998; Richardson et al. 2001) and are unlikely to be found in the LSA due to lack of suitable habitat.

3.3.7 Terrain and Soils

The Project is within the northern part of the Interior Plains, a low relief area between the Canadian Shield and the western Cordillera (Vincent and Klassen 1989). The plains are underlain by flat-lying sedimentary bedrock (carbonates, shales, and sandstones), which is poorly consolidated (Vincent and Klassen 1989). The sedimentary rocks in the RSA (Section 3.1.4) were deposited in a marine environment during the middle Devonian period (393 to 382 Ma) (Rhodes et al. 1984). The topography is generally subdued with a gentle slope extending down in a northeast direction toward the southern shore of Great Slave Lake. Elevations range from approximately 262 m in the southwest part of the RSA to 156 m in the northeast (LSI 2018, 2019).

The Project is located in a generally level area (between 0% and 2% slope) with the exception of higher slope gradients associated with glaciolacustrine beach ridges (5% to 9%), eolian sand dunes (15% to 30%), and the steeper erosional banks of fluvial systems (LSI 2019). Previous surficial geology mapping by the Geological Survey of Canada (GSC 2016) at a scale of 1:250,000 suggests the RSA is dominated by glaciolacustrine sediments and till; however, previous baseline surveys at a scale of 1:100,000 and 1:25,000 by Rescan (2012a,b) indicate organic deposits are also dominant in this area. The main topographic features are the glaciolacustrine (beach) ridges composed of sand and gravel. These overlie gently nearly level to undulating uplands of varying soil texture (usually fine-textured glaciolacustrine and till sediments). The low-lying areas between the uplands are in-filled with poorly to very poorly drained mineral and organic materials. Lesser extents of eolian sediments, lacustrine deposits adjacent to Great Slave Lake, and fluvial sediments associated with Buffalo River are also present within the RSA (GSC 2016).

The Project is located in an area of sporadic discontinuous permafrost (NRC 1995) where between 10% and 50% of the land is underlain by permafrost and the ground ice content in the upper 10 to 20 m of the ground is less than 10% by volume of visible ice. Ice wedges are sparse (NRC 1995). Permafrost has not been intersected by any recent core drilling in the area; however, it was detected at one location during a soil/vegetation reconnaissance survey in 2019.

The LSA and RSA consists of existing undisturbed upland and wetland, and natural (e.g., burns) and human-related disturbed land cover types (i.e., forest ecosites). Much of the existing disturbance in the LSA is related to the historical Pine Point mine (i.e., brownfield site) and includes spoil piles, pits, and roads. Soil surveys have been limited to natural forest ecosites. Previous studies indicate that soils in the RSA are primarily Eluviated Eutric Brunisols in upland areas, and Gleysols and Terric Organics in lowland areas (EBA 2005b). Other work suggest that Eutric Brunisols are commonly found on glaciolacustrine beach ridges and eolian dune features, while Orthic Gray Luvisols have developed in finer-textured till and glaciolacustrine materials on moderately well to well drained, gently undulating topography (Rescan 2012a,b; Golder 2019a). However, due to the low degree of topography, much of the soils are imperfectly to very poorly drained forming Gleysols and Organic soils (Rescan 2012a,b; Golder 2019a). Soil textures are commonly fine-textured (heavy clay/clay) or coarse textured (sand/gravel) with little variation. Much of the coarser textured (sandier) soil has a high coarse fragment content and has likely been deposited as glaciolacustrine beach deposits or washed till processes. Both coarse and fine-textured parent materials were developed from calcareous bedrock, and therefore, the sediments are high in carbonates and have relatively high pH values.

3.3.8 Vegetation

Vegetation ecosystems or communities provide habitat for aquatic and terrestrial species and associated resources or ecological services for traditional and non-traditional land users, such as hunting, trapping, plants and berry gathering, outfitting and tourism. Field surveys of plants and vegetation communities have been completed in the LSA and RSA (Section 3.1.4) since 2005.

3.3.8.1 Ecoregions and Protected Areas

At the scale of the NWT, the Project and RSA for vegetation ecosystems are within the Level II Taiga Plains Ecoregion. At a smaller scale, the RSA is within the Level III Taiga Plains Mid-Boreal Ecoregion, which includes the Great Slave Lowland Mid-Boreal and Slave Upland Mid-Boreal Level IV Ecoregions (ECG 2009).

The Level III Taiga Plains Mid-Boreal Ecoregion is characterized by warm, moist summers, and cold and snowy winters. Vegetation cover consists predominantly of closed canopy mixedwood forests, with trembling aspen (*Populus tremuloides*), white spruce (*Picea glauca*), and occasional birch (*Betula papyrifera*) and jack pine (*Pinus banksiana*) stands in drier sites (ECG 2009). Permafrost in the Taiga Plains Mid-Boreal Ecoregion is largely discontinuous; peatlands, palsas, northern ribbed fens, and horizontal fens are the most common types of peatlands (ECG 2009).

Level IV Great Slave Lowland Mid-Boreal Ecoregion

Treed, shrubby, and sedge dominated fens are characteristic vegetation of low-lying areas in the Great Slave Lowland Mid-Boreal Ecoregion (ECG 2009). Jack pine and mixed jack pine-trembling aspen stands occur in well drained areas with coarse soils, whereas upland areas with finer textured soils support trembling aspen and mixedwood stands (ECG 2009). Open black spruce (*Picea mariana*) and common Labrador tea (*Rhododendron groenlandicum*) - lichen stands form complexes with sedge (*Carex* spp.) - cotton grass (*Eriophorum* spp.) collapse scars on peat plateaus (ECG 2009).

Level IV Slave Upland MB Ecoregion

Young post-fire jack pine-trembling aspen forests form dense stands with minimal understory species in dry uplands, with remnant white spruce stands occurring in the western portion of this ecoregion (ECG 2009). Transitional areas support mixed black spruce and white spruce stands, often containing tamarack (*Larix laricina*) (ECG 2009). Dominant wetland types included willow (*Salix* spp.) and dwarf-birch (*Betula glandulosa*), and sedge dominated horizontal fens on the wettest mineral soils. Peat plateaus with stunted black spruce are also present on raised permafrost areas and collapse scars (ECG 2009).

Protected Areas

No federally or territorially protected areas exist within the RSA. The closest protected area is Wood Buffalo National Park, located approximately 18 km to the south of the RSA.

3.3.8.2 Ecosite Phases

A stand-level or ground-based ecological classification system is not available for ecosystems in the NWT. Therefore, ecological communities were classified to ecosite phase according to the ecosites of Northern Alberta classification system (Beckingham and Archibald 1996), Canadian Shield ecological area. Ecological attributes from the NWT Forest Inventory Data (GNWT 2012) were used to classify forest inventory polygons to Canadian Shield ecosite phases in the LSA and RSA. Fifteen specific ecosite phases, including terrestrial and wetland types, and ten general ecosite types were identified through a combination of existing data and field sampling points (Table 3-12).

Table 3-12: Ecosite Phases identified within the Local and Regional Study Areas

Ecosite Phase/Type	Description
UPLAND	
a1	bearberry jack pine
b1	Canada buffalo-berry-green alder jack pine-aspen-white birch
b2	Canada buffalo-berry-green alder aspen
b3	Canada buffalo-berry-green alder aspen-white spruce-black spruce
c1	Labrador tea-mesic jack pine-black spruce
d1	Labrador tea-subhygric black spruce-jack pine
burned upland	undifferentiated burned upland
WETLAND	
e1	willow/horsetail aspen-white birch-balsam poplar
e2	willow/horsetail aspen-white spruce-black spruce
f1	treed bog
f2	shrubby bog
g1	treed poor fen
g2	shrubby poor fen
h1	treed rich fen
h2	shrubby rich fen
h3	graminoid rich fen
burned wetland	undifferentiated wetland
bryoid moss	mosses, liverworts, and hornworts greater than 50% of the bryoid cover
UNDEFINED[(a)]	
herb	herb dominated with no distinction between forbs and graminoids
low shrub	shrub dominated with average shrub height less than two metres
tall shrub	shrub with average shrub height greater than or equal to two metres
DISTURBANCE	
non-vegetated	total vegetation cover is less than 5% of the surface area
road	road
disturbance	anthropogenic disturbance
WATER	
Water	*Open Water*

(a) require additional ground truthing information to confirm ecosite phase/type

3.3.8.2.1 Upland Ecosites

Ecosystems were classified to ecosite phase following the Ecosites of Northern Alberta Field Guide (Beckingham and Archibald 1996) for the Canadian Shield ecological area. Seven upland ecosite phases were identified based on 2019 field observations (Golder 2019a) and previous studies (EBA 2005b; Rescan 2012a,b).

a1 – bearberry jack pine

The bearberry jack pine (a1) ecosite phase is characterized by submesic to xeric moisture regime and a poor to very poor nutrient regime. This ecosite is typically located in upper slope to mid-slope landscape positions, with rapidly drained, coarse textured acidic soils (Beckingham and Archibald 1996). A relatively open canopy of jack pine dominates the tree layer often with a characteristic white birch component. The shrub layer is dominated by bearberry (*Arctostaphylos uva-ursi*), common blueberry (*Vaccinium myrtilloides*), bog cranberry (*Vaccinium vitis-idaea*), green alder (*Alnus viridis*), and juniper (*Juniperus* spp.). The forb layer is poorly developed; however, bunchberry (*Cornus canadensis*), bastard toad-flax (*Geocaulon lividum*), and wild lily-of-the-valley (*Maianthemum canadense*) are characteristic of this ecosite phase. Graminoid cover and bryophyte cover are poorly developed with Schreber's moss (*Pleurozium schreberei*) and awned hair cap moss (*Polytrichium piliferum)* representing the most common moss. Lichen cover is high and dominated by reindeer lichen (*Cladonia* spp.) (Beckingham and Archibald 1996). Graminoid cover is typically low.

b1 – Canada buffalo-berry-green alder jack pine-aspen-white birch

The Canada buffalo-berry-green alder jack pine-aspen-white birch (b1) ecosite phase is characterized by a submesic to mesic moisture regime and medium to poor nutrient regime. Typically, this ecosite phase is located in upper to lower slope landscape positions (Beckingham and Archibald 1996). A combination of jack pine, aspen, and white birch make up the tree layer. The shrub layer is dominated by green alder, and to a lesser extent prickly rose (*Rosa acicularis*), low-bush cranberry (*Viburnum edule*), and aspen. Common low shrubs include bearberry, bog cranberry, and blueberry, while bunchberry, bastard toad-flax, wild sarsaparilla (*Aralia nudicaulis*) and twinflower (*Linnaea borealis*) are the characteristic forbs. Schreber's moss and stair-step moss (*Hylocomium splendens*) represent the most common moss. Lichen cover is moderate with reindeer lichen being the most common species (Beckingham and Archibald 1996). Graminoid cover is typically low.

b2 – Canada buffalo-berry-green alder-aspen

The Canada buffalo-berry-green alder jack pine-aspen (b2) ecosite phase is characterized by a mesic moisture regime and medium nutrient regime. Typically, this ecosite phase is located in level landscape positions (Beckingham and Archibald 1996). The canopy is dominated by aspen, and occasionally balsam poplar and characteristically includes minor amounts of jack pine and white spruce. The shrub layer is dominated by Canada buffalo-berry (*Shepherdia canadensis*), prickly rose, bog cranberry, and willow (*Salix* spp.), while bunchberry, wild sarsaparilla, fireweed (*Chamerion angustifolium*), and dewberry (*Rubus pubescens*) are characteristic of the forb layer. The graminoid layer includes hairy wild rye (*Leymus innovatus*) and bluejoint reed grass (*Calamagrostis canadensis*) species (Beckingham and Archibald 1996). Lichen and moss cover if present are inconspicuous.

b3 – Canada buffalo-berry-green alder aspen-white spruce-black spruce

The Canada buffalo-berry-green alder aspen-white spruce-black spruce (b3) ecosite phase is characterized by a submesic to mesic moisture regime and medium to poor nutrient regime. Typically, this ecosite phase is located in midslope landscape positions (Beckingham and Archibald 1996). The canopy is dominated by aspen, white spruce and black spruce (*Picea mariana*) and includes minor amounts of jack pine, balsam poplar, and white birch. The shrub layer is dominated by Canada buffalo-berry, Labrador tea (*Rhododendron groenlandicum*), green alder, prickly rose, bog cranberry, and white spruce, while bunchberry, dewberry, and fireweed are characteristic of the forb layer. (Beckingham and Archibald 1996). Graminoid cover is minimal, while feather mosses including stair-step moss, and Schreber's moss cover the forest floor (Beckingham and Archibald 1996).

c1 – Labrador tea-mesic jack pine-black spruce

The Labrador tea-mesic jack pine-black spruce (d1) ecosite phase generally occurs in level landscape positions where subhygric to mesic moisture conditions exist (Beckingham and Archibald 1996). Soils are usually well to moderately well-drained. A poor to medium nutrient regime for this ecosite phase is typical (Beckingham and Archibald 1996). The tree layer is composed of a moderate cover of black spruce and jack pine, with black spruce, bog cranberry, and Labrador tea dominating the shrub layer. The forb layer is poorly developed and composed of bastard toad-flax, while a carpet of feather mosses, including Schreber's moss, stair-step moss, knight's plume (*Ptillium crista-castrensis*), and juniper hair-cap moss (*Polytrichum juniperinum*) covers the forest floor (Beckingham and Archibald 1996). Graminoid cover is typically low.

d1 – Labrador tea-subhygric black spruce-jack pine

The Labrador tea-subhygric black spruce-jack pine (d1) ecosite phase generally occurs in level, lower and upper slope landscape positions where subhygric moisture conditions exist (Beckingham and Archibald 1996). Soils are usually imperfectly drained. A medium to poor nutrient regime for this ecosite phase is typical (Beckingham and Archibald 1996). The canopy is usually composed of a moderate cover of black spruce and jack pine, with black spruce, Labrador tea, common blueberry and bog cranberry, twin-flower and willow dominating the shrub layer. The forb layer is predominately composed of dwarf scouring rush (*Equisetum scirpoides*) and bunchberry. Feather mosses, including Schreber's moss and stair-step moss interspersed with reindeer lichen typically cover the forest floor (Beckingham and Archibald 1996). Graminoid cover if present is typically low.

Burned upland

The burned upland ecosite phase occurs in variable landscape positions with moisture regimes ranging from subhygric to xeric, and variable nutrient regimes. This ecosite phase shows evidence of recent wildlife, either natural or prescribed. Vegetation of less than 5% crown cover is present at the time of polygon description and cannot be further refined.

Based on field observations, dominant terrestrial ecosite phases in the surveyed area include Canada buffalo-berry-green alder aspen-white spruce-black spruce (b3), bearberry jack pine (a1), and Canada buffalo-berry-green alder jack pine-aspen-white birch (b1). Summary descriptions of the dominant upland ecosites observed are presented in Table 3-13.

Table 3-13: Summary Descriptions of Dominant Upland Ecosite Phases Observed

Ecosite Phase	Slope Position	Moisture Regime	Nutrient Regime	Forest Characteristics	Characteristic Tree Species	Characteristic Understorey Species
a1 – bearberry jack pine	Level, midslope, upper slope, lower slope and crest	xeric to submesic	poor to very poor	dominated by jack pine with lichen covering much of forest floor	jack pine	bearberry, blueberry, bog cranberry, and reindeer lichen
b1 – Canada buffalo-berry-green alder jack pine-aspen-white birch	Upper slope, lower slope and midslope	submesic to mesic	medium to poor	dominated by jack pine and aspen	jack pine and aspen	green alder, bog cranberry, blueberry, bearberry, Schreber's moss, stair-step moss, reindeer lichen
b3 – Canada buffalo-berry-green alder aspen-white spruce-black spruce	Midslope, level, lower slope and upper slope	mesic	medium to poor	dominated by aspen, white spruce and black spruce	aspen, white spruce, black spruce	Canada buffalo-berry, Labrador tea, green alder, bunchberry, stair-step moss, Schreber's moss

3.3.8.2.2 Wetland Ecosites

Wetlands are ecosystems that are saturated with water long enough to promote formation of water-altered soils, growth of water-tolerant vegetation, and various kinds of biological activity adapted to wet environments (ESRD 2015). All wetlands in the LSA and RSA and surveyed area were classified according to the Canadian Wetland Classification System (National Wetlands Working Group 1997), which differentiates wetlands by their environmental and developmental characteristics (Table 3-14).

Bog

Bogs are acidic, mineral-poor peatlands that are raised above the groundwater by an accumulation of peat, with pH levels generally ranging between three and four (Crum 1992). In general, they are characterized by a hummocky ground surface covered with *Sphagnum* moss, ericaceous shrubs and black spruce. Bogs develop under ombrotrophic conditions where water, minerals and nutrients are derived solely from precipitation (Halsey et al. 2004). Groundwater and associated minerals are not able to reach the bog rooting layer because it is blocked by a layer of impermeable peat. Bogs are found along drainage divides, stagnation zones of peatland complexes and small isolated basins (Halsey et al. 2004). All bogs contain peat layers that are at least 40 cm thick.

Fen

Fens are peatlands that are influenced by mineral-rich groundwater or surface water. Fens receive minerals and nutrients from precipitation and groundwater. A distinguishing feature of fens is that they are characterized by a prominent layer of sedges. Soil chemistry in fens ranges widely with pH values varying from about four in extreme poor fens to more than seven in extremely rich fens (Crum 1992). Fens are divided on the basis of landform and forest cover that typically includes black spruce and tamarack, and the presence of peat plateaus and internal lawns in treed fens (Halsey et al. 2004). All fens contain peat layers that are at least 40 cm thick.

Marsh

Marsh wetlands are characterized by mineral soils, fluctuating water levels and a range of chemical gradients (ESRD 2015). Marshes are only graminoid in structure, with water levels at or above the ground surface for variable parts of the growing season (ESRD 2015). Nutrient levels in the water are high, providing greater amount of available nutrients for plants than peatland wetlands (Smith et al. 2007). Wetland permanence is defined by the vegetation community with greater than 25% cover in most years (ESRD 2015).

Swamp

Swamps are highly productive, mineral rich wetlands that are typically located at margins of wetlands, river floodplains, adjacent to waterbodies that are subjected to flooding, or in areas influenced by fluctuating water levels (Halsey et al. 2004). Fluctuating water levels within swamps may be the result of seasonal variation or slope drainage. The groundwater moving through the soil is typically well oxygenated and close to the surface within the rooting zone (ESRD 2015).

Shallow Open Water

Shallow open waters typically have an open water zone supporting floating and/or submersed aquatic vegetation in the deepest wetland zone covering more than 25% of the total area in the majority of years; however, wetlands with sparse vegetation (e.g., salt flats) also exist. Shallow open water wetlands are less than two metres deep at midsummer. Graminoid communities similar to those in marshes often surround the open water zone in shallow open water wetlands.

Four wetland classes (and eight wetland ecosite phases) were identified in the 2019 field program (Golder 2019b) and previous studies (EBA 2005b; Rescan 2012a,b).

Table 3-14: Wetland Classification Summary

Wetland Class	Wetland Category	Associated Ecosite	Wetland Characteristics
Bog	Organic[(a)]	f1 f2	■ surface raised/level with surrounding terrain ■ water table at or slightly below surface ■ ombrogenous ■ dominated by sphagnum mosses with tree, shrub, or treeless vegetation cover
Fen		g1 g2 g3 h1 h2 h3	■ surface is level with water table, with water flow on surface and through subsurface ■ fluctuating water table at or slightly below the surface ■ minerogenous ■ graminoids and shrubs characterize vegetation cover
Marsh	mineral	e1 e2	■ shallow surface water which fluctuates dramatically ■ minerogenous ■ vegetation dominated by rushes, reeds, grasses, and sedges
Swamp			■ water table at or below surface ■ minerogenous ■ coniferous or deciduous trees, or tall shrub vegetation cover
Shallow open water		N/A	■ transition between seasonally wet/saturated wetlands (bog, fen, marsh or swamp) and permanent deep waterbodies

(a) organic wetlands = wetlands with greater than 40 cm of peat accumulation

Disturbance

The disturbance ecosite phase represents existing human disturbances, including brownfield areas in the historical Pine Point mine site. It also includes borrow pits, industrial areas, well sites, and clearings. Vegetation associated with disturbances may be absent or may be highly modified (e.g., regenerating borrow pits). Highly modified vegetation may range from low growing vegetation comprised of grasses and shrubs on more recently cleared sites (i.e., within the last 3 to 5 years) to young stands of regenerating trees and shrubs on older sites. Pre-existing vegetated linear features (i.e., seismic, exploration, cut lines) were not considered disturbances.

Water

A naturally occurring, static body of water, or a watercourse formed when water flows between continuous, definable banks. These flows may be intermittent or perennial; but do not include ephemeral flows where a channel with no definable banks is present.

Undefined

Ecosite phases requiring additional data in order to be classified.

3.3.8.3 Plant Species and Species of Concern

Based on 2019 field observations (Golder 2019b) and previous studies (Rescan 2012a,b; EBA 2005b), 142 vascular plants have been documented in the LSA, of which 124 were identified to species level and 18 were identified to genus level. A total of 40 non-vascular plants (22 bryophytes and 18 lichens) were identified, of which 33 were identified to species and 7 specimens were identified to genus level. The most common and widespread vascular species found were black spruce, white spruce, prickly rose, Canada buffaloberry, and trembling aspen.

Culturally important plant species and resources that occur in the LSA and identified by the communities of Deninu Kųę First Nation, Fort Resolution Métis, and Hay River Métis include Labrador tea, white rat root (*Acorus americanus*), spruce gum, tamarack, poplar buds, and birch trees (Swisher 2006a,b).

The Working Group on General Status Ranks of Wild Species in the NWT (2016) lists 99 sensitive plant species (71 vascular and 28 non-vascular) with potential to occur in the LSA and RSA. Previous field surveys have identified the presence of three sensitive species at eight locations within the LSA (Table 3-15). No federally listed (COSEWIC or SARA) plant species (threatened, special concern, or endangered) have been identified to date or are expected to occur in the LSA and RSA.

Table 3-15: Previously Identified Sensitive Plant Species Occurrences in the Local Study Area

Scientific Name	Common Name	NWT Status Rank[(a)]	Location		
			UTM Zone	Northing	Easting
Carex lasiocarpa	hairy-fruited sedge	Sensitive	11V	6734152	616346
			11V	6735535	618635
			11V	6743529	634484
Gentianopsis virgata	Macoun's fringed gentian	Sensitive	11V	6759660	660782
Salix discolor	pussy willow	Sensitive	11V	6760509	658948
			11V	6759822	658922
			11V	6761085	658116
			11V	6758957	659162

Source: (a) Working Group on General Status of NWT Species (2016)

3.3.9 Wildlife

The presence of specific land cover types or the composition and structure of vegetation communities (i.e., habitat types) influences the wildlife species that inhabit a region. Vegetation structure and composition is determined by the terrain, soil, climate, and hydrologic regime of an area. Wildlife species represent an integral part of the terrestrial ecosystem and many species have important cultural, social, and/or economical value (i.e., ecological services). The wildlife existing conditions section includes a review of current literature, as well as field data and information collected from 2005 to 2018. The information will be used to help select wildlife valued components to be assessed in the Developer's Assessment Report.

3.3.9.1 Species of Concern

Wildlife species of concern are those that are listed as endangered, threatened, or of special concern under the federal SARA, the *Species at Risk (NWT) Act*, and/or by the COSEWIC. As the *Species at Risk (NWT) Act* is implemented, it is expected that the NWT Species at Risk Committee will complete further species assessments and the Conference of Management Authorities will prepare the List of Species at Risk, providing legal protection for these species. This could mean changes to the species of concern for the Project.

Species of concern were identified that are known to be or are expected to be in the area of the historical Pine Point mine and could potentially interact with the Project (Table 3-16). ECCC has issued Species at Risk Recovery Strategies for seven of the species of concern: caribou (boreal population) (*Rangifer tarandus caribou*), wood bison (*Bison bison athabascae*), little brown myotis (*Myotis lucifugus*), northern myotis (*Myotis septentrionalis*), common nighthawk (*Chordeiles minor*), olive-sided flycatcher (*Contopus cooperi*), and whooping crane (*Grus americana*) (Environment Canada 2007, 2012, 2016a,b, ECCC 2018c,d). Critical habitat has been defined for caribou (boreal population; hereafter boreal or woodland caribou) (Government of Canada 2019a).

ECCC has also issued Species at Risk Management Plans for three of the species of concern: rusty blackbird (*Euphagus carolinus*), yellow rail (*Coturnicops noveboracensis*), and northern leopard frog (*Lithobates pipiens*) (Environment Canada 2013a,b, 2015a).

Table 3-16: Wildlife Species of Concern that may Interact with the Project

Species	NWT Species at Risk Committee Status[a]	Federal *Species at Risk Act* Schedule 1 Status[b]	Committee on the Status of Endangered Wildlife in Canada Status[c]	Observed in the Local Study Area?
Caribou (boreal population)	Threatened	Threatened	Threatened	Yes
Wood bison	Threatened	Threatened	Special Concern	Yes
Wolverine	Not at Risk	Special Concern	Special Concern	Yes
Little brown myotis	Special Concern	Endangered	Endangered	Yes
Northern myotis	Special Concern	Endangered	Endangered	Yes
Short-eared owl	Not applicable	Special Concern	Special Concern	No
Whooping crane	Not applicable	Endangered	Endangered	Yes
Bank swallow	Not applicable	Threatened	Threatened	Yes
Barn swallow	Not applicable	Threatened	Threatened	No
Common nighthawk	Not applicable	Threatened	Threatened	Yes
Horned grebe (western population)	Not applicable	Special Concern	Special Concern	Yes
Olive-sided flycatcher	Not applicable	Threatened	Threatened	Yes
Rusty blackbird	Not assessed	Special Concern	Special Concern	Yes

Table 3-16: Wildlife Species of Concern that may Interact with the Project

Species	NWT Species at Risk Committee Status[(a)]	Federal *Species at Risk Act* Schedule 1 Status[(b)]	Committee on the Status of Endangered Wildlife in Canada Status[(c)]	Observed in the Local Study Area?
Yellow rail	Not applicable	Special Concern	Special Concern	No
Northern leopard frog	Threatened	Special Concern	Special Concern	No
Gypsy cuckoo bumble bee	Data Deficient	Endangered	Endangered	No
Yellow-banded bumble bee	Not at Risk	Special Concern	Special Concern	No

Sources:
(a) GNWT (2018b)
(b) Government of Canada (2019a)
(c) COSEWIC (2019)

3.3.9.2 Ungulates

There are three ungulate species that may use habitats in the LSA and RSA (Section 3.1.4): caribou (boreal population), wood bison, and moose (*Alces alces*).

3.3.9.2.1 Boreal Caribou

Boreal caribou are a threatened species in the NWT and Canada (GNWT 2018b; Government of Canada 2019b; COSEWIC 2019). The boreal caribou in the NWT are all considered part of the same population (NT1). There are estimated to be 6,000 to 7,000 boreal caribou in the NT1 population (Conference of Management Authorities 2017). The density of boreal caribou in the Dehcho and South Slave Region of the NWT is estimated to be 3 caribou per 100 km^2 (Haas 2014).

Boreal caribou require large tracts of dense, mature or old growth pine (*Pinus* spp.) or spruce (*Picea* spp.) forests that contain an abundance of terrestrial and arboreal lichen (Environment Canada 2012; Conference of Management Authorities 2017). These habitat types are usually associated with wetlands such as marshes, peatlands, and lakes (Environment Canada 2012). Forests less than 40 years of age are considered unsuitable for boreal caribou (Environment Canada 2012). During the calving season, females generally select areas that are difficult for predators to access such as islands in the middle of lakes or upland areas in bog complexes (Environment Canada 2012). A boreal caribou habitat suitability model has been developed for the region, which could be used to assess effects from the Project (Golder 2018a).

The NT1 population is considered “likely self-sustaining” because, as of 2017, undisturbed habitat makes up 69% of the range (Government of Canada and GNWT 2019). Environment Canada (2012) identified 65% undisturbed habitat within a range as a threshold for providing measurable probability (60%) that a population is self-sustaining. To date, the NT1 range has not experienced substantial habitat loss or fragmentation and the risk of destruction of critical habitat by human activities (e.g., seismic lines, forestry cut blocks, and roads) in the NWT portion of the NT1 range is “likely low” (Government of Canada and GNWT 2019). Instead, wildfire is considered the largest threat to boreal caribou habitat in the NWT; approximately 23.7% of the NT1 range is currently disturbed by fire (Government of Canada and GNWT 2019). However, habitat disturbance in the NT1 range is unevenly distributed and most natural and human-related disturbance is in the Southern NWT region (Government of Canada and GNWT 2019), which intersects the RSA. Most of the human disturbance footprint in the Southern NWT region is from old seismic lines that were constructed prior to the implementation of modern best management practices (Government of Canada and GNWT 2019).

Natural and anthropogenic habitat disturbance increases the number of alternate prey (e.g., moose) and, subsequently, the number of carnivores in an area. Increased numbers of predators can lead to increased predation rates on caribou. High levels of habitat disturbance, and associated increases in predator numbers, are considered to be the main factors of boreal caribou population declines in Canada (Conference of Management Authorities 2017). Increasing harvest levels in certain areas, such as southern NWT, and climate change (e.g., increased fire frequency and intensity) may be exacerbating boreal caribou declines (Conference of Management Authorities 2017). Boreal caribou do not migrate. Instead, females space out throughout the forest for calving, which decreases predation risk (Conference of Management Authorities 2017).

One caribou was observed by workers at the existing exploration site in 2017. Two caribou and caribou tracks were observed by exploration personnel in 2018. Remote cameras deployed in brownfield and greenfield areas of the LSA in 2018 detected two boreal caribou (Golder 2018a). Caribou sign (e.g., hair, tracks, and pellets) was observed at four locations in September 2005 (EBA 2005c). In 2011, remote cameras captured images of caribou in the LSA (Rescan 2012h). Eight caribou were observed during aerial surveys in 2018 in the Fort Resolution Forest Management Area, which overlaps the RSA (ABMI 2018). Caribou tracks were observed during a reconnaissance survey between Buffalo River and Hay River in 1980 (Beak 1980). A total of 116 boreal caribou individuals and observations of sign were noted during aerial surveys in the Buffalo Lake, River, and Trails Candidate Area in 2010, which overlaps the RSA (Haas 2014). The Buffalo Lake, River, and Trails Candidate Area encompasses the section of Buffalo Lake that is not within the current boundaries of Wood Buffalo National Park, including the Yates and Whitesand Rivers, as well as traditional trails from Buffalo Lake to the Hay River Reserve, home of the K'atl'odeeche First Nation, and follows the Lower Buffalo River as it flows from the boundaries of Wood Buffalo National Park to Great Slave Lake.

3.3.9.2.2 Wood Bison

Wood bison are listed as a threatened species under the *Species at Risk (NWT) Act* (GNWT 2018b) and Species at Risk Public Registry (Government of Canada 2019a). The Northwest Territories Bison Control Area partially overlaps the RSA but the Project is outside of the range of the Greater Wood Buffalo Bison Metapopulation (GNWT 2020b). The Bison Control Area is managed as a bison-free zone to prevent bison from the Slave River Lowlands or Greater Wood Buffalo metapopulations that are infected with brucellosis and tuberculosis from coming into contact with the uninfected Mackenzie, Nahanni and Hay-Zama (Alberta) populations (GNWT 2020b).

Wood bison sign (i.e., scat, tracks, and feeding areas) was observed at two locations in the LSA in 2005 (EBA 2005c). No wood bison were recorded on remote cameras deployed in the LSA in 2018 (Golder 2018a). Four wood bison were observed during aerial surveys in 2018 in the Fort Resolution Forest Management Area, which overlaps the RSA (ABMI 2018).

Threats to wood bison habitat include fire suppression, forestry, and oil and gas development (COSEWIC 2013a). In addition, exclusion of bison from the Disease Control Area, where bison are diseased by brucellosis and tuberculosis, is functionally a form of habitat loss for wood bison (COSEWIC 2013a). A wood bison habitat suitability model has been developed for the region, which could be used to assess effects from the Project (Golder 2018a).

3.3.9.2.3 Moose

Moose is not a territorial or federal species at risk (GNWT 2018b; Government of Canada 2019a) but is a valued subsistence species for Indigenous peoples. Moose occur at low densities throughout the NWT. Moose density in the Buffalo Lake, River, and Trails Candidate Area, which overlaps the RSA, was calculated to be 5 moose per 100 km^2 (Haas 2014). Densities of moose near Yellowknife have been estimated to range from 2.0 to 3.5 moose per 100 km^2 (Cluff 2005). A total of 22 moose were observed in the LSA (EBA 2005c). Eighteen moose were observed during field surveys in the Buffalo Lake, River, and Trails Candidate Area in 2010, which overlaps the RSA (Haas 2014). One juvenile moose was observed by workers at the exploration site on 7 August 2018. No moose were recorded on remote cameras deployed in the LSA in 2018 (Golder 2018a). Ten moose were observed during aerial surveys in the Fort Resolution Forest Management Area in 2018 (ABMI 2018).

Moose are usually found in forested areas, but the species has recently expanded its range to include tundra and prairie habitats. In the summer, moose prefer semi-open forests with an abundance of shrubs that are located close to waterbodies. In the winter, moose prefer dense coniferous stands as these provide protection from inclement weather and predators. Forest regeneration is apparently optimal for moose at 10 to 26 years post-fire (Nelson et al. 2008). During spring, summer, and fall, moose primarily consume fresh shoots and leaves from deciduous shrubs, young deciduous trees, and wetland vegetation (Davidson-Hunt et al. 2012).

Preferred fall and winter browse includes willow, trembling aspen (*Populus tremuloides*), bog/dwarf birch (*Betula glandulosa*), and alder (*Alnus* spp.) (Stelfox 1993). In the spring and early summer, moose travel to bays, shorelines, and river and creek systems that have large quantities of aquatic plants to replenish their bodies with sodium.

3.3.9.3 Large Carnivores

Wolverine (*Gulo gulo*), gray wolf (*Canis lupus*), black bear (*Ursus americanus*), and Canada lynx (*Lynx canadensis*) are large carnivores that may use habitats in the LSA and RSA (Section 3.1.4).

3.3.9.3.1 Wolverine

Wolverine is a species of special concern under SARA but is not a listed species under the *Species at Risk (NWT) Act*. The highest densities of wolverine occur in the northern mountain and northern boreal ecosystem areas of the western sub-population (5 to 10 wolverines per 1,000 km^2), where vegetation associations, food resources, and large carnivores are most diverse and abundant (COSEWIC 2014). The number for wolverines in the NWT is unknown, but the population is considered stable with a sparsely distributed population consisting of thousands of individuals (ENR 2019a).

In general, studies within North America suggest that wolverines inhabit a variety of treed and treeless areas at all elevations including the northern forested wilderness, the alpine tundra of the western mountains, and the Arctic tundra (COSEWIC 2014). Habitat use is best described as a function of large undisturbed wilderness areas and seasonal variation in food abundance, denning requirements, or human disturbance (Johnson et al. 2005; May et al. 2006; Krebs et al. 2007; COSEWIC 2014). Their diet is extremely varied; however, ungulates (in the form of carrion) are a main food source across their range (COSEWIC 2014). Copeland et al. (2010) reported a strong correlation between global wolverine distribution and persistent spring snow cover. A wolverine habitat suitability model has been developed for the region, which could be used to assess effects from the Project (Golder 2018a).

One wolverine was observed during a muskrat aerial survey of the Buffalo Lake, River, and Trails Candidate Area in 2010, which overlaps the RSA (Haas 2014). Wolverines were not observed by field personnel or workers at the exploration site in 2005, 2011, 2017, or 2018 (EBA 2005c; Rescan 2012h,i). Wolverine were not recorded on remote cameras deployed in the LSA in 2018 (Golder 2018a).

3.3.9.3.2 Gray Wolf

There are three groups of gray wolves in the NWT: timber (boreal), tundra, and Arctic populations (ENR 2019b). The boreal population lives below the treeline and depends primarily on non-migratory prey such as moose, boreal caribou, bison, and deer (*Odocoileus* spp.) (ENR 2019b). The number of gray wolves in the NWT is unknown, but populations are considered stable (ENR 2019b). Wolf density in the Hay River Lowlands was estimated to be 1.6 wolves per 1,000 km^2 (Serrouya et al. 2016).

The gray (boreal) wolf prefers heavily forested areas and research shows that the species can adapt to the presence of humans (Mech 1995; Thiel et al. 1998; Boitani 2000; Hebblewhite and Merrill 2008), although studies have also demonstrated changes to habitat use in response to high levels of human activity (Houle et al. 2010). Gray wolf habitat preference is likely dependent on optimizing fitness by reducing travel costs, while maintaining potential for encountering prey (Alexander et al. 2005). Wolves will use cutlines and other linear disturbances for ease of movement (Paquet and Callaghan 1996; James and Stuart-Smith 2000; Gurarie et al. 2011).

Three wolves were observed near in the LSA in 2005 (EBA 2005c). One wolf was observed during a moose aerial survey of the Buffalo Lake, River, and Trails Candidate Area in 2010, which overlaps the RSA (Haas 2014). One wolf was observed in the LSA in 2011 (Rescan 2012h). No wolves were recorded on cameras deployed within the LSA in 2011 (Rescan 2012i). Wolf tracks were observed in the historical Pine Point mine footprint by staff in 2017. One wolf was observed by workers at the exploration site in 2018. One wolf was recorded on remote cameras deployed in the LSA in 2018 (Golder 2018a). Three wolves were observed during aerial surveys in the Fort Resolution Forest Management Area in 2018 (ABMI 2018).

3.3.9.3.3 Black Bear

Black bears are widely distributed below the treeline in the NWT (ENR 2019c). Although the number of black bears in the NWT is unknown, the population is considered stable (Pelton et al. 2003). Black bears prefer forested areas that are interspersed with open habitats (e.g., meadows), which provide berries, shrubs, and grasses. Males and females are not territorial where food is abundant (Horner and Powell 1990) and home ranges of many bears can overlap (Schenk et al. 1998).

A total of 37 black bear observations were recorded in the LSA by field personnel in 2005 (EBA 2005c). Many of these observations likely represent the same individuals. Three black bears were recorded on cameras deployed in the LSA in 2011 (Rescan 2012i). Seven and 57 black bear sightings were reported by workers at the exploration site in 2017 and 2018, respectively. Two black bear observations were recorded on remote cameras deployed in the LSA in 2018 (Golder 2018a).

3.3.9.3.4 Canada Lynx

Canada lynx is a common and abundant species in most of the NWT (ENR 2019d). Lynx primarily consume snowshoe hare (*Lepus americanus*), and as such, lynx numbers fluctuate with cycles of snowshoe hare populations. In western NWT, lynx prefer dense coniferous and dense deciduous forests and avoided wetland-lake complexes and open black spruce forests (Poole et al. 1996). Wildfire may have a positive effect on populations of lynx and snowshoe hare by maintaining or increasing the availability of dense forest habitats (Poole et al. 1996).

One lynx was observed in 2005 (EBA 2005c) and three individuals were observed by workers at the exploration site in 2017. One lynx was recorded on remote cameras deployed in the LSA in 2018 (Golder 2018a).

3.3.9.4 Furbearers

There are several furbearing mammal species that can be important resources for traditional use and may occur in habitats in LSA and RSA (Section 3.1.4) including red fox (*Vulpes vulpes*), American marten (*Martes americana*), beaver (*Castor canadensis*), and muskrat (*Ondatra zibethicus*).

3.3.9.4.1 Red Fox

Red fox populations are common throughout mainland Canada (Lariviére and Pasitschniak-Arts 1996; Reid 2006). They are not considered a species at risk in the NWT (GNWT 2018b) or Canada (Government of Canada 2019a). Habitat is typically not a limiting factor as the species is adaptable and have shown resilience to human disturbance (Adkins and Stott 1998; Gosselink et al. 2007; MNR 2007). Red foxes are commonly observed in the LSA, with site personnel reporting 14 sightings in 2017 and 9 sightings in 2018. Typically, red fox prefers mixed habitat of shrubland and fields, edges of forest and farmland, and marshy areas (Reid 2006). Lariviére and Pasitschniak-Arts (1996) reported that shrub habitats are selected in the winter because of lower snow accumulations and increased snow hardness.

3.3.9.4.2 American Marten

The American marten is not a territorial or federal species at risk (GNWT 2018b; COSEWIC 2019; Government of Canada 2019a). However, the species is often considered a valued resource for Indigenous people. Historically, marten have been trapped for fur in North America, and populations have declined since European contact (Buskirk and Ruggiero 1994). Marten occupy larger home ranges than would be expected for a mammal of their size (Buskirk and Ruggiero 1994), with adult males in Canada occupying ranges of 0.8 to 45 km^2, and adult females occupying ranges of 0.42 to 27 km^2 (Burnett 1981; Mech and Rogers 1977; Latour et al. 1994; Smith and Schaefer 2002). Home ranges vary as a function of geographic area, habitat type, and prey density (Soutiere 1979; Thompson and Colgan 1987). Nine sightings of unidentified Mustelidae (weasel family) species were reported by field personnel in 2005 (EBA 2005c) and one marten was observed by workers at the exploration site in 2018.

American marten are commonly associated with mature coniferous and mixed-coniferous forests with abundant coarse woody debris and a well-developed understory (Buskirk and Ruggiero 1994; Clark et al. 1987; Lyon et al. 1994; Thompson and Harestad 1994; Payer and Harrison 2000; Slauson et al. 2007; Thompson et al. 2012). They do not regularly occur in open habitats with low canopy cover such as bogs, meadows and burns, and recent clearcuts (Koehler and Hornocker 1977; Taylor and Abrey 1982; Godbout and Ouellet 2008; Cheveau et al. 2013). Structural complexity is important to marten because it creates quality conditions for foraging, resting, and reproduction.

3.3.9.4.3 Beaver

Beaver is not a territorial or federal listed species (GNWT 2018b; COSEWIC 2019; Government of Canada 2019a) but is often considered a valued traditional resource for Indigenous people. Beavers inhabit streams, ponds, and the margins of large lakes (Allen 1983). For waterbodies to be suitable for beaver, there must be a stable water supply, channel gradient less than 15%, and adequate food resources (Allen 1983). Beaver eat a variety of plants but prefer trembling aspen (*Populus tremuloides*), willow (*Salix* spp.), balsam poplar (*Populus balsamifera*), and alder (*Alnus* spp.) (Allen 1983). Four beavers were observed by field personnel in 2005 (EBA 2005c). Workers at the exploration site reported five beaver sightings in the LSA in 2018. Beaver dams were reported along the tributary streams of the Buffalo River and in Twin Creek in 1977 (BC Research 1977), and along unnamed watercourses in the RSA in 2011 (Rescan 2012e).

3.3.9.4.4 Muskrat

Muskrat is not a territorial or federal listed species (GNWT 2018b; COSEWIC 2019, Government of Canada 2019a). However, this species can be an important subsidence species for Indigenous peoples. Muskrat inhabit waterbodies that have water year-round and water levels that do not fluctuate more than 90 cm per year (Allen and Hoffman 1984). Muskrat habitat quality increases with an increase in emergent vegetation in waterbodies (Allen and Hoffman 1984). Few muskrat pushups were observed during aerial surveys in the Buffalo Lake, River, and Trails Candidate Area in 2010, which overlaps the RSA (Haas 2014). Most muskrat pushups were recorded in areas south of the LSA, specifically on the south side of Buffalo Lake, where the Whitesand and Yates rivers flow into the lake, and an unnamed lake south of Buffalo Lake (Haas 2014).

3.3.9.5 Bats

Several bat species may use areas in the LSA and RSA for foraging and roosting including little brown myotis (*Myotis lucifugus*), northern myotis (*Myotis septentrionalis*), hoary bat (*Aeorestes cinereus*), silver-haired bat (*Lasionycteris noctivagans*), and eastern red bat (*Lasiurus borealis*) (Golder 2018a). Hoary, silver-haired, and eastern red bats are not territorial or federal listed species but little brown myotis and northern myotis are listed as endangered under the SARA (Government of Canada 2019a) and are species of special concern under the *Species at Risk (NWT) Act* (GNWT 2018b).

Until the arrival of white nose syndrome in eastern Canada in the winter of 2009/2010, little brown myotis and northern myotis were common throughout much of Canada and the United States (COSEWIC 2013b). Currently white nose syndrome has not been recorded in the NWT (Canadian Wildlife Health Cooperative 2019). Eight detections of little brown myotis and three detections of northern myotis were recorded on autonomous recording units deployed in greenfield and brownfield areas of the LSA (Golder 2018a).

Little brown myotis and northern myotis are not habitat specialists and have been documented in a wide variety of coniferous and deciduous forest types (COSEWIC 2013b); however, Broders et al. (2006) found that male northern myotis preferred to roost in coniferous stands. Little brown myotis is well adapted to human disturbance and will use buildings, bat houses, and bridges for maternity roosts, indicating that they are resilient to changes in summer habitat. Northern myotis is more of a forest specialist than little brown myotis because it prefers undisturbed forest for roosting and foraging, and is less likely to roost in man-made structures. As aerial hawkers, little brown myotis and northern myotis forage in open areas, often over water (ECCC 2018c).

Winter hibernacula are likely more limiting than summer maternity roosting habitat because specific physiological requirements limit the number of sites that provide suitable overwintering habitat. In the Northwest Territories, caves harbour the greatest concentrations of hibernating little brown myotis, which often overwinter at the same locations as northern myotis (Environment Canada 2018c; NWT Species at Risk Committee 2017). It is suspected that most northern myotis and little brown myotis in the Northwest Territories overwinter in two hibernacula (Environment Canada 2018c; NWT Species at Risk Committee 2017). Minor hibernacula that harbour smaller concentrations of bats are poorly understood but have the potential to play a critical role in the recovery of the population from white-nose syndrome.

3.3.9.6 Birds

There is a wide range of bird species and species groups that may use habitats in the LSA and RSA (Section 3.1.4) seasonally and throughout the year. Surveys by Beak (1980) suggests that there is potential for 206 bird species to use habitats in the RSA, which includes 30 waterfowl, 18 raptor, 29 shorebird, and 87 passerine species.

3.3.9.6.1 Upland Breeding Birds

Upland breeding birds include grouse, ptarmigan, swallow, woodpecker, nighthawk, and passerines. Most upland breeding bird species are protected under the *Migratory Birds Convention Act, 1994* (MBCA).

A total of 19 upland breeding bird species were observed during field studies in September 2005 (EBA 2005c). Thirty upland breeding bird species were detected during point count surveys in the LSA in 2011 (Rescan 2012h,i). In 2018, 51 upland breeding bird species were recorded on autonomous recording units (ARUs) that were deployed in greenfield and brownfield portions of the LSA (Golder 2018a). Numerous sharp-tailed grouse (*Tympanuchus phasianellus*) were observed in shrub fens and mixed forest habitats during surveys in the Buffalo Lake, River, and Trails Candidate Area in 2010 (Haas 2014).

Common Nighthawk

Common nighthawk (*Chordeiles minor*) is an upland breeding bird species of concern that was recorded on ARUs in 2018 (Golder 2018a); common nighthawk is listed as threatened species under SARA (Government of Canada 2019a) but is not listed under the *Species at Risk (NWT) Act* (GNWT 2018b). Common nighthawks appear to be relatively abundant in the LSA with 81 recordings on 16 of the 20 ARUs deployed in 2018 (Golder 2018a). Common nighthawk was also detected during point count surveys in the LSA in 2011 (Rescan 2012h) and during surveys in the Buffalo Lake, River, and Trails Candidate Area in 2010, which overlaps the RSA (Haas 2014).

Common nighthawks are associated with a variety of open or semi-open habitats, including forest clearings, burned areas, grassy meadows, rocky outcrops, sandy areas, grasslands, pastures, peat bogs, marshes, lake shores, quarries, mines, and urban areas (Peck and James 1983; COSEWIC 2007a; Brigham et al. 2011). Wetlands and open water are often used as foraging locations (Brigham et al. 2011). Forested areas with low canopy closure may also provide habitat for the common nighthawk (COSEWIC 2007a). Critical habitat has not yet been identified for common nighthawk due to the diversity of nesting, roosting, and foraging habitats that have been reported (Environment Canada 2016b). Nighthawks eat a wide variety of insects but most commonly consume queen ants, beetles, caddisflies, moths, and true bugs (Brigham et al. 2011). Common nighthawks are generally crepuscular, foraging under low light conditions at dusk and dawn, and often forage in large groups at particular times of the year (Brigham et al. 2011).

Olive-sided Flycatcher

Olive-sided flycatcher (*Contopus cooperi*) is listed as threatened species under SARA (Government of Canada 2019a) but is not listed under the *Species at Risk (NWT) Act* (GNWT 2018b). Olive-sided flycatchers appear to be common in the LSA with 35 recordings on 8 of the 20 ARUs deployed in 2018 (Golder 2018a). Olive-sided flycatcher was also detected during point count surveys in the LSA in 2011 (Rescan 2012h) and during surveys in the Buffalo Lake, River, and Trails Candidate Area in 2010, which overlaps the RSA (Haas 2014).

Olive-sided flycatchers prefer tall trees and snags adjacent to open areas, which provide individuals with perches from which they hunt flying arthropods (Altman and Sallabanks 2012). Olive-sided flycatchers nest in forested stands but, because of their foraging behaviour, are associated with high contrast habitats including burned forests, logged areas, and natural forest openings such as gaps within old-growth forest stands, as well as meadows, rivers, and wetlands adjacent to forested habitat (Altman and Sallabanks 2012; COSEWIC 2007b). In the Yukon Territory, olive-sided flycatchers are primarily associated with low density, open forest, wet areas, and regenerating forest (Stelehin 2020).

The North American breeding bird survey data suggests an average annual decline of 3.4% in Canada's olive-sided flycatcher population between 1973 and 2012 (Environment Canada 2014). The consistent population decline across a wide breeding range suggests that habitat loss and alteration on migration and wintering grounds may be implicated (COSEWIC 2007b). Pesticide use may be detrimental to food supply in some areas, but data are deficient (Altman and Sallabanks 2012).

Canada Warbler

Canada warblers breed in forested areas in Canada and parts of the United States and overwinter in South America. Throughout their breeding range, Canada warblers nest in a variety of usually wet forest types, with a well-developed dense shrub layer (COSEWIC 2008a; Environment Canada 2016c). Canada warblers are associated with wet mixed wood forests and early successional forests (6 to 30 years) created by forest harvesting or natural disturbance (Ball and Bayne 2014; Environment Canada 2016c).

Canada warblers have not been reported in the LSA during field surveys in 2005, 2011, or 2018 (EBA 2005c; Rescan 2012h; Golder 2018a).

Rusty Blackbird

Rusty blackbird (*Euphagus carolinus*), which is listed under SARA as a species of special concern (Government of Canada 2019a), was detected during point count surveys in the LSA in 2011 (Rescan 2012h,i). Rusty blackbirds were also incidentally observed during field surveys in the LSA in September 2005 (EBA 2005c).

During the summer, rusty blackbirds inhabit boreal forested wetlands including bogs, marshes, and sedge meadows (COSEWIC 2006). Rusty blackbirds primarily feed in shallow, slow-moving water habitat, and along riparian edges (Avery 2013). Their diet is mostly composed of aquatic insect larvae, snails, and crustaceans (COSEWIC 2006). Recent population trends in Canada have indicated a large decrease in rusty blackbird numbers with an average annual decline of 6.3% recorded Canada-wide between 1970 and 2012 (Environment Canada 2014). Current threats for the rusty blackbird include extensive habitat loss in their overwintering range (southern United States) as well as conversion of wetlands to agricultural land and urban areas in their summer range (COSEWIC 2006).

Bank Swallow and Barn Swallow

Bank swallow (*Riparia riparia*), a federal listed threatened species (Government of Canada 2019a), was incidentally observed during field surveys in the LSA in September 2005 (EBA 2005c) and during surveys in the Buffalo Lake, River, and Trails Candidate Area in 2010, which overlaps the RSA (Haas 2014). Exploration site personnel observed bank swallows at deposits I46 and I48 in 2018. Bank swallows primarily breed in friable soils in vertical banks, cliffs, and bluffs along ocean coasts, rivers, streams, lakes, reservoirs, and wetlands (Garrison 1999). Most nesting colonies in natural habitats are found along low gradient, meandering waterways with eroding streamside banks (Garrison 1999). Nesting colonies are also commonly found in artificial habitats such as sand and gravel quarries and road cuts (Garrison 1999). Bank swallows avoid dense forests because of the lack of suitable nesting sites (Garrison 1999). Foraging habitats primarily include wetlands, open water, grasslands, riparian woodlands, agricultural areas, and shrublands (Garrison 1999).

Barn swallow (*Hirundo rustica*) is a federal listed threatened species. No barn swallows have been observed in the LSA during surveys in 2005, 2011, and 2018 (EBA 2005c; Rescan 2012h; Golder 2018a). Barn swallows typically nest in a vertical or horizontal substrate (often enclosed), near open areas (e.g., fields and meadows) for foraging, and a body of water that provides mud for nest building (Brown and Brown 1999). Barn swallow nests are typically found inside or outside of buildings, under bridges, and in road culverts and this species commonly forages in open habitats such as riparian habitats, road corridors, urban and residential areas, and clearings in wooded areas (Brown and Brown 1999; Heagy et al. 2014). Vegetation clearing can improve habitat by creating open habitats that can be used by barn swallow for foraging (Brown and Brown 1999; Heagy et al. 2014).

3.3.9.6.2 Shorebirds and Waterbirds

Shorebirds include sandpipers, plovers, dowitchers, yellowlegs, and snipes. Waterbirds include loons, grebes, ducks, geese, herons, bitterns, rails, cranes, coots, and gulls. All shorebird and waterbird species are protected under the MBCA.

Beak (1980) reported concentration of waterbirds on Great Slave Lake near the mouth of Twin Creek. Five waterbird and four shorebird species were observed in the LSA and along the shores of Paulette Bay during surveys in 2011 (Rescan 2012i). A total of 14 waterbird and 3 shorebird species were recorded in the LSA during waterbird surveys in 2011 (Rescan 2012h). Twelve species of waterbirds were observed during aerial surveys in the Buffalo Lake, River, and Trails Candidate Area in 2010, which overlaps the RSA (Haas 2014). A total of 11 waterbird and 7 shorebird species were recorded on ARUs deployed in brownfield and greenfield areas of the LSA in 2018 (Golder 2018a). Workers at the exploration site commonly observe waterfowl and loons using pits and ditches that contain water.

Horned Grebe

Horned grebe (*Podiceps auritus*), which is a federal species of special concern (Government of Canada 2019a), was recorded at one wetland in the LSA during waterbird ground surveys in 2011 (Rescan 2012h); an additional individual was observed approximately 20 km from the existing development in the RSA (Rescan 2012i).

For breeding habitat, horned grebes mainly select semi-permanent and permanent freshwater ponds and shallow bays or marshes containing open water and rich with emergent vegetation such as sedges, rushes and cattails (Stedman 2000). Nests are built within a few metres of open water and are generally floating in emergent vegetation (Stedman 2000). Horned grebes have also been shown to breed in constructed structures with water such as borrow pits in the boreal forest (Fournier and Hines 1999; Kuczynski 2009). Horned grebes have been reported using ponds up to about 18 ha in size for breeding, though most studies suggest smaller ponds up to about 2 ha in size are preferred (COSEWIC 2009).

The decline in the western population of the horned grebe has been largely attributed to the loss of wetland habitat in the prairies, most of which occurred before recent population declines; however, wetland conversion to agriculture and other development continues (COSEWIC 2009). Habitat loss is unlikely to be a major threat to northern populations, and changes to habitat availability in boreal and subarctic regions that have occurred have not likely contributed measurably to broad population declines.

Whooping Crane

Whooping crane (*Grus americana*), a federal listed endangered species (Government of Canada 2019a), was incidentally observed during field surveys in the LSA in September 2005 (EBA 2005c). Whooping crane was a key species of concern noted in ECCC's referral for completion of an EA assessment for the Tamerlane Pine Point Pilot Project (EA0607- 002).

Whooping crane have a restricted known breeding range in Canada within Wood Buffalo National Park, which spans the NWT and Alberta borders near the Slave River. They inhabit marshes, bogs, and shallow lakes. Wetlands used for nesting are separated by narrow ridges that support an overstory of white spruce, black spruce, tamarack, and willows and an understory of dwarf birch, Labrador tea, and bearberry (COSEWIC 2010). Bulrush is the dominant emergent in the potholes used for nesting, although cattail, sedge, musk-grass, and other aquatic plants are common. Whooping cranes appear to be more limited by risks faced during migration and factors affecting their wintering grounds than environmental pressures affecting breeding grounds.

Yellow Rail

Yellow rail (*Coturnicops noveboracensis*) is listed under SARA as a species of special concern (Government of Canada 2019a). Yellow rail occupies wetlands dominated by sedges, true grasses, and rushes, where there is little or no standing water, and where the substrate remains saturated throughout the summer (COSEWIC 2009), which closely describes herbaceous wetland habitat in the LSA. No yellow rails have been detected in the LSA during field surveys in 2005, 2011, and 2018 (EBA 2005c; Rescan 2012h; Golder 2018a).

3.3.9.6.3 Raptors

Raptors are birds of prey and include hawks, eagles, falcons, and owls. Raptors are not protected under the MBCA, but are protected in the NWT under the *Wildlife Act* and *Wildlife General Regulation* R-051-2019. Nests are protected year-round but can be removed if authorized under a Wildlife General Permit. Several raptor species may use habitats in the LSA and RSA (Section 3.1.4).

Bald eagle (*Haliaeetus leucocephalus*), American kestrel (*Falco sparverius*), great horned owl (*Bubeo virginianus*), boreal owl (*Aegolius funereus*), golden eagle (*Aquila chrysaetos*), peregrine falcon (*Falco peregrinus*), red-tailed hawk (*Buteo jamaicensis*), northern harrier (*Circus cyaneus*), rough-legged hawk (*Buteo lagopus*), and sharp-shinned hawk (*Accipiter striatus*) were observed during field surveys in the LSA in 2011 (Rescan 2012h,i). Bald eagle, northern harrier, rough-legged hawk, American kestrel, and peregrine falcon were also recorded in the LSA in 2005 (EBA 2005c).

Raptor species that were observed during surveys in the Buffalo Lake, River, and Trails Candidate Area in 2010 were bald eagle, osprey (*Pandion haliaetus*), northern harrier, great horned owl, boreal owl, short-eared owl (*Asio flammeus*), and northern goshawk (*Accipiter gentilis*). Short-eared owl is a species of special concern under SARA (Government of Canada 2019a). All other raptor species that have been reported in the LSA are not species of concern in the NWT or Canada (GNWT 2018b; Government of Canada 2019a).

Bald Eagle

Bald eagles are found near major lakes or rivers (Armstrong 2014), often using perches within 500 m of open water when foraging at or near the surface of the water (Buehler 2000). Shallow water and near-shore emergent vegetation increases the likelihood that live fish prey will be available near the surface (Buehler 2000; Armstrong 2014). Quality of hunting habitat may also be higher in areas without human development and disturbance (Buehler 2000). Bald eagle breeding territories tend to be within 2 km of water near lakes greater than 1,000 ha with more than 11 km of shoreline, and average territory sizes range from 0.5 to 4 km² (Armstrong 2014). Bald eagle was the most numerous raptor species observed during surveys in the Buffalo Lake, River, and Trails Candidate Area in 2010 and was usually observed along watercourses, especially the Buffalo River (Haas 2014), which overlaps the RSA.

Short-Eared Owl

Short-eared owl nest in a variety of grassland and wetland habitats (Wiggins et al. 2006). Females prefer to nest in areas with short (<60 cm) dense grass (Wiggins et al. 2006), as well as in tundra with small willows (COSEWIC 2008b). Nest sites are often located on dry sites, such as small knolls or hummocks (Wiggins et al. 2006). Forested areas do not represent suitable breeding habitat (Wiggins et al. 2006).

3.3.9.7 Amphibians

Four amphibian species have potential to occur in the LSA and RSA (Section 3.1.4): Canadian toad (*Bufo hemiophyrs*), northern leopard frog (*Lithobates pipiens*), wood frog (*Lithobates sylvatica*), and boreal chorus frog (*Pseudacris maculata*). Wood frogs and boreal chorus frogs were the only amphibian species recorded in the LSA during amphibian surveys in 2011 (Rescan 2012h). Similarly, only wood frogs and boreal chorus frogs were recorded on ARUs in greenfield and brownfield portions of the LSA in 2018 (Golder 2018a).

Northern Leopard Frog

Northern leopard frogs are semi-aquatic and use both aquatic and terrestrial environments during their life cycle. Different habitats are required throughout the year: breeding occurs in shallow marshes, moist uplands are used for foraging, and permanent water bodies are required for overwintering (Environment Canada 2013b). These three habitat types must be located in close proximity to each other and must be connected because leopard frogs have limited dispersal capability (Environment Canada 2013b).

3.3.9.8 Insects

Bumble Bees

Both the yellow-banded bumble bee and gypsy cuckoo bumble bee are generalist foragers, feeding on the nectar and pollen of a wide variety of plant species (COSEWIC 2015a,b). The yellow-banded bumble bee (*Bombus terricola*) is a species of special concern under SARA (Government of Canada 2019a). Yellow-banded bumble bee is a habitat generalist that is found within a wide variety of open to semi-open habitats including open coniferous, deciduous, and mixed-wood forests, and wet and dry. They also occupy meadows and prairie grasslands, meadows bordering riparian zones, and along roadsides in taiga adjacent to wooded areas, urban parks, gardens and agricultural areas, and subalpine habitats (COSEWIC 2015a). Nests are typically established in abandoned rodent burrows, but also in grassy hummocks, rotting logs, or cavities in dead wood (COSEWIC 2015a).

The gypsy cuckoo bumble bee (*Bombus bohemicus*) is an endangered species under SARA (Government of Canada 2019a). Gypsy cuckoo bumble bees are obligate social parasites that use host colonies of bumble bees belonging to the subgenus *Bombus senso stricto* to raise their young (COSEWIC 2015b). Consequently, habitat preferences are strongly dependent on the host species.

3.4 Human Environment

The human environment baseline section presents a high-level overview of current socio-economic conditions and cultural features of potentially affected communities and the traditional territories of Indigenous communities, including important harvesting and cultural use areas. Information on conditions in most of the socio-economic LSA communities (Section 3.1.7) is publicly available to some extent, largely in the form of statistics from the GNWT Bureau of Statistics and Statistics Canada. More detailed, contextual information will be collected through future baseline studies.

Information presented in the EA Initiation Package has been based on preliminary desktop studies and review of publicly available information. Additional baseline information will be collected in support of the Developer's Assessment Report for the Project. Further, information presented below will be verified through additional engagement and revised, as required. Such work detailed in the Baseline Study Plan for 2020 (Appendix C). ITK regarding the traditional use of land and resources in the vicinity of the Project will be confirmed and expanded upon with Indigenous communities through the baseline study process pursuant to the ITK protocols of respective Indigenous groups and forthcoming Knowledge Sharing Agreements.

3.4.1 Heritage Resources

The Project is located on the south shore of Great Slave Lake between the Slave and Hay rivers. The history of the region extends from precontact times, through the fur trade and historical mining era. Several sources were reviewed to identify the existing environment for Heritage Resources within the LSA (Section 3.1.5). This included:

- The Northwest Territories Archaeological Sites Database maintained by the GNWT Department of Education, Culture & Employment, Cultural Places Program.
- The NWT Contaminated Sites website maintained by Crown-Indigenous Relations and Northern Affairs Canada, which contains information on historical infrastructure and abandoned mine sites that may be of heritage interest.
- The Canadian Register of Historic Places administered by Parks Canada that lists registered historic places throughout Canada.
- Relevant published and unpublished literature and reports pertaining to previous archaeological, historical, and cultural studies completed in the LSA.

A summary of previous archaeological studies and documented heritage resources is discussed below.

3.4.1.1 Previous Studies

A search of the archaeological sites database indicates that at least 13 archaeological studies have been carried out in the region between the mouth of the Hay River and Slave River beginning in 1966 through 2018 that resulted in the recording of more than 50 precontact and historic sites. This includes studies along the mouth of the Hay River (Noble 1966; Hanks and Irving 1987; Lobb 1998), along the Slave River (Heintzman 1980, 1981), within Wood Buffalo National Park along Buffalo Lake (Deck 2016), and within the K'atl'odeeche First Nation traditional lands (Smethurst 2017, 2018). However, most relevant were six Archaeological Impact Assessments and two Archaeological Overview Assessments conducted between 2006 and 2018. These latter studies resulted in the recording of 13 archaeological sites within the LSA (Table 3-17).

Table 3-17: Previous Research in the Local Study Area

Permit No./Year	Affiliation	Proponent	Relevant Assessment Area	Location	Recorded Sites
2006	J. Bussey Points West Heritage Consulting Ltd.	Tamerlane Ventures Inc.	Pine Point Pilot Project Study Area (R109)	West Zone	0
2011-009	D. Walker Rescan Environmental Services Ltd.	Tamerlane Ventures Inc.	Seven deposits (O556, P499, R190, X25, Z155, G03, N204)	West Zone and N204 Zone	JePr-1, 2, 3, 4
2016-003	M. Moors Stantec Consulting Ltd.	GNWT-INF	Fort Resolution Highway 6 Prospect 4, 5, 7, 11, 12, 14, 15	East Mill Zone and Central Zone	JfPp-1; JfPn-1,2; JfPo-3
2016-012	D. Finch	PWNHC	Pine Point Base Camp	East Mill Zone	JfPo-1, 2
2017 AOA	G. Prager Points West Heritage Consulting Ltd.	Pine Point Mining Limited	Pine Point Exploration Project Phase I: desktop evaluation of 11 mineral claims in proximity to the former Pine Point Mine and townsite; Claims D1 to D6; D9 to D13	East Mill Zone	N/A

Table 3-17: Previous Research in the Local Study Area

Permit No./Year	Affiliation	Proponent	Relevant Assessment Area	Location	Recorded Sites
2017-016	N. Smethurst GNWT-Education, Culture and Employment	K'atlo'deeche First Nation Archaeology Project	Buffalo River	West Zone	JePr-5, JfPs-1 and 2
2018 AOA	Soriak Consulting & Research Ltd.	Osisko Metals Incorporated	Pine Point Mine Exploration Project – Phase II: Desktop evaluation of remaining leases and claims	N204, East Mill, Central, North, and West Zone	N/A
2018-009	Soriak Consulting & Research Ltd.	Osisko Metals Incorporated	Pine Point Mine Exploration Project; Claims D1 to D4, D13; Leases M2 to M6	East Mill Zone	0

AOA = Archaeological Overview Assessment; INF = Department of Infrastructure; PWNHC = Prince of Wales Northern Heritage Centre; N/A = non applicable

In 2006, a Preliminary Archaeological Assessment of the Pine Point Pilot Project was undertaken on behalf of Tamerlane Ventures Inc. (Bussey 2006). The project proposed the development of underground bulk sampling and ancillary infrastructure. The project footprint area was visited to evaluate archaeological potential and it was determined to be low as a result of extensive disturbance from previous mine development. As a result, no field assessment was deemed necessary.

In 2011, heritage baseline studies were carried out to assess seven deposits that were feasible for development as part of an EA (Rescan 2012j,k). During the assessment, four archaeological sites (JePr-1 to 4) were recorded immediately east of the Buffalo River adjacent to Mellor Rapids. All sites were prehistoric lithic scatters initially observed in trail exposures, with two producing formed tools. Avoidance or further mitigation was recommended for JePr-1 to 4 sites, while there were no further concerns identified in the remaining deposits.

In 2016, an Archaeological Impact Assessment was carried out on proposed granular sources for road construction and maintenance on behalf of the GNWT Department of Infrastructure (Moors 2017). This included various sources along Highways 5 and 6, with several occurring within and adjacent to Pine Point claim and lease areas. A total of four sites were documented. This included a historic can scatter (JfPp-1) and a log lined stone cairn feature, which was identified as a potential historic grave (JfPo-3). The remaining sites are located outside mineral leases to the east and include another historic can scatter (JfPn-1) and an isolated historic bottle find (JfPn-2).

Also in 2016, a detailed recording of the historic mine camp used to support exploration activities between 1929 and 1952 was undertaken and designated archaeological site JfPo-1 (Finch 2017). Twenty-two dilapidated structures and 20 additional features including can middens, core piles, crates, cat train skids, and fire pits were documented. A dilapidated log structure (JfPo-2) identified as a historical archaeological structure was also recorded approximately 7.5 km to the north towards Great Slave Lake. It was built by the General Exploration Company in 1929 and used for one year during the early exploration period.

In 2017, an Archaeological Overview Assessment was conducted for the Phase I exploration drilling program within mineral claims D1 to D6 and D9 to D13 on behalf of Darnley Bay Resources, now PPML (Praeger 2017). This desktop study presented a summary of past archaeological studies and documented heritage resources, in addition to identifying high potential areas recommended for avoidance or further assessment prior to drilling.

Also in 2017, archaeologists from the Culture and Heritage Division, GNWT-Education, Culture and Employment were involved with the K'atlo'deeche First Nation Archaeology Project (Smethurst 2017, 2018). This included surveys within the K'atl'odeeche First Nation traditional lands along the Hay River as well as the shore of Great Slave Lake and Buffalo River. As a result of this program, three sites were recorded within the LSA. This included JePr-5, a lithic and faunal scatter site located on the west bank of Buffalo River adjacent to Mellor Rapids. The remaining two sites were recorded 14 km north at the mouth of Buffalo River on Great Slave Lake. These sites consisted of a prehistoric/historic lithic and faunal scatter site (JfPs-1) and a prehistoric lithic scatter site (JfPs-2).

In 2018, an Archaeological Overview Assessment was conducted for the Phase II Pine Point drilling program on behalf of Osisko Metals Incorporated (Soriak 2018). This desktop study examined areas within the remaining 40 mining leases and two claims stretching 70 km across three deposit trends. An updated summary of past archaeological studies and documented heritage resources was presented as well as high potential areas recommended for avoidance or further assessment.

Later in 2018, an Archaeological Impact Assessment was carried out on behalf of Osisko Metals Incorporated within the Phase I exploration drilling area in mineral claims D1 to D3 and D13, as well as areas east in leases M2 to M6 (Soriak 2019). Ten Areas of Interest were examined; however, no new archaeological sites were recorded. This was attributed to previous mine disturbance and generally featureless terrain. Three previously recorded sites were revisited to obtain status updates (JfPp-1, JfPo-1, and JfPo-3).

3.4.1.2 Documented Heritage Resources

As a result of these previous studies, 13 sites have been documented within the LSA including seven prehistoric sites and six historic sites (Table 3-18). The prehistoric sites (JePr-1 to 5; JfPs-1 and 2) relate to precontact Indigenous occupation of the area. All were identified along the Buffalo River, which is the area least disturbed by mining activity. It is also the most important drainage feature in the LSA exhibiting the greatest archaeological potential. All sites consist of lithic scatters or waste flakes produced as a result of stone tool manufacture. None of the sites produced diagnostic tools to indicate a potential age or cultural affiliation; however, the most productive site (JePr-1) produced two chert bifaces that were suggested to represent the Arctic Small Tool Tradition (ASTt) (Rescan 2012j). The ASTt is an archaeological tradition that dates from approximately 3,500 years before present (BP) to 2,600 BP with origins in the northern Arctic (Gordon 1996). This Tradition is known to occur throughout the NWT and as far south as northern Alberta, Saskatchewan, and Manitoba. It is considered to represent northern coastal peoples moving inland to hunt caribou during a particularly cold period.

Within the broader region, the Taltheilei Tradition is also present. This Tradition is considered to represent ancestral Dene and spanned from approximately 2,600 BP to 200 BP (Gordon 1996). Excavations have been carried out at a site (JePw-1) in Hay River that was discovered in a garden. Radiocarbon samples from two separate occupations at this site returned dates of approximately 1,860 +/-135 BP and 1,635 +/-280 BP (Hanks and Irving 1987), which corresponds with the Early to Middle Taltheilei Periods.

Although no fur trade sites were recorded in the LSA, it should be noted that the fur trade period has a long history in the region. Fort Resolution is a National Historic Site located 30 km to the east of the Project that is recognized as the oldest continuously occupied community in the NWT with origins in the fur trade, as well as being the principal fur trade post on Great Slave Lake (CRHP 2010). It was established by the Northwest Company near the mouth of the Slave River in 1791 and was soon followed by a Hudson’s Bay Company post. After the two companies merged in 1821, the forts also united and moved to the present-day community of Fort Resolution. The Hudson's Bay Company established another fur trade post at the mouth of the Hay River in 1868, which was soon followed by a Roman Catholic Mission in 1869 and an Anglican Mission in 1894. The Hay River Mission Sites are also designated as a National Historic Site (CRHP 2009).

The six historic sites documented in the LSA appear to be associated with 20th century mining activity related to the historical Pine Point mine site. All occur in areas surrounding the historical Pine Point mine and include the former mine base camp (JfPo-1), historical archaeological structure (JfPo-2), three can/bottle middens (JfPn-1 and 2; JfPp-1), and the log lined stone cairn feature (JfPo-3).

The historical Pine Point mine has a long history in the region. Lead-zinc deposits were first discovered in 1898 by prospectors heading to the Klondike gold rush (Silke 2009). This resulted in a claim staking period through the 1920s. Exploration began in earnest in 1929 when Cominco started test-pitting, drilling, and shaft sinking. A camp (JfPo-1) was built that same year and served as a base for operations through to 1953 (Finch 2017). In the early 1960s, Cominco proceeded to construction and in 1963 the mine and townsite were developed. A rail line between Pine Point and Peace River, Alberta was built at the same time to deliver lead and zinc concentrates to southern smelting plants. The historical Pine Point mine operated between 1964 and 1988 and included 50 separate open-pits and two underground deposits, distributed along a 70 km trend. At its peak, the town of support workers and families had a population of 1,900. The mining operation closed in 1988 followed soon after by the abandonment of the town (Finch 2017). Remediation of the historical Pine Point mine continued over several years. Pine Point houses were sold, and many moved to Fort Resolution, Hay River and northern Alberta. The remaining buildings were demolished and only the street and sidewalk layout remain (Soriak 2019). The Pinecrest Cemetery associated with the townsite still exists, which is a fenced 25 m by 20 m area located on the northwest side of town. The earliest grave dates to 1878, while the most recent dates to 2017 (Soriak 2019). Neither the contemporary town or cemetery are designated archaeological sites.

Table 3-18: Previously Recorded Heritage Resources in the Local Study Area

Borden No.	Classification	Location	Description	Age
JePr-1	Prehistoric	East of Buffalo River – Mellor Rapids; Lease G3H2B	Lithic workshop/camp:163 artifacts (2 chert bifaces, 1 core, 3 retouched flakes, 1 hammerstone and debitage)	Chert biface tentatively identified as ASTt
JePr-2	Prehistoric	East of Buffalo River – Mellor Rapids; Lease G3H2B	Lithic scatter: 8 artifacts (1 core, 7 debitage)	Unknown
JePr-3	Prehistoric	East of Buffalo River – Mellor Rapids; Lease G3H2B	Lithic scatter: 13 artifacts (1 biface, 12 debitage)	Unknown
JePr-4	Prehistoric	East of Buffalo River – Mellor Rapids; Lease G3H2B	Lithic scatter: 8 debitage	Unknown
JePr-5	Prehistoric	West of Buffalo River – Mellor Rapids; Lease M19	Lithic scatter	Unknown
JfPn-1	Historic	Located 2 km east of claim D12	Can scatter: 2 (1 tobacco can, 1 square can)	Mid 20th century
JfPn-2	Historic	2 km east of claim D12	Isolated bottle (1 medicine bottle)	Mid 20th century
JfPo-1	Historic	Lease M4/buffer	Former Mine Base Camp - 22 dilapidated structures, 20 features	1929 to 1953
JfPo-2	Historic	7 km north of Lease M5	Dilapidated prospector cabin	1929
JfPo-3	Historic	On flat upland terrain –Claim D12/buffer	Cairn/grave? (rectangular cairn lined with logs)	Mid 20th century
JfPp-1	Historic	On a small ridge -Lease M7	Can scatter (5 cans)	Mid 20th century
JfPs-1	Prehistoric/ historic	Mouth of Buffalo River – 13 km northwest of Lease M19	Lithic/bone scatter	Unknown
JfPs-2	Prehistoric	Mouth of Buffalo River – 13 km northwest of Lease M19	Lithic scatter	Unknown
N/A	Contemporary	Pine Point Townsite – Claim D6	Pine Point Townsite	1963 to 1988
N/A	Contemporary	Pine Point Townsite – Claim D-6	Pinecrest cemetery	1878 to 2017

3.4.2 Traditional Land and Resource Use

The Project is within the traditional territories of the Deninu Kue First Nation, K'atl'odeeche First Nation, and Northwest Territory Métis Nation. Previous studies related to ITK and traditional land and resource uses in the vicinity of the Project include ITK studies for the communities of Fort Resolution (Deninu Kųé First Nation and Fort Resolution Métis Council; Swisher 2006a) and Hay River (Hay River Métis Council and Northwest Territory Métis Nation; Swisher 2006b), and an ITK assessment for the Hay River Reserve (K'atl'odeeche First Nation; Eagle Eye Concepts 2007). These studies were conducted for Tamerlane Ventures Inc.'s Pine Point Pilot Project as part of the EA process. This section provides an overview of the TLRU in the terrestrial LSA (Section 3.1.4) and South Slave Region from these studies.

3.4.2.1 Deninue Kųę First Nation and Northwest Territory Métis Nation

Community members from Deninu Kųé First Nation, Fort Resolution Métis, and Hay River Métis have extensive familial roots in the South Slave Region and indicated that they or their family frequented the LSA or broader general area (Swisher 2006a,b). Some community members began to use the area for traditional activities after the highway was built in the 1960s, but others have been using the area since the 1920s, which was accessed in the winter by dog team and during the summer by boat or overland by cutlines (Swisher 2006a). Hay River Métis community members indicated their historical use of the area ranges from 26 years to many generations (Swisher 2006b).

The LSA is used by the Deninu Kųé First Nation, Fort Resolution Métis, and Hay River Métis for hunting, trapping, medical plant and berry gathering, collecting firewood and also for employment activities associated with the Tamerlane 2005 Drill Program (Swisher 2006a,b). Community members stated they have walked or travelled through the LSA or larger region in recent years, including actively snowmobiling in the South Great Slave region for traditional and work-related activities (Swisher 2006a,b).

Trapping areas are typically rotated, and the LSA is viewed as part of a larger traditional use area. Wildlife traditionally harvested by Deninu Kųé First Nation, Fort Resolution Métis, and Hay River Métis in the LSA and general South Slave Region are presented in Table 3-19. In general, terrestrial furbearers are typically harvested from November to mid-March, aquatic furbearers are harvested from mid-October to mid-May, waterfowl are hunted in the spring, game birds are hunted in the fall and winter, and large game are typically hunted year-round (Swisher 2006a,b).

Table 3-19: Traditionally Harvested Wildlife in the Local Study Area and South Slave Region

Local Name			
Birds	**Large Game**	**Terrestrial Furbearers**	**Aquatic Furbearers**
Waterfowl Upland game birds (e.g., prairie chicken, spruce chicken, and ruffed grouse)	Wood bison (buffalo) Moose Woodland caribou Barren-ground caribou Muskox Black bear White-tailed deer	Marten Lynx Mink Wolf Fox Wolverine Squirrel Ermine Fisher Rabbit Coyote Porcupine	Muskrat Beaver Otter

Source: Swisher 2006a,b

Medicinal plants are used in the communities of Deninu Kųé First Nation, Fort Resolution Métis, and Hay River Métis, and species identified in the LSA include Labrador tea, white rat root, spruce gum, tamarack, popular buds, and birch trees (Swisher 2006a,b).

Some community members considered both groundwater and surface water in the terrestrial LSA to be poor quality, because it is alkaline and sulphurous, and not fit for consumption (Swisher 2006a,b). It was noted that the water was drinkable prior to the start of the historical Pine Point Mine, but some believed that the water quality was alkaline and had a high pH prior to the historical Pine Point Mine (Swisher 2006a).

Community members from Deninu Kųé First Nation, Fort Resolution Métis, and Hay River Métis either historically or currently fish in the South Slave Region, and fish were traditionally harvested for food, dog food, bait traps, and for trade (Swisher 2006a,b). Several community members were commercial fishermen on Great Slave Lake and at the mouth of the Rocher River, starting in the 1950s. Big Buffalo River was identified as a primary fish harvesting location, where Whitefish or Inconnu, were traditionally harvested. Twin Creek might also be used for fishing by some community members, where pickerel (i.e., Walleye), suckers (i.e., Longnose Sucker, White Sucker), and stickleback (i.e., Ninespine Stickleback) are present at the mouth of the creek. Polar Lake is generally not used for traditional purposes because it was a stocked lake (Swisher 2006a,b). Specific fish species traditionally harvested in Big Buffalo River include Whitefish, Inconnu, Pickerel, Lake Trout, Jackfish (i.e., Northern Pike), Arctic Grayling, Sucker (i.e., Longnose Sucker), Goldeye, Cisco, and Mullet (Swisher 2006a). Fish harvested by Deninu Kųé First Nation, Fort Resolution Métis, and Hay River Métis in the South Slave Region are presented in Table 3-20.

Table 3-20: Traditionally Harvested Fish in the South Slave Region

Local Name	
Whitefish (i.e., Lake Whitefish or Round Whitefish) Rocky Mountain Whitefish (i.e., Mountain Whitefish) Jackfish (i.e., Northern Pike) Pickerel (i.e., Walleye) Inconnu Lake Trout Dog-Face Salmon Sucker (i.e., Longnose Sucker, White Sucker, Mountain Sucker) Silver Sucker Goldeye	Tullibee (i.e., Cisco) Loche, Maria (i.e., Burbot) Arctic Grayling Mullet Chub (i.e., Lake Chub) Stickleback (i.e., Ninespine Stickleback) Lamprey (i.e., Arctic Lamprey)

Note: Common names of traditionally harvested fish are shown in parentheses in cases where colloquial names differ from common names. Dog-face Salmon and Silver Sucker are colloquial names for which the common name is uncertain (Adapted from Swisher 2006a,b).

Although Deninu Kųé First Nation, Fort Resolution Métis, and Hay River Métis community members did not specifically know of anyone living in the LSA, they had observed evidence of old prospector and hunting cabins, and it was noted that people historically used the area seasonally to hunt, and historic cabins existed (Swisher 2006a,b). It was also noted that evidence of people using the bush (e.g., axe marks) was commonly observed while out on the land. Although there were no known gravesites in the vicinity of the Project, community members noted that they had the potential to exist in the LSA since historically, people were buried at the site where they died (Swisher 2006a). Previously recorded heritage resources in the LSA align with ITK, as a cairn/wood feature was identified as a potential historic grave (JfPo-3; Section 3.3.1.2). The LSA is currently used for traditional harvesting, berry gathering, and cutting wood, and community members indicated there is a high potential that culturally significant sites occur in the area. It was also noted that trappers from Hay River and Fort Resolution must have used the area because of evidence of old cans they had observed (Swisher 2006a). A summary of previous archaeological studies and documented heritage resources is provided in Section 3.4.1.

Within the Métis community and culture, traditional harvesting grounds are considered to be cultural sites, and community members stated that as part of a broader area, the LSA is recognized by the Métis as a cultural site used for traditional harvesting activities (Swisher 2006b).

3.4.2.2 K'atl'odeeche First Nation

K'atl'odeeche First Nation community members reported use of the LSA for hunting and harvesting resources and the community has strong economic ties with the land (Eagle Eye Concepts 2007). Caribou, moose, and waterfowl (e.g., ducks and geese) are hunted for sustenance. Elék'eh is a muskeg area on the south shore of Great Slave Lake and east of Buffalo River, and supports beaver, muskrat, and other wildlife, and is an important waterfowl nesting area. Specific moose harvesting sites were identified along the southern shore of Great Slave Lake, High Point, Birch Creek, and Twin Creek. Hunting also occurs along the Buffalo River (Eagle Eye Concepts 2007).

K'atl'odeeche First Nation community members noted that water flows to the Great Slave Lake via creeks and rivers, and also accumulates in swamps in the south shores of the Great Slave Lake through other drainage systems that do not flow out into the Great Slave Lake (Eagle Eye Concepts 2007). Snow water and rain drains from the LSA into the Buffalo River and Great Slave Lake. During the spring runoff, the Inconnu and Suckers are reported to make their spawning run up the Buffalo River and then make their journey back to the Great Slave Lake in the fall in early October.

The LSA is used by the K'atl'odeeche First Nation for sustenance and economic well-being and has an abundance of resources on which they are dependent. The K'atl'odeeche First Nation also recognize themselves as stewards of their traditional lands and waters and are responsible for their protection for future generations (Eagle Eye Concepts 2007).

3.4.2.3 Additional Studies

Additional studies of land use and ITK in the area around the historical Pine Point mine include: a study of post-industrial land use at the historical Pine Point mine (LeClerc and Keeling 2015); a paper regarding the integration of biophysical sciences, social sciences, and ITK regarding the land around Fort Resolution (Wolfe et al. 2006); and a report on boreal caribou and their species at risk status (NWT Species at Risk Committee 2012). Other sources of ITK regarding TLRU of Indigenous communities in the broader region exist in the form of baseline studies for other industrial developments (e.g., the Gahcho Kué Mine) and academic and community-based literature.

3.4.3 Socio-economics

3.4.3.1 Population

The population of the NWT has grown in recent years by around 2% from 43,884 in 2014 to 44,826 in 2018, half of which are Indigenous people. Roughly a third of the territory's Indigenous population can speak an Indigenous language. The territory is projected to experience modest population growth over the next five years (GNWTBS 2018). Yellowknife (population 21,183) is the closest large regional centre to the Project and is the economic hub of the NWT. The city has experienced population growth of 4% over the past five years, and is forecasted to continue to grow, albeit at a more modest rate, in the years leading up to 2025[2]. Around one quarter of the city's population is Indigenous, 21% of which can speak an Indigenous language (Table 3-21).

[2] Population projections are basic straight-line considering birth and death rates, and do not factor in external drivers of population change.

Other than Yellowknife, the largest communities in the LSA are Hay River (population 3,749) and Fort Smith (population 2,639). Both communities are characterized by high non-Indigenous populations (roughly half) relative to the smaller communities in the LSA. Over the past five years, the population of the two communities has remained relatively stable, with marginal decline in Hay River (-0.3%) and modest growth (0.2%) in Fort Smith. The ability to speak an Indigenous language is low amongst the Indigenous population of both communities (15.7% and 16.1%, respectively) (Table 3-21).

The population of the smaller LSA communities ranges from 110 (Enterprise) to 684 (Fort Providence). Since 2014, there has been population growth in Fort Resolution, Fort Smith, the Hay River Reserve, and Dettah (4.1%, 0.2%, 5.4%, and 4.3%, respectively). During the same period, Enterprise and Fort Providence have experienced substantial population decline of 10.0% and 13.5%, respectively. Population growth is expected to occur in the small communities over the next five years, with the exception of Łutsel K'e, where the population is expected to decline by around 8% (Table 3-21).

While the majority of the population of Enterprise (57%) is not Indigenous, the populations of the other small communities in the LSA are largely Indigenous. With the exception of the Hay River Reserve, the small communities exhibit a high male to female ratio, with 1.24 to 1.34 males for every female, depending on the community. The ability to speak an Indigenous language is variable among the small communities, being lowest in Enterprise, the Hay River Reserve, and Fort Resolution (38%, 33%, and 30%, respectively) and highest in Dettah, Fort Providence, and Łutsel K'e (56%, 62%, and 64%, respectively) (Table 3-21).

Table 3-21: Population and Select Demographic Characteristics in Communities

Community	Total Population (2019)	Indigenous Population (%) (2019)	Male to Female Ratio (2019)	Population Change (2014-2019,%)	Population Projection (2025)	Population Speaking an Indigenous Language (%)[(a)]
Enterprise	110	42.7	1.24	-10.0	125	37.7
Fort Providence	684	93.0	1.31	-13.5	698	62.3
Fort Resolution	532	86.7	1.27	4.1	554	29.9
Fort Smith	2,639	58.7	1.03	0.2	2,650	16.1
Hay River	3,749	45.7	1.07	-0.3	3,966	15.7
Hay River Reserve	335	98.2	0.94	5.4	360	33.3
Dettah	234	97.4	1.07	4.3	280	55.9
Łutsel K'e	314	90.4	1.34	-1.0	289	64.3
Yellowknife	21,183	24.4	1.02	4.1	21,424	20.9
NWT	44,826	49.9	1.06	2.1	45,110	35.6

Source: GNWTBS 2018, 2019a-b.

Note: Hay River Reserve is also known as Hay River Dene 1, and is home to the K'atl'odeeche First Nation.

(a) Percentage of the Indigenous population in the community with the ability to speak an Indigenous language.

3.4.3.2 Economics and Employment

This section provides an overview of labour force conditions, incomes, educational attainment, and economic activities in the LSA communities and the NWT. Data regarding employment, incomes, and educational attainment have been drawn from the most recent Statistics Canada census in 2016 (2017a-j) and the GNWT Bureau of Statistics community statistical profiles (GNWTBS 2019c). Data on the traditional economy are sourced from the most recent surveys of participation in traditional activities (GNWTBS 2015a,b). Information regarding local business activity and economic development planning has been sourced from municipal and organizational websites and publications.

3.4.3.2.1 Employment, Incomes, and Cost of Living

In 2019, 25,785 people were active in the NWT labour force, representing a participation rate of 73.6% of the population aged 15 and over. Of those participating in the labour force, 10.9% are unemployed. Yellowknife's size and concentration of territorial economic and service provision activity creates an environment where participation in the labour force is high (78.9%), and unemployment is low (4.7%). In Hay River and Fort Smith, participation in the labour force (76.5% and 70.0%, respectively) and unemployment rates (6.6% and 10.2%) are in line with territorial averages, reflective of their larger size relative to the other South Slave communities, and the greater abundance of economic opportunities (Table 3-22).

Of the remaining communities, labour force participation rates are highest in Fort Resolution and Fort Providence (65.9% and 65.0%, respectively); however, the unemployment rate in both communities is high (29.7% and 30.6%, respectively). This reflects a labour market where a large portion of the population aged 15 and over is seeking work, but unable to secure employment. Participation in the labour force is lowest on the Hay River Reserve (58.9%), in Dettah (58.8%), Enterprise (55%), and Łutsel K'e (54.2%). With the exception of Enterprise, the unemployment rate in each community is high, suggesting that, as is the case in the larger South Slave communities, securing employment is a challenge for those participating in the labour force due to a lack of opportunities (Table 3-22).

Table 3-22: Labour Force Characteristics (2019) in Communities

Community	Population 15+	Labour Force	Employed	Unemployed	Participation Rate (%)	Unemployment Rate (%)
Enterprise	88	48	42	6	55.0	13.1
Fort Providence	635	413	286	126	65.0	30.6
Fort Resolution	433	285	201	85	65.9	29.7
Fort Smith	2,145	1,502	1,348	154	70.0	10.2
Hay River	3,172	2,427	2,267	160	76.5	6.6
Hay River Reserve	251	148	82	66	58.9	44.6
Dettah	178	105	81	24	58.8	22.7
Łutsel K'e	255	138	98	40	54.2	28.7
Yellowknife	16,561	13,073	12,464	610	78.9	4.7
NWT	35,046	25,785	23,034	2,750	73.6	10.7

Source: GNWTBS 2019c.
Note: Yellowknife includes N'Dilo.

Median household ($117,688) and individual ($46,864) incomes in the NWT are high relative to the rest of Canada. Median incomes are highest in Yellowknife, where households ($142,616) and individuals ($67,792) benefit from the availability of employment opportunities. The city also has the lowest percentage of families with incomes below $30,000 (6.9%). Median household incomes in Hay River and Fort Smith ($115,424 and $105,899, respectively) are slightly lower than the territorial average; however, individual incomes ($53,431 and $48,333, respectively) are higher. This could be indicative of a greater number of households including a single income earner. Of the remaining communities, household incomes are lower, ranging from $50,304 in Łutsel K'e to $79,104 in Enterprise (Table 3-23). Łutsel K'e and Fort Providence have the highest proportion of families with incomes less than $30,000 (37.5% and 27.3%, respectively).

Table 3-23: Incomes and Associated Indicators in Communities

Community	Median Total Household Income (2015, $)	Median Total Individual Income (2015, $)	Families with Incomes Less than $30,000 (2017,%)	Living Cost Differential (2018)[(a)]	Market Basket Measure (2017, $)
Enterprise	79,104	x	n/a	n/a	n/a
Fort Providence	59,008	19,984	27.3	137.5	n/a
Fort Resolution	55,424	23,360	15.4	152.5	n/a
Fort Smith	105,899	48,333	13.2	127.5	60,178
Hay River	115,424	53,431	12.0	n/a	64,105
Hay River Reserve	61,312	22,592	n/a	n/a	n/a
Dettah	59,264	x	n/a	157.5	n/a
Łutsel K'e	50,304	21,952	37.5	n/a	n/a
Yellowknife	142,616	67,792	6.9	138.6	59,304
NWT	117,688	46,864	12.9	n/a	n/a

Source: Statistics Canada 2017a-j.
x = area and data suppression; n/a = non applicable
(a) Edmonton = 100

The cost of living is high in the NWT. In the LSA communities, the cost of living is between 28% (Fort Smith) and 58% (Łutsel K'e) higher than the reference point of Edmonton, Alberta[3]. This is heavily influenced by the cost of transporting goods to the communities, particularly Łutsel K'e. The Market Basket Measure calculates the cost of food, clothing, transportation, shelter, and other basic expenses for a family of four representative of a modest, basic standard of living. While the cost of meeting this standard is substantial in Yellowknife ($59,304 per year), high household incomes help to offset the impact on household finances. In the communities large enough for the measure to be applied (i.e., Hay River and Fort Smith), the cost of these basic expenses is roughly equivalent to 80% of a household's median income after deductions such as income tax. While the measure is not applied in the smaller communities, it can be assumed that, given the lower household incomes and more remote locations the cost of meeting a basic standard of living is more challenging (Table 3-23).

3.4.3.2.2 Education and Training

Many employment opportunities in the economy require varying levels of educational attainment, with a high school education often serving as the basic requirement for access to entry-level opportunities, including those in the mining industry. It is not, therefore, unexpected that educational attainment is highest in LSA communities where participation in the labour force is high and unemployment is low. Yellowknife and Hay River have a low portion of the population aged 15 and over without a high school education (14.5% and 17.8%, respectively) relative to the NWT (27.4%). In Enterprise and Fort Smith, the proportion is lower but more in line with the territorial average (23.5% and 25.0%, respectively) (Table 3-24).

[3] Edmonton is used as a standard reference point for comparing cost of living to against northern communities, representing a moderate cost of living.

In the remaining communities, between half and two thirds of the population aged 15 and over have not completed high school, depending on the community. Most of the LSA communities have a larger portion of the population aged 15 and over in possession of a college certificate, an apprenticeship designation, or a trade than the overall territorial population aged 15 and over. This reflects a labour force trained in areas of employment valuable to, amongst other industries, construction and mining activity (Table 3-24). Semi-skilled and skilled employment opportunities are typically filled by candidates with some form of certification, apprenticeship, or trade, and are also those most associated with mining activities.

Table 3-24: Highest Level of Educational Attainment Amongst the Population Aged Fifteen and Over (2016)

Community	Population, Age 15 and Over	Less Than High School (%)	High School (%)	College Certificate (%)	Apprenticeship or Trade (%)	University Degree (%)
Enterprise	85	23.5	17.6	29.4	23.5	0.0
Fort Providence	580	54.3	18.1	8.6	13.8	4.3
Fort Resolution	375	49.3	13.3	14.7	17.3	6.7
Fort Smith	1,560	25.0	19.2	10.6	25.0	17.6
Hay River	1,995	17.8	20.1	17.3	24.8	17.5
Hay River Reserve	230	60.9	10.9	8.7	17.4	0.0
Dettah	180	63.9	19.4	5.6	8.3	0.0
Łutsel K'e	230	52.2	15.2	10.9	13.0	8.7
Yellowknife	15,400	14.5	24.3	8.4	20.3	29.1
NWT	32,325	27.4	21.4	9.8	18.9	20.0

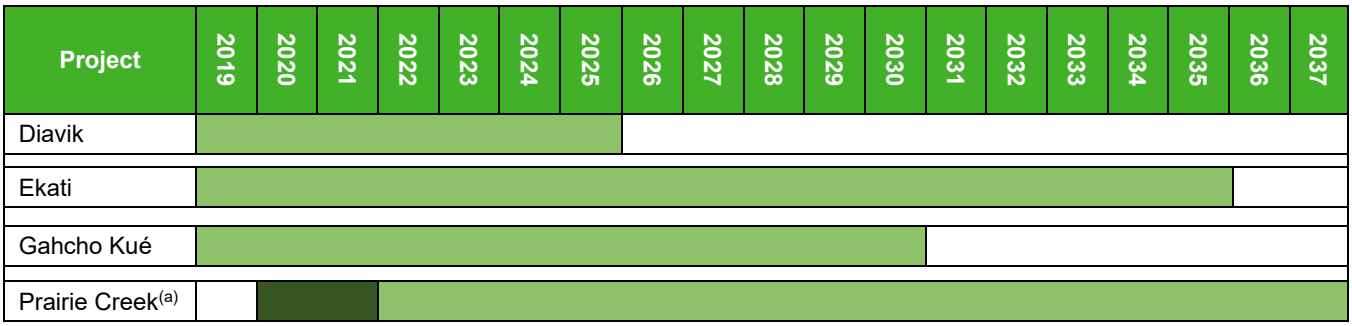
Source: Statistics Canada 2017a-j

Educational services are available in LSA communities through primary, secondary, and post-secondary institutions. Primary education is provided in all LSA communities, except Enterprise. Students in Enterprise are bussed to Hay River for school. In Dettah, school is available from kindergarten to Grade 9, with high school provided in Yellowknife. Kindergarten to Grade 12 schools are present in the other LSA communities. Learning centres that focus on the provision of mine training are available in all communities, except Enterprise and the Hay River Reserve. Career centres are available in Fort Smith, Hay River, and Yellowknife to offer career counselling and skills development programming. Thebacha Campus also operates in Fort Smith, providing courses in administration, trades, and mining. The Aurora College campus in Yellowknife is the territory's main post-secondary campus, offering university and college transfer courses.

3.4.3.2.3 Industrial Development

The NWT economy is heavily reliant on the mining industry for private investment and revenue generation (e.g., property taxes, taxes on production). Since its beginnings in the late 1990s, diamond mining continues to be the most important economic activity in the territory, with oil and gas extraction and tourism also playing large economic roles. The value of diamond mining production peaked in 2004 when the combined activities of the Ekati and Diavik mines produced $2.1 billion in diamonds. The global recession in 2009 brought temporary shutdowns at the Diavik and Snap Lake mines, reducing diamond production levels in the territory. The value of production returned to peak levels in 2010, but declined to below $2 billion between 2011 and 2016, before recovering again in 2017. Overall, diamond production values have grown to nearly $2.1 billion in 2018, representing a boom to the territorial economy as increased production influences employment and government revenues. Oil and gas production values, while remaining relatively stable and representing around a fifth of total territorial mineral production (including oil and gas) until 2015, have declined sharply in recent years to represent only 1% of mineral resource production in 2018 (GNWT 2019a).

The economic effect of the closure of existing, operational diamond mines in the NWT may be offset in part by the development of new mining operations such as the Prairie Creek Mine in the Dehcho Region, or other projects without defined future timelines (e.g., the NICO mine) (Avalon 2019; NorZinc 2019). Each will create employment and contracting opportunities that may be accessible to those communities most affected by the closure of the Diavik and Gahcho Kué mines. The Ekati mine is currently expected to continue to operate into the future (2035). In the South Slave Region, the development of the Taltson Hydroelectric Project is also expected to contribute to local economic activity (GNWT no date). The schedule for the existing and reasonably foreseeable mining developments is depicted in Figure 3-15.



(a) The Prairie Creek project is scheduled for construction between 2020 and 2021

Figure 3-15: Operational Mine Life for NWT Mines

The development and, subsequently, production timelines for the approved and likely projects presented in Figure 3-15 may change as developers evaluate construction feasibility in future years.

3.4.3.2.4 Local Business

There are a number of businesses associated with the K'atl'odeeche First Nation, most of which are based out of Hay River and the Hay River Reserve. Construction and contracting services are most prevalent, although other services such as transportation and forest firefighting are also available (Table 3-25).

Table 3-25: Local Businesses with Services Supporting Mining - K'atl'odeeche First Nation

Business	Services Offered	Location
Naegha Zhia Inc.	Real estate management and construction	Hay River
Evergreen Forestry	Forest firefighting	Hay River
Denedeh Helicopters	Aerial services	Yellowknife
Manny's Company	Construction	Hay River Reserve
Les Norn Contracting	General contracting, gravel delivery, heavy equipment operations, sewage removal	Hay River Reserve
Sunrise Contracting	General contracting, building construction	Hay River Reserve

Source: K'atl'odeeche 2009a,b.

The Deninu Kue Development Corporation is the economic development arm of the Deninu Kue First Nation. The Corporation supplies both goods (e.g., building construction materials, containers and packing material, lumber/plywood) and services (e.g., bus transportation, fence construction, rental and leasing of commercial space, taxi services) in the South Slave Region. The Hay River Metis Government Council (5323 NWT Ltd.) offers a number of services ranging from hospitality to transportation (water, bussing, trucking), construction, and consulting, and others (GNWTITI No date (a)).

The Densoline Corporation is based out of Yellowknife, offering a number of services that include transportation, material and equipment provision, and site maintenance (Table 3-26).

Table 3-26: Local Businesses with Services Supporting Mining Activities - Denesoline Corporation

Business	Services Offered	Location
Denesoline Corporation		
Denesoline - Acasta Heliflight	Helicopter services	Yellowknife
Denesoline - Arctic West Transport	Open deck, bulk transportation, and heavy haul applications	Yellowknife
Dene-Dyno Nobel Explosives	Explosives and blasting materials	Yellowknife
Denesoline Real Estate	Real estate management	Yellowknife
Denesoline - Air Tindi	Fixed-wing charter aviation	Yellowknife
Denesoline - Petro-Canada Lubricants	Equipment lubricants	Yellowknife
Dene - Gilbert NWT Contracting Ltd.	Mine site maintenance	Yellowknife
DTR First Nation's Construction Company	Ice road services	Yellowknife
Dene-Ryfan Limited	Mechatronics	Yellowknife
Denesoline Fire Fighting	Firefighting, forest fire management, community protection and hazard reduction, equipment and facility maintenance, and facility maintenance	Łutsel K'e
Dene - Aurora Manufacturing	Manufacturing and metalwork, equipment maintenance, repair and testing, fuel storage, handling, and dispensing	Hay River
Dene - Tire North	Supplier of tires and tire installation for northern mines	Not applicable

Source: Det'on Cho Companies no date; Denesoline Corporation 2018a,b.

Businesses associated with the Yellowknives Dene First Nation that could service the mining industry are based out of Yellowknife, and largely associated with the Det'on Cho Corporation. Services offered are varied, from housekeeping and camp services, to construction and site maintenance (Table 3-27).

Table 3-27: Local Businesses with Services Supporting Mining - Yellowknives Dene First Nation

Business	Services Offered	Location
Bouwa Whee	Management, housekeeping, and janitorial services with major diamond mine contracts	Yellowknife, NWT
Det'on Cho Construction Services	Construction	Yellowknife, NWT
Det'on Cho DT Electric	Construction and operation services such as wiring of new facilities, renovation and additions, preventative and restorative maintenance programs	Yellowknife, NWT
Det'on Cho Environmental	Environmental consulting	Yellowknife, NWT
Det'on Cho Logistics	Expedited logistics, freight forwarding, freight management and inventory control, and supply chain logistics	Yellowknife, NWT
Det'on Cho Landtran Transport	Transportation services	Yellowknife, NWT
Det'on Cho Medic North	Health care personnel, medical equipment, and supplies and emergency vehicles for northern employers and workers	Yellowknife, NWT
Det'on Cho Nahanni Construction	Pipe and mechanical installations, and mine site services including earthworks	Yellowknife, NWT
Det'on Cho NUNA	Giant Mine site management, maintenance, and remedial improvements and demolition	Yellowknife, NWT
Det'on Cho Scarlet Security	Security services to mine sites, pipelines, roadways, and building	Yellowknife, NWT

Table 3-27: Local Businesses with Services Supporting Mining - Yellowknives Dene First Nation

Business	Services Offered	Location
Det'on Cho Summit Aviation LP	Passenger and freight transportation	Yellowknife, NWT
Diamond International Canada / Aboriginal Diamonds Group	Rough diamond appraisals	Yellowknife, NWT
Kete Whii Ltd.	Full-service provider specializing in developments of open-pit, underground mining, and civil infrastructures	Yellowknife, NWT
We Le Dai Corp	Dietary, housekeeping, laundry, translation, and shuttle services	Yellowknife, NWT

Source: GNWTITI 2019a.

There are a number of local businesses in the LSA that offer services that could be of value to the construction and operation of a mine, including companies operating out of Enterprise, Łutsel K'e, and Fort Providence (Table 3-28).

Table 3-28: Local Businesses with Services Supporting Mining in Enterprise, Łutsel K'e, and Fort Providence

Business	Services Offered	Location
Lisa's Place	Accommodations, meals, and catering	Enterprise
Blackstone Homes	Building construction and maintenance	Enterprise
Key Contracting	Trucking transportation, general contracting, remediation services, road maintenance, and wrecking/demolition	Enterprise
Cliff's Custom Cutting	Forestry, landscaping/agricultural, material management, piling contractor, rental/leasing, snow removal, storage/warehouse, and wrecking/demolition	Enterprise
Tammy's Administrative Services	Computer services, graphic design, financial services, research services, word/data processing, and secretarial/clerical	Enterprise
Eric's Bobcat Service	Freight/cargo/moving services, earthmoving/excavating/bulldozing	Enterprise
Floyd's General Contracting	Road maintenance, equipment and vehicle rental and leasing, road construction, and airport/runway construction	Łutsel K'e
LK-RCS Resource Services Ltd.	Mining construction and contracting, remediation services, and technical services	Łutsel K'e
Northern Medical Travel	Road transportation	Fort Providence
Built Right Construction	Construction, general contracting	Fort Providence
Steadyflow Plumbing Services	General contracting	Fort Providence
The North West Company LP	Equipment	Fort Providence
Big River Service Centre Limited Partner Big River Service Centre LP	Catering	Fort Providence
Cherdon Enterprises	Boarding home, general contracting, road transportation and maintenance, equipment rental and leasing	Fort Providence
Digga Enterprises	Construction, janitorial, property management, real estate development, vehicle rental, leasing, repair, road maintenance	Fort Providence
Snowshoe Inn NWT Ltd.	Construction equipment and supplies	Fort Providence

Source: GNWTITI 2019a.

3.4.3.2.5 Traditional Economy

With the exception of Dettah and the Hay River Reserve, participation in traditional activities increased in all LSA communities in in the decade between 2004 and 2014. More recent comparable data are not publicly available. However, during the same period, these communities experienced a reduction in the number of households where 75% or more of the meat and fish they consumed came from traditional harvesting activities (Table 3-29). This could suggest that the nature of traditional activities changed over the decade with a decreased focus on hunting and fishing, that hunting and fishing activities yielded lower harvests for consumption, and/or that an increasing portion of meat and fish harvested was instead sold (GNWTBS 2015a,b). Recent bans on caribou harvesting in the NWT have also likely played a role in reduced participation in traditional hunting activities.

In 2014, the number of households where traditional harvesting was the main source of meat and fish was lowest was in Yellowknife (4%), Hay River (8%), and Fort Smith (9%), which are the communities with the highest participation in the wage economy and with the greatest access to consumer goods. Conversely, the number of households consuming primarily harvested meat and fish was highest in those communities where participation in the wage economy is less pronounced. In most of these communities, around a third of households consumed primarily traditionally harvested meat and fish. In Łutsel K'e, over half of all households relied on traditional harvesting to supply most of the meat and fish that they consume (Table 3-29).

Table 3-29: Participation in Traditional Economic Activities (Percentage) in Communities

Community	Participation in Traditional Activities (2004)[(a)]	Participation in Traditional Activities (2014)[(a)]	Consumption of Harvested Meat or Fish (2004)[(b)]	Consumption of Harvested Meat or Fish (2014)[(b)]	Change in Participation (2004-2014)	Change in Consumption (2004-2014)
Enterprise	28.1	46.2	-	-	64.1	n/a
Fort Providence	44.3	54.0	38.9	28.5	22.0	-26.7
Fort Resolution	53.3	62.2	43.6	32.4	16.8	-25.6
Fort Smith	33.3	41.2	10.9	9.4	23.9	-13.9
Hay River	26.4	48.0	8.5	7.5	81.8	-12.4
Hay River Reserve	37.7	37.7	21.6	33.4	0.0	55.0
Dettah	43.3	37.1	30.7	39.3	-14.4	27.9
Łutsel K'e	73.6	79.8	68.1	52.5	8.4	-23.0
Yellowknife	32.3	37.1	5.0	3.7	14.8	-27.5
NWT	36.7	44.7	17.5	13.8	21.7	-20.9

Source: GNWTBS 2015a,b.

- = indicates zero or too small to be expressed.

n/a = not applicable.

(a) Hunted or fished in the previous year.

(b) Households where 75% or more of the meat or fish eaten in the house was obtained through hunting or fishing.

3.4.3.2.6 Economic Development Planning

The GNWT Department of Industry, Tourism and Investment maintains the community economic development Support for Entrepreneurs and Economic Development initiative that seeks to provide funding to organizations pursuing regional economic development activities. The initiative invests in planning, infrastructure, media, and events promoting economic activities, and is open to NWT Indigenous organizations, NWT-based businesses, and municipalities. The initiative provides a maximum of $25,000 for the following (GNWTITI 2020a):

- Feasibility studies, strategic plans, evaluations and planning costs that investigate economic opportunities and build on existing community resources.
- The purchase or further development of physical infrastructure (i.e., capital assets) where the lack of infrastructure constrains business development.
- Improving access to business information.
- Host and promote community-based festivals and events that highlight NWT products or talent and are key to economic development for the community.

The GNWT Department of Industry, Tourism and Investment also maintains a network of Community Development Officers to promote economic activity and business development in the NWT. Community Development Officers are charged with supporting community economic development through (GNWTITI 2020b):

- New business development and existing business expansion.
- Access to field specialists, such as regional tourism officers, petroleum officers, and business development officers.
- Mentoring, funding and business network development.
- Business training, awareness and counseling.
- Sourcing information and market data.
- Development of opportunities in a wide range of economic sectors.

The City of Yellowknife's Economic Development Strategy for 2014 to 2019 identifies priority areas for economic development (City of Yellowknife 2014). The City has a goal of increasing its population to increase per capita federal transfer funding as a means of creating income to spend on economic development initiatives. The City currently operates as a key supplier of goods and services to other communities and industries in the NWT and the western regions of Nunavut. The Economic Development Strategy recognizes that continuing this role will be integral in building other areas of the economy.

The Strategy identifies tourism, and in particular that related to Indigenous culture and the natural environment, as a key current and future economic driver for the City and the surrounding region. Linked to this, the Strategy seeks to develop the local arts and culture industry, and to improve the condition of the downtown core to act as a draw for tourists from southern locales. Strengthening the local capture of employment, contracting, and other business opportunities associated with territorial mining activities is another priority outlined by the strategy, along with diversification away from dependency on mining into areas of environmental and alternative energy technology (e.g., hydro power, biomass, solar, and geothermal energy). Finally, stakeholder input into the Strategy indicated that the expansion of post-secondary education services to retain youth and attract workers is of key importance to the overall economic health of the City and the NWT (City of Yellowknife 2014).

The Town of Hay River has an Economic Development Division that focuses on developing the town's role as a transportation, shipping, and freight hub for the South Slave Region, and the NWT more generally (Town of Hay River 2020). In addition of being a hub for daily commercial flights and a staging area for charter air travel, the community is also the northernmost railhead in Canada, connecting to Edmonton via the RailLink route (Town of Hay River 2020). Hay River serves as a supply hub for mining operations, both historically (e.g., the historical Pine Point mine) and for operating mines in the North Slave Region. Maintaining this role as a supplier of goods ad services to the mining industry continues to be a priority. Commercial fishing is another economic development priority for Hay River. In 2019, the GNWT announced funding for the construction of a new fish processing plant in Hay River to replace the existing plant, which currently only receives fish that is transported to Winnipeg for processing (Cabin Radio 2019; GNWTITI 2019b).

The Economic Development Strategy in place for the Town of Fort Smith spans the period of 2018 to 2022 (Town of Fort Smith 2018). The Strategy lays out a vision of the town working with partners to enhance quality of life by respecting values, traditions, and healthy lifestyles, and centres around the concepts of business development, attracting residents, and developing tourism potential. The Strategy contains detailed implementation plans to achieve the town's targeted economic development goals (Town of Fort Smith 2018).

The Yellowknives Dene are in the process of developing an Economic Development Strategy, and a joint strategy with the City of Yellowknife to capture mutual economic benefits associated with each community's individual economic development planning. Ongoing economic development for the Yellowknives Dene is addressed through the Yellowknife Dene First Nation Chamber of Commerce, and the Deton'Cho Corporation (YKDFN 2020).

3.4.3.3 Health and Well-being

The physical and mental health of an individual is influenced by a myriad of social determinants of health (Government of Canada 2019c), including:

- Income and social status
- Employment and working conditions
- Education and literacy
- Childhood experiences
- Physical environments/housing
- Social supports and coping skills
- Healthy behaviours
- Access to health services
- Biology and genetics
- Gender
- Culture
- Race/Racism

Many of the social determinants of health have been discussed based on publicly available statistical data in other sections (e.g., income, employment, and education presented above, while housing and access to services are presented below). While useful to understand high-level health conditions in the territory, statistical data are complemented by contextual, community-specific information that addresses the social determinants of health in greater detail. The Draft EA Initiation Guidelines for Developers of Major Projects (MVEIRB 2018) require a discussion of health rates, addictions, and crime rates. Information on these topics has been summarized and provided below based on publicly available statistics and will be expanded on in the Developer's Assessment Report following further engagement with communities.

3.4.3.3.1 Healthcare System Overview

The Northwest Territories Health and Social Services Authority was created in 2016 when the six operating health authorities were merged into the territorial body. In the South Slave Region, the Hay River Health and Social Services Authority is outside the Northwest Territories Health and Social Services Authority. The Northwest Territories Health and Social Services Authority and Hay River Health and Social Services Authority, along with the Tlicho Community Service Agency, operate as an integrated territorial health and social services system with a shared governance structure (GNWTHSS 2018). The Authorities provide the following services:

- diagnostic and curative services
- mental health and addictions services
- promotion and prevention services
- long-term care, supported living, palliative care and home and community care
- child and family services
- in-patient services
- critical care services
- diagnostic and therapeutic services
- rehabilitation services
- specialist services

Other diagnostic and specialized treatment services are provided outside of the NWT through contractual arrangements with Alberta Health Services (GNWTHSS 2018).

3.4.3.3.2 Health Rates

The prevalence of chronic conditions in the NWT is not substantially different from Canada. The rate of hypertension in the territory amongst the population aged 12 and over was 13.1% in 2014, while the diabetes rate was 7.4% (compared to 17.7% and 6.7% nationally) (GNWTBS 2014). The leading causes of death in the NWT include neoplasms typically associated with cancer (death rate[4] of 14.43) and diseases of the circulatory system, many linked to hypertension and diabetes (death rate of 11.89). Diseases of the respiratory system and accidental death (including suicide) are other high-contributing causes of death (death rates of 5.21 and 5.72, respectively) (GNWTBS 2019d).

Overall, the rate of sexually transmitted infections (STIs)[5] in the NWT population is approximately six times higher than the national average. Sexually transmitted infections are most prevalent amongst the youth demographic, with nearly 6% of males and 11% of females between the ages of 15 and 24 having at least one STI (GNWTHSS 2019a). Chlamydia remains the most prevalent STI in the territory, with an infection rate (3,653) approximately eleven times higher than the national average (334). Rates of gonorrhea have climbed in recent years, with the territorial rate (1,051) measuring nearly 17 times the national rate (65) (Health Canada 2016).

[4] The death rate is calculated as the number of deaths per 10,000, averaged over the three-year period of 2016 to 2018.
[5] The STI rate measures the number of people affected by an STI per 100,000.

3.4.3.3.3 Substance Use and Addictions

Addictions can affect both the physical and mental health of individuals, and the well-being of families and communities. They can also lead to cascading effects on other determinants of health, affecting the ability to maintain employment, access stable incomes, or connect with social and institutional support networks.

Around a third (33%) of the NWT population aged 15 and over smoke tobacco regularly. Males have a higher rate of smoking (36%) than females (31%). Those aged 24 to 39 had the highest rate of smoking (41%), while those 15 to 24 had the lowest (29%) (GNWTHSS 2019b). More than one quarter (26%) of the NWT population over the age of 15 has used cannabis in the past 12 months. Use of cannabis is highest amongst the population aged 15 to 24 (36%), and more prevalent amongst males. Of those who used cannabis in the past year, the majority use it daily or almost daily (GNWTHSS 2019c). Nearly half of the NWT male population over the age of 15 (47%) and over one third of females (39%) are considered to be heavy drinkers[6]. Overall, 43% of the NWT population over the age of 15 drink heavily. Heavy drinking rates are relatively consistent across age groups between 15 and 60, but are highest (47%) amongst those aged 25 to 39 (GNWTHSS 2019d). The use of crack/cocaine in the NWT is high (11% of the population aged 15 and above) relative to the national rate (7%), and is more prevalent amongst males (12%) than females (9%) (GNWTHSS 2019e).

Nearly half of all mental health hospitalizations in the NWT are due to substance abuse, with 86% of substance abuse-related hospitalizations being associated with alcohol. At the national level, alcohol accounts for 53% of substance abuse-related hospitalizations. Hospitalizations due to cannabis or cocaine use are similar to those nationally, while hospitalizations due to use of opioids, other controlled stimulants and depressants, or multiple drug interactions are lower (GNWTHSS 2019f). Around 75% of those who enter residential addiction treatment in the NWT complete treatment (GNWTHSS 2019f).

3.4.3.3.4 Crime Rates

The crime rate is the number of police-reported offences per 1,000 people in a community. The rate of violent and property crimes in the NWT is high (83.2 and 198.0, respectively). While lower than those of the territory, the crime rates in Yellowknife are still high (45.3 [violent crimes] and 146.5 [property crimes]). With the exception of Fort Smith, violent crime rates are higher in the smaller communities, with the rate in Fort Providence (249.4) tripling that of the territory. Property crime rates are similarly much higher in the South Slave communities, with the exception of Łutsel K'e, than in the territory overall. The highest rate of property crime is experienced in Fort Resolution, where the rate is over three times that of the territory (Table 3-30).

[6] The NWT Department of Health and Social Services defines heavy drinking as consuming four to five or more alcoholic beverages in a single sitting or occasion at least once a month, within the past 12 months.

Table 3-30: Criminal Activity in Communities

Community	Police Reported Crimes (2018)	Violent Crime Rate[(a)] (2017)	Property Crime Rate[(a)] (2017)
Enterprise	-	-	-
Fort Providence	615	249.4	355.8
Fort Resolution	358	159.8	457.6
Fort Smith	787	63.6	207.7
Hay River	1,592	94.0	143.0
Hay River Reserve	-	-	-
Dettah	-	-	-
Łutsel K'e	93	130.3	97.0
Yellowknife	6,330	45.3	146.5
NWT	20,353	83.2	198.0
Canada	1,958,023[(b)]	11.0	32.5

Source: GNWTBS 2018. Statistics Canada 2018.
- = data not available
(a) Crime rate is the number of police-reported offences per 1,000 people in a community.
(b) 2017.

3.4.3.3.5 Healthcare and Protective and Services

Healthcare services are available in most LSA communities. The Stanton Territorial Hospital in Yellowknife is a full medical service facility and operates as a hub for healthcare services in the region. Treatment for chronic and acute care is available through health centres in Fort Providence, Fort Resolution, Fort Smith, Hay River, and Łutsel K'e. Those needing care in Enterprise and Dettah are referred for treatment at healthcare facilities in Hay River and Yellowknife, respectively. The Hay River Reserve has a wellness centre, but residents are referred to healthcare services in Hay River for diagnosis and treatment of some conditions (GNWT 2013b, 2019b). Protective and emergency services in the LSA communities include fire and police. With the exception of Dettah, all LSA communities have a fire hall, and all but Dettah, the Hay River Reserve, and Enterprise have an RCMP detachment for the provision of protective services (City of Yellowknife 2019; GNWT 2013b, 2019b).

3.4.3.3.6 Recreational Services

Recreational services are present in all LSA communities. Each community has a community hall and gymnasium (10 in the Yellowknife). Other recreational facilities are present in the larger LSA communities, such as arenas, curling rinks, and swimming pools (GNWT 2013b; GNWT-ECE 2019; Aurora College 2020; South Slave Divisional Educational Council 2020).

3.4.3.4 Infrastructure and Housing

3.4.3.4.1 Physical Infrastructure

The LSA communities use a combination of hydroelectric connection and diesel generators for power. The Snare Hydro System, based from the Snare River, provides power to Yellowknife and Dettah (NTPC 2014). Additional power for Yellowknife is provided by the Bluefish Hydro Transmission Line, based from the Yellowknife River (NTPC 2014). Between Fort Smith, Hay River, Hay River Reserve, Fort Resolution, and Enterprise, is the Taltson Hydro Transmission Line (NTCP 2014). These hydroelectric transmission lines are owned by the Northwest Territories Power Corporation.

Drinking water is sourced from nearby rivers and treated with conventional Class II water treatment facilities (Fort Providence, Fort Resolution, Fort Smith, and Hay River) or membrane filtration and chlorination (Łutsel K'e, Yellowknife). Water is then piped to buildings for use.

All LSA communities are accessible through all-season access roads, and most have airports. Those communities on Great Slave Lake also have access to marine re-supply facilities (GNWT 2013b, 2015, 2016a). Most LSA communities are accessible through the territorial highway system year-round, with the exception of Łutsel K'e.

3.4.3.4.2 Housing

Housing in the NWT is split roughly in half between owned (54%) and rented (46%) property. With the exception of Dettah, where the ownership rate is 44%, the majority of housing in Yellowknife and the smaller LSA communities is owned. Ownership rates are highest in Hay River (65%), Enterprise (67%), and the Hay River Reserve (82%). Roughly a fifth of all housing in the NWT, Yellowknife, Fort Smith, and Enterprise is in need of repair, while in the remaining smaller communities, the core need[7] rate increases to between 25% (Fort Resolution) and 40% (Hay River Reserve). The exception is in Hay River, where 8% of housing needs repair. Hay River also has the lowest portion of households with six or more people (3%) in the LSA. This is low relative to the territory, where around 6% of households have more than six people. More than 10% of households in Enterprise and the Hay River Reserve have over six people (Table 3-31). Houses with six or more people may not have a suitable number of bedrooms for the residents of the household, and may qualify as being of core need.

Table 3-31: Housing Conditions in Communities

Community	Total Housing (2016)	Owned (2016)		Rented (2016)		Housing in Core Need (%) (2014)	Households of 6+ (%) (2014)
		#	%	#	%		
Enterprise	45	30	66.7	15	33.3	20.7	10.3
Fort Providence	250	125	50.0	115	46.0	31.3	6.7
Fort Resolution	190	110	57.9	80	42.1	24.9	8.0
Fort Smith	955	560	58.6	395	41.4	17.3	5.6
Hay River	1,385	905	65.3	480	34.7	8.3	3.2
Hay River Reserve	85	70	82.4	15	17.6	39.8	11.6
Dettah	75	35	46.7	40	53.3	37.2	6.7
Łutsel K'e	110	60	54.5	50	45.5	29.8	7.8
Yellowknife	7,130	4,010	56.2	3,120	43.8	17.9	4.5
NWT	14,980	8,045	53.7	6,920	46.2	19.8	6.1

Note: the sum of rented and owned houses may not equal total housing in a community due to Statistics Canada rounding conventions.
Source: GNWTBS 2018.

[7] "A household is said to be in 'core housing need' if its housing falls below at least one of the adequacy, affordability, or suitability standards and it would have to spend 30% or more of its total before-tax income to pay the median rent of alternative local housing that is acceptable. Adequate housing is reported by their residents as not requiring any major repairs. Affordable housing has shelter costs equal to less than 30% of total before-tax household income. Suitable housing has enough bedrooms for the size and composition of resident households according to National Occupancy Standard (NOS) requirements". (Statistics Canada 2017k).

3.4.4 Non-Traditional Land and Resource Use

The communities of Enterprise, Fort Providence, Fort Resolution, Fort Smith, Hay River and Hay River Reserve are within the South Slave Administrative Region. The communities of Dettah, Łutsel K'e, and Yellowknife are within the North Slave Administrative Region. While no regional Land Use Plan exists for either region (GNWT 2016b), the Dehcho Land Use Plan (Dehcho Land Use Planning Committee 2006) outlines land use priorities in the vicinity of Hay River, the Hay River Reserve, and Enterprise, including conservation and special management zones, protected areas, and proposed industrial use areas.

Numerous outfitters and tour operators operate around Great Slave Lake with most companies are based in the City of Yellowknife (GNWTITI No date [b]). Between 2014 and 2019, 30 tourism operator licences were issued in the South Slave Region and over 80 in the North Slave Region (GNWTITI No date [c]). Some of the recreational activities offered include guided hunting, angling, boat tours, wildlife viewing, and northern lights viewing. Game species commonly hunted in the area include wood bison, black bear, wolf, and moose. Snowshoe hare, beaver, porcupine, wolverine, ermine, mink, marten, and lynx are also present in the area.

Numerous parks and campgrounds are also found in many of the LSA communities, with the exception of the Hay River Reserve and Łutsel K'e. Territorial parks in the vicinity of the communities include Lady Evelyn Falls Territorial Park near Enterprise, and the Little Buffalo River Crossing Territorial Park near Fort Resolution. Visitor centres are present in Yellowknife, Fort Smith, and Hay River (GNWT 2013b).

Commercial fishing is centred on Great Slave Lake with hubs in Yellowknife and Hay River (GNWTITI No date [d]). While commercial fishing production in the NWT has been in decline for several years with production less than half of historical levels, recent efforts have been made to reverse this trend with the release of the GNWT's Strategy for Revitalizing the Great Slave Lake Commercial Fishery (GNWT 2017b). The revitalization will seek to increase production, fish processing in the NWT, grow the NWT market and access export markets.

Signature Page

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https://golderassociates.sharepoint.com/sites/111329/project files/5 technical work/001_mveirb_ea initiation package/existing environment/existing environment/volume 3 - description of existing environment.docx

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APPENDIX A

2015-2019 Ambient Background Summary

Table A1: 2015-2019 Summary of Ambient CO Concentrations at Fort Smith

Location	Avg. Period	Parameter	2015	2016	2017	2018	2019	Average
CO								
Fort Smith	1-hr	Max Conc. [µg/m³]	3,029.1	2,036.2	4,812.2	1,683.5	2,169.1	2,746.0
		90th percentile Conc. [µg/m³]	239.4	323.0	367.6	406.6	363.0	339.9
		Average Conc. [µg/m³]	69.0	162.8	185.7	201.4	276.2	179.0
		Median Conc. [µg/m³]	11.5	151.2	166.1	154.6	280.6	152.8
		AAQS [µg/m³]	15,000	15,000	15,000	15,000	15,000	15,000
		#> AAQS	0	0	0	0	0	0
	8-hr	Max Conc. [µg/m³]	1,338.9	977.9	2,254.1	793.6	1,091.0	1291.1
		90th percentile Conc. [µg/m³]	236.9	322.1	366.5	410.2	372.9	341.7
		Average Conc. [µg/m³]	69.2	162.8	185.7	201.3	276.2	895.3
		Median Conc. [µg/m³]	20.2	155.6	168.5	158.6	282.6	157.1
		AAQS [µg/m³]	6,000	6,000	6,000	6,000	6,000	6,000
		#> AAQS	0	0	0	0	0	0

= number; AAQS = Government of the North-West Territories' Ambient Air Quality Standards; Avg. = averaging; CO = carbon monoxide; Conc. = concentration; hr = hour; µg/m³ = micrograms per cubic meter.

Table A2: 2015-2019 Summary of Ambient CO Concentrations at Yellowknife

Location	Avg. Period	Parameter	2015	2016	2017	2018	2019	Average
CO								
Yellowknife	1-hr	Max Conc. [µg/m³]	3,623.5	2,060.3	4,041.5	1,219.7	3,375.0	2,864.0
		90th percentile Conc. [µg/m³]	792.5	817.7	285.2	255.4	261.1	482.4
		Average Conc. [µg/m³]	390.9	422.4	218.2	187.1	194.1	282.5
		Median Conc. [µg/m³]	255.4	215.3	189.0	172.9	171.8	200.9
		AAQS [µg/m³]	15,000	15,000	15,000	15,000	15,000	15,000
		#> AAQS	0	0	0	0	0	0
	8-hr	Max Conc. [µg/m³]	1,961.8	1,245.7	2,282.3	633.6	3,020.7	1,828.8
		90th percentile Conc. [µg/m³]	800.3	816.2	284.9	257.6	261.0	484.0
		Average Conc. [µg/m³]	387.7	422.1	218.2	187.0	194.2	281.8
		Median Conc. [µg/m³]	261.8	214.6	191.3	176.0	176.9	204.1
		AAQS [µg/m³]	6,000	6,000	6,000	6,000	6,000	6,000
		#> AAQS	0	0	0	0	0	0

= number; AAQS = Government of the North-West Territories' Ambient Air Quality Standards; Avg. = averaging; CO = carbon monoxide; Conc. = concentration; hr = hour; µg/m³ = micrograms per cubic meter.

Table A3: 2015-2019 Summary of Ambient NO_2 Concentrations at Fort Smith

Location	Avg. Period	Parameter	2015	2016	2017	2018	2019	Average
NO_2								
Fort Smith	1-hr	Max Conc. [µg/m³]	62.6	62.1	54.2	78.8	63.0	64.1
		90th percentile Conc. [µg/m³]	7.9	3.4	7.0	7.5	8.5	6.8
		Average Conc. [µg/m³]	3.5	1.4	2.4	3.5	3.8	2.9
		Median Conc. [µg/m³]	1.9	0.0	0.0	1.9	1.7	1.1
		AAQS [µg/m³]	400	400	400	400	400	400
		#> AAQS	0	0	0	0	0	0
	24-hr	Max Conc. [µg/m³]	19.0	21.1	20.2	40.9	29.6	26.2
		90th percentile Conc. [µg/m³]	6.8	3.3	5.5	6.3	7.9	5.9
		Average Conc. [µg/m³]	3.5	1.3	2.5	3.5	3.8	2.9
		Median Conc. [µg/m³]	2.8	0.4	1.6	3.0	2.4	2.0
		AAQS [µg/m³]	200	200	200	200	200	200
		#> AAQS	0	0	0	0	0	0
	Annual	Average Conc. [µg/m³]	3.5	1.4	2.4	3.5	3.8	2.9
		AAQS [µg/m³]	60	60	60	60	60	60

= number; AAQS = Government of the North-West Territories' Ambient Air Quality Standards; Avg. = averaging; NO_2 = nitrogen dioxide; Conc. = concentration; hr = hour; µg/m³ = micrograms per cubic meter.

Table A4: 2015-2019 Summary of Ambient NO_2 Concentrations at Yellowknife

Location	Avg. Period	Parameter	2015	2016	2017	2018	2019	Average
NO_2								
Yellowknife	1-hr	Max Conc. [µg/m³]	64.3	62.4	68.8	75.4	58.1	65.8
		90th percentile Conc. [µg/m³]	14.1	10.5	17.3	15.2	7.9	13.0
		Average Conc. [µg/m³]	5.7	3.6	6.6	5.4	2.4	4.7
		Median Conc. [µg/m³]	3.0	0.9	3.2	2.3	0.0	1.9
		AAQS [µg/m³]	400	400	400	400	400	400
		#> AAQS	0	0	0	0	0	0
	24-hr	Max Conc. [µg/m³]	31.7	33.7	33.6	29.7	28.8	31.5
		90th percentile Conc. [µg/m³]	11.9	10.0	16.9	14.7	9.5	12.6
		Average Conc. [µg/m³]	5.7	3.6	6.6	5.4	2.4	4.7
		Median Conc. [µg/m³]	4.5	1.5	4.1	3.1	0.3	2.7
		AAQS [µg/m³]	200	200	200	200	200	200
		#> AAQS	0	0	0	0	0	0
	Annual	Average Conc. [µg/m³]	5.7	3.6	6.6	5.4	2.4	4.7
		AAQS [µg/m³]	60	60	60	60	60	60

= number; AAQS = Government of the North-West Territories' Ambient Air Quality Standards; Avg. = averaging; NO_2 = nitrogen dioxide; Conc. = concentration; hr = hour; µg/m³ = micrograms per cubic meter.

Table A5: 2015-2019 Summary of Ambient O3 Concentrations at Fort Smith and Yellowknife

Location	Avg. Period	Parameter	2015	2016	2017	2018	2019	Average
O_3								
Fort Smith	8-hr Rolling	Max Conc. [µg/m³]	110.5	90.4	113.1	92.4	107.2	102.7
		90th percentile Conc. [µg/m³]	79.1	74.2	75.3	68.3	74.9	74.4
		Average Conc. [µg/m³]	61.0	54.9	58.4	51.9	54.0	56.0
		Median Conc. [µg/m³]	59.5	54.6	57.9	51.2	53.4	55.3
		AAQS [µg/m³]	126	126	126	126	126	126
		#> AAQS	0	0	0	0	0	0
Yellowknife	8-hr Rolling	Max Conc. [µg/m³]	97.8	90.3	90.7	104.9	99.7	96.7
		90th percentile Conc. [µg/m³]	74.4	77.4	72.6	76.9	74.3	75.1
		Average Conc. [µg/m³]	56.2	57.3	54.8	58.0	58.2	56.9
		Median Conc. [µg/m³]	55.8	56.8	55.4	56.9	58.1	56.6
		AAQS [µg/m³]	126	126	126	126	126	126
		#> AAQS	0	0	0	0	0	0

= number; AAQS = Government of the North-West Territories' Ambient Air Quality Standards; Avg. = averaging; O_3 = ozone; Conc. = concentration; hr = hour; µg/m³ = micrograms per cubic meter.

Table A6: 2015-2019 Summary of Ambient PM2.5 Concentrations at Fort Smith

Location	Avg. Period	Parameter	2015	2016	2017	2018	2019	Average
$PM_{2.5}$								
Fort Smith	24-hr	Max Conc. [µg/m³]	119.1	44.1	171.3	50.8	65.3	90.1
		90th percentile Conc. [µg/m³]	9.8	9.7	11.2	11.4	11.9	10.8
		Average Conc. [µg/m³]	7.2	5.6	7.3	8.0	7.2	7.1
		Median Conc. [µg/m³]	4.7	4.4	5.7	7.0	5.6	5.5
		AAQS [µg/m³]	28	28	28	28	28	28
		#> AAQS	12	2	3	1	7	5
	Annual	Average Conc. [µg/m³]	7.2	5.6	7.4	8.0	7.2	7.1
		AAQS [µg/m³]	10	10	10	10	10	10

= number; AAQS = Government of the North-West Territories' Ambient Air Quality Standards; Avg. = averaging; $PM_{2.5}$ = fine particulate matter; Conc. = concentration; hr = hour; $\mu g/m^3$ = micrograms per cubic meter.

Table A7: 2015-2019 Summary of Ambient PM2.5 Concentrations at Yellowknife

Location	Avg. Period	Parameter	2015	2016	2017	2018	2019	Average
$PM_{2.5}$								
Yellowknife	24-hr	Max Conc. [µg/m³]	105.4	35.4	135.7	22.0	54.0	70.5
		90th percentile Conc. [µg/m³]	13.5	10.8	7.9	5.9	7.0	9.0
		Average Conc. [µg/m³]	8.7	7.8	4.5	2.9	4.4	5.7
		Median Conc. [µg/m³]	6.3	7.1	2.6	2.4	3.2	4.3
		AAQS [µg/m³]	28	28	28	28	28	28
		#> AAQS	9	2	5	0	5	4
	Annual	Average Conc. [µg/m³]	8.6	7.8	4.6	2.9	4.4	5.6
		AAQS [µg/m³]	10	10	10	10	10	10

= number; AAQS = Government of the North-West Territories' Ambient Air Quality Standards; Avg. = averaging; $PM_{2.5}$ = fine particulate matter; Conc. = concentration; hr = hour; $\mu g/m^3$ = micrograms per cubic meter.

Table A8: 2015-2019 Summary of Ambient SO2 Concentrations at Fort Smith

Location	Avg. Period	Parameter	2015	2016	2017	2018	2019	Average
SO_2								
Fort Smith	1-hr	Max Conc. [µg/m³]	7.6	3.9	5.5	2.4	282.1	60.3
		90th percentile Conc. [µg/m³]	1.8	1.6	1.8	1.8	1.0	1.6
		Average Conc. [µg/m³]	0.5	0.7	0.5	0.6	0.3	0.5
		Median Conc. [µg/m³]	0.0	0.8	0.0	0.0	0.0	0.2
		AAQS	450	450	450	450	450	450
		#> AAQS	0	0	0	0	0	0
	24-hr	Max Conc. [µg/m³]	4.6	2.1	2.6	2.1	19.0	6.1
		90th percentile Conc. [µg/m³]	1.7	1.3	1.7	1.5	1.0	1.4
		Average Conc. [µg/m³]	0.5	0.7	0.5	0.6	0.4	0.5
		Median Conc. [µg/m³]	0.0	0.8	0.2	0.3	0.0	0.3
		AAQS [µg/m³]	150	150	150	150	150	150
		#> AAQS	0	0	0	0	0	0
	Annual	Average Conc. [µg/m³]	0.5	0.7	0.5	0.6	0.3	0.5
		AAQS [µg/m³]	30	30	30	30	30	30

= number; AAQS = Government of the North-West Territories' Ambient Air Quality Standards; Avg. = averaging; SO_2 = sulphur dioxide; Conc. = concentration; hr = hour; µg/m³ = micrograms per cubic meter.

Table A9: 2015-2019 Summary of Ambient SO2 Concentrations at Yellowknife

Location	Avg. Period	Parameter	2015	2016	2017	2018	2019	Average
SO_2								
Yellowknife	1-hr	Max Conc. [µg/m³]	10.2	7.5	4.8	4.2	7.4	6.8
		90th percentile Conc. [µg/m³]	2.0	1.1	0.8	1.3	1.9	1.4
		Average Conc. [µg/m³]	0.8	0.5	0.4	0.6	0.9	0.6
		Median Conc. [µg/m³]	0.6	0.3	0.2	0.6	0.7	0.5
		AAQS	450	450	450	450	450	450
		#> AAQS	0	0	0	0	0	0
	24-hr	Max Conc. [µg/m³]	3.0	3.1	1.4	1.9	2.6	2.4
		90th percentile Conc. [µg/m³]	2.0	1.1	0.7	1.4	1.8	1.4
		Average Conc. [µg/m³]	0.8	0.5	0.4	0.6	0.9	0.6
		Median Conc. [µg/m³]	0.6	0.4	0.3	0.6	0.8	0.5
		AAQS	150	150	150	150	150	150
		#> AAQS	0	0	0	0	0	0
	Annual	Average Conc. [µg/m³]	0.8	0.5	0.4	0.6	0.9	0.6
		AAQS [µg/m³]	30	30	30	30	30	30

= number; AAQS = Government of the North-West Territories' Ambient Air Quality Standards; Avg. = averaging; SO_2 = sulphur dioxide; Conc. = concentration; hr = hour; µg/m³ = micrograms per cubic meter.

APPENDIX B

Water Quality Data Summary from Previous Studies

Table B1: Summary of Previous Water Quality Studies Conducted on or near the Project

Watercourse/Waterbody	Study[a]	Number of Stations	Number of Samples per Station	Sampling Year	Sampling Months	Additional Data Collected?
Birch Creek	Rescan 2012g	1	3[b]	2012	May, August, October	Sediment Quality (September), Benthic Invertebrates (August)
	Golder 2020	1	1	2020	October	-
Twin Creek	Beak 1980	2	1	1979	September	-
	EBA 2005a	3	1	2005	September	Stream Habitat Data
	Rescan 2012g	2	3[b]	2012	May, August, October	Sediment Quality (September), Benthic Invertebrates (August)
	Golder 2020	1	1	2020	October	-
Buffalo River	Beak 1980	2	1	1979	September	-
	EBA 2005a	4	1	2005	September	Stream Habitat Data
	Rescan 2012g	3	3[b]	2012	May, August, October	Sediment Quality (September), Benthic Invertebrates (August)
	Golder 2020	1	1	2020	October	-
Paulette Creek	Rescan 2012f	2	2	2012	May[c], August, October	Sediment Quality (September), Benthic Invertebrates (August)
	Golder 2020	1	1	2020	October	-
Little Buffalo River	Evans 1998	1	1	1996	September	Sediment Quality
	Golder 2020	1	1	2020	October	-
Polar Lake	Beak 1980	1	1	1979	September	-
Great Slave Lake	EBA 2005a	3	1	2005	September	-
	Rescan 2012g	5	1	2012	August	-
	Golder 2020	1	1	2020	October	-

a) An additional baseline study was conducted by EBA Engineering Consultants Ltd in 2006, in which water quality samples were collected for Buffalo River, Twin Creek and Great Slave Lake. These data were not available for use in this report; however, general water quality parameter concentrations were generally consistent with those provided in the EBA 2005 report (Tamerlane 2007).

b) One sample collected at each station per month.

c) One station, N-204-S1, was only sampled in May due to low water levels in August and October.

Table B2: Summary of Water Quality Data for Watercourses located on or near to the Project

Parameter	Units	Birch Creek[a]				Twin Creek[b]				Buffalo River[c]				Paulette Creek[d]				Little Buffalo River[e]
		Count	Min	Median	Max	Count	Min	Median	Max	Count	Min	Median	Max	Count	Min	Median	Max	
Conventional Parameters																		
Specific Conductivity	µS/cm	4	350	448.5	491	10	246	432.5	559	13	155	246	325	6	122	687	792	3,670
pH[f]	pH	4	8.2	8.4	8.4	9	7.9	8.1	8.4	12	8.0	8.1	8.2	6	7.4	8.2	8.4	8
Hardness	mg/L	4	8.3	223.5	277	11	179	271	415	14	60	129.5	226	6	60	355	430	1,600.0
Total Suspended Solids	mg/L	4	<1	<3	<3	7	<3	4.75	6.8	10	25	54	130	6	<3.0	12.9	39	3.3
Total Dissolved Solids	mg/L	4	234	276.5	326	7	221	312	338	10	109	167	214	6	96	502.5	523	2,670
Turbidity	NTU	4	0.23	0.32	0.56	7	0.16	0.31	2.2	10	25	43	130	6	0.6	1.7	4.0	2.7
Major Ions																		
Total Calcium	mg/L	4	56	72	80	7	51	77	86.8	10	19	34	43	6	13	85	94	440
Dissolved Calcium	mg/L	4	54	72	82	9	51	77	110	12	16	34	44	6	13	81	93	480
Bromide	mg/L	4	<0.01	<0.05	<0.25	7	<0.01	<0.01	<0.01	10	<0.050	<0.050	0.011	6	<0.25	<0.25	0.02	0.22
Chloride	mg/L	4	3.4	4.9	6.0	7	1.4	4.3	17	12	2.3	3.1	6.4	6	4.7	9.7	17	450
Fluoride	mg/L	4	0.14	0.14	0.20	9	0.15	0.22	0.26	12	0.12	0.15	0.18	6	0.14	0.22	0.24	0.76
Total Magnesium	mg/L	4	13	17	19	7	13	20	22	10	6	10	13	6	6.7	38	44	83
Dissolved Magnesium	mg/L	4	12	17	19	9	12	20	34	12	5	10	13	6	6.5	37	48	90
Total Potassium	mg/L	4	0.65	1.3	19	7	0.38	0.55	1.3	10	0.99	1.2	2.7	6	1.2	2.4	4.2	3.6
Dissolved Potassium	mg/L	4	0.63	1.2	19	9	0.36	0.56	1.2	12	0.60	0.98	1.2	6	1.1	2.3	4.1	3.6
Total Sodium	mg/L	4	4.8	6.4	19	7	3.9	5.5	11.0	10	3.8	6.7	9.7	6	2.1	13	17	290
Dissolved Sodium	mg/L	4	4.5	6.3	19	9	3.7	5.6	11	12	3.7	7.0	8.9	6	2.1	12	16	280
Sulfate	mg/L	4	0.66	2.4	19	7	0.96	8.5	54	10	13	28	63	6	5.4	55	160	1,200
Nutrients																		
Ammonia	mg-N/L	4	0.014	0.016	0.017	7	0.017	0.020	0.028	9	0.0090	0.014	0.035	6	0.017	0.024	0.048	0.019
Nitrate	mg-N/L	4	<0.0050	<0.0050	<0.010	7	<0.0050	0.052	0.066	12	0.0072	0.0082	0.0110	6	<0.025	<0.025	0.059	<0.010
Nitrite	mg-N/L	4	<0.0010	<0.0010	<0.010	7	<0.0010	<0.0050	<0.010	10	<0.0010	<0.0010	<0.01	6	<0.0050	<0.0050	0.0062	<0.010
Total Kjeldahl Nitrogen	mg-N/L	4	0.70	0.81	1.2	7	0.67	0.88	0.97	9	0.48	0.70	0.89	6	0.73	1.3	2.0	0.61
Total Nitrogen	mg-N/L	4	0.75	0.86	1.1	7	0.74	0.88	1.25	9	0.61	0.69	0.90	6	0.75	1.3	2.2	0.61
Dissolved Orthophosphate	mg-P/L	4	<0.0010	<0.0010	<0.0030	7	<0.0010	<0.0010	<0.0030	10	<0.0010	<0.0010	0.0034	6	0.0021	0.0050	0.0077	0.0031
Total Phosphorus	mg/L	4	0.0032	0.0038	0.0050	9	0.0028	0.0035	0.0090	12	0.028	0.056	0.13	6	0.010	0.031	0.059	0.0078
Total Organic Carbon	mg/L	4	19	21	25	9	19	22	42	9	14	15	18	6	18	33	45	14
Total Metals																		
Aluminum	mg/L	4	0.0038	0.00485	0.013	7	0.0030	0.0060	0.043	13	0.41	1.9	7.7	6	0.027	0.035	0.094	0.059
Arsenic	mg/L	4	0.00032	0.00036	0.00045	9	0.00036	0.00043	0.000574	10	0.00091	0.0012	0.0031	6	0.00045	0.00090	0.0017	0.00057
Barium	mg/L	4	0.044	0.046	0.060	10	0.021	0.028	0.29	12	0.042	0.059	0.12	6	0.014	0.027	0.03	0.022
Boron	mg/L	4	0.0070	0.0088	0.011	9	0.0055	0.0068	0.0084	10	0.017	0.027	0.030	6	0.014	0.026	0.034	0.39
Cadmium	mg/L	4	<0.000010	<0.000010	<0.000020	9	<0.000010	<0.000010	<0.0050	10	0.000029	0.000041	0.00043	6	<0.000010	<0.000010	0.000040	<0.000020
Chromium	mg/L	4	0.00013	0.00014	0.00015	9	0.00011	0.00013	0.00016	10	0.00080	0.0019	0.0084	6	0.00018	0.00020	0.00033	<0.0010
Copper	mg/L	4	0.00064	0.00064	0.00064	9	<0.00050	<0.00050	0.00029	10	0.0018	0.0028	0.0064	6	<0.00050	<0.00050	0.0010	0.001
Iron	mg/L	4	0.049	0.055	0.075	10	0.018	0.0455	0.12	13	0.89	2.9	6	6	0.11	0.19	0.22	0.290
Lead	mg/L	4	<0.000050	<0.000050	<0.00020	9	<0.000050	0.00015	0.00017	10	0.00053	0.0011	0.0034	6	<0.000050	<0.000050	0.00010	<0.00020
Manganese	mg/L	4	0.0046	0.013	0.017	7	0.0010	0.015	0.075	10	0.027	0.047	0.11	6	0.0092	0.07	0.19	0.020
Mercury	mg/L	4	<0.0000020	<0.000010	<0.000010	9	<0.0000020	<0.000010	<0.000010	10	<0.0000092	<0.000010	<0.000010	6	<0.0000020	<0.000010	<0.000010	<0.0000020
Nickel	mg/L	4	0.00010	0.00016	0.00020	7	0.00012	0.00017	0.0007	10	0.0018	0.0031	0.0074	6	0.0004	0.0005	0.0014	0.00074
Silver	mg/L	4	<0.000010	<0.000010	<0.00010	7	<0.000010	<0.000010	<0.00010	10	<0.00010	0.000016	0.000035	6	<0.000010	<0.000010	0.000024	<0.00010
Zinc	mg/L	4	<0.0030	<0.0030	<0.0030	9	<0.0030	<0.0030	0.0051	10	0.0037	0.0082	0.020	6	<0.0030	0.0037	0.0039	<0.0030

Table B2: Summary of Water Quality Data for Watercourses located on or near to the Project

Parameter	Units	Birch Creek[a]				Twin Creek[b]				Buffalo River[c]				Paulette Creek[d]				Little Buffalo River[e]
		Count	Min	Median	Max	Count	Min	Median	Max	Count	Min	Median	Max	Count	Min	Median	Max	
Dissolved Metals																		
Aluminum	mg/L	4	<0.0030	0.0046	0.0050	7	<0.0030	<0.0030	<0.0030	13	<0.0030	0.017	0.37	6	<0.0030	<0.0030	0.019	<0.0030
Arsenic	mg/L	4	0.00032	0.00036	0.00045	9	0.00035	0.00047	0.013	12	0.00029	0.00046	0.012	6	0.00043	0.00061	0.0011	0.00046
Barium	mg/L	4	0.042	0.044	0.061	10	0.021	0.025	0.0325	14	0.026	0.043	0.063	6	0.013	0.026	0.029	0.021
Boron	mg/L	4	0.0058	0.0084	0.0090	7	<0.0050	0.0065	0.0067[g]	12	<0.010	0.024	0.028	6	0.014	0.023	0.030	0.42
Cadmium	mg/L	4	<0.000010	<0.000010	<0.000020	9	<0.000010	<0.000020	<0.0050	12	<0.000010	<0.000010	0.000018	6	<0.000010	<0.000010	0.000010	<0.000020
Chromium	mg/L	4	<0.00010	<0.00010	<0.0010	9	<0.00010	<0.0010	<0.010	11	<0.00010	0.00013	0.00017	6	0.00012	0.00012	0.00025	<0.0010
Copper	mg/L	4	<0.00020	<0.00050	<0.00050	9	<0.00020	0.00107	0.0011	12	<0.0050	0.0016	0.0024	6	<0.00050	<0.00020	0.0010	0.00040
Iron	mg/L	4	0.018	0.032	0.034	10	<0.010	0.030	0.08	14	0.027	0.079	2.3	6	0.054	0.071	0.086	0.097
Lead	mg/L	4	<0.000050	<0.000050	<0.00020	9	<0.000050	<0.00020	<0.010	12	<0.000050	<0.000050	0.00011	6	<0.000050	<0.000050	<0.00020	<0.00020
Manganese	mg/L	4	0.0025	0.0078	0.0136	7	0.00073	0.0075	0.067	10	0.00017	0.00039	0.0037	6	0.0016	0.040	0.16	0.019
Mercury	mg/L	4	<0.0000020	<0.000010	<0.000010	9	<0.0000020	<0.000010	0.0013	12	<0.0000020	<0.000010	0.0010	6	<0.0000020	<0.000010	<0.000010	<0.0000020
Nickel	mg/L	4	0.00016	0.00018	0.00021	7	<0.00050	0.00018	0.00031	10	0.00094	0.0017	0.0022	6	<0.00050	0.00042	0.0013	0.00066
Silver	mg/L	4	<0.000010	<0.000010	<0.00010	7	<0.000010	<0.000010	<0.00010	10	<0.000010	<0.000010	<0.00010	6	<0.000010	<0.000010	<0.000010	<0.00010
Zinc	mg/L	4	<0.0030	<0.0030	<0.0030	9	<0.0030	<0.0030	0.070	12	<0.0030	<0.0030	<0.0030	6	<0.0030	<0.0030	<0.0030	<0.0030
Other																		
Total Cyanide	mg/L	4	0.010	0.011	0.011	7	<0.0020	0.012	0.013	10	<0.002	0.0087	0.012	6	0.015	0.017	0.019	<0.0020

a) Rescan 2012g, Golder 2020

b) Beak 1980, EBA 2005a, Rescan 2012g, Golder 2020

c) Beak 1980, EBA 2005a, Rescan 2012g, Golder 2020

d) Rescan 2012f, Golder 2020

e) Golder 2020

f) Includes both lab and field pH values.

g) Dissolved boron concentrations from Beak 1980 and Golder 2020 study removed as the DL is 0.01 and 0.02 mg/L respectively, which is above the maximum concentration from the 2012 study.

- = no data; µS/cm = microSiemens per centimetre; NTU = Nephelometric Turbidity Units; mg/L = milligrams per litre; mg-N/L = milligrams of Nitrogen per litre; mg-P/L = milligrams of Phosphorus per litre.

Table B3: Summary of Water Quality Data for Waterbodies Located on or near to the Project

Parameter	Units	Polar Lake[a]		Great Slave Lake[b]			
		Count	Value	Count	Min	Median	Max
Conventional Parameters							
Specific Conductivity	µS/cm	1	325[c]	7	237	250	322
pH[d]	pH	1	8.5	6	8.2	8.2	8.3
Hardness	mg/L	1	328[e]	8	98	102	150
Total Suspended Solids	mg/L	0	-	6	3.6	27	74
Total Dissolved Solids	mg/L	0	-	6	147	163	186
Turbidity	NTU	0	-	6	6.8	23	53
Major Ions							
Total Calcium	mg/L	0	-	6	28	30	39
Dissolved Calcium	mg/L	1	87	6	27	29	41
Bromide	mg/L	0	-	2	<0.050	<0.050	<0.050
Chloride	mg/L	1	0.40[e]	6	5.6	7.5	10
Fluoride	mg/L	1	0.18[e]	6	0.080	0.088	0.14
Total Magnesium	mg/L	0	-	6	6.8	7.3	10
Dissolved Magnesium	mg/L	1	27	6	6.4	7.2	11
Total Potassium	mg/L	0	-	6	1.1	1.1	1.3
Dissolved Potassium	mg/L	1	0.91	6	0.93	0.90	1.2
Total Sodium	mg/L	0	-	6	7.7	8.7	10.0
Dissolved Sodium	mg/L	1	1.6	6	7.9	8.5	9.7
Sulfate	mg/L	0	-	6	25	29	52
Nutrients							
Ammonia	mg-N/L	0	-	6	<0.0050	<0.0050	0.0065
Nitrate	mg-N/L	1	<0.050	6	<0.0050	<0.0050	0.0072
Nitrite	mg-N/L	0	-	6	<0.0010	<0.0010	<0.0010
Total Kjeldahl Nitrogen	mg-N/L	0	-	6	0.24	0.44	0.92
Total Nitrogen	mg-N/L	0	-	6	0.24	0.5	0.67
Dissolved Orthophosphate	mg-P/L	0	-	6	<0.0010	<0.0010	<0.0010
Total Phosphorus	mg/L	1	<0.0030	6	0.010	0.038	0.099
Total Organic Carbon	mg/L	0	-	6	5.2	10	15
Total Metals							
Aluminum	mg/L	0	-	9	0.31	0.47	1.9
Arsenic	mg/L	0	-	6	0.00051	0.00090	0.0012
Barium	mg/L	0	-	6	0.046	0.051	0.053
Boron	mg/L	0	-	6	0.019	0.020	0.024
Cadmium	mg/L	0	-	6	0.000016	0.000034	0.000061
Chromium	mg/L	0	-	6	0.00053	0.00074	0.0011
Copper	mg/L	0	-	6	0.0016	0.002245	0.0030
Iron	mg/L	0	-	7	0.29	0.74	1.2
Lead	mg/L	0	-	6	0.00016	0.00046	0.00085
Manganese	mg/L	0	-	6	0.0055	0.030	0.060
Mercury	mg/L	0	-	6	<0.000010	<0.000010	<0.000010
Nickel	mg/L	0	-	6	0.0013	0.0024	0.0029
Silver	mg/L	0	-	6	<0.000010	<0.000010	0.000019
Zinc	mg/L	0	-	6	0.0036	0.0047	0.0059
Dissolved Metals							
Aluminum	mg/L	0	-	6	0.0051	0.013	0.020
Arsenic	mg/L	1	0.006	5	0.00034	0.00045	0.00059
Barium	mg/L	0	-	7	0.040	0.043	0.044
Boron	mg/L	1	<0.010	5	0.017	0.019	0.024
Cadmium	mg/L	1	<0.0050	5	<0.000010	<0.000010	0.000011
Chromium	mg/L	1	<0.010	5	<0.00010	<0.00010	0.00010
Copper	mg/L	1	<0.0050	5	0.0008	0.0015	0.0018
Iron	mg/L	1	0.020	5	0.022	0.038	0.047
Lead	mg/L	1	<0.010	5	<0.000050	<0.000050	<0.000050
Manganese	mg/L	0	-	5	0.00032	0.00047	0.00070
Mercury	mg/L	1	0.0016	5	<0.000010	<0.000010	<0.000010
Nickel	mg/L	0	-	5	0.0012	0.0014	0.0019
Silver	mg/L	0	-	5	<0.000010	<0.000010	<0.000010
Zinc	mg/L	1	<0.0050	5	<0.0030	<0.0030	<0.0030
Other							
Total Cyanide	mg/L	0	-	5	0.0055	0.0056	0.0075

a) Beak 1980; surface water sample.

b) EBA 2005a, Rescan 2012g, Golder 2020; near-shore surface water samples.

c) Recorded as 'conductivity' in study, not specific conductivity.

d) Includes both lab and field pH values.

e) Dissolved species analysed only.

APPENDIX C

Pine Point Project 2020 Baseline Study Plan

REPORT

Baseline Study Plan for 2020

Pine Point Project

Submitted to:

Pine Point Mining Limited

Submitted by:

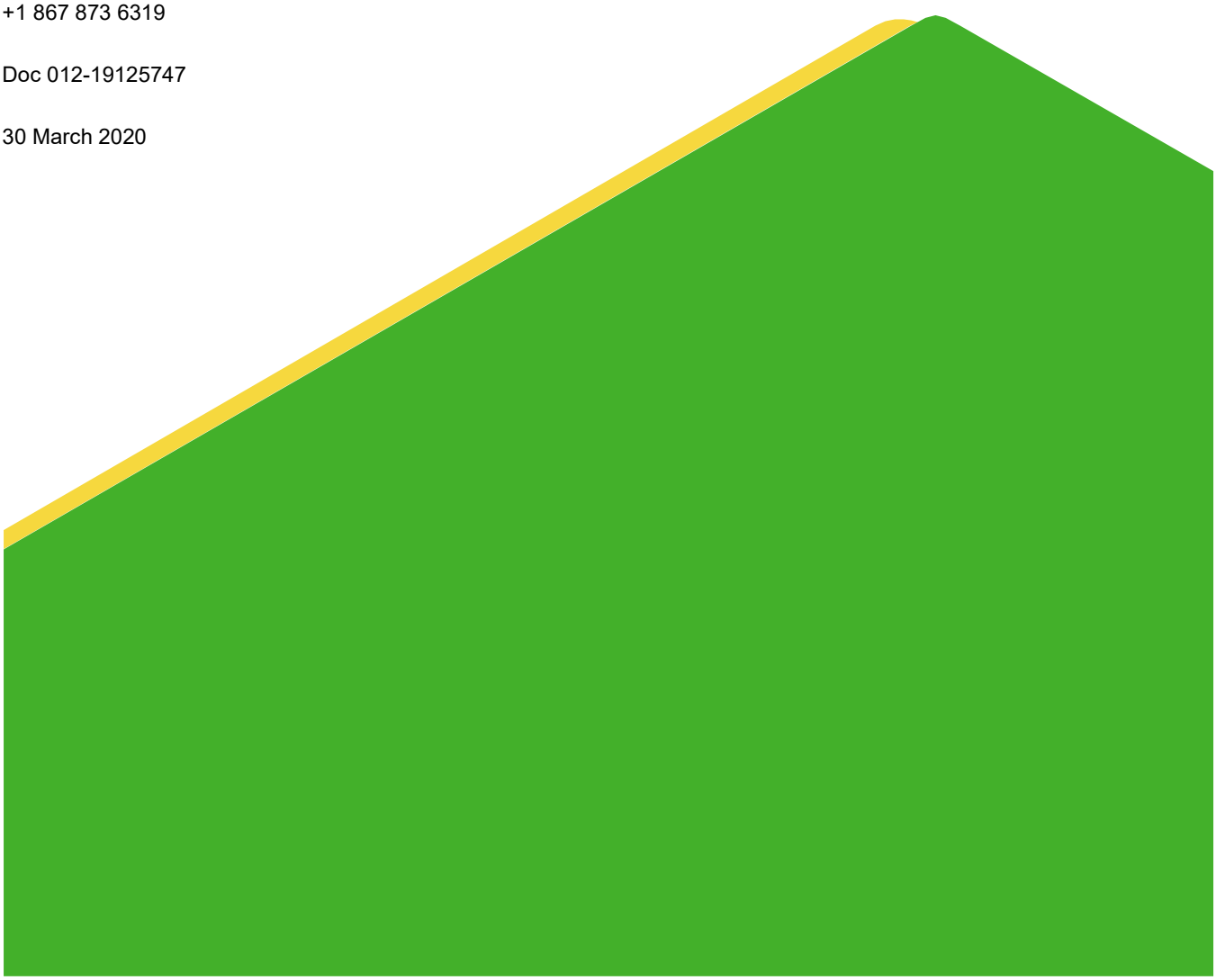
Golder Associates Ltd.

9, 4905 - 48 Street, Yellowknife, Northwest Territories, X1A 3S3, Canada

+1 867 873 6319

Doc 012-19125747

30 March 2020



Distribution List

1 Digital Copy to Pine Point Mining Limited

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TABLES

FIGURES

Abbreviation List

Abbreviation	Definitions
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
EA	environmental assessment
ELC	ecological land classification
GNWT	Government of the Northwest Territories
ITK	Indigenous Traditional Knowledge
MVEIRB	Mackenzie Valley Environmental Impact Review Board
NWT	Northwest Territories
PPML	Pine Point Mining Limited
QC	Quality Control
SEIA	Socio-Economic Impact Assessment
the Project	the Pine Point Project
TLRU	Traditional Land and Resource Use

1.0 INTRODUCTION

This document outlines suggested environmental studies for the Pine Point Project (the Project) on behalf of Pine Point Mining Limited (PPML) in anticipation of an environmental assessment (EA) and permitting under the *Mackenzie Valley Resource Management Act*.

The Project is located in the Northwest Territories within the South Slave District, south of Great Slave Lake, approximately 175 km directly south of Yellowknife, 75 km east of Hay River, and 53 km southwest of Fort Resolution. Access to the Project is presently via Highway 5 (Figure 1).

Golder reviewed existing environmental information available for the Project in a Gap Analysis Report (Golder 2019) and made suggestions for additional field surveys that may be required to support the EA. As this Project will be constructed and operated in predominantly a brownfield (i.e., previously disturbed) area, the data requirements and effort required for the EA are anticipated to be less than for a greenfield project.

1.1 Purpose

Based on the Gap Analysis (Golder 2019), this document outlines the baseline environmental studies proposed for each environmental discipline to prepare the EA and engage regulators and community groups in the process. Disciplines include air quality and noise, surface water quantity, surface water quality, fish and fish habitat, vegetation, wildlife and species at risk, socio-economics, traditional land and resource use, and archaeology.

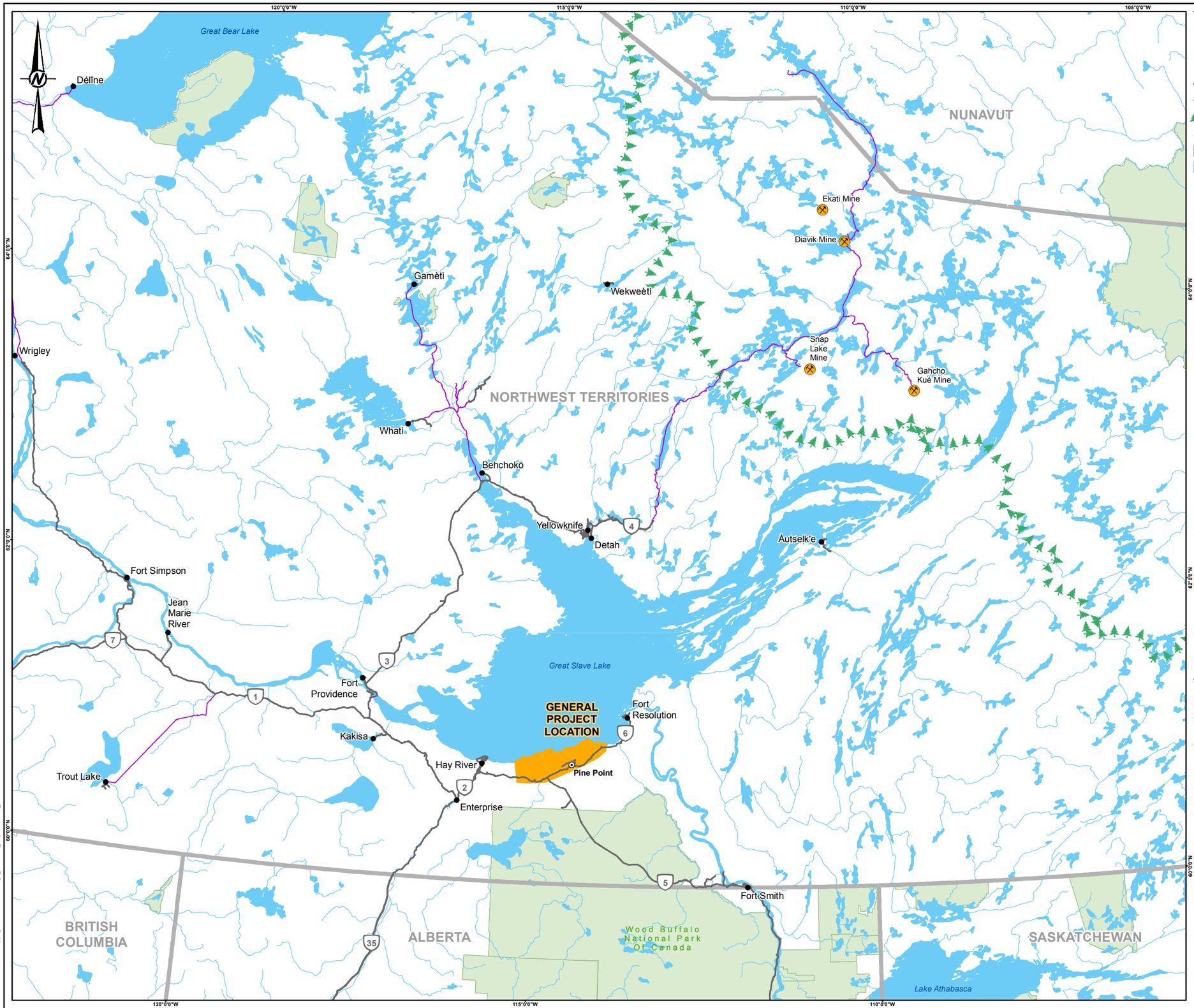
Sections 2 to 10 provide a high-level summary of the available information, the potential environmental effect pathways based on initial Project information, and the proposed environmental studies.

1.2 Project Understanding

Table 1 provides an overview of the activities that are anticipated for each project phase (construction, operations, closure, and post-closure).

Table 1: Anticipated Activities

Anticipated Activities	Construction	Operations	Closure and Post-closure
Site preparation	✓		
Infrastructure development	✓		
Water supply	✓	✓	✓
Workforce requirements and procurement	✓	✓	✓
Fleet movement		✓	
Ore processing		✓	
Mine Waste disposal		✓	
Water management	✓	✓	✓
Pit development		✓	
Decommissioning of infrastructure			✓
Project area reclamation			✓



LEGEND

- FORMER PINE POINT TOWN SITE
- POPULATED PLACE
- EXISTING MINE
- ALL-SEASON ROAD
- WINTER ROAD
- TREELINE
- WATERCOURSE
- PARK/PROTECTED AREA
- WATERBODY
- GENERAL PROJECT LOCATION

0 50 100

1:3,000,000 KILOMETRES

REFERENCE(S)

1. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
2. PARKS AND PROTECTED AREAS OBTAINED FROM CONSERVATION AREAS REPORTING AND TRACKING SYSTEM (CARTS), CANADIAN COUNCIL ON ECOLOGICAL AREAS, 2017.

PROJECTION: ALBERS CONIC EQUAL AREA

CLIENT
PINE POINT MINING LTD.

PROJECT
PINE POINT PROJECT 2020 BASELINE STUDY PLAN

TITLE
LOCATION OF PROJECT

CONSULTANT
GOLDER

YYYY-MM-DD	2020-02-24
DESIGNED	DC
PREPARED	BW
REVIEWED	LY
APPROVED	LY

PROJECT NO.	PHASE	REV.	FIGURE
19125747	7000	0	1

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2.0 AIR QUALITY AND NOISE

2.1 Background

Existing air quality and noise data were collected in the summer of 2011 and reported in 2012 (Rescan 2012a,b). The dataset is reasonable to characterize baseline conditions for these disciplines, but it is becoming dated and based on previous experience with the environmental assessment process in the Northwest Territories. New data may need to be collected for the compounds of potential concern for air quality.

Local meteorological data have not been collected for several decades; meteorological data collection will be required to support the air quality assessment and the hydrology assessment.

2.2 Potential Effects Pathways

Construction, operations, and closure related activities all have the potential to release emissions to the atmosphere. The operations phase of the work typically results in the highest intensity of emissions. Emissions released can change ground level concentrations of the contaminants of concern, which in turn can result in effects to people, vegetation, wildlife, soils, and water. Greenhouse gas emissions have the potential to contribute to the global matter of climate change.

2.3 Proposed Studies and Monitoring

A professional grade meteorological station was installed at the Project in October 2019 and will be calibrated in September 2020.

3.0 SURFACE WATER QUANTITY

3.1 Background

Local hydrological monitoring is recommended to characterize the current regional and local water balance and to provide a basis for assessment of Project effects on local hydrology. The collection of surface water quantity data is important to characterize the range of natural climatic variability, support water quality and fish studies, and collect data that could support the eventual development, parameterization, and calibration of hydrological models. The Project area is primarily a brownfield site that has been previously disturbed and much of site located in low-lying, poorly drained area. Historic local water quantity data include historical Water Survey of Canada data at Station 07PA001 (Buffalo River at Highway No. 5) from 1968 to 1990. and from 2011 (Rescan 2012a). No small-watershed data are available except for a single year of data from Twin Creek in 2011 (Rescan 2012a). The focus of the surface water quantity program will be to resume monitoring at the historic Buffalo River and Twin Creek stations, with an additional station on Paulette Creek, a small, local watercourse, to further characterize local small watershed runoff. The key periods of study are expected to include during the spring freshet, in the spring post-freshet, late summer, and fall sampling periods with automated measurements of water level completed between the freshet and fall field campaigns. A targeted under-ice water quantity field program may be necessary in the future when additional Project design details are available, and surface water flows across the Project area have been further delineated.

3.2 Potential Effects Pathways

- Site development and closed circuiting may affect runoff water quantity and timing.
- Site development may cause changes to runoff patterns, including watercourse diversions.

- Construction, operations, closure, and post-closure phases may have water supply requirements that affect local water quantity.
- Water management (e.g., runoff capture, diversion, storage, and consumptive use) may cause a change in surface water quantity.
- Pit development may affect groundwater, resulting in additional surface water.
- Ore processing may have a consumptive use of water; exported ore may include water.
- Waste rock and tailings management may represent a water demand.

3.3 Proposed Studies and Monitoring

An open-water hydrological field program will take place on Paulette Creek and Twin Creek (local) as well as the Buffalo River (regional). The field program will commence prior to freshet in 2020. However, desktop analysis of existing regional data started in 2019.

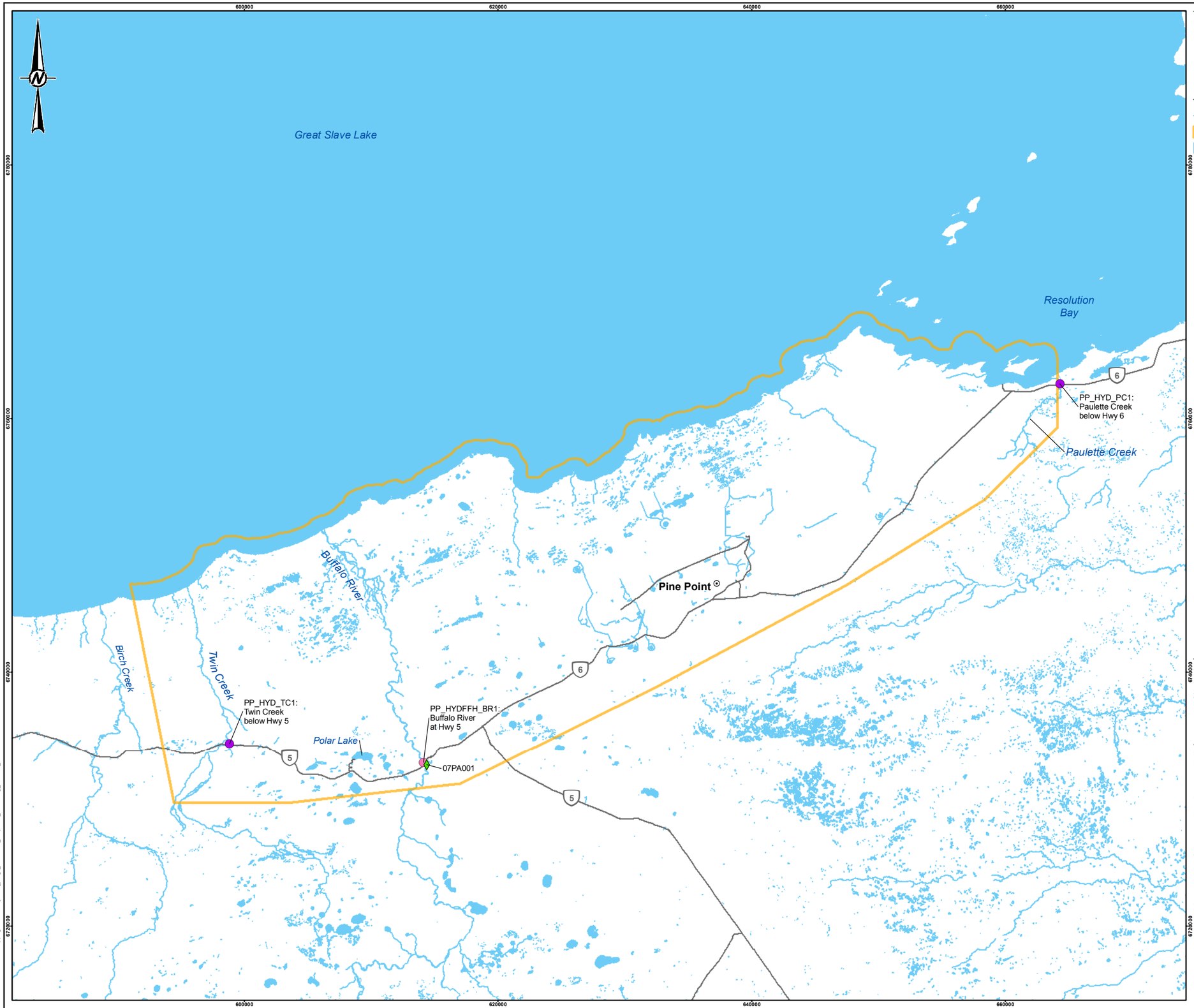
The hydrometric monitoring is intended to characterize local and regional runoff dynamics. The hydrological program proposed at the Buffalo River, Paulette Creek, and Twin Creek in 2020 will include a minimum of four field visits in the open water season: one in mid May to capture the spring freshet and deploy continuous water level monitoring instrumentation; one in late May to capture receding conditions post-freshet (combined with surface water quality); one in August to capture summer low flows (combined with surface water quality); and one in late September (combined with surface water quality) to retrieve continuous water level monitoring instrumentation prior to freeze-up. Water level will be surveyed relative to local benchmarks established at each station. Multiple field trips improve the quality of the rating curves by providing additional high discharge data before or after the freshet peak. The approximate locations of monitoring stations are shown in Figure 2 and summarized in Table 2.

The proposed hydrometric stations will be established at locations accessible from major roads (Highway 5 or Highway 6), if possible. The hydrometric station established on the Buffalo River will be at or near the site of the currently inactive WSC hydrometric station 07PA001. Detailed information on station 07PA001 will be compiled prior to the first field trip.

Table 2: Proposed Baseline Hydrometric Monitoring Stations

Station ID	Watercourse	Station Name	Latitude (°)	Longitude (°)	Continuous Water Level Recording	Water Level Surveys	Instantaneous Discharge
PP_HYD_TC1	Twin Creek	Twin Creek at Hwy 5	60.7327	-115.1877	✓	✓	✓
PP_HYD_PC1	Paulette Creek	Paulette Creek at Hwy 6	60.9655	-113.9647	✓	✓	✓
PP_HYDFFH_BR1	Buffalo River	Buffalo River at Hwy 5	60.7137	-114.9039	✓	✓	✓

° = degrees



LEGEND

- FORMER PINE POINT TOWN SITE
- HYDROMETRIC MONITORING STATION
- HYDROMETRIC MONITORING STATION WITH FISH SAMPLING LOCATION
- WATER SURVEY OF CANADA HYDROMETRIC STATION (INACTIVE)
- ALL-SEASON ROAD
- WATERCOURSE
- GENERAL PROJECT LOCATION
- WATERBODY

0 5 10
1:300,000 KILOMETRES

REFERENCE(S)

1. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
2. PARKS AND PROTECTED AREAS OBTAINED FROM CONSERVATION AREAS REPORTING AND TRACKING SYSTEM (CARTS), CANADIAN COUNCIL ON ECOLOGICAL AREAS, 2017.
3. POTENTIAL EFFLUENT DISCHARGE LOCATIONS PROVIDED BY ANDRÉE DROLET, PPML, BY EMAIL ON 27 JUNE 2019.

PROJECTION: UTM ZONE 11 DATUM: NAD 83

CLIENT
PINE POINT MINING LTD.

PROJECT
PINE POINT PROJECT 2020 BASELINE STUDY PLAN

TITLE
SURFACE WATER QUANTITY MONITORING STATIONS

CONSULTANT
GOLDER

YYYY-MM-DD	2020-03-30
DESIGNED	SB
PREPARED	MM
REVIEWED	LY
APPROVED	LY

PROJECT NO.	PHASE	REV.	FIGURE
19125747		0	2

4.0 SURFACE WATER QUALITY

4.1 Background

The collection of Project-related water quality baseline data is important, as changes to water quality may ultimately affect fish, wildlife, and human health, and water quality is typically a concern to regulators and communities. The Project must also adhere to the requirements regarding effluent release as per the federal *Fisheries Act* and the NWT *Waters Act*.

Existing water quality data for Buffalo River, the Great Slave Lake mixing zone area, Twin Creek, Little Buffalo River, and Paulette Creek are generally robust for the purposes of an EA. However, while there are multiple years worth of data, there are some limitations; including limited in situ seasonal physico-chemical data in the watercourses.

An updated seasonal water quality baseline dataset is expected to be required for the EA, as well as for subsequent water licence applications.

4.2 Potential Effects Pathways

- Hazardous substance spills may cause a change in surface water quality.
- Construction activities leading to air emissions (including dust), may cause a change in surface water quality.
- Water management effects (i.e., discharge of effluent) may cause a change in surface water quality.
- Use of industrial equipment in or near waterbodies during construction may cause a change in surface water quality.
- The operation of the Project (e.g., generation of acidifying air emissions, runoff from site [waste rock and tailings inputs], and treated effluent discharge) and closure activities may cause a change in surface water quality.

4.3 Proposed Studies and Monitoring

The surface water quality baseline characterization will be carried out through a combination of a desktop review on the existing available information and data collected in 2019 and 2020.

Prior to sampling for the Project in 2019, spring, summer, and fall surface water quality data were last collected in 2011; therefore, updated seasonal surface water quality data will be collected from waterbodies and watercourses, which are expected to receive direct influence (e.g., surface water drainage, discharge of effluent, and aerial emissions deposition) from the Project, including one potential discharge location in Great Slave Lake. The study area and sampling stations for the surface water quality component of the baseline study are based off of information gathered during the 2019 site reconnaissance study (Figure 3).

In fall 2019, surface water quality samples and field physico-chemical data were collected from one station in Great Slave Lake (i.e., near Paulette Creek in Resolution Bay; PP_WQ_GSL1) and one station in Buffalo River (i.e., upstream of the potential discharge location; PP_WQ_BR1). Additional samples and field data were collected from one station in each of the following watercourses: Birch Creek (PP_WQ_BC1), Twin Creek (PP_WQ_TC1), Paulette Creek (PP_WQ_PC1) and Little Buffalo River (PP_WQ_LBR1). Adequate flow was present for sampling at all of these watercourses during the October 2019 surface water quality sampling program. Additional surface water quality samples were collected at three creeks that drain through the Project

area (PP_WQ_CR1, PP_WQFFH_CR2, and PP_WQ_CR4) and from several waterbodies within the Project area (PP_WQ_PD1 and PP_WQ_WL1). Note that at station PP_WQFFH_CR2 both water quality and fish habitat data are collected. Based on the results of the fall 2019 site reconnaissance program and sampling data review, it was determined that most of the proposed sampling stations (i.e., creeks and ponds) would be frozen to bottom in winter due to their shallow depths; therefore, sampling for under-ice water quality was not conducted in winter 2020.

In 2020, the proposed surface water quality field work includes three open-water programs (i.e., May 2020 [spring or freshet], August 2020 [summer], and September 2020 [fall]). During each sampling event, field parameters will be documented, including supporting environmental data (e.g., ambient conditions at the time of sampling, etc.), and water samples will be collected for laboratory analysis.

4.3.1 Water Quality Samples

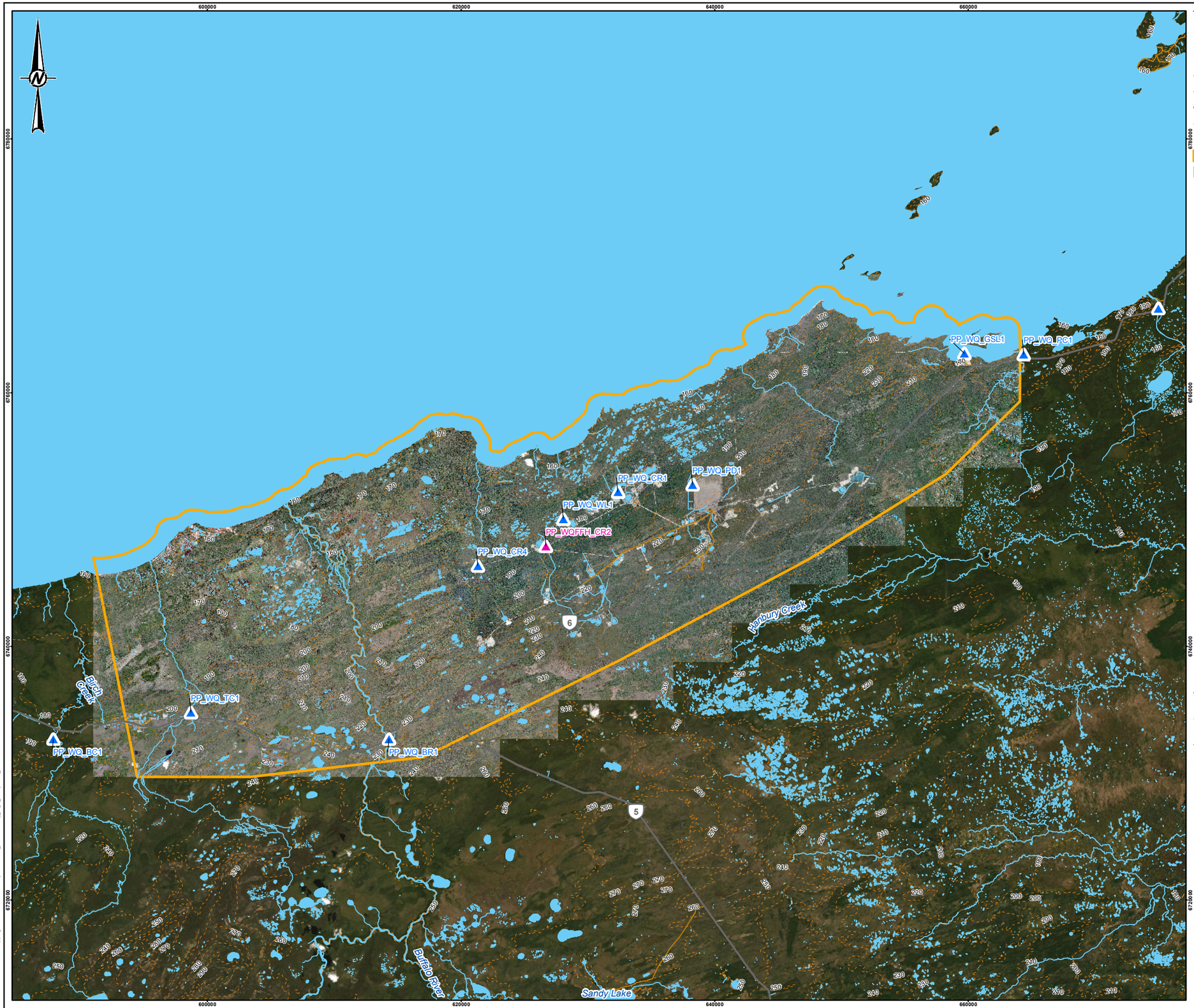
For all water quality sampling programs, quality control (QC) samples (blanks and duplicates) will represent approximately 10% of the total number of samples collected in the program. The QC samples will be analyzed for the same parameters of normal samples.

It is recommended that the standard Northwest Territories water samples analyses be completed (Table 3).

Table 3: Water Samples Standard for Analyses

Conventional Parameters	Nutrients	Total and Dissolved Metals, Metalloids, and Non-Metals
Bicarbonate alkalinity, chloride, carbonate alkalinity, turbidity, conductivity, hardness, calcium, potassium, magnesium, sodium, sulphate, pH, total alkalinity, total dissolved solids (TDS), and total suspended solids (TSS).	Ammonia-nitrogen, total Kjeldahl nitrogen, nitrate-nitrogen, nitrite-nitrogen, ortho-phosphate, total phosphorus, total organic carbon, dissolved organic carbon, and reactive silica.	Aluminum, antimony, arsenic, barium, beryllium, bismuth, boron, cadmium, cesium, chromium, cobalt, copper, iron, lead, lithium, manganese, mercury, molybdenum, nickel, selenium, silver, strontium, thallium, tin, titanium, uranium, vanadium, and zinc.

Water quality data will be compared to various guidelines, which include protection of aquatic life, protection of water for wildlife consumption, and protection of source for drinking water (as applicable).



LEGEND

- WATER QUALITY SAMPLING STATION
- WATER QUALITY SAMPLING STATION WITH FISH SAMPLING LOCATION
- HIGHWAY
- LOCAL ROAD
- TRANSMISSION LINE
- WATERCOURSE
- CONTOUR
- GENERAL PROJECT LOCATION
- WATERBODY

0 5 10

1:300,000 KILOMETRES

REFERENCE(S)

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PROJECTION: UTM ZONE 11N DATUM: NAD83

CLIENT
PINE POINT MINING LTD.

PROJECT
PINE POINT PROJECT 2020 BASELINE STUDY PLAN

TITLE
SURFACE WATER QUALITY STUDY AREA AND SAMPLING LOCATIONS

CONSULTANT
GOLDER

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PREPARED	MM
REVIEWED	JL
APPROVED	LY

PROJECT NO.	CONTROL	REV.	FIGURE
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5.0 FISH AND FISH HABITAT

5.1 Background

Fish have been historically documented or their preferred habitat identified in the Project area in the Buffalo River, Twin Creek, Paulette Creek, Great Slave Lake, and one pond near the existing disturbance area. Shortjaw Cisco (*Coregonus zenithicus*), is an aquatic species at risk listed under the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and the Northwest Territories Species at Risk Registry. Shortjaw Cisco are found in Great Slave Lake but are unlikely to be present within the Project area.

Historical fish and fish habitat data exist for Twin Creek, the Buffalo River, Paulette Creek, and several small watercourses and waterbodies in the Project area. The 2020 baseline field work will be designed to collect site-specific data at waterbodies and watercourses affected by Project activities (e.g., road crossings), verify fish and fish habitat at a subset of historically sampled sites (e.g., Twin Creek), and collect new data in locations not previously sampled for fish. Sampling locations will also be selected to investigate the connectivity of the channels and pits in the Project area to fish-bearing waters.

Baseline fish and fish habitat data collected for the EA will also be used to support future regulatory applications. For example, a Request for Project Review to Fisheries and Oceans Canada will be required under the *Fisheries Act* during the permitting stage of the Project. An Application for Authorization under the *Fisheries Act* may also be required, depending on level of disturbance to fish and fish habitat.

5.2 Potential Effects Pathways

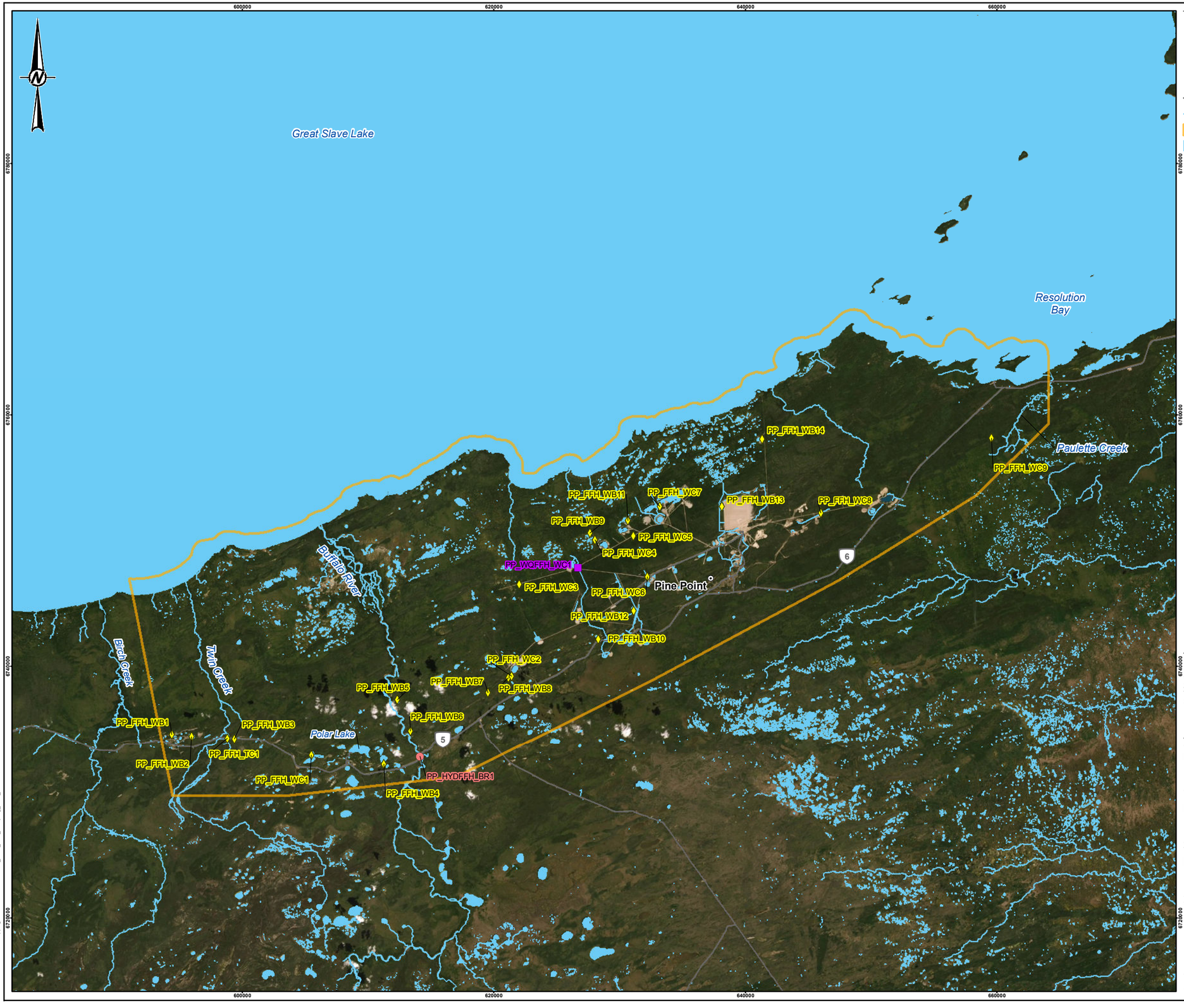
- Construction activities, including the development of open pits and related infrastructure (e.g., road crossings and water intakes), will result in a direct loss or alteration of fish habitat, which may affect fish habitat quantity and quality.
- The construction of water crossing structures for the mine site roads may alter stream hydraulics and geomorphology, which may affect fish passage, alter habitat connectivity and fish distribution.
- Hazardous substance spills can alter fish habitat quantity and quality and affect fish health, survival, and reproduction.
- Construction activities may cause air emissions (e.g., dust), which may affect habitat quality and fish health.
- Changes in site drainage may lead to changes in sediment concentration and deposition, which can alter fish habitat quality and quantity in downstream habitats (e.g., Twin Creek).
- Water management activities may alter local hydrology and affect fish habitat quantity and quality in downstream habitats (e.g., Twin Creek)
- Use of industrial equipment in or near waterbodies during construction may lead to changes in sediment concentrations and deposition, which can alter fish habitat quality and quantity in downstream habitats (e.g., Twin Creek).
- The operation of the Project (e.g., treated effluent discharge) may affect downstream water quality in the Resolution Bay area, which can alter fish habitat quality and affect fish health, survival, and reproduction.

5.3 Proposed Studies and Monitoring

The fish and fish habitat field program will be completed in the summer of 2020 and be combined with the surface water quantity component if feasible. Six sites previously sampled by EBA in 2005 or Rescan in 2011 will be revisited to verify historical fish and fish habitat conditions These locations include four Rescan ponds/waterbodies (P-15, P-16, P-38, P-45) which have been renamed PP_FFH_WB2, PP_FFH_WB3, PP_FFH_WB5, PP_FFH_WB6, respectively (Figure 4), and one location in Twin Creek (S-11), which has been renamed PP_FFH_TC1 (Figure 4) (Rescan 2012c) and one site at the Buffalo River (BRS1) which has been renamed PP_HYDFFH_BR1 (EBA 2005). An additional 20 new locations have been proposed for sampling across the Project area and include watercourses or waterbodies at potential road crossings, near diversions and open pits, and where no fish and fish habitat data have been historically collected (Figure 4). One sampling location for fish and fish habitat overlaps with a water quality sampling location (PP_WQFFH_WC1) and another with a hydrology monitoring station on the Buffalo River (PP_HYDFFH_BR1). 2020 baseline studies and sampling locations will be refined when a detailed Project Description is available.

The field program will include:

- Collection of site-specific baseline data (e.g., detailed habitat data and fish community inventory) to address the Project activities in or near fish-bearing waters or potentially fish-bearing water, including Twin Creek.
- Spatial scope will include waterbodies and watercourses affected by discharge pipelines (or diffusers), intake pipelines, road crossings, and open pits.
- Scoping level evaluation of connectivity of diversions and open pits to potentially fish-bearing habitats.



LEGEND

- FISH SAMPLING LOCATION
- FISH SAMPLING LOCATION WITH WATER QUALITY SAMPLING STATION
- FISH SAMPLING LOCATION WITH HYDROMETRIC MEASURING STATION
- FORMER PINE POINT TOWN SITE
- ALL-SEASON ROAD
- WATERCOURSE
- GENERAL PROJECT LOCATION
- WATERBODY

0 7.5 15

1:300,000 KILOMETRES

REFERENCE(S)

1. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
2. PARKS AND PROTECTED AREAS OBTAINED FROM CONSERVATION AREAS REPORTING AND TRACKING SYSTEM (CARTS), CANADIAN COUNCIL ON ECOLOGICAL AREAS, 2017.
3. POTENTIAL EFFLUENT DISCHARGE LOCATIONS PROVIDED BY ANDRÉE DROLET, PPML, BY EMAIL ON 27 JUNE 2019.

PROJECTION: UTM ZONE 11 DATUM: NAD 83

CLIENT
PINE POINT MINING LTD.

PROJECT
PINE POINT PROJECT 2020 BASELINE STUDY PLAN

TITLE
FISH AND FISH HABITAT SAMPLING LOCATIONS

CONSULTANT
GOLDER

YYYY-MM-DD	2020-03-30
DESIGNED	BF
PREPARED	MM
REVIEWED	LY
APPROVED	LY

PROJECT NO.	PHASE	REV.	FIGURE
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6.0 VEGETATION

6.1 Background

An ecological land classification (ELC) map is required to evaluate direct and indirect Project effects on vegetation resources, as well as soils and terrain, within the Project area. The Project area ELC map is also used to assess effects to wildlife habitat. As a stand-level or ground-based ecological classification system is not available for ecosystems in the Northwest Territories, ecological attributes from the Northwest Territories Forest Inventory Data (GNWT 2012) were used to classify forest inventory polygons to Canadian Shield ecosite phases for the Project area.

A regional study area ELC map is required to evaluate indirect and cumulative Project effects on vegetation resources. The regional study area map is also used to assess effects to wildlife habitat.

Invasive plant surveys will be completed as part of the baseline vegetation surveys for the Project. Considering the history of development at the Project area and equipment being brought for construction and operational phases, it is expected that invasive species are present in the Project area.

Plant species listed under the COSEWIC and the Northwest Territories Species at Risk Registry with the potential to occur in the Project area will be identified prior to any field surveys.

If Knowledge Sharing Agreements are agreed upon between PPML and the communities, then it would be beneficial to have community members develop a list of traditional plant use species in the local study area. This list would be used to support traditional plant in the Project area and species use surveys documenting.

6.2 Potential Effects Pathways

- Direct loss of vegetation communities, rare vascular plants, and traditional use plants from vegetation clearing in areas of new open pits and associated infrastructure.
- Changes to soil quantity and quality.
- Vegetation community fragmentation.
- Vegetation effects due to changes in hydrology and hydrological regime resulting from water management activities.
- Wetland hydrology and functional changes due to mine dewatering and water management activities.
- Changes to vegetation and soils from changes in water quality.
- Construction activities leading to air emissions (including dust), which may affect vegetation communities and vegetation health.
- Hazardous substance spills leading to changes to degraded soil or vegetation community quality.
- Increased access leading to the introduction or spread of regulated weed or invasive, non-native species.

6.3 Proposed Studies and Monitoring

- Baseline soils and terrain field program for the local study area focusing on spatial gaps from 2012 programs in undisturbed areas.
- Baseline ELC/wetland, listed plant, and regulated weed/invasive plant program for a local study area, focusing mainly on spatial gaps from 2012 programs in undisturbed areas.

7.0 WILDLIFE AND SPECIES AT RISK

7.1 Background

Baseline studies completed in 2018 (Golder 2019) and previous studies to support exploration projects (Rescan 2012d,e) provide useful information to support the EA. These studies have identified the presence of boreal caribou, other large mammals, many migratory birds, bats, amphibians and species at risk. Table 4 provides wildlife species of concern that may interact with the Project.

Table 4: Wildlife Species of Concern that may Interact with the Project

Species	NWT Species at Risk Committee Status[a]	Federal *Species at Risk Act* Schedule 1 Status[b]	Committee on the Status of Endangered Wildlife in Canada Status[c]	Observed at Pine Point?
Caribou (boreal population)	Threatened	Threatened	Threatened	Yes
Wood bison	Threatened	Threatened	Special Concern	Yes
Wolverine	Not at Risk	Special Concern	Special Concern	Yes
Little brown myotis	Special Concern	Endangered	Endangered	Yes
Northern myotis	Special Concern	Endangered	Endangered	Yes
Short-eared owl	Not applicable	Special Concern	Special Concern	No
Whooping crane	Not applicable	Endangered	Endangered	Yes
Bank swallow	Not applicable	Threatened	Threatened	Yes
Barn swallow	Not applicable	Threatened	Threatened	No
Common nighthawk	Not applicable	Threatened	Threatened	Yes
Horned grebe (western population)	Not applicable	Special Concern	Special Concern	Yes
Olive-sided flycatcher	Not applicable	Threatened	Threatened	Yes
Rusty blackbird	Not assessed	Special Concern	Special Concern	Yes
Yellow rail	Not applicable	Special Concern	Special Concern	No
Gypsy cuckoo bumble bee	Data Deficient	Endangered	Endangered	No
Yellow-banded bumble bee	Not at Risk	Special Concern	Special Concern	No
Northern leopard frog	Threatened	Special Concern	Special Concern	No

a) GNWT (2019)
b) Government of Canada (2019)
c) COSEWIC (2019)

Existing roads related to previous mining and exploration are frequently used for harvesting, creating potential land use conflict.

7.2 Potential Effects Pathways

- Habitat loss (changes in habitat quantity) and habitat fragmentation from the Project.
- Hazardous substance spills leading to negative changes to health or mortality of individual animals.
- Sensory disturbance from construction activities leading to changes in wildlife habitat quality and survival and reproduction.
- Vegetation clearing leading to destruction of migratory bird nests.
- Wetland hydrology and functional changes due to water management activities, which may alter the abundance, distribution, and survival and reproduction of wildlife.
- Attraction to camps leading to problem wildlife and injury or mortality to individual animals.
- Improved access leading to increased predation on/harvesting of wildlife.
- Construction activities leading to air emissions (including dust), which may affect vegetation communities and thereby alter the abundance, distribution, and survival and reproduction of wildlife.

7.3 Proposed Studies and Monitoring

Based on work previously completed (Golder 2018; Rescan 2012d,e) in the Project area, the wildlife data that have been collected previously are considered sufficient for the completion of an EA. Consultation with the Environment and Climate Change Canada and Government of Northwest Territories – Environment and Natural Resources will be conducted to discuss the potential need for additional baseline studies related to Project species at risk. If necessary, additional baseline studies will be planned according to the feedback from engagement meetings with communities and regulators in April and May 2020. Habitat suitability indices developed for Project species at risk will be further refined with more recent landcover information.

8.0 SOCIO-ECONOMICS

8.1 Background

Socio-Economic Impact Assessment (SEIA) is the process of determining the impact of a project on communities and other stakeholder groups. It is participatory and involves working with communities to characterize the existing environment, determine potential effects, identify appropriate mitigation and benefit enhancement measures, and assess residual project impacts. Recent regulatory proceedings have indicated that the GNWT, Mackenzie Valley Environmental Impact Review Board (MVEIRB), and Crown-Indigenous Relations and Northern Affairs Canada are changing the expectations of mining operators for their impact on socio-economic conditions in the territory.

The Project, although brownfield, represents a new economic activity in the Northwest Territories that will generate economic benefits and employment, but also potential for associated deleterious social impacts in communities. Given the nature of the Project (i.e., resource development), it is expected to trigger a comprehensive SEIA per MVEIRB's Guidelines for SEIA (2007). The Guidelines include requirements for socio-economic baseline data collection that would ultimately support the assessment of the Project's impacts on existing conditions.

8.2 Potential Effects Pathways

- Construction and operations workforce requirements could generate direct local employment opportunities and associated incomes.
- The requirement for a workforce skilled in mine construction and operation will require some level of out-of-area workers who will be housed in camps while on-shift.
- Construction and operations procurement and hiring could result in indirect and induced employment.
- Procurement of materials, goods, and services during construction and operations could affect local and regional business revenues.
- Construction and operations employment incomes could increase access to equipment and materials required to participate in traditional and recreational activities.
- Construction and operations employment incomes could be used to fund poor lifestyle choices (e.g., gambling and substance abuse) and associated social maladies (e.g., crime, family violence, parental absenteeism).
- The requirement for construction and operations workers to stay in camps while on rotation can create family conflict and reduced time for volunteering and other community activities.
- The use of both local and out-of-area personnel during construction could result in workplace or cross-cultural conflict.
- The Project's out-of-area construction and operations workforce could increase demand for emergency medical services.
- The transportation of materials, goods, and the workforce during construction and operations will result in increased traffic and access restrictions on roads used to access the Project-related winter roads and staging areas.
- Increased Project traffic on roads shared with other users introduces greater risk of collisions.
- The Project's use of air transportation for materials, goods, and out-of-area workers during construction and operations will place additional demand on air transportation services.
- Project construction will generate solid waste requiring disposal, thereby potentially increasing demand for waste management services and on waste management infrastructure.
- Project construction and operations camps will increase demand for potable water and wastewater disposal.
- Project operations will generate property taxes and other government revenues.
- Project operations will contribute to territorial economic activity and gross domestic product.
- Project operations will likely yield Impact Benefit Agreements with local communities, securing local benefits.
- Project operations will influence forthcoming economic shocks associated with other mine closures in the Northwest Territories.

- Changes in the abundance, quality, and distribution of fish, plants, and wildlife, can impact the availability or suitability or resources for outfitted and recreational hunting and angling, camping, or lodge experiences.
- Sensory disturbance during construction and operations can influence outfitted and recreational hunting and angling, camping, or lodge experiences in the vicinity of the Project.
- Access restrictions during construction and operations can influence the access to resources and the ability of people to participate in outfitted and recreational hunting, angling or camping in the vicinity of the Project.
- Hazardous substance spills leading to degraded soils, vegetation communities, and wildlife health can impact the availability or suitability or resources for outfitted and recreational hunting and angling.
- The Project decommissioning and closure could bring about an end to positive economic impacts associated with employment, incomes, taxes, and economic contributions to the territory. At the same time, adverse social impacts are unlikely to dissipate with closure, and out-migration is a possibility.

8.3 Proposed Studies and Monitoring

Social and economic conditions in communities change rapidly. Much socio-economic data and information is publicly available and can be drawn from statistical databases, publications, and government and non-governmental organization websites. Secondary data collection (desktop) will occur in 2020. This will involve the review and analysis of publicly available sources (e.g., Statistics Canada census data, GNWT Bureau of Statistics data and reports, and literature and publications regarding socio-economic conditions in study area communities). Where data gaps exist, telephone interviews will be conducted. It is anticipated that more detailed information regarding contemporary community dynamics, challenges, and opportunities will not be publicly available, instead requiring engagement to obtain the information required to assess the Project's impacts.

MVEIRB's Guidelines for SEIA note that socio-economic engagement should "involve[e] … potentially affected communities … early and extensively" and use "experts from government and communities" and "information from primary and secondary sources". The Guidelines go on to note that the method of engagement should allow communities and vulnerable subpopulations to be involved in the collection of baseline data (MVEIRB 2007). Involving impact communities in the social baseline process connects their experience with the description of existing conditions against which a project's potential impacts are evaluated.

Following desktop studies and preliminary engagement, socio-economic engagement is expected to involve two phases: 1) Meeting with government and service providers in the regional hub, Yellowknife; and 2) engagement with communities acting as hubs for other smaller communities. Meetings will be planned and scheduled with relevant municipal contacts, the business community, and community service organizations, and will be organized around the socio-economic topics covered in the SEIA. The socio-economic lead will conduct the engagement, and local content will be sourced to assist in facilitation, note-taking and recording as required.

Meetings will also be planned and scheduled with representative study area communities through consultation. The outcome of early engagement may result in the refinement of this list of communities engaged. The goal of socio-economic baseline engagement with communities will in part be to identify perceived trends in Indigenous health, wellbeing, and community life since mining began in the Northwest Territories, and to acquire information on features of the community such as community infrastructure, service, and condition. Given the necessarily high level of involvement of communities in the development of the socio-economic baseline approach, the methods proposed here will be re-evaluated based on community feedback and revised as required.

9.0 TRADITIONAL LAND AND RESOURCE USE

9.1 Background

According to the Mackenzie Valley Land and Water Board's Engagement and Consultation Policy, developers are required to engage with potentially affected communities early in the EA process to identify, consider, and address issues and concerns. Early engagement with potentially affected communities will also help to identify components of the environment that are important to Indigenous groups and facilitate the earlier collection of baseline information.

Although the site is brownfield, according to MVEIRB's Guidelines for SEIA and the EA Initiation Guidelines (MVEIRB 2018), both historic and current land use information of potentially affected communities should be included in the description of baseline conditions. Land use information includes a description of harvesting activities and their importance to potentially affected communities, harvest species, levels, and importance of the traditional economy, places of cultural and spiritual value, and access to land use areas.

MVEIRB requires developers to consider and incorporate Indigenous Traditional Knowledge (ITK) during project development and throughout the EA process and has developed the Guidelines for Incorporating ITK in Environmental Impact Assessment as a resource that outlines MVEIRB's expectations and processes for incorporating ITK in the EA. In addition, EA Initiation Guidelines indicate that developers should provide a description of how ITK was considered and incorporated into project planning as part of the Project overview.

9.2 Potential Effects Pathways

- Changes in the abundance, quality and distribution of fish, plants, and wildlife, can impact the availability or suitability or resources for traditional harvesting.
- Direct mortality of wildlife from the Project (e.g., collisions with Project vehicles leading to changes in the abundance of wildlife, which may alter the availability of resources for traditional harvesting).
- Habitat loss and fragmentation from the Project area can alter the availability or movement patterns of traditionally harvested species.
- Changes in water quality can influence consumption during on-the-land activities.
- Sensory disturbance during construction and operations can influence traditional harvesting and land access in the vicinity of the Project.
- Access restrictions during construction and operations can influence the access to resources and the ability of people to participate in traditional activities in the vicinity of the Project.
- Access restrictions during construction and operations can interfere with use of cabins, camp sites, travel routes, and culturally/spiritually important sites.
- Increased access associated with Project access roads can increase the number of people involved in traditional harvesting activities, but also competition for resources.
- Hazardous substance spills leading to degraded soils, vegetation communities, and wildlife health can impact the availability or suitability or resources for traditional harvesting.
- Changes to participation in traditional land use activities can lead to changes in cultural values and practices.

9.3 Proposed Studies and Monitoring

Desktop literature review will occur in early 2020. This will involve a review of publicly available sources (i.e., reports or other documents prepared by or on behalf of Indigenous communities for other industrial projects, and regional traditional land use studies prepared by or on behalf of Indigenous communities). Data collection will focus on those Indigenous groups which land claims and/or traditional territories overlapping with the Project area. The desktop review will help to identify gaps, and where more detailed information is required for the baseline report. Feedback provided during preliminary engagement will also inform the scope for Traditional Land and Resource Use (TLRU) and ITK literature review (e.g., which potentially affected communities to include). It is anticipated that more detailed contextual information regarding current TLRU will not be available through desktop sources, and that further information gathering will be required to obtain the information required to assess the Project's impacts on TLRU.

Communities will be engaged to determine the most appropriate and effective approach to gather information. Information gathering can be conducted through consultation with communities representing the Indigenous groups noted above. Ideally, and at this preliminary stage, a series of maps would be created with the Project area and traditional territories overlain for mark-up at community meetings, or in the Indigenous groups' preferred forum per their ITK protocols. Participants would be provided the opportunity to identify preferred traditional harvesting sites, relevant ITK (e.g., caribou migration routes, furbearer denning sites, fish habitat), culturally important sites and landscapes, and other aspects of TLRU on the maps, for inclusion in the TLRU baseline. Maps and reports themselves may not be made publicly available; however, information therein would inform the TLRU baseline and impact assessment, which ultimately become public documents.

Recently, communities prioritized for involvement by PPML (i.e., Deninu Kue, K'atl'odeeche, and Northwest Territories Metis Nation) have expressed interest in leading their own ITK studies. Golder will work with communities in the capacity determined appropriate to support community-led ITK studies.

10.0 ARCHAEOLOGY

10.1 Background

Archaeological sites are considered unique and highly cherished resources by the federal and territorial governments, as well as local communities and organizations of the Northwest Territories.

As a result, archaeological sites are protected by legislation, regulation, and policy in the Northwest Territories. This includes the NWT *Archaeological Sites Act* and the NWT Archaeological Sites Regulations, the *Mackenzie Valley Resource Management Act* and the Mackenzie Valley Land Use Regulations.

The Project, through development of mining infrastructure, has the potential to impact both documented and undocumented archaeological resources within undeveloped Project areas.

10.2 Potential Effects Pathways

Activities related to project construction, operations, and closure leading to ground disturbance has potential to impact known and unknown archaeological sites.

10.3 Proposed Studies and Monitoring

Baseline studies are proposed for 2020 when a detailed Project Description is available and impacts to the ground surface are known.

Baseline archaeology field program for the local study area will focus on spatial gaps from 2006 to 2018 programs in undisturbed areas of high archaeology potential that may be impacted by the Project. The approach and extent of baseline studies will be determined in consultation with the Culture and Heritage Division of the Government of Northwest Territories - Department of Education, Culture and Employment.

11.0 PRELIMINARY BASELINE STUDIES SCHEDULE

The preliminary schedule for the field programs is presented in Table 5.

Table 5: Preliminary Schedule for Field Programs

Discipline	Location	Date
Air Quality and Noise		
Calibration of the grade meteorological station	Grade meteorological station in Pine Point (installed in 2019)	September 2020
Surface Water Quantity		
Open-water hydrological field program - freshet	Buffalo River, Twin Creek, and Paulette Creek	May 2020
Open-water hydrological field program - post-freshet survey	Buffalo River, Twin Creek, and Paulette Creek	May 2020 / June 2020
Open-water hydrological field program – late summer	Buffalo River, Twin Creek, and Paulette Creek	August 2020
Open-water hydrological field program - fall survey	Buffalo River, Twin Creek, and Paulette Creek	September 2020
Surface Water Quality		
Open-water program (spring)	Waterbodies and watercourses which may receive direct influence and flow through the Project area	May 2020
Open-water program (summer)	Waterbodies and watercourses which may receive direct influence and flow through the Project area	August 2020
Open-water program (fall)	Waterbodies and watercourses which may receive direct influence and flow through the Project area	September 2020

Table 5: Preliminary Schedule for Field Programs

Discipline	Location	Date
Fish and Fish Habitat		
Collection of site-specific fish and fish habitat baseline data	Waterbodies and watercourses affected by discharge pipelines (or diffusers), intake pipelines, road crossings, and open pits	August 2020
Evaluation of connectivity of diversions and open pits to potentially fish-bearing habitats.	Waterbodies and watercourses throughout the Project area	August 2020
Vegetation		
Baseline soils and terrain field program	Focus on spatial gaps from 2012 programs in undisturbed areas within the local study area	July to Mid-August 2020
Baseline ELC/Wetland and soils map	Desktop – integrate existing and field data to complete detailed soils and ELC/wetland map of the local study area	July to November 2020
Baseline ELC/wetland, listed plant and regulated weed/invasive plant program	Focus on information gaps from previous programs, ground truthing ELC/wetland mapping and listed/invasive plants in undisturbed areas within the local study area	July to Mid-August 2020
Socio-Economics		
Secondary data collection	Desktop study	January to June 2020
Primary data collection	Yellowknife, Fort Resolution, Fort Smith, Hay River/Hay River Dene 1 (pending engagement) - Government and community service providers, and other participants as considered appropriate through consultation	August through November 2020 (depending on engagement and scoping activity schedules)
Traditional Land and Resource Use and Indigenous Traditional Knowledge		
Information and ITK gathering	Fort Resolution, Fort Smith, Hay River/Hay River Dene 1 with First Nations and Métis groups (pending engagement, with potential for expansion as required) - Land users and Elders, and other participants as considered appropriate through consultation	August to early November 2020 (depending on engagement and scoping activity schedules)
Archaeology		
Baseline archaeology field program	Focus on spatial gaps from 2006 to 2018 programs in undisturbed areas that may be impacted by the Project	July to September 2020 (depending on understanding of disturbance)

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Original signed by:

Lasha Young, MSc
Associate, Project Manager

KM/LY/sc

https://golderassociates.sharepoint.com/sites/111329/project files/5 technical work/001_mveirb_ea initiation package/existing environment/2020 baseline study plan/final/doc012_19125747__pine point project_2020 baseline study plan.docx

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REPORT

Identification of Potential Project-Interactions and Proposed Mitigation Measures

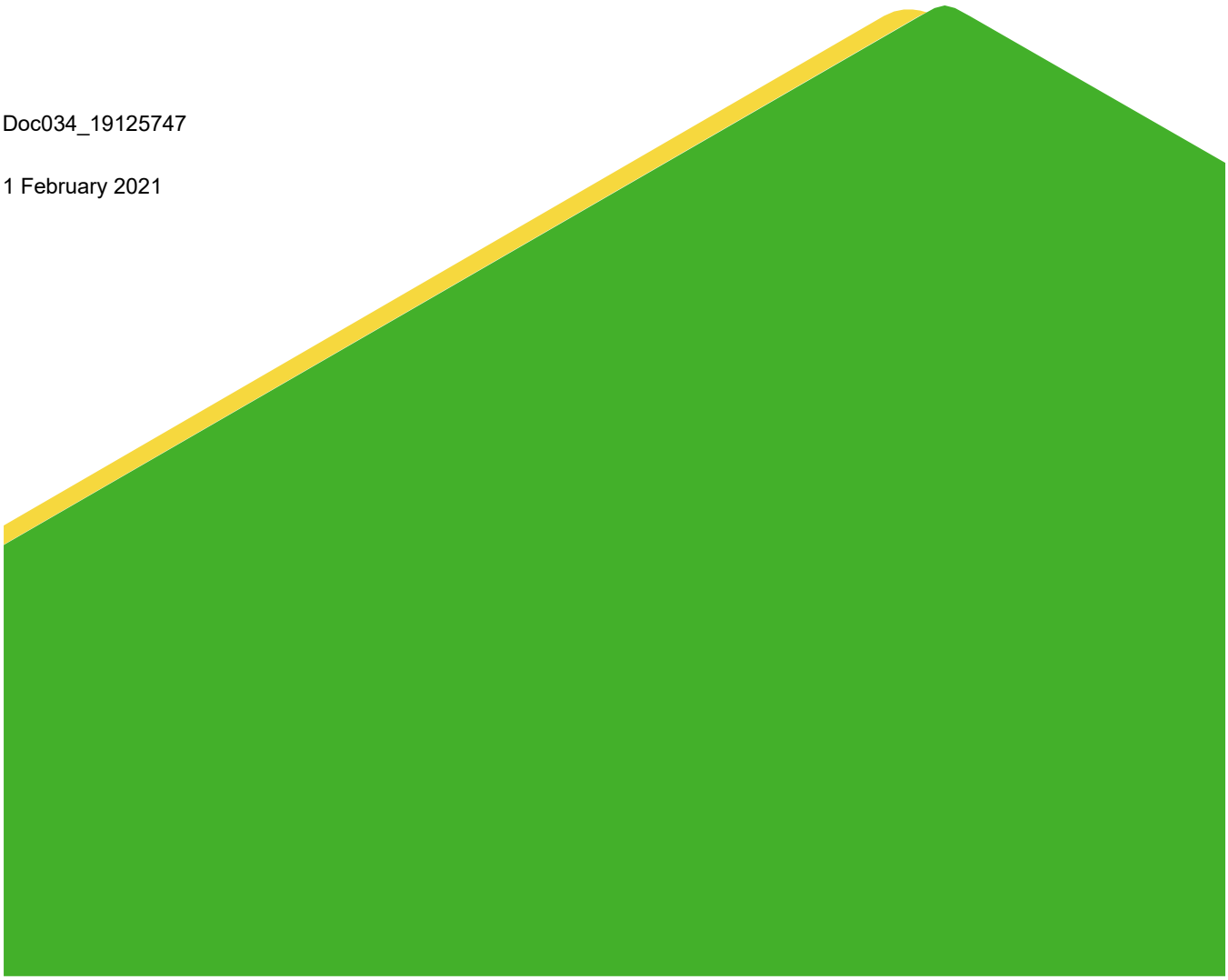
Environmental Assessment Initiation Package for Pine Point Project

Submitted to:

Pine Point Mining Ltd.

Submitted by:

Golder Associates Ltd.



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1 February 2021

Distribution List

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One digital copy to Golder Associates Ltd.

One digital copy to Mackenzie Valley Environmental Impact Review Board

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1.0 INTRODUCTION

1.1 Overview

This document provides a description of potential Project-environment interactions and proposed mitigation measures, as a component of the Environmental Assessment Initiation Package (EA Initiation Package) for the Pine Point Mining Limited (PPML) Pine Point Project (the Project), as outlined in the Mackenzie Valley Environmental Impact Review Board (MVEIRB) Draft Environmental Assessment Initiation Guidelines for Developers of Major Projects (EA Initiation Guidelines; MVEIRB 2018). The Project is located in the Northwest Territories (NWT) within the South Slave Mining District, approximately 175 kilometres (km) south of Yellowknife, on a brownfield site associated with historical mining activity by Cominco Ltd. The Project will consist of open-pit and underground mining for lead and zinc, and development of a process plant, storage and management facilities for processed mineralized material, and ancillary support facilities, including a camp for workers.

This document provides information related to how the proposed Project could interact with and affect components of the biophysical and human environments. A description of proposed mitigation measures that could be used to avoid or limit effects is also provided. As recommended in the EA Initiation Guidelines, this description includes consideration of how the Project could affect air, water, land, fish and wildlife, as well as surrounding communities and residents, socio-economic conditions such as employment, culture, way of life of Indigenous people, archaeological and cultural sites, harvesting, and traditional activities. Consideration of potential cumulative effects that could result from the proposed Project and from past, current, and reasonably foreseeable future developments and activities, as well as natural environmental vulnerabilities and events are also discussed.

Consistent with recommendations outlined in the EA Initiation Guidelines, information provided in this document was also used to consider and identify the key issues and interactions with intermediate and valued components that are proposed to be carried forward in the Developer's Assessment Report, as described in the Developer's Assessment Proposal (Volume 5). The Developer's Assessment Proposal also provides details related to the proposed assessment methods that will be used for the investigation of Project effects. The Project interactions and mitigations described below will be finalized in the Developer's Assessment Report based on additional Project details in the Project Description to be included in the Developer's Assessment Report and following feedback from communities and regulators on the EA Initiation Package.

1.2 Organization

This document has been prepared according to the recommendations outlined in Section 4.3 of the EA Initiation Guidelines:

- Section 2.0 provides a list and brief description of potential Project interactions with the environment. This description includes consideration of accidents and malfunctions and effects of the environment on the Project, including climate change, where appropriate. Instances where there is no pathway to an effect on an environmental component are also identified, where applicable.
- Section 2.0 also provides a list and brief description of recommended mitigation actions, procedures and policies (measures) that would be used to avoid, minimize, or restore (reclaim) the identified effects. In the Developer's Assessment Report, a description of how the mitigation measures were developed and would reliably and sufficiently mitigate the identified effects will be provided.
- Section 3.0 provides a description of how cumulative effects that could result from the proposed Project will be identified. This discussion considers the cumulative effects from past, current, and reasonably foreseeable future developments and activities, as well as natural environmental vulnerabilities and events such as climate change, forest fires, and flooding, which could interact with Project effects.

2.0 IDENTIFICATION OF PROJECT INTERACTIONS AND MITIGATIONS

2.1 Methods

A pathway analysis approach was used as the primary method for identifying potential Project interactions with components of the biophysical and human environments. Pathway analysis defines a comprehensive list of potential interactions between the Project and environment (i.e., effect pathways), identifies mitigation that could be used to eliminate and/or minimize potential adverse effects, and focuses further assessment on key or principal effects from the Project that remain after practicable mitigation has been applied. Each pathway is initially considered to have a linkage to potential effects on components of the biophysical and human environments. For an effect to occur, there must be a source (i.e., a Project component or activity that interacts with the biophysical or social environment) that results in a measurable change in the environment and a corresponding effect on at least one measurement indicator for a valued component or intermediate component

Potential pathways from Project components/activities to components of the biophysical and human environment were identified using the following information:

- review of the Project Description (current version in Volume 1) and scoping of potential effects by the environmental and engineering teams for the Project
- input from early public and community engagement and Indigenous Traditional Knowledge (currently described in Volume 2)
- information related to the existing environment (currently described in Volume 3)
- scientific knowledge
- previous experience with mining projects, including feedback from past regulatory applications for the Pine Point property

Potential adverse effects of the Project were then identified, and environmental design features and mitigation were applied to avoid or minimize effects to components of the biophysical and human environments. Avoidance and minimization are widely recognized as the most important for biodiversity conservation (BBOP 2015). Offsetting may also be considered for certain environmental disciplines where residual effects remain after applying reclamation/restoration actions. Policies, guidelines, and actions to enhance positive outcomes of the Project are also provided, where applicable. Finally, management and monitoring plans that will be developed and implemented for Project are identified, where applicable. These plans represent the primary mechanism for verifying effect predictions, identifying unanticipated effects, and providing the framework for implementation of adaptive management. Additional information related to management and monitoring plans is provided in Volume 6.

The environmental design features, mitigation measures, and regulatory standards and policies identified for the Project were defined based on accepted and proven best management practices that are generally well understood and that have been applied to similar types of projects. These measures also include consideration of feedback received from early engagement completed for the Project and are considered to be effective strategies for reducing adverse effects on components of the biophysical and human environments. Although these lists will need to be refined based on the Project Description and confirmation of Project effects, it is anticipated that mitigation will reliably and sufficiently avoid or reduce the identified effects, such that significant adverse environmental effects can be avoided.

The effectiveness of mitigation proposed for each pathway analysis was assessed to determine whether the mitigation would address the potential effect of the Project such that the pathway is eliminated or results in a negligible adverse effect to a component. Where minimization is proposed, for example by limiting an activity, it will be to the extent allowable by regulation and to the extent that is practical. Uncertainty in the effectiveness of mitigation was considered in the process of completing the pathway analysis. Where uncertainty is anticipated to be high, mitigation is not considered sufficient to remove a pathway or result in a negligible effect (i.e., the analysis applies a precautionary approach). Further discussion related to how uncertainty will be considered in the future Developer's Assessment Report is provided in the Developer's Assessment Proposal (Volume 5).

Each potential effect pathway was evaluated using proposed mitigation to predict whether the pathway had the potential to cause residual adverse effects. Using Indigenous Traditional Knowledge and scientific knowledge, logic, experience with similar developments, and an understanding of the effectiveness of mitigation (i.e., level of certainty that mitigation will work), each pathway was categorized as one of the following:

- No pathway – the analysis reveals that the pathway could be removed (i.e., effect is avoided) by mitigation or design so that the Project would result in no measurable environmental change relative to existing conditions or guideline values (e.g., air, soil, or water quality guidelines), and therefore, would have no residual effect on a biophysical or human environment component.
- Secondary – the pathway could result in a measurable minor environmental change relative to existing conditions or guideline values, but the change is sufficiently small that it would have a negligible residual effect on a biophysical or human environment component (e.g., an increase in an air quality parameter that is small compared to the range of existing values and is well within the air quality guideline for that parameter). Therefore, the pathway is not expected to contribute to effects of other existing, approved, or reasonably foreseeable projects to cause a significant effect.
- Primary – the pathway is likely to result in an environmental change relative to existing conditions or guideline values that could cause a greater than negligible effect on a biophysical or human environment component.

The potential effects pathways from each Project interaction, associated mitigation measures, and pathway categorization are described for each biophysical or human environment component in Section 2.2. The primary objective of pathway analysis is to complete a screening level assessment of potential adverse effects from the Project on valued and intermediate components. Predicted adverse effects on environmental components are characterized in terms of the definitions outlined above (i.e., no pathway, secondary, and primary). Positive or beneficial outcomes are also identified (e.g., employment and training opportunities, income levels) and typically classified as primary or no pathway. An assessment of positive effects and potential enhancement measures will be completed in the Developer's Assessment Report, where applicable.

The effects pathways and mitigations represent a current understanding of the potential Project-environment interactions based on the preliminary Project Description (Volume 1) and will be finalized in the Developer's Assessment Report. That is, the Project interactions will be updated, as required, based on further Project design details, as well as additional mitigation measures identified through discussions with the engineering and environmental teams for the Project. The Developer's Assessment Report will also provide a detailed analysis of Project effects according to the methods outlined in the Developer's Assessment Proposal (Volume 5).

2.2 Results

2.2.1.1 Biophysical Environment

Project components and activities, effects pathways, environmental design features and mitigation, and the categorization of effects pathways (no pathway, secondary, and primary) for the air quality, noise and climate; groundwater quantity and quality; surface water quantity; surface water quality; fish and fish habitat; terrain and soils; vegetation; caribou; and wildlife components are summarized in Tables 1 to 11.

Table 1: Potential Pathways for Effects to Air Quality

Project Components/Activities	Effects Pathway	Environmental Design Features and Mitigation Measures	Pathway Assessment

Project components/activities that contribute to criteria air contaminant emissions include:
• Combustion of fossil fuels in mobile vehicles and heavy equipment for the following:
  ○ Land clearing, site preparation, and construction of facilities and infrastructure
  ○ Development and mining of open pits and underground mines
  ○ Handling and storage of waste rock and mineralized material
  ○ Process plant and processing
  ○ Site traffic
  ○ Transportation of personnel and materials to and from the site
  ○ Removal of infrastructure
  ○ Restoration and revegetation of facilities and infrastructure
• Combustion of fossil fuels in stationary equipment (e.g., power generation)
• Non-hazardous waste incineration
	• Emissions of criteria air contaminants from mobile and stationary combustion sources including nitrogen and sulphur oxides, particulates, and carbon monoxide can affect air quality.	• Hydroelectric power will be used to supplement fossil fuel methods for power generation.
		• Secondary (or backup) power generation will be mainly compressed natural gas (CNG) to minimize use of diesel.
		• An Air Quality Effects Mitigation and Monitoring Plan will be developed and implemented that includes ambient air monitoring for criteria air contaminants and adaptive management based on ambient air quality standards.
		• Procurement criteria will be developed to confirm stationary and mobile engines meet applicable performance standards, such as equipment that has the lowest practical and economically achievable nitrogen oxide emission rates.
		Ultra-low sulphur diesel (less than 15 parts per million sulphur) will be used in all equipment to reduce ambient concentrations of nitrogen dioxide.
		• Transportation of workers will be completed using large vehicles where possible to reduce the number of engines in use, thereby reducing vehicle combustion and fugitive emissions
		• Emissions control devices will be used and maintained on fossil-fuel based engines.
		• Equipment will be regularly maintained
		• Idling of vehicles and equipment will be limited to the extent practical.
			Primary

Project components/activities that contribute to mercury, dioxins, and furans emissions include: • Non-hazardous waste incineration	• Emissions of mercury, dioxins, and furans may adversely affect air quality.	• On-site incineration will be conducted using equipment and methods consistent with the federal guidance on batch waste incineration. As an alternative or supporting action, off-site disposal of some or all garbage is also being considered. • Canadian Council of Ministers of the Environment guidelines will be complied with. • Stack testing and adaptive management will be conducted if required. • Operator training and operational management will be implemented.	Primary
Project components/activities that contribute to dust emissions include: • Land clearing, site preparation and construction of facilities and infrastructure • Development and mining of open pits and underground mines • Handling and storage of waste rock and mineralized material (includes conveyors) • Process plant and processing (includes crushers and conveyors) • Site traffic • Transportation of personnel and materials to and from the site • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Emissions of fugitive dust can affect air quality.	• An Air Quality Effects Mitigation and Monitoring Plan will be developed and implemented that includes ambient air monitoring for fugitive dust and adaptive management. • Water and/or dust suppressants will be applied to site roads as necessary. • Speed limits will be established and enforced on site roads to reduce dust production. • Crushers and conveyors will be covered.	Primary
Project activities that result in wind-borne concentrate along transportation route during operation: • Hauling concentrate from Project to Hay River or Enterprise for rail transport	• Wind-borne emissions of concentrate from haul trucks can affect air quality.	• Concentrate will be covered during transportation to rail yards.	No pathway
Accidents and Malfunctions	• Releases of criteria air contaminants from a wildfire started by Project activities can alter air quality and greenhouse gas emissions and affect climate.	• A Wildfire Prevention and Preparedness Plan will be developed and implemented. • All heavy equipment and fuelling sites will be equipped with approved and fully charged fire extinguishers. • Firefighting training will be provided to on-site personnel (as deemed appropriate). • No smoking will be allowed at equipment fuelling stations or outside of designated areas at all times. • Safety management systems (e.g., hot work permits) will be in place. • Firebreaks and vegetation management (e.g., removal of understory fuel loads) will be implemented as required.	No pathway

Table 2: Potential Pathways for Effects to Noise

Project Components/Activities	Effects Pathway	Environmental Design Features and Mitigation Measures	Pathway Assessment
Project components/activities that contribute to noise emissions during construction, operation, and closure and reclamation: • Land clearing, site preparation and construction of facilities and infrastructure • Development and mining of open pits and underground mines • Handling and storage of waste rock and mineralized material (includes conveyors) • Process plant and processing (includes crushers and conveyors) • Site traffic • Transportation of personnel and materials to and from the site • Power generation • Additional infrastructure (e.g., camp, maintenance shop, and offices) • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Noise emissions from Project activities and equipment will increase sound levels.	• A health and safety program will be implemented. • Noisy equipment will be enclosed in buildings, where feasible. • Internal combustion engines will be outfitted with well-maintained muffler systems. • Power plant generator facilities will have louvers on ventilation openings and exhaust mufflers. • Sound levels will be monitored, as per the noise management plan, and adaptive management applied if required.	Primary
Project components/activities that contribute to ground vibration and air blast overpressure during construction and operation: • Development and mining of open pits and underground mines	• Blasting will result in ground vibration and air blast overpressure.	• A Blast Management Plan will be developed and implemented. • Blasting activities will be limited to the daytime periods, where possible. • Blasting activities will follow a regular schedule, where possible, and site-wide notice will be given prior to each blast. • A standard safety buffer around blasts will be cleared of staff and contractors, where applicable.	Primary

Table 3: Potential Pathways for Effects to Climate

Project Components/Activities	Effects Pathway	Environmental Design Features and Mitigation Measures	Pathway Assessment

Project components/activities that contribute to greenhouse gas emissions include:
• Combustion of fossil fuels in mobile vehicles and heavy equipment for the following:
  ○ Land clearing, site preparation, and construction of facilities and infrastructure
  ○ Development and mining of open pits and underground mines
  ○ Process plant and processing
  ○ Site traffic
  ○ Transportation of personnel and materials to and from the site
  ○ Removal of infrastructure
  ○ Restoration and revegetation of facilities and infrastructure
• Combustion of fossil fuels in stationary equipment (e.g., power generation)
• Non-hazardous waste incineration
	• Greenhouse gas emissions from land use change, refrigeration, and fossil fuel combustion can affect climate.	• Hydroelectric power will be used to supplement fossil fuel methods for power generation.
		• Secondary (or backup) power generation will be mainly compressed natural gas (CNG) to minimize use of diesel.
		• Emissions control devices will be used and maintained on fossil-fuel based engines.
		• Equipment will be regularly maintained.
		• Idling of vehicles and equipment will be limited to the extent practical.
		• Procurement criteria will be developed to confirm stationary and mobile engines meet applicable performance standards.
		• An energy management program will be developed for monitoring and adaptive management of thermal and electrical energy.
		• Energy performance standards will be developed for infrastructure (e.g., insulation for buildings meet codes) and equipment.
			Primary

Accidents and Malfunctions	• Releases of criteria air contaminants from a wildfire started by Project activities can alter air quality and greenhouse gas emissions and affect climate.	• A Wildfire Prevention and Preparedness Plan will be developed and implemented. • All heavy equipment and fuelling sites will be equipped with approved and fully charged fire extinguishers. • Firefighting training will be provided to on-site personnel (as deemed appropriate). • No smoking will be allowed at equipment fuelling stations or outside of designated areas at all times. • Safety management systems (e.g., hot work permits) will be in place. • Firebreaks and vegetation management (e.g., removal of understory fuel loads) will be implemented as required.	No pathway

Table 4: Potential Pathways for Effects to Groundwater Quantity and Quality

Project Components/Activities	Effects Pathway	Environmental Design Features and Mitigation Measures	Pathway Assessment
Project components/activities that influence groundwater processes during construction, operation, and closure and reclamation: • Land clearing, site preparation, and construction of facilities and infrastructure • Development and mining of open pits and underground mines • Tailings disposal and management	• Development of open pits and underground mines can change groundwater flow patterns and distribution.	• The footprint of the open pits and underground mining areas will be designed to minimize the area required to access the mineable resource, to the extent practicable and safe. • Groundwater inflows will be monitored to verify the groundwater model and predicted effects on the groundwater resources for adaptive management, if required. • The Water Management Plan and Tailings and Waste Rock Management Plan will be implemented, including adaptive management, as required.	Primary
Project components/activities that potentially change groundwater quality during construction, operation, and closure and reclamation: • Development and mining of open pits and underground mines • Tailings disposal and management	• Development of open pits and underground mines can change groundwater quality.	• Tailings generated from the process plant will be pumped to and stored in the tailings disposal areas, which will be designed to minimize potential environmental effects by using pre-existing open pits. • Studies will be undertaken to evaluate the suitability of multiple locations as tailings disposal sites and to select locations that will avoid and minimize risk of potential environmental effects. • Studies will be undertaken to evaluate the potential use of re-injection wells as an additional method to dispose of underground saline water that will infiltrate open pits and underground mines. • Seepage from the pits will be managed, if necessary, as described in the Tailings and Waste Rock Management Plan. • Groundwater monitoring around injection sites will be as described in the Tailings and Waste Rock Management Plan. • The Water Management Plan and Tailings and Waste Rock Management Plan will be implemented, including adaptive management, if required.	Secondary or Primary
Project components/activities that potentially change groundwater quality during construction, operation, and closure and reclamation: • Handling and storage of waste rock • Tailings disposal and management	• Seepage from waste rock deposition areas can cause changes in groundwater quality.	• Mineralized material and waste rock will be stored in a contained area. Waste rock will be disposed of onto constructed waste rock storage facilities, or where possible, into historical open pits. • Potential acid generating material will be segregated from non-potential acid generating material. • Seepage will be monitored and managed, if necessary, as described in the Tailings and Waste Rock Management Plan • The Water Management Plan and Tailings and Waste Rock Management Plan will be implemented, including adaptive management, if required. • The Closure and Reclamation Plan will be implemented.	Secondary or No Pathway
Accidents and Malfunctions	• Chemical or hazardous materials spills on site and during transport offsite may enter groundwater and affect groundwater quality.	• The Spill Contingency Plan and Waste Management Plan will be implemented. • Standard best management practices for general activities with regards to use, handling, and storage of deleterious substances will be followed. • Hazardous waste will be stored in appropriate containers that will be located in a lined bermed containment pad, which will provide secondary containment of spills. • No fuels, oils, or other hazardous substances will be stored within 150 m of groundwater springs or areas of upwelling, unless otherwise authorized. • No equipment maintenance or refuelling will be conducted within 150 m of groundwater springs or areas of upwelling, unless otherwise authorized. • The tailings transport pipeline will have drainage points and spill containment areas located along the route. • Regular maintenance of vehicles and equipment will be conducted. • Spill kits will be available at various locations throughout the site and will be maintained in good working order. • Hazardous waste will be transported to a licensed hazardous waste receiving facility for disposal. • Fuel and hazardous materials will be transported in approved containers in licensed vehicles. • If a major spill occurs, the cleanup, treatment, and disposal of the contaminated waste and soil will be handled and disposed of using approved methods. • Speed limits will be enforced.	No Pathway

Table 5: Potential Pathways for Effects to Surface Water Quantity

Project Components/Activities	Effects Pathway	Environmental Design Features and Mitigation Measures	Pathway Assessment
Project components/activities that may divert water from its natural course and result in changes to surface watersheds during construction and operation: • Land clearing, site preparation, and construction of facilities and infrastructure • Development of open pits and underground mines • Handling and storage of waste rock and mineralized material • Process plant • Additional infrastructure (e.g., roads, camp, maintenance shop, and offices)	• Project construction and footprint may change local surface water quantity, routing, and timing.	• The Project disturbance footprint will be limited to the extent practical, and where possible and practical, infrastructure will be built on previously disturbed sites. • Areas of vegetation clearing and soil disturbance will be limited to the immediate area of the future activity at that location. • Roads will be designed to the minimum allowable possible width and follow best practices for design speeds and expected vehicle traffic. • Clearing equipment will be used that minimizes surface disturbance, soil compaction and topsoil loss (e.g., equipment with low ground pressure tracks or tires, blade shoes and brush) where feasible. • Steepness and length of slopes of disturbed areas and stockpiled soils will be limited.	Secondary
	• Project operation and footprint may alter site drainage and runoff and change local hydrology, which can affect drainage patterns and timing.		Primary

Table 5: Potential Pathways for Effects to Surface Water Quantity

Project Components/Activities	Effects Pathway	Environmental Design Features and Mitigation Measures	Pathway Assessment
Project components/activities that may divert water from its natural course and result in changes to surface watersheds during closure and reclamation: • Cessation of site water management activities, including mine water discharge • Reconnection of closure drainages to the local surface water environment • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• During closure, residual ground disturbance, cessation of site water management activities, and reconnection of drainages to the surface water environment may cause changes to local hydrology, which can affect drainage patterns and timing.	• Where possible, work will be avoided in sensitive areas during the time-of-year when erosion is more likely (e.g., spring freshet). • Areas disturbed/altered will be regraded to conform to the local topography to maintain drainage patterns. • Routine inspection and maintenance of containment and conveyance structures (i.e., roadside ditches and culverts) will be conducted to limit the risk of road wash-out or sediment release to the environment. • Culverts will be sized to convey flows under design conditions. • Water crossing structures will be constructed and installed in a manner that protects the banks from erosion and maintains surface water flows. • Where possible, a 30 metre (m) buffer will be established between Project components/infrastructure and permanent waterbodies and watercourses. • Progressive reclamation and revegetation will be implemented for areas disturbed by the Project that are no longer required. • The Closure and Reclamation Plan will be implemented.	Primary
Project components/activities that alter watercourse hydraulics and geomorphology during construction, operation, and closure and reclamation: • Installation of cross drainage structures	• Cross-drainage structures for site roads may alter watercourse hydraulics and geomorphology, which may affect local drainage and a risk of blocking flow.	• Roads will be designed to the minimum allowable possible width and follow best practices for design speeds and expected vehicle traffic. • The road alignment will minimize stream crossings and alterations to existing drainage patterns. • Cross-drainage structures will be designed to limit the area disturbed within waterbodies and watercourses and crossings will be located to avoid sensitive habitats, where possible. • Culverts will be sized to convey flows under design conditions. • Water crossing structures will be constructed and installed in a manner that protects the banks from erosion and maintains surface water flows. • Culverts will be regularly inspected and maintained to prevent blockages from forming and causing ponding or backwater effects, including snow removal at inlets and outlets prior to freshet.	No pathway
Project components/activities that may influence surface water flows and sedimentation during construction, operation, and closure and reclamation: • Land clearing, site preparation, and construction of facilities and infrastructure • Development and mining of open pits and underground mines • Handling and storage of waste rock and mineralized material • Process plant and processing • Additional infrastructure (e.g., roads, camp, maintenance shop, and offices) • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Release of sediment during instream construction, ground disturbance, and altered surface flows may result in transport of suspended sediment and deposition downstream.	• The Project disturbance footprint will be limited to the extent practical, and where possible and practical, infrastructure will be built on previously disturbed sites. • Areas of vegetation clearing and soil disturbance will be limited to the immediate area of the future activity at that location. • Roads will be designed to the minimum allowable possible width and follow best practices for design speeds and expected vehicle traffic. • The road alignment will minimize stream crossings and alterations to existing drainage patterns. • Where possible, work in sensitive areas will be avoided during the time-of-year when erosion is more likely (e.g., spring freshet). • The steepness and length of slopes of disturbed areas and stockpiled soils will be limited. • The Water Management Plan, Tailings and Waste Rock Management Plan, and Erosion and Sediment Control Plan will be implemented, including adaptive management, as required. • Routine inspection and maintenance of containment and conveyance structures (i.e., roadside ditches and culverts) will be conducted to limit the risk of road wash-out or sediment release to the environment. • Where possible, a 30 m buffer will be established between Project components/infrastructure and permanent waterbodies and watercourses. • Progressive reclamation and revegetation will be implemented for areas disturbed by the Project that are no longer required. • The Closure and Reclamation Plan will be implemented.	Secondary
Project components/activities that influence hydrological processes and water balance during construction, operation, and closure and reclamation: • Land clearing, site preparation, and construction of facilities and infrastructure • Development and mining of open pits and underground mines • Handling and storage of waste rock and mineralized material • Process plant and processing • Tailings disposal and management • Mine water discharge • Domestic wastewater discharge following treatment • Additional infrastructure (e.g., roads, camp, maintenance shop, and offices) • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Physical changes to land cover and land surface can result in changes to local hydrological processes and water balance.	• The Project disturbance footprint will be limited to the extent practical, and where possible and practical, infrastructure will be built on previously disturbed sites. • Areas of vegetation clearing and soil disturbance will be limited to the immediate area of future activity at that location. • Roads will be designed to the minimum allowable possible width and will follow best practices for design speeds and expected vehicle traffic. • The road alignment will minimize stream crossings and alterations to existing drainage patterns. • The Water Management Plan and Tailings and Waste Rock Management Plan will be implemented, including adaptive management, as required. • An Aquatic Effects Monitoring Program (AEMP) and Surveillance Network Program (SNP) will be developed and implemented to monitor effects of the mine on the aquatic receiving environment. Adaptive management actions as per an aquatic response framework within the AEMP will be enabled if necessary. • Water withdrawals will adhere to guidance from regulators such as Fisheries and Oceans Canada as to the allowable rate and timing of withdrawals from the point of supply. • Process water will be recirculated and water from tailings disposal areas will be recovered for recycling. • Process water for start-up may be pumped from historical open pits if the water has suitable quality and quantity, or if not, from Great Slave Lake. • The number of water intake and discharge locations will be limited to reduce effects to surface water quantity. • The Closure and Reclamation Plan will be implemented.	Primary
	• Development of open pits and underground mines and associated surface and groundwater changes can result in local increases or decreases in surface water quantity, which may change surface water flow regimes.		Primary
	• Water supply requirements (potable and process) and water discharge for the Project may alter local hydrology and water balance.		Primary or Secondary
Accidents and Malfunctions	• Flow over emergency spillways of water containment structures during extreme flood events may alter local hydrology, drainage and/or stream characteristics.	• Overflow spillways and downstream conveyance structures will be designed to be stable and maintain function, and provide sufficient erosion protection during a design flood. • Routine inspections will be completed and the storm water management system will be maintained.	No pathway

Table 6: Potential Pathways for Effects to Surface Water Quality

Project Components/Activities	Effects Pathway	Environmental Design Features and Mitigation Measures	Pathway Assessment
Project components/activities that may change surface water and sediment quality through alterations in site drainage and runoff during construction and operation: • Land clearing, site preparation, and construction of facilities and infrastructure • Development of open pits and underground mines • Handling and storage of waste rock and mineralized material • Process plant and processing • Additional infrastructure (e.g., roads, camp, maintenance shop, and offices)	• Altered site drainage and runoff during construction and operation may change local hydrology (subsurface water flows, drainage, lake and stream levels) and affect surface water and sediment quality in receiving and downstream aquatic environments.	• The Project disturbance footprint will be limited to the extent practical, and where possible and practical, infrastructure will be built on previously disturbed sites. • Areas of vegetation clearing and soil disturbance will be limited to the immediate area of future activity at that location. • Roads will be designed to the minimum allowable possible width and follow best practices for design speeds and expected vehicle traffic. • Clearing equipment will be used that minimizes surface disturbance, soil compaction, and topsoil loss (e.g., equipment with low ground pressure tracks or tires, blade shoes and brush), where feasible. • Steepness and length of slopes of disturbed areas and stockpiled soils will be limited. • Where possible, work will be avoided in sensitive areas during the time-of-year when erosion is more likely (e.g., spring freshet). • Routine inspection and maintenance of containment and conveyance structures (i.e., roadside ditches and culverts) will be conducted to limit the risk of road wash-out or sediment release to the environment. • Culverts will be sized to convey flows under design conditions. • Water crossing structures will be constructed and installed in a manner that protects the banks from erosion and maintains surface water flows. • Where possible, a 30 metre (m) buffer will be established between Project components/infrastructure and permanent waterbodies and watercourses. • Progressive reclamation and revegetation will be implemented for areas disturbed by the Project that are no longer required. • The Closure and Reclamation Plan will be implemented.	Secondary
Project components/activities that may change surface water and sediment quality through alterations in site drainage and runoff during closure and reclamation: • Cessation of site water management activities, including mine water discharge • Reconnection of closure drainages to the local surface water environment • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• During closure, residual ground disturbance, cessation of site water management activities, and reconnection of drainages to the surface water environment may cause changes to local hydrology, which can affect surface water and sediment quality in the receiving and downstream aquatic environments.		Secondary
Project components/activities that alter watercourse hydraulics and geomorphology during construction, operation, and closure and reclamation: • Installation of cross-drainage structures	• Cross-drainage structures for site roads may alter watercourse hydraulics and geomorphology, which may affect local drainage and alter surface water and sediment quality.	• Roads will be designed to the minimum allowable possible width and follow best practices for design speeds and expected vehicle traffic. • The road alignment will minimize stream crossings and alterations to existing drainage patterns. • Cross-drainage structures will be designed to limit the area disturbed within waterbodies and watercourses and crossings located to avoid sensitive habitats, where possible. • Culverts will be sized to convey flows under design conditions. • Water crossing structures will be constructed and installed in a manner that protects the banks from erosion and maintains surface water flows. • Culverts will be regularly inspected and maintained to prevent blockages from forming and causing ponding or backwater effects, including snow removal at inlets and outlets prior to freshet.	No pathway
Project components/activities that may influence surface water flows and sedimentation during construction, operation, and closure and reclamation: • Land clearing, site preparation, and construction of facilities and infrastructure • Development and mining of open pits and underground mines • Handling and storage of waste rock and mineralized material • Process plant and processing • Additional infrastructure (e.g., roads, camp, maintenance shop, and offices) • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Release of sediment during instream construction and ground disturbance and altered surface flows may cause a change in surface water and sediment quality in receiving and downstream aquatic environments.	• The Project disturbance footprint will be limited to the extent practical, and where possible and practical, infrastructure will be built on previously disturbed sites. • Areas of vegetation clearing and soil disturbance will be limited to the immediate area of future activity at that location. • Roads will be designed to the minimum allowable possible width and follow best practices for design speeds and expected vehicle traffic. • The road alignment will minimize stream crossings and alterations to existing drainage patterns. • Where possible, work will be avoided in sensitive areas during the time-of-year when erosion is more likely (e.g., spring freshet). • Steepness and length of slopes of disturbed areas and stockpiled soils will be limited. • The Water Management Plan, Tailings and Waste Rock Management Plan, and Erosion and Sediment Control Plan will be implemented, including adaptive management, if required. • Routine inspection and maintenance of containment and conveyance structures (i.e., roadside ditches and culverts) will be conducted to limit the risk of road wash-out or sediment release to the environment. • Where possible, a 30 m buffer will be established between Project components/infrastructure and permanent waterbodies and watercourses. • Progressive reclamation and revegetation will be implemented for areas disturbed by the Project that are no longer required. • The Closure and Reclamation Plan will be implemented.	Secondary

Table 6: Potential Pathways for Effects to Surface Water Quality

Project Components/Activities	Effects Pathway	Environmental Design Features and Mitigation Measures	Pathway Assessment
Project components/activities that may change surface water and sediment quality during construction and operation: • Land clearing, site preparation, and construction of facilities and infrastructure • Development and mining of open pits and underground mines • Handling and storage of waste rock and mineralized material • Process plant and processing • Tailings disposal and management • Mine water discharge	• Direct discharge of mine water may cause physical erosion of lake or stream bottom sediments near the discharge location resulting in changes to surface water quality.	• If required, the discharge of mine water to a receiving waterbody or watercourse will be directed through a properly designed diffuser, where appropriate, to minimize erosion effects from high velocity outflows.	Secondary
	• Direct discharge of mine water, as well as surface runoff, groundwater inflow and seepage from the Project will cause changes to surface water quality in receiving and downstream aquatic environments.	• The Project disturbance footprint will be limited to the extent practical, and where possible and practical, infrastructure will be built on previously disturbed sites. • Areas of vegetation clearing and soil disturbance will be limited to the immediate area of the future activity at that location. • Roads will be designed to the minimum allowable possible width and follow best practices for design speeds and expected vehicle traffic. • The road alignment will minimize stream crossings and alterations to existing drainage patterns. • The Water Management Plan and Tailings and Waste Rock Management Plan will be implemented, including adaptive management, if required. • Water that interacts with the site footprint, waste rock, and tailings management areas will be captured and managed. • If required, the mine water discharge will meet all regulatory guidelines including Effluent Quality Criteria defined in a future Type A Water Licence and the Canadian Metal and Diamond Mining Effluent Regulations – Schedule 4 limits. • If water is to be discharged during operations, the location of the mine water discharge will be selected that will minimize effects to water quality and fish habitat. • Studies will be undertaken to evaluate the potential use of re-injection wells as an additional method to dispose of underground saline water that will infiltrate open pits and underground mines. • Depending on the location, the pumped mine water discharge to a receiving water body (river or lake system), if required, may be directed through a properly designed diffuser system to rapidly attenuate the discharge, as appropriate • Discharge water will be regularly sampled and monitored, enabling adaptive management actions if necessary. • An Aquatic Effects Monitoring Program (AEMP) and Surveillance Network Program (SNP) will be developed and implemented to monitor effects of the mine on the aquatic receiving environment. Adaptive management actions as per an aquatic response framework within the AEMP will be enabled if necessary. • Mineralized material and waste rock will be stored in contained areas. Waste rock will be disposed of onto constructed waste rock storage facilities, or where possible, into historical open pits. • Tailings generated from the process plant will be pumped to and stored in the tailings disposal areas, which will be designed to minimize potential environmental effects by using pre-existing open pits. • A Blast Management Plan will be developed and implemented.	Primary
Project components/activities that may change surface water and sediment quality through treated domestic effluent release during construction, operation, and closure and reclamation: • Domestic wastewater discharge following treatment	• Discharge of treated domestic wastewater and sewage may cause a change in surface water quality in receiving and downstream aquatic environments.	• Treated domestic effluent will be discharged to the septic field or may be discharged to a waterbody if it meets effluent criteria. • The Water Management Plan and Waste Management Plan will be implemented.	No pathway or Secondary
Project components/activities that influence hydrological processes and water balance during construction, operation, and closure and reclamation: • Land clearing, site preparation and construction of facilities and infrastructure • Development and mining of open pits and underground mines • Handling and storage of waste rock and mineralized material • Process plant and processing • Tailings disposal and management • Mine water discharge • Domestic wastewater discharge following treatment • Additional infrastructure (e.g., roads, camp, maintenance shop, and offices) • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Alterations in land cover and development of open pits and underground mines and associated surface and groundwater changes can result in local increases or decreases in surface water quantity, which may change surface water quality in receiving and downstream aquatic environments.	• The Project disturbance footprint will be limited to the extent practical, and where possible and practical, infrastructure will be built on previously disturbed sites. • Areas of vegetation clearing and soil disturbance will be limited to the immediate area of future activity at that location. • Roads will be designed to the minimum allowable possible width and follow best practices for design speeds and expected vehicle traffic. • The road alignment will minimize stream crossings and alterations to existing drainage patterns. • The Water Management Plan and Tailings and Waste Rock Management Plan will be implemented, which includes adaptive management, if required.	Secondary
	• Water supply requirements (potable and process) and water discharge for the Project may alter local hydrology and water balance and change surface water quality in receiving and downstream aquatic environments.	• Water withdrawals will adhere to guidance from regulators such as Fisheries and Oceans Canada as to the allowable rate and timing of withdrawals from the point of supply. • Process water will be recirculated and water from tailings disposal areas will be recovered for recycling. • Process water for start-up may be pumped from historical open pits if the water has suitable quality and quantity, or if not, from Great Slave Lake. • The number of water intake and discharge locations will be limited to reduce effects to surface water quantity. • The Closure and Reclamation Plan will be implemented.	Secondary

Table 6: Potential Pathways for Effects to Surface Water Quality

Project Components/Activities	Effects Pathway	Environmental Design Features and Mitigation Measures	Pathway Assessment
Project components/activities that contribute to emissions and deposition of fugitive dust during construction, operation, and closure and reclamation: • Land clearing, site preparation and construction of facilities and infrastructure • Development and mining of open pits and underground mines • Handling and storage of waste rock and mineralized material (includes conveyors) • Process plant and processing (includes crushers and conveyors) • Site traffic • Transportation of personnel and materials to and from the site • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Deposition of fugitive dust emissions (e.g., metals) may change surface water quality in the local aquatic receiving environment.	• An Air Quality Effects Mitigation and Monitoring Plan will be developed and implemented that includes ambient air monitoring for fugitive dust and adaptive management. • An AEMP will be developed and implemented to monitor effects of the mine on the aquatic receiving environment. Adaptive management actions as per an aquatic response framework within the AEMP will be enabled if necessary. • Water and/or dust suppressants will be applied to site roads as necessary. • Speed limits will be established and enforced on site roads to reduce dust production. • Crushers and conveyors will be covered. • Concentrate will be covered during transportation to rail yards.	Secondary
Project components/activities that contribute to criteria air contaminant emissions during construction, operation, and closure and reclamation: • Land clearing, site preparation and construction of facilities and infrastructure • Development and mining of open pits and underground mines • Handling and storage of waste rock and mineralized material (includes conveyors) • Process plant and processing • Site traffic • Transportation of personnel and materials to and from the site • Power generation • Non-hazardous waste incineration • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Deposition suspended solids in criteria air contaminant emissions (e.g., sulphur and nitrogen oxides) may change surface water quality in the local aquatic receiving environment.	• Hydroelectric power will be used to supplement fossil fuel methods for power generation. • Secondary (or backup) power generation will be mainly compressed natural gas (CNG) to minimize use of diesel. • An Air Quality Effects Mitigation and Monitoring Plan will be developed and implemented that includes ambient air monitoring for criteria air contaminants and adaptive management based on ambient air quality standards. • An Aquatics Effects Monitoring Program (AEMP) will be developed and implemented to monitor effects of the mine on the aquatic receiving environment. Adaptive management actions as per an aquatic response framework within the AEMP will be enabled if necessary. • Procurement criteria will be developed to ensure stationary and mobile engines meet applicable performance standards, such as equipment that has the lowest practical and economically achievable nitrogen oxide emission rates. • Ultra-low sulphur diesel (less than 15 parts per million sulphur) will be used in all equipment to reduce ambient concentrations of nitrogen dioxide. • Transportation of workers will be completed using large vehicles where possible to reduce the number of engines in use, thereby reducing vehicle combustion and fugitive emissions • Emissions control devices will be used and maintained on fossil-fuel based engines. • Regular maintenance of equipment will be conducted. • Idling of vehicles will be limited to the extent practical.	Secondary
Project components/activities that potentially change groundwater quality during construction, operation, and closure and reclamation: • Development and mining of open pits and underground mines • Tailings disposal and management	• Changes in groundwater quality from open pits, underground mines and tailings can affect surface water and sediment quality.	• The Water Management Plan and Tailings and Waste Rock Management Plan will be implemented, including adaptive management, if required. • Tailings generated from the process plant will be pumped to and stored in the tailings disposal areas, which will be designed to minimize potential environmental effects by using pre-existing open pits. • Studies will be undertaken to evaluate the suitability of multiple locations as tailings disposal sites and to select locations that will avoid and minimize risk of potential environmental effects. • The Closure and Reclamation Plan will be implemented.	Secondary
Project components/activities that potentially change groundwater quality during construction, operation, and closure and reclamation: • Handling and storage of waste rock and mineralized material	• Seepage from waste rock deposition areas can cause changes in groundwater quality and surface water and sediment quality.	• The Water Management Plan and Tailings and Waste Rock Management Plan will be implemented, including adaptive management, if required. • Waste rock will be deposited into historical mined open pits or onto constructed stockpile pads adjacent to deposits being mined. • The Closure and Reclamation Plan will be implemented.	Secondary
Accidents and Malfunctions	• Chemical or hazardous materials spills on site and during transport offsite may adversely affect surface water quality in the local aquatic receiving environment.	• The Spill Contingency Plan and Waste Management Plan will be implemented. • Standard best management practices for general activities with regards to use, handling, and storage of deleterious substances will be followed. • Hazardous waste will be stored in appropriate containers that will be located in a lined bermed containment pad, which will provide secondary containment of spills. • No fuels, oils, or other hazardous substances will be stored within 150 m of waterbodies. • No equipment maintenance or refuelling will be conducted within 150 m of waterbodies. • The tailings transport pipeline will have drainage points and spill containment areas located along the route. • Regular maintenance of vehicles and equipment will be conducted. • Spill kits will be available at various locations throughout the site and will be maintained in good working order. • Hazardous waste will be transported to a licensed hazardous waste receiving facility for disposal. • Fuel and hazardous materials will be transported in approved containers in licensed vehicles. • If a major spill occurs, the cleanup, treatment, and disposal of the contaminated waste and soil will be handled and disposed using approved methods. • Speed limits will be enforced.	No pathway
Accidents and Malfunctions	• Flow over emergency spillways of water containment structures during extreme flood events may adversely affect surface water quality.	• Overflow spillways and downstream conveyance structures will be designed to be stable and maintain function, and provide sufficient erosion protection during a design flood. • Routine inspections and maintenance of storm water management system will be conducted.	No pathway

Table 6: Potential Pathways for Effects to Surface Water Quality

Project Components/Activities	Effects Pathway	Environmental Design Features and Mitigation Measures	Pathway Assessment
Accidents and Malfunctions	• A wildfire started by Project activities may adversely affect surface water quality.	• A Wildfire Prevention and Preparedness Plan will be developed and implemented. • All heavy equipment and fuelling sites will be equipped with approved and fully charged fire extinguishers. • Firefighting training will be provided to on-site personnel (as deemed appropriate). • No smoking will be allowed at equipment fuelling stations or outside of designated areas at all times. • Safety management systems (e.g., hot work permits) will be implemented. • Firebreaks and vegetation management (e.g., removal of understory fuel loads) will be implemented.	No pathway

Table 7: Potential Pathways for Effects to Fish and Fish Habitat

Project Components/Activities	Effects Pathway	Environmental Design Features and Mitigation Measures	Pathway Assessment
Project components/activities that may divert water from its natural course and result in changes to surface watersheds during construction and operation: • Land clearing, site preparation and construction of facilities and infrastructure • Development of open pits and underground mines • Handling and storage of waste rock and mineralized material • Process plant • Additional infrastructure (e.g., roads, camp, maintenance shop, and offices)	• Changes to local hydrology from surface disturbances during construction may alter fish habitat quantity and quality and affect habitat connectivity and fish distribution.	• The Project disturbance footprint will be limited to the extent practical, and where possible and practical infrastructure will be built on previously disturbed sites. • Areas of vegetation clearing and soil disturbance will be limited to the immediate area of the future activity at that location. • Roads will be designed to the minimum allowable possible width and follow best practices for design speeds and expected vehicle traffic. • Clearing equipment will be used that minimizes surface disturbance, soil compaction and topsoil loss (e.g., equipment with low ground pressure tracks or tires, blade shoes and brush) where feasible. • Steepness and length of slopes of disturbed areas and stockpiled soils will be limited. • Where possible, work will be avoided in sensitive areas during the time-of-year when erosion is more likely (e.g., spring freshet). • Routine inspection and maintenance of containment and conveyance structures (i.e., roadside ditches and culverts) will be conducted to limit the risk of road wash-out or sediment release to the environment. • Culverts will be sized to convey flows under design conditions. • Water crossing structures will be constructed and installed in a manner that protects the banks from erosion and maintains surface water flows. • Where possible, a 30 metre (m) buffer will be established between Project components/infrastructure and permanent waterbodies and watercourses. • Progressive reclamation and revegetation will be implemented for areas disturbed by the Project that are no longer required. • The Closure and Reclamation Plan will be implemented.	No pathway
	• Altered site drainage and runoff from facilities during operation may change local hydrology and affect fish habitat quantity and quality (e.g., Twin Creek and Paulette Creek).		Secondary or Primary
Project components/activities that may divert water from its natural course and result in changes to surface watersheds during closure and reclamation: • Cessation of site water management activities, including mine water discharge • Reconnection of closure drainages to the local surface water environment • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Residual ground disturbance at closure, cessation of site water management activities, and reconnection of closure drainages to the local surface water environment may cause permanent changes to local hydrology, which can affect fish habitat quantity and quality.		Secondary
Project components/activities that may change surface water and sediment quality through alterations in site drainage and runoff during construction and operation: • Land clearing, site preparation and construction of facilities and infrastructure • Development of open pits and underground mines • Handling and storage of waste rock and mineralized material • Process plant and processing • Additional infrastructure (e.g., roads, camp, maintenance shop, and offices)	• Altered site drainage and runoff during construction and operation may change local hydrology and surface water and sediment quality and alter fish habitat quality affect the survival and reproduction of fish.	• The Project disturbance footprint will be limited to the extent practical, and where possible and practical infrastructure will be built on previously disturbed sites. • Areas of vegetation clearing and soil disturbance will be limited to the immediate area of the future activity at that location. • Roads will be designed to the minimum allowable possible width and follow best practices for design speeds and expected vehicle traffic. • Clearing equipment will be used that minimizes surface disturbance, soil compaction and topsoil loss (e.g., equipment with low ground pressure tracks or tires, blade shoes and brush) where feasible. • Steepness and length of slopes of disturbed areas and stockpiled soils will be limited. • Where possible, work will be avoided in sensitive areas during the time-of-year when erosion is more likely (e.g., spring freshet). • Routine inspection and maintenance of containment and conveyance structures (i.e., roadside ditches and culverts) will be conducted to limit the risk of road wash-out or sediment release to the environment. • Culverts will be sized to convey flows under design conditions. • Water crossing structures will be constructed and installed in a manner that protects the banks from erosion and maintains surface water flows. • Where possible, a 30 m buffer will be established between Project components/infrastructure and permanent waterbodies and watercourses. • Progressive reclamation and revegetation will be implemented for areas disturbed by the Project that are no longer required. • The Closure and Reclamation Plan will be implemented.	Secondary
Project components/activities that may change surface water and sediment quality through alterations in site drainage and runoff during closure and reclamation: • Cessation of site water management activities, including mine water discharge • Reconnection of closure drainages to the local surface water environment • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Residual ground disturbance at closure, cessation of site water management activities, and reconnection of closure drainages to the local surface water environment may cause changes to water quality, which alter affect fish habitat quality and affect the survival and reproduction of fish.		Secondary
Project components/activities that contribute to emissions and deposition of fugitive dust during construction, operation, and closure and reclamation: • Land clearing, site preparation, and construction of facilities and infrastructure • Development and mining of open pits and underground mines • Handling and storage of waste rock and mineralized material (includes conveyors) • Process plant and processing (includes crushers and conveyors) • Site traffic • Transportation of personnel and materials to and from the site • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Deposition of fugitive dust emissions (e.g., metals) may change surface water quality, which can alter fish habitat quality and affect the survival and reproduction of fish.	• An Air Quality Effects Mitigation and Monitoring Plan will be developed and implemented that includes ambient air monitoring for fugitive dust and adaptive management. • An Aquatic Effects Monitoring Program (AEMP) will be developed and implemented to monitor effects of the mine on the aquatic receiving environment. Adaptive management actions as per an aquatic response framework within the AEMP will be enabled if necessary. • Water and/or dust suppressants will be applied to site roads as necessary. • Speed limits will be established and enforced on site roads to reduce dust production. • Crushers and conveyors will be covered. • Concentrate will be covered during transportation to rail yards.	Secondary

Table 7: Potential Pathways for Effects to Fish and Fish Habitat

Project Components/Activities	Effects Pathway	Environmental Design Features and Mitigation Measures	Pathway Assessment
Project components/activities that contribute to criteria air contaminant emissions during construction, operation, and closure and reclamation: • Land clearing, site preparation and construction of facilities and infrastructure • Development and mining of open pits and underground mines • Handling and storage of waste rock and mineralized material • Process plant and processing • Site traffic • Transportation of personnel and materials to and from the site • Power generation • Non-hazardous waste incineration • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Deposition suspended solids in criteria air contaminant emissions (e.g., sulphur and nitrogen oxides) may change surface water quality, which can alter fish habitat quality and affect the survival and reproduction of fish.	• Hydroelectric power will be used to supplement fossil fuel methods for power generation. • Secondary (or backup) power generation will be mainly compressed natural gas (CNG) to minimize use of diesel. • An Air Quality Effects Mitigation and Monitoring Plan will be developed and implemented that includes ambient air monitoring for criteria air contaminants and adaptive management based on ambient air quality standards. • An Aquatic Effects Monitoring Program (AEMP) will be developed and implemented to monitor effects of the mine on the aquatic receiving environment. Adaptive management actions as per an aquatic response framework within the AEMP will be enabled if necessary. • Procurement criteria will be developed to ensure stationary and mobile engines meet applicable performance standards, such as equipment that has the lowest practical and economically achievable nitrogen oxide emission rates. • Ultra-low sulphur diesel (less than 15 parts per million sulphur) will be used in all equipment to reduce ambient concentrations of nitrogen dioxide. • Transportation of workers will be completed using large vehicles where possible to reduce the number of engines in use, thereby reducing vehicle combustion and fugitive emissions • Emissions control devices will be used and maintained on fossil-fuel based engines. • Regular maintenance of equipment will be conducted. • Idling of vehicles will be limited to the extent practical.	Secondary
Project components/activities that result in a direct loss of fish habitat during construction, operation, and closure and reclamation: • Land clearing, site preparation, and construction of facilities and infrastructure • Installation of cross drainage structures, diffuser for mine water discharge, and water intakes	• Project footprint will result in a direct loss or alteration of fish habitat, which may affect habitat quantity, quality, and connectivity and fish distribution.	• The Project disturbance footprint will be limited to the extent practical, and where possible and practical infrastructure will be built on previously disturbed sites. • Roads will be designed to the minimum allowable possible width and follow best practices for design speeds and expected vehicle traffic. • Removal of riparian vegetation will be minimized • If necessary, a fisheries offsetting plan will be developed in consultation with Fisheries and Oceans Canada (DFO) and with engagement of local Indigenous communities. • Progressive reclamation and revegetation will be implemented for areas disturbed by the Project that are no longer required. • The Closure and Reclamation Plan will be implemented.	Primary or Secondary
Project components/activities that alter watercourse hydraulics and geomorphology during construction, operation, and closure and reclamation: • Installation of cross-drainage structures	• Water crossing structures for site roads may alter watercourse hydraulics and geomorphology, which may affect fish habitat quantity and quality and alter habitat connectivity and fish passage and distribution.	• Roads will be designed to the minimum allowable possible width and follow best practices for design speeds and expected vehicle traffic. • The road alignment will minimize stream crossings and alterations to existing drainage patterns. • Culverts will be sized to convey flows under design conditions. • Crossing structures will be designed to limit the area disturbed within waterbodies and watercourses and locate crossings to avoid sensitive fish habitats where possible. • Culverts will be designed to allow for fish passage, where appropriate. An assessment of water flow conditions and fish presence will be completed prior to construction to establish a culvert design that will allow for passage of fish. • Water crossings structures will be constructed and installed in a manner that protects the banks from erosion and maintains the flows in the water body and follows permits or authorizations issued for the Project from the appropriate regulatory agencies and DFO's *Measures to Protect Fish and Fish Habitat* (DFO 2019). • Culverts will be regularly inspected and maintained to prevent blockages from forming and causing ponding or backwater effects, including snow removal at inlets and outlets prior to freshet. • Where culverts are installed at fish bearing water bodies, debris removal activities will follow DFO's guidance (i.e., gradual removal such that flooding downstream, extreme flows downstream, release of suspended sediment, and fish stranding can be avoided).	Secondary

Table 7: Potential Pathways for Effects to Fish and Fish Habitat

Project Components/Activities	Effects Pathway	Environmental Design Features and Mitigation Measures	Pathway Assessment

Project components/activities that may influence surface water flows and sedimentation during construction, operation, and closure and reclamation:
• Land clearing, site preparation and construction of facilities and infrastructure
• Development and mining of open pits and underground mines
• Handling and storage of waste rock and mineralized material
• Process plant
• Additional infrastructure (e.g., roads, camp, maintenance shop, and offices)
• Removal of infrastructure
• Restoration and revegetation of facilities and infrastructure
	• Release of sediment during instream construction and from ground disturbance and altered surface flow may alter fish habitat quality.	• The Project disturbance footprint will be limited to the extent practical, and where possible and practical; infrastructure will be built on previously disturbed sites.
		• Areas of vegetation clearing and soil disturbance will be limited to the immediate area of the future activity at that location.
		• Roads will be designed to the minimum allowable possible width and follow best practices for design speeds and expected vehicle traffic.
		• The road alignment will minimize stream crossings and alterations to existing drainage patterns.
		• Where possible, work will be avoided in sensitive areas during the time-of-year when erosion is more likely (e.g., spring freshet).
		• Steepness and length of slopes of disturbed areas and stockpiled soils will be limited.
		• The Water Management Plan, Tailings and Waste Rock Management Plan, and Erosion and Sediment Control Plan will be implemented, including adaptive management, if required. DFO's *Measures to Protect Fish and Fish Habitat* (DFO 2019) will be considered.
		• Areas disturbed/altered will be regraded to conform to the local topography to maintain drainage patterns.
		• Routine inspection and maintenance of containment and conveyance structures (i.e., roadside ditches and culverts) will be conducted to limit the risk of road wash-out or sediment release to the environment.
		• Where possible, a 30 m buffer will be established between Project components/infrastructure and permanent waterbodies and watercourses.
		• Progressive reclamation and revegetation will be implemented for areas disturbed by the Project that are no longer required.
		• The Closure and Reclamation Plan will be implemented.
		• Where possible, instream construction in areas of potential spawning habitat will take place outside the spawning period for fish VCs. Construction activities will be scheduled to avoid work during DFO's *Restricted Activity Timing Windows for the Protection of Fish and Fish Habitat* (DFO 2013). Restricted activity periods for fish VCs are as follows:
		  ○ Great Slave Lake, Buffalo River, and Paulette Creek fish communities:
		  ○ April 1 to July 15 for spring spawning species [e.g., Northern Pike (*Esox lucius*) and Walleye (*Sander vitreus*)]
		  ○ September 15 to June 30 for fall spawning species [e.g., Lake Whitefish (*Coregonus clupeaformis*)]
		  ○ Twin Creek fish community:
		  ○ April 1 to July 15 for spring spawning species (e.g., Northern Pike and Walleye)
		  ○ No fall spawning species are likely to be present in Twin Creek
			Secondary

Project components/activities that may change surface water and sediment quality during construction and operation: • Land clearing, site preparation and construction of facilities and infrastructure • Development and mining of open pits and underground mines • Handling and storage of waste rock and mineralized material • Process plant and processing • Tailings disposal and management • Mine water discharge	• Direct discharge of mine water, as well as surface runoff, groundwater inflow and seepage from the Project will cause changes to downstream surface water quality, which can alter fish habitat quality and affect the survival and reproduction of fish.	• The Project disturbance footprint will be limited to the extent practical, and where possible and practical, infrastructure will be built on previously disturbed sites. • Areas of vegetation clearing and soil disturbance will be limited to the immediate area of the future activity at that location. • Roads will be designed to the minimum allowable possible width and follow best practices for design speeds and expected vehicle traffic. • The road alignment will minimize stream crossings and alterations to existing drainage patterns. • The Water Management Plan and Tailings and Waste Rock Management Plan will be implemented, including adaptive management, if required. • Water that interacts with the site footprint, waste rock, and tailings management areas will be captured and managed. • If water is to be discharged during operations, the location of the mine water discharge will be selected that will minimize effects to water quality and fish habitat. • Studies will be undertaken to evaluate the potential use of re-injection wells as an additional method to dispose of underground saline water that will infiltrate open pits and underground mines. • If required, the mine water discharge will meet all regulatory guidelines including Effluent Quality Criteria defined in a future Type A Water Licence and the Canadian Metal and Diamond Mining Effluent Regulations – Schedule 4 limits. • Depending on the location, the pumped mine water discharge to a receiving water body (river or lake system) may be directed through a properly designed diffuser system to rapidly attenuate the discharge, as appropriate • Discharge water will be regularly sampled and monitored, enabling adaptive management actions if necessary. • An Aquatic Effects Monitoring Program (AEMP) and Surveillance Network Program (SNP) will be developed and implemented to monitor effects of the mine on the aquatic receiving environment. Adaptive management actions as per an aquatic response framework within the AEMP will be enabled if necessary. • Mineralized material and waste rock will be stored in a contained area. Waste rock will be disposed of onto constructed waste rock storage facilities, or where possible, into historical open pits. • Tailings generated from the process plant will be pumped to and stored in the tailings disposal areas, which will be designed to minimize potential environmental effects by using pre-existing open pits. • A Blast Management Plan will be developed and implemented.	Secondary or Primary

Table 7: Potential Pathways for Effects to Fish and Fish Habitat

Project Components/Activities	Effects Pathway	Environmental Design Features and Mitigation Measures	Pathway Assessment
Project components/activities that influence hydrological processes and water balance during construction, operation, and closure and reclamation: • Land clearing, site preparation and construction of facilities and infrastructure • Development and mining of open pits and underground mines • Handling and storage of waste rock and mineralized material • Process plant • Tailings disposal and management • Mine water discharge • Domestic wastewater discharge following treatment • Additional infrastructure (e.g., roads, camp, maintenance shop, and offices) • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Alterations in land cover and development of open pits and underground mines and associated surface and groundwater changes can result in local increases or decreases in surface water quantity, which may change surface water quality and affect fish habitat quantity and quality.	• The Project disturbance footprint will be limited to the extent practical, and where possible and practical, infrastructure will be built on previously disturbed sites. • Areas of vegetation clearing and soil disturbance will be limited to the immediate area of the future activity at that location. • Roads will be designed to the minimum allowable possible width and follow best practices for design speeds and expected vehicle traffic. • The road alignment will minimize stream crossings and alterations to existing drainage patterns. • The Water Management Plan and Tailings and Waste Rock Management Plan will be implemented, which includes adaptive management, if required.	Secondary
	• Water supply requirements (potable and process) and water discharge for the Project may alter local hydrology and water balance and change surface water quality, which can affect fish habitat quantity and quality.	• Water withdrawals will adhere to guidance from regulators such as DFO as to the allowable rate and timing of withdrawals from the point of supply. • Process water will be recirculated and water from tailings disposal areas will be recovered for recycling. • Process water for start-up may be pumped from historical open pits if the water has suitable quality and quantity, or if not, from Great Slave Lake. • The number of water intake and discharge locations will be limited to reduce effects to surface water quantity. • The Closure and Reclamation Plan will be implemented.	Secondary
Project components/activities that may change surface water and sediment quality through treated domestic effluent release during construction, operation, and closure and reclamation: • Domestic wastewater discharge following treatment	• Discharge of treated domestic wastewater and sewage may cause a change in surface water quality, which can alter fish habitat quality and affect the survival and reproduction of fish.	• Treated domestic effluent will be discharged to the septic field or may be discharged to a waterbody if it meets effluent criteria. • The Water Management Plan and Waste Management Plan will be implemented.	No pathway or Secondary
Project activities that directly alter fish habitat during operation, and closure and reclamation: • Diffuser for modifying flow of mine water discharge • Removal of diffuser	• The area of turbulence around the diffuser may affect fish habitat quantity and quality and fish distribution.	• If required, the pumped mine water discharge will be directed through a properly designed diffuser to minimize effects from changes in velocity. • The diffuser will be located to avoid sensitive fish habitat (e.g., shoals, spawning areas). • Direct discharge flow rates will be developed and maintained to address erosion concerns. • The diffuser discharge ports will be located above the lakebed to minimize erosion.	No pathway
Project activities that may result in risk of injury/mortality to fish during construction, operation, and closure and reclamation: • Installation of cross drainage structures, diffuser for mine water discharge, and water intakes • Development and mining of open pits and underground mines • Removal of infrastructure	• The use of explosives near fish-bearing water may cause injury or mortality to fish.	• Blasting operations will follow DFO's *Measures to Protect Fish Habitat* and *Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters* (Wright and Hopky 1998) for setback distances from fish bearing waterbodies. • Blasting will occur on land during the open pit and underground mine development, where no water or fish are present. Blasting will not occur in a water body.	No pathway
	• Impingement and entrainment of fish in intake pumps during operation may cause injury or mortality to fish.	• The water intake(s) will be screened to prevent entrainment or impingement of fish. • Pump intake screens will be designed in accordance with DFO's *Freshwater Intake End-of-Pipe Fish Screen Guideline* (DFO 1995) and the interim code of practice (DFO 2020). • The water intake(s) will be located in areas and depths of water away from high quality fish habitat.	Secondary
	• Instream construction activities may alter fish habitat quality and affect the survival of fish.	• Where possible, instream construction in areas of potential spawning habitat will take place outside the spawning period for fish VCs. Construction activities will be scheduled to avoid work during DFO's *Restricted Activity Timing Windows for the Protection of Fish and Fish Habitat* (DFO 2013). • Water crossing structures and water intakes will be constructed and installed in a manner that protects the banks from erosion and maintains the flows in the water body and follows permits or authorizations issued for the Project from the appropriate regulatory agencies and DFO's *Measures to Protect Fish and Fish Habitat*. • Instream construction will be completed in isolation of flowing water (i.e., use of isolation methods for the installation of instream developments where surface water exists at the time of construction). • For isolations/diversions, 100% downstream flow will be maintained. Pump intakes should not disturb the bed. Water diversion hoses will be screened as per DFO's *Freshwater Intake End-of-Pipe Fish Screen Guidelines* (DFO 2015) and the interim code of practice (DFO 2020). • A qualified aquatics professional will be retained to complete or oversee the fish rescue from within the exclusion area(s). Salvaged fish will be relocated from work isolation areas to adjacent sections of tributaries, outside the work location. Fish handling time will be kept to a minimum, and appropriate, non-lethal sampling methods will be used during the fish rescue (e.g., backpack electrofishing, minnow trapping).	No pathway
Project components/activities that create changes in access during construction, operation, and closure and reclamation: • Construction of Project roads and access trails • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Changes to public access to fishing areas and increased density of people (i.e., Project staff and contractors) in the area could affect fish abundance.	• Existing roads and trails will be used where possible. • To reduce risks to public health and safety, access will be restricted by installing gates and fencing on private roads. • A "No hunting and fishing" policy will be implemented on the Project site that applies to staff and contractors.	No pathway
Project components/activities that potentially change groundwater quality during construction, operation, and closure and reclamation: • Development and mining of open pits and underground mines • Tailings disposal and management	• Changes in groundwater quality from open pits, underground mines and tailings can affect surface water and sediment quality, which can alter fish habitat quality and affect the survival and reproduction of fish.	• The Water Management Plan and Tailings and Waste Rock Management Plan will be implemented, including adaptive management, if required. • Tailings generated from the process plant will be pumped to and stored in the tailings disposal areas, which will be designed to minimize potential environmental effects by using pre-existing open pits. • Studies will be undertaken to evaluate the suitability of multiple locations as tailings disposal sites and to select locations that will avoid and minimize risk of potential environmental effects. • The Closure and Reclamation Plan will be implemented.	Secondary

Table 7: Potential Pathways for Effects to Fish and Fish Habitat

Project Components/Activities	Effects Pathway	Environmental Design Features and Mitigation Measures	Pathway Assessment
Project components/activities that potentially change groundwater quality during construction, operation, and closure and reclamation: • Handling and storage of waste rock and mineralized material	• Seepage from waste rock deposition areas can cause changes in groundwater quality and surface water and sediment quality, which can alter fish habitat quality and affect the survival and reproduction of fish.	• The Water Management Plan and Tailings and Waste Rock Management Plan will be implemented, including adaptive management, if required. • Waste rock will be deposited into historical mined open pits or onto constructed stockpile pads adjacent to deposits being mined. • The Closure and Reclamation Plan will be implemented.	Secondary
Accidents and Malfunctions	• Chemical or hazardous materials spills on site and during transport offsite can alter fish habitat quantity and quality and affect the survival and reproduction of fish.	• The Spill Contingency Plan and Waste Management Plan will be implemented and will consider DFO's *Measures to Protect Fish Habitat* • Standard best management practices for general activities with regards to use, handling, and storage of deleterious substances will be followed. • Hazardous waste will be stored in appropriate containers that will be located in a lined bermed containment pad, which will provide secondary containment of spills. • No fuels, oils, or other hazardous substances will be stored within 150 m of waterbodies. • No equipment maintenance or refuelling will be conducted within 150 m of waterbodies. • The tailings transport pipeline will have drainage points and spill containment areas located along the route. • Regular maintenance of vehicles and equipment will be conducted. • Spill kits will be available at various locations throughout the site and will be maintained in good working order. • Hazardous waste will be transported to a licensed hazardous waste receiving facility for disposal. • Fuel and hazardous materials will be transported in approved containers in licensed vehicles. • If a major spill occurs, the cleanup, treatment, and disposal of the contaminated waste and soil will be handled and disposed of using approved methods. • Speed limits will be enforced.	No pathway
Accidents and Malfunctions	• Flow over emergency spillways of water containment structures during extreme flood events may adversely alter surface water quality and affect fish habitat quantity and quality and the survival and reproduction of fish.	• Overflow spillways and downstream conveyance structures will be designed to be stable and maintain function, and provide sufficient erosion protection during a design flood. • Routine inspections and maintenance of storm water management system will be conducted.	No pathway
Accidents and Malfunctions	• A wildfire started by Project activities may adversely alter surface water quality and affect fish habitat quantity and quality and the survival and reproduction of fish.	• A Wildfire Prevention and Preparedness Plan will be developed and implemented. • All heavy equipment and fuelling sites will be equipped with approved and fully charged fire extinguishers. • Firefighting training will be provided to on-site personnel (as deemed appropriate). • No smoking will be allowed at equipment fuelling stations or outside of designated areas at all times. • Safety management systems (e.g., hot work permits) will be implemented. • Firebreaks and vegetation management (e.g., removal of understory fuel loads) will be implemented.	No pathway

Table 8: Potential Pathways for Effects to Terrain and Soils

Project Components/Activities	Effects Pathway	Environmental Design Features and Mitigation Measures	Pathway Assessment
Project components/activities that alter soil conditions or final terrain (topography) conditions during construction, operation, and closure and reclamation: • Land clearing, site preparation, and construction of facilities and infrastructure • Development of open pits and underground mines • Handling and storage of waste rock and mineralized material • Process plant • Additional infrastructure (e.g., roads, camp, maintenance shop, and offices) • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Alteration of soil and terrain conditions (e.g., quantity, quality, and distribution) may adversely affect soil productivity and the types of ecosystems that can be reclaimed on the landscape.	• The Project disturbance footprint will be limited to the extent practical, and where possible and practical, infrastructure will be built on previously disturbed sites. • Areas of vegetation clearing and soil disturbance will be limited to the immediate area of the future activity at that location. • A pipe bench will be constructed to accommodate the pipelines, which will follow existing and proposed road alignments to the extent practical to minimize the Project footprint. • Roads will be designed to the minimum allowable possible width and follow best practices for design speeds and expected vehicle traffic. • The road alignment will minimize stream crossings and alterations to existing drainage patterns. • Clearing equipment will be used that minimizes surface disturbance, soil compaction, and topsoil loss (e.g., equipment with low ground pressure tracks or tires, blade shoes and brush) where feasible. • Steepness and length of slopes of disturbed areas and stockpiled soils will be limited. • Work will be avoided in sensitive areas during the time-of-year when erosion is more likely (e.g., spring freshet). • Progressive reclamation and revegetation will be implemented for areas disturbed by the Project that are no longer required. • The Closure and Reclamation Plan will be implemented.	Primary

Table 8: Potential Pathways for Effects to Terrain and Soils

Project Components/Activities	Effects Pathway	Environmental Design Features and Mitigation Measures	Pathway Assessment
Project components/activities that may contribute to slope instability during construction, operation, and closure and reclamation: • Land clearing, site preparation, and construction of facilities and infrastructure • Development of open pits and underground mines • Handling and storage of waste rock and mineralized material • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Activities may affect terrain through an increase in potential slope instability and/or failures.	• The Water Management Plan will be implemented. • The Erosion and Sediment Control Plan will be implemented. • Routine inspection and maintenance of containment and conveyance structures (i.e., roadside ditches and culverts) will be conducted to limit the risk of road wash-out or sediment release to the environment. • Areas of vegetation clearing and soil disturbance will be limited to the immediate area of the future activity at that location. • Progressive reclamation and revegetation will be implemented for areas disturbed by the Project that are no longer required.	No pathway
Project components/activities that contribute to the Project footprint and may alter soils during construction, operation, and closure and reclamation: • Land clearing, site preparation and construction of facilities and infrastructure • Development of open pits and underground mines • Handling and storage of waste rock and mineralized material • Process plant • Additional infrastructure (e.g., roads, camp, maintenance shop, and offices) • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Site clearing, contouring and excavation can cause admixing, compaction, and increase erosion potential, which may change the quantity, quality, and distribution of soil.	• The Project disturbance footprint will be limited to the extent practical, and where possible and practical, infrastructure will be built on previously disturbed sites. • The Erosion and Sediment Control Plan will be implemented. • Areas of vegetation clearing and soil disturbance will be limited to the immediate area of the future activity at that location. • Roads will be designed to the minimum allowable possible width and follow best practices for design speeds and expected vehicle traffic. • A pipe bench will be constructed to accommodate the pipelines, which will follow existing and proposed road alignments to the extent practical to minimize the Project footprint. • Clearing equipment will be used that minimizes surface disturbance, soil compaction, and topsoil loss (e.g., equipment with low ground pressure tracks or tires, blade shoes and brush) where feasible. • Steepness and length of slopes of disturbed areas and stockpiled soils will be limited. • Work in sensitive areas will be avoided during the time-of-year when erosion is more likely (e.g., spring freshet). • Progressive reclamation and revegetation will be implemented for areas disturbed by the Project that are no longer required.	Secondary
	• Soil transport and stockpiling can increase erosion potential and change soil quality.	• The Erosion and Sediment Control Plan will be implemented. • If soils are prone to wind erosion, areas will be tackifed, covered, seeded, and/or water will be applied during periods of high erosion potential (e.g., summer and fall). • Organics and upper soil material will be salvaged to the extent practical for future use in reclamation. • Soil salvage stockpiles will be constructed in such a way as to reduce changes to quality, erosion, and loss (e.g., slumping).	No pathway
Project components/activities that may contribute to permafrost degradation during construction, operation, and closure and reclamation: • Land clearing, site preparation, and construction of facilities and infrastructure • Development of open pits and underground mines • Handling and storage of waste rock and mineralized material • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Soil disturbance can alter soil temperature and lead to changes in permafrost depth or prevalence.	• The Project disturbance footprint will be limited to the extent practical, and where possible and practical, infrastructure will be built on previously disturbed sites. • Areas of vegetation clearing and soil disturbance will be limited to the immediate area of the future activity at that location. • A pipe bench will be constructed to accommodate the pipelines, which will follow existing and proposed road alignments to the extent practical to minimize the Project footprint. • Roads will be designed to the minimum allowable possible width and follow best practices for design speeds and expected vehicle traffic. • Clearing equipment will be used that minimizes surface disturbance, soil compaction and topsoil loss (e.g., equipment with low ground pressure tracks or tires, blade shoes, and brush) where feasible.	No pathway or Secondary
Project components/activities that contribute to deposition of fugitive dust emissions during construction, operation, and closure and reclamation: • Land clearing, site preparation, and construction of facilities and infrastructure • Development and mining of open pits and underground mines • Handling and storage of waste rock and mineralized material (includes conveyors) • Process plant and processing (includes crushers and conveyors) • Site traffic • Transportation of personnel and materials to and from the site • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Deposition of fugitive dust emissions (e.g., metals) may change soil chemistry and adversely affect soil quality.	• An Air Quality Effects Mitigation and Monitoring Plan will be developed and implemented that includes ambient air monitoring for fugitive dust and adaptive management. • Water and/or dust suppressants will be applied to site roads as necessary. • Speed limits will be established and enforced on site roads to reduce dust production. • Crushers and conveyors will be covered. • Concentrate will be covered during transportation to rail yards.	Secondary
Project components/activities that contribute to criteria air contaminant emissions during construction, operation, and closure and reclamation: • Land clearing, site preparation and construction of facilities and infrastructure • Development and mining of open pits and underground mines • Handling and storage of waste rock and mineralized material • Process plant and processing • Site traffic • Transportation of personnel and materials to and from the site • Power generation • Non-hazardous waste incineration • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Deposition of suspended solids in criteria air contaminant emissions (e.g., potential acid inputs) may change soil chemistry and adversely affect soil quality.	• Hydroelectric power will be used to supplement fossil fuel methods for power generation. • Secondary (or backup) power generation will be mainly compressed natural gas (CNG) to minimize use of diesel. • An Air Quality Effects Mitigation and Monitoring Plan will be developed and implemented that includes ambient air monitoring for criteria air contaminants and adaptive management based on ambient air quality standards. • Procurement criteria will be developed to ensure stationary and mobile engines meet applicable performance standards, such as equipment that has the lowest practical and economically achievable nitrogen oxide emission rates. • Ultra-low sulphur diesel (less than 15 parts per million sulphur) will be used in all equipment to reduce ambient concentrations of nitrogen dioxide. • Transportation of workers will be completed using large vehicles where possible to reduce the number of engines in use, thereby reducing vehicle combustion and fugitive emissions. • Emissions control devices will be used and maintained on fossil-fuel based engines. • Equipment will be regularly maintained. • Idling of vehicles will be limited to the extent practical.	Secondary

Table 8: Potential Pathways for Effects to Terrain and Soils

Project Components/Activities	Effects Pathway	Environmental Design Features and Mitigation Measures	Pathway Assessment
Project components/activities that potentially increase soil erosion through changes in surface water runoff and drainage areas during construction, operation, and closure and reclamation: • Land clearing, site preparation and construction of facilities and infrastructure • Development and mining of open pits and underground mines • Handling and storage of waste rock and mineralized material • Mine water discharge • Water withdrawals for potable and process water use • Domestic wastewater discharge following treatment • Additional infrastructure (e.g., roads, camp, maintenance shop, and offices) • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Changes in site surface water runoff can increase soil erosion and affect soil quality and distribution.	• The Project disturbance footprint will be limited to the extent practical, and where possible and practical, infrastructure will be built on previously disturbed sites. • Areas of vegetation clearing and soil disturbance will be limited to the immediate area of the future activity at that location. • Roads will be designed to the minimum allowable possible width and follow best practices for design speeds and expected vehicle traffic. • The road alignment will minimize stream crossings and alterations to existing drainage patterns. • Work will be avoided in sensitive areas during the time-of-year when erosion is more likely (e.g., spring freshet). • Steepness and length of slopes of disturbed areas and stockpiled soils will be limited. • The Water Management Plan, Tailings and Waste Rock Management Plan, and Erosion and Sediment Control Plan will be implemented, and includes that applies adaptive management, if required. • Process water will be recirculated and water from tailings disposal areas will be recovered for recycling. • Process water for start-up may be pumped from historical open pits if the water has suitable quality and quantity, or if not, from Great Slave Lake. • Areas disturbed/altered will be regraded to conform to the local topography to maintain drainage patterns. • Routine inspection and maintenance of containment and conveyance structures (i.e., roadside ditches and culverts) will be conducted to limit the risk of road wash-out or sediment release to the environment. • Culverts will be sized to convey flows under design conditions. • Water crossing structures will be constructed and installed in a manner that protects the banks from erosion and maintains surface water flows. • Where possible, a 30 metre buffer will be established between Project components/infrastructure and permanent waterbodies and watercourses. • Progressive reclamation and revegetation will be implemented for areas disturbed by the Project that are no longer required. • The Closure and Reclamation Plan will be implemented.	Secondary
	• Changes in surface water levels, flows and drainage areas can increase soil erosion and sedimentation along waterbodies and watercourses and affect soil quality and distribution.		Secondary
Project components/activities that contribute to changes in site surface water quality and affect soil chemistry and quality during construction, operation, and closure and reclamation: • Land clearing, site preparation and construction of facilities and infrastructure • Handling and storage of waste rock and mineralized material • Process plant and processing • Additional infrastructure (e.g., roads, camp, maintenance shop, and offices) • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Changes in surface water quality from contact with Project facilities and additional infrastructure may alter soil chemistry and affect soil quality.	• The Water Management Plan and Tailings and Waste Rock Management Plan will be implemented and includes adaptive management, if required. • Progressive reclamation and revegetation will be implemented for areas disturbed by the Project that are no longer required. • The Closure and Reclamation Plan will be implemented.	Secondary
Project components/activities that potentially change groundwater quality during construction, operation, and closure and reclamation: • Development and mining of open pits and underground mines • Tailings disposal and management	• Changes in groundwater quality from open pits, underground mines, and tailings can affect soil quality.	• The Water Management Plan and Tailings and Waste Rock Management Plan will be implemented that include adaptive management, if required. • Tailings generated from the process plant will be pumped to and stored in the tailings disposal areas, which will be designed to minimize potential environmental effects by using pre-existing open pits. • Studies will be undertaken to evaluate the suitability of multiple locations as tailings disposal sites and to select locations that will avoid and minimize risk of potential environmental effects. • The Closure and Reclamation Plan will be implemented.	No pathway
Project components/activities that potentially change groundwater quality during construction, operation, and closure and reclamation: • Handling and storage of waste rock and mineralized material	• Seepage from waste rock deposition areas can cause changes in groundwater quality and soil quality.	• The Water Management Plan and Tailings and Waste Rock Management Plan will be implemented that include adaptive management, if required. • Waste rock will be deposited into historical mined open or onto constructed stockpile pads adjacent to deposits being mined. • The Closure and Reclamation Plan will be implemented.	Secondary

Table 8: Potential Pathways for Effects to Terrain and Soils

Project Components/Activities	Effects Pathway	Environmental Design Features and Mitigation Measures	Pathway Assessment
Accidents and Malfunctions	• Chemical or hazardous materials spills on site and during transport offsite may adversely affect soil quality.	• The Spill Contingency Plan and Waste Management Plan will be implemented. • Standard best management practices for general activities with regards to use, handling, and storage of deleterious substances will be followed. • Hazardous waste will be stored in appropriate containers that will be located in a lined bermed containment pad, which will provide secondary containment of spills. • No fuels, oils, or other hazardous substances will be stored within 150 m of waterbodies. • No equipment maintenance or refuelling will be conducted within 150 m of waterbodies. • The tailings transport pipeline will have drainage points and spill containment areas located along the route. • Vehicles and equipment will be regularly maintained. • Spill kits will be available at various locations throughout the site and will be maintained in good working order. • Hazardous waste will be transported to a licensed hazardous waste receiving facility for disposal. • Fuel and hazardous materials will be transported in approved containers in licensed vehicles. • If a major spill occurs, the cleanup, treatment, and disposal of the contaminated waste and soil will be handled and disposed of using approved methods. • Speed limits will be enforced.	No pathway
Accidents and Malfunctions	• A wildfire started by Project activities may adversely affect soil quality and distribution.	• A Wildfire Prevention and Preparedness Plan will be developed and implemented. • All heavy equipment and fuelling sites will be equipped with approved and fully charged fire extinguishers. • Firefighting training will be provided to on-site personnel (as deemed appropriate). • No smoking will be allowed at equipment fuelling stations or outside of designated areas at all times. • Safety management systems (e.g., hot work permits) will be implemented. • Firebreaks and vegetation management (e.g., removal of understory fuel loads) will be implemented.	No pathway
Accidents and Malfunctions	• Failure of storm water management features (culverts, roadside ditches) following a severe rainfall event can influence surface water levels, flows and drainage areas, which can affect soil quality and distribution.	• Storm water features will be designed to carry/contain a suitable return rainfall event as well as provide sufficient erosion protection during those events. • Routine inspections and maintenance of storm water management system will be conducted.	No pathway

Table 9: Potential Pathways for Effects to Vegetation

Project Components/Activities	Effects Pathway	Environmental Design Features and Mitigation Measures	Pathway Assessment
Project components/activities that contribute to the Project footprint during construction, operation, and closure and reclamation: • Land clearing, site preparation and construction of facilities and infrastructure • Development of open pits and underground mines • Handling and storage of waste rock and mineralized material • Process plant • Additional infrastructure (e.g., roads, camp, maintenance shop, and offices) • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Direct loss, alteration, and fragmentation of upland, wetland, and riparian ecosystems from the Project footprint.	• The Project disturbance footprint will be limited to the extent practical, and where possible and practical, infrastructure will be built on previously disturbed sites. • Areas of vegetation clearing and soil disturbance will be limited to the immediate area of the future activity at that location. • Roads will be designed to the minimum allowable possible width and follow best practices for design speeds and expected vehicle traffic. • A pipe bench will be constructed to accommodate the pipelines, which will follow existing and proposed road alignments to the extent practical to minimize the Project footprint. • Construction of the Project will be planned to avoid environmentally sensitive areas (e.g., listed plants and wetlands) to the extent practical. • The road alignment will minimize stream crossings and alterations to existing drainage patterns. • Clearing equipment will be used that minimizes surface disturbance, soil compaction, and topsoil loss (e.g., equipment with low ground pressure tracks or tires, blade shoes and brush) where feasible. • Steepness and length of slopes of disturbed areas and stockpiled soils will be limited. • Work will be avoided in sensitive areas during the time-of-year when erosion is more likely (e.g., spring freshet). • Progressive reclamation and revegetation will be implemented for areas disturbed by the Project that are no longer required. • The Closure and Reclamation Plan will be implemented.	Primary
Project components/activities that alter soil conditions or final terrain (topography) conditions during construction, operation, and closure and reclamation: • Land clearing, site preparation and construction of facilities and infrastructure • Development of open pits and underground mines • Handling and storage of waste rock and mineralized material • Process plant • Additional infrastructure (e.g., roads, camp, maintenance shop, and offices) • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Alteration of final terrain and soil conditions, and/or plant species composition could change the types of ecosystems that can be reclaimed on the landscape, and adversely affect vegetation ecosystem availability, distribution, and condition.		Primary

Table 9: Potential Pathways for Effects to Vegetation

Project Components/Activities	Effects Pathway	Environmental Design Features and Mitigation Measures	Pathway Assessment
Project components/activities that contribute to deposition of fugitive dust emissions during construction, operation, and closure and reclamation: • Land clearing, site preparation and construction of facilities and infrastructure • Development and mining of open pits and underground mines • Handling and storage of waste rock and mineralized material (includes conveyors) • Process plant and processing (includes crushers and conveyors) • Site traffic • Transportation of personnel and materials to and from the site • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Deposition of fugitive dust emissions (e.g., metals) may adversely change soil quality and/or cover plants and affect the availability, distribution and condition of vegetation ecosystems.	• An Air Quality Effects Mitigation and Monitoring Plan will be developed and implemented that includes ambient air monitoring for fugitive dust and adaptive management. • Water and/or dust suppressants will be applied to site roads as necessary. • Speed limits will be established and enforced on site roads to reduce dust production. • Crushers and conveyors will be covered. • Concentrate will be covered during transportation to rail yards.	Secondary
Project components/activities that contribute to criteria air contaminant emissions during construction, operation, and closure and reclamation: • Land clearing, site preparation and construction of facilities and infrastructure • Development and mining of open pits and underground mines • Handling and storage of waste rock and mineralized material • Process plant and processing • Site traffic • Transportation of personnel and materials to and from the site • Power generation • Non-hazardous waste incineration • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Deposition of suspended solids in criteria air contaminant emissions (e.g., potential acid inputs) may change soil chemistry and affect the availability, distribution and condition of vegetation ecosystems.	• Hydroelectric power will be used to supplement fossil fuel methods for power generation. • Secondary (or backup) power generation will be mainly compressed natural gas (CNG) to minimize use of diesel. • An Air Quality Effects Mitigation and Monitoring Plan will be developed and implemented that includes ambient air monitoring for criteria air contaminants and adaptive management based on ambient air quality standards. • Procurement criteria will be developed to ensure stationary and mobile engines meet applicable performance standards, such as equipment that has the lowest practical and economically achievable nitrogen oxide emission rates. • Ultra-low sulphur diesel (less than 15 parts per million sulphur) will be used in all equipment to reduce ambient concentrations of nitrogen dioxide. • Transportation of workers will be completed using large vehicles where possible to reduce the number of engines in use, thereby reducing vehicle combustion and fugitive emissions. • Emissions control devices will be used and maintained on fossil-fuel based engines. • Equipment will be regularly maintained. • Idling of vehicles will be limited to the extent practical.	Secondary
Project components/activities that contribute to the introduction of designated weed species during construction, operation, and closure and reclamation: • Land clearing, site preparation and construction of facilities and infrastructure • Development and mining of open pits and underground mines • Site roads • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Introduction of invasive or non-native plant species can affect the condition of upland, wetland, and riparian ecosystems.	• Certified seed will be used for reclamation activities, per the Closure and Reclamation Plan. • Reclamation objectives for areas disturbed by the Project will reflect the local native vegetation communities. • New equipment brought to Project will be cleaned to reduce the potential for introduction or spread of invasive and non-native species, according to established practices. • If non-native invasive species are identified, a response plan will be established.	Secondary
Project components/activities that potentially alter surface water levels, flows and drainage areas during construction, operation, and closure and reclamation: • Land clearing, site preparation and construction of facilities and infrastructure • Development and mining of open pits and underground mines • Handling and storage of waste rock and mineralized material • Mine water discharge • Water withdrawals for potable and process water use • Domestic wastewater discharge following treatment • Additional infrastructure (e.g., roads, camp, maintenance shop, and offices) • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Changes in site surface water runoff can affect soils and the availability, distribution, and condition of upland, wetland, and riparian ecosystems.	• The Project disturbance footprint will be limited to the extent practical, and where possible and practical, infrastructure will be built on previously disturbed sites. • Areas of vegetation clearing and soil disturbance will be limited to the immediate area of the future activity at that location. • Roads will be designed to the minimum allowable possible width and follow best practices for design speeds and expected vehicle traffic. • The road alignment will minimize stream crossings and alterations to existing drainage patterns. • Work will be avoided in sensitive areas during the time-of-year when erosion is more likely (e.g., spring freshet). • Steepness and length of slopes of disturbed areas and stockpiled soils will be limited. • The Water Management Plan, Tailings and Waste Rock Management Plan, and Erosion and Sediment Control Plan will be implemented, and includes that applies adaptive management, if required. • Process water will be recirculated and water from tailings disposal areas will be recovered for recycling. • Process water for start-up may be pumped from historical open pits if the water has suitable quality and quantity, or if not, from Great Slave Lake. • Routine inspection and maintenance of containment and conveyance structures (i.e., roadside ditches and culverts) will be conducted to limit the risk of road wash-out or sediment release to the environment. • Culverts will be sized to convey flows under design conditions. • Water crossing structures will be constructed and installed in a manner that protects the banks from erosion and maintains surface water flows. • Where possible, a 30 metre buffer will be established between Project components/infrastructure and permanent waterbodies and watercourses. • Progressive reclamation and revegetation will be implemented for areas disturbed by the Project that are no longer required. • The Closure and Reclamation Plan will be implemented.	No pathway or Secondary
	• Changes in surface water levels, flows and drainage areas can increase soil erosion and sedimentation along waterbodies and watercourses and affect the availability, distribution, and condition of upland, wetland, and riparian ecosystems.		No pathway or Secondary
	• Changes in surface water levels and flows can alter waterbodies and watercourses and affect the availability, distribution, and condition of upland, wetland, and riparian ecosystems.		No pathway or Secondary

Table 9: Potential Pathways for Effects to Vegetation

Project Components/Activities	Effects Pathway	Environmental Design Features and Mitigation Measures	Pathway Assessment
Project components/activities that contribute to changes in site surface water quality and affect soil chemistry and vegetation during construction, operation, and closure and reclamation: • Land clearing, site preparation and construction of facilities and infrastructure • Handling and storage of waste rock and mineralized material • Process plant and processing • Additional infrastructure (e.g., roads, camp, maintenance shop, and offices) • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Changes in surface water quality from contact with surface facilities and additional infrastructure could adversely affect soil chemistry and the condition of upland, wetland and riparian ecosystems.	• The Water Management Plan and Tailings and Waste Rock Management Plan will be implemented and includes adaptive management, if required. • Progressive reclamation and revegetation will be implemented for areas disturbed by the Project that are no longer required. • The Closure and Reclamation Plan will be implemented.	No pathway or Secondary
Project components/activities that may change surface water and sediment quality during construction and operation: • Land clearing, site preparation and construction of facilities and infrastructure • Development and mining of open pits and underground mines • Handling and storage of waste rock and mineralized material • Process plant and processing • Tailings disposal and management • Mine water discharge	• Direct discharge of mine water, as well as surface runoff, groundwater inflow and seepage from the Project will cause changes to surface water quality, which can adversely affect the condition of upland, wetland, riparian ecosystems.	• The Project disturbance footprint will be limited to the extent practical, and where possible and practical, infrastructure will be built on previously disturbed sites. • Areas of vegetation clearing and soil disturbance will be limited to the immediate area of the future activity at that location. • Roads will be designed to the minimum allowable possible width and follow best practices for design speeds and expected vehicle traffic. • The road alignment will minimize stream crossings and alterations to existing drainage patterns. • The Water Management Plan and Tailings and Waste Rock Management Plan will be implemented, including adaptive management, if required. • Water that interacts with the site footprint, waste rock, and tailings management areas will be captured and managed. • Studies will be undertaken to evaluate the potential use of re-injection wells as an additional method to dispose of underground saline water that will infiltrate open pits and underground mines. • If required, the mine water discharge will meet all regulatory guidelines including Effluent Quality Criteria defined in a future Type A Water Licence and the Canadian Metal and Diamond Mining Effluent Regulations – Schedule 4 limits. • Depending on the location, the pumped mine water discharge to a receiving water body (river or lake system) may be directed through a properly designed diffuser system to rapidly attenuate the discharge, as appropriate • Discharge water will be regularly sampled and monitored, enabling adaptive management actions if necessary. • An Aquatic Effects Monitoring Program (AEMP) and Surveillance Network Program (SNP) will be developed and implemented to monitor effects of the mine on the aquatic receiving environment. Adaptive management actions as per an aquatic response framework within the AEMP will be enabled if necessary. • Mineralized material and waste rock will be stored in a contained area. Waste rock will be disposed of onto constructed waste rock storage facilities, or where possible, into historical open pits. • Tailings generated from the process plant will be pumped to and stored in the tailings disposal areas, which will be designed to minimize potential environmental effects by using pre-existing open pits. • A Blast Management Plan will be developed and implemented.	No pathway or Secondary
Project components/activities that may change surface water and sediment quality through treated domestic effluent release during construction, operation, and closure and reclamation: • Domestic wastewater discharge following treatment	• Discharge of treated domestic wastewater and sewage may cause a change in surface water quality, which can affect the condition of upland, wetland, and riparian ecosystems.	• Treated domestic effluent will be discharged to the septic field or may be discharged to a waterbody if it meets effluent criteria. • The Water Management Plan and Waste Management Plan will be implemented.	No pathway
Project components/activities that potentially change groundwater quality during construction, operation, and closure and reclamation: • Development and mining of open pits and underground mines • Tailings disposal and management	• Changes in groundwater quality from open pits, underground mines, and tailings can alter soil chemistry and affect the condition of upland, wetland, and riparian ecosystems.	• The Water Management Plan and Tailings and Waste Rock Management Plan will be implemented that include adaptive management, if required. • Tailings generated from the process plant will be pumped to and stored in the tailings disposal areas, which will be designed to minimize potential environmental effects by using pre-existing open pits. • Studies will be undertaken to evaluate the suitability of multiple locations as tailings disposal sites and to select locations that will avoid and minimize risk of potential environmental effects. • The Closure and Reclamation Plan will be implemented.	No pathway
Project components/activities that potentially change groundwater quality during construction, operation, and closure and reclamation: • Handling and storage of waste rock and mineralized material	• Seepage from waste rock deposition areas can cause changes in groundwater quality and soil chemistry, which can affect the condition of upland, wetland, and riparian ecosystems.	• The Water Management Plan and Tailings and Waste Rock Management Plan will be implemented that include adaptive management, if required. • Waste rock will be deposited into historical mined open or onto constructed stockpile pads adjacent to deposits being mined. • The Closure and Reclamation Plan will be implemented.	No pathway

Table 9: Potential Pathways for Effects to Vegetation

Project Components/Activities	Effects Pathway	Environmental Design Features and Mitigation Measures	Pathway Assessment
Accidents and Malfunctions	• Chemical or hazardous materials spills on site and during transport offsite may adversely affect upland, wetland, and riparian ecosystems.	• The Spill Contingency Plan and Waste Management Plan will be implemented. • Standard best management practices for general activities with regards to use, handling, and storage of deleterious substances will be followed. • Hazardous waste will be stored in appropriate containers that will be located in a lined bermed containment pad, which will provide secondary containment of spills. • No fuels, oils, or other hazardous substances will be stored within 150 m of waterbodies. • No equipment maintenance or refuelling will be conducted within 150 m of waterbodies. • The tailings transport pipeline will have drainage points and spill containment areas located along the route. • Vehicles and equipment will be regularly maintained. • Spill kits will be available at various locations throughout the site and will be maintained in good working order. • Hazardous waste will be transported to a licensed hazardous waste receiving facility for disposal. • Fuel and hazardous materials will be transported in approved containers in licensed vehicles. • If a major spill occurs, the cleanup, treatment, and disposal of the contaminated waste and soil will be handled and disposed of using approved methods. • Speed limits will be enforced.	No pathway
Accidents and Malfunctions	• A wildfire started by Project activities may adversely affect upland, wetland, and riparian ecosystems.	• A Wildfire Prevention and Preparedness Plan will be developed and implemented. • All heavy equipment and fuelling sites will be equipped with approved and fully charged fire extinguishers. • Firefighting training will be provided to on-site personnel (as deemed appropriate). • No smoking will be allowed at equipment fuelling stations or outside of designated areas at all times. • Safety management systems (e.g., hot work permits) will be implemented. • Firebreaks and vegetation management (e.g., removal of understory fuel loads) will be implemented.	No pathway
Accidents and Malfunctions	• Failure of storm water management features (culverts, roadside ditches) following a severe rainfall event can influence surface water levels, flows and drainage areas, which can affect upland, wetland, and riparian ecosystems.	• Storm water features will be designed to carry/contain a suitable return rainfall event as well as provide sufficient erosion protection during those events. • Routine inspections and maintenance of storm water management system will be conducted.	No pathway

Table 10: Potential Pathways for Effects to Caribou

Project Components/Activities	Effects Pathway	Environmental Design Features and Mitigation Measures	Pathway Assessment
Project components/activities that contribute to the Project footprint during construction, operation, and closure and reclamation: • Land clearing, site preparation and construction of facilities and infrastructure • Development of open pits and underground mines • Handling and storage of waste rock and mineralized material • Process plant • Additional infrastructure (e.g., roads, camp, maintenance shop, and offices) • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Direct removal/alteration and fragmentation of vegetation ecosystems (i.e., caribou habitat) can affect caribou abundance and distribution.	• The Project disturbance footprint will be limited to the extent practical, and where possible and practical, infrastructure will be built on previously disturbed sites. • Areas of vegetation clearing and soil disturbance will be limited to the immediate area of the future activity at that location. • Roads will be designed to the minimum allowable possible width and follow best practices for design speeds and expected vehicle traffic. • A pipe bench will be constructed to accommodate the pipelines, which will follow existing and proposed road alignments to the extent practical to minimize the Project footprint. • Construction of the Project will be planned to avoid environmentally sensitive areas (e.g., wetlands) to the extent practical. • The road alignment will minimize stream crossings and alterations to existing drainage patterns. • Clearing equipment will be used that minimizes surface disturbance, soil compaction, and topsoil loss (e.g., equipment with low ground pressure tracks or tires, blade shoes and brush) where feasible. • Steepness and length of slopes of disturbed areas and stockpiled soils will be limited. • Work will be avoided in sensitive areas during the time-of-year when erosion is more likely (e.g., spring freshet). • Progressive reclamation and revegetation will be implemented for areas disturbed by the Project that are no longer required. • The Closure and Reclamation Plan will be implemented.	Primary
Project components/activities that alter soil conditions or final terrain (topography) conditions during construction, operation, and closure and reclamation: • Land clearing, site preparation and construction of facilities and infrastructure • Development of open pits and underground mines • Handling and storage of waste rock and mineralized material • Process plant and processing • Additional infrastructure (e.g., roads, camp, maintenance shop, and offices) • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Alteration of final terrain and soil conditions, and/or plant species composition could change the types of ecosystems that can be reclaimed on the landscape, and adversely affect caribou habitat availability and distribution, and survival and reproduction.		Primary

Table 10: Potential Pathways for Effects to Caribou

Project Components/Activities	Effects Pathway	Environmental Design Features and Mitigation Measures	Pathway Assessment
Project components/activities that contribute to sensory disturbance (e.g., presence of people, lights, sounds, smells, and vibrations) during construction, operation, and closure and reclamation: • Land clearing, site preparation and construction of facilities and infrastructure • Development of open pits and underground mines • Handling and storage of waste rock and mineralized material • Process plant and processing • Site traffic • Transportation of personnel and materials to and from site • Power generation • Additional infrastructure (e.g., roads, camp, maintenance shop, and offices) • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Sensory disturbance can alter caribou movement and behaviour and adversely affect functional habitat availability and caribou abundance and distribution.	• The Wildlife Protection Plan will be implemented. • Construction will be planned to occur outside of sensitive and breeding windows for caribou (e.g., calving and post-calving periods) • A no harassing, feeding, or approaching wildlife policy will be implemented through the Wildlife Protection Plan. • Noisy equipment will be enclosed in buildings, where feasible. • Internal combustion engines will be outfitted with well-maintained muffler systems. • Power plant generator facilities will have louvers on ventilation openings and exhaust mufflers. • Sound levels will be monitored, as per the noise management plan, and adaptive management applied if required. • Progressive reclamation and revegetation will be implemented for areas disturbed by the Project that are no longer required. • The Closure and Reclamation Plan will be implemented.	Primary
Project components/activities that contribute to the introduction of designated weed species during construction, operation, and closure and reclamation: • Land clearing, site preparation and construction of facilities and infrastructure • Development and mining of open pits and underground mines • Site roads • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Introduction of invasive or non-native plant species can affect caribou habitat availability and distribution.	• Certified seed will be used for reclamation activities, per the Closure and Reclamation Plan. • Reclamation objectives for areas disturbed by the Project will reflect the local native vegetation communities. • New equipment brought to Project will be cleaned to reduce the potential for introduction or spread of invasive and non-native species, according to established practices. • If non-native invasive species are identified, a response plan will be established.	Secondary
Project components/activities that change access for predators during construction, operation, and closure and reclamation: • Development and improvement of site roads • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Increased access for predators (e.g., wolf and black bear) and prey may increase predation risk and decrease caribou survival and reproduction.	• The Project disturbance footprint will be limited to the extent practical, and where possible and practical, infrastructure will be built on previously disturbed sites. • Areas of vegetation clearing and soil disturbance will be limited to the immediate area of the future activity at that location. • Existing roads and trails will be used where possible. • Progressive reclamation and revegetation will be implemented for areas disturbed by the Project that are no longer required. • The Closure and Reclamation Plan will be implemented.	Primary
Project components/activities that change public access for during construction, operation, and closure and reclamation: • Development and improvement of site roads • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Changes in public access to hunting/trapping areas and increased density of people (i.e., Project staff and contractors) in the area may increase harvesting of caribou and affect abundance.	• The Project disturbance footprint will be limited to the extent practical, and where possible and practical, infrastructure will be built on previously disturbed sites. • Areas of vegetation clearing and soil disturbance will be limited to the immediate area of the future activity at that location. • Existing roads and trails will be used where possible. • To reduce risks to public health and safety, access will be restricted by installing gates and fencing on private roads. • A “no hunting and fishing” policy will be implemented on the Project site that applies to staff and contractors. • Progressive reclamation and revegetation will be implemented for areas disturbed by the Project that are no longer required. • The Closure and Reclamation Plan will be implemented.	Primary or Secondary
Project components/activities that contribute to deposition of criteria air contaminant and fugitive dust emissions during construction, operation, and closure and reclamation: • Land clearing, site preparation and construction of facilities and infrastructure • Development and mining of open pits and underground mines • Handling and storage of waste rock and mineralized material (includes conveyors) • Process plant and processing (includes crushers and conveyors) • Site traffic • Transportation of personnel and materials to and from the site • Power generation • Non-hazardous waste incineration • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Deposition of suspended solids in criteria air contaminant emissions (e.g., potential acid inputs) and fugitive dust containing metals may change soil and vegetation and affect caribou habitat availability and distribution.	• Hydroelectric power will be used to supplement fossil fuel methods for power generation. • Secondary (or backup) power generation will be mainly compressed natural gas (CNG) to minimize use of diesel. • An Air Quality Effects Mitigation and Monitoring Plan will be developed and implemented that includes ambient air monitoring for criteria air contaminants and fugitive dust and adaptive management based on ambient air quality standards. • Procurement criteria will be developed to ensure stationary and mobile engines meet applicable performance standards, such as equipment that has the lowest practical and economically achievable nitrogen oxide emission rates. • Ultra-low sulphur diesel (less than 15 parts per million sulphur) will be used in all equipment to reduce ambient concentrations of nitrogen dioxide. • Transportation of workers will be completed using large vehicles where possible to reduce the number of engines in use, thereby reducing vehicle combustion and fugitive emissions. • Emissions control devices will be used and maintained on fossil-fuel based engines. • Equipment will be regularly maintained. • Idling of vehicles will be limited to the extent practical. • Water and/or dust suppressants will be applied to site roads as necessary. • Speed limits will be established and enforced on site roads to reduce dust production. • Crushers and conveyors will be covered. • Concentrate will be covered during transportation to rail yards.	Secondary

Table 10: Potential Pathways for Effects to Caribou

Project Components/Activities	Effects Pathway	Environmental Design Features and Mitigation Measures	Pathway Assessment
Project components/activities that potentially alter surface water levels, flows and drainage areas during construction, operation, and closure and reclamation: • Land clearing, site preparation and construction of facilities and infrastructure • Development and mining of open pits and underground mines • Handling and storage of waste rock and mineralized material • Mine water discharge • Water withdrawals for potable and process water use • Domestic wastewater discharge following treatment • Additional infrastructure (e.g., roads, camp, maintenance shop, and offices) • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Changes in surface water levels, flows and drainage areas can affect soils and vegetation, and caribou habitat availability and distribution.	• The Project disturbance footprint will be limited to the extent practical, and where possible and practical, infrastructure will be built on previously disturbed sites. • Areas of vegetation clearing and soil disturbance will be limited to the immediate area of the future activity at that location. • Roads will be designed to the minimum allowable possible width and follow best practices for design speeds and expected vehicle traffic. • The road alignment will minimize stream crossings and alterations to existing drainage patterns. • Work will be avoided in sensitive areas during the time-of-year when erosion is more likely (e.g., spring freshet). • Steepness and length of slopes of disturbed areas and stockpiled soils will be limited. • The Water Management Plan, Tailings and Waste Rock Management Plan, and Erosion and Sediment Control Plan will be implemented, and including the application of adaptive management, if required. • Process water will be recirculated and water from tailings disposal areas will be recovered for recycling. • Process water for start-up may be pumped from historical open pits if the water has suitable quality and quantity, or if not, from Great Slave Lake. • Routine inspection and maintenance of containment and conveyance structures (i.e., roadside ditches and culverts) will be conducted to limit the risk of road wash-out or sediment release to the environment. • Culverts will be sized to convey flows under design conditions. • Water crossing structures will be constructed and installed in a manner that protects the banks from erosion and maintains surface water flows. • Where possible, a 30 metre buffer will be established between Project components/infrastructure and permanent waterbodies and watercourses. • Progressive reclamation and revegetation will be implemented for areas disturbed by the Project that are no longer required. • The Closure and Reclamation Plan will be implemented.	No pathway or Secondary
Project components/activities that contribute to changes in site surface water quality and affect soil chemistry and vegetation during construction, operation, and closure and reclamation: • Land clearing, site preparation and construction of facilities and infrastructure • Handling and storage of waste rock and mineralized material • Process plant and processing • Additional infrastructure (e.g., roads, camp, maintenance shop, and offices) • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Changes in surface water quality from contact with surface facilities and additional infrastructure could affect soil chemistry and vegetation, and caribou habitat availability and distribution.	• The Water Management Plan and Tailings and Waste Rock Management Plan will be implemented and includes adaptive management, if required. • Progressive reclamation and revegetation will be implemented for areas disturbed by the Project that are no longer required. • The Closure and Reclamation Plan will be implemented.	No pathway or Secondary
Project components/activities that may change surface water and sediment quality during construction and operation: • Land clearing, site preparation and construction of facilities and infrastructure • Development and mining of open pits and underground mines • Handling and storage of waste rock and mineralized material • Process plant and processing • Tailings disposal and management • Mine water discharge	• Direct discharge of mine water, as well as surface runoff, groundwater inflow and seepage from the Project will cause changes to surface water quality, which can adversely affect vegetation and caribou habitat availability and distribution.	• The Project disturbance footprint will be limited to the extent practical, and where possible and practical, infrastructure will be built on previously disturbed sites. • Areas of vegetation clearing and soil disturbance will be limited to the immediate area of the future activity at that location. • Roads will be designed to the minimum allowable possible width and follow best practices for design speeds and expected vehicle traffic. • The road alignment will minimize stream crossings and alterations to existing drainage patterns. • The Water Management Plan and Tailings and Waste Rock Management Plan will be implemented, including adaptive management, if required. • Water that interacts with the site footprint, waste rock, and tailings management areas will be captured and managed. • Studies will be undertaken to evaluate the potential use of re-injection wells as an additional method to dispose of underground saline water that will infiltrate open pits and underground mines. • If required, the mine water discharge will meet all regulatory guidelines including Effluent Quality Criteria defined in a future Type A Water Licence and the Canadian Metal and Diamond Mining Effluent Regulations – Schedule 4 limits. • Depending on the location, the pumped mine water discharge to a receiving water body (river or lake system) may be directed through a properly designed diffuser system to rapidly attenuate the discharge, as appropriate • Discharge water will be regularly sampled and monitored, enabling adaptive management actions if necessary. • An Aquatic Effects Monitoring Program (AEMP) and Surveillance Network Program (SNP) will be developed and implemented to monitor effects of the mine on the aquatic receiving environment. Adaptive management actions as per an aquatic response framework within the AEMP will be enabled if necessary. • Mineralized material and waste rock will be stored in a contained area. Waste rock will be disposed of onto constructed waste rock storage facilities, or where possible, into historical open pits. • Tailings generated from the process plant will be pumped to and stored in the tailings disposal areas, which will be designed to minimize potential environmental effects by using pre-existing open pits. • A Blast Management Plan will be developed and implemented.	No pathway

Table 10: Potential Pathways for Effects to Caribou

Project Components/Activities	Effects Pathway	Environmental Design Features and Mitigation Measures	Pathway Assessment
Project components/activities that may change surface water and sediment quality through treated domestic effluent release during construction, operation, and closure and reclamation: • Domestic wastewater discharge following treatment	• Discharge of treated domestic wastewater and sewage may cause a change in surface water quality, which can affect vegetation and caribou habitat availability and distribution.	• Treated domestic effluent will be discharged to the septic field or may be discharged to a waterbody if it meets effluent criteria. • The Water Management Plan and Waste Management Plan will be implemented.	No pathway
Project components/activities that potentially change groundwater quality during construction, operation, and closure and reclamation: • Development and mining of open pits and underground mines • Tailings disposal and management	• Changes in groundwater quality from open pits, underground mines, and tailings can alter soil chemistry and affect vegetation and caribou habitat availability and distribution.	• The Water Management Plan and Tailings and Waste Rock Management Plan will be implemented that include adaptive management, if required. • Tailings generated from the process plant will be pumped to and stored in the tailings disposal areas, which will be designed to minimize potential environmental effects by using pre-existing open pits. • Studies will be undertaken to evaluate the suitability of multiple locations as tailings disposal sites and to select locations that will avoid and minimize risk of potential environmental effects. • The Closure and Reclamation Plan will be implemented.	No pathway
Project components/activities that potentially change groundwater quality during construction, operation, and closure and reclamation: • Handling and storage of waste rock and mineralized material	• Seepage from waste rock deposition areas can cause changes in groundwater quality and soil chemistry, which can affect vegetation and caribou habitat availability and distribution.	• The Water Management Plan and Tailings and Waste Rock Management Plan will be implemented that include adaptive management, if required. • Waste rock will be deposited into historical mined open or onto constructed stockpile pads adjacent to deposits being mined. • The Closure and Reclamation Plan will be implemented.	No pathway
Project activities that use explosives during construction and operation: • Development and mining of open pits and underground mines	• Blasting and associated fly rock may result in injury or mortality to caribou.	• A Blast Management Plan will be developed and implemented. • Blasting activities will be limited to the daytime periods, where possible. • Blasting activities will follow a regular schedule, where possible, and site-wide notice will be given prior to each blast. • A survey of the blast area will be completed prior to the blast and caribou will be deterred from areas of risk.	No pathway
Project activities that contribute to risk of vehicle-wildlife collisions during construction, operation, and closure and reclamation: • Land clearing, site preparation, and construction of facilities and infrastructure • Handling and storage of waste rock and mineralized material • Site traffic • Transportation of personnel and materials to and from the site • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Collisions with vehicles and equipment on site, and vehicles travelling to and from site may cause injury or mortality to individual animals.	• The Wildlife Protection Plan will be implemented. • Speed limits and signage will be established on all roads to limit risk of vehicle-animal collisions. • Caribou will be provided with the right of way. • When caribou are observed on or adjacent to the road, drivers will stop and report/communicate and allow animals to move away before continuing to drive. • Any collisions with caribou along any road will be reported.	Secondary
Project components/activities that contribute to the attraction of wildlife to the Project during construction, operation, and closure and reclamation: • Land clearing, site preparation, and construction of facilities and infrastructure • Process plant and processing • Additional infrastructure (e.g., roads, camp, maintenance shop, and offices) • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Attraction of wildlife to the Project (e.g., food waste, sewage, petroleum-based products, salt, explosive powder) may increase human-wildlife interactions and alter predator-prey relationships, or result in direct removal/mortality of problem wildlife resulting in an affect to wildlife abundance.	• The Wildlife Protection Plan will be implemented. • Littering and feeding of wildlife will be prohibited. • The Waste Management Plan will be implemented • Domestic (e.g., food) waste will be incinerated regularly. • Industrial (e.g., used oil and lubricants) waste will be collected and incinerated and/or transported off site for recycling or disposal at a licensed disposal facility. • Wastes will be stored in wildlife proof containers. • Work sites will be maintained and materials (e.g., cables, wires, fencing) will be properly stored so as not to entangle caribou or other wildlife.	No pathway
Accidents and Malfunction	• Chemical or hazardous materials spills on site or during transport offsite can affect soil, vegetation, and caribou habitat availability and survival and reproduction of individual animals.	• The Spill Contingency Plan and Waste Management Plan will be implemented. • Standard best management practices for general activities with regards to use, handling, and storage of deleterious substances will be followed. • Hazardous waste will be stored in appropriate containers that will be located in a lined bermed containment pad, which will provide secondary containment of spills. • No fuels, oils, or other hazardous substances will be stored within 150 m of waterbodies. • No equipment maintenance or refuelling will be conducted within 150 m of waterbodies. • The tailings transport pipeline will have drainage points and spill containment areas located along the route. • Vehicles and equipment will be regularly maintained. • Spill kits will be available at various locations throughout the site and will be maintained in good working order. • Hazardous waste will be transported to a licensed hazardous waste receiving facility for disposal. • Fuel and hazardous materials will be transported in approved containers in licensed vehicles. • If a major spill occurs, the cleanup, treatment, and disposal of the contaminated waste and soil will be handled and disposed of using approved methods. • Speed limits will be enforced.	No pathway

Table 10: Potential Pathways for Effects to Caribou

Project Components/Activities	Effects Pathway	Environmental Design Features and Mitigation Measures	Pathway Assessment
Accidents and Malfunctions	• A wildfire started by Project activities may result in loss of caribou and caribou habitat.	• A Wildfire Prevention and Preparedness Plan will be developed and implemented. • All heavy equipment and fuelling sites will be equipped with approved and fully charged fire extinguishers. • Firefighting training will be provided to on-site personnel (as deemed appropriate). • No smoking will be allowed at equipment fuelling stations or outside of designated areas at all times. • Safety management systems (e.g., hot work permits) will be implemented. • Firebreaks and vegetation management (e.g., removal of understory fuel loads) will be implemented.	No pathway
Accidents and Malfunctions	• Failure of storm water management features (culverts, roadside ditches) following a severe rainfall event can influence surface water levels, flows and drainage areas, which can affect caribou habitat availability and distribution.	• Storm water features will be designed to carry/contain a suitable return rainfall event as well as provide sufficient erosion protection during those events. • Routine inspections and maintenance of storm water management system will be conducted.	No pathway

Table 11: Potential Pathways for Effects to Wildlife

Project Components/Activities	Effects Pathway	Environmental Design Features and Mitigation Measures	Pathway Assessment
Project components/activities that contribute to the Project footprint during construction, operation, and closure and reclamation: • Land clearing, site preparation and construction of facilities and infrastructure • Development of open pits and underground mines • Handling and storage of waste rock and mineralized material • Process plant • Additional infrastructure (e.g., roads, camp, maintenance shop, and offices) • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Direct removal/alteration and fragmentation of vegetation ecosystems (i.e., wildlife habitat) can affect wildlife abundance and distribution.	• The Project disturbance footprint will be limited to the extent practical, and where possible and practical, infrastructure will be built on previously disturbed sites. • Areas of vegetation clearing and soil disturbance will be limited to the immediate area of the future activity at that location. • Roads will be designed to the minimum allowable possible width and follow best practices for design speeds and expected vehicle traffic. • A pipe bench will be constructed to accommodate the pipelines, which will follow existing and proposed road alignments to the extent practical to minimize the Project footprint. • Construction of the Project will be planned to avoid environmentally sensitive areas (e.g., wildlife trees and wetlands) to the extent practical. • The road alignment will minimize stream crossings and alterations to existing drainage patterns. • Clearing equipment will be used that minimizes surface disturbance, soil compaction, and topsoil loss (e.g., equipment with low ground pressure tracks or tires, blade shoes and brush) where feasible. • Steepness and length of slopes of disturbed areas and stockpiled soils will be limited. • Work will be avoided in sensitive areas during the time-of-year when erosion is more likely (e.g., spring freshet). • Progressive reclamation and revegetation will be implemented for areas disturbed by the Project that are no longer required. • The Closure and Reclamation Plan will be implemented.	Primary
Project components/activities that alter soil conditions or final terrain (topography) conditions during construction, operation, and closure and reclamation: • Land clearing, site preparation and construction of facilities and infrastructure • Development of open pits and underground mines • Handling and storage of waste rock and mineralized material • Process plant and processing • Additional infrastructure (e.g., roads, camp, maintenance shop, and offices) • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Alteration of final terrain and soil conditions, and/or plant species composition could change the types of ecosystems that can be reclaimed on the landscape, and adversely affect wildlife habitat availability and distribution, and survival and reproduction.		Primary
Project activities that contribute to risk of wildlife injury/mortality during construction: • Land clearing, site preparation, and construction of facilities and infrastructure	• Vegetation removal and soil alterations during site preparation and construction may result in injury or mortality to individual animals with low motility (e.g., denning marten, overwintering amphibians) and destruction of nests, eggs, and individuals of migratory birds (incidental take).	• Soil disturbance will be focused within previously disturbed areas to avoid overwintering habitat for hibernating amphibians or other wildlife with low motility. Where possible, soil disturbance will be completed outside of the overwintering period for northern leopard frogs (November through March). • Clearing of mature forest and hollow wildlife trees (i.e., dead or decaying trees, standing or fallen) will be avoided from March 11 to July 31 to avoid destruction of active American marten natal and maternal dens (Ellis 1999; Environment Canada 2013c; Strickland and Douglas 1987). • Vegetation clearing will be outside of general nesting periods for migratory birds (May 5 to August 10; ECCC 2018). • If vegetation clearing is required to occur during the nesting period for migratory birds, activities will be managed to comply with the *Species at Risk Act* and the *Migratory Birds Convention Act*.	Secondary

Table 11: Potential Pathways for Effects to Wildlife

Project Components/Activities	Effects Pathway	Environmental Design Features and Mitigation Measures	Pathway Assessment
Project components/activities that contribute to sensory disturbance (e.g., presence of people, lights, sounds, smells, and vibrations) during construction, operation, and closure and reclamation: • Land clearing, site preparation and construction of facilities and infrastructure • Development of open pits and underground mines • Handling and storage of waste rock and mineralized material • Process plant and processing • Site traffic • Transportation of personnel and materials to and from site • Power generation • Additional infrastructure (e.g., roads, camp, maintenance shop, and offices) • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Sensory disturbance can alter wildlife movement and behaviour and adversely affect wildlife habitat availability and animal abundance and distribution.	• The Wildlife Protection Plan will be implemented. • Construction activities will be planned to occur outside of sensitive and breeding windows for wildlife (e.g., migratory bird nesting period, black bear and marten denning periods). If sensitive periods cannot be avoided, pre-clearance surveys and buffers (setbacks) would be applied, as required (e.g., ECCC 2018). • A no harassing, feeding, or approaching wildlife policy will be implemented through the Wildlife Protection Plan. • Noisy equipment will be enclosed in buildings, where feasible. • Internal combustion engines will be outfitted with well-maintained muffler systems. • Power plant generator facilities will have louvers on ventilation openings and exhaust mufflers. • Sound levels will be monitored, as per the noise management plan, and adaptive management applied if required. • Progressive reclamation and revegetation will be implemented for areas disturbed by the Project that are no longer required. • The Closure and Reclamation Plan will be implemented.	Primary
Project components/activities that contribute to the introduction of designated weed species during construction, operation, and closure and reclamation: • Land clearing, site preparation and construction of facilities and infrastructure • Development and mining of open pits and underground mines • Site roads • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Introduction of invasive or non-native plant species can affect wildlife habitat availability and distribution.	• Certified seed will be used for reclamation activities, per the Closure and Reclamation Plan. • Reclamation objectives for areas disturbed by the Project will reflect the local native vegetation communities. • New equipment brought to Project will be cleaned to reduce the potential for introduction or spread of invasive and non-native species, according to established practices. • If non-native invasive species are identified, a response plan will be established.	Secondary
Project components/activities that change access for predators during construction, operation, and closure and reclamation: • Development and improvement of site roads • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Increased access for predators (e.g., wolf and black bear) and prey may increase predation risk and decrease survival and reproduction for ungulates (e.g., bison, moose).	• The Project disturbance footprint will be limited to the extent practical, and where possible and practical, infrastructure will be built on previously disturbed sites. • Areas of vegetation clearing and soil disturbance will be limited to the immediate area of the future activity at that location. • Existing roads and trails will be used where possible. • Progressive reclamation and revegetation will be implemented for areas disturbed by the Project that are no longer required. • The Closure and Reclamation Plan will be implemented.	Secondary
Project components/activities that change public access during construction, operation, and closure and reclamation: • Development and improvement of site roads • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Changes in public access to hunting/trapping areas and increased density of people (i.e., Project staff and contractors) in the area may alter ungulate and carnivore survival and reproduction and affect abundance.	• The Project disturbance footprint will be limited to the extent practical, and where possible and practical, infrastructure will be built on previously disturbed sites. • Areas of vegetation clearing and soil disturbance will be limited to the immediate area of the future activity at that location. • Existing roads and trails will be used where possible. • To reduce the risk to public health and safety, access will be restricted by installing gates and fencing on private roads. • A “no hunting and fishing” policy will be implemented on the Project site that applies to staff and contractors. • Progressive reclamation and revegetation will be implemented for areas disturbed by the Project that are no longer required. • The Closure and Reclamation Plan will be implemented.	Secondary
Project components/activities that contribute to deposition of criteria air contaminant and fugitive dust emissions during construction, operation, and closure and reclamation: • Land clearing, site preparation and construction of facilities and infrastructure • Development and mining of open pits and underground mines • Handling and storage of waste rock and mineralized material (includes conveyors) • Process plant and processing (includes crushers and conveyors) • Site traffic • Transportation of personnel and materials to and from the site • Power generation • Non-hazardous waste incineration • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Deposition of suspended solids in criteria air contaminant emissions (e.g., potential acid inputs) and fugitive dust containing metals may change soil and vegetation and affect wildlife habitat availability and distribution.	• Hydroelectric power will be used to supplement fossil fuel methods for power generation. • Secondary (or backup) power generation will be mainly compressed natural gas (CNG) to minimize use of diesel. • An Air Quality Effects Mitigation and Monitoring Plan will be developed and implemented that includes ambient air monitoring for criteria air contaminants and fugitive dust and adaptive management based on ambient air quality standards. • Procurement criteria will be developed to ensure stationary and mobile engines meet applicable performance standards, such as equipment that has the lowest practical and economically achievable nitrogen oxide emission rates. • Ultra-low sulphur diesel (less than 15 parts per million sulphur) will be used in all equipment to reduce ambient concentrations of nitrogen dioxide. • Transportation of workers will be completed using large vehicles where possible to reduce the number of engines in use, thereby reducing vehicle combustion and fugitive emissions. • Emissions control devices will be used and maintained on fossil-fuel based engines. • Equipment will be regularly maintained. • Idling of vehicles will be limited to the extent practical. • Water and/or dust suppressants will be applied to site roads as necessary. • Speed limits will be established and enforced on site roads to reduce dust production. • Crushers and conveyors will be covered. • Concentrate will be covered during transportation to rail yards.	Secondary

Table 11: Potential Pathways for Effects to Wildlife

Project Components/Activities	Effects Pathway	Environmental Design Features and Mitigation Measures	Pathway Assessment
Project components/activities that potentially alter surface water levels, flows and drainage areas during construction, operation, and closure and reclamation: • Land clearing, site preparation, and construction of facilities and infrastructure • Development and mining of open pits and underground mines • Handling and storage of waste rock and mineralized material • Mine water discharge • Water withdrawals for potable and process water use • Domestic wastewater discharge following treatment • Additional infrastructure (e.g., roads, camp, maintenance shop, and offices) • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Changes in surface water levels, flows and drainage areas can affect soils and vegetation, and wildlife habitat availability and distribution.	• The Project disturbance footprint will be limited to the extent practical, and where possible and practical, infrastructure will be built on previously disturbed sites. • Areas of vegetation clearing and soil disturbance will be limited to the immediate area of the future activity at that location. • Roads will be designed to the minimum allowable possible width and follow best practices for design speeds and expected vehicle traffic. • The road alignment will minimize stream crossings and alterations to existing drainage patterns. • Work will be avoided in sensitive areas during the time-of-year when erosion is more likely (e.g., spring freshet). • Steepness and length of slopes of disturbed areas and stockpiled soils will be limited. • The Water Management Plan, Tailings and Waste Rock Management Plan, and Erosion and Sediment Control Plan will be implemented, and includes that applies adaptive management, if required. • Process water will be recirculated and water from tailings disposal areas will be recovered for recycling. • Process water for start-up may be pumped from historical open pits if the water has suitable quality and quantity, or if not, from Great Slave Lake. • Areas disturbed/altered will be regraded to conform to the local topography to maintain drainage patterns. • Routine inspection and maintenance of containment and conveyance structures (i.e., roadside ditches and culverts) will be conducted to limit the risk of road wash-out or sediment release to the environment. • Culverts will be sized to convey flows under design conditions. • Water crossing structures will be constructed and installed in a manner that protects the banks from erosion and maintains surface water flows. • Where possible, a 30 metre (m) buffer will be established between Project components/infrastructure and permanent waterbodies and watercourses. • Progressive reclamation and revegetation will be implemented for areas disturbed by the Project that are no longer required. • The Closure and Reclamation Plan will be implemented.	No pathway or Secondary
Project components/activities that contribute to changes in site surface water quality and affect soil chemistry and vegetation during construction, operation, and closure and reclamation: • Land clearing, site preparation and construction of facilities and infrastructure • Handling and storage of waste rock and mineralized material • Process plant and processing • Additional infrastructure (e.g., roads, camp, maintenance shop, and offices) • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Changes in surface water quality from contact with surface facilities and additional infrastructure could affect soil chemistry and vegetation, and wildlife habitat availability and distribution.	• The Water Management Plan and Tailings and Waste Rock Management Plan will be implemented and includes adaptive management, if required. • Progressive reclamation and revegetation will be implemented for areas disturbed by the Project that are no longer required. • The Closure and Reclamation Plan will be implemented.	No pathway or Secondary
Project components/activities that may change surface water and sediment quality during construction and operation: • Land clearing, site preparation, and construction of facilities and infrastructure • Development and mining of open pits and underground mines • Handling and storage of waste rock and mineralized material • Process plant and processing • Tailings disposal and management • Mine water discharge	• Direct discharge of mine water, as well as surface runoff, groundwater inflow and seepage from the Project will cause changes to surface water quality, which can adversely affect vegetation and wildlife habitat availability and distribution.	• The Project disturbance footprint will be limited to the extent practical, and where possible and practical, infrastructure will be built on previously disturbed sites. • Areas of vegetation clearing and soil disturbance will be limited to the immediate area of the future activity at that location. • Roads will be designed to the minimum allowable possible width and follow best practices for design speeds and expected vehicle traffic. • The road alignment will minimize stream crossings and alterations to existing drainage patterns. • The Water Management Plan and Tailings and Waste Rock Management Plan will be implemented, including adaptive management, if required. • Water that interacts with the site footprint, waste rock, and tailings management areas will be captured and managed. • Studies will be undertaken to evaluate the potential use of re-injection wells as an additional method to dispose of underground saline water that will infiltrate open pits and underground mines. • The mine water discharge will meet all regulatory guidelines including Effluent Quality Criteria defined in a future Type A Water Licence and the Canadian Metal and Diamond Mining Effluent Regulations – Schedule 4 limits. • Depending on the location, the mine water discharge to a receiving water body (river or lake system) may be directed through a properly designed diffuser system to rapidly attenuate the discharge, as appropriate • Discharge water will be regularly sampled and monitored, enabling adaptive management actions if necessary. • An Aquatic Effects Monitoring Program (AEMP) and Surveillance Network Program (SNP) will be developed and implemented to monitor effects of the mine on the aquatic receiving environment. Adaptive management actions as per an aquatic response framework within the AEMP will be enabled if necessary. • Mineralized material and waste rock will be stored in a contained area. Waste rock will be disposed of onto constructed waste rock storage facilities, or where possible, into historical open pits. • Tailings generated from the process plant will be pumped to and stored in the tailings disposal areas, which will be designed to minimize potential environmental effects by using pre-existing open pits. • A Blast Management Plan will be developed and implemented.	No pathway

Table 11: Potential Pathways for Effects to Wildlife

Project Components/Activities	Effects Pathway	Environmental Design Features and Mitigation Measures	Pathway Assessment
Project components/activities that may change surface water and sediment quality through treated domestic effluent release during construction, operation, and closure and reclamation: • Domestic wastewater discharge following treatment	• Discharge of treated domestic wastewater and sewage may cause a change in surface water quality, which can affect vegetation and wildlife habitat availability and distribution.	• Treated domestic effluent will be discharged to the septic field or may be discharged to a waterbody if it meets effluent criteria. • The Water Management Plan and Waste Management Plan will be implemented.	No pathway
Project components/activities that potentially change groundwater quality during construction, operation, and closure and reclamation: • Development and mining of open pits and underground mines • Tailings disposal and management	• Changes in groundwater quality from open pits, underground mines, and tailings can alter soil chemistry and affect vegetation and wildlife habitat availability and distribution.	• The Water Management Plan and Tailings and Waste Rock Management Plan will be implemented that include adaptive management, if required. • Tailings generated from the process plant will be pumped to and stored in the tailings disposal areas, which will be designed to minimize potential environmental effects by using pre-existing open pits. • Studies will be undertaken to evaluate the suitability of multiple locations as tailings disposal sites and to select locations that will avoid and minimize risk of potential environmental effects. • The Closure and Reclamation Plan will be implemented.	No pathway
Project components/activities that potentially change groundwater quality during construction, operation, and closure and reclamation: • Handling and storage of waste rock and mineralized material	• Seepage from waste rock deposition areas can cause changes in groundwater quality and soil chemistry, which can affect vegetation and wildlife habitat availability and distribution.	• The Water Management Plan and Tailings and Waste Rock Management Plan will be implemented that include adaptive management, if required. • Waste rock will be deposited into historical mined open or onto constructed stockpile pads adjacent to deposits being mined. • The Closure and Reclamation Plan will be implemented.	No pathway
Project activities that use explosives during construction and operation: • Development and mining of open pits and underground mines	• Blasting and associated fly rock may result in injury or mortality to wildlife.	• A Blast Management Plan will be developed and implemented. • Blasting activities will be limited to the daytime periods, where possible. • Blasting activities will follow a regular schedule, where possible, and site-wide notice will be given prior to each blast. • Wildlife will be deterred from areas of risk. • Blasting operations will follow DFO's *Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters* (Wright and Hopky 1998) for setback distances from fish bearing waterbodies, which is likely to reduce the risk to waterbirds.	No pathway
Project activities that contribute to risk of vehicle-wildlife collisions during construction, operation, and closure and reclamation: • Land clearing, site preparation, and construction of facilities and infrastructure • Handling and storage of waste rock and mineralized material • Site traffic • Transportation of personnel and materials to and from the site • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Collisions with vehicles and equipment on site, and vehicles travelling to and from site may cause injury or mortality to individual animals.	• The Wildlife Protection Plan will be implemented. • Speed limits and signage will be established on all roads to limit risk of vehicle-animal collisions. • Wildlife will be provided with the right of way. • When wildlife is observed on or adjacent to the road, drivers will stop and report/communicate and allow animals to move away before continuing to drive. • Any collisions with wildlife along any road will be reported.	Secondary
Project components/activities that contribute to the attraction of wildlife to the Project during construction, operation, and closure and reclamation: • Land clearing, site preparation and construction of facilities and infrastructure • Process plant and processing • Additional infrastructure (e.g., roads, camp, maintenance shop, and offices) • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Attraction of wildlife to the Project (e.g., food waste, sewage, petroleum-based products, salt, explosive powder) may increase human-wildlife interactions and alter predator-prey relationships, or result in direct removal/mortality of problem wildlife resulting in an affect to wildlife abundance.	• The Wildlife Protection Plan will be implemented. • Littering and feeding of wildlife will be prohibited. • The Waste Management Plan will be implemented • Domestic (e.g., food) waste will be incinerated regularly. • Industrial (e.g., used oil and lubricants) waste will be collected and incinerated and/or transported off site for recycling or disposal at a licensed disposal facility. • Wastes will be stored in wildlife proof containers. • Work sites will be maintained and materials (e.g., cables, wires, fencing) will be properly stored so as not to entangle caribou or other wildlife.	Secondary
Project components that contribute to risk of injury/mortality to birds during construction, operation, and closure and reclamation: • Above ground power distribution lines	• Electrocution or collisions with powerlines may cause injury or mortality to birds.	• Markers will be installed to enhance the visibility of lines in key movement corridors and staging areas.	Secondary
Project components/activities that provide nesting habitat for raptors: • Development and mining of open pits and underground mines	• Raptors nesting in open pits can result in injury or mortality to individual birds.	• The Wildlife Protection Plan will be implemented. • Pit walls will be surveyed regularly during the nesting period and birds will be deterred from nesting in pits. • If a nest is established in a pit, a restricted area of activity will be applied and the nest monitored to determine success.	Secondary

Table 11: Potential Pathways for Effects to Wildlife

Project Components/Activities	Effects Pathway	Environmental Design Features and Mitigation Measures	Pathway Assessment
Accidents and Malfunction	• Chemical or hazardous materials spills on site or during transport offsite can affect soil, vegetation, and wildlife habitat availability and survival and reproduction of individual animals.	• The Spill Contingency Plan and Waste Management Plan will be implemented. • Standard best management practices for general activities with regards to use, handling, and storage of deleterious substances will be followed. • Hazardous waste will be stored in appropriate containers that will be located in a lined bermed containment pad, which will provide secondary containment of spills. • No fuels, oils, or other hazardous substances will be stored within 150 m of waterbodies. • No equipment maintenance or refuelling will be conducted within 150 m of waterbodies. • The tailings transport pipeline will have drainage points and spill containment areas located along the route. • Vehicles and equipment will be regularly maintained. • Spill kits will be available at various locations throughout the site and will be maintained in good working order. • Hazardous waste will be transported to a licensed hazardous waste receiving facility for disposal. • Fuel and hazardous materials will be transported in approved containers in licensed vehicles. • If a major spill occurs, the cleanup, treatment, and disposal of the contaminated waste and soil will be handled and disposed of using approved methods. • Speed limits will be enforced.	No pathway
Accidents and Malfunctions	• A wildfire started by Project activities may result in loss of wildlife and wildlife habitat.	• A Wildfire Prevention and Preparedness Plan will be developed and implemented. • All heavy equipment and fuelling sites will be equipped with approved and fully charged fire extinguishers. • Firefighting training will be provided to on-site personnel (as deemed appropriate). • No smoking will be allowed at equipment fuelling stations or outside of designated areas at all times. • Safety management systems (e.g., hot work permits) will be implemented. • Firebreaks and vegetation management (e.g., removal of understory fuel loads) will be implemented.	No pathway
Accidents and Malfunctions	• Failure of storm water management features (culverts, roadside ditches) following a severe rainfall event can influence surface water levels, flows and drainage areas, which can affect wildlife habitat availability and distribution.	• Storm water features will be designed to carry/contain a suitable return rainfall event as well as provide sufficient erosion protection during those events. • Routine inspections and maintenance of storm water management system will be conducted.	No pathway

2.2.1.2 Human Environment

Project components and activities, effects pathways, environmental design features and mitigation, and the categorization of effects pathways (no pathway, secondary, and primary) for the heritage resources; traditional land and resource use; socio-economics; and non- traditional land and resource use components are summarized in Tables 12 to 19.

Table 12: Potential Pathways for Effects to Heritage Resources

Project Components/Activities	Effects Pathway	Environmental Design Features and Mitigation Measures	Pathway Assessment
Project components/activities that contribute to the Project footprint and final landscape conditions during construction, operation, and closure and reclamation: • Land clearing, site preparation and construction of facilities and infrastructure • Development of open pits and underground mines • Handling and storage of waste rock and mineralized material • Process plant • Additional infrastructure (e.g., roads, camp, maintenance shop, and offices) • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Direct loss or alteration to heritage resources from the Project footprint and landscape alterations.	• The Project disturbance footprint will be limited to the extent practical, and where possible and practical, infrastructure will be built on previously disturbed sites. • Areas of vegetation clearing and soil disturbance will be limited to the immediate area of the future activity at that location. • Roads will be designed to the minimum allowable possible width and follow best practices for design speeds and expected vehicle traffic. • A pipe bench will be constructed to accommodate the pipelines, which will follow existing and proposed road alignments to the extent practical to minimize the Project footprint. • Construction of the Project will be planned to avoid heritage sensitive areas (e.g., archaeological sites) to the extent practical. • Archaeological Impact Assessments will be conducted in any remaining heritage sensitive areas in advance of Project developments in order to identify potential sites. • If heritage resources cannot be avoided, they will be mitigated through systematic data recovery (e.g., detailed site/feature mapping, collection of artifacts, shovel testing, archaeological excavation); effects to sites will be offset by the recovery and preservation of scientific data that may not otherwise have been gathered. • Awareness training and a manual for recognizing heritage resources will be provided to all staff and contractors. • A heritage resources management plan will be developed and implemented and will include chance find protocols for sites inadvertently discovered during construction.	Secondary

Table 13: Potential Pathways for Effects to Traditional Land and Resource Use

Project Components/Activities	Effects Pathway	Environmental Design Features and Mitigation Measures	Pathway Assessment
Project components/activities that contribute to the Project footprint and final landscape conditions during construction, operation, and closure and reclamation: • Land clearing, site preparation and construction of facilities and infrastructure • Development of open pits and underground mines • Handling and storage of waste rock and mineralized material • Water withdrawals for potable and process water use • Process plant • Tailings disposal and management • Installation of cross drainage structures and diffuser for mine water discharge • Mine water discharge • Site traffic • Transportation of personnel and materials to and from site • Power generation • Non-hazardous waste incineration • Additional infrastructure (e.g., roads, camp, maintenance shop, and offices) • Cessation of site water management activities, including mine water discharge • Reconnection of closure drainages to the local surface water environment • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Project footprint could result in direct loss or disturbance of traditional use areas, including hunting and trapping, fishing, plant harvesting and culturally important sites and areas (e.g., habitation, spiritual sites, or trails).	• The Project disturbance footprint will be limited to the extent practical, and where possible and practical, infrastructure will be built on previously disturbed sites. • Areas of vegetation clearing and soil disturbance will be limited to the immediate area of the future activity at that location. • Roads will be designed to the minimum allowable possible width and follow best practices for design speeds and expected vehicle traffic. • A pipe bench will be constructed to accommodate the pipelines, which will follow existing and proposed road alignments to the extent practical to minimize the Project footprint. • Construction of the Project will be planned to avoid environmentally sensitive areas (e.g., listed plants and wetlands) to the extent practical. • Clearing equipment will be used that minimizes surface disturbance, soil compaction, and topsoil loss (e.g., equipment with low ground pressure tracks or tires, blade shoes and brush) where feasible. • Steepness and length of slopes of disturbed areas and stockpiled soils will be limited. • Work will be avoided in sensitive areas during the time-of-year when erosion is more likely (e.g., spring freshet). • Progressive reclamation and revegetation will be implemented for areas disturbed by the Project that are no longer required. • An Air Quality Effects Mitigation and Monitoring Plan will be developed and implemented that includes ambient air monitoring for criteria air contaminants and fugitive dust and adaptive management based on ambient air quality standards • The Waste Management Plan will be implemented. • The Water Management Plan, Tailings and Waste Rock Management Plan, and Erosion and Sediment Control Plan will be implemented, and includes that applies adaptive management, if required. • An Aquatic Effects Monitoring Program (AEMP) and Surveillance Network Program (SNP) will be developed and implemented to monitor effects of the mine on the aquatic receiving environment. Adaptive management actions as per an aquatic response framework within the AEMP will be enabled if necessary. • The Wildlife Protection Plan will be implemented. • The Closure and Reclamation Plan will be implemented. • Ongoing engagement will occur with Indigenous communities on the implementation of appropriate mitigation actions and policies and their effectiveness. • Involvement of potentially affected Indigenous communities in monitoring programs and regular communication of the results of monitoring programs.	Primary
	• Residual landscape disturbance from Project facilities and activities can permanently alter the landscape and change traditional land and resources use in the area.		Primary
	• Project can change intangible values, including sense of place within the cultural landscape, and reduce the ability to transfer knowledge to future generations.		Primary

Table 13: Potential Pathways for Effects to Traditional Land and Resource Use

Project Components/Activities	Effects Pathway	Environmental Design Features and Mitigation Measures	Pathway Assessment
Project components/activities that alter surface water quantity and quality and contribute to the Project footprint, air and dust emissions and deposition, sensory disturbance (e.g., noise, lights, vibrations), and presence of workforce during construction, operation, and closure and reclamation: • Land clearing, site preparation and construction of facilities and infrastructure • Development of open pits and underground mines • Handling and storage of waste rock and mineralized material • Water withdrawals for potable and process water use • Process plant and processing • Tailings disposal and management • Installation of cross drainage structures and diffuser for mine water discharge • Mine water discharge • Site traffic • Transportation of personnel and materials to and from site • Power generation • Non-hazardous waste incineration • Additional infrastructure (e.g., roads, camp, maintenance shop, and offices) • Cessation of site water management activities, including mine water discharge • Reconnection of closure drainages to the local surface water environment • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Project footprint and activities may lead to changes in the water quality, and the availability of water for drinking.	• Mitigations that avoid and limit effects to water quantity (Table 5) and quality (Table 6), fish (Table 7), vegetation (Table 9), and wildlife (Table 11) will be implemented; examples include: o The Project disturbance footprint will be limited to the extent practical, and where possible and practical, infrastructure will be built on previously disturbed sites. o Areas of vegetation clearing and soil disturbance will be limited to the immediate area of the future activity at that location. o The road alignment will minimize stream crossings and alterations to existing drainage patterns. o Existing roads and trails will be used where possible. o The Water Management Plan, Tailings and Waste Rock Management Plan, and Erosion and Sediment Control Plan will be implemented, and includes that applies adaptive management, if required. o Water that interacts with the site footprint, waste rock, and tailings management areas will be captured and managed. o Process water will be recirculated and water from tailings disposal areas will be recovered for recycling. o Studies will be undertaken to evaluate the suitability of multiple locations as tailings disposal sites and to select locations that will avoid and minimize risk of potential environmental effects. o An Aquatic Effects Monitoring Program (AEMP) and Surveillance Network Program (SNP) will be developed and implemented to monitor effects of the mine on the aquatic receiving environment. Adaptive management actions as per an aquatic response framework within the AEMP will be enabled if necessary. o Water crossing structures and water intakes will be constructed and installed in a manner that protects the banks from erosion and maintains the flows in the water body and follows permits or authorizations issued for the Project from the appropriate regulatory agencies and DFO's *Measures to Protect Fish and Fish Habitat*. o The water intake(s) will be screened to prevent entrainment or impingement of fish. o The pumped mine water discharge will be directed through a properly designed diffuser to minimize effects from changes in velocity. o The diffuser will be located to avoid sensitive fish habitat (e.g., shoals, spawning areas). o Blasting operations will follow DFO's *Measures to Protect Fish and Fish Habitat* and *Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters* (Wright and Hopky 1998) for setback distances from fish bearing water bodies. o The Wildlife Protection Plan will be implemented. o Speed limits and signage will be established on all roads to limit risk of vehicle-animal collisions. o Wildlife will be provided with the right of way. • Procedures to reduce noise, dust, and light levels will be implemented, such as: o Noisy equipment will be enclosed in buildings, where feasible. o Internal combustion engines will be outfitted with well-maintained muffler systems. o Hydroelectric power will be used to supplement fossil fuel methods for power generation. o Secondary (or backup) power generation will be mainly compressed natural gas (CNG) to minimize use of diesel. o An Air Quality Effects Mitigation and Monitoring Plan will be developed and implemented that includes ambient air monitoring for criteria air contaminants and fugitive dust and adaptive management based on ambient air quality standards. o Water and/or dust suppressants will be applied to site roads as necessary. o Crushers and conveyors will be covered. • Progressive reclamation and revegetation will be implemented for areas disturbed by the Project that are no longer required. • The Closure and Reclamation Plan will be implemented. • Ongoing engagement will occur with Indigenous communities on the implementation of appropriate mitigation actions and policies and their effectiveness.	Secondary or Primary
	• Project footprint and activities may lead to changes in the abundance and distribution of fish, and the availability of fish for traditional fishing.		Secondary or Primary[1]
	• Project footprint and activities may lead to changes in the abundance and distribution of vegetation ecosystems, and the availability of plants for traditional harvesting.		Secondary or Primary
	• Project footprint and activities may lead to changes in the abundance and distribution of wildlife, and the availability of wildlife for traditional hunting and trapping.		Primary (caribou) Secondary or Primary (all other wildlife)

[1] The effects pathway related to changes in the availability of traditional resources for traditional hunting and trapping, fishing, and plant gathering will be secondary or primary depending on the results of the residual effects analysis for wildlife, fish and fish habitat, and vegetation, respectively.

Table 13: Potential Pathways for Effects to Traditional Land and Resource Use

Project Components/Activities	Effects Pathway	Environmental Design Features and Mitigation Measures	Pathway Assessment
Project components/activities that contribute to sensory disturbance (e.g., presence of people, dust, lights, smells, sounds, and vibrations) during construction, operation, and closure and reclamation: • Land clearing, site preparation and construction of facilities and infrastructure • Development of open pits and underground mines • Handling and storage of waste rock and mineralized material • Process plant and processing • Site traffic • Transportation of personnel and materials to and from site • Power generation • Additional infrastructure (e.g., roads, camp, maintenance shop, and offices) • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Sensory disturbances can affect the experience of Indigenous land users.	• An Air Quality Effects Mitigation and Monitoring Plan will be developed and implemented that includes ambient air monitoring for criteria air contaminants and fugitive dust and adaptive management based on ambient air quality standards. • Procurement criteria will be developed to ensure stationary and mobile engines meet applicable performance standards, such as equipment that has the lowest practical and economically achievable nitrogen oxide emission rates. • Ultra-low sulphur diesel (less than 15 parts per million sulphur) will be used in all equipment to reduce ambient concentrations of nitrogen dioxide. • Transportation of workers will be completed using large vehicles where possible to reduce the number of engines in use, thereby reducing vehicle combustion and fugitive emissions. • Emissions control devices will be used and maintained on fossil-fuel based engines. • Equipment will be regularly maintained. • Idling of vehicles will be limited to the extent practical. • Water and/or dust suppressants will be applied to site roads as necessary. • Speed limits will be established and enforced on site roads to reduce dust production. • Crushers and conveyors will be covered. • Noisy equipment will be enclosed in buildings, where feasible. • Internal combustion engines will be outfitted with well-maintained muffler systems. • Power plant generator facilities will have louvers on ventilation openings and exhaust mufflers. • Sound levels will be monitored, as per the noise management plan, and adaptive management applied if required. • Progressive reclamation and revegetation will be implemented for areas disturbed by the Project that are no longer required. • The Closure and Reclamation Plan will be implemented.	Primary
Project activities that change public access during construction, operation, and closure and reclamation: • Development and improvement of site roads • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Increased public access and human population from Project employment can lead to increased hunting and fishing and competition for resources.	• Existing roads and trails will be used where possible. • An access management plan will be developed and implemented in consultation with Indigenous communities. • Signage or fencing will be installed at known cultural sites to prohibit public access. • To reduce risks to public health and safety, access will be restricted by installing gates and fencing on private roads. • A “no hunting and fishing” policy will be implemented on the Project site that applies to staff and contractors. • Project employees and contractors will participate in cultural awareness training. • Progressive reclamation and revegetation will be implemented for areas disturbed by the Project that are no longer required. • The Closure and Reclamation Plan will be implemented. • Ongoing engagement will occur with Indigenous communities on the implementation of appropriate mitigation actions and policies and their effectiveness.	Secondary
	• Increased public access and human population from Project employment can lead to disturbance of culturally important sites and areas (e.g., habitation, spiritual sites, or trails).		Secondary
Project activities that change public access during construction, operation, and closure and reclamation: • Access restrictions on site roads and trails	• Access restrictions can affect the ability of Indigenous land users to access traditional use areas and to participate in traditional activities in the vicinity of the Project.	• An access management plan will be developed and implemented in consultation with Indigenous communities.	Secondary
Project components/activities that may influence traditional activities and cultural values during construction, operation, and closure and reclamation: • Land clearing, site preparation and construction of facilities and infrastructure • Development of open pits and underground mines • Handling and storage of waste rock and mineralized material • Process plant and processing • Transportation of personnel and materials to and from site • Additional infrastructure (e.g., roads, camp, maintenance shop, and offices) • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Involvement in Project activities by Indigenous people and associated changes in social and economic factors can affect participation in traditional activities and cultural values and practices.	• The Socio-economic Management Plan will be developed and implemented. • Workplace policies will be implemented to provide an effective working environment for Indigenous people. • Project employees and contractors will participate in cultural awareness training.	Primary

Table 13: Potential Pathways for Effects to Traditional Land and Resource Use

Project Components/Activities	Effects Pathway	Environmental Design Features and Mitigation Measures	Pathway Assessment
Accidents and Malfunctions	• Chemical or hazardous materials spills on site or during transport offsite can affect actual or perceive changes in water, fish, plants, and wildlife, which could affect participation in traditional activities and the consumption of traditional foods.	• The Spill Contingency Plan and Waste Management Plan will be implemented. • Standard best management practices for general activities with regards to use, handling, and storage of deleterious substances will be followed. • Hazardous waste will be stored in appropriate containers that will be located in a lined bermed containment pad, which will provide secondary containment of spills. • No fuels, oils, or other hazardous substances will be stored within 150 m of waterbodies. • No equipment maintenance or refuelling will be conducted within 150 m of waterbodies. • The tailings transport pipeline will have drainage points and spill containment areas located along the route. • Vehicles and equipment will be regularly maintained. • Spill kits will be available at various locations throughout the site and will be maintained in good working order. • Hazardous waste will be transported to a licensed hazardous waste receiving facility for disposal. • Fuel and hazardous materials will be transported in approved containers in licensed vehicles. • If a major spill occurs, the cleanup, treatment, and disposal of the contaminated waste and soil will be handled and disposed of using approved methods. • Speed limits will be enforced. • Ongoing consultation and communication of the results of monitoring plans and programs will occur with Indigenous communities. • Ongoing consultation with Indigenous communities will occur on the implementation of appropriate mitigation measures and their effectiveness.	No pathway
Accidents and Malfunctions	• A wildfire started by Project activities may result in loss of traditional land use.	• A Wildfire Prevention and Preparedness Plan will be developed and implemented. • All heavy equipment and fuelling sites will be equipped with approved and fully charged fire extinguishers. • Firefighting training will be provided to on-site personnel (as deemed appropriate). • No smoking will be allowed at equipment fuelling stations or outside of designated areas at all times. • Safety management systems (e.g., hot work permits) will be implemented. • Firebreaks and vegetation management (e.g., removal of understory fuel loads) will be implemented.	No pathway
Accidents and Malfunctions	• Failure of storm water management features (culverts, roadside ditches) following a severe rainfall event can influence surface water levels, flows and drainage areas, which can affect ecological services (e.g., water quality, fish, wildlife) and traditional land and resource use.	• Storm water features will be designed to carry/contain a suitable return rainfall event as well as provide sufficient erosion protection during those events. • Routine inspections and maintenance of storm water management system will be conducted.	No pathway

Table 14: Potential Pathways for Effects on Population Demographics

Project Components/Activities	Effects Pathway	Proposed Environmental Design Features, Mitigation, and Benefit Enhancement Measures for Discussion and Elaboration with Communities	Pathway Assessment
Project components/activities that contribute to employment and contracting during construction and operation: • Land clearing, site preparation, and construction of facilities and infrastructure • Development of open pits and underground mines • Handling and storage of waste rock and mineralized material • Process plant and processing • Site traffic • Transportation of personnel and materials to and from site • Food, housekeeping, maintenance, and environmental monitoring services	• The Project could induce in-migration to the NWT from southern communities.	• Local labour in local study area (LSA) communities will be prioritized for employment and local businesses for contracting opportunities. • Communities will be prioritized for hiring through Impact Benefit Agreements (IBAs) or other agreements. • A worker accommodation camp will be maintained as travelling from the site after a shift is a safety concern.	No pathway
	• The Project could induce out-migration from small LSA communities to Yellowknife.	• Local labour in LSA communities will be prioritized for employment and local businesses for contracting opportunities. • Communities will be prioritized for hiring through IBAs or other agreements. • Hiring priorities will be communicated to LSA communities.	Primary
	• The Project could induce migration from small LSA communities to Hay River or Fort Resolution.	• Local labour in LSA communities will be prioritized for employment and local businesses for contracting opportunities. • Communities will be prioritized for hiring through IBAs or other agreements. • Hiring priorities will be communicated to LSA communities.	Primary
	• The Project could induce out-migration from the NWT to southern communities if travel allowances or pickup points are provided for southern employees.	• Local labour in LSA communities will be prioritized for employment and local businesses for contracting opportunities. • Communities will be prioritized for hiring through IBAs or other agreements.	Primary
	• Uptake of northern labour from other mines as they close during Project operations could offset outmigration of skilled northern labour seeking mining employment.	• Other Northern labour will be included as a second priority for hiring after local labour from LSA communities. • Yellowknife will be maintained as a pick-up point community to provide a transportation hub for other Northern workers coming from the North Slave Region. • Communication will occur with other mining operators in the NWT to understand their closure schedules, and opportunities for workforce transition to the Project where possible and following prioritization of local labour from LSA communities.	Primary

Table 14: Potential Pathways for Effects on Population Demographics

Project Components/Activities	Effects Pathway	Proposed Environmental Design Features, Mitigation, and Benefit Enhancement Measures for Discussion and Elaboration with Communities	Pathway Assessment

Table 15: Potential Pathways for Effects on Economic Development and Government Revenues

Project Components/Activities	Effects Pathway	Proposed Environmental Design Features, Mitigation, and Benefit Enhancement Measures for Discussion and Elaboration with Communities	Pathway Assessment
Project components/activities that contribute to the Project expenditures during construction and operation: • Land clearing, site preparation and construction of facilities and infrastructure • Development of open pits and underground mines • Handling and storage of waste rock and mineralized material • Process plant and processing • Site traffic • Transportation of personnel and materials to and from site • Additional infrastructure (e.g., roads, camp, maintenance shop, and offices)	• Capital expenditures would add to the economic activity in the NWT, including investment.	• Strategies that increase capacity of local businesses will be used to supply the Project with goods and services.	Primary
Project components/activities that contribute to spending on goods and services during construction and operation: • Land clearing, site preparation, and construction of facilities and infrastructure • Development of open pits and underground mines • Handling and storage of waste rock and mineralized material • Process plant and processing • Site traffic • Transportation of personnel and materials to and from site • Food, housekeeping, maintenance, and environmental monitoring services	• Project activities will contribute to territorial economic activity and Gross Domestic Product (GDP).	• None required.	Primary
Project components/activities that contribute to employment and contracting during construction and operation: • Land clearing, site preparation, and construction of facilities and infrastructure • Development of open pits and underground mines • Handling and storage of waste rock and mineralized material • Process plant and processing • Site traffic • Transportation of personnel and materials to and from site • Food, housekeeping, maintenance, and environmental monitoring services	• Project-induced in-migration to the NWT from southern communities could increase consumer prices and result in inflation of consumer goods.	• Local labour in LSA communities will be prioritized for employment and local businesses for contracting opportunities. • Communities will be prioritized for hiring through IBAs or other agreements. • Other Northern labour will be included as a second priority for hiring after local labour from LSA communities. • Yellowknife will be maintained as a pick-up point community to provide a transportation hub for other Northern workers coming from the North Slave Region. • Communication will occur with other mining operators in the NWT to understand their closure schedules, and opportunities for workforce transition to the Project where possible and following prioritization of local labour from LSA communities.	No pathway
	• Project activities will influence forthcoming economic shocks associated with other mine closures in the NWT.	• Other Northern labour will be included as a second priority for hiring after local labour from LSA communities. • Yellowknife will be maintained as a pick-up point community to provide a transportation hub for other Northern workers coming from the North Slave Region. • Communication will occur with other mining operators in the NWT to understand their closure schedules, and opportunities for workforce transition to the Project where possible and following prioritization of local labour from LSA communities.	Primary
Project activities that result in community investment: • Implementation of community investment strategy • Development of Impact Benefit Agreements	• Project activities will yield Impact Benefit Agreements (IBA) with some local communities, and community investment securing local benefits.	• None required.	Primary
Project components/activities that contribute to territorial and federal revenues during construction and operation: • Land clearing, site preparation, and construction of facilities and infrastructure • Development of open pits and underground mines • Handling and storage of waste rock and mineralized material • Process plant and processing • Site traffic • Transportation of personnel and materials to and from site • Food, housekeeping, maintenance, and environmental monitoring services.	• Project activities will generate income taxes, corporate taxes, property taxes and other government revenues.	• None required.	Primary

Table 14: Potential Pathways for Effects on Population Demographics

Project Components/Activities	Effects Pathway	Proposed Environmental Design Features, Mitigation, and Benefit Enhancement Measures for Discussion and Elaboration with Communities	Pathway Assessment
Project activities during closure and reclamation: • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure • Cessation of Impact Benefit Agreements	• Project closure and reclamation will bring an end to many of the positive economic effects associated with employment, incomes, taxes, and economic contributions to the territory. At the same time, adverse social effects are unlikely to dissipate with closure, and out-migration is a possibility.	• A conceptual socio-economic closure framework will be developed in early stages of the Project, with action plans and meetings with stakeholders delivered annually, in order to facilitate social transition. • Economic development planning will be supported that emphasizes diversification. • Local businesses will be worked with to expand their capacity to serve broader industries during construction and operations. • Liaison will occur with communities, governments, workers and contractors regarding retrenchment opportunities and economic transition planning. • Benefit recipients (e.g., IBAs, community investment) and contractors will be worked with to encourage the investment of community contributions and capital in sustainable initiatives that better life in communities.	Primary

Table 16: Potential Pathways for Effects on Employment and Education

Project Components/Activities	Effects Pathway	Proposed Environmental Design Features, Mitigation, and Benefit Enhancement Measures for Discussion and Elaboration with Communities	Pathway Assessment
Project components/activities that contribute to employment and contracting during construction and operation: • Land clearing, site preparation, and construction of facilities and infrastructure • Development of open pits and underground mines • Handling and storage of waste rock and mineralized material • Process plant and processing • Site traffic • Transportation of personnel and materials to and from site • Food, housekeeping, maintenance, and environmental monitoring services	• Workforce requirements will generate direct local employment opportunities and associated incomes.	• Local labour in LSA communities will be prioritized for employment and local businesses for contracting opportunities. • Communities will be prioritized for hiring through IBAs or other agreements. • Other Northern labour will be included as a second priority for hiring after local labour from LSA communities. • Yellowknife will be maintained as a pick-up point community to provide a transportation hub for other Northern workers coming from the North Slave Region. • Communication will occur with other mining operators in the NWT to understand their closure schedules, and opportunities for workforce transition to the Project where possible and following prioritization of local labour from LSA communities.	Primary
Project components/activities that contribute to employment and contracting during construction and operation: • Land clearing, site preparation, and construction of facilities and infrastructure • Development of open pits and underground mines • Handling and storage of waste rock and mineralized material • Process plant and processing • Site traffic • Transportation of personnel and materials to and from site • Food, housekeeping, maintenance, and environmental monitoring services	• Procurement and hiring for the Project will result in indirect and induced employment in supplier industries and from worker spending.	• None required.	Primary
Project components/activities that contribute to employment and contracting during construction and operation: • Land clearing, site preparation, and construction of facilities and infrastructure • Development of open pits and underground mines • Handling and storage of waste rock and mineralized material • Process plant and processing • Site traffic • Transportation of personnel and materials to and from site • Food, housekeeping, maintenance, and environmental monitoring services	• Project employment opportunities will generate incomes, contributing to the overall labour income in communities and the NWT.	• Local labour in LSA communities will be prioritized for employment and local businesses for contracting opportunities. • Communities will be prioritized for hiring through IBAs or other agreements. • Other Northern labour will be included as a second priority for hiring after local labour from LSA communities. • Yellowknife will be maintained as a pick-up point community to provide a transportation hub for other Northern workers coming from the North Slave Region. • Communication will occur with other mining operators in the NWT to understand their closure schedules, and opportunities for workforce transition to the Project where possible and following prioritization of local labour from LSA communities.	Primary
Project components/activities that contribute to employment and contracting during construction and operation: • Land clearing, site preparation and construction of facilities and infrastructure • Development of open pits and underground mines • Handling and storage of waste rock and mineralized material • Process plant and processing • Site traffic • Transportation of personnel and materials to and from site • Food, housekeeping, maintenance, and environmental monitoring services	• Procurement of materials, goods and services will affect local and regional business revenues.	• Local labour in LSA communities will be prioritized for employment and local businesses for contracting opportunities. • Procurement strategies will be maintained that create accessible opportunities for smaller local businesses (e.g., breaking up construction bids into smaller opportunities, maintain a list of local businesses and capacity). • The local business community will be worked with to identify ways to expand their capacity to meet the needs of the Project.	Primary

Table 16: Potential Pathways for Effects on Employment and Education

Project Components/Activities	Effects Pathway	Proposed Environmental Design Features, Mitigation, and Benefit Enhancement Measures for Discussion and Elaboration with Communities	Pathway Assessment
Project components/activities that contribute to demand for a trained workforce during construction and operation: • Land clearing, site preparation and construction of facilities and infrastructure • Development of open pits and underground mines • Handling and storage of waste rock and mineralized material • Process plant and processing • Site traffic • Transportation of personnel and materials to and from site • Food, housekeeping, maintenance, and environmental monitoring services	• Project employment educational requirements could increase training and education uptake amongst the prospective workforce.	• Training opportunities will be provided. • Local education authorities will be worked with to communicate the need for education in the pursuit of mining employment. • Efforts will be supported to upgrade education. • Career information will be provided. • Priority hiring and contracting for Northerners and Northern Indigenous candidates will be maintained.	Primary
Project components/activities that could result in training opportunities during construction and operation: • Land clearing, site preparation, and construction of facilities and infrastructure • Development of open pits and underground mines • Handling and storage of waste rock and mineralized material • Process plant and processing • Site traffic • Transportation of personnel and materials to and from site • Food, housekeeping, maintenance, and environmental monitoring services	• Project training will continue to build capacity in the labour force, thereby strengthening the NWT population's ability to participate in the labour force.	• Training opportunities will be provided. • Local education authorities will be worked with to communicate the need for education in the pursuit of mining employment and positions needed by mining companies. • Efforts to upgrade education will be supported. • Career information will be provided. • Priority hiring and contracting for Northerners and Northern Indigenous candidates will be maintained.	Primary
Project components/activities that contribute to employment and associated in-migration during construction and operation: • Land clearing, site preparation, and construction of facilities and infrastructure • Development of open pits and underground mines • Handling and storage of waste rock and mineralized material • Process plant and processing • Site traffic • Transportation of personnel and materials to and from site • Food, housekeeping, maintenance, and environmental monitoring services	• In-migration of families to Yellowknife, Hay River, and Fort Resolution could lead to increased number of children of school-age, leading to higher enrolment and larger class sizes.	• Local labour in LSA communities will be prioritized for employment and local businesses for contracting opportunities. • Communities will be prioritized for hiring through IBAs or other agreements. • Hiring priorities will be communicated to LSA communities.	Primary
Project components/activities that contribute to employment and associated in-migration during construction and operation: • Land clearing, site preparation, and construction of facilities and infrastructure • Development of open pits and underground mines • Handling and storage of waste rock and mineralized material • Process plant and processing • Site traffic • Transportation of personnel and materials to and from site • Food, housekeeping, maintenance, and environmental monitoring services	• Teacher retention could be affected if substantial in-migration increases the cost of living in communities.	• Local labour in LSA communities will be prioritized for employment and local businesses for contracting opportunities. • Communities will be prioritized for hiring through IBAs or other agreements. • Hiring priorities will be communicated to LSA communities.	Primary
Project activities during closure and reclamation: • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure • Cessation of Impact Benefit Agreements	• Project closure and reclamation will bring an end to associated employment and incomes.	• A conceptual socio-economic closure framework will be developed in early stages of the Project, with action plans and meetings with stakeholders delivered annually to facilitate social transition. • Economic development planning will be supported that emphasizes diversification. • Local businesses will be worked with to expand their capacity to serve broader industries during construction and operations. • Liaison will occur with communities, governments, workers, and contractors regarding retrenchment opportunities and economic transition planning. • Benefit recipients (e.g., IBAs, community investment) and contractors will be worked with to encourage the investment of community contributions and capital in sustainable initiatives that better life in communities.	Primary

Table 17: Potential Pathways for Effects on Health and Well-being

Project Components/Activities	Effects Pathway	Proposed Environmental Design Features, Mitigation, and Benefit Enhancement Measures for Discussion and Elaboration with Communities	Pathway Assessment
Project components/activities that contribute to employment and associated health and safety training during construction and operation: • Land clearing, site preparation, and construction of facilities and infrastructure • Development of open pits and underground mines • Handling and storage of waste rock and mineralized material • Process plant and processing • Site traffic • Transportation of personnel and materials to and from site • Food, housekeeping, maintenance, and environmental monitoring services	• Project health and safety training (e.g., defensive driving, first aid) will improve safety awareness, prevent injuries and provide skills for treatment of minor injuries.	• None required.	Primary
Project components/activities that contribute to employment and associated access to healthcare and counselling services during construction and operation: • Land clearing, site preparation and construction of facilities and infrastructure • Development of open pits and underground mines • Handling and storage of waste rock and mineralized material • Process plant and processing • Site traffic • Transportation of personnel and materials to and from site • Food, housekeeping, maintenance, and environmental monitoring services	• Project medical and counselling services could improve access to healthcare services and improve health seeking behaviors of employees and their families.	• None required.	Primary
Project components/activities that contribute to employment and contracting during construction and operation: • Land clearing, site preparation and construction of facilities and infrastructure • Development of open pits and underground mines • Handling and storage of waste rock and mineralized material • Process plant and processing • Site traffic • Transportation of personnel and materials to and from site • Food, housekeeping, maintenance, and environmental monitoring services	• Preferential hiring of Indigenous candidates and women will build capacity in these groups, and provide employment, thereby potentially reducing their vulnerability to poverty.	• Local labour in LSA communities will be prioritized for employment and local businesses for contracting opportunities. • Communities will be prioritized for hiring through IBAs or other agreements. • Recruitment strategies will be developed that target these groups and put in place communication strategies to communicate opportunities specifically to women and Indigenous candidates.	Primary
Project components/activities that contribute to employment and contracting, and associated increased incomes during construction and operation: • Land clearing, site preparation and construction of facilities and infrastructure • Development of open pits and underground mines • Handling and storage of waste rock and mineralized material • Process plant and processing • Site traffic • Transportation of personnel and materials to and from site • Food, housekeeping, maintenance, and environmental monitoring services	• Employment income will contribute to income disparity between employee families and families not benefiting from employment, and between communities.	• Additional discussion with communities is required to develop effective and appropriate mitigation.	Primary
	• The Project may contribute to social maladies similar to those evident in monitoring data in other mining-affected regions, including a linkage between mining and increased use of drugs and alcohol in communities, and concerns associated with interaction between work camps and nearby communities.	• Zero tolerance policies will be in place regarding the use of drugs and alcohol while on shift or in transit. • A worker code of conduct will be developed and enforced. • Access to an Employee and Family Assistance Program (EFAP) will be provided. • Additional discussion with communities is required to develop effective and appropriate mitigation.	Primary
	• The Project may indirectly contribute to social ills such as family violence and crime associated with increased use of drugs and alcohol made increasingly accessible through incomes and growth in illegal markets	• Additional discussion with communities is required to develop effective and appropriate mitigation.	Primary
Project components/activities that require rotational employment during construction and operation: • Land clearing, site preparation and construction of facilities and infrastructure • Development of open pits and underground mines • Handling and storage of waste rock and mineralized material • Process plant and processing • Site traffic • Transportation of personnel and materials to and from site • Food, housekeeping, maintenance, and environmental monitoring services	• The requirement for construction and operations workers to stay in camps while on rotation can influence family conflict as workers are removed from the home for extend periods of time.	• The Project will use several different rotations to meet operational needs. • Engagement with communities will continue to determine effective and proactive management of social impacts.	Primary
	• The requirement for construction and operations workers to stay in camps while on rotation reduces time for volunteering and participation in other community activities.	• The Project will use several different rotations to meet operational needs. • Engagement with communities will continue to determine effective and proactive management of social impacts.	Primary

Table 17: Potential Pathways for Effects on Health and Well-being

Project Components/Activities	Effects Pathway	Proposed Environmental Design Features, Mitigation, and Benefit Enhancement Measures for Discussion and Elaboration with Communities	Pathway Assessment
Project components/activities that require specialized labour from outside the NWT during construction and operation: • Land clearing, site preparation, and construction of facilities and infrastructure • Development of open pits and underground mines • Handling and storage of waste rock and mineralized material • Process plant and processing • Site traffic • Transportation of personnel and materials to and from site • Food, housekeeping, maintenance, and environmental monitoring services	• The use of both local and out-of-area personnel during construction could result in workplace or cross-cultural conflict, and concerns regarding public health risks (e.g., COVID-19)	• Cultural awareness training will be provided and an environment of respect will be cultivated. • Workplace policies regarding worker codes of conduct and harassment will be maintained. • Elder counselling opportunities for Indigenous staff will be maintained.	Primary
Project components/activities that contribute to employment and contracting during construction and operation: • Land clearing, site preparation, and construction of facilities and infrastructure • Development of open pits and underground mines • Handling and storage of waste rock and mineralized material • Process plant and processing • Site traffic • Transportation of personnel and materials to and from site • Food, housekeeping, maintenance, and environmental monitoring services	• Employment incomes can increase access to equipment and materials required to participate in traditional and recreational activities.	• None required.	Primary
	• Employment incomes can increase access to nutritious foods, and can be used to support the nutritional needs of families.	• None required.	Primary

Table 18: Potential Pathways for Effects on Housing, Services, and Infrastructure

Project Components/Activities	Effects Pathway	Proposed Environmental Design Features, Mitigation, and Benefit Enhancement Measures for Discussion and Elaboration with Communities	Pathway Assessment
Project components/activities that contribute to employment and contracting during construction and operation: • Land clearing, site preparation, and construction of facilities and infrastructure • Development of open pits and underground mines • Handling and storage of waste rock and mineralized material • Process plant and processing • Site traffic • Transportation of personnel and materials to and from site • Food, housekeeping, maintenance, and environmental monitoring services	• Project-induced in-migration to Yellowknife, Hay River and Fort Resolution could increase demand for housing at a level that could push beyond current stock and drive up prices.	• Local labour in LSA communities will be prioritized for employment and local businesses for contracting opportunities. • Communities will be prioritized for hiring through IBAs or other agreements. • Hiring priorities will be communicated to LSA communities.	Primary
	• Project workforce housing requirements could increase demand on the rental housing market in Yellowknife, Hay River and Fort Resolution.	• Workers, including those from outside the NWT, will be housed in full-service construction and operations camps.	No pathway
	• The Project's out-of-area workforce could increase demand for health, social, and protective services.	• A first responder medical station will be provided at the accommodation camp facilities to meet workers' medical needs while at site, to limit the demand for governmental health facilities for work related injuries. • Pre-employment medical exams will be conducted in hometown. • First aid training will be provided. • Driver training will be provided and a driver code of conduct will be enforced, to control speeds and encourage considerate driving. • Zero tolerance policies will be in place regarding the use of drugs and alcohol while on shift or in transit. • A worker code of conduct will be developed and enforced. • Access to an Employee and Family Assistance Program (EFAP) will be provided such that private fee for service organizations are used and the public or non-profit sector does not see an increase in demand.	No pathway
	• Project-induced in-migration to Yellowknife, Hay River and Fort Resolution may increase demand on health, social, and protective services.	• Local labour in LSA communities will be prioritized for employment and local businesses for contracting opportunities. • Communities will be prioritized for hiring through IBAs or other agreements. • Hiring strategies to LSA communities will be communicated to dispel the idea that they must be in the closest communities to secure employment. • A first responder medical station will be provided at the accommodation camp facilities to meet workers' medical needs while at site, to limit the demand for governmental health facilities for work related injuries. • First aid training will be provided. • Driver training will be provided and a driver code of conduct will be enforced, to control speeds and encourage considerate driving. • Zero tolerance policies will be in place regarding the use of drugs and alcohol while on shift or in transit. • A worker code of conduct will be developed and enforced. • Access to an Employee and Family Assistance Program (EFAP) will be provided.	Primary

Table 18: Potential Pathways for Effects on Housing, Services, and Infrastructure

Project Components/Activities	Effects Pathway	Proposed Environmental Design Features, Mitigation, and Benefit Enhancement Measures for Discussion and Elaboration with Communities	Pathway Assessment
Transportation of personnel and materials to and from site during construction and operations	• The transportation of materials, goods, and the workforce during construction and operations will result in increased traffic and access restrictions on roads used to access the Project-related roads and staging areas.	• Liaison will occur with other industrial road users (e.g., NWT Power) and GNWT Transportation regarding transportation schedules on Highway 6 and associated access roads.	Primary
	• Increased Project traffic on roads shared with other users introduces greater risk of collisions.	• Driver training will be provided and a driver code of conduct will be enforced, to control speeds and encourage considerate driving. • Liaison will occur with other industrial road users (e.g., NWT Power) and GNWT Transportation regarding transportation schedules on Highway 6 and associated access roads.	Primary
	• The Project's use of air and water transportation for materials, goods, and out-of-area workers during construction and operations will place additional demand on air and shipping transportation services.	• Liaison will occur with air and shipping service providers to ensure capacity is available to move goods, equipment, and personnel. • Service agreements will be established with providers in advance, and make them aware of shipping and air transportation requirements.	No pathway
Project components/activities that require power during construction and operation: • Land clearing, site preparation and construction of facilities and infrastructure • Development of open pits and underground mines • Handling and storage of waste rock and mineralized material • Process plant and processing • Site traffic • Food, housekeeping, maintenance, and environmental monitoring services	• Project construction and operations will generate demand for power and place pressure on the power supply system.	• Arrangements will be made with NWT Power to provide services to some extent in a manner that does not jeopardize the electricity security for other users. • Diesel generators will be used as required to offset surplus and emergency demand for electricity extra to that provided by the NWT Power grid.	No pathway
Project components/activities that generate waste during construction and operation: • Land clearing, site preparation and construction of facilities and infrastructure • Development of open pits and underground mines • Handling and storage of waste rock and mineralized material • Process plant and processing • Site traffic • Food, housekeeping, maintenance, and environmental monitoring services	• The Project will generate solid waste requiring disposal, thereby potentially affecting capacity of waste management services infrastructure.	• The Waste Management Plan will be implemented. • Waste management agreements will be established with service providers capable of handling solid and hazardous waste. • Inert waste may be disposed in an onsite landfill. • Organic waste from the camp may be incinerated on site.	No pathway
Project components/activities that contribute to employment and contracting during construction and operation: • Land clearing, site preparation and construction of facilities and infrastructure • Development of open pits and underground mines • Handling and storage of waste rock and mineralized material • Process plant and processing • Site traffic • Transportation of personnel and materials to and from site • Food, housekeeping, maintenance, and environmental monitoring services	• Project-induced in-migration to Yellowknife, Hay River and Fort Resolution could increase demand for waste management infrastructure beyond capacity.	• Local labour in LSA communities will be prioritized for employment and local businesses for contracting opportunities. • Communities will be prioritized for hiring through IBAs or other agreements. • Hiring priorities will be communicated to LSA communities.	No pathway
Project activities that contribute to use of potable water during construction, operation, and closure and reclamation: • Food, housekeeping, maintenance, and environmental monitoring services	• Project will increase demand for potable water and wastewater treatment and disposal.	• Water will be drawn from an appropriate potable source. • Wastewater management agreements will be established with service providers capable of effectively collecting, transporting, and treating wastewater.	No pathway
Project components/activities that contribute to employment and contracting during construction and operation: • Land clearing, site preparation and construction of facilities and infrastructure • Development of open pits and underground mines • Handling and storage of waste rock and mineralized material • Process plant and processing • Site traffic • Transportation of personnel and materials to and from site • Food, housekeeping, maintenance, and environmental monitoring services	• Project-induced in-migration to Yellowknife, Hay River and Fort Resolution could increase demand for water and wastewater treatment and disposal infrastructure.	• Local labour in LSA communities will be prioritized for employment and local businesses for contracting opportunities. • Communities will be prioritized for hiring through IBAs or other agreements. • Hiring priorities will be communicated to LSA communities.	Primary

Table 19: Potential Pathways for Effects to Non-Traditional Land and Resource Use

Project Components/Activities	Effects Pathway	Environmental Design Features and Mitigation Measures	Pathway Assessment
Project components/activities that contribute to the Project footprint and final landscape conditions during construction, operation, and closure and reclamation: • Land clearing, site preparation and construction of facilities and infrastructure • Development of open pits and underground mines • Handling and storage of waste rock and mineralized material • Water withdrawals for potable and process water use • Process plant • Tailings disposal and management • Installation of cross drainage structures and diffuser for mine water discharge • Mine water discharge • Site traffic • Transportation of personnel and materials to and from site • Power generation • Non-hazardous waste incineration • Additional infrastructure (e.g., roads, camp, maintenance shop, and offices) • Cessation of site water management activities, including mine water discharge • Reconnection of closure drainages to the local surface water environment • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Presence of Project infrastructure will restrict access and reduce area available for non-traditional land and resource users.	• The Project disturbance footprint will be limited to the extent practical. Where possible and practical, infrastructure will be built on previously disturbed sites. • Areas of vegetation clearing and soil disturbance will be limited to the immediate area of the future activity at that location. • Roads will be designed to the minimum allowable possible width and follow best practices for design speeds and expected vehicle traffic. • A pipe bench will be constructed to accommodate the pipelines, which will follow existing and proposed road alignments to the extent practical to minimize the Project footprint. • Construction of the Project will be planned to avoid environmentally sensitive areas (e.g., listed plants and wetlands) to the extent practical. • Clearing equipment will be used that minimizes surface disturbance, soil compaction, and topsoil loss (e.g., equipment with low ground pressure tracks or tires, blade shoes and brush) where feasible. • Steepness and length of slopes of disturbed areas and stockpiled soils will be limited. • Work will be avoided in sensitive areas during the time-of-year when erosion is more likely (e.g., spring freshet). • Progressive reclamation and revegetation will be implemented for areas disturbed by the Project that are no longer required. • An Air Quality Effects Mitigation and Monitoring Plan will be developed and implemented that includes ambient air monitoring for criteria air contaminants and fugitive dust and adaptive management based on ambient air quality standards • The Waste Management Plan will be implemented. • The Water Management Plan, Tailings and Waste Rock Management Plan, and Erosion and Sediment Control Plan will be implemented, and includes that applies adaptive management, if required. • An Aquatic Effects Monitoring Program (AEMP) and Surveillance Network Program (SNP) will be developed and implemented to monitor effects of the mine on the aquatic receiving environment. Adaptive management actions as per an aquatic response framework within the AEMP will be enabled if necessary. • The Wildlife Protection Plan will be implemented. • The Closure and Reclamation Plan will be implemented. • Engagement will occur with guides, outfitters, lodges, and other land and resource users.	Primary
	• Residual landscape disturbance from Project facilities and activities can permanently alter the landscape and change non-traditional land and resource use in the area.		Primary

Table 19: Potential Pathways for Effects to Non-Traditional Land and Resource Use

Project Components/Activities	Effects Pathway	Environmental Design Features and Mitigation Measures	Pathway Assessment

Project components/activities that alter surface water quantity and quality and contribute to the Project footprint, air and dust emissions and deposition, sensory disturbance (e.g., noise, lights, vibrations), and presence of workforce during construction, operation, and closure and reclamation:
• Land clearing, site preparation and construction of facilities and infrastructure
• Development of open pits and underground mines
• Handling and storage of waste rock and mineralized material
• Water withdrawals for potable and process water use
• Process plant and processing
• Tailings disposal and management
• Installation of cross drainage structures and diffuser for mine water discharge
• Mine water discharge
• Site traffic
• Transportation of personnel and materials to and from site
• Power generation
• Non-hazardous waste incineration
• Additional infrastructure (e.g., roads, camp, maintenance shop, and offices)
• Cessation of site water management activities, including mine water discharge
• Reconnection of closure drainages to the local surface water environment
• Removal of infrastructure
• Restoration and revegetation of facilities and infrastructure
	• Project footprint and activities may lead to changes in the abundance and distribution of fish, vegetation ecosystems, and wildlife and the availability or suitability of resources for outfitted and recreational hunting and angling, camping, or lodge experiences.	• Mitigations that avoid and limit effects to water quantity (Table 5) and quality (Table 6), fish (Table 7), vegetation (Table 9), and wildlife (Table 11); examples include:
		  ○ The Project disturbance footprint will be limited to the extent practical. Where possible and practical, infrastructure will be built on previously disturbed sites.
		  ○ Areas of vegetation clearing and soil disturbance will be limited to the immediate area of the future activity at that location.
		  ○ The road alignment will minimize stream crossings and alterations to existing drainage patterns.
		  ○ Existing roads and trails will be used where possible.
		  ○ The Water Management Plan, Tailings and Waste Rock Management Plan, and Erosion and Sediment Control Plan will be implemented, and includes that applies adaptive management, if required.
		  ○ Water that interacts with the site footprint, waste rock, and tailings management areas will be captured and managed.
		  ○ Process water will be recirculated and water from tailings disposal areas will be recovered for recycling.
		  ○ Studies will be undertaken to evaluate the suitability of multiple locations as tailings disposal sites and to select locations that will avoid and minimize risk of potential environmental effects.
		  ○ An Aquatic Effects Monitoring Program (AEMP) and Surveillance Network Program (SNP) will be developed and implemented to monitor effects of the mine on the aquatic receiving environment. Adaptive management actions as per an aquatic response framework within the AEMP will be enabled if necessary.
		  ○ Water crossing structures and water intakes will be constructed and installed in a manner that protects the banks from erosion and maintains the flows in the water body and follows permits or authorizations issued for the Project from the appropriate regulatory agencies and DFO's *Measures to Protect Fish and Fish Habitat*.
		  ○ The water intake(s) will be screened to prevent entrainment or impingement of fish.
		  ○ The pumped mine water discharge will be directed through a properly designed diffuser to minimize effects from changes in velocity.
		  ○ The diffuser will be located to avoid sensitive fish habitat (e.g., shoals, spawning areas).
		  ○ Blasting operations will follow DFO's *Measures to Protect Fish and Fish Habitat* and *Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters* (Wright and Hopky 1998) for setback distances from fish bearing water bodies.
		  ○ The Wildlife Protection Plan will be implemented.
		  ○ Speed limits and signage will be established on all roads to limit risk of vehicle-animal collisions.
		  ○ Wildlife will be provided with the right of way.
		• Procedures to reduce noise, dust, and light levels will be implemented such as:
		  ○ Noisy equipment will be enclosed in buildings, where feasible.
		  ○ Internal combustion engines will be outfitted with well-maintained muffler systems.
		  ○ Hydroelectric power will be used to supplement fossil fuel methods for power generation.
		  ○ Secondary (or backup) power generation will be mainly compressed natural gas (CNG) to minimize use of diesel.
		  ○ An Air Quality Effects Mitigation and Monitoring Plan will be developed and implemented that includes ambient air monitoring for criteria air contaminants and fugitive dust and adaptive management based on ambient air quality standards.
		  ○ Water and/or dust suppressants will be applied to site roads as necessary.
		  ○ Crushers and conveyors will be covered.
		• Progressive reclamation and revegetation will be implemented for areas disturbed by the Project that are no longer required.
		• The Closure and Reclamation Plan will be implemented.
		• Engagement will occur with guides, outfitters, lodges, and other land and resource users.
			Secondary or Primary[2]

[2] The effects pathway related to changes in the availability or suitability of resources for outfitted and recreational hunting and angling, camping, or lodge experiences are expected to be secondary, but may be primary depending on the results of the residual effects analysis for wildlife, fish and fish habitat, and vegetation.

Table 19: Potential Pathways for Effects to Non-Traditional Land and Resource Use

Project Components/Activities	Effects Pathway	Environmental Design Features and Mitigation Measures	Pathway Assessment
Project components/activities that contribute to sensory disturbance (e.g., presence of people, dust, lights, smells, sounds, and vibrations) during construction, operation, and closure and reclamation: • Land clearing, site preparation and construction of facilities and infrastructure • Development of open pits and underground mines • Handling and storage of waste rock and mineralized material • Process plant and processing • Site traffic • Transportation of personnel and materials to and from site • Power generation • Additional infrastructure (e.g., roads, camp, maintenance shop, and offices) • Removal of infrastructure • Restoration and revegetation of facilities and infrastructure	• Sensory disturbances can influence outfitted and recreational hunting and angling, camping, or lodge experiences in the vicinity of the Project.	• An Air Quality Effects Mitigation and Monitoring Plan will be developed and implemented that includes ambient air monitoring for criteria air contaminants and fugitive dust and adaptive management based on ambient air quality standards. • Procurement criteria will be developed to ensure stationary and mobile engines meet applicable performance standards, such as equipment that has the lowest practical and economically achievable nitrogen oxide emission rates. • Ultra-low sulphur diesel (<15 ppm sulphur) will be used in all equipment to reduce ambient concentrations of nitrogen dioxide. • Transportation of workers will be completed using large vehicles where possible to reduce the number of engines in use, thereby reducing vehicle combustion and fugitive emissions. • Emissions control devices will be used and maintained on fossil-fuel based engines. • Equipment will be regularly maintained. • Idling of vehicles will be limited to the extent practical. • Water and/or dust suppressants will be applied to site roads as necessary. • Speed limits will be established and enforced on site roads to reduce dust production. • Crushers and conveyors will be covered. • Noisy equipment will be enclosed in buildings, where feasible. • Internal combustion engines will be outfitted with well-maintained muffler systems. • Power plant generator facilities will have louvers on ventilation openings and exhaust mufflers. • Sound levels will be monitored, as per the noise management plan, and adaptive management applied if required. • Progressive reclamation and revegetation will be implemented for areas disturbed by the Project that are no longer required. • The Closure and Reclamation Plan will be implemented. • Engagement will occur with guides, outfitters, lodges, and other land and resource users.	Primary
Project activities that change public access during construction, operation, and closure and reclamation: • Access restrictions on site roads and trails	• Access restrictions can affect the ability of people to participate in outfitted and recreational hunting and angling or camping in the vicinity of the Project.	• An access management plan will be developed and implemented in consultation with guides, outfitters, lodges, and other land and resource users. • Engagement will occur with guides, outfitters, lodges, and other land and resource users.	Secondary
Accidents and Malfunctions	• Chemical or hazardous materials spills on site or during transport offsite can influence water, fish, and wildlife, which could affect availability or suitability of resources for outfitted and recreational hunting and fishing.	• The Spill Contingency Plan and Waste Management Plan will be implemented. • Standard best management practices for general activities with regards to use, handling, and storage of deleterious substances will be followed. • Hazardous waste will be stored in appropriate containers that will be located in a lined bermed containment pad, which will provide secondary containment of spills. • No fuels, oils, or other hazardous substances will be stored within 150 m of waterbodies. • No equipment maintenance or refuelling will be conducted within 150 m of waterbodies. • The tailings transport pipeline will have drainage points and spill containment areas located along the route. • Vehicles and equipment will be regularly maintained. • Spill kits will be available at various locations throughout the site and will be maintained in good working order. • Hazardous waste will be transported to a licensed hazardous waste receiving facility for disposal. • Fuel and hazardous materials will be transported in approved containers in licensed vehicles. • If a major spill occurs, the cleanup, treatment, and disposal of the contaminated waste and soil will be handled and disposed of using approved methods. • Speed limits will be enforced.	No pathway
Accidents and Malfunctions	• A wildfire started by Project activities may result in loss of non-traditional land and resource use.	• A Wildfire Prevention and Preparedness Plan will be developed and implemented. • All heavy equipment and fuelling sites will be equipped with approved and fully charged fire extinguishers. • Firefighting training will be provided to on-site personnel (as deemed appropriate). • No smoking will be allowed at equipment fuelling stations or outside of designated areas at all times. • Safety management systems (e.g., hot work permits) will be implemented. • Firebreaks and vegetation management (e.g., removal of understory fuel loads) will be implemented.	No pathway
Accidents and Malfunctions	• Failure of storm water management features (culverts, roadside ditches) following a severe rainfall event can influence surface water levels, flows and drainage areas, which can affect ecological services (e.g., water quality, fish, wildlife) and non-traditional land and resource use.	• Storm water features will be designed to carry/contain a suitable return rainfall event as well as provide sufficient erosion protection during those events. • Routine inspections and maintenance of storm water management system will be conducted.	No pathway

2.2.1.3 Effects of Extreme Events

2.2.1.3.1 Effects of the Environment on the Project

The EA Initiation Guidelines indicate that the description of potential Project interactions with the environment provided in the EA Initiation Package should include consideration of effects of the environment on the Project. Natural environment vulnerabilities and events that may interact with components of the biophysical and human environments include potential effects from climate change, extreme precipitation events, seasonal flooding and spring thaw patterns, changes in permafrost, natural fires, ice jams, and seismic events. Further details related to how effects from these potential sources will be assessed in the Developer's Assessment Report are provided in the Developer's Assessment Proposal (Volume 5).

2.2.1.3.2 Accidents and Malfunctions

The EA Initiation Guidelines indicate that the description of potential Project interactions with the environment provided in the EA Initiation Package should include consideration of potential accidents and malfunctions. Accidents and malfunctions are unplanned events caused by industrial or natural hazards, such as structural or operation failures. Accidents and malfunctions that could conceivably occur as a result of mining activity include small to large fuel spills, slope failures, failure of turbidity control systems, pipeline leaks or ruptures, erosion of roads connecting to water management components, and failure of pumps or overflow of sumps. Further details related to how effects from these potential sources will be assessed in the Developer's Assessment Report are provided in the Developer's Assessment Proposal (Volume 5). Accidents and malfunctions that may occur as part of normal Project operations (e.g., small scale spills) are identified in the tables in Sections 2.2.1.1 and 2.2.1.2.

3.0 IDENTIFICATION OF CUMULATIVE EFFECTS

Cumulative effects are those effects that result from a combination of a project with other past, present, and reasonably foreseeable future developments (MVEIRB 2004). Cumulative effects represent the sum of all natural and human induced influences on the physical, biological, social, cultural, and economic components of the environment through time and across space. Changes may be human-related, such as increasing mineral development and some changes may be associated with natural phenomena such as fire, insect outbreaks, floods, and climate change. It is the goal of cumulative effects assessment to predict the relative contribution of human-related influences on valued and intermediate components in context of natural factors.

Cumulative effects will be assessed in the Developers Assessment Report following the environmental assessment methods defined in the Developer's Assessment Proposal (Volume 5). Cumulative effects will be identified and evaluated in the context of the spatial and temporal boundaries defined for each biophysical or human environment component (Section 4.1.3.1 and 4.1.3.2 of Volume 5). The concept of assessment cases (Section 4.1.3.3 of Volume 5) will be applied to the associated component-specific environmental assessment boundaries to estimate the incremental and cumulative effects from the Project and other developments. Assessment cases will include a Base Case (existing environment), an Application Case, and a Reasonably Foreseeable Development (RFD) Case.

Each of the assessment cases included in the Developer's Assessment Report considers the potential for cumulative effects within the temporal and spatial boundaries of the assessment. The Base Case (i.e., the existing environment) includes consideration of cumulative effects from all previous, existing, and approved developments, activities, and natural disturbances that have occurred within the spatial and temporal boundaries of the assessment. For example, the brownfield nature of the historical Pine Point Mine will be considered on components of the biophysical or human environments in the Base Case. The Application Case will provide predictions of the cumulative effects of the developments in the Base Case combined with the effects from the Project, in isolation from potential future land-use activities or natural disturbances.

The RFD Case will consider the Application Case plus the cumulative effects from all previous, existing, approved, and future projects and activities. A summary of projects currently recommended to be considered in the RFD Case, and a list of criteria used for their selection, is provided in the Developer's Assessment Proposal (Volume 5). The list of projects will be finalized once the regional study areas (see Section 4.1.3 of Volume 5) defined for individual biophysical and human environment components are confirmed. Finalizing the regional study areas is important, as this is the spatial scale that is considered when evaluating cumulative effects from the Project and other previous, existing, and reasonably foreseeable developments.

The evaluation of cumulative effects in the RFD Case will focus on Project-interactions that have the potential to overlap spatially and temporally with similar types of effects from other existing, approved, or reasonably foreseeable developments. Only effect pathways that are predicted to result in a greater than negligible residual effect on a biophysical or human environment component (i.e., primary pathways) will be considered in the RFD Case. Cumulative effects are considered for secondary pathways; however, these pathways are predicted to result in a negligible residual effect on an environmental component and have no measurable contribution to effects from other existing, approved, or reasonably foreseeable projects to cause a significant effect. Natural environmental vulnerabilities and events, such as climate change, forest fires, and flooding may be also be considered in the RFD Case for individual components, where relevant.

Not all components or effect pathways will require an analysis of cumulative effects in the RFD Case. Confirmation of the regional study areas that will be used for each component is required to determine whether an RFD Case assessment may be needed. In addition, more detailed Project design information and the results of environmental modelling (e.g., groundwater, air quality surface water quantity, water quality) are needed to confirm whether Project activities will result in greater than negligible effects on environmental components, and thus, whether cumulative effects from other existing, approved, or reasonably foreseeable developments are possible.

Due to the considerations noted above, it is not possible at the current stage of planning for the Project to specifically identify the expected cumulative effects of the Project and other existing, approved, or reasonably foreseeable developments. However, in general, cumulative effects are more likely to occur in components that are more widely distributed, or that travel over large areas, and that consequently, could be influenced by a number of developments (e.g., caribou and socio-economics). In these instances, the analysis of cumulative effects can be necessary and important. For example, job creation associated with the Project and other existing, approved, or reasonably foreseeable developments has the potential result in a cumulative effect on employment conditions in the communities affected by the Project. For other components, there is little or no potential for cumulative effects in the RFD Case because there is little or no overlap with other projects (e.g., terrain and soils, heritage resources). For example, ground disturbance affecting soils and archeological sites would be limited to the footprint area of each project and there is no to little potential for multiple projects to result in cumulative effects.

Identification and analysis of cumulative effects will occur during the preparation of the Developer's Assessment Report. The approach will be based on the environmental assessment approach (e.g., spatial and temporal boundaries; list of reasonably foreseeable developments) described in the Developer's Assessment Proposal, while taking into account relevant feedback on the EA Initiation Package. This process will also consider findings from ongoing engagement, Indigenous Traditional Knowledge data collection, results from environmental modelling, and the updated Project Description.

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REPORT

Developer's Assessment Proposal

Environmental Assessment Initiation Package for the Pine Point Project

Submitted to:

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Submitted by:

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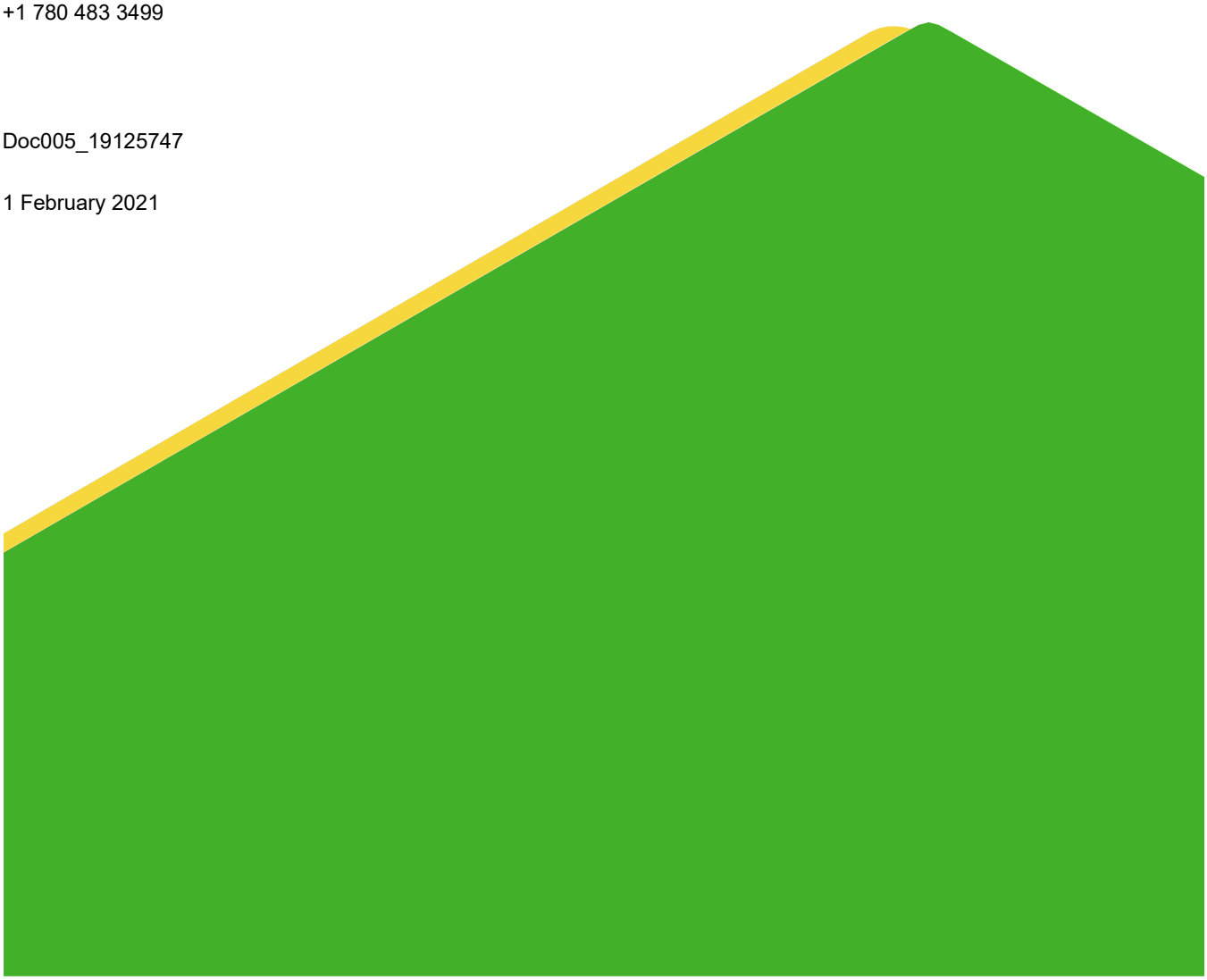
1 February 2021



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One Digital Copy to Pine Point Mining Limited

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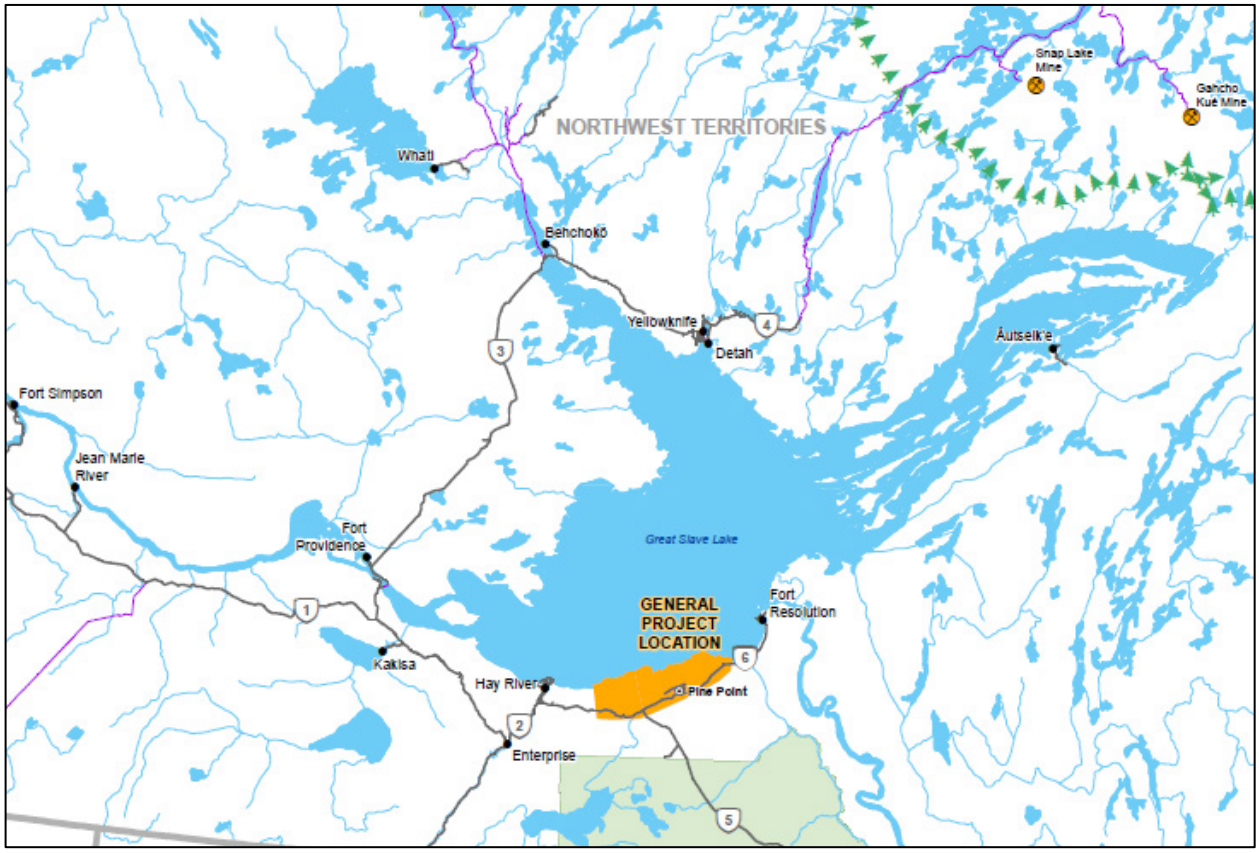
DISCLAIMER

PLAIN LANGUAGE SUMMARY

This document is a plain language summary of the Developer's Assessment Proposal for the Pine Point Project. It is much shorter than the Developer's Assessment Proposal and talks about only some of the topics. Readers should read the full Developer's Assessment Proposal if they are interested in more details about this information.

Pine Point Project

Pine Point Mining Limited (PPML) is proposing to build the Pine Point Project (Project), a zinc and lead mine, in the Northwest Territories (NWT), 175 kilometres (km) south of Yellowknife and 42 km east of Hay River.



The property where the Project will be built has a long history of mining activity by Cominco Ltd. The Project will take about a year and a half to build and mining will take 10 to 15 years. Zinc and lead will be mined using both open-pit and underground mining. A process plant, camp, and other facilities will be built. Once mining is finished, closure and reclamation will take place. More information about the Project is available in Volume 1.

Environmental Assessment in the Northwest Territories

To develop the Project, PPML must obtain a number of permits and licences from the governments of the NWT and Canada. To help with making a decision about whether these permits and licences can be issued, an environmental assessment is required. In the NWT, the government agency that oversees environmental assessment is the Mackenzie Valley Environmental Impact Review Board. The purpose of the environmental assessment will be to provide information about the Project and explain what the environmental effects might be. The document that will provide this information is called the "Developer's Assessment Report."

Developer's Assessment Proposal

As part of the early planning for the environmental assessment, PPML needs to provide the Review Board and affected communities and parties with a description of the key issues and topics they think should be made a priority in the Developer's Assessment Report. This information is provided in a document called the "Developer's Assessment Proposal."

The purpose of the Developer's Assessment Proposal is to list the main issues of concern for the Project and explain how environmental, social, and economic effects will be assessed. The Developer's Assessment Proposal forms a part of the "Environmental Assessment Initiation Package" that is needed by the Review Board as a first step to beginning an environmental assessment for a new project.

Valued Components

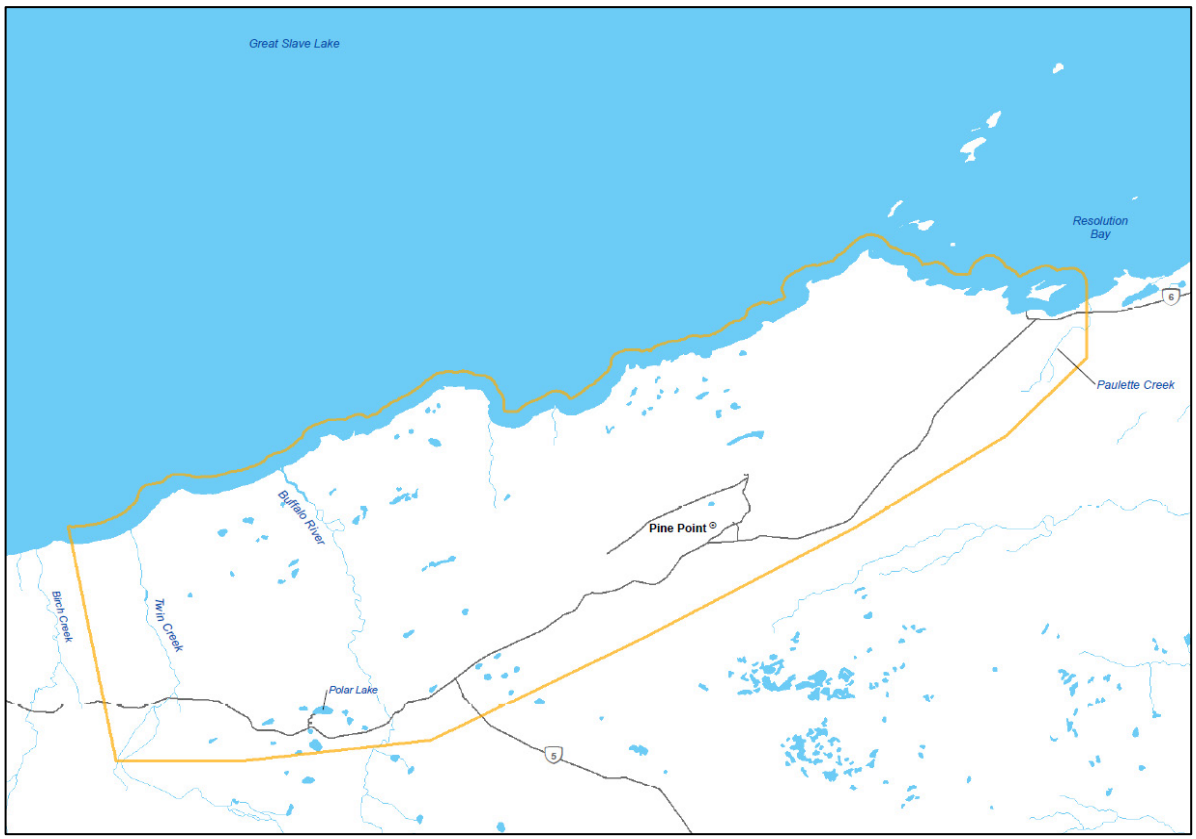
The Developer's Assessment Report will focus on "valued components," which are parts of the environment or society that are considered important by communities, governments, and the public. Valued components may be fish or wildlife species, or aspects of society, such as jobs, or the health and well-being of communities. Choosing specific valued components helps to focus the environmental assessment on the most important topics and concerns.

The types of information that PPML considered when selecting valued components include:

- results of early engagement with affected communities, governments, and the public
- information shared by Indigenous knowledge holders
- scientific knowledge
- information about the local environment
- potential for environmental, social, or economic effects
- presence of species of conservation concern, which are legally protected in the NWT and in Canada
- value to communities, governments, and the public

The initial list valued components chosen to be included in the Developer's Assessment Report are listed below:

- Fish
  - Fish communities in the main lakes and streams near the Project (Great Slave Lake Fish Community, Twin Creek Fish Community, Buffalo River Fish Community, and Paulette Creek Fish Community)



- Vegetation (for example, plants, trees, and lichen), including upland (meaning occurring on the land), wetland, and riparian (meaning occurring along rivers and lakes) ecosystems.


Photo of forest at Pine Point

- Wildlife
  - Four mammals: Woodland Caribou (Boreal Population), Wood Bison, Wolverine, and Gray Wolf
  - Two bats: Little Brown Myotis and Northern Myotis
  - Eleven birds: Short-eared Owl, Olive-sided Flycatcher, Whooping Crane, Common Nighthawk, Evening Grosbeak, Bank Swallow, Barn Swallow, Yellow Rail, Rusty Blackbird, Horned Grebe, and Red-necked Phalarope
  - One amphibian: Northern Leopard Frog
  - Two insects: Gypsy Cuckoo Bumble Bee and Yellow-banded Bumble Bee
  - Some of these wildlife species will be considered in more detail (Caribou, Wood Bison, Gray Wolf, Little Brown Myotis, Olive-sided Flycatcher, Whooping Crane, Evening Grosbeak, Yellow Rail, Rusty Blackbird)

Photo of a boreal caribou from a remote camera at Pine Point in 2018

- Heritage Resources (for example, archeological sites or culturally important sites)
- Traditional Land and Resource Use (meaning the use of the land and the resources it provides by Indigenous peoples)

- Socio-economics
  - Population Demographics (meaning the characteristics of communities such as population size)
  - Economic Development and Government Revenues (meaning the health and growth of the economy)
  - Employment and Education (for example, jobs, training opportunities, and contracts for local businesses)
  - Community Health and Wellbeing
  - Housing, Services, and Infrastructure
  - Non-Traditional Land and Resource Use (meaning the use of the land and the resources it provides by non-Indigenous peoples)

The Developer's Assessment Report will also consider supporting topics, called "intermediate components." These are topics that are important to understand when looking at how the Project could affect valued components. For example, the water quality of nearby lakes and streams is important to consider when looking at potential effects on fish communities and wildlife because water quality can affect the habitat and health of fish and wildlife species.

The intermediate components chosen to be included in the Developer's Assessment Report are listed below:

- Air Quality
- Noise
- Vibration
- Climate
- Groundwater Quantity and Quality
- Surface Water Quantity
- Surface Water Quality
- Terrain and Soils

Air quality monitoring station at Pine Point

The final list of valued and intermediate components included in the Developer's Assessment Report will incorporate feedback from reviewers of the Developer's Assessment Proposal.

Key Issues and Questions

The environmental assessment will focus on the issues and questions that concern people the most. “Key issues” are specific topics or areas of concern that are important to affected communities, governments, and the general public. For example, caribou are important to the culture of Indigenous peoples and other residents of the NWT. Therefore, effects on caribou will be considered as a key issue for the Developer’s Assessment Report.

The level of attention given to each key issue in the Developer’s Assessment Report will depend on its importance to local communities and government agencies. In the NWT, the most important issues considered in an environmental assessment are called “Key Lines of Inquiry.” These are topics that will be given the most attention in the Developer’s Assessment Report. The Key Lines of Inquiry that will be considered in the Developer’s Assessment Report are listed below.

- Impacts to Water Quality
  - *Impacts to Water Quality* was chosen as a Key Line of Inquiry because water quality is generally a concern for governments and communities. Water quality is important for the health of fish and wildlife, as well as Indigenous and other land-users in the NWT.
- Impacts to Caribou
  - *Impacts to Caribou* was chosen as a Key Line of Inquiry because caribou are important to the culture of Indigenous peoples and other residents of the NWT. They are a critical component of the diet of many northerners, and they are an important resource harvested by communities with traditional lands near the Project. People are particularly concerned about caribou because their numbers are declining.
- Impacts to Traditional Land and Resource Use
  - *Impacts to Traditional Land and Resource Use* was chosen as a Key Line of Inquiry because communities are generally concerned about being able to continue to use the land for traditional activities during construction, once the Project is built, and after closure. Therefore, protecting the resources provided by the land surrounding the Project is a key concern. These resources include fish, wildlife, plants, and water.
- Impacts to Social and Economic Conditions
  - *Impacts to Social and Economic Conditions* was chosen as a Key Line of Inquiry because communities and governments will be interested in understanding what opportunities and outcomes are expected from the Project. Opportunities and outcomes could include jobs for people and local businesses, learning opportunities, and changes to community health and wellness.

A number of other topics, called “Subjects of Note,” will be considered in the Developer’s Assessment Report. Subjects of Note are important issues that will be considered in the environmental assessment, but that are generally not considered as high of a priority as Key Lines of Inquiry. The Subjects of Note that will be considered in the environmental assessment include the topics listed below:

- Impacts to Air Quality, Noise, Vibration, and Climate
- Impacts to Groundwater Quantity and Quality
- Impacts to Surface Water Quantity

- Impacts to Fish and Fish Habitat
- Impacts to Terrain and Soils
- Impacts to Vegetation
- Impacts to Wildlife
- Impacts to Heritage Resources
- Impacts to Non-Traditional Land and Resource Use

Each of the Key Lines of Inquiry and Subjects of Note listed above will have its own section in the Developer's Assessment Report and will be investigated in detail as a part of the environmental assessment.

Project Effects and Mitigations

A main purpose of the Developer's Assessment Report will be to identify mitigations that can be used to reduce potential effects on the environment. The Developer's Assessment Report will provide information about which Project activities or components could affect valued or intermediate components. A list of Project effects, called "pathways" will be provided. An example of a pathway is that building the Project could change habitat for wildlife. For each pathway, a list of mitigations will be provided. Mitigations are actions that PPML will take to avoid or reduce effects on valued components. For example, PPML will make use of existing roads and facilities that were previously used by Cominco to help mitigate potential changes to wildlife habitat.

The Developer's Assessment Report will explain how the Project will affect each valued component, taking into consideration that mitigations will be used. Information about whether the effects on valued components are positive or negative, how long they might last, and how widespread they might be, will also be provided.

Engagement Plan Framework and Indigenous Traditional Knowledge

To accompany the Developer's Assessment Proposal, PPML has prepared an engagement plan for the Project. The purpose the engagement plan is to explain how PPML will engage with affected communities and other interested parties. The engagement plan can be found in a document called the "Engagement and Collaboration Framework" in Volume 2.

The information and concerns shared during engagement will considered when preparing the Developer's Assessment Report, as well as available Indigenous Traditional Knowledge. PPML's desire is that the list of valued components and key issues provided in this document reflect the priorities and concerns of affected communities and the public. Updates to the list of valued components and key issues will be made, as needed, so that the most important topics identified during engagement are considered in the Developer's Assessment Report.

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Abbreviations and Units of Measure

Abbreviation	Definition
CIRNAC	Crown-Indigenous Relations and Northern Affairs Canada
Cominco	Cominco Ltd.
EA	environmental assessment
GNWT	Government of the Northwest Territories
ITK	Indigenous Traditional Knowledge
KLOI	Key Line of Inquiry
LSA	local study area
LWBMV	Land and Water Boards of the Mackenzie Valley
MVEIRB	Mackenzie Valley Environmental Impact Review Board
MVLWB	Mackenzie Valley Land and Water Board
NTLRU	non-traditional land and resource use
NWT	Northwest Territories
PPML	Pine Point Mining Limited
Project	Pine Point Project
RFD	reasonably foreseeable development
RSA	regional study area
SARA	*Species at Risk Act*
SON	Subject of Note
TLRU	traditional land and resource use
TOR	Terms of Reference
VC	valued component

Unit of Measure	Definition
ha	hectare
km	kilometre
m	metre
m^3	cubic metre
MW	megawatt
ppb	parts per billion

1.0 INTRODUCTION

1.1 Overview

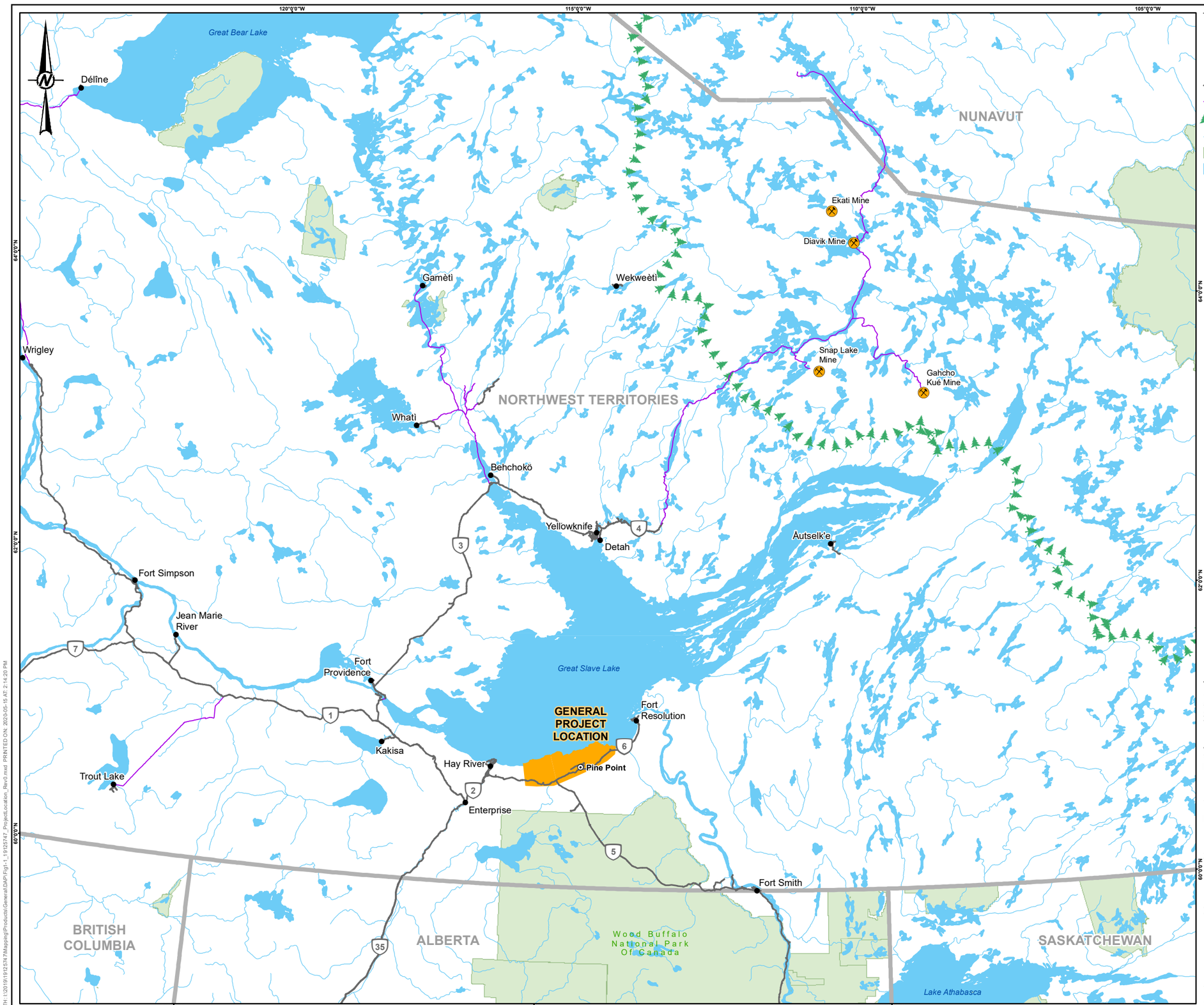
This document fulfills the requirement to provide a Developer's Assessment Proposal, as a component of the Environmental Assessment (EA) Initiation Package for the Pine Point Mining Limited (PPML or "the developer") Pine Point Project (Project), as outlined in the Mackenzie Valley Environmental Impact Review Board (MVEIRB) *Draft Environmental Assessment Initiation Guidelines for Developers of Major Projects* (EA Initiation Guidelines; MVEIRB 2018).

The Project is located in the Northwest Territories (NWT) within the South Slave Mining District, approximately 175 km south of Yellowknife (Figure 1-1 and Figure 1-2), on a brownfield site associated with historical mining activity by Cominco Ltd. (Cominco). The Project will consist of open pit and underground mining for zinc and lead, construction and operation of a processing mill (or "concentrator") and pre-concentration facilities, storage and management of processed mineralized material and waste materials, water management, construction and operation of ancillary support facilities including a camp for workers and the transportation of zinc and lead concentrates to global markets.

The Developer's Assessment Proposal for the Project has been prepared according to Section 5.0 of the EA Initiation Guidelines. The Developer's Assessment Proposal outlines the proposed valued components (VCs) and priority issues that have been identified during the early Project planning stages. It also outlines the proposed methods that PPML will use to assess effects on VCs through the EA process. The assessment methods described herein are intended to provide a proposed scope and methods that will direct the production of a future Developer's Assessment Report for the Project, and are informed by the Project-related information presented in other documents submitted as part of the EA Initiation Package, and which are referenced throughout this document:

- Volume 1: Project Description
- Volume 2: Engagement and Collaboration Plan
- Volume 3: Description of Existing Environment
- Volume 4: Identification of Potential Project-Interactions and Proposed Mitigation Measures
- Volume 6: Management and Monitoring Framework for the Biophysical and Human Environments

The information presented in the Developer's Assessment Proposal will be used by the MVEIRB as a starting point for identifying assessment priorities and assessment methods during scoping. The Developer's Assessment Proposal provides necessary and sufficient information early in the EA planning process to inform the development of a Terms of Reference (TOR) for the Developer's Assessment Report. The TOR, which will be issued by the MVEIRB, outlines the information PPML must provide in the Developer's Assessment Report, and sets out priority areas of investigation and assessment methods for the EA. Therefore, the Developer's Assessment Proposal is intended to provide information that results in a more informed, accurate, and tailored TOR, which will improve the focus and effectiveness of the subsequent Developer's Assessment Report and increase the overall efficiency and quality of the EA process.



LEGEND

- FORMER PINE POINT TOWN SITE
- POPULATED PLACE
- EXISTING MINE
- ALL-SEASON ROAD
- WINTER ROAD
- TREELINE
- WATERCOURSE
- PARK/PROTECTED AREA
- WATERBODY
- GENERAL PROJECT LOCATION

0 50 100

1:3,000,000 KILOMETRES

REFERENCE(S)

1. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
2. PARKS AND PROTECTED AREAS OBTAINED FROM CONSERVATION AREAS REPORTING AND TRACKING SYSTEM (CARTS), CANADIAN COUNCIL ON ECOLOGICAL AREAS, 2017.

PROJECTION: ALBERS CONIC EQUAL AREA

CLIENT
PINE POINT MINING LTD.

PROJECT
PINE POINT PROJECT

TITLE
LOCATION OF PROJECT

CONSULTANT
GOLDER

YYYY-MM-DD	2020-05-15
DESIGNED	DC
PREPARED	BW
REVIEWED	LY
APPROVED	LY

PROJECT NO.	PHASE	REV.	FIGURE
19125747	B9000	0	1-1

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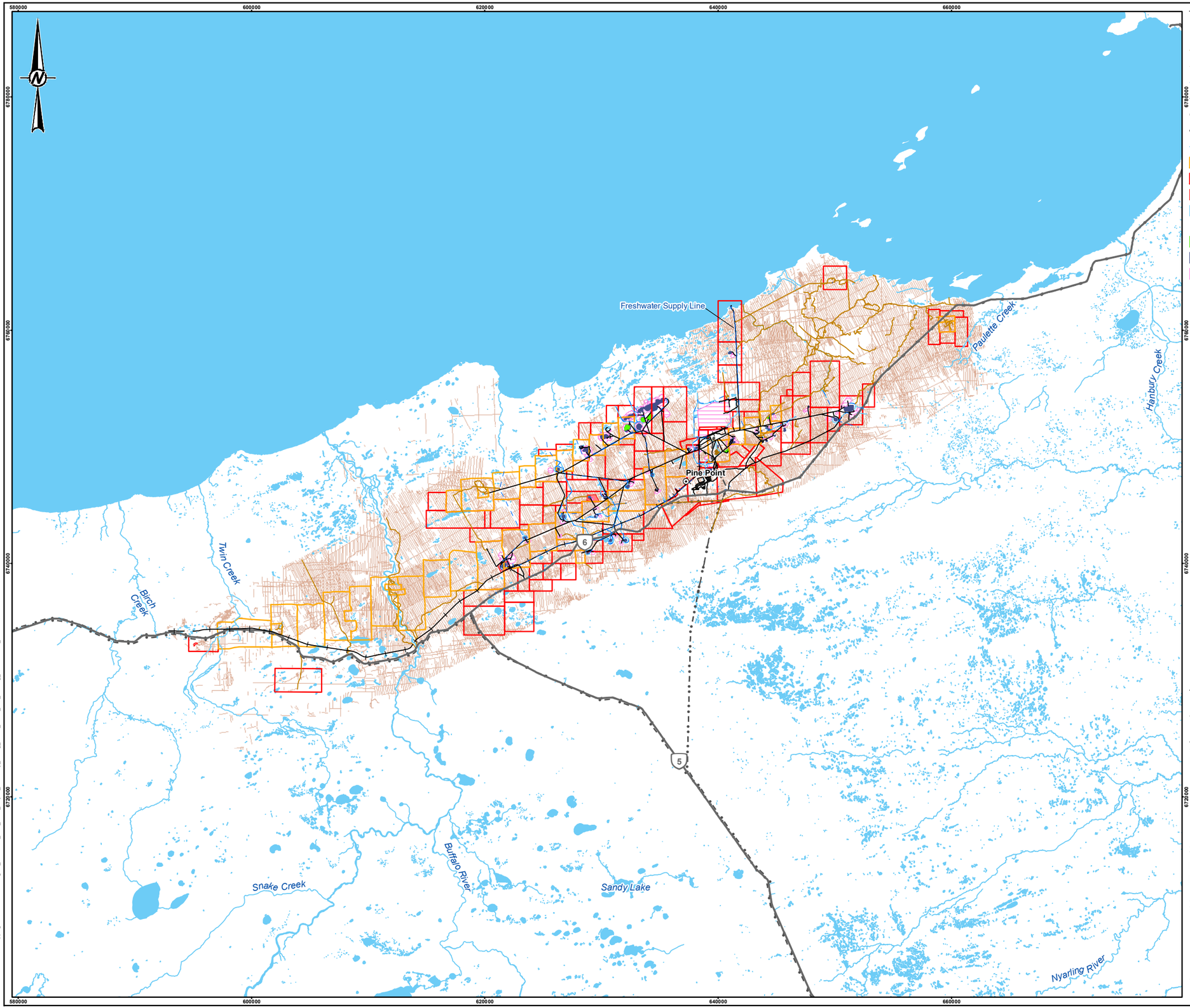

LEGEND

- FORMER PINE POINT TOWN SITE
- BUSH ROAD
- CUTLINE
- DRAINAGE DITCH
- HISTORIC RAILBED
- HIGHWAY
- TRANSMISSION LINE
- WATERCOURSE
- ACTIVE MINERAL LEASE
- ACTIVE MINERAL CLAIM
- CUTBLOCK
- WATERBODY

PINE POINT EXISTING MINING DISTURBANCE

- BACKFILLED PIT
- MINED PIT
- WASTE PILE

0 5 10

1:325,000 KILOMETRES

REFERENCE(S)

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PROJECTION: UTM ZONE 11N DATUM: NAD83

CLIENT
PINE POINT MINING LTD.

PROJECT
PINE POINT PROJECT

TITLE
PINE POINT PROJECT BOUNDARY, MINING LEASE AREAS, AND EXISTING DISTURBANCES

CONSULTANT
GOLDER

YYYY-MM-DD	2020-11-05
DESIGNED	JV
PREPARED	MM/PMT
REVIEWED	DP
APPROVED	DP

PROJECT NO.	CONTROL	REV.	FIGURE
19125747		0	1-2

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The proposed VCs, key issues, and assessment methods were developed with consideration of the preliminary Project Description (Volume 1), feedback from early engagement with the public and Indigenous communities (Volume 2), information related to the existing environment (Volume 3), and the current understanding of potential interactions between the Project and components of the environment (Volume 4). The results of engagement and feedback from previous regulatory applications for the site by other proponents were also considered. The proposed methods will be finalized in the Developer's Assessment Report following feedback from communities and regulators on the Developer's Assessment Proposal and based on the final TOR for the Project.

1.2 Organization

This document has been organized according to the requirements for the Developer's Assessment Proposal set out in Section 5.0 of the EA Initiation Guidelines:

- Section 2.0 provides a description of the proposed VCs for the EA, which includes representation of both the biophysical and human environments, and a rationale for selecting each VC.
- Section 3.0 provides a description of the proposed key issues (Project interactions) and questions prioritized in terms of Key Lines of Inquiry (KLOIs; Section 3.1) or Subjects of Note (SONs; Section 3.2).
- Section 4.0 provides a description of the proposed assessment methods for all VCs (Section 4.1) and the investigation of individual KLOIs and SONs (Sections 4.2), including:
  - general assessment approach and methods for each VC, including analytical and assessment techniques and study boundaries (temporal and spatial)
  - information sources to be used, including completed and planned data collection (i.e., baseline and site-specific studies)
  - timelines, assumptions, information gaps, uncertainties, and approach to addressing information gaps and uncertainties

Assessment methods and priority areas of investigation related to accidents and malfunctions and effects of the environment on the Project are provided in Section 4.3. A proposed table of contents for the Developer's Assessment Report for the Project is provided in Section 5.0.

2.0 VALUED COMPONENTS

This section outlines the list of VCs recommended to be advanced to the Developer's Assessment Report. Valued components are "*element*[s] *of the biophysical or human environment that may be affected by a proposed development and that* [are] *identified as important, such as having ecological, scientific, social, cultural, economic, historical, archaeological, or aesthetic importance*" (MVEIRB 2018). They are identified to be of concern by the proponent, scientists, government agencies, Indigenous peoples, or the public (MVEIRB 2004). The selection of appropriate VCs allows the assessment to be focused on those aspects of the biophysical and human environments that are of greatest importance to society and species conservation. Proposed VCs were selected with consideration of the results of existing baseline information for the Project and findings from early engagement with the public and Indigenous communities. Focusing the assessment on VCs facilitates effective decision-making with respect to the Project.

The following factors will be considered when developing the list of VCs for the Project and Developer's Assessment Report. This list of criteria includes consideration of the guidance outlined in the EA Initiation Guidelines for selecting VCs:

- feedback from early public and Indigenous engagement
- Indigenous Traditional Knowledge (ITK)
- scientific knowledge
- conditions of the existing environment
- potential for interaction with the Project and degree of interaction, including presence, abundance, and degree of spatial overlap of a component with the Project
- sensitivity to potential effects of the Project and level of risk should an adverse effect occur
- species conservation status or concern (e.g., rarity, sensitivity, and uniqueness)
- ecological and socio-economic value to communities, government agencies, and the public
- avoidance of ecological or socio-economic assessment redundancy with other VCs. That is, if two potential VCs represent the same issues, mitigation actions, and potential effects from the Project, only one would be evaluated as part of the assessment
- recent experience with similar projects
- professional judgment

The potential list and rationale for VCs to be included to the Developer's Assessment Report is provided in Table 2-1. Feedback from communities and regulators on the Developer's Assessment Proposal and engagement will be used to help determine the final list of VCs identified in the TOR for evaluation in the Developer's Assessment Report.

Table 2-1: Proposed Valued Components to be Used in the Developer's Assessment Report

Biological or Human Component	Valued Component	Rationale for Selection
Fish and Fish Habitat	Great Slave Lake Fish Community	■ Important commercial, recreational, and traditional subsistence fishery ■ Presence of Shortjaw Cisco (*Coregonus zenithicus*), which is designated by the Committee on the Status of Endangered Wildlife in Canada as Threatened and listed territorially as At Risk under the *Species at Risk (NWT) Act* ■ Presence of sport fish and forage fish ■ Potential connectivity to upstream waterbodies and watercourses affected by Project activities
	Twin Creek Fish Community	■ Drains several small lakes and wetlands south of the Project into Great Slave Lake ■ Presence of sport fish and forage fish and/or their habitats ■ Potential for effects from Project activities
	Buffalo River Fish Community	■ Drains several lakes and wetlands south of the Project into Great Slave Lake ■ Presence of sport fish and forage fish and/or their habitats ■ Commercial and traditional fishery at the mouth to Great Slave Lake ■ Potential for effects from Project activities
	Paulette Creek Fish Community	■ Watercourse with connectivity to Great Slave Lake ■ Presence of sport fish and forage fish and/or their habitats ■ Potential for effects from Project activities
Vegetation	Vegetation (upland, wetland, riparian ecosystems)	■ Loss or fragmentation of vegetation (upland, wetland, and riparian ecosystems) communities, listed plants, and traditional land use plants from vegetation clearing, which are important for ecosystem processes and services as well as spiritual, traditional, or aesthetic values ■ Traditional use plants with subsistence and cultural value ■ Listed plant species, which may be disproportionately affected by Project activities
Wildlife[(a)]	Woodland Caribou (Boreal Population)	■ Listed as Threatened under the federal *Species At Risk Act* (SARA) and the territorial *Species at Risk (NWT) Act* ■ Important subsistence and cultural species ■ Large home range and seasonal movements ■ Prey species for large carnivores ■ Population affected by predation as a result of habitat change
	Wood Bison	■ Listed as Special Concern under SARA and the *Species at Risk (NWT) Act* ■ Important subsistence, cultural and economic species ■ Expansive range with seasonal movements – the NWT Bison Control Area partially overlaps with the Project ■ Population affected by predation as a result of habitat change ■ Population affected by bovine tuberculosis and brucellosis

Table 2-1: Proposed Valued Components to be Used in the Developer's Assessment Report

Biological or Human Component	Valued Component	Rationale for Selection
Wildlife (cont'd)	Wolverine and Gray Wolf	■ Important fur-bearing and economic species ■ Large home ranges with local seasonal movements ■ Wolverine is an important predator and scavenger and is listed as Special Concern under SARA ■ Gray wolf is an important predator of woodland caribou and wood bison
	Little Brown Myotis and Northern Myotis	■ Species are listed as Endangered under SARA and of Special Concern under the *Species at Risk (NWT) Act* ■ Species ranges overlap with Project ■ Often roost in old mine sites
	Short-eared Owl	■ Listed as Special Concern under SARA ■ Species' range overlaps with Project ■ Threatened by habitat loss and alteration
	Olive-sided Flycatcher	■ Listed as Threatened under SARA ■ Species' range overlaps with Project ■ Associated with open areas containing tall live trees or snags for perching ■ Threatened by habitat loss and alteration
	Whooping Crane	■ Listed as Threatened under SARA ■ Species' range may overlap with Project ■ Associated with marshes, bogs and shallow lakes ■ Threated by habitat loss and alteration on wintering grounds
	Common Nighthawk	■ Listed as Threated under SARA ■ Species' range overlaps with Project ■ Threatened by habitat loss and alteration
	Evening Grosbeak	■ Listed as Special Concern under SARA ■ Species' range overlaps with Project ■ Associated with mixedwood forests where fir or white spruce are dominant species ■ Threatened by habitat loss and alteration ■ May also be threatened by declining insect populations, climate change, and habitat loss on wintering grounds
	Bank Swallow and Barn Swallow	■ Species are listed as Threatened under SARA ■ Species ranges overlap with Project ■ Threatened by loss of nesting and foraging habitat ■ May also be threatened by declining insect populations, climate change, and habitat loss on wintering grounds
	Yellow Rail	■ Listed as Special Concern under SARA ■ Threatened by habitat loss and degradation on breeding grounds and climate change ■ May also be threatened by declining insect populations and habitat loss on wintering grounds

Table 2-1: Proposed Valued Components to be Used in the Developer's Assessment Report

Biological or Human Component	Valued Component	Rationale for Selection
Wildlife (cont'd)	Rusty Blackbird	■ Listed as Special Concern under SARA ■ Threatened by habitat loss and degradation on breeding grounds and climate change ■ May also be threatened by declining insect populations and habitat loss on wintering grounds
	Horned Grebe	■ Listed as Special Concern under SARA ■ Threatened by habitat loss and degradation on breeding grounds and climate change ■ May also be threatened by declining insect populations and habitat loss on wintering grounds
	Red-necked Phalarope	■ Listed as Special Concern under SARA ■ Threatened by habitat loss and degradation on breeding grounds and climate change ■ May also be threatened by declining insect populations and habitat loss on wintering grounds
	Northern Leopard Frog	■ Listed as Special Concern under SARA and Threatened under *Species at Risk (NWT) Act* ■ Species' range overlap with Project ■ Threatened by habitat loss and alteration
	Gypsy Cuckoo Bumble Bee and Yellow-banded Bumble Bee	■ Gypsy cuckoo species listed as Endangered under SARA ■ Yellow-banded species listed as Special Concern under SARA ■ Species ranges overlap with Project ■ Threatened by habitat loss and alteration
Heritage Resources	Heritage Resources	■ Compliance with applicable territorial and federal regulations ■ Ground disturbance has potential to affect heritage resource sites located in Project footprint
Traditional Land and Resource Use	Traditional Land and Resource Use	■ The land and its resources are used by Indigenous peoples for cultural, spiritual, recreational, subsistence, and economic purposes
Socio-economics	Population Demographics	■ Population volume influences demand for infrastructure, services, and housing ■ Mobility and migration can affect community composition and viability of community services
	Economic Development and Government Revenues	■ The territory relies heavily on mining for contributions to economic activity as measured by Gross Domestic Product ■ Local business spending is a key driver of local benefit capture and revenues ■ Resource development is a key economic development priority for the territory ■ Traditional economic activities are an important livelihood for the Indigenous population ■ Government revenues are the basis for funding territorially supported infrastructure, services, and programs

Table 2-1: Proposed Valued Components to be Used in the Developer's Assessment Report

Biological or Human Component	Valued Component	Rationale for Selection
Socio-economics (cont'd)	Employment and Education	■ Employment is a key driver of local benefits associated with development, generating incomes ■ Competition for labour between industrial developments can influence labour market conditions territorially ■ Employment incomes can create induced employment in the broader economy ■ Education and training are long-term benefits that build capacity in the labour force
	Community Health and Wellbeing	■ New markets, some illegal, follow development and associated incomes. Illegal markets may have a negative effect on communities ■ Increased employment incomes are often associated with a rise in substance misuse, family violence and crime ■ Community-defined facets of wellbeing are nuanced, and can be impacted by other social and economic effects of development
	Housing, Services, and Infrastructure	■ Population changes in communities can yield varying demand for and pressure on infrastructure and housing relied upon by local residents ■ Changes in population levels can increase demand on health, social and protective services ■ Changes in rates of communicable diseases can influence demand for health services ■ Changes in crime rates can influence demand for protective services
	Non-traditional Land and Resource Use	■ Non-traditional land uses represent important economic and recreational activities for the local population ■ Regional land use planning prioritizes different areas for different uses, including areas of high mineral extraction potential

a) It is anticipated that not all potential wildlife valued components will be assessed comprehensively in the Developer's Assessment Report (see Section 4.2.1.9)

Intermediate components of the biophysical environment will also be assessed to support VC assessments (Table 2-2). Intermediate components are critical to the assessment; however, the VC is the ultimate receptor of concern. For example, the importance of predicted changes in air quality, surface water quality, or groundwater quality will be evaluated considering the consequences that these changes have on VCs such as plants, fish, wildlife, and traditional and non-traditional land and resource use. Except for significance determination (Section 4.1.9), there is no difference in the way that VCs and intermediate components will be assessed in the Developer's Assessment Report. Like VCs, intermediate components will be analyzed to determine the Project-specific environmental changes using a rigorous science-based approach which integrates ITK, and includes cumulative effects analysis, if applicable. Significance determination for components, such as surface water quality, cannot be made in isolation of the effects on aquatic or terrestrial receptors (i.e., fish and wildlife) or land use (i.e., drinking water). For example, an increase of a parameter in milligrams per litre cannot be determined to be significant based solely on the change itself. The determination of the magnitude of the change must be based on the potential for this change to cause an adverse effect on fish, wildlife, or land use. Water quality guidelines, which are generally used as screening criteria, are based on the potential for change to these receptors (i.e., for aquatic life, for wildlife, or for drinking water).

Table 2-2: Proposed Intermediate Components to be Used in the Developer's Assessment Report

Environmental or Social Component	Intermediate Component	Rationale
Air Quality, Noise, and Climate	Air Quality	■ Sensitivity of the biophysical environment (soils, water, plants, animals) and people to air quality and dust emissions ■ Compliance with applicable standards
	Noise	■ Influence on Indigenous and other land and resource use ■ Sensitivity of some wildlife species to noise
	Vibration	■ Influence on Indigenous and other land and resource use ■ Sensitivity of some wildlife species to vibration ■ Potential for damage to buildings and other structures
	Climate	■ Greenhouse gas (GHG) emissions contribute to territorial and national GHG emissions and climate change
Groundwater Quantity and Quality	Groundwater Quantity and Quality	■ Important component in the hydrologic cycle ■ Linked to surface water quantity through exchange with overlying surface water features, which is important for fish and fish habitat ■ Linked to surface water quality through overlying surface water features, which is important for fish and fish habitat, overall ecological integrity, and traditional and non-traditional land and resource use
Surface Water Quantity	Surface Water Quantity	■ Strong link to fish and fish habitat ■ Key attribute of healthy and functioning aquatic and terrestrial ecosystems
Surface Water Quality	Surface Water Quality	■ Compliance with applicable territorial and federal regulations ■ Indigenous and other land users may use local waterbodies and watercourses for recreational or cultural practices ■ Key attribute of healthy and functioning aquatic and terrestrial ecosystems
Terrain and Soils	Terrain and Soils	■ Provides physical structure and foundation for aquatic and terrestrial ecosystems

3.0 ISSUES PRIORITIZATION

The purpose of this section is to identify key issues associated with the Project and to prioritize them to the extent possible, so that the Developer's Assessment Report is focused on the most important issues. Priority issues are organized in the context of Key Lines of Inquiry (KLOIs) and Subjects of Note (SONs). KLOIs are areas of concern that have been identified as requiring the most attention in the Developer's Assessment Report, whereas SONs are topics that require a thorough analysis but do not require the same level of attention and detail as KLOIs.

As a requirement of the EA Initiation Package for the Project, a pathway analysis was undertaken to identify risks to the biophysical and human environments from the Project for each intermediate and valued component (Volume 4). A pathway analysis defines a comprehensive list of potential interactions between the Project and environment (i.e., effect pathways), identifies mitigation that could be used to eliminate and/or minimize potential adverse effects, and focuses further assessment on key or principal effects from the Project that remain after practicable mitigation has been applied. A detailed summary of the approach and methods used to complete the pathway analysis are provided in Volume 4. The results are provided in a tabular format for each EA component (Volume 4). As indicated in the EA Initiation Guidelines, the pathway analysis considered all potential Project-environment interactions that are possible at the current stage of planning for the Project.

The results of the pathway analysis were used to inform the selection of KLOIs and SONs. Other criteria noted in Section 4.3 of the EA Initiation Guidelines for identifying key issues were also considered when selecting KLOIs and SONs (i.e., feedback from public and community engagement and ITK, conditions of the existing environment, scientific knowledge, and professional judgment based on previous EA experience). The following subsections identify the KLOIs and SONs proposed to be advanced to the Developer's Assessment Report. The KLOIs and SONs will be finalized in the Developer's Assessment Report following feedback from communities and regulators on the Developer's Assessment Proposal and based on the final TOR for the Project. KLOIs and SONs will be defined in the "Introduction" section of the Developer's Assessment Report, according to the table of contents proposed for the Developer's Assessment Report in Section 5.0.

3.1 Proposed Key Lines of Inquiry

KLOIs are areas of concern that have been identified as requiring the most attention during the EA and the most rigorous analysis and detail in the Developer's Assessment Report. KLOIs are identified to provide a comprehensive, detailed analysis of the issues that were identified as bringing about potential significant public concern. A standalone assessment will be provided in the Developer's Assessment Report for each identified KLOI. The assessment for each KLOI will consider Project-specific residual effects and potential cumulative effects from the Project and other previous, existing, and reasonably foreseeable developments (if applicable).

Two KLOIs pertaining to the biophysical environment and two KLOIs pertaining to the human environment were identified for the Project:

- KLOI-1: Impacts to Water Quality
- KLOI-2: Impacts to Caribou
- KLOI-3: Impacts to Traditional Land and Resource Use
- KLOI-4: Impacts to Social and Economic Conditions

These four topics will be considered as the primary focus of the Developer's Assessment Report. The VCs associated with these KLOIs are defined in Section 4.1.2. A description of Project-related effects on the VCs associated with each KLOI is provided. Proposed assessment methods for the investigation of each KLOI are provided in Section 4.2.

KLOI-1: Impacts to Water Quality

Impacts to Water Quality was selected as a KLOI as water quality is a cornerstone of the aquatic ecosystem; water quality in receiving environments helps facilitate functioning and healthy aquatic and terrestrial ecosystems and is an important component of traditional land and resource use (TLRU). Water quality is generally a concern for regulators and communities (i.e., water in the receiving environment is safe for aquatic life and drinking by wildlife and humans). However, water quality is an intermediate component as changes to water quality (i.e., concentrations of parameters) only matter to the receptor (e.g., fish and fish habitat, TLRU). Similar to other intermediate components, there is no determination of significance for effects on surface water quality. Thresholds for water quality are related to guidelines, and guidelines for water quality are explicitly linked to aquatic organisms, wildlife, and people. Therefore, the consequences and significance of changes in surface water quality will be evaluated in applicable sections of the fish and fish habitat, caribou, wildlife, and TLRU sections of the Developer's Assessment Report. Overall, the Project has the potential to affect water quality through site water management, including mine water discharge (if required), surface runoff, and groundwater inflow and seepage from the Project.

KLOI-2: Impacts to Caribou

Impacts to Caribou was selected as a KLOI as caribou in the NWT are a wildlife species of concern for regulators and communities. Therefore, understanding Project effects on the ability of caribou populations to be self-sustaining and ecologically effective is expected to be a primary focus of the Developer's Assessment Report. This information will also be used in the TLRU assessment. The Project has the potential to affect caribou through direct and indirect habitat loss and alteration, sensory disturbance, and changes to access leading to increased predation on or harvesting of caribou.

KLOI-3: Impacts to Traditional Land and Resource Use

Impacts to Traditional Land and Resource Use was selected as a KLOI as the ability to continue to use the land for traditional activities during construction and operation and following closure of a project is a concern of communities. Therefore, understanding the effect of the Project on the ability to practice TLRU in the area is expected to be a primary focus of the Developer's Assessment Report. The Project has the potential to affect TLRU in the surrounding landscape through: direct disturbance to traditional use areas; direct and indirect effects on water quality, fish, vegetation, and wildlife; changes in access; and sensory disturbance influencing the experience of Indigenous land users practicing traditional activities.

KLOI-4: Impacts to Social and Economic Conditions

Impacts to Social and Economic Conditions was selected as a KLOI as communities and governments will be interested in understanding the opportunities and beneficial outcomes generated by the Project, and the developer's approach to maximizing the capture of local benefits. Positive economic opportunities and benefits may include employment, contracting and spending with local businesses, and training and educational opportunities. The Project also represents a potential driver of adverse effects on community and family cohesion, wellbeing, service provision, and infrastructure capacity and condition.

3.2 Proposed Subjects of Note

The Developer's Assessment Report will include an assessment SONs that contain other VCs and intermediate components described in Section 2.0 that are not KLOIs (Sections 3.1 and 4.1.2). Every concern identified in the Developer's Assessment Proposal requires a sufficient analysis to demonstrate whether the development is likely to cause significant adverse effects on VCs. The SONs also provide supporting information to KLOIs. For example, results from the assessments of changes to groundwater quality and surface water quantity are used in the assessments of surface water quality and TLRU. The SONs represent lower priority relative to KLOIs but will be evaluated as standalone sections in the Developer's Assessment Report.

Nine SONs were identified for the Project:

- SON-1: Impacts to Air Quality, Noise, Vibration, and Climate
- SON-2: Impacts to Groundwater Quantity and Quality
- SON-3: Impacts to Surface Water Quantity
- SON-4: Impacts to Fish and Fish Habitat
- SON-5: Impacts to Terrain and Soils
- SON-6: Impacts to Vegetation
- SON-7: Impacts to Wildlife
- SON-8: Impacts to Heritage Resources
- SON-9: Impacts to Non-traditional Land and Resource Use

The valued or intermediate components associated with SONs are defined in Section 4.1.2. Proposed assessment methods for the investigation of each SON are provided in Section 4.2.

4.0 ENVIRONMENTAL ASSESSMENT METHODS

The purpose of this section is to describe the scope and EA approach and methods that are proposed to be used in the Developer's Assessment Report for the Project. The scope of the assessment will be to identify and evaluate the potential adverse effects and benefits associated with the Project. At the current stage of planning for the Project, this includes an 18 to 24-year period from the beginning of construction to the end of closure and reclamation. Longer term effects from the Project that extend beyond closure will also considered, where necessary.

As indicated in the EA Initiation Guidelines, descriptions are provided for the general assessment approach that will be used for all valued and intermediate components (Section 4.1) and the specific methods that will be used for the investigation of individual KLOIs and SONs (Section 4.2). Assessment methods related to accidents and malfunctions and effects of the environment on the Project are provided in Section 4.3.

4.1 General Methods

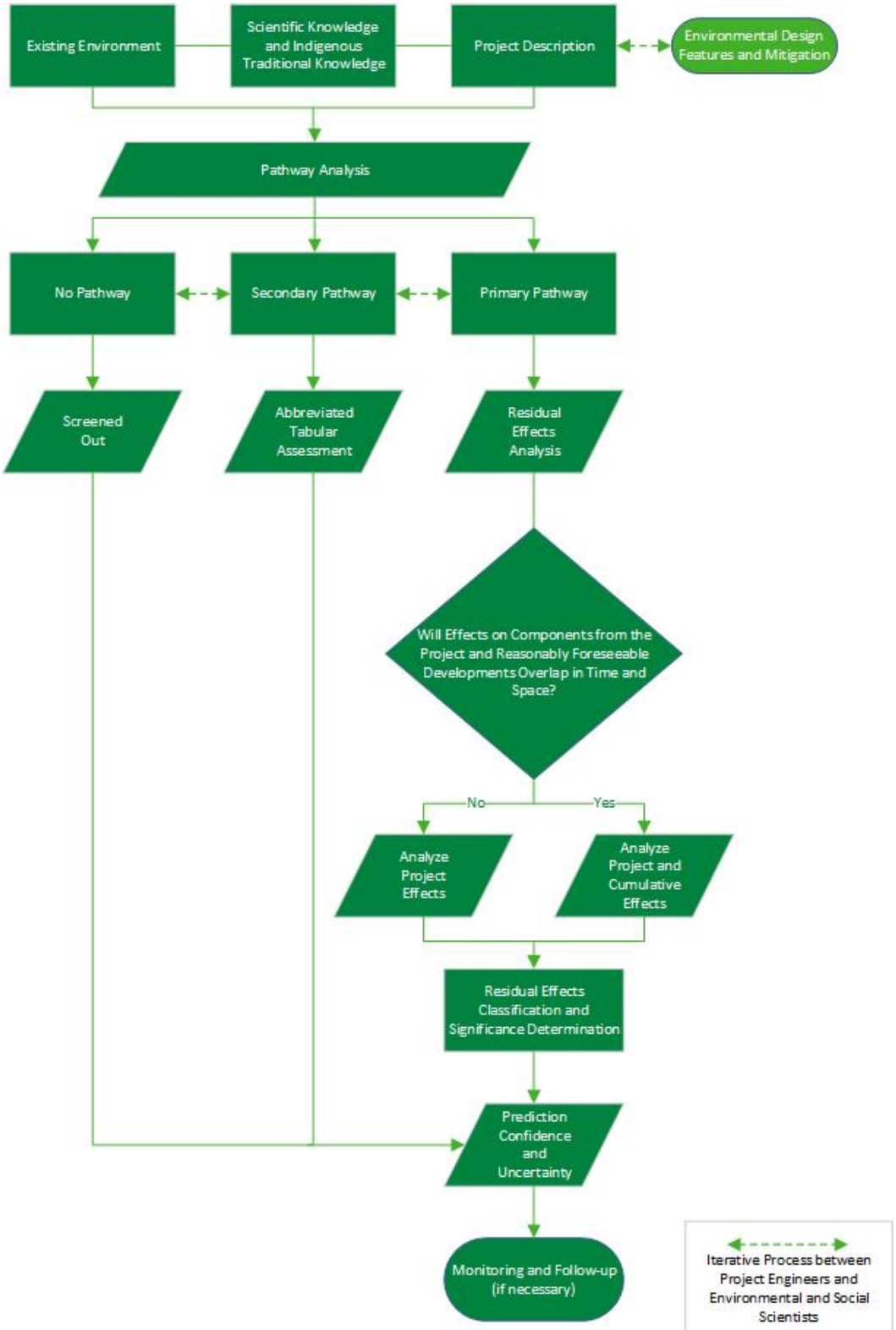
This section provides an overview of the general assessment approach that will be used to complete the EA and to prepare the Developer's Assessment Report. The methods presented will be provided in an "Environmental Assessment Approach and Methods" section included in the Developer's Assessment Report, as per the table of contents proposed for the Developer's Assessment Report in Section 5.0.

The EA approach for the Developer's Assessment Report will be applied to individual discipline components of the biophysical and human environments (e.g., climate, air quality and noise; groundwater quantity and quality; surface water quantity; water quality; fish and fish habitat; terrain and soils; vegetation; caribou; wildlife; heritage resources; TLRU; socio-economics; and non-traditional land and resource use [NTLRU]). The EA in the Developer's Assessment Report is expected to include the following steps (Figure 4-1), as applicable. Additional information for each of these steps is provided here, with the subsections shown in parentheses:

- Provide the information sources that will be considered to support the scoping process for the Developer's Assessment Report (Section 4.1.1).
- Define the valued and intermediate components of the biophysical and human aspects of the environment potentially affected by the Project, and associated assessment endpoints and measurement indicators (Section 4.1.2).
- Define the spatial and temporal boundaries of the assessment (Section 4.1.3).
- Describe how public and Indigenous engagement for the Project will occur and how the findings will be incorporated into the Developer's Assessment Report (Section 4.1.4).
- Describe how ITK will be collected and incorporated into the Developer's Assessment Report (Section 4.1.5).
- Describe the existing environment, which includes the cumulative effects of previous and existing developments, to provide context for evaluating potential incremental (i.e., Project-specific) and cumulative effects from the Project (Section 4.1.6).
- Provide the definition of pathways, environmental design features and mitigation, and approach and methods for evaluating relevant effects pathways (interactions) between the Project and biophysical, socio-economic, and cultural components (Section 4.1.7).
- Complete an assessment for each component and associated primary pathways to predict Project-specific residual effects, including cumulative effects from the Project and other previous, existing, and reasonably foreseeable developments, if applicable (Section 4.1.8).
- Classify residual effects and determine significance (Section 4.1.9). Residual effects are classified and tabulated using criteria such as magnitude, geographic extent, duration, frequency, and probability of occurrence to provide structure and comparability across intermediate and valued components. Significance determination is completed for VCs only.
- Identify key uncertainties and explain how these uncertainties were addressed to achieve a precautionary assessment. The implications of these approaches for confidence in the residual effects analysis and classification are presented (Section 4.1.10).
- Identify monitoring and follow-up to test predicted residual effects, evaluate success of planned mitigation designs, policies, and practices, and address key sources of uncertainty (Section 4.1.11).

Although all biophysical and human environment components will follow the general framework, approach, and methods presented in Section 4.1, the specific approach that will be used in the investigation of each KLOI and SON may vary to account for differences among the individual disciplines and the selected components. Component-specific assessment methods are presented for each KLOI and SON section of the Developer's Assessment Report in Section 4.2.

Figure 4-1: Flow Diagram for Assessment Approach



4.1.1 Information Sources

Information sources that will be used to support the analyses in the Developer's Assessment Report are anticipated to include the following:

- the Project Description, which identifies the physical works and activities associated with the Project (current version in Volume 1)
- results of Project engagement activities (currently described in Volume 2 and Section 4.1.4)
- ITK provided through Project engagement and ITK studies (currently described in Volume 2 and Section 4.1.5)
- the 2007 Developer's Assessment Report prepared by Tamerlane Ventures Inc. for the Pine Point Pilot Project, and related materials
- materials describing effects of similar projects in the NWT and Canada
- baseline reports prepared for each EA component (i.e., climate, air quality and noise; groundwater quantity and quality; surface water quantity; water quality; fish and fish habitat; terrain and soils; vegetation; caribou; wildlife; heritage resources; TLRU; socio-economics; and NTLRU)
- previous environmental and socio-economic monitoring studies completed by Tamerlane Ventures Inc. for the Pine Point Pilot Project
- historical reports prepared by Cominco for the Pine Point site
- framework or conceptual versions of environmental management plans (e.g., Water Management Plan, Tailings and Waste Rock Management Plan, Erosion and Sediment Control Plan, Spill Contingency Plan, Waste Management Plan, Closure and Reclamation Plan)
- framework or conceptual versions of environmental monitoring plans (e.g., Air Quality Mitigation and Monitoring Plan, Aquatic Effects Monitoring Program, Wildlife Protection Plan)
- framework or conceptual versions of socio-economic management plans (e.g., Socio-economic Management Plan and Engagement and Collaboration Plan)
- territorial and federal environmental legislation and regulations
- MVEIRB guidelines related to environmental and socio-economic impact assessment
  - *Environmental Impact Assessment Guidelines* (MVEIRB 2004)
  - *Socio-Economic Impact Assessment Guidelines* (MVEIRB 2007)
- MVEIRB *Guidelines for Incorporating Traditional Knowledge in Environmental Impact Assessment* (MVEIRB 2005)

Additional information sources will be considered in the scoping process undertaken by individual biophysical and human environment components. These additional information sources are described further in Section 4.2.

4.1.2 Selection of Valued Components, Assessment Endpoints, and Measurement Indicators

4.1.2.1 Valued Components

A list of potential VCs and intermediate components to be used in the assessment of effects from the Project on the biophysical and human environments, along with a rationale for selecting each VC and intermediate component, is provided in Section 2.0. The criteria used to select the final list of VCs and intermediate components that will be applied in the Developer's Assessment Report are also outlined in Section 2.0.

4.1.2.2 Assessment Endpoints and Measurement Indicators

Assessments undertaken for each VC will use assessment endpoints and measurement indicators to help structure analyses and facilitate assessment conclusions and determination of significance. Assessment endpoints are qualitative expressions that represent the key properties of VCs that should be protected; assessment endpoints are considered as significance thresholds but are typically not quantifiable. Sustainability concepts, scientific principles, and the outcomes from community engagement will be used to help define the assessment endpoints for biological and human environment VCs. For example, an assessment endpoint for a biophysical VC may involve the maintenance of self-sustaining and ecologically effective populations of fish or wildlife, whereas human environment VCs may consider the maintenance of way of life or community well-being. Unlike VCs, intermediate components do not have assessment endpoints (Section 4.1.2). This is because the importance or significance of changes in intermediate component measurement indicators (Section 4.1.2) can only be evaluated in context of effects on a VC. For example, changes to water quantity or quality can only be evaluated in the context of how these changes affect the receptor; numerical changes in flows or concentrations are meaningless except in how these changes would affect fish and fish habitat or vegetation.

Measurement indicators represent physical and biological/human attributes of the biophysical and human environments that can be measured and used to characterize changes to VCs to inform conclusions about effects on VCs, and ultimately, assessment endpoints. Measurement indicators may be quantitative (e.g., concentrations of metals in surface water, amount of employment and income) or qualitative (e.g., descriptions of expected movement and behaviour of wildlife in response to noise and general human activity or descriptions of expected changes in community cohesion).

Determining whether an assessment endpoint is maintained or achieved typically requires the interpretation and compilation of the results from several measurement indicators and predicted effects on VCs that collectively provide a meaningful evaluation of the assessment endpoint. For example, changes in habitat quantity and quality (measurement indicators) are used to determine the significance of residual effects from the Project on the ability of a wildlife population to be self-sustaining and ecologically effective (an assessment endpoint). Measurement indicators also provide the primary factors for discussing the uncertainty of effects on VCs (and intermediate components, see below) and, subsequently, can be key variables for study in potential follow-up and monitoring activities.

The proposed assessment endpoints and measurement indicators recommended to be used in the assessment for VCs are presented in Table 4-1, and measurement indicators recommended to be used in the assessment for intermediate components are presented in Table 4-2. The assessment endpoints and description of measurement indicators for VCs and intermediate components will be provided in each component section of the Developer's Assessment Proposal. The final assessment endpoints and measurement indicators will incorporate feedback from engagement and comments on the Developer's Assessment Proposal.

Table 4-1: Proposed Assessment Endpoints and Measurement Indicators for Valued Components

Valued Component	Key Line of Inquiry/ Subject of Note	Assessment Endpoint(s)	Measurement Indicators
Fish and Fish Habitat ■ Great Slave Lake Fish Community ■ Twin Creek Fish Community ■ Buffalo River Fish Community ■ Paulette Creek Fish Community	SON-4: Impacts to Fish and Fish Habitat	■ Ongoing fisheries productivity ■ Self-sustaining and ecologically effective fish populations	■ Habitat quantity (water quantity, flow discharge, surface area) ■ Habitat quality (water quality, substrate, depth) ■ Habitat distribution (arrangement and connectivity) ■ Fish survival and reproduction
Vegetation (upland, wetland, and riparian ecosystems)	SON-6: Impacts to Vegetation	■ Self-sustaining and ecologically effective ecosystems	■ Ecosystem availability (amount) ■ Ecosystem and wetland distribution (arrangement and connectivity) ■ Ecosystem condition (e.g., plant community composition, plant species at risk, proliferation of invasive species)
Woodland Caribou (Boreal Population)	KLOI-2: Impacts to Caribou	■ Self-sustaining and ecologically effective caribou population	■ Habitat availability (quantity and quality) ■ Environment and Climate Change Canada (Environment Canada 2012) threshold for undisturbed caribou habitat for critical habitat identification (i.e., 65% undisturbed habitat) ■ Habitat distribution (arrangement and connectivity) ■ Animal survival and reproduction
Wildlife[(a)] ■ Wood Bison ■ Gray Wolf ■ Wolverine ■ Little Brown Myotis and Northern Myotis ■ Short-eared Owl ■ Olive-sided Flycatcher ■ Whooping Crane ■ Common Nighthawk ■ Evening Grosbeak ■ Bank Swallow and Barn Swallow ■ Yellow Rail ■ Rusty Blackbird ■ Horned Grebe ■ Red-necked Phalarope ■ Northern Leopard Frog ■ Gypsy Cuckoo Bumble Bee and Yellow-banded Bumble Bee	SON-7: Impacts to Wildlife	■ Self-sustaining and ecologically effective wildlife populations	■ Habitat availability (quantity and quality) ■ Habitat distribution (arrangement and connectivity) ■ Animal survival and reproduction

Table 4-1: Proposed Assessment Endpoints and Measurement Indicators for Valued Components

Valued Component	Key Line of Inquiry/ Subject of Note	Assessment Endpoint(s)	Measurement Indicators
■ Heritage Resources (archaeological or historical sites, burial sites, artifacts and other objects of historical, cultural, or religious significance)	SON-8: Impacts to Heritage Resources	■ Preservation of Heritage Resources	■ Number of archaeological sites ■ Quality (e.g., scientific or cultural significance) of documented sites
Traditional Land and Resource Use	KLOI-3: Impacts to Traditional Land and Resource Use	■ Continued opportunities to practice TLRU	■ Availability of traditional use areas ■ Availability of traditionally harvested wildlife, fish, and plant resources ■ Physical access to TLRU areas ■ Sensory disturbances (e.g., noise, odours, and visual disturbance) ■ Social and economic factors affecting participation in traditional activities ■ Changes in the intangible values associated with TLRU (e.g., sense of place, ability to transfer knowledge)
Population Demographics	KLOI-4: Impacts to Social and Economic Conditions	■ Population stability. The effects of population change potentially affects other VCs (e.g., housing, service capacity, infrastructure)	■ Population growth or decline ■ In- and out-migration ■ Ethnicity ■ Age and gender ■ Language ■ Household size
Economic Development and Government Revenues		■ Continued economic productivity in the territory ■ Maximization of local participation in the Project ■ Maintenance of the viability of the traditional and mixed economies ■ Continued government revenue streams	■ Capital investment ■ Gross Domestic Product ■ Local business ■ Taxes and royalties ■ Municipal and regional revenues ■ Municipal and regional expenditure
Employment and Education		■ Enhancement of the capacity of the labour force ■ Increase in skills relative to labour market ■ Maximization of local participation in the Project	■ Local and regional employment ■ Labour force participation, employment, and unemployment rates ■ Income levels and distribution ■ Educational attainment ■ Educational services and training initiatives

Table 4-1: Proposed Assessment Endpoints and Measurement Indicators for Valued Components

Valued Component	Key Line of Inquiry/ Subject of Note	Assessment Endpoint(s)	Measurement Indicators
Community Health and Well-being	KLOI-4: Impacts to Social and Economic Conditions (cont'd)	■ Avoidance of contributions to adverse social conditions in communities affecting wellbeing	■ Morbidity and disease ■ Household composition ■ Family violence ■ Income disparity between communities ■ Rates of substance use ■ Occupational health and safety ■ Public security and crime rates ■ Indicators of wellbeing
Housing, Service, and Infrastructure		■ Maintenance of capacity of health, social, and protective services ■ Maintenance of the capacity and condition of infrastructure in communities and the territory ■ Avoidance of a spike in housing demand that would result in price increases	■ Housing stock and condition ■ Crowding ■ Service capacity ■ Demand for service ■ Infrastructure capacity ■ Infrastructure condition ■ Traffic levels
Non-traditional Land and Resource Use	SON-9: Impacts to Non-traditional Land and Resource Use	■ Continued opportunities for NTLRU	■ Tourism ■ Hunting (outfitting) ■ Commercial and sport fishing ■ Outdoor recreation ■ Parks and protected areas ■ Other development potentially affected by the Project

a) It is anticipated that not all potential wildlife VCs will be assessed comprehensively in the Developer's Assessment Report (see Section 4.2.1.9)
SON = Subject of Note; KLOI = Key Line of Inquiry; TLRU = traditional land and resource use; VC = valued component; NTLRU = non-traditional land and resource use

Table 4-2: Proposed Measurement Indicators for Intermediate Components

Intermediate Component	Key Line of Inquiry / Subject of Note	Measurement Indicators
Air Quality	SON-1: Impacts to Air Quality, Noise, and Climate	■ Comparison of Project criteria air contaminant emissions to applicable territorial and federal ambient air quality criteria: ▪ total suspended particulates ▪ fine particulate matter ($PM_{2.5}$) ▪ sulphur dioxide ▪ nitrogen dioxide ▪ carbon monoxide
Noise		■ Equivalent continuous sound levels for the daytime period (Leq,day) and the nighttime period (Leq,night), expressed in A-weighted decibels (dBA) and C-weighted decibels (dBC) ■ Combined day-night sound levels (Ldn), expressed in dBA
Vibration		■ Peak particle velocity ground vibration expressed in millimetres per second (mm/s) ■ Peak pressure level airblast overpressure expressed in linear decibels (dBL)
Climate		■ Project greenhouse gas (GHG) emissions ■ Contribution to NWT and national GHG emissions
Water Quality	KLOI-1: Impacts to Water Quality	■ In situ water quality parameters (e.g., temperature, pH, dissolved oxygen, conductivity) ■ Concentration of major ions, suspended solids, nutrients, and metals in water
Groundwater Quality and Quantity	SON-2: Impacts to Groundwater Quantity and Quality	■ Groundwater levels and flow patterns ■ Spatial and temporal distribution of groundwater ■ Concentrations of physical analytes (e.g., pH, conductivity) ■ Concentrations of major ions and nutrients ■ Concentrations of dissolved metals
Surface Water Quantity	SON-3: Impacts to Surface Water Quantity	■ Surface water levels and discharges ■ Basin water yields ■ Stream channel parameters (e.g., channel depth, width, and wetted perimeter)
Terrain and Soils	SON-5: Impacts to Terrain and Soils	■ Distribution of terrain units ■ Topography and slope stability ■ Distribution of soil map units ■ Soil quality (productivity)

SON = Subject of Note; $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter; KLOI = Key Line of Inquiry

4.1.3 Environmental Assessment Boundaries

4.1.3.1 Spatial Boundaries

Defining spatial boundaries within which the assessment will be constrained is a key element of the assessment scoping process. Spatial boundaries will be selected for intermediate and valued components of the biophysical and human environments using the following criteria:

- physical extent of the Project footprint
- physical extent of Project-related effects, including those that extend beyond the Project footprint
- spatial extent of key ecological and socio-economic systems (e.g., watershed boundary of potentially affected lakes and streams, jurisdictional boundaries of affected Indigenous communities)

- geographic distribution, movement, and spatial interaction of intermediate and valued components

The recommended spatial boundaries that will be considered for each VC or intermediate component and the rationale for their selection are identified in Section 4.2. These study areas will be finalized in the Developer's Assessment Report following feedback from communities and regulators on the Developer's Assessment Proposal and any changes to the Project design. For some components (e.g., air quality) study areas cannot be defined for the Developer's Assessment Proposal because details on the location and size of Project facilities and infrastructure are currently too uncertain. Multiple spatial scales will be considered, depending on the assessment requirements of the components. Biological populations and communities function within the environment at different spatial and temporal scales (Wiens 1989), and the response of physical, chemical, and biological processes to changes in the environment can occur across several spatial scales at the same time (Holling 1973; Levin 1992). Similar cross-scale patterns exist in socio-economic systems (Folke 2006).

Although additional spatial scales are possible for individual VCs, spatial scales typically are expected to include a minimum of a local study area (LSA) and a regional study area (RSA). The LSA is defined at a scale that contains most, or all, of the expected effects of the Project on a VC and supporting intermediate components; as such, more detailed data are typically collected in the LSA to describe environmental conditions. The RSA provides broader context for the assessment of the effects of the Project on components and may also be a scale at which some effects of the Project can be measured (e.g., downstream water quality). The RSA for intermediate and valued components will be defined to be an appropriate scale for the assessment of cumulative effects where there is potential for spatial overlap or interactions with effects from the Project and other previous, existing, and reasonably foreseeable developments.

4.1.3.2 Temporal Boundaries

The temporal scope of the assessment will focus on the period from the beginning of construction to the end of closure and reclamation and is intended to evaluate the shorter and longer term changes from the Project and associated Project-specific and cumulative effects on the biophysical and human environments. At the current stage of planning for the Project, the period from the beginning of construction to the end of closure and reclamation is anticipated to last 18 to 24 years. The duration of effects may extend beyond specific phases of the Project, including closure, and is dependent on the physical, biological, social, and/or cultural properties and resilience of intermediate and valued components. The minimum temporal boundary for the effects assessment is defined by the following Project phases:

- **Construction**—includes site preparation; open pit, underground mine, process plant, and additional infrastructure development; transportation of people and materials to and from the Project site; and all activities associated with constructing the Project up until the operation phase commences. Construction activities are expected to occur for a period of approximately 18 months. At this stage of planning for the Project, and pending receipt of all applicable permits and approvals, construction is anticipated to commence in the third quarter of 2023.
- **Operation**—includes all activities associated with mining and processing mineralized materials; open pit and underground mining and mine development; tailings management; management of waste rock and mine water, and domestic waste and hazardous materials; operational discharge; surface storage of clean material; site maintenance; progressive reclamation; and transportation of the people and materials to and from the Project site. The operation phase is expected to occur for a period of 10 to 15 years. At this stage of planning for the Project, and pending receipt of all applicable permits and approvals, the operation phase is anticipated to commence in the fourth quarter of 2024.

- **Closure and reclamation**—includes demolition activities, removal of physical infrastructure, reclamation and remediation of disturbed areas developed or used by the Project, and any other activities required to achieve closure objectives and to return the site to a safe and stable condition. Closure and reclamation activities will also involve a period of monitoring to verify that closure objectives and criteria for the Project have been met. Active closure and reclamation, and associated monitoring activities, are expected to occur over a period of about five to seven years.

Baseline studies associated with each VC identify temporal variation (e.g., annual or seasonal changes in water flow or landcover types, or trends over time in community populations and employment) and other biophysical and socio-economic constraints relevant to the assessment of the Project.

The actual temporal boundaries that will be used in the assessment are component specific and will include the Project phases described above. For some components, residual effects will be assessed for all phases of the Project, but not necessarily for each specific phase. For example, Project effects on wildlife begin during the construction phase with the removal and alteration of habitat (i.e., results in direct and indirect changes) and continue through the operation and closure and reclamation phases, and post-closure until effects are reversed or determined to be irreversible (i.e., permanent). Therefore, effects on wildlife will be analyzed and predicted from construction through closure and reclamation and typically beyond, which generates the maximum potential spatial and temporal extent of effects and provides confident and ecologically relevant effects predictions.

Alternatively, for some valued and intermediate components, the assessment will be completed for those phases of the Project where predicted effects would be expected to peak, or at several key snapshot points in time. These snapshots may be taken at several points within a Project phase or phases. An example is evaluating water quantity predictions at specific times that represent key milestones throughout the life of the Project.

Similarly, the temporal boundaries identified for cumulative effects assessments often vary among intermediate and valued components. Temporal boundaries include the duration of residual effects from previous and existing developments that overlap with residual effects of the Project, and the period during which the residual effects from reasonably foreseeable developments (RFDs) will overlap with residual effects from the Project.

Recommended temporal boundaries that will be considered for individual components and the rationale for their selection are described in Section 4.2. These recommended temporal boundaries will be finalized in the Developer's Assessment Report and reflect the final Project description and comments on the Developer's Assessment Proposal.

4.1.3.3 Assessment Cases

The concept of assessment cases will be applied to the associated component-specific EA boundaries to estimate the incremental and cumulative effects from the Project and other developments. The approach will incorporate temporal and spatial boundaries for analyzing the potential effects from previous, existing, approved, and reasonably foreseeable developments before, during, and after the anticipated life of the Project. Assessment cases will include a Base Case, Application Case, and Reasonably Foreseeable Development (RFD) Case. The amount and level of analysis in assessment cases can vary among components depending on the number, size, and type of existing and known or hypothetical projected human activities and developments in the spatial boundary of the assessment. Assessment cases that will be considered in the effects analysis for individual components are identified in Section 4.2 and will be defined in each component section in the Developer's Assessment Report.

4.1.3.3.1 Base Case (Existing Environment)

To provide context for evaluating potential changes from the Project, each discipline component assessment will include a description of the existing environment (Section 4.1.6; Volume 3). In the context of assessment cases, the Base Case is generally represented by the existing environment. The Base Case describes the existing environment in the local and regional study areas before the application of the Project to provide an understanding of the current physical, biological, economic, social, and cultural conditions that may be influenced by the Project. The temporal boundary of the Base Case includes the combined effects from approved previous and existing developments and activities within the spatial assessment boundaries of intermediate and valued components, which will include Cominco's historical mining operations, on the landscape. The description of the existing environment represents the cumulative effects of historical and current environmental pressures that have influenced the observed condition/patterns of a component.

4.1.3.3.2 Application Case

The Application Case represents the residual effects of the Project relative to the Base Case (i.e., incremental or Project-specific effects). This case is also used to identify and discuss the predicted cumulative effects from the Project and existing environment or the Base Case (i.e., existing and approved developments and activities plus the Project).

The temporal boundary of the Application Case includes the combined effects from the Base Case, the period from Project construction to closure and reclamation, and the duration of residual effects from the Project. For several intermediate and valued components, the temporal extent of some effects may be greater than the lifespan of the Project because the effects will not be reversible until beyond closure. For other components, some effects may be determined to be irreversible. Such effects may be permanent, or the duration of the effect may not be known, except that it is expected to be extremely long and uncertain.

4.1.3.3.3 Reasonably Foreseeable Development Case

The RFD Case includes the Base Case, Application Case, and projects/activities that are currently under application review or that have officially entered a regulatory application process and are therefore considered reasonably foreseeable. Thus, the temporal boundary of the RFD Case will include the predicted duration of residual effects from the Project, plus residual effects from other previous, existing, and future projects and activities. Only effect pathways that are predicted to have a greater than negligible residual effect on valued or intermediate components (Section 4.1.7) will be considered in the RFD Case. The difference between the Application and RFD cases is that the Application Case considers the incremental effect from the Project in isolation of potential future land use activities. RFDs are defined as projects that fit the following criteria:

- are currently under regulatory review or have officially entered a regulatory application process
- have a reasonable likelihood of being initiated during the life of the Project, or may be induced by the Project
- have the potential to change the Project or the effects predictions
- occur in the spatial assessment boundary defined by the intermediate and valued components

The RFD Case may not be required for all components, as it will depend on the review of the RFDs within the spatial and temporal assessment boundaries and the potential to overlap with the component. At the current stage of planning for the Project, it is unclear which components will include an RFD Case in their respective assessments. Additional information is needed to confirm whether residual effects from the Project and from RFDs have the potential to overlap in time and space. Confirmation of Project design details, and the results of

environmental modelling (e.g., groundwater, air quality, surface water quantity, water quality), are needed to determine if Project activities will result in greater than negligible effects on valued and intermediate components. Confirmation of the RSAs that will be used for each component is required, as the RSA is the spatial scale that is considered when evaluating cumulative effects from the Project and other previous, existing, and reasonably foreseeable developments.

A key criterion for selecting other projects to include in the assessment is that those projects must cause similar effects on the same intermediate and valued components influenced by the Project (Hegmann et al. 1999). A summary of the RFDs that are to be considered in the Developer's Assessment Report based on the above definition and criteria is provided in Table 4-3, with a map showing their locations in Figure 4-2. Not all RFDs may necessarily be included in the effects analysis for each component that will include an RFD Case. The list of RFDs that will be considered in the effects assessment for each discipline will be provided in the respective component sections of the Developer's Assessment Report. The list will consider additional material from the updated Project Description, available information regarding potential RFDs, input from engagement, and feedback on the Developer's Assessment Proposal.

Depending on the level of information available for RFDs, the analysis may necessarily be qualitative or conceptual. However, projects should only be considered in the assessment if there is enough information about the potential developments to evaluate their effects. In cases where it is expected that an RFD Case will be included for individual components, a brief summary of the proposed assessment methods that will be used in the Developer's Assessment Report has been provided in Section 4.2.

Table 4-3: Summary of Reasonably Foreseeable Developments that may be Considered in the Developer's Assessment Report

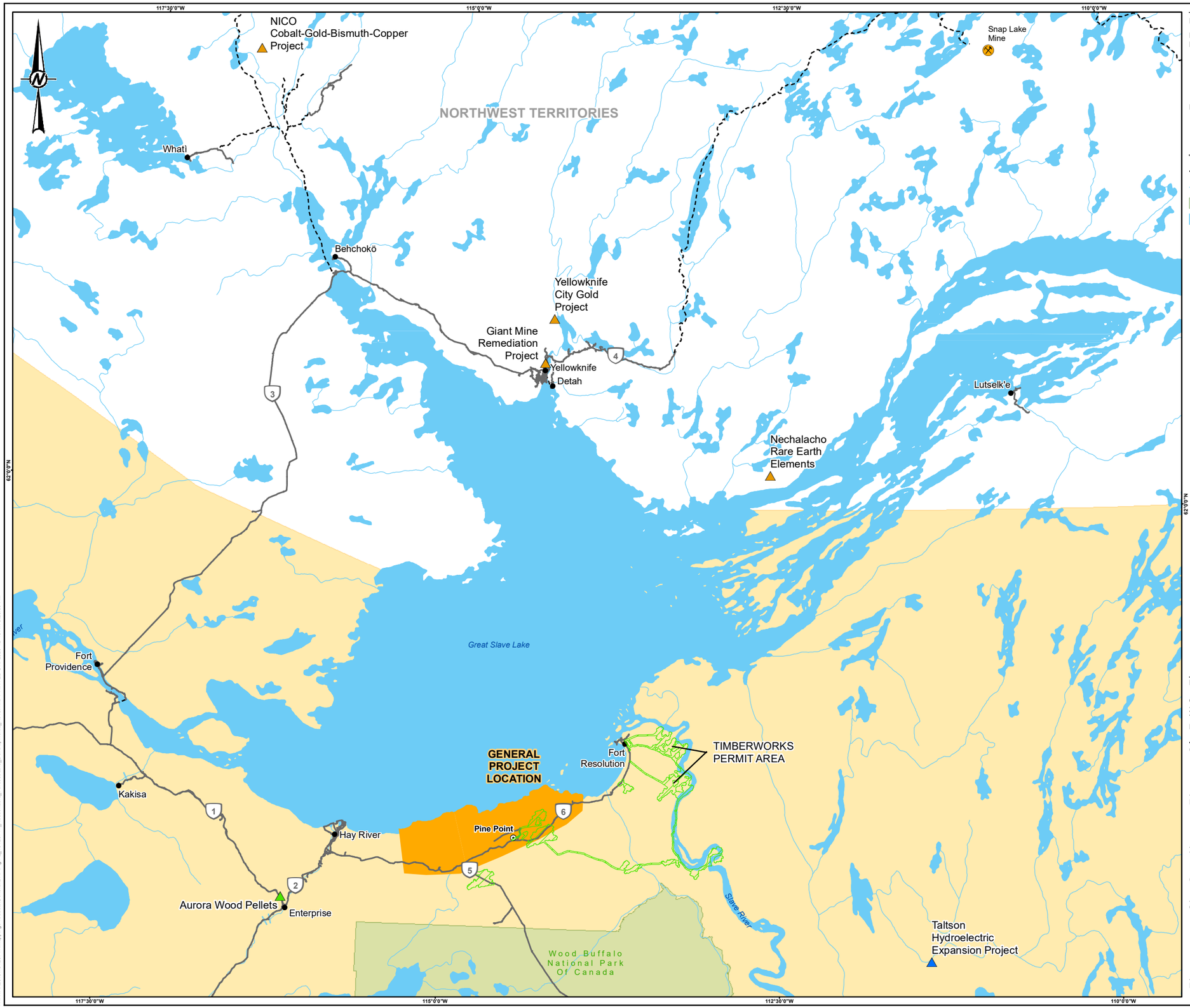
Project	Proponent	Overview
Yellowknife City Gold Project	Gold Terra Resource Corporation (Gold Terra)	The Yellowknife Gold Project is an advanced gold exploration project located 88 km north of Yellowknife near the historical Discovery Mine site. In September 2006, applications for the development of the Yellowknife Gold Project were referred by the Mackenzie Valley Environmental Impact Review Board (MVEIRB) to EA; however, due to inactivity, the EA was suspended. In 2019 Gold Terra updated the Mackenzie Valley Land and Water Board (MVLWB) Land-Use permit for the site and announced commencement of a drilling program in 2020. Although the existing mine plan is expected to change in response to results of a 2012 feasibility study (SRK Consulting, Lyntek Incorporated, Knight Piésold Consulting 2012) and an anticipated date of construction and development is not known, the Yellowknife Gold Project is expected to last for approximately 14 years once operational and employ over 250 people. Access to the project is via an existing winter road built from Prosperous Lake. However, this project has been in the EA process since 2005, and the process has been suspended indefinitely by the MVEIRB until such time as the proponent can show cause why it should be reinstated.
Giant Mine Remediation Project	Governments of Canada and the Northwest Territories	The former Giant Mine is located approximately 5 km north of Yellowknife, lying within the city limits and in close proximity to the communities of Ndilǫ and Dettah. Gold was found at the site in 1935 and the mine operated between 1948 and 2004. Remediation of the site became the responsibility of the Government of Canada when the final owner went bankrupt. The Giant Mine Remediation Project addresses long-term containment and management of arsenic trioxide waste, demolition and removal of buildings on the surface, and the remediation of surface areas including the tailings ponds at the former Giant Mine site. It also includes water management and treatment options. The project was referred to EA and the Developer's Assessment Report was submitted in 2010. The project was approved in 2014. The application for a Type A Water Licence was submitted to the MVLWB in 2019. The remediation plan is currently undergoing revisions and will be resubmitted as a Closure and Reclamation Plan. The remediation of the Giant Mine is anticipated to begin in 2020-2021.
NICO Cobalt-Gold-Bismuth-Copper Project	Fortune Minerals Limited (Fortune)	The NICO Project is a cobalt, gold, and bismuth deposit located in the Tłı̨chǫ region, approximately 50 km northwest from the community of Whatì. Fortune Minerals Limited proposes to mine the deposit using a combination of open pit and underground methods. Ore processing will be limited to crushing, grinding, and flotation consisting of primary and secondary stages to produce bulk concentrate. The resulting bulk concentrate will be thickened and filtered, packaged, and shipped to a second site, the Saskatchewan Metals Process Plant in Langham, Saskatchewan. The EA process is complete and the federal and Tłı̨chǫ governments have approved the NICO mine and mill. Fortune has received its Type A Water Licence and Land Use Permit for the site. It is estimated that NICO reserves will support an 18- to 20-year mine and employ up to 300 people. Access to the NICO Project requires an all-season road connection to Highway 3 near Behchokǫ̀. Construction of the project is expected to commence as soon as financing is secured.
Nechalacho Rare Earth Element Project	Avalon Advanced Materials (Avalon)	The Nechalacho Project is a rare earth elements deposit located approximately 100 km southeast of Yellowknife near Hearne Channel on the East Arm of Great Slave Lake. Rare earth elements will be mined underground from the Nechalacho deposit. Ore will be processed at a hydrometallurgical plant, which is to be constructed at the old Pine Point site on the southern shores of Great Slave Lake. Concentrates will be loaded into bulk transport containers, hauled to the seasonal dock facility along the north shore of Great Slave Lake, and barged during the summer to the hydrometallurgical plant. In November 2013, the federal minister of Aboriginal Affairs and Northern Development Canada approved the MVEIRB's Report of EA recommending project approval. The project was put on hold in 2014 following substantial decline in rare earth element prices. Due to rising prices, work on the project was re-initiated in 2018, with preliminary construction activities beginning in 2019. Access to the mine site will be via air and barge. Access to the hydrometallurgical site will be via existing highways and all-season access roads (MVEIRB 2013).

Table 4-3: Summary of Reasonably Foreseeable Developments that may be Considered in the Developer's Assessment Report

Project	Proponent	Overview
Aurora Wood Pellet Project	Aurora Wood Pellets Limited (Aurora Wood Pellets)	Aurora Wood Pellets is proposing to construct a wood pellet mill north of Enterprise. The mill is expected to create an annual demand for 125,000 m^3 of wood. More than 40 people will be employed at the Enterprise site with the potential to create additional jobs in the region. The mill would purchase sustainably harvested timber from local suppliers and harvest the timber into pellets.
Timber harvesting	Timberworks Inc.	Timberworks Inc. is a business partnership between the Deninu Kųé First Nation and the Fort Resolution Métis Council, and has been awarded timber harvesting rights within a Forest Management Agreement (FMA) area extending from the Slave River to the Buffalo River. The development would, at first, harvest trees from the existing road network at Pine Point and eventually expand to other areas. Some of the harvested timber would be supplied to the Aurora Wood Pellet Project to develop a local forest biomass industry. Eventually, this expanded forestry operation is estimated to support 34 jobs within the community of Fort Resolution. The Annual Sustainable Harvest Level for the Fort Resolution FMA is currently set at 180,600 m^3/yr.
Taltson Hydroelectric Expansion Project	Government of Northwest Territories	The Taltson Hydroelectric Project would expand the existing Taltson generating station and connect the NWTs' hydroelectric systems to provide clean energy to the Slave Geological Province and resource sector. The project would connect the Taltson Hydro System to the North Slave Hydro System and add 60 megawatts (MW) of additional capacity to the existing 18 MW facility and connect the NWT electrical grid to the southern electrical grid. The 60 MW run-of-the-river expansion project would have no new flooding. Approximately 270 km of transmission lines would connect Taltson to North Slave hydro system. The project would provide partnership opportunities for Indigenous governments and job opportunities for Northerners and would stabilize electricity rates for NWT residents and businesses. A previous proponent of the project, Deze Energy Corporation (Deze), initiated a regulatory process for long-term development of the Taltson Hydroelectric Project. The MVLWB referred the project to EA in 2007; however, the EA process was terminated in 2012. Federal funding was secured in late 2018 to review and update feasibility work completed by Deze. The Government of Canada has committed additional funding over the next three years to advance the project.

Note: The list of reasonably foreseeable developments considered for each discipline in the Developer's Assessment Report will depend on residual effects of the Project and whether the developments have the potential to overlap in time and space.

MVEIRB = Mackenzie Valley Environmental Impact Review Board; EA = environmental assessment; MVLWB = Mackenzie Valley Land and Water Board



LEGEND

REASONABLY FORESEEABLE DEVELOPMENTS

- FORESTRY
- HYDROELECTRIC
- MINING

EXISTING DEVELOPMENTS/FEATURES

- FORMER PINE POINT TOWN SITE
- EXISTING MINE
- ALL-SEASON ROAD
- WINTER ROAD
- WATERCOURSE
- PARK / PROTECTED AREA
- WATERBODY
- GENERAL PROJECT LOCATION
- SOUTH SLAVE REGION

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1:1,500,000 KILOMETRES

REFERENCE(S)

1. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
2. PARKS AND PROTECTED AREAS OBTAINED FROM CONSERVATION AREAS REPORTING AND TRACKING SYSTEM (CARTS), CANADIAN COUNCIL ON ECOLOGICAL AREAS, 2017.

PROJECTION: ALBERS CONIC EQUAL AREA

CLIENT
PINE POINT MINING LTD.

PROJECT
PINE POINT PROJECT

TITLE
REASONABLY FORESEEABLE DEVELOPMENTS THAT MAY BE CONSIDERED IN THE DEVELOPER'S ASSESSMENT REPORT

CONSULTANT
GOLDER

YYYY-MM-DD	2020-12-15
DESIGNED	LJ
PREPARED	MM
REVIEWED	JV
APPROVED	JV

PROJECT NO.	PHASE	REV.	FIGURE
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4.1.4 Input from Engagement

Volume 2 presents the Engagement and Collaboration Framework. The framework outlines the PPML's approach to engagement, potentially affected parties, and the reporting requirements for engagement as the Project advances. The Engagement and Collaboration Framework is a living document that will be updated following the MVEIRB's EA Initiation Package scoping consultation with input provided by communities to create an Engagement and Collaboration Plan. The plan will include an Engagement Log, as well as engagement summaries for specific parties engaged. At reporting milestones, the summary of engagement will be updated to reflect the overall evolution of engagement and relationships with potentially affected parties over the life of the Project. The Engagement Plan, Log, and summaries will be included in the Developer's Assessment Report submitted to the MVEIRB.

Project engagement activities will be guided by the Land and Water Boards of the Mackenzie Valley[1] *Engagement and Consultation Policy* (LWBMV 2018a) and *Engagement Guidelines for Applicants and Holders of Water Licences and Land Use Permits* (LWBMV 2018b). The LWBMV recommends that "*proponents focus their engagement efforts towards parties that will likely be the most directly impacted.*" This is done to focus engagement activities on those parties with the greatest interest in the Project, and to avoid consultation fatigue. PPML has, at this time, prioritized potentially affected parties for involvement based on the expected level of effect. A preliminary list of potentially affected parties has been developed based on a review of previous work completed on the Pine Point property, engagement activities, and Crown-Indigenous Relations and Northern Affairs Canada's *NWT Land Information Related to Aboriginal Groups* (CIRNAC 2018) resource.

The Project is within the South Slave Region, and within the traditional territories of the Deninu Kue First Nation, K'atl'odeeche First Nation, and Northwest Territory Métis Nation. The Deninu Kųę First Nation is in close proximity to the Project, and has to date been the most engaged. The Hay River Métis Council and the Fort Resolution Métis Council were initially engaged separately; however, more recently, engagement has been through the Northwest Territory Métis Nation. It has been proposed that these Indigenous groups be prioritized for a high level of involvement throughout the Project engagement process. Other potentially affected parties have been identified for engagement based the potential for interaction with Project land use, development, or environmental effects, or previously asserted interest in the Project (Volume 2). The list of potentially affected parties will be updated as the Project advances based on feedback from those engaged and other parties that self-identify throughout Project development. At this stage, it is anticipated that feedback obtained through the MVEIRB's EA Initiation Package scoping consultations will result in refinement of the list of potentially affected parties for engagement.

The EA Initiation Package includes information regarding the Project and the assessment approach for comments from communities, government, and public. Input received through PPML's preliminary engagement has been incorporated into the Developer's Assessment Proposal in advance of MVEIRB's EA Initiation Package scoping consultations. Information relevant to the biophysical and human environments baseline studies and associated effects assessments will be extracted from the Engagement Log for consideration in each respective study as future Project engagement activities unfold. Information from engagement can help to inform the selection of study areas, valued components, and assessment approach, and highlight potential effects that are of greatest importance to Indigenous communities and other people interested in the Project. It is anticipated that the approach to the assessment will be refined with the results of PPML's engagement activities, and the results of the MVEIRB's EA Initiation Package scoping consultations.

[1] Mackenzie Valley Land and Water Board (MVLWB), Sahtu Land and Water Board, Gwich'in Land and Water Board, Wek'èezhìı Land and Water Board.

As engagement activities unfold and more information is made available regarding the Project's development, it is anticipated that concerns and aspirations will be raised by potentially affected parties. Further, with more detailed information regarding the Project Description, it is expected that those engaged may have suggestions regarding mitigation or benefit enhancement measures. Such information will be used in the assessment of the potential effects of the Project on the biophysical and human environments. The effects assessment will document and identify how mitigation measures or Project design elements address issues of concern or enhance the benefits of the Project to communities. Issues, concerns, and aspirations will be grouped thematically and included in a table in the introduction section of each KLOI and SON within the Developer's Assessment Report. In addition to identifying the engagement feedback relevant to each specific environmental and socio-economic component of the Developer's Assessment Report, the tables will direct the reader to the section(s) where the issue or concern is addressed.

Previous engagement activities associated with the Project's exploration activities were focused on potential for employment and contracting, land rights, and the approach to interaction between PPML and communities. Recent engagement with communities regarding the Project Description has yielded some key, overarching themes for consideration as the Project advances. PPML has met with the Deninu Kųę First Nation (9 September 2020), K'atl'odeeche First Nation (25 August 2020), and Northwest Territory Métis Nation (31 August 2020), as communities prioritized for involvement in the Project. PPML is also actively engaging with other communities farther from the Project who may have an interest in Project development to deliver similar presentations. To date, PPML has been able to meet with the Łutsel K'e Dene First Nation (26 August 2020). PPML will continue efforts to reach out to communities regarding the Project.

Indigenous communities have expressed the need for advanced notice of Project opportunities and requirements, and for employment and contracting opportunities to be kept local as much as possible to benefit those communities that may be most affected by the Project. To facilitate access to opportunities, early training will be required so that the local labour force is positioned to participate in Project opportunities. PPML will work with communities as the Project evolves to communicate economic opportunities and associated requirements, and to facilitate the accessibility of such opportunities to Indigenous candidates and companies. Considerations around worker and public safety with the ongoing and evolving COVID-19 pandemic, as well as the safety of Indigenous women in light of Canada's Missing and Murdered Indigenous Women and Girls, are of high priority to the communities. PPML is committed to following all applicable territorial protocols regarding workforce management during the COVID-19 pandemic. Water management, site remediation, and the effects on the environment and traditional lands of Indigenous peoples have also at this stage been highlighted as focal areas of concern for communities.

4.1.5 Incorporation of Indigenous Traditional Knowledge

The MVEIRB requires developers to consider and incorporate ITK during Project development and throughout the EA process, and has developed the *Guidelines for Incorporating Traditional Knowledge in Environmental Impact Assessment* (MVEIRB 2005) as a resource that outlines MVEIRB's expectations and processes for incorporating ITK in the Developer's Assessment Report. In addition, the EA Initiation Guidelines stipulate that developers are required to provide a description of how ITK will be considered and incorporated into Project planning as part of the Project overview.

Communities will be engaged to determine the most appropriate and effective approach to gather information, based on their cultural protocols. Information gathering can be completed through consultation with communities representing the Indigenous groups identified in Section 4.1.4. Ideally, and at this preliminary stage, a series of maps could be created with the Project and traditional territories overlain for mark-up at community meetings, or

in the Indigenous groups' preferred forum according to their ITK protocols. Participants, including Elders, women, and youth, would be provided the opportunity to identify preferred traditional harvesting sites, relevant ITK (e.g., caribou seasonal ranges, furbearer denning sites, fish habitat), culturally important sites and landscapes, and other aspects of TLRU on the maps for inclusion in the TLRU baseline. At the discretion of the knowledge holders, maps and ITK reports themselves may or may not be made publicly available; however, information gathered during the engagement process would inform the TLRU baseline and effects assessment, which ultimately become public documents. Where ITK collected through community-specific studies is withheld, it cannot be used in the EA process.

The Developer's Assessment Report will consider and integrate ITK alongside scientific knowledge. Data collection methods and approaches that will be used for the incorporation of ITK into the Project will be developed collaboratively with Indigenous communities. ITK will be summarized as it relates to specific biophysical or human environment EA components (e.g., air quality, groundwater, surface water quantity and quality, fish and fish habitat, vegetation; wildlife, heritage resources, TLRU and socio-economics), and incorporated into EA sections prepared for each component. ITK gathered during engagement will help inform the selection of VCs, component baseline reporting, identification of potential Project effects or pathways, and the design of mitigation measures, management plans, and monitoring programs.

Specific information types and sources of ITK that may be considered in the individual EA sections are summarized in Section 4.2. The ability to include this information will depend upon the outcomes of the ITK collection process, including whether the information is available and shared by the knowledge holders, and whether they approve its inclusion in the Developer's Assessment Report. The ITK information types and sources outlined in Section 4.2 will be discussed with Indigenous groups and governments to help guide the ITK data collection process for the Project.

4.1.6 Existing Environment

For the purpose of this document, and the future Developer's Assessment Report, *baseline* conditions refer to *existing* environmental conditions, and comprise the current physical, chemical, biological, social, economic, and cultural setting in which the Project is located, and where Project effects might be expected to occur. As a result of past mining activities and the brownfield nature of the historical Pine Point Mine site, the existing environment does not necessarily reflect historical background conditions (i.e., before any industrial development occurred). Rather, the existing environment represents the outcome of historical and current environmental and socio-economic pressures or factors that have shaped the observed condition of biophysical, social, economic, and cultural components of the surrounding environment. Environmental and socio-economic pressures can be natural (e.g., weather, wildfire, predation, and disease) and human-related (e.g., previous mining development, remediation activities, fishing, and hunting).

The description of the existing environment (i.e., Base Case) provided in the Developer's Assessment Report for each VC and intermediate component will expand on the information included in Volume 3 (Existing Environment). Information that will be used to support the description of the existing environment will include published and unpublished material, and data from baseline studies conducted within the anticipated Project footprint and local and regional study areas. Baseline studies identify temporal variation (e.g., annual or seasonal changes in water flow or landcover types, or trends over time in community populations and employment) and other conditions relevant to the assessment of the Project. Other available data and information obtained from government and industry will also be used to establish and characterize the existing environment for the physical, biological, economic, social, and cultural components that may be influenced by the Project.

Data collected in the anticipated Project footprint and in the immediate vicinity of the Project (i.e., LSA) will be used to provide measures of environmental conditions prior to construction of the Project and predict the direct and indirect changes resulting from the Project on intermediate and valued components (e.g., changes to terrestrial and aquatic habitat from the physical footprint or from dust and air emissions). Data collected at larger scales (i.e., RSA) will be used to measure broader scale environmental conditions and provide regional context for the effects of the Project.

A baseline study plan (Volume 3, Appendix C) has been developed for the Project based on the results of a gap analysis completed for previous environmental data from the site, and other publicly available information (Golder 2019). The purpose of the gap analysis was to identify environmental data gaps or missing information and provide recommendations for additional data collection that may be required to support the EA. Additional information recommended to be collected for individual EA components in the baseline study plan (Volume 3, Appendix C) will be included in the existing environment description provided in the Developer's Assessment Report.

4.1.7 Project Interactions and Mitigations

Assessing the adverse effects of the Project begins by identifying the risks to the biophysical and human environments from the Project for each intermediate and valued component and applying practicable mitigation to avoid or minimize the potential adverse effects generated from that risk. As a requirement of the EA Initiation Package, a pathway analysis was undertaken to identify risks to the biophysical and human environments from the Project for each intermediate and valued component (Volume 4). A pathway analysis provides a comprehensive list of potential interactions between the Project and environment, identifies mitigation that could be used to eliminate and/or minimize potential adverse effects, and focuses further assessment on key or principal effects from the Project that remain after mitigation has been applied. The approach and methods used to complete the pathway analysis for the EA Initiation Package are summarized in Volume 4. Section 2.0 of Volume 4 (Pathway Analysis Methods) provides additional information related to the concepts discussed below.

The results of the pathway analysis completed for the EA Initiation Package are provided in Volume 4. For each KLOI and SON, a table provides a description of the Project components/activities that may interact with the associated intermediate or valued components, specific pathways that may change measurement indicators and result in effects on the component, Project design and mitigation measures that are expected to avoid or limit effects, and a categorization of predicted residual effects from the pathway (i.e., no pathway, secondary, or primary). As indicated in the EA Initiation Guidelines, the pathway analysis considered all potential Project-environment interactions that are possible at the current stage of planning for the Project. Hence, the analysis was precautionary, and consequently, there is the potential that some pathways may be no longer be considered (i.e., no pathway or pathway does not exist) once additional details on Project design and mitigation become available.

While the process used to identify effect pathways and associated mitigation was comprehensive and considered information from early engagement and experience with similar projects, there is potential that ongoing engagement and additional Project design details could result in identification of new effect pathways and/or refinement of mitigation. The residual effects categorization applied for certain pathways will need to be confirmed through planned environmental modelling work, baseline data collection, and additional information related to Project design. While the pathway designations provided in Volume 4 are preliminary, it is anticipated that they provide a reasonable estimation of the likelihood and magnitude of residual effects.

The pathway analysis completed as part of the EA Initiation Package will be finalized in the Developer's Assessment Report, and will consider updates to the Project Description, feedback from engagement, and reviewer comments on the Developer's Assessment Proposal. The methods used in the Developer's Assessment Report to complete the final pathway analysis are proposed to be those provided in Volume 4. With the intent of focusing the EA on the most important issues and avoiding assessment of interactions that are unlikely to result in measurable or greater than negligible adverse effects, it is recommended that:

- The interactions categorized as no pathway in Volume 4 are screened out of the Developer's Assessment Report. These potential Project-interactions can be removed by mitigation, and consequently the Project would result in no measurable environmental change relative to existing conditions or guideline values (e.g., air, soil, or water quality guidelines), and therefore, would have no residual effect on a VC or intermediate component. The mitigation that is proposed for these Project-interactions include standard mitigation and best management practices that are typically used and demonstrated to be effective at other mines/developments in the NWT and Canada. The mitigation and management practices are standard management practices that are often implemented as fundamental elements of management plans. Based on the implementation and effectiveness of these standard mitigation at other mines, the mitigation is considered to 100% effective for these interactions. Additional screening information for the Project-interactions classified as no pathway is provided in Appendix A.
- It is proposed that these pathways are not considered in the effects assessment provided in each component section of the Developer's Assessment Report (i.e., these interactions would be excluded from the final pathways effects tables and the supporting text).
- Secondary pathways will be addressed in the Developer's Assessment Report using an abbreviated, tabular format. Secondary pathways are interactions that could result in a measurable minor environmental change but would have a negligible residual effect on a VC or intermediate component. As the predicted magnitude of residual effects is negligible, these pathways are not considered to be priority issues for the Project EA and review process. While it is recommended that they be considered in the EA, these pathways do not warrant a substantial level of detail or attention in the Developer's Assessment Report. These pathways will not be advanced for further assessment in the detailed analysis described in Section 4.1.8.

The evaluation of secondary pathways will consist of tables providing a description of each secondary pathway, and a brief, bulleted list of predicted changes to VCs and intermediate components. The tables would be presented in the effects assessment for each KLOI and SON and would be supported by the pathway of effects and mitigations tables (i.e., the final versions of the tables provided in Volume 4). An example of a secondary pathway assessment using this approach is provided in Table 4-4. Previous EAs submitted to the MVEIRB have provided a reasoned narrative describing the predicted effects for secondary pathways on VCs and intermediate components; this narrative has often been lengthy and repeats the same type of information presented in other EAs. This is inefficient and contributes to an unnecessarily long and less focused Developer's Assessment Report. The tabular approach has been used successfully for EAs submitted to other regulatory boards (e.g., the Nunavut Impact Review Board).

It is important to emphasize that the Project interactions designated as secondary or no pathway are still considered for determining the potential effects of the Project. However, these pathways are not key issues for the EA, as they are predicted to result in either non-measurable (no pathway) or negligible (secondary) residual effects on VCs following implementation of mitigation. The environmental risks associated with the activities or mechanisms contributing to these pathways can be removed or reduced through implementation of environmental management and monitoring systems, which are being developed for the Project (Volume 6). These plans will incorporate adaptive management to monitor and respond to changing or unexpected conditions. An environmental management and monitoring framework for the Project is provided in Volume 6.

By screening out interactions designated as no pathway and evaluating secondary pathways using an abbreviated approach, the EA can be focused on priority issues, resulting in a shorter, and more efficient Developer's Assessment Report. This is consistent with the concepts noted in the EA Initiation Guidelines, which emphasizes that the Developer's Assessment Report should be focused on priority effects and mitigations and should leave out effects that are unlikely to lead to significant effects.

Primary pathways, which are likely to result in environmental change that could contribute to greater than negligible residual effects on a VC, will be the focus of a detailed analysis described in Section 4.1.8. These are the most important issues for the Project and will be given the most attention in the Developer's Assessment Report.

Table 4-4: Example of the Proposed Assessment Approach for Secondary Pathways

Secondary Pathway	Summary of Predicted Effects
Release of sediment during instream construction and from ground disturbance may alter fish habitat quality	■ Increases in suspended sediment concentrations may occur directly due to disturbance of bed materials during instream construction, or indirectly due increased erosion delivered to the waterbody from site runoff. ■ Increases in fine sediment can cause effects on fish ranging from minor physiological stress to mortality. Turbidity can affect the visual ability of fish to detect prey and predators, which can result in reduced growth rates. ■ Release of fine sediment can result in sediment deposition that alters substrate composition and modifies the suitability of habitats used by fish and benthic invertebrates, which are an important food source for fish. ■ Introduction of fine sediment to waterbodies from instream activities and runoff is expected to result in small, localized increases in suspended sediment concentrations and deposition, primarily during the construction phase. ■ Effects from sediment release are expected to be minimal with implementation of the mitigation measures outlined in Volume 4, the Surface Water Management Plan and the Sediment and Erosion Control Plan. ■ Consequently, this Project interaction is anticipated to have a negligible residual effect on fish and fish habitat VCs.

VC = valued component

4.1.8 Residual Effects Analysis

The residual effects analysis will be based on the Project interactions that are determined to be primary in the pathway analysis (Section 4.1.7) and will describe the effects of the Project on intermediate and valued components relative to the Base Case (existing environment). Residual effects will be described for each primary pathway influencing a component and associated measurement indicator(s) in the local and regional study areas (Section 4.1.3.1). Effects that occur during the temporal boundaries of the assessment will be described (numerically or qualitatively), with emphasis on periods when the predicted adverse effects are largest.

The concept of assessment cases (Section 4.1.3.3) will be applied to estimate the incremental and cumulative adverse effects from the Project, as well as previous, existing, and reasonably foreseeable developments. Individual discipline component assessments (i.e., KLOIs and SONs) will describe the approach for residual effects analysis that will be completed for the Application Case and the RFD Case (if applicable). Identification of components that require a cumulative effects assessment under the RFD Case will consider the extent of the adverse effects from the Project and potential to overlap or interact spatially and temporally with effects from other projects/activities.

The assessment of the RFD Case will also consider mitigation and monitoring programs for future projects/activities (if known) intended to reduce the likelihood of adverse cumulative effects. Any assumptions or uncertainty regarding the implementation of anticipated mitigation for other projects/activities (e.g., similar mitigation as the Project, or land use and water licence permit conditions) will be described. Existing territorial and/or federal management actions and policies (e.g., territorial hunting regulations, federal recovery strategies for listed species) applicable to biophysical and socio-economic components will also be included in the evaluation of cumulative effects. Mitigation policies and actions implemented by the Project are expected to avoid and limit the Project's contribution to cumulative effects.

The residual effects analysis for intermediate and valued components will include the concepts of effects criteria, such as direction, magnitude, duration, and geographic extent, which are defined in Section 4.1.9.1. The actual effects criteria terms (e.g., direction, magnitude, geographic extent) may not necessarily be used to describe how changes to measurement indicators from the Project influence VCs and intermediate components. Results will be presented in the form of an integrated narrative that will highlight the predicted effects at the point when adverse effects of the Project are anticipated to be greatest during the temporal boundary of the assessment case(s). For VCs, the outcome of the residual effects analysis will be described considering the influence on the assessment endpoints.

Environmental context, which forms part of the existing environment, will also be used in the analysis of effects on VCs. Context for biophysical VCs will include consideration of current status and trends, ecological thresholds, resilience and adaptive capacity, and applicable legislation and best management practices. Similarly, context for socio-economic VCs will include existing social pressures, tolerance limits and vulnerability, political trends, applicable legislation, standards, plans and policies, and traditional way of life for Indigenous people.

Primary pathways that will be carried forward to the residual effects analysis for components associated with KLOIs and SONs are outlined in Section 4.2, along with a description of the proposed assessment methods that will be used to evaluate effects on valued and intermediate components. The methods follow the principles outlined in this section, but the details vary among components. The proposed assessment methods outlined in Section 4.2 were developed based on experience with similar projects, feedback from early engagement, and in certain cases, feedback from previous regulatory applications for the property.

The final methods and results of the residual effects analysis for VCs and intermediate components will be provided in each component section (i.e., KLOI or SON) of the Developer's Assessment Report. The final methods will consider the results of future engagement activities and feedback on the Developer's Assessment Proposal. Presentation of large amounts of data and detailed and lengthy analyses or modelling will be provided in appendices. Results from the residual effects analysis will be used to inform residual effects classification for intermediate and valued components and to help determine the significance of Project effects on VCs.

4.1.9 Residual Effects Classification and Determination of Significance

4.1.9.1 Residual Effects Classification

A summary or classification of the residual effects analysis will be provided in the Developer's Assessment Report in tabular form for both intermediate and valued components. The use of effects criteria to facilitate classification of residual effects is an accepted practice in EA. The purpose of the residual effects classification is to describe the incremental and cumulative effects from the previous and existing developments and the Project (Application Case) and future developments (RFD Case, if applicable) using a common set of classification criteria. The classification of residual effects criteria in tabular form is intended to provide structure and comparability across all intermediate components and VCs assessed for the Project. The residual effects classification will then be used to help make significance determinations for VCs (Section 4.1.9.2).

The residual effects classification will use direction, magnitude, geographic extent, duration, reversibility, frequency, and probability of occurrence as criteria. The classification for the Application Case will be completed for the phase or period (temporal snapshot) when adverse effects from the Project are predicted to be greatest. For the RFD Case, the classification will also be completed under the assumption of capturing the maximum combined overlapping temporal and spatial effects of the existing and approved developments, the Project, and future developments (if applicable). Definitions of categories that will be used to describe changes in each effect criterion will be presented in each component section of the Developer's Assessment Report. General classification schemes that will be applied to each effect criterion used in the Developer's Assessment Report are as follows:

Direction—Typically classified as negative (i.e., net loss or adverse effect), neutral (i.e., no change), or positive (i.e., net gain or beneficial effect). Direction may change over time (i.e., the Project could have adverse effects during some time periods and positive effects during others).

Magnitude—Magnitude is a measure of the intensity or the degree of change (effect size) caused by the Project (and other developments, if applicable) relative to conditions prior to the implementation of the Project, guideline values, or known threshold values. Magnitude will be presented as a quantitative or qualitative expression of effect size for most components (e.g., quantity of groundwater or surface water flow, concentration of constituents of potential concern, hectares of habitat, amount of change in animal connectivity or movement). Magnitude values will be presented quantitatively where possible, and qualitatively where necessary. When categorical definitions are used, magnitude will be classified as negligible, low, moderate, or high and supported by a reasoned narrative.

Geographic extent—Geographic or spatial extent refers to the area (or distance covered, range, or zone of influence) of the effect on the component. The geographic extent of effects can occur at several different scales within the spatial boundary of the assessment and is component specific. Categorical classifications may include effects that are confined to the Project footprint, effects that may extend beyond the Project footprint but are confined to the LSA, effects that may extend beyond the LSA but are confined to the RSA, and effects that may extend beyond the RSA.

Duration—Duration will be presented as numerical values for most components (e.g., days, months, years, decades). When duration is classified categorically, it is typically expressed as short-term or long-term relative to Project activity periods or phases. Duration has two components: the amount of time between the start and end of a Project activity or stressor (which is related to Project phases), plus the time required for the effect on the component to be reversible. In some cases, the duration of a residual effect may not be known, except that it is expected to last for a very long time, well beyond the temporal boundary of the Project. In such cases, where science and logic predict that the likelihood of reversibility is very low or uncertain, the residual effect will be considered permanent (i.e., apply a precautionary approach).

Reversibility—After removal of the Project activity or stressor, reversibility is the likelihood that the Project will no longer influence a component at a future predicted time. This criterion usually has one of two alternatives: reversible or irreversible. The period will be provided for reversibility (i.e., duration) if a residual effect is reversible. Permanent residual effects are considered irreversible.

Frequency—Frequency refers to how often an effect will occur during the temporal boundary of the assessment. Occasional residual effects occur once or a few times (e.g., once during the installation of a culvert). Continuous effects occur all the time for a specified duration. Periodic effects occur consistently at regular intervals or associated with temporal events (e.g., during breeding or spawning season, spring freshet, low flows, growing season or plant harvest season).

Probability of occurrence—The probability of an effect occurring is typically described in parallel with uncertainty, which may be influenced by a variety of factors such as the likelihood of a negative response by the component occurring or the likelihood of mitigation being successful. Defined categorically as unlikely, possible, probable, or certain.

4.1.9.2 Significance Determination

Following the classification of residual adverse effects from associated primary pathways, a determination of significance will be completed only for VCs, which have assessment endpoints or qualitatively defined significance thresholds.

Significance will be determined for both the residual effects of the Project alone and the cumulative effects of the Project combined with other developments. However, a determination of significance generally cannot be accomplished without a cumulative effects assessment because effects of a single Project infrequently cause an environmentally significant effect on their own (McCold and Saulsbury 1996), and many environmental effects of primary concern are cumulative (Canter and Ross 2010). Therefore, significance will be determined by combining the cumulative effects identified in the Base Case with the incremental effects identified for the Application Case, and then for RFD Case (if applicable) to assess the total predicted cumulative effect. Although the significance of the incremental effects of the Project in isolation will not be determined, the relative contribution of the Project to potential significant adverse cumulative effects will be discussed. Understanding the contribution of the Project to a significant adverse effect is necessary because it enables decision makers to properly weigh the adverse effects and benefits of the Project.

The predicted changes in measurement indicators and associated residual effects classification of primary pathways provide the foundation for determining the significance of incremental and cumulative effects from the Project and other previous, existing, and future projects on VC assessment endpoints. The determination of significance will consider the entire set of primary pathways and affected measurement indicators that influence a particular assessment endpoint. Thus, significance is not explicitly assigned to each pathway or measurement indicator. Rather, the relative contribution of each pathway or measurement indicator will be used to determine the significance of potential adverse effects of the Project and other developments on an assessment endpoint. The approach is based on a “weight of evidence” or an evaluation of the persuasiveness of the collective evidence. The relative effect from each pathway will be discussed; however, pathways that are predicted to have the greatest influence on effects on assessment endpoints are assumed to contribute the most to the determination of significance.

Ecological and socio-economic context is often relevant when describing the significance of residual effects on biophysical and socio-economic VCs. Ecological context relates to the potential for environmental effects to cause disruption of ecological functions and processes in the receiving environment, which may be fragile with little resilience to further imposed stresses or may be already adversely affected by human activities (Holling 1973). For example, the magnitude of an effect on a fish or wildlife VC depends on the current level of disturbance, population status and trend, and resilience of the VC to further changes in habitat availability and connectivity. Similarly, duration includes consideration of reversibility, and the duration of residual effects on VCs with high resilience (ability to recover from disturbance) would be expected to be shorter relative to VCs with lower resilience or adaptive capacity to disturbance.

Consistent with the notion of ecosystem resilience, a resilient human community is one that has the capacity to cope with change and disturbance without shifting into a qualitatively different state. A resilient community can tolerate change and, if disturbed, can adapt. This adaptation and renewal can be accelerated through mitigation.

In contrast, a vulnerable community has a limited capacity to adapt to further disturbances. Where relevant, ecological or socio-economic context is discussed in the determination of significance.

Details on the approach and methods for determining significance on VCs will be provided in each KLOI and SON section. In general, significance determination of residual effects will be accomplished by evaluating the following against assessment endpoints defined for each VC:

- magnitude, geographic extent, duration, reversibility, frequency, and probability of occurrence of the residual adverse effect for each applicable measurement indicator and related intermediate component
- uncertainty in effects predictions

Magnitude, geographic extent, and duration will be the primary factors affecting significance determination, with other criteria used as modifiers. Resilience, tolerance, and adaptive capacity provide important ecological and socio-economic context for determining significance. Where possible and appropriate, established guidelines, thresholds, and screening values will be used to support the conclusion. If a cumulative adverse effect of the Project and other developments has a sufficiently high magnitude, affects a sufficiently large area, and lasts for a sufficient duration to cause a significance threshold defined by the assessment endpoint for a VC to be exceeded, then a significant adverse effect will be identified. Where uncertainty is high and the effect either significant or not significant, the assessment will use a precautionary approach and identify the effect as significant. Additional follow-up actions will then be proposed to reduce the uncertainty.

4.1.10 Prediction Confidence and Uncertainty

The purpose of an EA is to predict the future conditions of the biophysical and socio-economic environments as a result of the Project and previous, existing, and future projects. Because the biophysical and socio-economic environments change naturally and continually through time and across space, most assessments of effects and predictions about future conditions embody some degree of uncertainty.

The assessment will apply a precautionary approach to address uncertainty by identifying the greatest magnitude, duration, and geographic extent of potential adverse effects when a range of possible outcomes are possible. Consequently, uncertainty will be addressed in a manner that increases the level of confidence that residual effects are not be worse than predicted.

Confidence in effects analyses can be related to many elements, including the following:

- adequacy of the baseline data for providing an understanding of the existing environment and the direction, magnitude, and spatial extent of future fluctuations in ecological, cultural, and socio-economic variables, independent of effects from the Project and other developments (e.g., climate change, fire, or flood)
- assumptions, conditions, and constraints of model inputs
- understanding of Project-related effects on complex ecosystems that contain interactions across different scales of time and space (e.g., how and why the Project will influence wildlife and TLRU)
- knowledge and experience with the type of effect in the system
- knowledge of the effectiveness of Project (environmental) design features or mitigation for removing or reducing effects
- uncertainties associated with the exact location, physical footprint, activity level, and the timing and rate of future developments

Uncertainty in these elements can decrease confidence in the residual effects analysis and determination of significance. Key sources of uncertainty that are relevant to each component discipline, and that will be addressed in the Developer's Assessment Report, are summarized in Section 4.2. The KLOI and SON assessments provided in the Developer's Assessment Report will provide a qualitative discussion to assess prediction confidence to the extent reasonable. Where appropriate, residual uncertainty will be addressed by additional mitigation and in monitoring and follow-up programs. Each KLOI and SON section will include a discussion of how uncertainty will be addressed and will provide a qualitative evaluation of the resulting level of confidence. The implications of uncertainty will also be included in the residual effects analysis and classification (probability of occurrence criterion) and in the determination of significance.

4.1.11 Monitoring and Follow-up

Monitoring programs will be proposed in the Developer's Assessment Report to address the uncertainties associated with the effects predictions and to evaluate the performance of mitigation. In general, monitoring is used to verify the effects predictions. Monitoring is also used to identify any unanticipated effects and provide for the implementation of adaptive management to limit these effects. Typically, monitoring includes one or more of the following categories, which may be applied during the development of the Project:

- **Compliance monitoring**—monitoring activities, procedures, and programs undertaken to confirm the implementation of approved design standards, mitigation, and conditions of approval, and company commitments (e.g., inspecting the installation of a silt fence, monitoring the quality of water discharged from the Project).
- **Follow-up monitoring**—programs designed to test the accuracy of effects predictions, reduce or address uncertainties, determine the effectiveness of mitigation, or provide appropriate feedback to operations for implementing adaptive management. Results from these programs can be used to update environmental effects predictions (i.e., as an aspect of operational environmental monitoring programs such as aquatic effects monitoring programs; MVLWB and GNWT 2019) and can increase the certainty of effect predictions in future EAs.

These programs will form part of the Environmental Management System for the Project. If monitoring or follow-up detects effects that are different from predicted effects or identifies the need for improved or modified design features and mitigation, then adaptive management will be implemented. This may include increased monitoring, changes in monitoring plans, or additional mitigation.

A conceptual Management and Monitoring Framework for the Biophysical and Human Environments (Volume 6) has been developed for the Project to support the EA Initiation Package. The Developer's Assessment Proposal provides framework versions of a subset of management and monitoring plans that will be considered in the environmental management system for the Project. A similar approach will be used in the Developer's Assessment Report, which will provide versions of monitoring and management plans to support the EA. The conceptual Management and Monitoring Framework for the Biophysical and Human Environments will be provided as a supporting section of the Developer's Assessment Report, according to the table of contents proposed for the Developer's Assessment Report in Section 5.0. These monitoring and management plans will be referenced in Developer's Assessment Report by component disciplines, where applicable.

Anticipated monitoring activities or programs that are relevant to individual component disciplines are outlined in Section 4.2. Proposed monitoring and follow-up activities or programs will be finalized in each KLOI and SON section of the Developer's Assessment Report and, where relevant, conceptual monitoring activities or programs will be proposed to deal with the uncertainties associated with the effect predictions and mitigation. Upon Project

approval, these management and monitoring plans will be included in the Project's Environmental Management System. The conceptual management and monitoring framework included with the Developer's Assessment Report, and recommendations for individual components, will consider feedback from engagement and the Developer's Assessment Proposal.

4.2 Methods for Key Lines of Inquiry and Subjects of Note

This section provides details relating to the methods that will be used to assess effects from the Project for the KLOIs and SONs identified in Section 3.0, for biophysical (Section 4.2.1) and human (Section 4.2.2) environment components.

4.2.1 Biophysical Environment

4.2.1.1 SON-1: Impacts to Air Quality, Noise, and Climate

The investigation of SON-1: Impacts to Air Quality, Noise (including vibrations), and Climate will be separated into three sections. Descriptions of the assessment methods expected to be used in the Developer's Assessment Report for the air quality, noise, and climate components are provided in Table 4-5, Table 4-6, and Table 4-7 respectively.

Table 4-5: Assessment Methods for Air Quality

Assessment Approach for SON-1: Impacts to Air Quality		
Information Sources	Information sources that will be used to support the air quality assessment are anticipated to include the relevant sources listed in Section 4.1.1 and the following: ■ The Air Quality, Noise, and Climate Baseline Report ■ Territorial and federal legislation and guidance such as the Territorial Ambient Air Quality Standards (Draft) ■ Compendia of published emission factors for industrial sources ■ Additional regulatory guidance sourced from other jurisdictions for which there is a regulatory gap in the NWT for compounds assessed that may be unique to this Project and Pine Point Mining Limited (PPML) becomes aware of during the assessment process ■ PPML's engineering team will be an important source of information. Project-specific details including site layout, fleet and processing information, power supply options, Project boundaries, building dimensions, and other details will be required to complete the air quality assessment. A comprehensive emissions request document will be prepared that requests these details at the onset of the assessment	
Intermediate Components and Measurement Indicators	Intermediate Component(s)	Air quality will be considered as an intermediate component in the Developer's Assessment Report. A rationale for the selection of air quality as an intermediate component is provided in Section 2.0 and Table 2-2.
	Measurement Indicators	Measurement indicators for air quality are defined in Section 4.1.2 and Table 4-2. As air quality is an intermediate component, an assessment endpoint is not defined (Section 4.1.2).
Environmental Assessment Boundaries	Spatial Boundaries	Details related to the location and size of existing and new facilities and infrastructure for the Project (i.e., physical Project footprint) are currently being developed through the design process and cannot be included in the EA Initiation Package. These details on the Project Description are necessary to define the spatial boundaries for air quality and are expected to be available for the Developer's Assessment Report. The spatial boundaries considered in the air quality assessment will include a local study area (LSA) and a broader regional study area (RSA; Section 4.1.3): ■ The LSA would likely include the Project footprint plus a minimum of a 10 km area beyond the Project footprint. ■ The RSA will be sized to evaluate air quality predicted concentrations to approximately 10% of the affiliated air quality standard. For example, if the nitrogen dioxide (NO_2) 1-hour standard is 213 parts per billion (ppb), the study area would be sized to enclose the 21 ppb air quality prediction contour. The RSA cannot be defined fully until the scope of the emissions inventory is better understood and basic testing of the air dispersion model is completed.

Table 4-5: Assessment Methods for Air Quality

Assessment Approach for SON-1: Impacts to Air Quality		
Environmental Assessment Boundaries (cont'd)	Temporal Boundaries	The temporal boundaries for the air quality assessment will focus on the Project phases defined in Section 4.1.3: construction, operation, and closure and reclamation. It is likely that the operation phase of the Project will yield the highest emissions rates of all the phases, and within the operation phase, it is further likely that there will be a peak year of operation that is expected to be the basis of the air quality assessment. The peak year of emissions will be considered with other factors in determining a snapshot year to consider as the potential "worst case." Other factors to consider include the location and duration of emissions within the Project boundary. Other phases of the Project will be considered more peripherally, without an explicit modelling assessment because the construction and closure and reclamation phases, as well as post-closure, will likely result in smaller changes in air quality than the peak of the operation phase.
	Assessment Cases	■ The air quality residual effects analysis will consist of up to three assessment cases, as defined in Section 4.1.3: a Base Case, an Application Case and, possibly, a Reasonably Foreseeable Development (RFD) Case. The methods that will be used to assess the Base Case and the Application Case are defined in Section 4.1.3 and in the "Existing Environment" and "Residual Effects Analysis" descriptions provided below. ■ The determination of whether an RFD Case assessment will be included in the air quality section will be made during preparation of the Developer's Assessment Report, based on the methods outlined in Section 4.1.3. If an RFD Case is required, it is anticipated that the assessment will be qualitative and conceptual, and that the approach taken will depend upon the level of information available for individual RFDs.
Input from Engagement	Information and concerns raised during the engagement process undertaken for the Project (Section 4.1.4 and Volume 2) will be considered in the air quality assessment; specific issues raised will be documented in the assessment and a description of how the issue was addressed will be provided.	
Incorporation of Indigenous Traditional Knowledge (ITK)	The general methods that will be used to integrate local and ITK into the air quality assessment are defined in Section 4.1.5. Specific types of ITK that may be used in the air quality assessment are anticipated to include the following information types and sources: ■ feedback and observations provided by Indigenous community members ■ locations of cabins, camps, and other dwellings where people may be present and potentially exposed to changes in air quality as a result of the Project ■ recreational, spiritual, and cultural locations where specific air quality predictions may be made through dispersion modelling	
Existing Environment	The description of the existing environment provided in the Developer's Assessment Report for air quality will follow the general methods outlined in Section 4.1.6 and will expand on the information provided in Volume 3. The description of existing environment will incorporate historical and recent baseline sampling information regarding existing air quality and meteorology. The existing baseline information related to air quality is considered adequate to complete the effects assessment. A small, supplemental air quality baseline data collection program is being conducted in summer 2020 (Volume 3, Appendix C).	
Project Interactions and Mitigations	Identification of Project interactions and mitigations for the air quality component will follow the general methods outlined in Section 4.1.7. A description of the anticipated Project-environment interactions identified for air quality, along with the associated residual effects categorization (i.e., no pathway, secondary, or primary) and proposed mitigation measures, is provided in Volume 4.	

Table 4-5: Assessment Methods for Air Quality

Assessment Approach for SON-1: Impacts to Air Quality	

Residual Effects Analysis	The residual effects analysis for the air quality component will follow the general methods outlined in Section 4.1.8 and will focus on the Project-environment interactions that are determined to be primary in the pathway analysis (Volume 4). Three Project-environment interactions were determined to be primary for air quality. Assessment methods that will be used to evaluate the potential residual environmental effects of these pathways on the air quality intermediate component are described below.
	■ Emissions of criteria air contaminants from mobile and stationary combustion sources including nitrogen and sulphur oxides, particulates, and carbon monoxide can affect air quality.
	■ Emissions of mercury, dioxins, and furans may adversely affect air quality.
	■ Emissions of fugitive dust can affect air quality.
	  ▪ Emissions are expected from the operation of on-site vehicles, mining and processing equipment, power generation, waste management, fugitive dust emissions from site roads and wind erosion from stockpiles. All of these emission sources will be quantified in an emissions calculation exercise and will be the primary inputs to the CALPUFF dispersion model, which will predict ground level concentrations of the key parameters.
	  ▪ The air quality dispersion modelling assessment will be used to predict ground-level concentrations of air quality parameters beyond the developed area boundary of the Project. The CALPUFF dispersion model will be used. The model inputs will consist of emissions estimates from all important sources at the Project, a representative meteorological dataset, and digital terrain information. Background concentrations of key parameters (e.g., NO_2) will also be used to inform the assessment. The output of the model will be processed and compared to the measurement endpoints defined by the NWT air quality standards. CALPUFF is the most appropriate model to use when changes to air quality need to be evaluated over a large area. It is the most common refined air dispersion model used in Canada for projects of this nature, including most of the mining projects in the NWT and Nunavut.
	Technically and economically feasible mitigation will be identified in coordination with PPML's mine design team.

Residual Effects Classification	The residual effects classification completed for the air quality assessment will follow the methods defined in Section 4.1.9. Component-specific definitions will be developed for the residual effects classification criteria of direction, magnitude, geographic extent, duration, reversibility, frequency, and probability of occurrence. A determination of significance will not be completed for air quality, which will be considered as an intermediate component in the Developer's Assessment Report (Section 4.1.9).
Prediction Confidence and Uncertainty	Prediction confidence and uncertainty will be evaluated according the general methods defined in Section 4.1.10. Key sources of uncertainty that are relevant to the air quality assessment, and that will be addressed in the Developer's Assessment Report, are anticipated to include the consideration of the following elements: ■ Air quality modelling inputs, specifically estimates of Project emissions, which will likely be conservative estimates, and modelling results that will be derived from the CALPUFF dispersion model that attempt to estimate the conditions likely to occur in a dynamic environment. Air dispersion modelling results will be designed to "err on the high side" to account for some of the inherent uncertainty in the assessment process. ■ Adequacy of baseline data for understanding current conditions and future changes unrelated to the Project. ■ Knowledge of the final proposed mitigation and environmental design features designed for reducing or removing Project effects. Air quality dispersion modelling assessment requires specific and detailed information to make reasonable predictions of potential changes to air quality and it is common that final information of this nature is unavailable early in the Project development stages when environmental work is generally completed. The usual approach to mitigate this uncertainty is to make what are believed to be conservative estimates of emissions at the outset of the exercise and to carry those assumptions through the assessment (i.e., freeze the Project design for assessment). It must be understood further, however, that it is probable that changes to the design will be required at some point when additional Project details are known. Finalized data of this nature may not be available in some cases until after the air quality assessment is complete. It will be the goal of the assessment to mitigate this uncertainty to the extent possible through detailed information requests, ongoing communication with the Project design team, and maintenance of conservative, yet reasonable assumptions throughout the assessment process.
Monitoring and Follow-up	The air quality section of the Developer's Assessment Report will include a brief description of the monitoring activities proposed to address the uncertainties associated with effect predictions and the performance of environmental design features and mitigation related to the Project. As described in Section 4.1.11, the description of monitoring activities will include consideration of both compliance monitoring and follow-up monitoring. Monitoring of air quality is anticipated and is expected to include the following elements to be developed after the Developer's Assessment Report, in the permitting phase of the Project: ■ Air Quality Effects Mitigation and Monitoring Program ■ Emissions Management Plan Monitoring activities defined for waste management (Volume 6) are also relevant to the air quality component and will be considered in the air quality section of the Developer's Assessment Report. The air quality section of the Developer's Assessment Report will include a description of the specific objectives, monitoring techniques and general analysis procedures that will be used for the planned monitoring activities. Where applicable, links to adaptive management responses will be defined. The design of monitoring activities will also consider previously collected data and will incorporate ITK and information gathered through engagement with communities, where appropriate.

Table 4-5: Assessment Methods for Air Quality

Assessment Approach for SON-1: Impacts to Air Quality	
Supporting Annexes	Supporting documentation relevant to air quality is anticipated to include the following annexes which will be appended to the air quality section of the Developer's Assessment Report: ■ Air Quality, Noise, and Climate Baseline Report ■ Air Quality Modelling Report ■ Air Quality Emissions Report ■ Air Quality Meteorology Report Other information sources will be considered in the air quality assessment (see the "Information Sources" section above) but will not be appended to the air quality section of the Developer's Assessment Report.

Table 4-6: Assessment Methods for Noise (Including Vibration)

Assessment Approach for SON-1: Impacts to Noise (Including Vibration)		
Information Sources	Information sources that will be used to support the noise and vibration assessment scoping are anticipated to include the relevant sources listed in Section 4.1.1 and the following: ■ project equipment lists, plot plans, building drawings, and mine plans ■ the Air Quality, Noise, and Climate Baseline Report ■ federal guidance such as Environment Canada's *Environmental Code of Practice for Metal Mines* and Health Canada's *Guidance for Evaluating Human Health Impacts in Environmental Assessment: Noise* ■ noise and vibration guidance documents from other jurisdictions such as Alberta Energy Regulator Directive 038: Noise Control and the Australia and New and New Zealand Environment Council's *Technical Basis for Guidelines to Minimise Annoyance Due to Blasting Overpressure and Ground Vibration*	
Intermediate Components and Measurement Indicators	Intermediate Component(s)	Noise and vibration will be considered as intermediate components in the Developer's Assessment Report. A rationale for the selection of noise and vibration as intermediate components is provided in Section 2.0 and Table 2-2.
	Measurement Indicators	The measurement indicators recommended to be used in the noise and vibration assessment are defined in Table 4-2. As noise and vibration are intermediate components, an assessment endpoint is not defined (Section 4.1.2)
Environmental Assessment Boundaries	Spatial Boundaries	Similar to air quality, details related to the location and size of existing and new facilities and infrastructure for the Project (i.e., physical Project footprint) are currently being developed through the design process and cannot be included in the EA Initiation Package. These details on the Project Description are necessary to define the spatial boundaries for noise and vibration and are expected to be available for the Developer's Assessment Report. The spatial boundaries considered in the noise and vibration assessment will include a local study area (LSA) and a broader regional study area (RSA): ■ The LSA would likely include the Project footprint plus a 1.5 km buffer. This definition is based on guidance provided in Alberta Energy Regulator Directive 038: Noise Control (AER 2007). There is no equivalent guidance available in the NWT. ■ The RSA would likely include the Project footprint plus a 5 km buffer. This RSA is large enough to capture potential cumulative noise and vibration effects arising from interaction between the Project and other sources/facilities.
	Temporal Boundaries	The temporal boundaries for the noise and vibration assessment will include the Project phases defined in Section 4.1.3: construction, operation, and closure and reclamation. Noise and vibration during post-closure will not be assessed, as it is anticipated that there will be no noise or vibration sources present on site following closure and reclamation. It is anticipated that quantitative modelling for the noise and vibration assessment will focus on one snapshot of construction activities and one or two snapshots of activities during operation. Specific assessment snapshots will aim to capture the maximum effects of the Project, and so may include the year when Project activities are most intense (e.g., greatest production or largest equipment fleet) and/or the year when Project activities are closest to sensitive receptors. Specific assessment snapshots will be selected once additional Project design details become available. Noise and vibration during closure and reclamation will be discussed qualitatively, as it is anticipated that Project activities during this phase will be similar, but less intense, than during construction.
	Assessment Cases	■ The noise and vibration residual effects analysis will consist of up to three assessment cases, as defined in Section 4.1.3: a Base Case, an Application Case and, possibly, a Reasonably Foreseeable Development (RFD) Case. The methods that will be used to assess the Base Case and the Application Case are defined in Section 4.1.3 and in the "Existing Environment" and "Residual Effects Analysis" descriptions provided below. ■ The determination of whether an RFD Case assessment will be included in the noise and vibration section will be made during preparation of the Developer's Assessment Report, based on the methods outlined in Section 4.1.3. If an RFD Case is required, it is anticipated

Table 4-6: Assessment Methods for Noise (Including Vibration)

Assessment Approach for SON-1: Impacts to Noise (Including Vibration)		
		that the assessment will be qualitative and conceptual, and that the approach taken will depend upon the level of information available for individual RFDs.
Input from Engagement	Information and concerns raised during the engagement process undertaken for the Project (Volume 2) will be incorporated into the noise and vibration assessment according to the methods defined in Section 4.1.4; specific issues raised will be documented in the assessment and a description of how the issue was addressed will be provided.	
Incorporation of Indigenous Traditional Knowledge (ITK)	The general methods that will be used to integrate local and ITK into the noise and vibration assessment are defined in Section 4.1.5. Specific types of ITK that may be used in the noise and vibration assessment are anticipated to include the following information types and sources: ■ locations of cabins, camps, and other dwellings where disturbance from noise and vibration may occur ■ hunting and fishing locations where disturbance from noise and vibration may occur ■ recreational, spiritual, and cultural locations where disturbance from noise and vibration may occur ■ observations and knowledge of how noise and vibration from anthropogenic sources may disturb or otherwise affect wildlife	
Existing Environment	The description of the existing environment provided in the Developer's Assessment Report for noise and vibration will follow the general methods outlined in Section 4.1.6 and will expand on the information provided in Volume 3. The description of existing environment will incorporate historical and recent baseline sampling information regarding representative noise and vibration levels in the LSA and RSA for a variety of environmental conditions. The existing baseline information related to noise and vibration is considered adequate to complete the effects assessment. No additional baseline information is recommended to be collected for the noise and vibration component (Volume 3, Appendix C).	
Project Interactions and Mitigations	Identification of Project interactions and mitigations for the noise and vibration component will follow the general methods outlined in Section 4.1.7. A description of the anticipated Project-environment interactions identified for noise and vibration, along with the associated residual effects categorization (i.e., no pathway, secondary, or primary) and proposed mitigation measures, is provided in Volume 4.	

Residual Effects Analysis	The residual effects analysis for the noise and vibration component will follow the general methods outlined in Section 4.1.8 and will focus on the Project-environment interactions that are determined to be primary in the pathway analysis (Volume 4). Two Project-environment interactions were determined to be primary for noise and vibration. Assessment methods that will be used to evaluate the potential residual environmental effects of these pathways on the noise and vibration intermediate component are described below.
	■ Noise emissions from Project activities and equipment will increase sound levels.
	  ■ Computer noise models will be developed for one snapshot of construction activities and one or two snapshots of activities during operation. The computer noise models will make use of the ISO 9613-2 (ISO 1996) technical standard to simulate noise propagation. Inputs to the computer models will include source noise emissions in the form octave band sound power levels, as well as environmental parameters that influence propagation (e.g., wind speed/direction, temperature, ground cover).
	  ■ Computer noise models will be used to predict Project sound levels ($L_{eq,day}$, $L_{eq,night}$, L_{dn}) at sensitive receptors identified based on ITK and for a receptor grid that covers the LSA and RSA.
	  ■ Predicted Project sound levels will be compared to thresholds from appropriate guidance documents. Guidance documents that may be considered in the noise assessment include Environment Canada's *Environmental Code of Practice for Metal Mines*, Health Canada's *Guidance for Evaluating Human Health Impacts in Environmental Assessment: Noise*, and Alberta Energy Regulator Directive 038: Noise Control. There is no equivalent guidance available in the NWT.
	  ■ Predicted Project sound levels will also be compared to existing noise levels measured in the LSA and RSA to characterize Project-related changes.
	  ■ Sound levels from closure and reclamation will not be modelled but will instead be assessed qualitatively, on the understanding that Project activities during this phase will be similar, but less intense, than during construction.
	  ■ There are no regulatory or guidance documents that provide noise assessment thresholds specific to caribou or other wildlife species. As such, it will not be possible to provide a quantitative assessment of effects on wildlife as part of the noise and vibration component. Instead, noise modelling results will be provided to the wildlife component for consideration in a holistic assessment of sensory disturbance to wildlife.
	■ Blasting will result in ground vibration and airblast overpressure.
	  ■ Numerical models of explosive blasting will be developed for one snapshot of construction activities and one or two snapshots of operation activities. The numerical models will make use of empirical formulae from blasting handbooks. Inputs to the numerical models will include charge mass, burden depth, and parameters that describe the blasting substrate.
	  ■ Numerical blasting models will be used to predict ground vibration (peak particle velocity) and airblast overpressure (peak pressure level) at sensitive receptors identified based on ITK and as a function of distance from the blast site.	

Table 4-6: Assessment Methods for Noise (Including Vibration)

Assessment Approach for SON-1: Impacts to Noise (Including Vibration)	
	▪ Predicted Project ground vibration and airblast overpressure levels will be compared to thresholds from appropriate guidance documents. Guidance documents that may be considered in the vibration assessment include Environment Canada's *Environmental Code of Practice for Metal Mines* and the Australia and New and New Zealand Environment Council's *Technical Basis for Guidelines to Minimise Annoyance Due to Blasting Overpressure and Ground Vibration*. There is no equivalent guidance available in the NWT. ▪ There are no regulatory or guidance documents that provide ground vibration or airblast overpressure thresholds specific to caribou or other wildlife species. As such, it will not be possible to provide a quantitative assessment of effects on wildlife as part of the noise and vibration component. Instead, blast modelling results will be provided to the wildlife component for consideration in a holistic assessment of sensory disturbance to wildlife.
Residual Effects Classification	The residual effects classification completed for the noise and vibration assessment will follow the methods defined in Section 4.1.9. Component-specific definitions will be developed for the residual effects classification criteria of direction, magnitude, geographic extent, duration, reversibility, frequency, and probability of occurrence. Due to the considerations noted in Section 4.1.9, a determination of significance will not be completed for vibration and noise, which will be considered as an intermediate component in the Developer's Assessment Report.
Prediction Confidence and Uncertainty	Prediction confidence and uncertainty will be evaluated according the general methods defined in Section 4.1.10. Key sources of uncertainty that are relevant to noise and vibration, and that will be addressed in the Developer's Assessment Report, are anticipated to include the consideration of the following elements: ■ location and noise emissions for Project equipment and activities ■ location, size, and construction materials used in Project buildings ■ location, charge mass, burden depth, and substrate parameters for Project blasting ■ adequacy of baseline data for understanding current conditions and future changes unrelated to the Project
Monitoring and Follow-up	The noise and vibration section of the Developer's Assessment Report will include a description of the monitoring activities proposed to address uncertainties associated with effect predictions and the performance of environmental design features and mitigation related to the Project. As described in Section 4.1.11, the description of monitoring activities will include consideration of both compliance monitoring and follow-up monitoring. Noise and vibration monitoring is anticipated to consist of the following: ■ One round of noise and vibration monitoring during the construction phase. The monitoring should occur during a period when construction activities are expected to be most intense. Specific monitoring locations will be selected based on the results of noise and vibration modelling. ■ One round of noise and vibration monitoring during the operation phase. The monitoring should occur as soon as practical after the commencement of full operation. Specific monitoring locations will be selected based on the results of noise and vibration modelling. The noise and vibration section of the Developer's Assessment Report will include a description of the specific objectives, monitoring techniques and general analysis procedures that will be used for the planned monitoring activities. The design of monitoring activities will incorporate ITK and information gathered through engagement with communities, where appropriate.
Supporting Annexes	Supporting documentation relevant to the noise and vibration assessment is anticipated to include the following annex which will be appended to the noise and vibration section of the Developer's Assessment Report: ■ Noise and Vibration Modelling Report Other information sources will be considered in the noise and vibration assessment (see the "Information Sources" section above) but will not be appended to the noise and vibration section of the Developer's Assessment Report.

Table 4-7: Assessment Methods for Climate

Assessment Approach for SON-1: Impacts to Climate		
Information Sources	Information sources that will be used to support the climate assessment scoping are anticipated to include the relevant sources listed in Section 4.1.1 and the following: ■ The Air Quality, Noise, and Climate Baseline Report ■ The emission inventory developed for the air quality assessment based primarily on fuel use information provided by PPML ■ Published emission factors and greenhouse gas data presented in Canada's Official Greenhouse Gas Inventory (Government of Canada n.d.) ■ The *Draft Strategic Assessment of Climate Change* document produced by Environment and Climate Change Canada (ECCC) (Government of Canada 2019) provides guidance on how federal assessments will consider a project's greenhouse gas (GHG) emissions and its resilience to climate change effects. Although this is not a federal assessment, the methods for evaluation will remain the same.	
Intermediate Components and Measurement Indicators	Intermediate Component(s)	Climate will be considered as an intermediate component in the Developer's Assessment Report. A rationale for the selection of climate as an intermediate component is provided in Section 2.0 and Table 2-2.
	Measurement Indicators	Measurement indicators for climate are defined in Section 4.1.2 and Table 4-2. As climate is an intermediate component, an assessment endpoint is not defined (Section 4.1.2).
Environmental Assessment Boundaries	Spatial Boundaries	The spatial boundaries considered in the climate assessment will be considered in the spatial context of the NWT and of Canada.
	Temporal Boundaries	The climate change assessment will be based on the highest predicted GHG emissions year projected for the Project.
	Assessment Cases	The climate change assessment will be based on the Project emissions relative to existing emissions in the NWT and Canada
Input from Engagement	Information and concerns raised during the engagement process undertaken for the Project (Section 4.1.4 and Volume 2) will be considered in the climate assessment; specific issues raised will be documented in the assessment and a description of how the issue was addressed will be provided.	
Incorporation of Indigenous Traditional Knowledge (ITK)	The general methods that will be used to integrate local and ITK into the climate assessment are defined in Section 4.1.5. Specific types of ITK that may be used in the climate assessment are anticipated to include the following information types and sources: ■ Feedback from communities gathered in the consultation process will be incorporated in the climate assessment to the extent possible.	
Existing Environment	The description of the existing environment provided in the Developer's Assessment Report for climate will follow the general methods outlined in Section 4.1.6 and will expand on the information provided in Volume 3. The existing baseline information related to climate is considered adequate to complete the effects assessment. No additional baseline information is recommended to be collected for the climate component (Volume 3, Appendix C).	
Project Interactions and Mitigations	Identification of Project interactions and mitigations for the climate component will follow the general methods outlined in Section 4.1.7.	
Residual Effects Analysis	The residual effects analysis for the climate component will follow the general methods outlined in Section 4.1.8 and will focus on the Project-environment interactions that are determined to be primary in the pathway analysis (Volume 4). One Project-environment interaction was determined to be primary for climate. Assessment methods that will be used to evaluate the potential residual environmental effects of this pathways on the climate intermediate component are described below. ■ Greenhouse gas emissions from land use change and fossil fuel combustion can affect climate. ■ Greenhouse gas emissions will be quantified from Project activities and evaluated in the context of the territorial and national totals.	
Residual Effects Classification	The residual effects classification completed for the climate assessment will follow the methods defined in Section 4.1.9. Component-specific definitions will be developed for the residual effects classification criteria of direction, magnitude, geographic extent, duration, reversibility, frequency, and probability of occurrence. A determination of significance will not be completed for climate, which will be considered as an intermediate component in the Developer's Assessment Report (Section 4.1.9).	
Prediction Confidence and Uncertainty	Prediction confidence and uncertainty will be evaluated according the general methods defined in Section 4.1.10. Key sources of uncertainty that are relevant to the climate assessment, and that will be addressed in the Developer's Assessment Report, are anticipated to include the consideration of the following elements: ■ Preliminary fuel combustion information is expected to be used to estimate the GHG emissions from the Project. The level of certainty regarding the predicted emissions is directly related to the level of certainty in the fuel consumption estimates provided by PPML	
Monitoring and Follow-up	Direct greenhouse gas monitoring is not expected for the Project; however, fuel records will be maintained and emissions of GHGs will reported to the territorial and federal programs as appropriate and dependent upon meeting emissions thresholds.	
Supporting Annexes	There are no supporting annexes planned for the climate assessment.	

4.2.1.2 SON-2: Impacts to Groundwater Quantity and Quality

A description of the assessment methods expected to be used in the Developer's Assessment Report for the groundwater quantity and quality component is provided in Table 4-8.

Table 4-8: Assessment Methods for Groundwater Quantity and Quality

Assessment Approach for SON-2: Impacts to Groundwater Quantity and Quality		
Information Sources	Information sources that will be used to support the groundwater quantity and quality assessment scoping are anticipated to include the relevant sources listed in Section 4.1.1 and the following: ■ the Groundwater Quantity and Quality Baseline Report ■ public sources for hydrogeological information ■ published information from other mine sites in the north ■ the site water balance ■ environmental management and monitoring plans, including framework or conceptual versions of the Water Management Plan, Tailings and Waste Rock Management Plan, Waste Management Plan, and Closure and Reclamation Plan ■ territorial and federal legislation and guidance such as the NWT's *Mackenzie Valley Resource Management Act* and *Waters Act*	
Intermediate Components and Measurement Indicators	Intermediate Component(s)	Groundwater quantity and quality will be considered as an intermediate component in the Developer's Assessment Report. A rationale for the selection of groundwater quantity and quality as an intermediate component is provided in Section 2.0 and Table 2-2.
	Measurement Indicators	Measurement indicators for groundwater quantity and quality are defined in Section 4.1.2 and Table 4-2. As groundwater quantity and quality is an intermediate component, an assessment endpoint is not defined (Section 4.1.2).
Environmental Assessment Boundaries	Spatial Boundaries	The spatial boundaries considered in the groundwater quantity and quality assessment will include a local study area (LSA) and a broader regional study area (RSA; Section 4.1.3): ■ The LSA includes all active mineral claims, existing bush roads, cutlines, historic railbed, waste rock piles, and backfilled and mined pits (Figure 4-3). The western and eastern boundaries of the LSA are defined by the western boundary of the Twin Creek watershed and the eastern boundary of the Paulette Creek watershed, respectively. The northern extent of the LSA includes a 10-m buffer north of the shoreline of Great Slave Lake and the outlets of the Twin Creek, Buffalo River, and Paulette Creek. The southern extent of the LSA includes Highway 6, connecting the western and eastern boundaries. It will align with the surface water quantity, water quality, and fish and fish habitat LSA. The LSA is anticipated to be large enough to capture direct and indirect effects on groundwater flow and quality resulting from the Project. ■ The RSA includes the LSA plus Birch Creek, which is located 5 km to the west of the LSA (Figure 4-4). The RSA boundary extends 2 km into Great Slave Lake and provides broader context for characterizing baseline conditions and capturing the maximum potential effects from the Project. It will align with the RSA for surface water quantity and water quality.
	Temporal Boundaries	The temporal boundaries for the groundwater quantity and quality assessment will focus on the Project phases defined in Section 4.1.3: construction, operation, and closure and reclamation. The assessment will also consider potential effects on groundwater quantity and quality during post-closure, where relevant. It is anticipated that quantitative modelling for the groundwater quantity and quality assessment will focus on the following three time snapshots: ■ baseline (pre-Project / existing conditions) focused on stream flows and groundwater levels and quality ■ when maximum areal extent of the Project is reached and maximum pit depth/extents are achieved (i.e., often end of mine life, but not always) ■ far future scenario; post-closure when the groundwater system reaches steady state conditions (i.e., often used is 100 years after end of mining operations)
	Assessment Cases	■ The groundwater quantity and quality residual effects analysis will consist of up to three assessment cases, as defined in Section 4.1.3: a Base Case, an Application Case and, if required, a Reasonably Foreseeable Development (RFD) Case. The methods that will be used to assess the Base Case and the Application Case are defined in Section 4.1.3 and in the "Existing Environment" and "Residual Effects Analysis" descriptions provided below. ■ The determination of whether an RFD Case assessment will be included in the groundwater quantity and quality section will be made during preparation of the Developer's Assessment Report, based on the methods outlined in Section 4.1.3. If an RFD Case is required, it is

Table 4-8: Assessment Methods for Groundwater Quantity and Quality

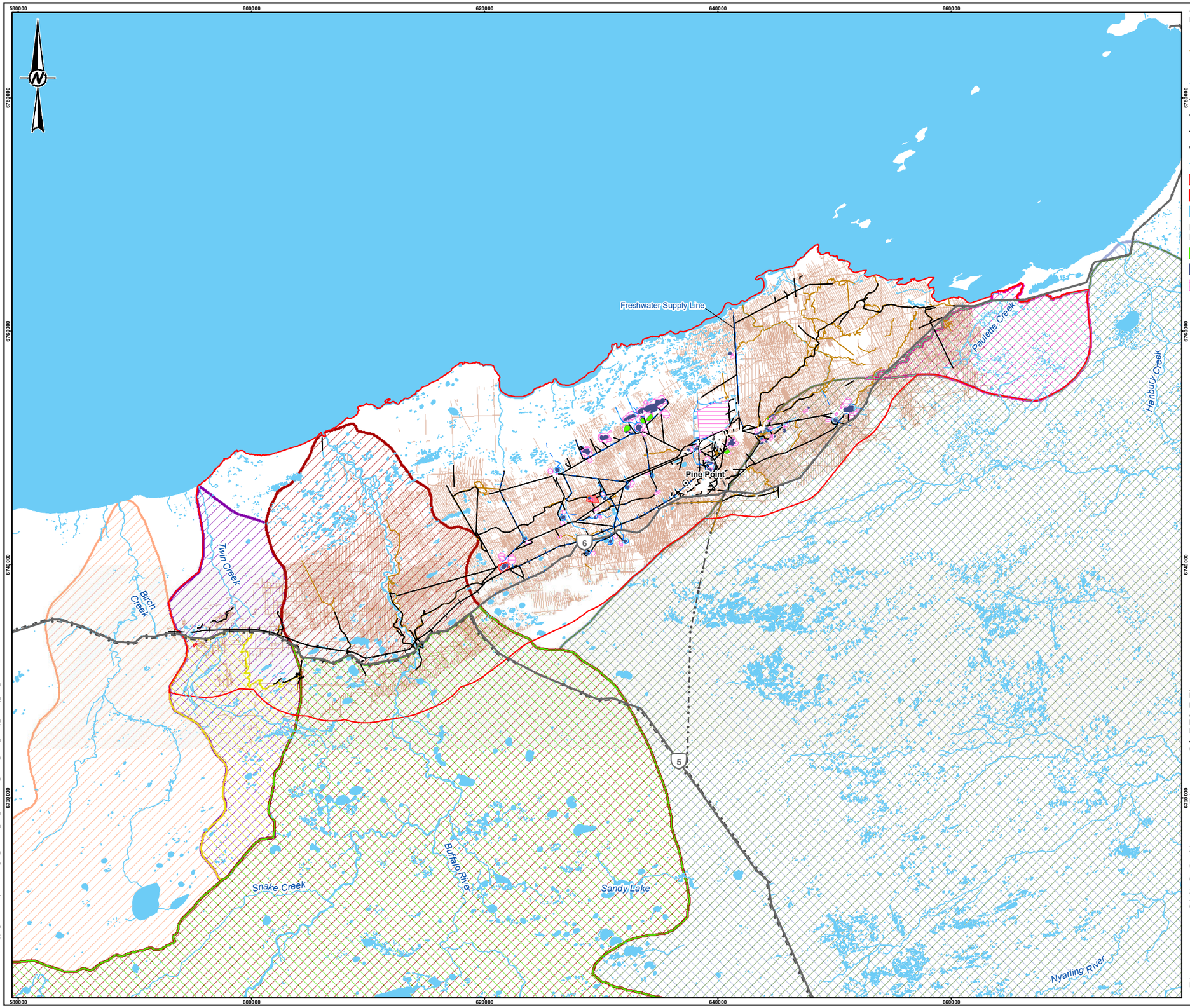
Assessment Approach for SON-2: Impacts to Groundwater Quantity and Quality		
		anticipated that the assessment will be qualitative and conceptual, and that the approach taken will depend upon the level of information available for individual RFDs.
Input from Engagement	Information and concerns raised during the engagement process undertaken for the Project (Volume 2) will be incorporated into the groundwater quantity and quality assessment according to the methods defined in Section 4.1.4; specific issues raised will be documented in the assessment and a description of how the issue was addressed will be provided.	
Incorporation of Indigenous Traditional Knowledge (ITK)	The general methods that will be used to integrate local and ITK into the groundwater quantity and quality assessment are defined in Section 4.1.5. Specific types of ITK that may be used in the groundwater quantity and quality assessment are anticipated to include the following information types and sources: ■ observations on the locations of springs, wells, or areas of groundwater upwelling or artesian flows ■ observations related to groundwater flows or seasonal fluctuations in groundwater ■ Indigenous use of groundwater resources (i.e., as drinking water or for other purposes)	
Existing Environment	The description of the existing environment provided in the Developer's Assessment Report for groundwater quantity and quality will follow the general methods outlined in Section 4.1.6 and will expand on the information provided in Volume 3. The description of existing environment will include characterization of groundwater flow, recharge and discharge sources, hydraulic conductivity of hydrostratigraphic units, groundwater quantity, and groundwater quality. Additional information recommended to be collected for the groundwater quantity and quality component in the baseline study plan for the Project (Volume 3, Appendix C) will be included in the existing environment description.	
Project Interactions and Mitigations	Identification of Project interactions and mitigations for the groundwater quantity and quality component will follow the general methods outlined in Section 4.1.7. A description of the anticipated Project-environment interactions identified for groundwater quantity and quality, along with the associated residual effects categorization (i.e., no pathway, secondary or primary) and proposed mitigation measures, is provided in Volume 4.	
Residual Effects Analysis	The residual effects analysis for the groundwater quantity and quality component will follow the general methods outlined in Section 4.1.8 and will focus on the Project-environment interactions that are determined primary in the pathway analysis (Volume 4). One Project-environment interaction was determined to be primary for groundwater quantity and quality: ■ Development of open pits and underground mines can change groundwater flow patterns and distribution. In addition, one Project-environment interaction may be assessed as either primary or secondary depending on the outcome of environmental modelling work and confirmation of Project design details. In the event that this pathway is determined to be secondary in the pathway analysis, it will not be carried forward to the residual effects analysis. ■ Development of open pits and underground mines can change groundwater quality. Assessment methods that will be used to evaluate the potential residual environmental effects of these pathways on the surface water quantity intermediate component are described below. The effects on measurement indicators of groundwater quantity and quality will be evaluated with an industry standard numerical groundwater flow model (e.g., FEEFLOW or MODFLOW). As a result of mining operations, groundwater drawdown and groundwater discharge to the mine pits will be simulated for various assessment cases and time snapshots. The drawdown simulation results will be compared to existing (baseline) conditions. Changes to groundwater discharge will also be computed at locations of discharge to surface water. Particle tracking analysis will be completed to delineate the mine contact groundwater seepage pathways to the receptors and quantify the seepage rates. To evaluate potential changes to groundwater quality, groundwater discharge rates will be multiplied by geochemical source term concentrations and combined with the larger runoff component for contact water to compute the change in concentrations and loading for surface water quality. The groundwater model predictions will be used as inputs to the surface water quantity (hydrology) and surface water quality assessments. Technically and economically feasible mitigation options will be identified in coordination with the hydrology and surface water quality components.	
Residual Effects Classification	The residual effects classification completed for the groundwater quantity and quality assessment will follow the methods defined in Section 4.1.9. Component-specific definitions will be developed for the residual effects classification criteria of direction, magnitude, geographic extent, duration, reversibility, frequency, and probability of occurrence. Due to the considerations noted in Section 4.1.9, a determination of significance will not be completed for groundwater quantity and quality, which will be considered as an intermediate component in the Developer's Assessment Report.	
Prediction Confidence and Uncertainty	Prediction confidence and uncertainty will be evaluated according the general methods defined in Section 4.1.10. Key sources of uncertainty that are relevant to the surface water quantity assessment, and that will be addressed in the Developer's Assessment Report, are anticipated to include the consideration of the following elements: ■ groundwater modelling inputs (e.g., pit inflow volumes, groundwater quality) and results ■ adequacy of baseline data for understanding current conditions and future changes unrelated to the Project	

Table 4-8: Assessment Methods for Groundwater Quantity and Quality

Assessment Approach for SON-2: Impacts to Groundwater Quantity and Quality	

Monitoring and Follow-up	The groundwater quality and quantity section of the Developer's Assessment Report will include a description of the monitoring activities proposed to address the uncertainties associated with effect predictions and the performance of environmental design features and mitigation related to the Project. As described in Section 4.1.11, the description of monitoring activities will include consideration of both compliance monitoring and follow-up monitoring.
	Monitoring of groundwater quality and levels is anticipated and will include the following elements:
	■ A Surveillance Network Program required as a condition of a future Type A Water Licence issued for the Project, which will include:
	  ■ monitoring of groundwater inflow quantity and quality to the open pits and underground mining areas
	  ■ monitoring of groundwater levels to evaluate drawdown propagation from pumping
	  ■ monitoring of seepage quantity and quality from the waste rock storage areas
	The groundwater quality and quantity section of the Developer's Assessment Report will include a description of the specific objectives, monitoring techniques and general analysis procedures that will be used for the planned monitoring activities. Where applicable, links to adaptive management responses will be defined. The design of monitoring activities will also consider previously collected data and will incorporate ITK and information gathered through engagement with communities, where appropriate.

Supporting Annexes	Supporting documentation relevant to water quality is anticipated to include the following annexes which will be appended to the water quality section of the Developer's Assessment Report: ■ Groundwater Quantity and Quality Baseline Report ■ Groundwater Quantity and Quality Modelling Report Other information sources will be considered in the water quality assessment (see the "Information Sources" section above) but will not be appended to the water quality section of the Developer's Assessment Report.



LEGEND

- FORMER PINE POINT TOWN SITE
- BUSH ROAD
- CUTLINE
- DRAINAGE DITCH
- HISTORIC RAILBED
- HIGHWAY
- MINE ROAD
- TRANSMISSION LINE
- WATERCOURSE
- CUTBLOCK
- LOCAL STUDY AREA -
- WATERBODY

PINE POINT EXISTING MINING DISTURBANCE

- BACKFILLED PIT
- MINED PIT
- WASTE PILE

WATERSHEDS

- BIRCH CREEK
- BUFFALO RIVER
- BUFFALO RIVER AT HIGHWAY 5
- LITTLE BUFFALO RIVER
- LITTLE BUFFALO RIVER AT HWY 6
- PAULETTE CREEK
- PAULETTE CREEK AT HIGHWAY 6
- TWIN CREEK
- TWIN CREEK AT HIGHWAY 5

0 5 10
1:325,000 KILOMETRES

REFERENCE(S)

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PROJECTION: UTM ZONE 11N DATUM: NAD83

CLIENT
PINE POINT MINING LTD.

PROJECT
PINE POINT PROJECT

TITLE
GROUNDWATER QUANTITY AND QUALITY, SURFACE WATER QUANTITY AND QUALITY, AND FISH AND FISH HABITAT LOCAL STUDY AREA

CONSULTANT
GOLDER

YYYY-MM-DD	2020-12-15
DESIGNED	JV
PREPARED	MM/PMT
REVIEWED	JV
APPROVED	JV

PROJECT NO.	CONTROL	REV.	FIGURE
19125747		0	4-3

580000 600000 620000 640000 660000

6780000 6760000 6740000 6720000

Freshwater Supply Line
Pine Point
Paulette Creek
Hanbury Creek
Twin Creek
Birch Creek
Snake Creek
Buffalo River
Sandy Lake
Nyarling River
6
5

LEGEND

- FORMER PINE POINT TOWN SITE
- BUSH ROAD
- CUTLINE
- DRAINAGE DITCH
- HISTORIC RAILBED
- HIGHWAY
- MINE ROAD
- TRANSMISSION LINE
- WATERCOURSE
- CUTBLOCK
- REGIONAL STUDY AREA -
- WATERBODY

PINE POINT EXISTING MINING DISTURBANCE

- BACKFILLED PIT
- MINED PIT
- WASTE PILE

WATERSHEDS

- BIRCH CREEK
- BUFFALO RIVER
- BUFFALO RIVER AT HIGHWAY 5
- LITTLE BUFFALO RIVER
- LITTLE BUFFALO RIVER AT HWY 6
- PAULETTE CREEK
- PAULETTE CREEK AT HIGHWAY 6
- TWIN CREEK
- TWIN CREEK AT HIGHWAY 5

KEY MAP

0 5 10
1:325,000 KILOMETRES

REFERENCE(S)

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PROJECTION: UTM ZONE 11N DATUM: NAD83

CLIENT
PINE POINT MINING LTD.

PROJECT
PINE POINT PROJECT

TITLE
GROUNDWATER QUANTITY AND QUALITY, SURFACE WATER QUANTITY AND QUALITY, AND FISH AND FISH HABITAT REGIONAL STUDY AREA

CONSULTANT
GOLDER

YYYY-MM-DD	2020-12-15
DESIGNED	JV
PREPARED	MM/PMT
REVIEWED	JV
APPROVED	JV

PROJECT NO.	CONTROL	REV.	FIGURE
19125747		0	4-4

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

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4.2.1.3 SON-3: Impacts to Surface Water Quantity

A description of the assessment methods expected to be used in the Developer's Assessment Report for the surface water quantity component is provided in Table 4-9.

Table 4-9: Assessment Methods for Surface Water Quantity

Assessment Approach for SON-3: Impacts to Surface Water Quantity		
Information Sources	Information sources that will be used to support the surface water quantity assessment scoping are anticipated to include the relevant sources listed in Section 4.1.1 and the following: ■ the Water Quantity Baseline Report ■ historical hydrometric data collected by the Water Survey of Canada ■ historical climate data available from various publicly available sources including Environment and Climate Change Canada ■ historical snowpack data available from the Government of the Northwest Territories (GNWT) annual snow surveys (GNWT-ENR 2020) ■ historical climate global re-analysis data from the European Centre for Medium-Range Weather Forecasts (ECMWF 2020) ■ historical remotely sensed snowpack data available from the European Space Agency (ESA 2019) ■ results of the effects assessments for groundwater quantity and quality ■ the site water balance ■ environmental management and monitoring plans, including framework or conceptual versions of the Water Management Plan, Tailings and Waste Rock Management Plan, Erosion and Sediment Control Plan, Waste Management Plan, Closure and Reclamation Plan, and Aquatic Effects Monitoring Program ■ territorial and federal legislation and guidance such as the NWT's *Mackenzie Valley Resource Management Act* and *Waters Act*	
Intermediate Components and Measurement Indicators	Intermediate Component(s)	Surface water quantity will be considered as an intermediate component in the Developer's Assessment Report. A rationale for the selection of surface water quantity as an intermediate component is provided in Section 2.0 and Table 2-2.
	Measurement Indicators	Measurement indicators for surface water quantity are defined in Section 4.1.2 and Table 4-2. As surface water quantity is an intermediate component, an assessment endpoint is not defined (Section 4.1.2).
Environmental Assessment Boundaries	Spatial Boundaries	The spatial boundaries considered in the surface water quantity assessment will include a local study area (LSA) and a broader regional study area (RSA) (Section 4.1.3): ■ The LSA includes all active mineral claims, existing bush roads, cutlines, historic railbed, waste rock piles, and backfilled and mined pits (Figure 4-3). The western and eastern boundaries of the LSA are defined by the western boundary of the Twin Creek watershed and the eastern boundary of the Paulette Creek watershed, respectively. The northern extent of the LSA includes a 10-m buffer north of the shoreline of Great Slave Lake and the outlets of the Twin Creek, Buffalo River, and Paulette Creek. The southern extent of the LSA includes Highway 6, connecting the western and eastern boundaries. It will align with the surface water quantity, water quality, and fish and fish habitat LSA. The LSA is anticipated to be large enough to capture direct and indirect effects on surface water flows and levels resulting from the Project. ■ The RSA includes the LSA plus Birch Creek, which is located 5 km to the west of the LSA (Figure 4-4). The RSA boundary extends 2 km into Great Slave Lake and provides broader context for characterizing baseline conditions and capturing the maximum potential effects from the Project. It will align with the RSA for groundwater quantity and quality and surface water quality.
	Temporal Boundaries	The temporal boundaries for the surface water quantity assessment will include the Project phases defined in Section 4.1.3: construction, operation, and closure and reclamation. The assessment will also consider potential effects on surface water quantity during post-closure, where relevant. It is anticipated that quantitative modelling for the surface water quantity assessment will focus on one snapshot of construction activities, one snapshot of operation activities, one snapshot of closure and reclamation activities, and one snapshot for post-closure. Specific assessment snapshots will aim to capture the maximum effects of the Project within each Project phase and in post-closure. Specific assessment snapshots will be selected once additional Project design details become available. Quantitative modelling for each snapshot will be completed over a range of historical climate conditions to incorporate natural variations in climate.

Table 4-9: Assessment Methods for Surface Water Quantity

Assessment Approach for SON-3: Impacts to Surface Water Quantity		
Environmental Assessment Boundaries (cont'd)	Assessment Cases	■ The surface water quantity residual effects analysis will consist of up to three assessment cases, as defined in Section 4.1.3: a Base Case, an Application Case and, if required, a Reasonably Foreseeable Development (RFD) Case. The methods that will be used to assess the Base Case and the Application Case are defined in Section 4.1.3 and in the "Existing Environment" and "Residual Effects Analysis" descriptions provided below. ■ The determination of whether an RFD Case assessment will be included in the surface water quantity section will be made during preparation of the Developer's Assessment Report, based on the methods outlined in Section 4.1.3. If an RFD Case is required, it is anticipated that the assessment will be qualitative and conceptual, and that the approach taken will depend upon the level of information available for individual RFDs.
Input from Engagement	Information and concerns raised during the engagement process undertaken for the Project (Volume 2) will be incorporated into the surface water quantity assessment according to the methods defined in Section 4.1.4; specific issues raised will be documented in the assessment and a description of how the issue was addressed will be provided.	
Incorporation of Indigenous Traditional Knowledge (ITK)	The general methods that will be used to integrate local and ITK into the surface water quantity assessment are defined in Section 4.1.5. Specific types of ITK that may be used in the surface water quantity assessment are anticipated to include: ■ observations of the timing and duration of historical drought periods including or photographs showing water levels ■ observations of the timing and duration of historical flooding including or photographs showing water levels ■ observations of changes in local water quantity conditions over time	
Existing Environment	The description of the existing environment provided in the Developer's Assessment Report for surface water quantity will follow the general methods outlined in Section 4.1.6 and will expand on the information provided in Volume 3. The description of existing environment will incorporate historical and recent baseline sampling information regarding hydroclimate (e.g., rainfall, snowfall, evaporation), drainage patterns, water levels, and discharges. Additional information recommended to be collected for the surface water quantity component in the baseline study plan for the Project (Volume 3, Appendix C) will be included in the existing environment description. This will include information from four open-water hydrological field programs on Paulette Creek and Twin Creek and the Buffalo River planned in 2020. Further details are provided in Volume 3, Appendix C.	
Project Interactions and Mitigations	Identification of Project interactions and mitigations for the surface water quantity component will follow the general methods outlined in Section 4.1.7. A description of the anticipated Project-environment interactions identified for surface water quantity, along with the associated residual effects categorization (i.e., no pathway, secondary, or primary) and proposed mitigation measures, is provided in Volume 4.	
Residual Effects Analysis	The residual effects analysis for the surface water quantity component will follow the general methods outlined in Section 4.1.8 and will focus on the Project-environment interactions that are determined primary in the pathway analysis (Volume 4). Four Project-environment interactions were determined to be primary for surface water quantity: ■ Project operation and footprint may alter site drainage and runoff and change local hydrology, which can affect drainage patterns and timing. ■ During closure, residual ground disturbance, cessation of site water management activities, and reconnection of drainages to the surface water environment may cause changes to local hydrology, which can affect drainage patterns and timing. ■ Physical changes to land cover and land surface can result in changes to local hydrological processes and water balance. ■ Development of open pits and underground mines and associated surface and groundwater changes can result in local increases or decreases in surface water quantity, which may change surface water flow regimes. In addition, one Project-environment interaction may be assessed as either primary or secondary depending on the outcome of environmental modelling work and confirmation of Project design details. In the event that this pathway is determined to be secondary in the pathway analysis, it will not be carried forward to the residual effects analysis. ■ Water supply requirements (potable and process) and water discharge for the Project may alter local hydrology and water balance.	

Table 4-9: Assessment Methods for Surface Water Quantity

Assessment Approach for SON-3: Impacts to Surface Water Quantity	
Residual Effects Analysis (cont'd)	Assessment methods that will be used to evaluate the potential residual environmental effects of these pathways on the surface water quantity intermediate component are described below. The core model framework is expected to be GoldSim (it is anticipated that the site water quality model may also be developed in GoldSim). The receiving environment surface water quantity model will integrate the hydrogeological quantity modelling and the mine site water balance. The model will be based on a Geographic Information System sub-watershed analysis and will consider rainfall and snowmelt runoff, lake storage and attenuation, lake evaporation, snow sublimation, as well as ice conditions at local lakes and streams, and mine site water management activities. The spatial domain of the receiving environment surface water quantity model will be the surface water quantity assessment LSA. Reference conditions in watercourses originating outside of the LSA will be estimated based on historical baseline data. The predicted changes to surface water quantity in the LSA calculated in the receiving environment surface water quantity model will be applied to historical baseline data for watercourses passing through the LSA in order to estimate conditions under the different Project phases. Simplified hydraulic models assuming uniform flow will be used to estimate changes in stream channel parameters resulting from changes in discharge. The receiving environment surface water quantity model predictions will be used as inputs to the surface water quality and fish and fish habitat components. Technically and economically feasible mitigation will be identified in coordination with the air quality, groundwater quantity and quality, surface water quality, and fish and fish habitat components.
Residual Effects Classification	The residual effects classification for the surface water quantity assessment will follow the methods defined in Section 4.1.9. Component-specific definitions will be developed for the residual effects classification criteria of direction, magnitude, geographic extent, duration, reversibility, frequency, and probability of occurrence. Due to the considerations noted in Section 4.1.9, a determination of significance will not be completed for surface water quantity, which will be considered as an intermediate component in the Developer's Assessment Report.
Prediction Confidence and Uncertainty	Prediction confidence and uncertainty will be evaluated according the general methods defined in Section 4.1.10. Key sources of uncertainty that are relevant to the surface water quantity assessment, and that will be addressed in the Developer's Assessment Report, are anticipated to include the consideration of the following elements: ■ water balance modelling inputs and results ■ adequacy of baseline data for understanding current conditions and future changes unrelated to the Project ■ non-stationarity of climate data used as input for water balance modelling Prediction confidence and uncertainty with respect to groundwater quantity are also relevant to the surface water quantity assessment and will be considered in the surface water quantity section of the Developer's Assessment Report.
Monitoring and Follow-up	The surface water quantity section of the Developer's Assessment Report will include a description of the monitoring activities proposed to address the uncertainties associated with effect predictions and the performance of environmental design features and mitigation related to the Project. As described in Section 4.1.11, the description of monitoring activities will include consideration of both compliance monitoring and follow-up monitoring. Monitoring of surface water quantity will include the following elements: ■ an Aquatic Effects Monitoring Program, required as a condition of a future Type A Water Licence issued for the Project ■ a Surveillance Network Program required as a condition of a future Type A Water Licence issued for the Project Monitoring activities defined for the groundwater quantity and water quality components are also relevant to the surface water quantity component and will be considered in the surface water quantity section of the Developer's Assessment Report. Surface water quantity monitoring activities are often completed to support data needs for accompanying surface water quality monitoring. The surface water quantity section of the Developer's Assessment Report will include a summary description of the specific objectives, monitoring techniques, and general analysis procedures that will be used for the planned monitoring activities. Where applicable, links to adaptive management responses will be defined. The design of monitoring activities will also consider previously collected data and will incorporate ITK gathered through engagement with communities, where appropriate.
Supporting Annexes	Supporting documentation relevant to water quality is anticipated to include the following annexes which will be appended to the surface water quantity section of the Developer's Assessment Report: ■ Surface Water Quantity Baseline Report ■ Surface Water Quantity Modelling Report Other information sources will be considered in the surface water quantity assessment (see the "Information Sources" section above) but will not be appended to the surface water quantity section of the Developer's Assessment Report.

4.2.1.4 KLOI-1: Impacts to Water Quality

A description of the assessment methods expected to be used in the Developer's Assessment Report for the surface water quality component is provided in Table 4-10.

Table 4-10: Assessment Methods for Water Quality

Assessment Approach for KLOI-1: Impacts to Water Quality		
Information Sources	Information sources that will be used to support the water quality assessment scoping are anticipated to include the relevant sources listed in Section 4.1.1 and the following: ■ the Water Quality Baseline Report ■ results of the effects assessments for groundwater quantity and quality, and surface water quantity, air quality, terrain and soils, and vegetation ■ environmental management and monitoring plans, including framework or conceptual versions of the Water Management Plan, Tailings and Waste Rock Management Plan, Erosion and Sediment Control Plan, Spill Contingency Plan, Waste Management Plan, Closure and Reclamation Plan, and Aquatic Effects Monitoring Program ■ territorial and federal legislation and guidance such as the NWT's *Mackenzie Valley Resource Management Act* and *Waters Act*, the Metal and Diamond Mining Effluent Regulations (MDMER), and federal Canadian Water and Sediment Quality Guidelines as per the Canadian Council of Ministers of the Environment	
Intermediate Components and Measurement Indicators	Intermediate Component(s)	Surface water quality will be considered as an intermediate component in the Developer's Assessment Report. A rationale for the selection of surface water quantity as an intermediate component is provided in Section 2.0 and Table 2-2.
	Measurement Indicators	The assessment endpoints and measurement indicators recommended to be used in the water quality assessment are defined in Section 4.1.2 and Table 4-1. As surface water quantity is an intermediate component, an assessment endpoint is not defined (Section 4.1.2).
Environmental Assessment Boundaries	Spatial Boundaries	The spatial boundaries considered in the water quality assessment will include a local study area (LSA) and a broader regional study area (RSA; Section 4.1.3): ■ The LSA includes all active mineral claims, existing bush roads, cutlines, historic railbed, waste rock piles, and backfilled and mined pits (Figure 4-3). The western and eastern boundaries of the LSA are defined by the western boundary of the Twin Creek watershed and the eastern boundary of the Paulette Creek watershed, respectively. The northern extent of the LSA includes a 10-m buffer north of the shoreline of Great Slave Lake and the outlets of the Twin Creek, Buffalo River, and Paulette Creek. The southern extent of the LSA includes Highway 6, connecting the western and eastern boundaries. It will align with the surface water quantity, water quality, and fish and fish habitat LSA. The LSA is anticipated to be large enough to capture direct and indirect effects on water quality resulting from the Project. ■ The RSA includes the LSA plus Birch Creek, which is located 5 km to the west of the LSA (Figure 4-4). The RSA boundary extends 2 km into Great Slave Lake and provides broader context for characterizing baseline conditions and capturing the maximum potential effects from the Project. It will align with the RSA for groundwater quantity and quality and surface water quantity.
	Temporal Boundaries	The temporal boundaries for the water quality assessment will focus on the Project phases defined in Section 4.1.3: construction, operation, and closure and reclamation. Effects on water quality will be evaluated across all phases of the Project and will include consideration of potential changes in water quality during post-closure, where relevant. Each phase will be assessed, with water quality trends (for each major water quality constituent group) and the maximum predicted constituent concentration identified.
	Assessment Cases	■ The water quality residual effects analysis will consist of up to three assessment cases, as defined in Section 4.1.3: a Base Case, an Application Case and, if required, a Reasonably Foreseeable Development (RFD) Case. The methods that will be used to assess the Base Case and the Application Case are defined in Section 4.1.3 and in the "Existing Environment" and "Residual Effects Analysis" descriptions provided below ■ The determination of whether an RFD Case assessment will be included in the water quality section will be made during preparation of the Developer's Assessment Report, based on the methods outlined in Section 4.1.3. If an RFD Case is required, it is anticipated that the assessment will be qualitative and conceptual, and that the approach taken will depend upon the level of information available for individual RFDs.
Input from Engagement	Information and concerns raised during the engagement process undertaken for the Project (Volume 2) will be incorporated into the water quality assessment according to the methods defined in Section 4.1.4; specific issues raised will be documented in the assessment and a description of how the issue was addressed will be provided.	

Table 4-10: Assessment Methods for Water Quality

Assessment Approach for KLOI-1: Impacts to Water Quality	
Incorporation of Indigenous Traditional Knowledge (ITK)	The general methods that will be used to integrate local and ITK into the water quality assessment are defined in Section 4.1.5. Specific types of ITK that may be used in the water quality assessment are anticipated to include the following information types and sources: ■ locations where drinking water is collected ■ observations of changes in local water quality conditions over time
Existing Environment	The description of the existing environment provided in the Developer's Assessment Report for water quality will follow the general methods outlined in Section 4.1.6 and will expand on the information provided in Volume 3. The description of existing environment will incorporate historical and recent baseline sampling information, including characterization of water quality and physical limnology of natural waterbodies and watercourses in the LSA and RSA. A summary of the available water quality and physical limnology data for the former pits on site will also be included in the existing environment description in the Developer's Assessment Report. Additional information recommended to be collected for the water quality component in the baseline study plan for the Project (Volume 3, Appendix C) will be included in the existing environment description. This will consist of collecting seasonal surface water quality data from waterbodies and watercourses that are expected to be affected by the Project as a result of surface water drainage, discharge of mine water, and aerial emissions deposition. Further details are provided in Volume 3, Appendix C.
Project Interactions and Mitigations	Identification of Project interactions and mitigations for the water quality component will follow the general methods outlined in Section 4.1.7. A description of the anticipated Project-environment interactions identified for water quality, along with the associated residual effects categorization (i.e., no pathway, secondary, or primary) and proposed mitigation measures, is provided in Volume 4.
Residual Effects Analysis	The residual effects analysis for the water quality component will follow the general methods outlined in Section 4.1.8 and will focus on the Project-environment interactions that are determined primary in the pathway analysis (Volume 4). One Project-environment interaction was determined to be primary for water quality. Assessment methods that will be used to evaluate the potential residual environmental effects of this pathways on the water quality VC are described below. ■ Direct discharge of mine water, as well as surface runoff, groundwater inflow and seepage from the Project will cause changes to surface water quality in receiving and downstream aquatic environments. ▪ A water quality model will be developed, which will be integrated with the site water balance and receiving environment surface water quantity model and factor in the results of the hydrogeological modelling. The Project infrastructure, and waste and water management, will influence on-site and off-site (downstream) water quality from the development. Therefore, a predictive site-wide and receiving water quality numerical model will be constructed to project water quality that has the potential to drain/discharge from site water management facilities (e.g., for runoff and seepage from mine infrastructure such as mine rock and mineralized material storage facilities, water management ponds and operational discharges, open pits, other site surfaces) to the receiving environment during construction, operation, and closure and reclamation phases, and into post-closure. This modelling will be used to predict changes to water quality in the downstream receiving environment through all Project phases. ▪ The core model framework is expected to be GoldSim (integrated site, receiving environment, and pit lake models); it is anticipated that the surface water quantity model may also be developed in GoldSim. The water quality model will build on the water balance and integrate the hydrogeological quantity and quality modelling and geochemical load inputs. As required, other models may be used to supplement the site and receiving water quality models (e.g., pit lake model). ▪ Depending on the water balance and Water Management Plan developed to support the Developer's Assessment Report, other models may also be considered, such as Excel-based worksheets (high-level receiving environment model), CE-QUAL or WASP (hydrodynamic receiving environment and pit lake models), and CORMIX (receiving environment near-field discharge dispersion modelling). This determination will be identified following review of the Project Description and Water Management Plan for the Developer's Assessment Report to confirm the interactions between the Project and water quality. ▪ The modelling task requires the following information, at least at a conceptual level: • hydrogeological quantity and quality data, hydrological (bathymetry, site water balance, and receiving environment surface water quantity model) and geochemical source terms for each lithology • the Water Management Plan detailing the quantity and quality of proposed site discharges (e.g., mine water discharge [if necessary], sewage treatment plant) • all site-influencing factors (other Project components, runoff, diversions, covers, etc.) for construction, operation, and closure and reclamation phases, and into post-closure

Table 4-10: Assessment Methods for Water Quality

Assessment Approach for KLOI-1: Impacts to Water Quality	
Residual Effects Analysis (cont'd)	▪ Water quality will be modelled for all Project phases (i.e., construction through operation and closure and reclamation) and into post-closure through superimposing loading from mine-related inputs (e.g., runoff, seepage, discharges) on existing environment conditions and accounting for load accumulation, where appropriate. Water quality constituents will include each of the major water chemistry groups (e.g., major ions, nutrients, metals) and may include physico-chemical parameters such as dissolved oxygen. ▪ Model results will be provided as average monthly water quality (based on average climate year data) for all water quality constituents. The model will return predicted water quality of mine contact water at specified mine water management structures (as determined from a review of the Project Description), as well as downstream in the receiving environment. ▪ The focus of this assessment is expected to be on notable waterbodies (i.e., those with potential connectivity to fish-bearing waterbodies and watercourses) and the inshore bounds of Great Slave Lake during operation, and closure and reclamation. If the mine plan includes placement of tailings or mine contact water in open pits, the assessment may consider a subset (up to three) flooded pits that represent a range of anticipated closure conditions. The determination of the selected pits will be through a high-level water quality modelling exercise using Excel once the mine plan and an interim closure condition has been established. ▪ The water quality model predictions will be compared to baseline conditions and guidelines, which include protection of aquatic life, MDMER criteria, protection of water for wildlife consumption, and protection of source for drinking water, as applicable. ▪ Technically and economically feasible mitigation will be identified in coordination with the air quality, groundwater quantity and quality, surface water quantity, and fish and fish habitat components. Note that potential effects on Indigenous people from changes to water quality will be assessed in the traditional land and resource use (TLRU) section (see Section 4.2.2.3).
Residual Effects Classification	The residual effects classification completed for the water quality assessment will follow the methods defined in Section 4.1.9. VC-specific definitions will be developed for the residual effects classification criteria of direction, magnitude, geographic extent, duration, reversibility, frequency, and probability of occurrence. Due to the considerations noted in Section 4.1.9, a determination of significance will not be completed for surface water quality, which will be considered as an intermediate component in the Developer's Assessment Report.
Prediction Confidence and Uncertainty	Prediction confidence and uncertainty will be evaluated according the general methods defined in Section 4.1.10. Key sources of uncertainty that are relevant to the water quality assessment, and that will be addressed in the Developer's Assessment Report, are anticipated to include the consideration of the following elements: ▪ water balance modelling inputs and results ▪ water quality modelling inputs and results ▪ adequacy of baseline data for understanding current conditions and future changes unrelated to the Project ▪ understanding of Project-related effects on complex ecosystems that contain interactions across different scales of time and space ▪ knowledge of the effectiveness of mitigation and environmental design features for reducing or removing Project effects Prediction confidence and uncertainty with respect to air quality, groundwater quantity and quality and surface water quantity are also relevant to the water quality assessment and will be considered in the water quality section of the Developer's Assessment Report.
Monitoring and Follow-up	The water quality section of the Developer's Assessment Report will include a description of the monitoring activities proposed to address the uncertainties associated with effect predictions and the performance of environmental design features and mitigation related to the Project. As described in Section 4.1.11, the description of monitoring activities will include consideration of both compliance monitoring and follow-up monitoring. Monitoring of the aquatic receiving environment will include the following elements: ▪ an Aquatic Effects Monitoring Program, required as a condition of a future Type A Water Licence issued for the Project ▪ a Surveillance Network Program, required as a condition of a future Type A Water Licence issued for the Project ▪ mine water and water quality monitoring as required under MDMER ▪ construction monitoring, as appropriate (e.g., total suspended solids and turbidity monitoring during instream construction) Monitoring activities defined for the air quality, groundwater quantity and quality and surface water quantity components are also relevant to the water quality component and will be considered in the water quality section of the Developer's Assessment Report. The water quality section of the Developer's Assessment Report will include a description of the specific objectives, monitoring techniques and general analysis procedures that will be used for each monitoring type. Where applicable, links to adaptive management responses will be defined. The design of monitoring activities will also consider previously collected data and will incorporate ITK gathered through engagement with communities, where appropriate.

Table 4-10: Assessment Methods for Water Quality

Assessment Approach for KLOI-1: Impacts to Water Quality	
Supporting Annexes	Supporting documentation relevant to water quality is anticipated to include the following annexes which will be appended to the water quality section of the Developer's Assessment Report: ■ Water Quality Baseline Report ■ Water Quality Modelling Report Other information sources will be considered in the water quality assessment (see the "Information Sources" section above) but will not be appended to the water quality section of the Developer's Assessment Report.

4.2.1.5 SON-4: Impacts to Fish and Fish Habitat

A description of the assessment methods expected to be used in the Developer's Assessment Report for the fish and fish habitat component is provided in Table 4-11.

Table 4-11: Assessment Methods for Fish and Fish Habitat

Assessment Approach for SON-4: Impacts to Fish and Fish Habitat		
Information Sources	Information sources that will be used to support the fish and fish habitat assessment scoping are anticipated to include the relevant sources listed in Section 4.1.1 and the following: ■ the Fish and Fish Habitat Baseline Report ■ results of the effects assessments for air quality, groundwater quantity and quality, surface water quantity, and water quality ■ environmental management and monitoring plans, including framework or conceptual versions of the Water Management Plan, Tailings and Waste Rock Management Plan, Erosion and Sediment Control Plan, Spill Contingency Plan, Waste Management Plan, Closure and Reclamation Plan, and Aquatic Effects Monitoring Program ■ territorial and federal legislation and guidance such as the federal *Fisheries Act*, the NWT's *Wildlife Act*, the federal *Species-at-Risk Act*, and Committee on the Status of Endangered Wildlife in Canada	
Valued Components, Assessment Endpoints, and Measurement Indicators	Valued Components (VCs)	The VCs recommended to be used in the fish and fish habitat assessment, and a rationale for their selection, are provided in Section 2.0 and Table 2-1. VCs have been grouped by fish community (e.g., Twin Creek fish community, Great Slave Lake fish community). In grouping VCs by community, each waterbody or watercourse is recognized as supporting different fish species and habitats. Furthermore, each fish community is also affected by different Project activities.
	Assessment Endpoints and Measurement Indicators	The assessment endpoints and measurement indicators recommended to be used in the fish and fish habitat assessment are defined in Section 4.1.2 and Table 4-1.
Environmental Assessment Boundaries	Spatial Boundaries	The spatial boundaries considered in the fish and fish habitat assessment will include a local study area (LSA) and a broader regional study area (RSA; Section 4.1.3): ■ The LSA includes all active mineral claims, existing bush roads, cutlines, historic railbed, waste rock piles, and backfilled and mined pits (Figure 4-3). The western and eastern boundaries of the LSA are defined by the western boundary of the Twin Creek watershed and the eastern boundary of the Paulette Creek watershed, respectively. The northern extent of the LSA includes a 10-m buffer north of the shoreline of Great Slave Lake and the outlets of the Twin Creek, Buffalo River, and Paulette Creek. The southern extent of the LSA includes Highway 6, connecting the western and eastern boundaries. It will align with the surface water quantity, water quality, and fish and fish habitat LSA. The LSA is anticipated to be large enough to capture direct and indirect effects on fish and fish habitat resulting from the Project. ■ The RSA for fish and fish habitat includes the LSA plus Birch Creek, which is located 5 km to the west of the LSA (Figure 4-4). The RSA boundary extends 2 km into Great Slave Lake and provides broader context for characterizing baseline conditions and capturing the maximum potential effects from the Project, and considers Fisheries and Oceans Canada (DFO) management areas (Day et al. 2012) as appropriate. It is also expected to align with the RSA for surface water quantity and quality; however, in the Developer's Assessment Report, there may be a consideration for extending the RSA farther upstream into individual watersheds based on movement of resident fish in the watershed.

Table 4-11: Assessment Methods for Fish and Fish Habitat

Assessment Approach for SON-4: Impacts to Fish and Fish Habitat		
Environmental Assessment Boundaries (cont'd)	Temporal Boundaries	The temporal boundaries for the fish and fish habitat assessment will focus on the Project phases defined in Section 4.1.3: construction, operation, and closure and reclamation. The assessment will also consider potential effects on fish and fish habitat during post-closure, where relevant. For some pathways of effects, residual effects on fish and fish habitat VCs will evaluated across all phases of the Project, but not necessarily for each specific phase. Where applicable, residual effects may also be assessed in terms of specific temporal snapshots of the Project defined by intermediate components (e.g., surface water quantity and water quality) that may have a linkage to potential effects on fish and fish habitat VCs.
	Assessment Cases	■ The fish and fish habitat residual effects analysis will consist of up to three assessment cases, as defined in Section 4.1.3: a Base Case, an Application Case, and possibly, a Reasonably Foreseeable Development (RFD) Case. The methods that will be used to assess the Base Case and the Application Case are defined in Section 4.1.3 and in the "Existing Environment" and "Residual Effects Analysis" descriptions provided below. ■ The determination of whether an RFD Case assessment will be included in the fish and fish habitat section will be made during preparation of the Developer's Assessment Report, based on the methods outlined in Section 4.1.3. If an RFD Case is required, it is anticipated that the assessment will be qualitative and conceptual, and that the approach taken will depend upon the level of information available for individual RFDs.
Input from Engagement	Information and concerns raised during the engagement process undertaken for the Project (Volume 2) will be incorporated into the fish and fish assessment according to the methods defined in Section 4.1.4; specific issues raised will be documented in the assessment and a description of how the issue was addressed will be provided.	
Incorporation of Indigenous Traditional Knowledge (ITK)	The general methods that will be used to integrate local and ITK into the fish and fish habitat assessment are defined in Section 4.1.5. Specific types of ITK that may be used in the fish and fish habitat assessment are anticipated to include the following information types and sources: ■ fish species harvested for subsistence, cultural, or commercial purposes and their perceived value ■ locations where fish are harvested ■ fishing methods used to capture fish ■ fish species local distribution and abundance ■ fish species behaviour and habitat conditions ■ known spawning locations and timing ■ observations of changes in fish populations over time	
Existing Environment	The description of the existing environment provided in the Developer's Assessment Report for fish and fish habitat will follow the general methods outlined in Section 4.1.6 and will expand on the information provided in Volume 3. The description of existing environment will incorporate historical and recent baseline sampling information, including characterization of physical limnology, fish habitat conditions, benthic invertebrate communities, plankton communities, and fish populations in waterbodies and watercourses in the LSA and RSA. Additional information recommended to be collected for the fish and fish component in the baseline study plan for the Project (Volume 3, Appendix C) will be included in the existing environment description. The additional work planned in waterbodies and watercourses in the LSA will consist of assessing fish habitat (e.g., habitat types, bed substrate, cover for fish), sampling to determine the presence/absence of fish, and a scoping-level evaluation of connectivity of pits or diversions to fish-bearing habitats. Further details are provided in Volume 3, Appendix C.	
Project Interactions and Mitigations	Identification of Project interactions and mitigations for the fish and fish habitat component will follow the general methods outlined in Section 4.1.7. A description of the anticipated Project-environment interactions identified for fish and fish habitat, along with the associated residual effects categorization (i.e., no pathway, secondary, or primary) and proposed mitigation measures, is provided in Volume 4.	

Table 4-11: Assessment Methods for Fish and Fish Habitat

Assessment Approach for SON-4: Impacts to Fish and Fish Habitat	

Residual Effects Analysis	The residual effects analysis for the fish and fish habitat component will follow the general methods outlined in Section 4.1.8 and will focus on the Project-environment interactions that are determined to be primary in the pathway analysis (Volume 4).
	Assessment methods are provided for three Project-environment interactions that may be assessed as either primary or secondary pathways in the fish and fish habitat assessment, depending on the outcomes of environmental modelling work, confirmation of Project design details, and the results of the effects assessments completed for groundwater quantity and quality, surface water quantity, and water quality. In the event that these pathways are ultimately determined to be secondary in the pathway analysis, they will not be carried forward to the residual effects analysis. However, assessment methods have been provided to account for the possibility that these interactions may ultimately be determined to be primary.
	■ Altered site drainage and runoff from facilities may change local hydrology and affect fish habitat quantity and quality (e.g., in Twin Creek, Paulette Creek).
	  ▪ A qualitative evaluation will be completed for these two pathways that considers the quantitative outcome of the surface water quantity model and the water quantity assessment. Changes to fish habitat quality and quantity will be assessed based on predicted changes to variables such as water levels, water depths, and wetted/channel widths.
	■ Direct discharge of mine water, as well as surface runoff, groundwater inflow, and seepage from the Project, will cause changes to downstream surface water quality, which can alter fish habitat quality and affect the survival and reproduction of fish.
	  ▪ A qualitative evaluation will be completed that considers the outcome of the quantitative water quality model predictions. The water quality predictions for key parameters (e.g., nutrients, metals, ions) will be compared to guidelines (i.e., Canadian Council of Ministers of the Environment guidelines for the protection of aquatic life) to predict effects on fish community VCs potentially affected by the changes in water quality. Predicted changes in water quality will also be used to qualitatively assess changes to fish habitat (e.g., changes to habitat quality or changes to food availability from changes to water quality).

Residual Effects Analysis (cont'd)	■ Project footprint will result in a direct loss or alteration of fish habitat, which may affect habitat quantity, quality, and connectivity and fish distribution. ▪ A quantitative assessment will be completed of potential changes to total area of habitat present and calculated as an absolute (i.e., area) of loss or alteration, as appropriate. The calculation will be based on the likely presence of each VC (e.g., Twin Creek fish community) at a particular location, the width of the waterbody or the area of the structure, and the area of disturbance under the Project footprint (e.g., road crossing structure or water intake). This assessment will also consider the need for a conceptual Fisheries Offsetting Plan for the Project to offset the losses to fish habitat (i.e., harmful alteration, disruption or destruction of fish habitat as per the *Fisheries Act*). Technically and economically feasible mitigation will be identified in coordination with the air quality, groundwater quantity and quality, surface water quantity, and surface water quality components. Note that potential effects on Indigenous and other people from changes to fish availability (e.g., traditional and commercial harvest) will be assessed in the traditional land resource use (TLRU) and non-traditional land and resource use (NTLRU) sections, respectively (see Section 4.2.2.3 and Section 4.2.2.4).
Residual Effects Classification and Determination of Significance	The residual effects classification completed for the fish and fish habitat assessment will follow the methods defined in Section 4.1.9. VC specific definitions will be developed for the residual effects classification criteria of direction, magnitude, geographic extent, duration, reversibility, frequency, and probability of occurrence. A determination of significance will be completed for the fish and fish habitat VC according the methods described in Section 4.1.9.
Prediction Confidence and Uncertainty	Prediction confidence and uncertainty will be evaluated according the general methods defined in Section 4.1.10. Key sources of uncertainty that are relevant to the fish and fish habitat assessment, and that will be addressed in the Developer's Assessment Report, are anticipated to include the consideration of the following elements: ■ water quantity modelling inputs and results ■ water quality modelling inputs and results ■ adequacy of baseline data for understanding current conditions and future changes unrelated to the Project ■ understanding of Project-related effects on complex ecosystems that contain interactions across different scales of time and space ■ knowledge of the effectiveness of mitigation and environmental design features for reducing or removing Project effects Prediction confidence and uncertainty with respect to groundwater quantity and quality, surface water quantity, and water quality are also relevant to the fish and fish habitat assessment and will be considered in the fish and fish habitat section of the Developer's Assessment Report.

Table 4-11: Assessment Methods for Fish and Fish Habitat

Assessment Approach for SON-4: Impacts to Fish and Fish Habitat	
Monitoring and Follow-up	The fish and fish habitat section of the Developer's Assessment Report will include a description of the monitoring activities proposed to address the uncertainties associated with effect predictions and the performance of environmental design features and mitigation related to the Project. As described in Section 4.1.11, the description of monitoring activities will include consideration of both compliance monitoring and follow-up monitoring. Monitoring of the aquatic receiving environment will include the following elements: ■ an Aquatic Effects Monitoring Program, required as a condition of a future Type A Water Licence issued for the Project ■ an Environmental Effects Monitoring study required under the Metal Mining and Diamond Effluent Regulations ■ an evaluation of the effectiveness of fish habitat offsetting measures developed for the Project (if development of a Fisheries Offsetting Plan is required) ■ construction monitoring, as appropriate (e.g., total suspended solids and turbidity monitoring during instream construction) Monitoring activities defined for the groundwater quantity and quality, surface water quantity, and water quality components are also relevant to the fish and fish habitat component and will be considered in the fish and fish habitat section of the Developer's Assessment Report. The fish and fish habitat section of the Developer's Assessment Report will include a description of the specific objectives, monitoring techniques, and general analysis procedures that will be used for each monitoring type. Where applicable, links to adaptive management responses will be defined. The design of monitoring activities will also consider previously collected data and will incorporate ITK and information gathered through engagement with communities, where appropriate.
Supporting Annexes	Supporting documentation relevant to the fish and fish habitat assessment is anticipated to include the following annexes which will be appended to the fish and fish habitat section of the Developer's Assessment Report: ■ Fish and Fish Habitat Baseline Report ■ Conceptual Fisheries Offsetting Plan (if required) Other information sources will be considered in the fish and fish habitat assessment (see the "Information Sources" section above) but will not be appended to the fish and fish habitat section of the Developer's Assessment Report.

4.2.1.6 SON-5: Impacts to Terrain and Soils

A description of the assessment methods expected to be used in the Developer's Assessment Report for the terrain and soils component is provided in Table 4-12.

Table 4-12: Assessment Methods for Terrain and Soils

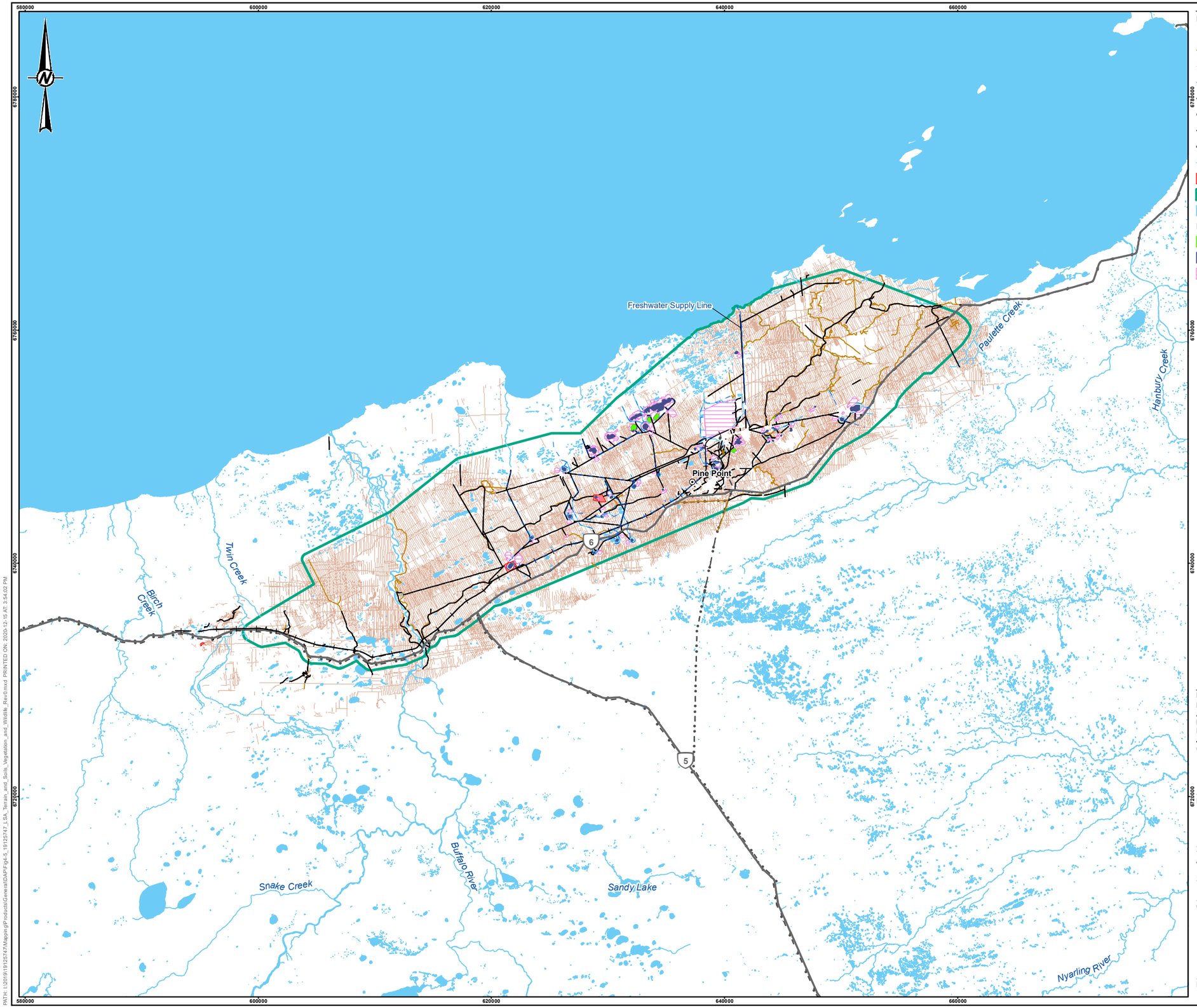
Assessment Approach for SON-5: Impacts to Terrain and Soils		
Information Sources	Information sources that will be used to support the terrain and soils assessment scoping are anticipated to include those listed in Section 4.1.1. and the following sources: ■ the Terrain and Soils Baseline Report ■ results of the effects assessments for air quality, groundwater quantity and quality, surface water quantity, water quality, and vegetation ■ environmental management and monitoring plans, including framework or conceptual versions of the Water Management Plan, Tailings and Waste Rock Management Plan, Erosion and Sediment Control Plan, Spill Contingency Plan, Waste Management Plan, and Closure and Reclamation Plan	
Intermediate Components and Measurement Indicators	Intermediate Component(s)	Terrain and soils will be considered as an intermediate component in the Developer's Assessment Report. A rationale for the selection of terrain and soils as an intermediate component is provided in Section 2.0 and Table 2-2.
	Measurement Indicators	Measurement indicators for terrain and soils are defined in Section 4.1.2 and Table 4-2. As terrain and soils is an intermediate component, an assessment endpoint is not defined (Section 4.1.2).
Environmental Assessment Boundaries	Spatial Boundaries	The spatial boundaries considered in the terrain and soils assessment will include a local study area (LSA) and a broader regional study area (RSA): ■ The LSA for terrain and soils is equivalent to vegetation and wildlife (including caribou) and will include the anticipated maximum extent of the Project footprint plus a 500 m buffer (771 km^2). All active mineral claims, existing bush roads, cutlines, historic railbed, waste rock piles, and backfilled and mined pits are included in the LSA. Other anticipated new and existing features for the Project contained within the LSA include access roads, laydown areas, and overburden stockpiles. The LSA is expected to capture the combined potential direct and indirect (e.g., dust deposition) effects from the Project on terrain and soils and provides local context for assessing effects (Figure 4-5).

Table 4-12: Assessment Methods for Terrain and Soils

Assessment Approach for SON-5: Impacts to Terrain and Soils		
		■ The RSA was defined for terrain and soils, vegetation, and small-ranging wildlife VCs to provide broader context for interpreting the local effects of the Project and covers approximately 1,851 km^2 (Figure 4-6). The RSA includes the LSA and is similar to the RSA for groundwater, hydrology, and surface water quality due to the ecological relationships among aquatic and soil and vegetation ecosystems, and wildlife habitats (e.g., wetland structure and function) (Figure 4-4). The RSA includes Birch Creek watershed and is bounded by the southern shore of Great Slave Lake. The RSA provides broader context for characterizing baseline conditions such as the presence of previous and existing developments, and natural disturbances (e.g., wildfire). The Project is predicted to have no measurable ecological effects on terrain and soils beyond the LSA.
	Temporal Boundaries	The temporal boundaries for the terrain and soils assessment will focus on the Project phases defined in Section 4.1.3: construction, operation, and closure and reclamation. The assessment will also consider potential effects on terrain and soils during post-closure, where relevant. For some pathways of effects, residual effects will be evaluated across all phases of the Project, but not necessarily for each specific phase. Where applicable, residual effects may also be assessed in terms of specific temporal snapshots of the Project defined by intermediate components (e.g., air quality) that may have a linkage to potential effects on terrain and soils.
	Assessment Cases	■ The terrain and soils residual effects analysis will consist of up to three assessment cases, as defined in Section 4.1.3: a Base Case, an Application Case and, possibly, a Reasonably Foreseeable Development (RFD) Case. The methods that will be used to assess the Base Case and the Application Case are defined in Section 4.1.3 and in the "Existing Environment" and "Residual Effects Analysis" descriptions provided below. ■ The determination of whether an RFD Case assessment will be included in the terrain and soils section will be made during preparation of the Developer's Assessment Report, based on the methods outlined in Section 4.1.3. If an RFD Case is required, it is anticipated that the assessment will be qualitative and conceptual, and that the approach taken will depend upon the level of information available for individual RFDs.
Input from Engagement	Information and concerns raised during the engagement process undertaken for the Project (Volume 2) will be incorporated into the terrain and soils assessment according to the methods defined in Section 4.1.4; specific issues raised will be documented in the assessment and a description of how the issue was addressed will be provided.	
Incorporation of Indigenous Traditional Knowledge (ITK)	The general methods that will be used to integrate local and ITK into the terrain and soils assessment are defined in Section 4.1.5. Specific types of ITK that may be used in the terrain and soils assessment are anticipated to include the following information types and sources: ■ land conservation ■ terrain features ■ slope stability ■ permafrost	
Existing Environment	The description of the existing environment provided in the Developer's Assessment Report for terrain and soils will follow the general methods outlined in Section 4.1.6 and will expand on the information provided in Volume 3. The description of existing environment will incorporate historical and recent baseline sampling information including but not limited to surficial material, characterization of soils, landscape description, and permafrost presence. Additional information recommended to be collected for the terrain and soils component in the baseline study plan for the Project (Volume 3, Appendix C) will also be included in the existing environment description. Further baseline studies were conducted in summer 2020. This will occur in conjunction with the vegetation discipline. Data related to Ecological Land Classification, terrain, and soils will be collected at each target site. Further details are provided in Volume 3, Appendix C.	
Project Interactions and Mitigations	Identification of Project interactions and mitigations for the terrain and soils component will follow the general methods outlined in Section 4.1.7. A description of the anticipated Project-environment interactions identified for terrain and soils, along with the associated residual effects categorization (i.e., no pathway, secondary, or primary) and proposed mitigation measures, is provided in Volume 4.	
Residual Effects Analysis	The residual effects analysis for the terrain and soils component will follow the general methods outlined in Section 4.1.8 and will focus on the Project-environment interactions that are determined to be primary in the pathway analysis (Volume 4). One Project-environment interaction was determined to be a primary pathway for the terrain and soils component. Assessment methods that will be used to evaluate the potential residual environmental effects of this pathway on water quality VCs are described below: ■ Alteration of soil and terrain conditions (e.g., quantity, quality, and distribution) may adversely affect soil productivity and the types of ecosystems that can be reclaimed on the landscape. ▪ Distribution of terrain and soil types will be mapped using up to date aerial photography and LiDAR, and supported by the Ecological Landscape Classification (ELC) developed for the vegetation assessment. This	

Table 4-12: Assessment Methods for Terrain and Soils

Assessment Approach for SON-5: Impacts to Terrain and Soils	
	map will be used to determine the amount and distribution of soil types in the Base Case and the amount of soil removed or altered/disturbed by the Project (Application Case), and RFD Case (if applicable). Soil productivity (quality) will be inferred from the classification of soil types, and associated suitability for reclamation. The assessment will be supported by scientific literature. Technically and economically feasible mitigation will be identified in coordination with the air quality, vegetation, and wildlife components.
Residual Effects Classification	The residual effects classification completed for the terrain and soils assessment will follow the methods defined in Section 4.1.9. Component-specific definitions will be developed for the residual effects classification criteria of direction, magnitude, duration, and geographic extent, duration, reversibility, frequency, and probability of occurrence. Due to the considerations noted in Section 4.1.9, a determination of significance will not be completed for terrain and soils, which will be considered as an intermediate component in the Developer's Assessment Report.
Prediction Confidence and Uncertainty	Prediction confidence and uncertainty will be evaluated according the general methods defined in Section 4.1.10. Key sources of uncertainty that are relevant to the terrain and soils assessment, and that will be addressed in the Developer's Assessment Report, are anticipated to include the consideration of the following elements: ■ air emissions modelling inputs and results ■ adequacy of baseline data for understanding current conditions and future changes unrelated to the Project ■ understanding of Project-related effects on complex ecosystems that contain interactions across different scales of time and space ■ knowledge of the effectiveness of mitigation and environmental design features for reducing or removing Project effects Prediction confidence and uncertainty with respect to surface water quantity and water quality are also relevant to the terrain and soils assessment and will be considered in the terrain and soils section of the Developer's Assessment Report.
Monitoring and Follow-up	The Developer's Assessment Report will not include monitoring programs directly for the terrain and soils discipline. The effectiveness of environmental design features and mitigation measures related to the Project will be measured and monitored through other disciplines. Monitoring activities defined for the air quality, groundwater quantity and quality, surface water quantity, and vegetation components are relevant to the terrain and soils component and will be considered in the terrain and soils section of the Developer's Assessment Report.
Supporting Annexes	Supporting documentation relevant to the terrain and soils assessment is anticipated to include the following annex which will be appended to the terrain and soils section of the Developer's Assessment Report: ■ Terrain and Soils Baseline Report Other information sources will be considered in the terrain and soils assessment (see the "Information Sources" section above) but will not be appended to the terrain and soils section of the Developer's Assessment Report.



LEGEND

- FORMER PINE POINT TOWN SITE
- BUSH ROAD
- CUTLINE
- DRAINAGE DITCH
- HISTORIC RAILBED
- HIGHWAY
- MINE ROAD
- TRANSMISSION LINE
- WATERCOURSE
- CUTBLOCK
- LOCAL STUDY AREA - TERRESTRIAL
- WATERBODY

PINE POINT EXISTING MINING DISTURBANCE

- BACKFILLED PIT
- MINED PIT
- WASTE PILE

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PROJECT
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TITLE
TERRAIN AND SOILS, VEGETATION, AND WILDLIFE LOCAL STUDY AREA

CONSULTANT
GOLDER

YYYY-MM-DD	2020-12-15
DESIGNED	JV
PREPARED	MM/PMT
REVIEWED	JV
APPROVED	JV

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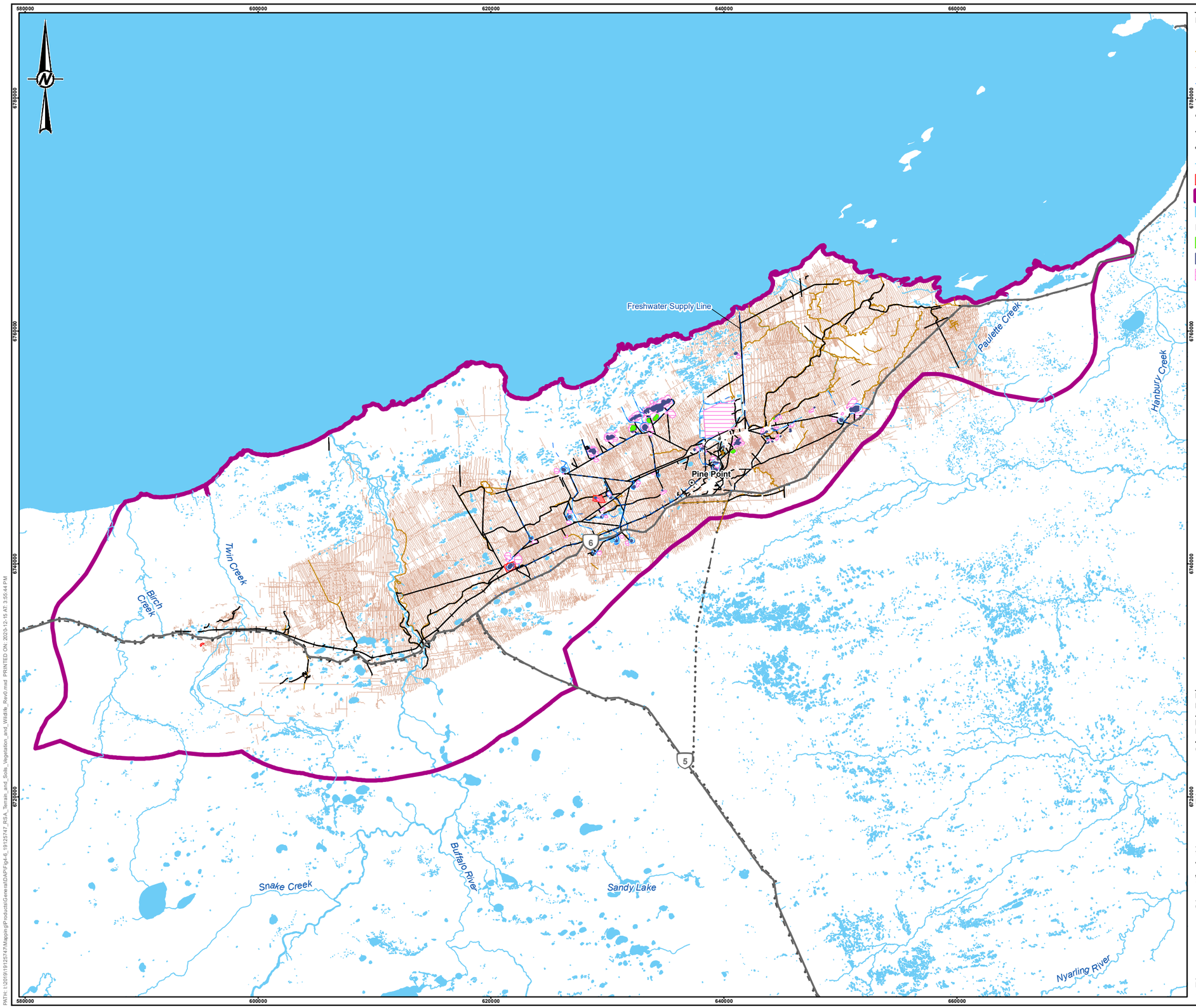

LEGEND

- FORMER PINE POINT TOWN SITE
- BUSH ROAD
- CUTLINE
- DRAINAGE DITCH
- HISTORIC RAILBED
- HIGHWAY
- MINE ROAD
- TRANSMISSION LINE
- WATERCOURSE
- CUTBLOCK
- REGIONAL STUDY AREA - TERRESTRIAL
- WATERBODY

PINE POINT EXISTING MINING DISTURBANCE

- BACKFILLED PIT
- MINED PIT
- WASTE PILE

0 5 10

1:325,000 KILOMETRES

REFERENCE(S)

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TITLE

TERRAIN AND SOILS, VEGETATION, AND SMALL-RANGING WILDLIFE REGIONAL STUDY AREA

CONSULTANT

GOLDER

YYYY-MM-DD	2020-12-15
DESIGNED	JV
PREPARED	MM/PMT
REVIEWED	JV
APPROVED	JV

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4.2.1.7 SON-6: Impacts to Vegetation

A description of the assessment methods expected to be used in the Developer's Assessment Report for the vegetation component is provided in Table 4-13.

Table 4-13: Assessment Methods for Vegetation

Assessment Approach for SON-6: Impacts to Vegetation		
Information Sources	Information sources that will be used to support the vegetation assessment scoping are anticipated to include the relevant sources listed in Section 4.1.1 and the following: ■ the Vegetation Baseline Report ■ results of the effects assessments for groundwater quantity and quality, surface water quantity, water quality, and air quality ■ environmental management and monitoring plans, including framework or conceptual versions of the Water Management Plan, Tailings and Waste Rock Management Plan, Erosion and Sediment Control Plan, Spill Contingency Plan, Waste Management Plan, Closure and Reclamation Plan, and Wildlife Protection Plan	
Valued Components, Assessment Endpoints, and Measurement Indicators	Valued Components (VCs)	The VCs to be used in the vegetation assessment include upland, wetland, and riparian ecosystems. A rationale for the selection of vegetation VCs is provided in Section 2.0 and Table 2-1.
	Assessment Endpoints and Measurement Indicators	The assessment endpoints and measurement indicators recommended to be used in the vegetation assessment are defined in Section 4.1.2 and Table 4-1.
Environmental Assessment Boundaries	Spatial Boundaries	The spatial boundaries considered in the vegetation assessment will include a local study area (LSA) and a broader regional study area (RSA): ■ The LSA for vegetation is equivalent to terrain and soils and will include the anticipated maximum extent of the Project footprint plus a 500 m buffer (771 km^2). All active mineral claims, existing bush roads, cutlines, historic railbed, waste rock piles, and backfilled and mined pits are included in the LSA. Other anticipated new and existing features for the Project contained within the LSA include access roads, laydown areas, and overburden stockpiles. The LSA is expected to capture the combined potential direct and indirect (e.g., dust deposition) effects from the Project on terrain and soils and provides local context for assessing effects (Figure 4-5). ■ The RSA was defined for terrain and soils, vegetation, and small-ranging wildlife VCs to provide broader context for interpreting the local effects of the Project and covers approximately 1,851 km^2 (Figure 4-6). The RSA includes the LSA and is similar to the RSA for groundwater, hydrology, and surface water quality due to the ecological relationships among aquatic and soil and vegetation ecosystems, and wildlife habitats (e.g., wetland structure and function) (Figure 4-4). The RSA includes Birch Creek watershed and is bounded by the southern shore of Great Slave Lake. In addition to existing human developments the RSA also includes disturbances from wildfires. ■ The RSA is expected to be at a scale suitable for assessing the significance of effects on upland, wetland, and riparian ecosystem VCs distributed inside the RSA, but probably also extend beyond its boundaries. The RSA is considered large enough to provide an ecologically relevant and confident assessment of the direct and indirect effects on vegetation VCs from the Project, and the cumulative effects from the Project and previous, existing, and reasonably foreseeable developments, and natural factors.
	Temporal Boundaries	The temporal boundaries for the vegetation assessment will focus on the Project phases defined in Section 4.1.3: construction, operation, and closure and reclamation. The assessment will also consider potential effects on vegetation during post-closure, where relevant. For some pathways of effects, residual effects will be evaluated across all phases of the Project, but not necessarily for each specific phase. Where applicable, residual effects may also be assessed in terms of specific temporal snapshots of the Project defined by intermediate components (e.g., air quality) that may have a linkage to potential effects on vegetation.
	Assessment Cases	■ The vegetation residual effects analysis will consist of up to three assessment cases, as defined in Section 4.1.3: a Base Case, an Application Case and, possibly, a Reasonably Foreseeable Development (RFD) Case. The methods that will be used to assess the Base Case and the Application Case are defined in Section 4.1.3 and in the "Existing Environment" and "Residual Effects Analysis" descriptions provided below. ■ The determination of whether an RFD Case assessment will be included in the vegetation section will be made during preparation of the Developer's Assessment Report, based on the methods outlined in Section 4.1.3. If an RFD Case is required, it is anticipated that the assessment will be qualitative and conceptual, and that the approach taken will depend upon the level of information available for individual RFDs.

Table 4-13: Assessment Methods for Vegetation

Assessment Approach for SON-6: Impacts to Vegetation	
Input from Engagement	Information and concerns raised during the engagement process undertaken for the Project (Volume 2) will be incorporated into the vegetation assessment according to the methods defined in Section 4.1.4; specific issues raised will be documented in the assessment and a description of how the issue was addressed will be provided.
Incorporation of Indigenous Traditional Knowledge (ITK)	The general methods that will be used to integrate local and ITK into the vegetation assessment are defined in Section 4.1.5. Specific types of ITK that may be used in the vegetation assessment are anticipated to include the following information types and sources: ■ traditional use species and communities ■ known locations of traditional use species
Existing Environment	The description of the existing environment provided in the Developer's Assessment Report for vegetation will follow the general methods outlined in Section 4.1.6 and will expand on the information provided in Volume 3. The description of existing environment will incorporate historical and recent baseline sampling information regarding plant species and species of conservation concern, ecoregions and protected areas, and ecosite phases in the LSA and RSA, which supports the development of the Ecological Landscape Classification (ELC) for the study areas. Additional information identified to be collected for the vegetation component in the baseline study plan for the Project (Volume 3, Appendix C) will be included in the existing environment description. Further baseline studies were conducted in summer 2020. These studies will be completed in conjunction with the soils discipline. Data related to the ELC and rare/invasive plants will be collected at sampling sites.
Project Interactions and Mitigations	Identification of Project interactions and mitigations for the vegetation component will follow the general methods outlined in Section 4.1.7. A description of the anticipated Project-environment interactions identified for vegetation, along with the associated residual effects categorization (i.e., no pathway, secondary, or primary) and proposed mitigation measures, is provided in Volume 4.

Residual Effects Analysis	The residual effects analysis for the vegetation component will follow the general methods outlined in Section 4.1.8 and will focus on the Project-environment interactions that are determined to be primary in the pathway analysis (Volume 4). Two Project-environment interactions were determined to be primary for vegetation. Assessment methods that will be used to evaluate the potential residual environmental effects of these pathways on the vegetation VCs (upland, wetland, and riparian ecosystems) are described below.
	■ direct loss, alteration, and fragmentation of upland, wetland, and riparian ecosystems from the Project footprint
	■ alteration of final terrain and soil conditions, and/or plant species composition could change the types of ecosystems that can be reclaimed on the landscape, and adversely affect vegetation ecosystem availability, distribution, and condition
	  ▪ Availability and distribution of upland, wetland, and riparian ecosystems in the LSA and RSA will be estimated from the ELC. Fire and human disturbance data from government sources will also be incorporated as landcover layers in the ELC. The ELC will be used to determine changes in the availability (quantitatively) and distribution (qualitatively) of vegetation VCs from the Base Case to the Application Case, and the RFD Case (if applicable).
	  ▪ Changes in the condition of upland, wetland, and riparian ecosystems will be assessed qualitatively through the results of the analysis of loss and fragmentation of vegetation ecosystems, and predicted changes in light and moisture regimes and potential for invasive plants, and the associated effects on community composition and listed and traditional use plant species. The analysis will be supported by scientific literature, and information gathered from ITK and community engagement, where available.
	Technically and economically feasible mitigation will be identified in coordination with the air quality, terrain and soils, and wildlife components.
	Note that potential effects on Indigenous people from changes in vegetation ecosystems (e.g., traditional use plants) will be assessed in the TLRU section (see Section 4.2.2.2).

Residual Effects Classification and Determination of Significance	The residual effects classification completed for vegetation assessment will follow the methods defined in Section 4.1.9. Component-specific definitions will be developed for the residual effects classification criteria of direction, magnitude, geographic extent, duration, reversibility, frequency, and probability of occurrence. A determination of significance will be completed for the vegetation communities (upland, wetland, riparian) and populations VC according the methods described in Section 4.1.9.
Prediction Confidence and Uncertainty	Prediction confidence and uncertainty will be evaluated according the general methods defined in Section 4.1.10. Key sources of uncertainty that are relevant to the vegetation assessment, and that will be addressed in the Developer's Assessment Report, are anticipated to include the consideration of the following elements: ■ air emissions modelling inputs and results ■ adequacy of baseline data for understanding current conditions and future changes unrelated to the Project ■ understanding of Project-related effects on complex ecosystems that contain interactions across different scales of time and space ■ knowledge of the effectiveness of mitigation and environmental design features for reducing or removing Project effects Prediction confidence and uncertainty with respect to air quality and terrain and soils are also relevant to the vegetation assessment and will be considered in the vegetation section of the Developer's Assessment Report.

Table 4-13: Assessment Methods for Vegetation

Assessment Approach for SON-6: Impacts to Vegetation	
Monitoring and Follow-up	The vegetation section of the Developer's Assessment Report will include a description of the monitoring activities proposed to address the uncertainties associated with effect predictions and the performance of environmental design features and mitigation related to the Project. As described in Section 4.1.11, the description of monitoring activities will include consideration of both compliance monitoring and follow-up monitoring. Monitoring for vegetation will include the following elements: ■ Confirmation of habitat losses as a part of the annual Wildlife Protection Plan. Once the Project is constructed, the Project footprint will be delineated to determine the actual extent of the physical footprint and associated loss of vegetation communities (habitat) for comparison with that predicted in the Developer's Assessment Report. ■ Monitoring of vegetation as a component of progressive reclamation under the Closure and Reclamation Plan. Lessons learned will be applied to the reclamation of the Project components. ■ Surveys for non-native invasive plant species following construction. The vegetation section of the Developer's Assessment Report will include a description of the specific objectives, monitoring techniques, and general analysis procedures that will be used for each monitoring type. Where applicable, links to adaptive management responses will be defined. The design of monitoring activities will also consider previously collected data and will incorporate ITK and information gathered through engagement with communities, where appropriate.
Supporting Annexes	Supporting documentation relevant to the vegetation assessment is anticipated to include the following annexes which will be appended to the vegetation section of the Developer's Assessment Report: ■ Vegetation Baseline Report Other information sources will be considered in the vegetation assessment (see the "Information Sources" section above) but will not be appended to the vegetation section of the Developer's Assessment Report.

4.2.1.8 KLOI-2 Impacts to Caribou

A description of the assessment methods expected to be used in the Developer's Assessment Report for caribou is provided in Table 4-14.

Table 4-14: Assessment Methods for Caribou

Assessment Approach for KLOI-2: Impacts to Caribou		
Information Sources	Information sources that will be used to support the caribou assessment scoping are anticipated to include the relevant sources listed in Section 4.1.1 and the following: ■ the Wildlife Baseline Report ■ results of the effects assessments for groundwater quantity and quality, surface water quantity, water quality, air quality, terrain and soils, vegetation, and wildlife ■ environmental management and monitoring plans, including framework or conceptual versions of the Water Management Plan, Tailings and Waste Rock Management Plan, Erosion and Sediment Control Plan, Spill Contingency Plan, Waste Management Plan, Closure and Reclamation Plan, and Wildlife Protection Plan ■ the NWT boreal caribou recovery strategy (Conference of Management Authorities 2017) ■ territorial and federal legislation and guidance such as the NWT's *Wildlife Act*, the federal *Species at Risk Act*, the Committee on the Status of Endangered Wildlife in Canada, and the Environment and Climate Change Canada (ECCC) threshold for undisturbed woodland caribou habitat as key requirement of ECCC's critical habitat identification (i.e., 65% undisturbed habitat; ECCC 2018).	
Valued Components, Assessment Endpoints, and Measurement Indicators	Valued Components (VCs)	The VC recommended to be used in the caribou assessment is woodland caribou (boreal population). A rationale for the selection of caribou as the VC is provided in Section 2.0 and Table 2-1.
	Assessment Endpoints and Measurement Indicators	The assessment endpoints and measurement indicators recommended to be used in the caribou assessment are defined in Section 4.1.2 and Table 4-1.

Table 4-14: Assessment Methods for Caribou

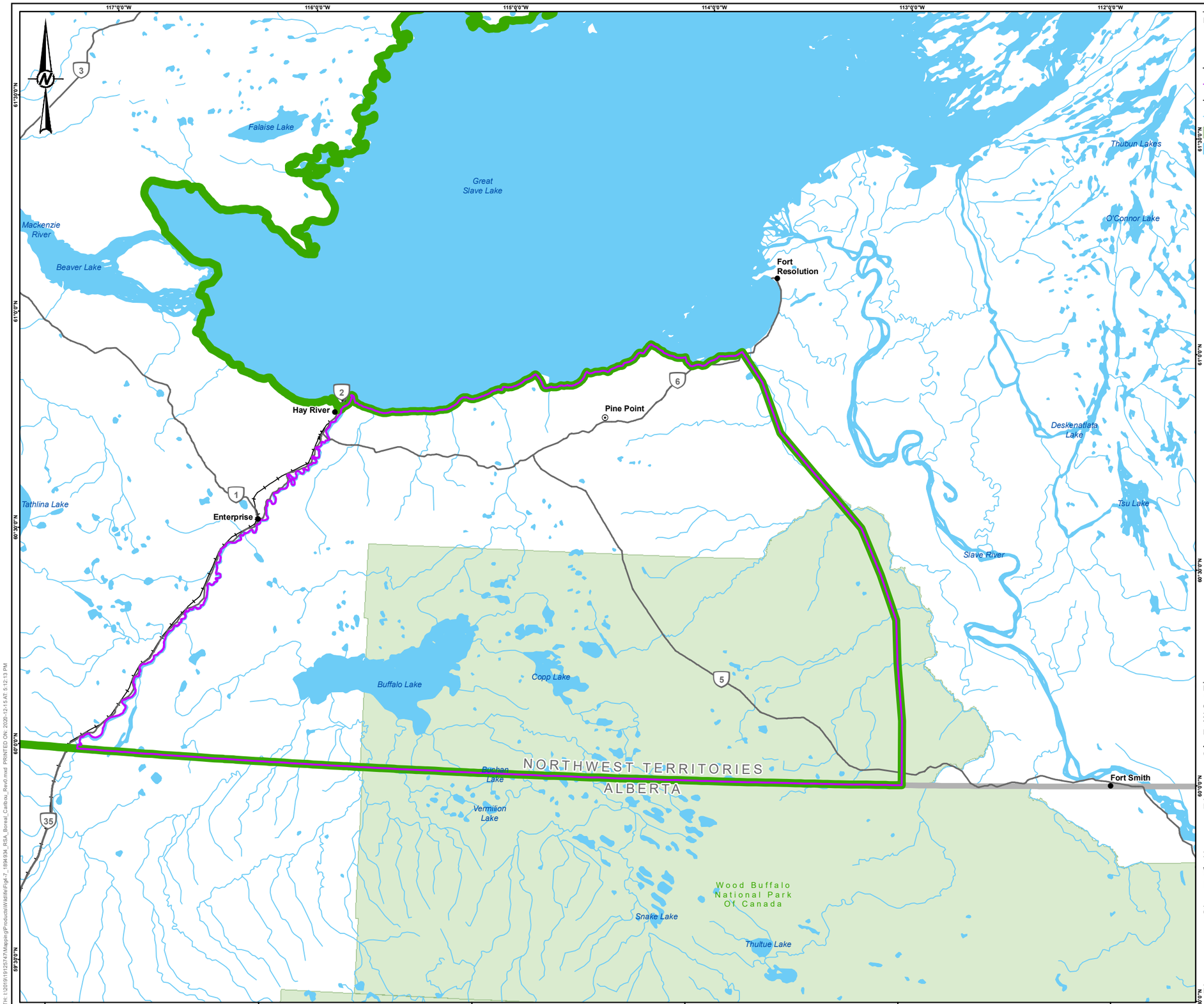
Assessment Approach for KLOI-2: Impacts to Caribou		
Environmental Assessment Boundaries	Spatial Boundaries	The spatial boundaries considered in the caribou assessment will include a local study area (LSA), regional study area (RSA) and the NT1 Boreal Caribou Range (Section 4.1.3): ■ The LSA for caribou is equivalent to terrain and soils, vegetation, and other wildlife and will include the anticipated maximum extent of the Project footprint plus a 500 m buffer (77,145 ha). All active mineral claims, existing bush roads, cutlines, historic railbed, waste rock piles, and backfilled and mined pits are included in the LSA (Figure 4-5). Other anticipated new and existing features for the Project contained within the LSA include access roads, laydown areas, and overburden stockpiles. The LSA is expected to capture the combined potential direct and indirect effects from the Project on caribou and provides local context for assessing effects. The 500 m buffer is expected to be large enough to capture sensory disturbance effects from noise, lights, smells, and human activity (ECCC 2018). Two additional spatial boundaries are used for the assessment of woodland caribou to provide a fuller understanding of the magnitude, geographic extent, duration, and context of predicted effects from habitat alterations due to the Project, and previous, existing and future developments. ■ The RSA is defined as the portion of the Southern NWT Range (GNWT 2019) east of the community of Hay River to the western boundary of NT1 Boreal Caribou Range, and bounded to the north by the shoreline of Great Slave Lake and to the south by the Northwest Territories-Alberta border (1,722,100 ha) (Figure 4-6). The area provides a biologically relevant scale to assess Project-related and cumulative changes on caribou and caribou habitat in context of existing conditions in this portion of the Southern NWT Range. Predator-prey interactions and effects on caribou are also expected to be relevant at this spatial scale. A qualitative assessment of the Southern NWT Range will also be completed to provide relevant ecological context for predicted incremental and cumulative effects from the Project and previous, existing, and reasonably foreseeable developments on caribou. ■ The NT1 Boreal Caribou Range (24,398,791 ha) is used to assess habitat loss at a scale to support information on the status of critical habitat (65% undisturbed habitat or not more than 35% disturbed habitat) at the population scale (ECCC 2018) (Figure 4-7). The NT1 Boreal Caribou Range is the scale for determining the significance of effects from the Project on caribou and will consider the analyses at the scales of the RSA and Southern NWT Range.
	Temporal Boundaries	The temporal boundaries for the caribou assessment will focus on the Project phases defined in Section 4.1.3: construction, operation, and closure and reclamation. For some pathways of effects, residual effects on caribou will be evaluated across all phases of the Project, but not necessarily for each specific phase. The assessment will also consider potential effects on caribou during post-closure, where relevant.
Environmental Assessment Boundaries (cont'd)	Assessment Cases	■ The caribou residual effects analysis will consist of up to three assessment cases, as defined in Section 4.1.3: a Base Case, an Application Case and, possibly a Reasonably Foreseeable Development (RFD) Case. The methods that will be used to assess the Base Case and the Application Case are defined in Section 4.1.3 and in the "Existing Environment" and "Residual Effects Analysis" methods descriptions provided below. ■ The determination of whether an RFD Case assessment will be included in the caribou section will be made during preparation of the Developer's Assessment Report, based on the methods outlined in Section 4.1.3. If an RFD Case is required, it is anticipated that the assessment will be qualitative and conceptual, and that the approach taken will depend upon the level of information available for individual RFDs.
Input from Engagement	Information and concerns raised during the engagement process undertaken for the Project (Volume 2) will be incorporated into the caribou assessment according to the methods defined in Section 4.1.4; specific issues raised will be documented in the assessment and a description of how the issue was addressed will be provided.	
Incorporation of Indigenous Traditional Knowledge (ITK)	The general methods that will be used to integrate local and ITK into the caribou assessment are defined in Section 4.1.5. Specific types of ITK that may be used in the caribou assessment are anticipated to include the following information types and sources: ■ locations where caribou are harvested ■ caribou local distribution and abundance ■ caribou behaviour and habitat conditions ■ observations of changes in caribou population abundance and distribution over time	

Table 4-14: Assessment Methods for Caribou

Assessment Approach for KLOI-2: Impacts to Caribou	
Existing Environment	The description of the existing environment provided in the Developer's Assessment Report for caribou will follow the general methods outlined in Section 4.1.6 and will expand on the information provided in Volume 3. The description of the existing environment will incorporate historical and recent baseline sampling information, including characterization of habitat conditions for caribou in the LSA and RSA. Habitat characterization likely will be completed using the habitat suitability model that was developed for the Project in 2018 (Golder 2018). Incorporation of ITK and community input is expected to support the characterization of existing conditions. The existing baseline information related to caribou is considered adequate to complete the effects assessment. No additional site-specific surveys are anticipated to be collected for caribou (Volume 3, Appendix C).
Project Interactions and Mitigations	Identification of Project interactions and mitigations for the caribou component will follow the general methods outlined in Section 4.1.7. A description of the anticipated Project-environment interactions identified for caribou, along with the associated residual effects categorization (i.e., no pathway, secondary, or primary) and proposed mitigation measures, is provided in Volume 4.
Residual Effects Analysis	The residual effects analysis for caribou will follow the general methods outlined in Section 4.1.8 and will focus on the Project-environment interactions that are determined to be primary in the pathway analysis (Volume 4). Four Project-environment interactions were determined to be primary for caribou. Assessment methods that will be used to evaluate the potential residual environmental effects of these pathways on caribou are described below. ■ Direct removal/alteration and fragmentation of vegetation ecosystems (i.e., caribou habitat) can affect caribou abundance and distribution. ■ Alteration of final terrain and soil conditions, and/or plant species composition, could change the types of ecosystems that can be reclaimed on the landscape, and adversely affect caribou habitat availability and distribution, and survival and reproduction. ▪ Availability and distribution of suitable habitat for caribou in the RSA will be estimated and mapped using the habitat suitability model developed by Golder (2018). Data used to develop the model include Landsat satellite data and the Earth Observation for Sustainable Development of Forests (EOSD) forest cover map imagery data for the Northwest Territories (provided courtesy of the Department of Environment and Natural Resources, Government of the Northwest Territories [GNWT-ENR]). The model also used ECCC data describing fire and development disturbance through 2015. Fire and human development disturbance since 2015 were added using the NWT Fire and Inventory of Landscape Change (acquired from the GNWT-ENR Cumulative Impact Monitoring Program website) datasets to maximize the amount of disturbance in the LSA and RSA. Development disturbance polygons, points, and linear features included a 500 m buffer, as per standard methods for assessment of caribou habitat (Environment Canada 2012; Golder 2018). ▪ The habitat model for the RSA will be used to determine changes in the availability (quantitatively) and distribution (qualitatively) of caribou habitat from the Base Case to the Application Case, and the RFD Case (if applicable). The analysis for the RFD Case may be quantitative and/or qualitative depending on the level of information available for RFDs.
Residual Effects Analysis (cont'd)	▪ Incremental and cumulative changes in existing caribou habitat and disturbance from the Project and other developments at the scale of the Southern NWT Range (GNWT 2019) will be calculated and qualitatively assessed to provide relevant ecological context for predicted effects from the Project on caribou in this region of the NT1 Boreal Caribou Range. ▪ At the scale of the NT1 Boreal Caribou Range, the incremental contribution from the Project to the loss of critical caribou habitat and associated increase in human (and total) disturbance relative to existing conditions will be calculated. ■ Sensory disturbance can alter caribou movement and behaviour and adversely affect functional habitat availability and caribou abundance and distribution. ▪ Effects from sensory disturbance on caribou will be captured quantitatively under the habitat availability and distribution assessment, as the 500 m buffer around human disturbance, which is used to calculate caribou habitat loss, also includes effects from sensory disturbance and perceived predation risk. ▪ Additional qualitative analyses on caribou abundance, distribution, and survival and reproduction will be completed using scientific literature, government reports, and other publicly available information that characterizes effects from sensory disturbance on woodland caribou. ■ Increased access for predators (e.g., wolf and black bear) and prey may increase predation risk and decrease caribou survival and reproduction. ▪ Changes in predator access will be assessed qualitatively through the results of the analysis of loss and fragmentation of suitable caribou habitat, and supported by scientific literature. In addition, a quantitative comparison of existing trails and roads with linear features developed for the Project (and RFDs, if applicable) will be used to qualitatively assess changes in predator access on effects on caribou survival and reproduction. Assessment methods are also provided for one Project-environment interaction that may be assessed as either a primary or secondary pathway on caribou, depending on feedback from communities and other people on the

Table 4-14: Assessment Methods for Caribou

Assessment Approach for KLOI-2: Impacts to Caribou	
	Developer's Assessment Proposal. In the event that this pathway is determined to be secondary in the pathway analysis, it will not be carried forward to the residual effects analysis. ■ Changes in public access to hunting/trapping areas and increased density of people (i.e., Project staff and contractors) in the area may increase harvesting of caribou and affect abundance. ■ A quantitative comparison of existing trails and roads with linear features developed for the Project (and RFDs, if applicable) will be used to qualitatively assess changes in public access on effects on caribou survival and reproduction. Information from ITK and communities on current harvest areas and levels of caribou would provide valuable support for the assessment of this pathway. Technically and economically feasible mitigation will be identified in coordination with the air quality, terrain and soils, vegetation, and wildlife components. Note that potential effects on Indigenous people from changes to caribou availability (e.g., traditional harvest) will be assessed in the traditional land and resource use (TLRU) section (see Section 4.2.2.3).
Residual Effects Classification and Determination of Significance	The residual effects classification completed for the caribou assessment will follow the methods defined in Section 4.1.9. Caribou-specific definitions will be developed for the residual effects classification criteria of direction, magnitude, geographic extent, duration, reversibility, frequency, and probability of occurrence. A determination of significance will be completed for the caribou VC according the methods described in Section 4.1.9.
Prediction Confidence and Uncertainty	Prediction confidence and uncertainty will be evaluated according the general methods defined in Section 4.1.10. Key sources of uncertainty that are relevant to the caribou assessment, and that will be addressed in the Developer's Assessment Report, are anticipated to include the consideration of the following elements: ■ adequacy of baseline data for understanding current conditions and future changes unrelated to the Project ■ understanding of Project-related effects on complex ecosystems that contain interactions across different scales of time and space ■ knowledge of the effectiveness of mitigation and environmental design features for reducing or removing Project effects Prediction confidence and uncertainty with respect to air quality, water quality, and vegetation, are also relevant to the caribou assessment and will be considered in the caribou section of the Developer's Assessment Report.
Monitoring and Follow-up	The caribou section of the Developer's Assessment Report will include a description of the monitoring activities proposed to address the uncertainties associated with effect predictions and the performance of environmental design features and mitigation related to the Project. As described in Section 4.1.11, the description of monitoring activities will include consideration of both compliance and follow-up monitoring. Monitoring of caribou will occur as a component of the Wildlife Protection Plan developed for the Project, and include the following elements: ■ wildlife sightings monitoring, which will consist of reporting of caribou sightings/activity by all staff ■ pre-clearing monitoring, which will consist of pre-clearing surveys to detect caribou ahead of clearing activities ■ wildlife incident reporting, which will consist of reporting of caribou incidents (e.g., caribou injury or mortality) by all staff Monitoring activities defined for air quality, water quality, and vegetation are also relevant to caribou and will be considered in the caribou section of the Developer's Assessment Report. The caribou section of the Developer's Assessment Report will include a description of the specific objectives, monitoring techniques, and general analysis procedures that will be used for each monitoring type. Where applicable, links to adaptive management responses will be defined. The design of monitoring activities will also consider previously collected data and will incorporate ITK and information gathered through engagement with communities, where appropriate.
Supporting Annexes	Supporting documentation relevant to the caribou assessment is anticipated to include the following annex which will be appended to the Developer's Assessment Report and referenced, as appropriate, in the caribou section of the Developer's Assessment Report: ■ Caribou Habitat Suitability Index Model Methods Other information sources will be considered in the caribou assessment (see the "Information Sources" section above) but will not be appended to the caribou section of the Developer's Assessment Report. The caribou baseline will be included in the Wildlife Baseline Report (Section 4.2.1.9).



LEGEND

- FORMER PINE POINT TOWN SITE
- POPULATED PLACE
- ALL-SEASON ROAD
- WINTER ROAD
- RAILWAY
- WATERCOURSE
- PARK/PROTECTED AREA
- WATERBODY
- NT1 BOREAL CARIBOU RANGE
- REGIONAL STUDY AREA – WOODLAND CARIBOU, WOOD BISON, WOLF, AND WOLVERINE

0 20 40

1:1,000,000 KILOMETRES

REFERENCE(S)

1. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
2. PARKS AND PROTECTED AREAS OBTAINED FROM CONSERVATION AREAS REPORTING AND TRACKING SYSTEM (CARTS), CANADIAN COUNCIL ON ECOLOGICAL AREAS, 2017.

PROJECTION: ALBERS CONIC EQUAL AREA

CLIENT

PINE POINT MINING LTD.

PROJECT

PINE POINT PROJECT

TITLE

WOODLAND CARIBOU AND OTHER WIDE-RANGING WILDLIFE REGIONAL STUDY AREA

CONSULTANT

GOLDER

YYYY-MM-DD	2020-12-15
DESIGNED	DC
PREPARED	PMT
REVIEWED	JV
APPROVED	JV

PROJECT NO.	PHASE	REV.	FIGURE
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4.2.1.9 SON-7: Impacts to Wildlife

A description of the assessment methods expected to be used in the Developer's Assessment Report for the wildlife component is provided in Table 4-15.

Table 4-15: Assessment Methods for Wildlife

Assessment Approach for SON-7: Impacts to Wildlife		
Information Sources	Information sources that will be used to support the wildlife assessment scoping are anticipated to include the relevant sources listed in Section 4.1.1 and the following: ■ the Wildlife Baseline Report ■ results of the effects assessments for groundwater quantity and quality, surface water quantity, water quality, air quality, terrain and soils, vegetation, and caribou ■ environmental management and monitoring plans, including framework of conceptual version of the Water Management Plan, Tailings and Waste Rock Management Plan, Erosion and Sediment Control Plan, Spill Contingency Plan, Waste Management Plan, Closure and Reclamation Plan, and Wildlife Protection Plan ■ territorial and federal legislation and guidance such as the NWT's *Wildlife Act*, the federal *Species at Risk Act*, the federal *Migratory Birds Convention Act*, and Committee on the Status of Endangered Wildlife in Canada.	
Valued Components, Assessment Endpoints, and Measurement Indicators	Valued Components (VCs)	The potential VCs for the wildlife assessment are listed in Section 2.0 and Table 2-1 Characterization of the existing environment and a pathway analysis are completed for all VCs listed in Table 2-1 to identify the primary pathways from the Project that may result in significant effects on wildlife VCs. However, not all potential wildlife VCs listed in Table 2-1 need to be assessed comprehensively in the Residual Effects Analysis, Residual Effects Classification and Significance Determination, and Prediction Confidence and Uncertainty sections of the Developer's Assessment Report. At a fine-filter level, wildlife VCs were selected for comprehensive assessment (including RFD Case, where applicable) to focus the assessment on the primary areas of concern with respect to the Project. In cases where effects would be similar for multiple wildlife species, only one species was selected as a VC for comprehensive assessment to minimize ecological and assessment redundancy. For example, the baseline and assessment for olive-sided flycatcher indicates similar habitat and potential Project and cumulative effects for other listed bird species, such as bank swallow, barn swallow, and common nighthawk because they have similar diets (i.e., aerial insectivores). Similarly, the baseline and assessment for yellow rail indicates similar habitat and potential Project and cumulative effects for horned grebe, red-necked phalarope other wetland-dependent species (e.g., northern leopard frog [not detected during baseline surveys]). At a coarser level, ecological and assessment redundancy is completed through the assessment of upland, wetland, and riparian ecosystems, and overall biodiversity, in the vegetation SON (Section 4.2.1.7). Assessing and managing biodiversity at the vegetation ecosystems level means that large numbers of biodiversity elements are addressed together. For example, wildlife guilds dependent on mature forests (e.g., caribou, wolverine, bats) that may contain very old live trees, standing dead trees, and coarse woody debris will be captured by the ecosystem level assessment. Similarly, analysis of the availability, distribution, and function of wetland and riparian ecosystems provides an assessment of amphibians, semi aquatic birds, and mammals, and potential movement corridors connecting habitats across the landscape. The coarse and fine filter assessments compliment and interact with one another, with each assessment providing context for the other. Combined, the coarse and fine filter assessments provide a holistic assessment of the potential effects of the Project on biodiversity. The following is a list of wildlife VCs selected for comprehensive assessment in the Developer's Assessment Report: ■ wood bison ■ wolverine ■ gray wolf ■ little brown myotis ■ olive-sided flycatcher ■ common nighthawk ■ evening grosbeak ■ yellow rail ■ rusty blackbird ■ whooping crane The inclusion of whooping crane in the comprehensive assessment was based on a recommendation from Parks Canada as it is a key indicator of Wood Buffalo National Park. A screening level assessment will be completed for all other wildlife VCs listed in Table 2-1, which includes characterization of existing conditions, pathway analysis, and tabulation of the classification of predicted Project residual effects and determination of significance. The screening tabulation of residual effects classification and determination of significance will be provided in an appendix to the wildlife SON in the Developer's Assessment Report.

Table 4-15: Assessment Methods for Wildlife

Assessment Approach for SON-7: Impacts to Wildlife		
Valued Components, Assessment Endpoints, and Measurement Indicators (cont'd)	Assessment Endpoints and Measurement Indicators	The assessment endpoints and measurement indicators recommended to be used in the wildlife assessment are defined in Section 4.1.2 and Table 2-2.
Environmental Assessment Boundaries	Spatial Boundaries	The spatial boundaries considered in the wildlife assessment will include a local study area (LSA) and two VC-specific regional study areas (RSAs; Section 4.1.3): ■ The LSA for wildlife is equivalent to terrain and soils and vegetation and will include the anticipated maximum extent of the Project footprint plus a 500 m buffer (77,145 ha). All active mineral claims, existing bush roads, cutlines, historic railbed, waste rock piles, and backfilled and mined pits are included in the LSA. Other anticipated new and existing features for the Project contained within the LSA include access roads, laydown areas, and overburden stockpiles. The LSA is expected to capture the combined potential direct and indirect (e.g., dust deposition, noise, changes in surface water quality) effects from the Project on wildlife and provides local context for assessing effects (Figure 4-5). ■ The RSA for small-ranging wildlife VCs (e.g., migratory birds, bats, amphibians, and bumble bees) was designed to provide broader context for interpreting the local effects of the Project and covers approximately 185,148 ha (Figure 4-6). The RSA includes the LSA and is similar to the RSA for groundwater, hydrology, surface water quality, soils and vegetation due to the ecological relationships among aquatic and soil and vegetation ecosystems, and wildlife habitats (e.g., wetland structure and function). The RSA includes Birch Creek watershed and is bounded by the southern shore of Great Slave Lake. In addition to existing human developments the RSA also includes disturbances from wildfires. ■ The area is expected to be at a scale suitable for assessing the significance of effects on wildlife VCs with small daily and seasonal ranges distributed inside the RSA, but probably also extend beyond its boundaries. The RSA is considered large enough to provide an ecologically relevant and confident assessment of the direct and indirect effects on wildlife VCs from the Project, and the cumulative effects from the Project and previous, existing, and reasonably foreseeable developments, and natural factors. ■ For more wide-ranging wildlife VCs (e.g., wood bison, wolverine, gray wolf) the RSA defined for caribou will be used to provide broader context for interpreting the local effects of the Project (Section 4.2.1.8). The RSA is defined as the portion of the Southern NWT Range (GNWT 2019) east of the community of Hay River to the western boundary of NT1 Boreal Caribou Range, and bounded to the north by the shoreline of Great Slave Lake and to the south by the Northwest Territories-Alberta border (1,722,100 ha) (Figure 4-7). The area is expected to capture a large enough portion of populations to make ecologically relevant predictions about the incremental and cumulative effects from the Project and other developments on all VCs that are likely to be distributed inside but may also extend outside the RSA. Predator-prey interactions are also expected to be relevant at this spatial scale.
	Temporal Boundaries	The temporal boundaries for the wildlife assessment will focus the Project phases defined in Section 4.1.3: construction, operation, and closure and reclamation. The assessment will also consider potential effects on wildlife during post-closure, where relevant. For some pathways of effects, residual effects on wildlife VCs will be evaluated across all phases of the Project, but not necessarily for each specific phase.
	Assessment Cases	■ The wildlife residual effects analysis will consist of up to three assessment cases, as defined in Section 4.1.3: a Base Case, an Application Case and, possibly, a Reasonably Foreseeable Development (RFD) Case. The methods that will be used to assess the Base Case and the Application Case are defined in Section 4.1.3 and in the “Existing Environment” and “Residual Effects Analysis” descriptions provided below. ■ The determination of whether an RFD Case assessment will be included in the wildlife section will be made during preparation of the Developer’s Assessment Report, based on the methods outlined in Section 4.1.3. If an RFD Case is required, it is anticipated that the assessment will be qualitative and conceptual, and that the approach taken will depend upon the level of information available for individual reasonably RFDs.
Input from Engagement	Information and concerns raised during the engagement process undertaken for the Project (Volume 2) will be incorporated into the wildlife assessment according to the methods defined in Section 4.1.4; specific issues raised will be documented in the assessment and a description of how the issue was addressed will be provided.	

Table 4-15: Assessment Methods for Wildlife

Assessment Approach for SON-7: Impacts to Wildlife	
Incorporation of Indigenous Traditional Knowledge (ITK)	The general methods that will be used to integrate local and ITK into the wildlife assessment are defined in Section 4.1.5. Specific types of ITK that may be used in the wildlife assessment are anticipated to include the following information types and sources: ■ wildlife species harvested for subsistence, cultural, or commercial purposes and their perceived value ■ locations where wildlife are harvested ■ wildlife species local distribution and abundance ■ wildlife species behaviour and habitat conditions ■ observations of changes in wildlife population abundance and distribution over time
Existing Environment	The description of the existing environment provided in the Developer's Assessment Report for wildlife will follow the general methods outlined in Section 4.1.6 and will expand on the information provided in Volume 3. The description of the existing environment will incorporate historical and recent baseline sampling information, including characterization of wildlife habitat conditions in the LSA and RSA. Habitat characterization could be completed using habitat suitability models that were developed for the Project in 2018 (Golder 2018). Incorporation of ITK and community input is expected to support the characterization of existing conditions. The existing baseline information related to wildlife is considered adequate to complete the effects assessment. No additional site-specific surveys are anticipated to be collected for the wildlife component (Volume 3, Appendix C).
Project Interactions and Mitigations	Identification of Project interactions and mitigations for the wildlife component will follow the general methods outlined in Section 4.1.7. A description of the anticipated Project-environment interactions identified for wildlife, along with the associated residual effects categorization (i.e., no pathway, secondary, or primary) and proposed mitigation measures, is provided in Volume 4.

Residual Effects Analysis	The residual effects analysis for the wildlife component will follow the general methods outlined in Section 4.1.8 and will focus on the Project-environment interactions that are determined to be primary in the pathway analysis (Volume 4). Three Project-environment interactions were determined to be primary for wildlife. Assessment methods that will be used to evaluate the potential residual environmental effects of these pathways on wildlife VCs are described below.
	■ Direct removal/alteration and fragmentation of vegetation ecosystems (i.e., wildlife habitat) can affect wildlife abundance and distribution.
	■ Alteration of final terrain and soil conditions, and/or plant species composition could change the types of ecosystems that can be reclaimed on the landscape, and adversely affect wildlife habitat availability and distribution, and survival and reproduction.
	  ■ For small- and wide-ranging wildlife VCs, availability and distribution of suitable habitats in each applicable RSA (see Spatial Boundaries) will be estimated and mapped using habitat suitability models (Golder 2018). Data used to develop the models include Landsat satellite data and the Earth Observation for Sustainable Development of Forests (EOSD) forest cover map imagery data (NRCAN and GNWT 2017) for the Northwest Territories (provided courtesy of the Department of Environment and Natural Resources, Government of the Northwest Territories [GNWT-ENR]). Fire data (from 1965 to present) are also applied as a separate layer to identify age of burns and incorporated into the habitat models. Human disturbance data (e.g., forest cut blocks, communities, powerlines, roads, and trails) were obtained from government sources and applied to the models as a separate layer.
	  ■ The habitat models for the RSAs will be used to determine changes in the availability (quantitatively) and distribution (qualitatively) of habitat for wildlife VCs from the Base Case to the Application Case, and the RFD Case (if applicable). The analysis for the RFD Case may be quantitative and/or qualitative depending on the level of information available for RFDs.
	■ Sensory disturbance can alter wildlife movement and behaviour and adversely affect wildlife habitat availability and animal abundance and distribution.
	  ■ Effects from sensory disturbance will be determined qualitatively using scientific literature, government reports, and other publicly available information that details effects from sensory disturbance on wildlife VCs.
	Technically and economically feasible mitigation will be identified in coordination with the air quality, terrain and soils, and vegetation components.
	Note that potential effects on Indigenous and other people from changes to wildlife availability (e.g., traditional hunting, outfitting) will be assessed in the TLRU and NTLRU sections, respectively (see Section 4.2.2.3 and Section 4.2.2.4).

Residual Effects Classification and Determination of Significance	The residual effects classification completed for the wildlife assessment will follow the methods defined in Section 4.1.9. Wildlife-specific definitions will be developed for the residual effects classification criteria of direction, magnitude, geographic extent, duration, reversibility, frequency, and probability of occurrence. A determination of significance will be completed for the wildlife VCs according the methods described in Section 4.1.9.

Table 4-15: Assessment Methods for Wildlife

Assessment Approach for SON-7: Impacts to Wildlife	
Prediction Confidence and Uncertainty	Prediction confidence and uncertainty will be evaluated according the general methods defined in Section 4.1.10. Key sources of uncertainty that are relevant to the wildlife assessment, and that will be addressed in the Developer's Assessment Report, are anticipated to include the consideration of the following elements: ■ adequacy of baseline data for understanding current conditions and future changes unrelated to the Project ■ understanding of Project-related effects on complex ecosystems that contain interactions across different scales of time and space ■ knowledge of the effectiveness of mitigation and environmental design features for reducing or removing Project effects Prediction confidence and uncertainty with respect to air quality, water quality, and vegetation are also relevant to the wildlife assessment and will be considered in the wildlife section of the Developer's Assessment Report.
Monitoring and Follow-up	The wildlife section of the Developer's Assessment Report will include a description of the monitoring activities proposed to address the uncertainties associated with effect predictions and the performance of environmental design features and mitigation related to the Project. As described in Section 4.1.11, the description of monitoring activities will include consideration of both compliance monitoring and follow-up monitoring. Monitoring of wildlife will occur as a component of the Wildlife Protection Plan developed for the Project, and will include the following elements: ■ wildlife sightings monitoring, which will consist of reporting of wildlife sightings/activity by all staff ■ wildlife surveillance monitoring, which will consist of systematic surveys of the accommodations camp and waste management areas to document wildlife activity ■ bird nesting and bat roosting monitoring, which will consist of non-intrusive pre-clearing surveys to detect bird nesting activity and potential bat maternity roosts, should vegetation clearing be required during the bat maternity roosting period or the migratory bird nesting period (1 May 1 to 15 August) ■ pre-clearing monitoring, which will consist of pre-clearing surveys to detect large mammals and raptor nests ahead of clearing activities ■ wildlife incident reporting, which will consist of reporting of wildlife incidents (e.g., wildlife injury or mortality, wildlife-caused damage to property) by all staff Monitoring activities defined for air quality, water quality, and vegetation are also relevant to wildlife and will be considered in the wildlife section of the Developer's Assessment Report. The wildlife section of the Developer's Assessment Report will include a description of the specific objectives, monitoring techniques and general analysis procedures that will be used for each monitoring type. Where applicable, links to adaptive management responses will be defined. The design of monitoring activities will also consider previously collected data and will incorporate ITK and information gathered through engagement with communities, where appropriate.
Supporting Annexes	Supporting documentation relevant to the wildlife assessment is anticipated to include the following annexes which will be appended to the Developer's Assessment Report: ■ Screening Level Assessment for Wildlife Valued Components ■ Wildlife Baseline Report ■ Habitat Suitability Index Model Methods ■ Residual Effects Classification and Significance Determination for Screening Level Valued Components Other information sources will be considered in the wildlife assessment (see the "Information Sources" section above) but will not be appended to the wildlife section of the Developer's Assessment Report. Caribou will be included in the Wildlife Baseline Report.

4.2.2 Human Environment

4.2.2.1 SON-8: Impacts to Heritage Resources

Heritage resources is identified in Table 2-1 as a proposed VC to be included in the Developer's Assessment Report. A description of the assessment methods expected to be used in the Developer's Assessment Report for heritage resources is provided in Table 4-16.

Table 4-16: Assessment Methods for Heritage Resources

Assessment Approach for SON-8: Impacts to Heritage Resources		
Information Sources	Information sources that will be used to support the heritage resources assessment scoping are anticipated to include the relevant sources listed in Section 4.1.1 and the following: ■ the Heritage Resources Baseline Report ■ results of the effects assessments for groundwater quantity and quality, surface water quantity, water quality, and air quality ■ environmental management and monitoring plans, including framework or conceptual versions of the following: Water Management Plan, Tailings and Waste Rock Management Plan, Erosion and Sediment Control Plan, Spill Contingency Plan, Waste Management Plan, and Closure and Reclamation Plan ■ other Archaeological Impact Assessment and Archaeological Overview Assessment reports prepared for Pine Point Mining Limited ■ territorial and federal legislation and guidance such as the *Northwest Territories Archaeological Sites Act*, *Northwest Territories Archaeological Sites Regulations*, *Mackenzie Valley Resource Management Act*, *Mackenzie Valley Land Use Regulations*	
Valued Components, Assessment Endpoints, and Measurement Indicators	Valued Components (VCs)	The VCs recommended to be used in the heritage resources assessment are defined in Section 2.0 and Table 2-1.
	Assessment Endpoints and Measurement Indicators	The assessment endpoints and measurement indicators recommended to be used in the heritage resources assessment are defined in Section 4.1.2 and Table 4-1.
Environmental Assessment Boundaries	Spatial Boundaries	The spatial boundaries considered in the heritage resources assessment will include a local study area (LSA) and a broader regional study area (RSA; Section 4.1.3): ■ The LSA is recommended to include the Project footprint or areas of direct ground disturbance that could affect heritage resources. ■ The RSA is recommended to be an area extending from Hay River in the west to Slave River in the east, and the shore of Great Slave lake in the North to the Alberta border in the south. This will provide context for documented heritage resources in the LSA.
	Temporal Boundaries	The temporal boundaries for the heritage resources assessment will focus on the Project phases defined in Section 4.1.3: construction, operation, and closure and reclamation. For some pathways of effects, the residual effects of the heritage resources VC will be evaluated across all phases of the Project, but not necessarily for each specific phase.
	Assessment Cases	■ The heritage resources residual effects analysis will consist of two assessment cases, which will include a Base Case and an Application Case (Section 4.1.3). The methods that will be used to assess the Base Case and the Application Case are defined in Section 4.1.3 and in the "Existing Environment" and "Residual Effects Analysis" descriptions provided below. ■ A Reasonably Foreseeable Development Case will not be included, as disturbance to heritage resource sites are spatially localized events that will not result in the negative effect on the condition of other archaeological sites in the region. Therefore, cumulative effects are not anticipated.
Input from Engagement	Information and concerns raised during the engagement process undertaken for the Project (Volume 2) will be incorporated into the heritage resources assessment according to the methods defined in Section 4.1.4; specific issues raised will be documented in the assessment and a description of how the issue was addressed will be provided.	
Incorporation of Indigenous Traditional Knowledge (ITK)	The general methods that will be used to integrate local and ITK into the heritage resources assessment are defined in Section 4.1.5. Specific types of ITK that may be used in the heritage resources assessment are anticipated to include the following information types and sources: ■ location of known heritage resource sites (e.g., observed artifacts or features) ■ locations of traditional use sites that could contain archaeological sites (e.g., campsites, cabins, fishing, or hunting locations)	

Table 4-16: Assessment Methods for Heritage Resources

Assessment Approach for SON-8: Impacts to Heritage Resources	
Existing Environment	The description of the existing environment provided in the Developer's Assessment Report for heritage resources will follow the general methods outlined in Section 4.1.6 and will expand on the information provided in Volume 3. The description of the existing environment will incorporate historical and recent baseline sampling information. Additional information recommended to be collected for heritage resources in the baseline study plan for the Project (Volume 3, Appendix C) will be included in the existing environment description. Further baseline studies were carried out in summer 2020 in areas of the Project footprint outside of previously disturbed areas. Heritage field studies will be carried out in high potential areas to identify presence of archeological sites. The description the existing environment for the heritage resources component will include characterization of each site (size, density, age, cultural affiliation, level of disturbance) within the LSA.
Project Interactions and Mitigations	Identification of Project interactions and mitigations for the heritage resources component will follow the general methods outlined in Section 4.1.7. A description of the anticipated Project-environment interactions identified for heritage resources, along with the associated residual effects categorization (i.e., no pathway, secondary or primary) and proposed mitigation measures, is provided in Volume 4.
Residual Effects Analysis	As indicated in Volume 4, there are no primary pathways identified for heritage resources; hence, a residual effects analysis will not be completed for the heritage resources component.
Residual Effects Classification and Determination of Significance	As there are no primary pathways identified for heritage resources, a residual effects classification and significance determination will not be completed for the heritage resources component.
Prediction Confidence and Uncertainty	Prediction confidence and uncertainty will be evaluated according to the general methods defined in Section 4.1.10. Key sources of uncertainty that are relevant to the heritage resources assessment, and that will be addressed in the Developer's Assessment Report, are anticipated to include the consideration of the following elements: ■ adequacy of baseline data for understanding current conditions and future changes unrelated to the Project ■ understanding of Project-related effects on complex ecosystems that contain interactions across different scales of time and space ■ knowledge of the effectiveness of mitigation and environmental design features for reducing or removing Project effects
Monitoring and Follow-up	The heritage resources section of the Developer's Assessment Report will include a description of the monitoring activities proposed to address the uncertainties associated with effect predictions and the performance of environmental design features and mitigation related to the Project. In the NWT, the Prince of Wales Northern Heritage Centre manages the permitting process to protect archaeological resources, including types of studies, and the need for mitigation and/or monitoring, where appropriate. As described in Section 4.1.11, the description of monitoring activities will include consideration of both compliance monitoring and follow-up monitoring. Monitoring and management for the heritage resources component will include the following elements: ■ A heritage resources management plan to be developed prior to Project construction that describes procedures to follow in the event unanticipated (chance find) heritage resources are encountered during construction, operation, or closure. ■ An education program for mine staff and contractors to enable identification of heritage resources and provides general guidelines for the appropriate response to the inadvertent discovery of known or suspected archaeological sites
Supporting Annexes	Supporting documentation relevant to the heritage resources assessment is anticipated to include the following annex which will be appended to the heritage resources section of the Developer's Assessment Report: ■ Heritage Resources Baseline Report Other information sources will be considered in the heritage resources assessment (see the "Information Sources" section above) but will not be appended to the heritage resources section of the Developer's Assessment Report.

4.2.2.2 KLOI-3: Impacts to Traditional Land and Resource Use

A description of the assessment methods expected to be used in the Developer's Assessment Report for the TLRU component is provided in Table 4-17.

Table 4-17: Assessment Methods for Traditional Land and Resource Use

Assessment Approach for KLOI-3: Impacts to Traditional Land and Resource Use		
Information Sources	Indigenous Traditional Knowledge (ITK) regarding the lands and waters used by the Indigenous peoples potentially affected by the Project will be integral in developing the traditional land and resource use (TLRU) baseline and effects assessment. Information sources that will be used to scope the TLRU assessment are anticipated to include the relevant sources listed in Section 4.1.1 and the following: ■ the TLRU Baseline Report ■ publicly available literature regarding TLRU in the region, and around the Project (e.g., academic publications, previous ITK studies completed in relation to the Pine Point Pilot Project), and validated by the communities ■ TLRU information provided through Project consultation and engagement ■ TLRU use information and ITK obtained through forthcoming Project-specific studies ■ inputs from the effects assessments for air quality, noise, climate, water quality, fish and fish habitat, vegetation, caribou, and wildlife	
Valued Components, Assessment Endpoints, and Measurement Indicators	Valued Components (VCs)	The VCs recommended to be used in the TLRU assessment include: traditional hunting and trapping, traditional fishing, traditional plant harvesting, and use of culturally important sites and areas. A rationale for the selection of these VCs is provided in Section 2.0 and Table 2-1.
	Assessment Endpoints and Measurement Indicators	The assessment endpoints and measurement indicators recommended to be used in the TLRU assessment are defined in Section 4.1.2 and Table 4-1.
Environmental Assessment Boundaries	Spatial Boundaries	The Project is within the traditional territories of the Deninu Kue First Nation, K'atl'odeeche First Nation, and Northwest Territory Métis Nation. The Deninu Kųę First Nation is in close proximity to the Project, and has to date been the most engaged. The Hay River Métis Council and the Fort Resolution Métis Council were initially engaged separately; however, more recently, engagement has been through the Northwest Territory Métis Nation. Project-induced effects on the TLRU of these groups will be largely assessed within the study areas defined for potentially affected resources. Therefore, the study areas for hunting and trapping and traditional plant harvesting activities correspond with those of the terrestrial disciplines (Table 4-12, Table 4-15, Figure 4-5 through Figure 4-7) and the study areas for fishing and water use correspond with those of the aquatic disciplines(Table 4-8, Table 4-11, Figure 4-3 and Figure 4-4). Consideration is also given to the noise study area when discussing effects on the experience of Indigenous land users (Table 4-6). When assessing effects on travel, access, and the use of the land for cultural and spiritual practices, the TLRU assessment does not rely on defined spatial boundaries. The TLRU study areas and issues will be refined in collaboration with affected Indigenous groups.
	Temporal Boundaries	The temporal boundaries for the TLRU assessment will focus on the Project phases defined in Section 4.1.3: construction, operation, closure and reclamation. The assessment will also consider potential effects on TLRU during post-closure, where relevant. For some pathways of effects, residual effects on TLRU VCs will be evaluated across all phases of the Project, but not necessarily for each specific phase.
	Assessment Cases	■ The TLRU residual effects analysis will consist of up to three assessment cases, as defined in Section 4.1.3: a Base Case, an Application Case and, possibly, a Reasonably Foreseeable Development (RFD) Case. The methods used to assess the Base Case and the Application Case are defined in Section 4.1.3 and in the "Existing Environment" and "Residual Effects Analysis" descriptions provided below. ■ The determination of whether an RFD Case assessment will be included in the TLRU section will be made during preparation of the Developer's Assessment Report, based on the methods outlined in Section 4.1.3. If an RFD Case is required, it is anticipated that the assessment will be qualitative and conceptual, and that the approach taken will depend upon the level of information available for individual reasonably RFDs.
Input from Engagement	TLRU information, ITK, and concerns raised during the Indigenous engagement process undertaken for the Project (Volume 2) will be incorporated into the TLRU assessment according to the methods defined in Section 4.1.4. Specific issues raised will be documented in the assessment and a description of how the issue was addressed will be provided.	

Table 4-17: Assessment Methods for Traditional Land and Resource Use

Assessment Approach for KLOI-3: Impacts to Traditional Land and Resource Use	
Incorporation of Indigenous Traditional Knowledge (ITK)	The general methods that will be used to integrate local and ITK into the TLRU assessment are defined in Section 4.1.5. Specific types of ITK that may be identified for inclusion in the TLRU assessment are anticipated to include: ■ traditionally important resources (e.g., wildlife, fish, medicinal plants) ■ country foods and food security ■ patterns of traditional land use ■ the cultural value of resources, places, and landscapes ■ cultural, spiritual, and ceremonial sites ■ the interaction between the wage and traditional economy ■ travel routes, including trails and water-based access routes ■ subsistence and harvesting activities ■ ecological knowledge of wildlife, vegetation, fish, water, and climate
Existing Environment	The description of the existing environment provided in the Developer's Assessment Report for TLRU will follow the general methods outlined in Section 4.1.6 and will expand on the information provided in Volume 3. The description of the existing environment will incorporate information regarding current TLRU of communities obtained through desktop literature review, feedback provided during engagement and through consultation with communities, following ITK protocols. The existing environment will also be informed by Project-specific ITK studies developed by the communities, or on behalf of the communities. The existing environment for land and resource use will include a description of harvesting activities and their importance to potentially affected communities, harvest species, levels, and importance to the traditional economy, places of cultural and spiritual value, and access to land use areas. Additional information recommended to be collected for TLRU component in the baseline study plan for the Project (Volume 3, Appendix C) will be included in the existing environment description. This will include information from a desktop literature review and future engagement activities. Further details are provided in Volume 3, Appendix C.
Project Interactions and Mitigations	Identification of Project interactions and mitigations for the TLRU component will follow the general methods outlined in Section 4.1.7. A description of the anticipated Project-environment interactions identified for TLRU, along with the associated residual effects categorization (i.e., no pathway, secondary, or primary) and proposed mitigation measures, is provided in Volume 4.
Residual Effects Analysis	The TLRU residual effects analysis will consist of a qualitative assessment, supported by quantitative analysis where possible, and will discuss the disturbance affecting traditional land use areas, changes in the availability of traditionally important resources (e.g., wildlife, fish and vegetation), changes in physical access, and the potential for sensory disturbances (i.e., noise, odour and visual effects) to affect Indigenous land users. The TLRU effects assessment will therefore incorporate the results of other relevant environmental disciplines when discussing effects on resources and the potential for sensory disturbance to affect Indigenous land users. In addition to the tangible values (e.g., wildlife species or traditional plants) associated with the use of lands and resources by Indigenous groups, the TLRU effects assessment will also discuss intangible values (e.g., changes to sense of place within the larger cultural landscape, and opportunities to transfer cultural values and knowledge to future generations) associated with TLRU. The TLRU results of Indigenous engagement will also be relied upon in determining potential and residual effects on TLRU. The residual effects analysis for the TLRU component will follow the general methods outlined in Section 4.1.8 and will focus on the Project-environment interactions that are determined to be primary in the pathway analysis (Volume 4). Assessment methods that will be used to evaluate the potential residual environmental effects of these pathways on TLRU VCs are described below. Several Project-environment interactions have been determined to be secondary or primary, depending on the outcome of the analyses of biological components and feedback from communities. In the event that these pathways are determined to be secondary in the pathway analysis, they will not be carried forward to the residual effects analysis: ■ changes in the abundance and distribution of wildlife, and the availability of wildlife for traditional hunting and trapping ■ changes in the abundance and distribution of fish, and the availability of fish for traditional fishing ■ changes in water quality, and the availability of water for drinking ■ changes in the abundance and distribution of vegetation, and the availability of plants for traditional harvesting ■ To determine changes in resource availability, the TLRU assessment will incorporate the results of the wildlife assessment, fish and fish habitat assessment, vegetation assessment, and water quality assessments.

Table 4-17: Assessment Methods for Traditional Land and Resource Use

Assessment Approach for KLOI-3: Impacts to Traditional Land and Resource Use	

Residual Effects Analysis (cont'd)	Other Project-environment interactions were determined to primary (Volume 4):
	■ the direct disturbance to, or loss of, traditional use areas, including hunting and trapping, fishing, plant harvesting, and culturally important sites and areas (e.g., habitation, spiritual sites, or trails)
	  ▪ Land disturbance from the Project will be calculated for traditional use areas identified by Indigenous communities, including areas used for hunting, trapping, fishing, plant harvesting, or culturally important sites, to identify the change in available land use areas between Base Case, Assessment Case, and RFD Case.
	■ sensory disturbances (e.g., noise, light, odour, and visual disturbance) can affect the experience of Indigenous land users
	  ▪ A qualitative assessment will be conducted, incorporating the results of engagement with Indigenous communities and the level of concern expressed, supported by a quantitative analysis from the noise and air quality assessments
	■ changes in intangible values, including sense of place within the cultural landscape, and reduced ability to transfer knowledge to future generations
	  ▪ A qualitative assessment will be conducted, incorporating the results of engagement with Indigenous communities and the level of concern expressed. Changes in intangible values will be considered holistically with other measurable parameters for each VC.
	■ changes in social and economic factors can affect participation in traditional activities (e.g., either positively or negatively) and changes in cultural values and practices
	  ▪ A qualitative assessment will be conducted, incorporating the results of engagement with Indigenous communities and the level of concern expressed, and the results of the socio-economic assessment.

Residual Effects Classification and Determination of Significance	The residual effect classification criteria for TLRU will generally be consistent with those presented in Section 4.1.9 and Section 4.2.2.3, with the exception of geographic extent. When assessing Project effects on TLRU, a local geographic extent will be assigned to effects within the associated local study area (LSA) of the resource affected. Similarly, a regional geographic extent will be assigned to effects within the associated regional study area (RSA) of the resource affected. For example, traditional plant harvesting will be assessed within the vegetation LSA. Beyond regional effects are those that extend outside of the RSAs for environmental resources used for traditional harvesting purposes. A determination of significance will be completed for the TLRU VCs according to the methods described in Section 4.1.9 and those described further in the socio-economic assessment methods (Section 4.2.2.3). In determining the significance of the Project's effects on TLRU, the level of concern expressed by communities and ITK collected in association with the Project will be included alongside scientific analyses and inference.
Prediction Confidence and Uncertainty	Key sources of uncertainty that are relevant to the TLRU assessment, and that will be addressed in the Developer's Assessment Report, are anticipated to include the consideration of the following elements: ■ Many of the effects on TLRU rely upon the assessments completed for other disciplines; therefore, limits in prediction confidence and uncertainties identified in those assessments may also be relevant to the assessment on Indigenous TLRU. ■ For TLRU, there are no established thresholds or standards for most measurement indicators. Although it may be possible to set thresholds for purposes of an EA, it often cannot be demonstrated that there is any consensus on a specific threshold value where an effect on TLRU occurs or what such a threshold means in terms of significance of an effect. As a result, professional judgment is often used in reaching conclusions on significance for effects on TLRU. ■ The effects on TLRU may not lend themselves to the assignment of criteria or determination of significance except in terms of potential, thus introducing a larger element of uncertainty into the TLRU assessment. There generally is the expectation that an effect brought forward for assessment will in fact occur, at least to some degree. However, it is difficult to predict, for example, whether some effects will be positive, negative, or both, who will be affected, and in what ways. ■ The approach taken for the TLRU assessment is to assess Project-related effects on the TLRU of Indigenous communities. As a result, there is uncertainty regarding human variability in the degree to which predicted effects will affect individual members. For example, not all individuals might be affected to the same degree by sensory disturbances (e.g., noise or air quality). To reduce the uncertainty regarding human variability in response to predicted effects, the TLRU assessment typically takes a conservative approach and assumes that predicted Project effects will affect the community as a whole and the future sustainability of TLRU. ■ ITK and the results of Indigenous engagement will be key in determining the effects of the Project on TLRU. The extent to which ITK and engagement results are accessible during the assessment process will influence prediction confidence and certainty in the Developer's Assessment Report.

Table 4-17: Assessment Methods for Traditional Land and Resource Use

Assessment Approach for KLOI-3: Impacts to Traditional Land and Resource Use	
Monitoring and Follow-up	Monitoring and follow up activities that are relevant to the TLRU component, and that will be addressed in the Developer's Assessment Report, are anticipated to include consideration of the following: ■ An education program for mine staff and contractors on the protection of identified Indigenous cultural sites, ongoing engagement with Indigenous communities on the effectiveness of mitigation measures, the results of environmental monitoring programs, and opportunities for community members to be involved in monitoring programs Monitoring activities defined for air quality, noise, water quality, fish and fish habitat, vegetation, wildlife, and caribou are also relevant to TLRU and will be considered in the TLRU section of the Developer's Assessment Report. These programs will incorporate ITK and information gathered through engagement with communities, where appropriate.
Supporting Annexes	Supporting documentation relevant to the TLRU assessment is anticipated to include the following annexes which will be appended to the TLRU section of the Developer's Assessment Report: ■ the TLRU Baseline Report It is anticipated that Project-specific ITK reports containing TLRU information will be produced in collaboration with Indigenous communities tiered as being the most affected by the Project. Such reports are the property of the communities providing ITK and may or may not be approved for submission as supporting documents to the Developer's Assessment Report by the Indigenous communities. If approved for submission, the ITK reports will be annexed to the Developer's Assessment Report and referenced, as appropriate, in the TLRU section. Other information sources will be considered in the TLRU assessment (see the "Information Sources" section above) but will not be appended to the TLRU section of the Developer's Assessment Report.

4.2.2.3 KLOI-4: Impacts to Social and Economic Conditions

A description of the assessment methods expected to be used in the Developer's Assessment Report for the socio-economic assessment is provided in Table 4-18.

Table 4-18: Assessment Methods for Socio-economic Assessment

Assessment Approach for KLOI-4: Impacts to Social and Economic Conditions		
Information Sources	Information sources that will be used to support the socio-economic assessment scoping are anticipated to include the relevant sources listed in Section 4.1.1 and the following: ■ the Socio-economic Baseline Report ■ the MVEIRB's *Socio-Economic Impact Assessment Guidelines* (MVEIRB 2007) ■ publicly available sources, including statistical databases (e.g., GNWT Bureau of Statistics; Statistics Canada), government publications (e.g., GNWT Health and Social Services; GNWT Industry, Trade and Investment), and other relevant literature regarding social and economic conditions in communities ■ specific economic information sourced from the PPML NI 43-101 (preliminary economic assessment) and internal PPML resources (used in economic modelling) ■ the conceptual Socio-economic Management Plan, developed as part of the Project, including a list of commitments ■ the Engagement and Collaboration Plan, developed as part of the Project, and updated as the EA process unfolds ■ information gathered through telephone interviews, key informant interviews in communities, and meetings with government and service providers with a mandate to monitor and manage social and economic conditions in communities, and the territory more broadly ■ guidance on engagement from the Land and Water Boards of the Mackenzie Valley (LWBMV 2018a,b)	
Valued Components, Assessment Endpoints, and Measurement Indicators	Valued Components (VCs)	The VCs recommended to be used in the socio-economic assessment, and a rationale for their selection, are provided in Section 2.0 and Table 2-1.
	Assessment Endpoints and Measurement Indicators	The assessment endpoints and measurement indicators recommended to be used in the socio-economic assessment are defined in Section 4.1.2 and Table 4-1.

Table 4-18: Assessment Methods for Socio-economic Assessment

Assessment Approach for KLOI-4: Impacts to Social and Economic Conditions		
Environmental Assessment Boundaries	Spatial Boundaries	The assessment of social and economic effects is not spatially bounded by a square, rectangle, or polygon but is instead focused on those communities and jurisdictions most affected by the Project. The Project is within the South Slave Region, and the traditional territories of the Deninu Kue First Nation, K'atl'odeeche First Nation, and Northwest Territory Métis Nation. The Deninu Kų́ First Nation is in close proximity to the Project, and has to date been the most engaged. The Hay River Métis Council and the Fort Resolution Métis Council were initially engaged separately; however, more recently, engagement has been through the Northwest Territory Métis Nation. The socio-economic local study area communities (Figure 4-8) include: **Communities Prioritized by PPML for Involvement and Closest to the Project** ■ Fort Resolution (South Slave community, Deninu Kų́ First Nation, Northwest Territory Métis Nation [Fort Resolution Métis Council]) ■ Hay River Dene 1 (K'atl'odeeche First Nation) ■ Hay River (South Slave community, Northwest Territory Métis Nation [Hay River Métis Council Government]) **Other Communities for Inclusion** ■ Enterprise (South Slave community) ■ Fort Providence (South Slave community) ■ Fort Smith (South Slave community, Northwest Territory Métis Nation [Fort Smith Métis Council]) ■ Kakisa (South Slave community) ■ Dettah (Akaitcho Dene [Yellowknives Dene First Nation]) ■ Łutsel K'e (Akaitcho Dene [Łutsel K'e Dene First Nation]) ■ Yellowknife (major population, economic and service hub) Data collection and presentation of baseline information for these communities will be tiered depending on their propensity to experience socio-economic effects. For example, the communities of Hay River and Fort Resolution would be more expected to experience population-driven effects given their proximity to the Project and the potential for in-migration, while the communities of Fort Providence, Łutsel K'e, and Fort Smith are farther away and less likely to attract relocating jobseekers. The socio-economic regional study area is the NWT. Regional-level effects are largely related to economic effects such as Project-driven contributions to territorial Gross Domestic Product (GDP), labour force conditions, government revenues, industry and commercial activity, and population change.
	Temporal Boundaries	The temporal boundaries for the socio-economic assessment will focus on the Project phases defined in Section 4.1.3: construction, operation, and closure and reclamation. Post-closure will be considered in tandem with the closure and reclamation phase for socio-economic effects assessment and will consider the long-term implications of closure in the future development context known at the time of assessment. For some pathways of effects, residual effects on social and economic VCs will be evaluated across all phases of the Project, but not necessarily for each specific phase.
	Assessment Cases	The socio-economic assessment is inherently cumulative in nature and does not consider the Project's effects in isolation. This is done because communities and economies are not affected by individual developments in a vacuum; rather, it is the cumulative interaction of developments in a region that combines to affect social and economic conditions in communities. When describing conditions and trends beyond present day, the socio-economic effects assessment considers all reasonably foreseeable projects in conjunction with current conditions. While some projects may have been announced, or are in the planning process, they are not necessarily considered to be reasonably included in predictions of future conditions from an economic standpoint. Rather, only projects with proven economics (e.g., funding, approvals) and a strong likelihood of proceeding are considered in the interest of providing a meaningful projection of future social and economic conditions. The economic components of the socio-economic residual effects analysis will consist of up to three assessment cases, as generally defined in Section 4.1.3: a Base Case, an Application

Table 4-18: Assessment Methods for Socio-economic Assessment

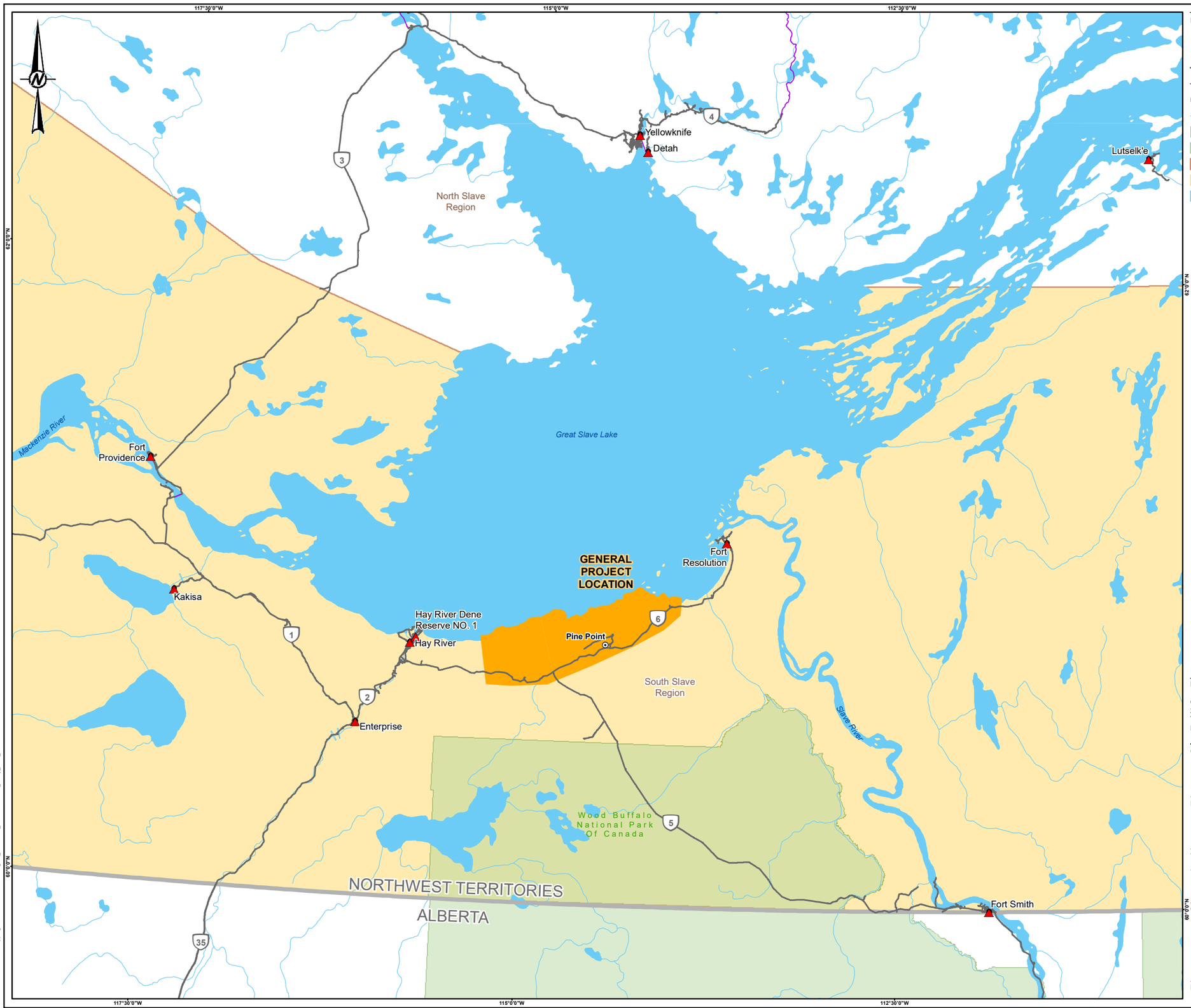
Assessment Approach for KLOI-4: Impacts to Social and Economic Conditions		
		Case and, possibly, a Reasonably Foreseeable Development (RFD) Case. The RFD case considers future projects that have overlapping economic influences with the Project. Attempting to predict future social conditions in communities without the Project is not likely to yield accurate or meaningful results against which to compare the Project's incremental impacts. Rather, the assessment of the Project's ability to influence social conditions in communities is based on current conditions and on feedback from communities. The "Base Case" for the social components of the assessment is, therefore, consistent with the baseline at the time of writing, and reflects the present priorities of communities. Cumulative effects from the Project and RFDs on social conditions are considered qualitatively.
Input from Engagement	Information and concerns raised during the engagement process undertaken for the Project (Volume 2) will be incorporated into the socio-economic assessment according to the methods defined in Section 4.1.4; specific issues raised will be documented in the assessment and a description of how the issue was addressed will be provided.	
Incorporation of Indigenous Traditional Knowledge (ITK)	The general methods that will be used to integrate local and ITK into the socio-economic assessment are defined in Section 4.1.5. Specific types of ITK that may be identified for inclusion in the socio-economic assessment are anticipated to include: ■ language and cultural retention ■ mobility ■ interaction between the wage and traditional economies ■ traditional economic activities ■ family and community roles ■ indicators of wellbeing ■ volunteerism ■ vulnerability ■ food security and nutrition	
Existing Environment	The description of existing environment provided in the Developer's Assessment Report for socio-economic VCs will follow the general methods outlined in Section 4.1.6 and will expand on the information provided in Volume 3. It is anticipated that much of the desktop information presented in Volume 3 will require updating given the tendency for socio-economic data to become out of date rapidly. Further, gaps in data have been identified and will require additional data collection to prepare an adequate socio-economic baseline. The description of the existing environment will incorporate current information regarding conditions in communities obtained through interviews with key informants able to speak to socio-economic conditions in their community. The socio-economic baseline program will be discussed with communities through preliminary engagement as described in Volume 2 and may be subject to an Aurora Research Licence permit, if appropriate. This will include information regarding population demography, labour market, economic activity, service provision, infrastructure and housing capacity, and health and wellbeing. Additional information recommended to be collected for the socio-economic component in the baseline study plan for the Project (Volume 3, Appendix C) will be included in the existing environment description. This will include information from a desktop literature review and future engagement activities. Further details are provided in Volume 3, Appendix C.	
Project Interactions and Mitigations	Identification of Project interactions and mitigations for the socio-economic component will follow the general methods outlined in Section 4.1.7. A description of the anticipated Project-environment interactions identified for the socio-economic component, along with the associated residual effects categorization (i.e., no pathway, secondary or primary) and proposed mitigation measures, is provided in Volume 4.	
Residual Effects Analysis	A Project will affect people and communities in different ways, depending on their proximity to the Project, their relationship with the area of the Project and on the degree to which they participate in the Project. While benefits are usually expected (e.g., employment, business development, incomes), they may not be realized by all individuals, families, and communities. Further, some people may experience adverse effects from the Project. Mitigation can attempt to address adverse Project effects and benefit enhancement measures can seek to maximize Project benefits for a wider group of people; however, the extent to which mitigations and enhancements are effective is not always apparent or measurable. The approach to the socio-economic effects analysis is therefore qualitative and nuanced. In coming to conclusions, including describing potential and residual effects, there is necessarily a high dependence on engagement results and comparable experiences. The Project's territorial economic and population effects will be assessed quantitatively using economic Input-Output modelling. The Project's potential employment effects will also be assessed quantitatively using projected workforce requirements relative to labour market conditions in communities and the territory, and in consideration of qualitative factors such as barriers to employment. A qualitative assessment will be conducted for the remaining socio-economic pathways identified in Volume 4, incorporating the results of engagement with Indigenous communities and the level of concern expressed. Only primary pathways as identified in Volume 4 will be carried forward to the residual effects analysis. In determining residual Project effects, the socio-economic assessment considers: ■ baseline conditions in communities potentially affected by the Project, with attention paid to differing contexts based on intersectional identity factors (e.g., gender, Indigeneity, age, or vulnerability)	

Table 4-18: Assessment Methods for Socio-economic Assessment

Assessment Approach for KLOI-4: Impacts to Social and Economic Conditions	
	■ the Project design or execution elements potentially interacting with socio-economic VCs and indicators (e.g., employment, rotations, contracting requirements, transportation, and worker housing) ■ the Project's economic inputs (e.g., workforce estimates, capital and operational expenditures are used in economic Input-Output models used to predict macroeconomic territorial population effects) ■ the concerns and aspirations raised by potentially affected parties through engagement, consultation, and other means of input (e.g., the socio-economic baseline study, ITK studies) ■ the results of applicable monitoring outcomes for communities in comparable contexts where mining development has contributed to socio-economic effects ■ Project-specific mitigation and benefit enhancement measures developed either to be in line with standard practice, or in response to input from potentially affected parties. Where the Project is determined to have residual effects on aspects of the socio-economic environment, this is described further in terms of who is likely to experience what effects and to what extent, taking into consideration the concerns expressed by potentially affected parties, the capacity of systems (e.g., healthcare, protective and emergency services, housing) and identity factor characteristics of the population, as appropriate. Residual effects criteria area assigned to classify and prioritize effects, as described below. The MVEIRB's *Socio-Economic Impact Assessment Guidelines* (2007) will be incorporated into the residual effects analysis process.
Residual Effects Classification and Determination of Significance	When determining the consequence of socio-economic effects, local and national geographic extents are weighted equally. This is done because the type of social effects addressed are either focused effects on a local population, or more broadly relevant but smaller effects in national capitals or other regions. Further, a key goal of the effects assessment is to identify benefits to communities mostly affected by the Project. The socio-economic residual effects assessment considers both positive and negative effects. Magnitude is assigned based on the potential for the effect to change a socio-economic feature, and the manageability of the effect. Most socio-economic effects occur continuously throughout the life of the Project (e.g., demand for labour, procurement, social effects associated with rotational employment), and are not reversible with the conclusion of a Project phase (e.g., adverse social effects that may develop in communities do not go away when employment incomes are removed). Where applicable, the definitions for these criteria described in Section 4.1.9 will be applied to the socio-economic assessment. Residual effects criteria are used to describe the Project's social and economic effects; however, in determining the significance of an effect on communities and other groups of people, the socio-economic effects assessment relies on the expected effect on the quality of life of those affected. The magnitude of the effect is often weighted heavily in the determination of significance and is influenced by the level of concern expressed by affected groups.
Prediction Confidence and Uncertainty	There is inherent uncertainty in assessing the significance of some socio-economic effects given the reliance of effect realization on the responses of individuals, families, and communities to effect stimuli, mitigation, and benefit enhancement measures. Forces outside the control of a single Project can further this uncertainty by undermining the effectiveness of mitigation and benefit enhancement measures. Many socio-economic effects may not lend themselves to the assignment of criteria or determination of significance except in terms of potential, thus introducing a larger element of uncertainty into socio-economic effects assessment. There generally is the expectation that an effect brought forward for assessment will in fact occur, at least to some degree. However, it is difficult, and in some cases not possible, to predict whether an effect will be positive, negative or both, and in what ways for whom. For example, Project employment incomes will be beneficial to those accessing employment opportunities and their families (positive effect); however, for vulnerable segments of society (e.g., women, children in single parent homes, the elderly), these opportunities may not be accessible, and not influence their quality of life (neutral effect). Where these employment incomes are concentrated in only a portion of households, this can create inequality (negative effect). The significance of the effect of Project-paid incomes is, therefore, nuanced. Confidence in the assessment of the significance of the Project's socio-economic effects necessarily depends on: ■ the perceptions and values of affected people and their leadership, as made evident through engagement ■ the adequacy of baseline data for understanding current conditions ■ the status of project planning and design features, including economic modelling inputs ■ knowledge of the effectiveness of mitigation in reducing or removing adverse effects, and of benefit enhancement measures ■ lessons learned from other experiences Confidence in the prediction of whether an effect is significant or not is often high, regardless of all the uncertainties in describing the detail of that effect. This may at times seem to be a contradiction. For example, effects on GDP and labour income are only an approximation based on Input-Output modelling. Even in the event of large errors in the approximation, however, the Project`s effects on GDP and labour income will necessarily be significant. Confidence in the results of the socio-economic effects assessment is enhanced through discussion with communities regarding what their past experience with development has been, and what their concerns are in relation to new development. Further, discussing mitigation and benefit enhancement measures with communities increased the confidence in the efficacy of such measures to meet the goals of the community.

Table 4-18: Assessment Methods for Socio-economic Assessment

Assessment Approach for KLOI-4: Impacts to Social and Economic Conditions	
Monitoring and Follow-up	The Socio-economic Management Plan will provide a full discussion of PPML's monitoring measures; a conceptual version will be submitted with the Developer's Assessment Report. PPML will collaborate with the government to track socio-economic trends in the region and in communities, and will track, internally, appropriate indicators within the purview of a developer as defined by the forthcoming Socio-economic Agreement between PPML and the GNWT. PPML will monitor direct employment and incomes by Indigenous identity, gender, and point of origin. Workforce training, educational initiatives, and community contributions will also be monitored, and reported on in the annual socio-economic monitoring report for the Project submitted in response to the Socio-economic Agreement. Efforts to support and encourage traditional pursuits will be similarly tracked and reported on. It has been recommended that employee and family use of the Project's Employee and Family Assistance Program, on-site medical services, Elder counselling, and other mental and physical health-related programming be monitored and evaluated.
Supporting Annexes	Supporting documentation relevant to socio-economics is anticipated to include the following annexes which will be appended to the socio-economics section of the Developer's Assessment Report: ■ the Socio-economic Baseline Report Other information sources will be considered in the socio-economic assessment (see the "Information Sources" section above) but will not be appended to the socio-economic section of the Developer's Assessment Report.



LEGEND

- FORMER PINE POINT TOWN SITE
- SOCIO-ECONOMIC STUDY AREA COMMUNITY
- ALL-SEASON ROAD
- WINTER ROAD
- TERRITORIAL/PROVINCIAL BOUNDARY
- WATERCOURSE
- GENERAL PROJECT LOCATION
- PARK / PROTECTED AREA
- REGIONAL BOUNDARY
- SOUTH SLAVE REGION
- WATERBODY

0 25 50
1:1,375,000 KILOMETRES

REFERENCE(S)

1. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
2. PARKS AND PROTECTED AREAS OBTAINED FROM CONSERVATION AREAS REPORTING AND TRACKING SYSTEM (CARTS), CANADIAN COUNCIL ON ECOLOGICAL AREAS, 2017.

PROJECTION: ALBERS CONIC EQUAL AREA

CLIENT
PINE POINT MINING LTD.

PROJECT
PINE POINT PROJECT

TITLE
SOCIO-ECONOMIC LOCAL STUDY AREA COMMUNITIES

CONSULTANT
GOLDER

YYYY-MM-DD	2020-12-15
DESIGNED	JO
PREPARED	MM
REVIEWED	JV
APPROVED	JV

PROJECT NO. 19125747 | PHASE | REV. 0 | FIGURE 4-8

4.2.2.4 SON-10: Impacts to Non-traditional Land and Resource Use

A description of the assessment methods expected to be used in the Developer's Assessment Report for the NTLRU assessment is provided in Table 4-19.

Table 4-19: Assessment Methods for the Non-traditional Land and Resource Use Assessment

Assessment Approach for SON-10: Impacts to Non-traditional Land and Resource Use		
Information Sources	Information sources that will be used to support the non-traditional land and resource use (NTLRU) assessment scoping are anticipated to include the relevant sources listed in Section 4.1.1 and the following: ■ the NTLRU Baseline Report. ■ publicly available sources, including statistical databases (e.g., GNWT Bureau of Statistics;), government publications (e.g., GNWT Industry, Trade and Investment), and other relevant literature regarding NTLRU activities in the local study area (LSA) and regional study area (RSA). ■ the Engagement and Collaboration Plan, developed as part of the Project, and updated as the EA process unfolds ■ information gathered through telephone interviews and key informant interviews in communities ■ guidance on engagement from the Land and Water Boards of the Mackenzie Valley (LWBMV 2018a,b)	
Valued Components, Assessment Endpoints, and Measurement Indicators	Valued Components (VCs)	The VCs recommended to be used in the NTLRU assessment, and a rationale for their selection, are provided in Section 2.0 and Table 2-1.
	Assessment Endpoints and Measurement Indicators	The assessment endpoints and measurement indicators recommended to be used in the NTLRU assessment are defined in Section 4.1.2 and Table 4-1.
Environmental Assessment Boundaries	Spatial Boundaries	NTLRU is linked to anthropogenic use of the land and resources for non-traditional activities. The resources hunted, fished, or harvested in the area of the Project effects, as well as the level of use in the vicinity of the Project, are considered. It is also linked to the ability of a Project to affect the visual and acoustic environments, insofar as a Project can create visual and auditory disturbances that interfere with tourism and other land use activities. Therefore, the study areas for NTLRU correspond to those of the noise, water quality, fish and fish habitat, vegetation, caribou, and wildlife components (Table 4-6 and Table 4-8 through Table 4-15; Figure 4-3 through Figure 4-7). Where there is variation between the study areas for these disciplines, the NTLRU baseline will discuss land and resource use at a scale appropriate to the specific discipline. Other industrial activity (e.g., resource extraction, power generation) is discussed at the regional scale where the Project has the potential to interact with these activities.
	Temporal Boundaries	The temporal boundaries for the NTLRU assessment will focus on the Project phases defined in Section 4.1.3: construction, operation, and closure and reclamation. The assessment will also consider potential effects on NTLRU during post-closure, where relevant. For some pathways of effects, residual effects on NTLRU VCs will be evaluated across all phases of the Project, but not necessarily for each specific phase.
	Assessment Cases	■ The NTLRU residual effects analysis will consist of up to three assessment cases, as defined in Section 4.1.3: a Base Case, an Application Case and, possibly, a Reasonably Foreseeable Development (RFD) Case. The methods used to assess the Base Case and the Application Case are defined in Section 4.1.3 and in the "Existing Environment" and "Residual Effects Analysis" descriptions provided below. ■ The determination of whether an RFD Case assessment will be included in the NTLRU section will be made during preparation of the Developer's Assessment Report, based on the methods outlined in Section 4.1.3. If an RFD Case is required, it is anticipated that the assessment will be qualitative and conceptual, and that the approach taken will depend upon the level of information available for individual RFDs.
Input from Engagement	Information and concerns raised during the engagement process undertaken for the Project (Volume 2) will be incorporated into the NTLRU assessment according to the methods defined in Section 4.1.4; specific issues raised will be documented in the assessment and a description of how the issue was addressed will be provided.	
Incorporation of Indigenous Traditional Knowledge (ITK)	The general methods that will be used to integrate local and ITK into the NTLRU assessment are defined in Section 4.1.5. Specific types of ITK that may be identified for inclusion in the NTLRU assessment are anticipated to include information about resources that may be accessed for NTLRU activities, such as outfitted hunting, angling, or commercial fishing.	

Table 4-19: Assessment Methods for the Non-traditional Land and Resource Use Assessment

Assessment Approach for SON-10: Impacts to Non-traditional Land and Resource Use	
Existing Environment	The description of the existing environment provided in the Developer's Assessment Report for NTLRU will follow the general methods outlined in Section 4.1.6 and will expand on the information provided in Volume 3. Gaps in data have been identified in the desktop data and will require additional data collection to prepare an NTLRU baseline. The description of the existing environment will incorporate current information regarding conditions obtained through interviews with key informants able to speak to NTLRU in the study areas. Additional information recommended to be collected for the NTLRU component in the baseline study plan for the Project (Volume 3, Appendix C) will be included in the existing environment description. This will include information from a desktop literature review and future engagement activities. Further details are provided in Volume 3, Appendix C.
Project Interactions and Mitigations	Identification of Project interactions and mitigations for the NTLRU component will follow the general methods outlined in Section 4.1.7. A description of the anticipated Project-environment interactions identified for NTLRU, along with the associated residual effects categorization (i.e., no pathway, secondary, or primary) and proposed mitigation measures, is provided in Volume 4.
Residual Effects Analysis	The residual effects analysis for the NTLRU component will follow the general methods outlined in Section 4.1.8 and will focus on the Project-environment interactions that are determined to be primary in the pathway analysis (Volume 4). One Project-environment interaction was determined to be primary for NTLRU: ■ Sensory disturbances can influence outfitted and recreational hunting and angling, camping, or lodge experiences in the vicinity of the Project. The approach to the NTLRU residual effects analysis will be generally consistent with those used in the socio-economic assessment (Section 4.2.2.3) and will employ the MVEIRB's *Socio-economic Impact Assessment Guidelines* (2007). In addition, one Project-environment interaction may be assessed as either primary or secondary depending on the outcome of the analysis for biological components. In the event that this pathway is determined to be secondary in the pathway analysis, it will not be carried forward to the residual effects analysis. ■ Project footprint and activities may lead to changes in the abundance and distribution of fish, vegetation ecosystems, and wildlife and the availability or suitability of resources for outfitted and recreational hunting and angling, camping, or lodge experiences. When discussing residual effects on resource-based activities (e.g., hunting, trapping, fishing), the NTLRU assessment considers the results of associated EAs (e.g., wildlife, fish and fish habitat).
Residual Effects Classification and Determination of Significance	The residual effect classification criteria for NTLRU are generally consistent with those presented in Section 4.1.9 and Section 4.2.2.3, with the exception of geographic extent. When assessing Project effects on NTLRU, a local geographic extent is assigned to effects within the associated LSA of the resource affected. Similarly, a regional geographic extent is assigned to effects within the associated RSA of the resource affected. For example, outfitted hunting is assessed within the wildlife LSA. Beyond regional effects are those that extend outside of the RSAs for environmental resources used economically or for recreation. A determination of significance will be completed for the NTLRU VCs according the methods described in Section 4.1.10 and those described further in the socio-economic assessment methods (Section 4.2.2.3).
Predictions Confidence and Uncertainty	Key sources of uncertainty that are relevant to the NTLRU assessment, and that will be addressed in the Developer's Assessment Report, are anticipated to include the consideration of the following elements: ■ Many of the effects on NTLRU rely upon the assessments completed for other disciplines; therefore, limits in prediction confidence and uncertainties identified in those assessments may also be relevant to the assessment on NTLRU. ■ For NTLRU, there are no established thresholds or standards for most measurement indicators. Although it may be possible to set thresholds for purposes of an EA, it often cannot be demonstrated that there is any consensus on a specific threshold value where an effect on NTLRU occurs or what such a threshold means in terms of significance of an effect. As a result, professional judgment is often used in reaching conclusions on significance for effects on NTLRU. ■ The effects on NTLRU may not lend themselves to the assignment of criteria or determination of significance except in terms of potential, thus introducing a larger element of uncertainty into the NTLRU assessment. There generally is the expectation that an effect brought forward for assessment will in fact occur, at least to some degree. However, it is difficult to predict, for example, whether some effects will be positive, negative or both, and in what ways.
Monitoring and Follow-up	The Socio-economic Management Plan will provide a full discussion of the PPML monitoring measures. PPML will collaborate with the government to track socio-economic trends in the region and in communities, and will track, internally, appropriate indicators within the purview of a developer as defined by the forthcoming Socio-economic Agreement between PPML and the GNWT. This may include NTLRU.
Supporting Annexes	Supporting documentation relevant to NTLRU is anticipated to include the following annexes which will be appended to the NTLRU section of the Developer's Assessment Report: ■ the NTLRU Baseline Report Other information sources will be considered in the NTLRU assessment (see the "Information Sources" section above) but will not be appended to the NTLRU section of the Developer's Assessment Report.

4.3 Effects of Extreme Events

4.3.1 Effects of the Environment on the Project

Section 4.3 of the EA Initiation Guidelines suggests that the potential effects of the physical environment on the Project be considered in the EA Initiation Package for the Project. Potential pathways of effects of the environment on the Project will be addressed in Effects of the Environment on the Project section of the Developer's Assessment Report. Environmental effects with a reasonable probability of occurring in and around the Project footprint during the various phases of the mine life will be considered, as informed through historical and baseline information for the region, experience with similar projects, and comments received from Indigenous communities, regulators, and other people interested in the Project.

Potential pathways of effects of the environment on the Project will be identified based on additional Project details, which will be included in the Project Description for the Developer's Assessment Report and are anticipated to include the following:

- climate change
- changes in permafrost
- extreme precipitation, including seasonal flooding and spring thaw patterns
- external natural events (e.g., wildfires, ice jams)
- seismic events

Environmental changes or events can have effects on the performance or stability of engineered structures or periods of operation. For example, climate change over the life of the Project could potentially result in shifts in weather conditions (e.g., temperature, precipitation levels) and/or the frequency of extreme weather events (e.g., floods, drought). These changes could potentially increase the risk of environmental effects on Project infrastructure, including any engineered structures.

For each identified pathway, potential effects will be considered, along with relevant Project design and mitigation. The likelihood of occurrence will be discussed. Monitoring or management plans, and the adaptive management framework, relevant to the effect pathways will also be identified.

4.3.2 Accidents and Malfunctions

Accidents and malfunctions are unplanned events caused by industrial or natural hazards, such as structural or operation failures, floods, and seismic events. Section 4.3 of the EA Initiation Guidelines suggests that accidents and malfunctions be considered in the EA Initiation Package for the Project. This section provides a summary of the approach that will be used in the Developer's Assessment Report to assess effects from potential accidents and malfunctions on biophysical and socio-economic components. Potential effects from natural hazards are addressed under effects of the environment on the Project in Section 4.3.1. Only accidents and malfunctions that have a reasonable probability of occurring during construction, operation, and closure and reclamation phases will be considered in the Developer's Assessment Report. Potential accidents and malfunctions for mining developments generally include, as an example:

- small to large fuel spills
- slope failures
- failure of tailings management infrastructure

- failure of turbidity control systems
- pipeline ruptures
- erosion of roads connecting to water management / Project components
- failure of pumps or overflow of sumps

The relevant accidents and malfunctions will be identified based on additional Project details, which will be included in the Project Description to be included with the Developer's Assessment Report. The risk of potential accidents or malfunctions will be identified sources, including any internal risk assessments, government guidelines, experience with other similar projects, and comments received from Indigenous communities, regulators, and other people interested in the Project. Medical and similar emergencies, while important, are unlikely to have an environmental effect and will be addressed through the company's emergency response strategy.

Where applicable, accidents and malfunctions will be considered in the relevant sections for the biophysical and socio-economic intermediate and valued components. For example, accidents and malfunctions related to small-scale spills are included in the pathway analysis tables (Volume 4); however, larger accidents and malfunctions that are not part of regular Project operations are addressed mainly in the Accidents and Malfunctions section in the Developer's Assessment Report.

5.0 PROPOSED STRUCTURE FOR THE DEVELOPER'S ASSESSMENT REPORT

An overview of the structure anticipated to be used for the Developer's Assessment Report is provided in Table 5-1. It is proposed that the Developer's Assessment Report will be organized into four volumes, as follows:

- Volume I will consist of an introduction and overview of the scope of the assessment; documentation of community, regulatory, and public engagement completed for the Project; and information related to how ITK will be collected and incorporated into the biophysical and socioeconomic effects assessments. Volume I will also include the Project Description, summary of Project alternatives, and information on the EA methods that will be used in the Developer's Assessment Report.
- Volume II will consist of an effects assessment for the biophysical environment, which includes the following EA components: air quality, noise, and climate; groundwater quantity and quality; surface water quantity; water quality; fish and fish habitat; terrain and soils; vegetation; caribou; and wildlife.
- Volume III will consist of an effects assessment for the human environment, which includes the following EA components: heritage resources, TLRU, socio-economics, and NTLRU.
- Volume IV will consist of supporting sections, which will include an assessment of potential effects of the environment on the Project and an assessment of potential effects from accidents and malfunctions. Volume IV will also include an environmental and socio-economic management and monitoring framework for the Project.

Table 5-1: Document Map for the Developer's Assessment Report

Volume I **Pine Point Project**	Plain Language Summary 1.0 Introduction and Overview 2.0 Community, Regulatory, and Public Engagement 3.0 Indigenous Traditional Knowledge 4.0 Project Description and Alternatives 5.0 Environmental Assessment Approach	Annex 1A: Terms of Reference Annex 1B: Table of Concordance Annex 2A: Engagement Records	
Volume II **Biophysical Environment Effects Assessment**	6.0 Air Quality, Noise, and Climate SON-1: Impacts to Air Quality, Noise, and Climate 7.0 Groundwater Quantity and Quality SON-2: Impacts to Groundwater Quantity and Quality 8.0 Surface Water Quantity SON-3: Impacts to Surface Water Quantity 9.0 Water Quality KLOI-1: Impacts to Water Quality 10.0 Fish and Fish Habitat SON-4: Impacts to Fish and Fish Habitat 11.0 Terrain and Soils SON-5: Impacts to Terrain and Soils 12.0 Vegetation SON-6: Impacts to Vegetation 13.0 Caribou KLOI-2: Impacts to Caribou 14.0 Wildlife SON-7: Impacts to Wildlife	Annex 6A: Air Quality, Noise, and Climate Baseline Report Annex 6B: Air Quality Modelling Report Annex 6C: Air Quality Emissions Report Annex 6D: Air Quality Meteorology Report Annex 6E: Noise and Vibration Modelling Results Annex 7A: Groundwater Quantity and Quality Baseline Report Annex 7B: Groundwater Quantity and Quality Modelling Report Annex 8A: Surface Water Quantity Baseline Report Annex 8B: Surface Water Quality Modelling Report Annex 9A: Water Quality Baseline Report Annex 9B: Water Quality Modelling Report Annex 10A: Fish and Fish Habitat Baseline Report Annex 10B: Conceptual Fisheries Offsetting Plan (if required) Annex 11A: Terrain and Soils Baseline Report Annex 12A: Vegetation Baseline Report Annex 13A: Caribou Habitat Suitability Index Model Methods and Figures Annex 14A: Screening Level Assessment for Wildlife Valued Components Annex 14B: Wildlife Baseline Report Annex 14C: Wildlife Habitat Suitability Index Model Methods and Figures Annex 14D: Residual Effects Classification and Significance Determination for Screening Level Valued Components	
Volume III **Human Environment Effects Assessment**	15.0 Heritage Resources SON-8: Impacts to Heritage Resources 16.0 Traditional Land and Resource Use KLOI-3: Impacts to Traditional Land and Resources 17.0 Socio-economics KLOI-4: Impacts to Social and Economic Conditions 18.0 Non-traditional Land and Resource Use SON-10: Impacts to Non-traditional Land and Resource Use	Annex 15A: Heritage Resource Baseline Report Annex 16A: Traditional Land and Resource Baseline Report Annex 16B: Indigenous Traditional Knowledge Reports (if approved by communities) Annex 17A: Socio-economic Baseline Report Annex 18A: Non-traditional Land and Resource Use Baseline Report	
Volume IV **Supporting Sections**	19.0 Effects of Extreme Events 20.0 Management and Monitoring Framework for the Biophysical and Human Environments	Annex 20A: Conceptual Spill Contingency Plan Annex 20B: Conceptual Waste Management Plan Annex 20C: Conceptual Erosion and Sediment Control Plan Annex 20D: Conceptual Tailings and Waste Rock Management Plan Annex 20E: Conceptual Water Management Plan Annex 20F: Conceptual Closure and Reclamation Plan	Annex 20G: Conceptual Air Quality Mitigation and Monitoring Plan (if required) Annex 20H: Conceptual Aquatic Effects Monitoring Program Annex 20I: Conceptual Wildlife Protection Plan Annex 20J: Conceptual Socio-economic Management Plan Annex 20K: Conceptual Engagement and Collaboration Plan

Note: The structure recommended in this document map is conceptual. Naming and numbering of sections and annexes will be finalized in the Developer's Assessment Report.
SON = Subject of Note; KLOI = Key Line of Inquiry

6.0 REFERENCES

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APPENDIX A

Additional Screening Information for No Pathways

Table A-1: Additional Screening Information for No Pathways

Effects Pathway	Environmental Design Features and Mitigation	Pathway Assessment	Rationale and Comments
▪ Wind-borne emissions of concentrate from haul trucks can affect air quality.	▪ Concentrate will be covered during transportation to rail yards.	No pathway	▪ Standard mitigation for the avoidance of wind-borne emissions ▪ Shown to be effective at other operations ▪ Mitigation expected to be 100% effective resulting in no measurable change to the atmospheric environment ▪ Therefore, no linkage to effects expected
▪ Seepage from waste rock deposition areas can cause changes in groundwater quality. ▪ Seepage from waste rock deposition areas can cause changes in groundwater quality and soil chemistry, which can affect the condition of upland, wetland, and riparian ecosystems. ▪ Seepage from waste rock deposition areas can cause changes in groundwater quality and soil chemistry, which can affect vegetation and caribou and other wildlife habitat availability and distribution.	▪ Mineralized material and waste rock will be stored in a contained area. Waste rock will be disposed of onto constructed waste rock storage facilities, or where possible, into historical open pits. ▪ Potential acid generating material (PAG) will be segregated from non-potential acid generating (non-PAG) material. ▪ Seepage will be monitored and managed, if necessary, as described in the Tailings and Waste Rock Management Plan ▪ The Water Management Plan and Tailings and Waste Rock Management Plan will be implemented, including adaptive management, if required. ▪ The Closure and Reclamation Plan will be implemented.	Secondary or No Pathway	▪ Standard mitigation for waste rock and seepage management ▪ Effective at other mines in the NWT and Canada ▪ Geochemical analyses show limited PAG on site ▪ Standard management practices will be employed as per management plans ▪ Mitigation expected to be 100% effective resulting in no measurable changes to groundwater quality ▪ Therefore, no linkage to effects expected ▪ Considered “no pathway” and screened out unless further information becomes available during the development of the Developer’s Assessment Report (DAR), in which case, it may be considered as a secondary pathway in the DAR
▪ Cross-drainage structures for site roads may alter watercourse hydraulics and geomorphology, which may affect local drainage and a risk of blocking flow. ▪ Cross-drainage structures for site roads may alter watercourse hydraulics and geomorphology, which may affect local drainage and alter surface water and sediment quality.	▪ Roads will be designed to the minimum possible width and follow best practices for design speeds and expected vehicle traffic. ▪ The road alignment will minimize stream crossings and alterations to existing drainage patterns. ▪ Cross-drainage structures will be designed to limit the area disturbed within waterbodies and watercourses and crossings will be located to avoid sensitive habitats, where possible. ▪ Culverts will be sized to convey flows under design conditions. ▪ Water crossing structures will be constructed and installed in a manner that protects the banks from erosion and maintains surface water flows. ▪ Culverts will be regularly inspected and maintained to prevent blockages from forming and causing ponding or backwater effects, including snow removal at inlets and outlets prior to freshet.	No pathway	▪ Standard mitigation for placement of cross-drainages structures, such as culverts ▪ Best management practices will be implemented ▪ Effective at other developments throughout Canada ▪ Standard management practices will be employed as per management plans ▪ Mitigation expected to be 100% effective resulting in no measurable changes to hydrology and geomorphology ▪ Therefore, no linkage to effects expected
▪ Discharge of treated domestic wastewater and sewage may cause a change in surface water quality in receiving and downstream aquatic environments. ▪ Discharge of treated domestic wastewater and sewage may cause a change in surface water quality, which can alter fish habitat quality and affect the survival and reproduction of fish. ▪ Discharge of treated domestic wastewater and sewage may cause a change in surface water quality, which can affect the condition of upland, wetland, and riparian ecosystems. ▪ Discharge of treated domestic wastewater and sewage may cause a change in surface water quality, which can affect vegetation and caribou and other wildlife habitat availability and distribution.	▪ Treated domestic effluent will be discharged to the septic field or may be discharged to a waterbody if it meets effluent criteria. ▪ The Water Management Plan and Waste Management Plan will be implemented.	No pathway or Secondary	▪ Best management practices will be implemented ▪ Effective at other developments throughout Canada ▪ Standard management practices will be employed as per management plans ▪ Design and mitigation expected to be 100% effective at preventing adverse changes to surface water quality ▪ Therefore, no linkage to effects expected ▪ Considered “no pathway” and screened out unless further information becomes available during the development of DAR, in which case, it may be considered as a secondary pathway in the DAR

Table A-1: Additional Screening Information for No Pathways

Effects Pathway	Environmental Design Features and Mitigation	Pathway Assessment	Rationale and Comments
▪ Changes to local hydrology from surface disturbances during construction may alter fish habitat quantity and quality and affect habitat connectivity and fish distribution.	▪ The Project disturbance footprint will be limited to the extent practical, and where possible and practical, infrastructure will be built on previously disturbed sites. ▪ Areas of vegetation clearing and soil disturbance will be limited to the immediate area of the future activity at that location. ▪ Roads will be designed to the minimum possible width and follow best practices for design speeds and expected vehicle traffic. ▪ Clearing equipment will be used that minimizes surface disturbance, soil compaction and topsoil loss (e.g., equipment with low ground pressure tracks or tires, blade shoes and brush) where feasible. ▪ Steepness and length of slopes of disturbed areas and stockpiled soils will be limited. ▪ Where possible, work will be avoided in sensitive areas during the time-of-year when erosion is more likely (e.g., spring freshet). ▪ Routine inspection and maintenance of containment and conveyance structures (i.e., roadside ditches and culverts) will be conducted to limit the risk of road wash-out or sediment release to the environment. ▪ Culverts will be sized to convey flows under design conditions. ▪ Water crossing structures will be constructed and installed in a manner that protects the banks from erosion and maintains surface water flows. ▪ Where possible, a 30 metre (m) buffer will be established between Project components/infrastructure and permanent waterbodies and watercourses. ▪ Progressive reclamation and revegetation will be implemented for areas disturbed by the Project that are no longer required. ▪ The Closure and Reclamation Plan will be implemented.	No pathway	▪ Standard mitigation and best management practices will be implemented ▪ Effective at other developments throughout Canada ▪ Mitigation expected to be 100% effective resulting in no measurable changes to local hydrology and fish habitat quantity, quality, and connectivity ▪ Therefore, no linkage to effects expected
▪ The area of turbulence around the diffuser may affect fish habitat quantity and quality and fish distribution.	▪ If required, the pumped mine water discharge will be directed through a properly designed diffuser to minimize effects from changes in velocity. ▪ The diffuser will be located to avoid sensitive fish habitat (e.g., shoals, spawning areas). ▪ Direct discharge flow rates will be developed and maintained to address erosion concerns. ▪ The diffuser discharge ports will be located above the lakebed to minimize erosion.	No pathway	▪ Standard mitigation and best management practices will be implemented ▪ Effective at other developments throughout Canada ▪ Mitigation expected to be 100% effective resulting in no measurable changes to fish habitat quality and quantity ▪ Therefore, no linkage to effects expected
▪ The use of explosives near fish-bearing water may cause injury or mortality to fish.	▪ Blasting operations will follow the Fisheries and Oceans Canada (DFO) *Measures to Protect Fish Habitat* and *Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters* (Wright and Hopky 1998) for setback distances from fish bearing waterbodies. ▪ Blasting will occur on land during the open pit and underground mine development, where no water or fish are present. Blasting will not occur in a water body.	No pathway	▪ Standard mitigation and best management practices will be implemented ▪ Setback will meet DFO's guidance ▪ Effective at other developments throughout Canada ▪ Therefore, no linkage to effects expected

Table A-1: Additional Screening Information for No Pathways

Effects Pathway	Environmental Design Features and Mitigation	Pathway Assessment	Rationale and Comments
▪ Instream construction activities may alter fish habitat quality and affect the survival of fish.	▪ Where possible, instream construction in areas of potential spawning habitat will take place outside the spawning period for fish valued components. Construction activities will be scheduled to avoid work during DFO's *Restricted Activity Timing Windows for the Protection of Fish and Fish Habitat* (DFO 2013). ▪ Water crossing structures and water intakes will be constructed and installed in a manner that protects the banks from erosion and maintains the flows in the water body and follows permits or authorizations issued for the Project from the appropriate regulatory agencies and DFO's *Measures to Protect Fish and Fish Habitat*. ▪ Instream construction will be completed in isolation of flowing water (i.e., use of isolation methods for the installation of instream developments where surface water exists at the time of construction). ▪ For isolations/diversions, 100% downstream flow will be maintained. Pump intakes should not disturb the bed. Water diversion hoses will be screened as per DFO's *Freshwater Intake End-of-Pipe Fish Screen Guidelines* (DFO 2015) and the interim code of practice (DFO 2020). ▪ A qualified aquatics professional will be retained to complete or oversee the fish rescue from within the exclusion area(s). Salvaged fish will be relocated from work isolation areas to adjacent sections of tributaries, outside the work location. Fish handling time will be kept to a minimum, and appropriate, non-lethal sampling methods will be used during the fish rescue (e.g., backpack electrofishing, minnow trapping).	No pathway	▪ Standard mitigation and best management practices will be implemented ▪ Will meet DFO's guidance ▪ Effective at other developments throughout Canada ▪ Mitigation expected to be 100% effective resulting in no measurable changes to fish habitat quality ▪ Therefore, no linkage to effects expected
▪ Changes to public access to fishing areas and increased density of people (i.e., Project staff and contractors) in the area could affect fish abundance.	▪ Existing roads and trails will be used where possible. ▪ To reduce risks to public health and safety, access will be restricted by installing gates and fencing on private roads. ▪ A "No hunting and fishing" policy will be implemented on the Project site that applies to staff and contractors.	No pathway	▪ Standard mitigation and best management practices will be implemented ▪ Will meet DFO's guidance ▪ Effective at other developments throughout Canada ▪ Mitigation expected to be 100% effective resulting in no measurable changes in public access relative to existing conditions ▪ Therefore, no linkage to effects expected
▪ Activities may affect terrain through an increase in potential slope instability and/or failures.	▪ The Water Management Plan will be implemented. ▪ The Erosion and Sediment Control Plan will be implemented. ▪ Routine inspection and maintenance of containment and conveyance structures (i.e., roadside ditches and culverts) will be conducted to limit the risk of road wash-out or sediment release to the environment. ▪ Areas of vegetation clearing and soil disturbance will be limited to the immediate area of the future activity at that location. ▪ Progressive reclamation and revegetation will be implemented for areas disturbed by the Project that are no longer required.	No pathway	▪ Standard mitigation and best management practices will be implemented ▪ Effective at other developments throughout Canada ▪ Mitigation expected to be 100% effective resulting in no measurable changes to slope instability and/or failures ▪ Therefore, no linkage to effects expected
▪ Soil transport and stockpiling can increase erosion potential and change soil quality.	▪ The Erosion and Sediment Control Plan will be implemented. ▪ If soils are prone to wind erosion, areas will be tackifed, covered, seeded, and/or water will be applied during periods of high erosion potential (e.g., summer and fall). ▪ Organics and upper soil material will be salvaged to the extent practical for future use in reclamation. ▪ Soil salvage stockpiles will be constructed in such a way as to reduce changes to quality, erosion, and loss (e.g., slumping).	No pathway	▪ Standard mitigation and best management practices will be implemented ▪ Effective at other developments throughout Canada ▪ Mitigation expected to be 100% effective resulting in no measurable change in erosion potential ▪ Therefore, no linkage to effects expected

Table A-1: Additional Screening Information for No Pathways

Effects Pathway	Environmental Design Features and Mitigation	Pathway Assessment	Rationale and Comments
▪ Soil disturbance can alter soil temperature and lead to changes in permafrost depth or prevalence.	▪ The Project disturbance footprint will be limited to the extent practical, and where possible and practical, infrastructure will be built on previously disturbed sites. ▪ Areas of vegetation clearing and soil disturbance will be limited to the immediate area of the future activity at that location. ▪ A pipe bench will be constructed to accommodate the pipelines, which will follow existing and proposed road alignments to the extent practical to minimize the Project footprint. ▪ Roads will be designed to the minimum possible width and follow best practices for design speeds and expected vehicle traffic. ▪ Clearing equipment will be used that minimizes surface disturbance, soil compaction and topsoil loss (e.g., equipment with low ground pressure tracks or tires, blade shoes, and brush) where feasible.	No pathway or Secondary	▪ Standard mitigation and best management practices will be implemented ▪ Permafrost is limited at the site ▪ Effective at other developments throughout Canada ▪ Standard management practices will be employed as per management plans ▪ Mitigation expected to be 100% effective resulting in no measurable change in soil temperature ▪ Therefore, no linkage to effects expected ▪ Considered “no pathway” and screened out unless further information becomes available during the development of DAR, in which case, it may be considered as a secondary pathway in the DAR
▪ Changes in groundwater quality from open pits, underground mines, and tailings can affect soil quality. ▪ Changes in groundwater quality from open pits, underground mines, and tailings can alter soil chemistry and affect the condition of upland, wetland, and riparian ecosystems. ▪ Changes in groundwater quality from open pits, underground mines, and tailings can alter soil chemistry and affect vegetation and caribou and other wildlife habitat availability and distribution.	▪ The Water Management Plan and Tailings and Waste Rock Management Plan will be implemented that include adaptive management, if required. ▪ Tailings generated from the process plant will be pumped to and stored in the tailings disposal areas, which will be designed to minimize potential environmental effects by using pre-existing open pits. ▪ Studies will be undertaken to evaluate the suitability of multiple locations as tailings disposal sites and to select locations that will avoid and minimize risk of potential environmental effects. ▪ The Closure and Reclamation Plan will be implemented.	No pathway	▪ Standard mitigation and best management practices will be implemented ▪ Effective at other developments throughout Canada ▪ Mitigation expected to be 100% effective resulting in no measurable change in groundwater quality ▪ Therefore, no linkage to effects expected
▪ Changes in site surface water runoff can affect soils and the availability, distribution, and condition of upland, wetland, and riparian ecosystems.	▪ The Project disturbance footprint will be limited to the extent practical, and where possible and practical, infrastructure will be built on previously disturbed sites. ▪ Areas of vegetation clearing and soil disturbance will be limited to the immediate area of the future activity at that location. ▪ Roads will be designed to the minimum possible width and follow best practices for design speeds and expected vehicle traffic. ▪ The road alignment will minimize stream crossings and alterations to existing drainage patterns. ▪ Work will be avoided in sensitive areas during the time-of-year when erosion is more likely (e.g., spring freshet). ▪ Steepness and length of slopes of disturbed areas and stockpiled soils will be limited. ▪ The Water Management Plan, Tailings and Waste Rock Management Plan, and Erosion and Sediment Control Plan will be implemented, and includes that applies adaptive management, if required. ▪ Process water will be recirculated and water from tailings disposal areas will be recovered for recycling. ▪ Process water for start-up may be pumped from historical open pits if the water has suitable quality and quantity, or if not, from Great Slave Lake. ▪ Routine inspection and maintenance of containment and conveyance structures (i.e., roadside ditches and culverts) will be conducted to limit the risk of road wash-out or sediment release to the environment. ▪ Culverts will be sized to convey flows under design conditions. ▪ Water crossing structures will be constructed and installed in a manner that protects the banks from erosion and maintains surface water flows. ▪ A 30 m buffer will be established between Project components/infrastructure and permanent waterbodies and watercourses. ▪ Progressive reclamation and revegetation will be implemented for areas disturbed by the Project that are no longer required. ▪ The Closure and Reclamation Plan will be implemented.	No pathway or Secondary	▪ Standard mitigation and best management practices will be implemented ▪ Effective at other developments throughout Canada ▪ Mitigation expected to be 100% effective resulting in no measurable change in surface water runoff ▪ Therefore, no linkage to effects expected ▪ Considered “no pathway” and screened out unless further information becomes available during the development of DAR, in which case, it may be considered as a secondary pathway in the DAR

Table A-1: Additional Screening Information for No Pathways

Effects Pathway	Environmental Design Features and Mitigation	Pathway Assessment	Rationale and Comments
▪ Changes in surface water quality from contact with surface facilities and additional infrastructure could adversely affect soil chemistry and the condition of upland, wetland and riparian ecosystems. ▪ Changes in surface water quality from contact with surface facilities and additional infrastructure could affect soil chemistry and vegetation, and caribou and other wildlife habitat availability and distribution.	▪ The Water Management Plan and Tailings and Waste Rock Management Plan will be implemented and includes adaptive management, if required. ▪ Progressive reclamation and revegetation will be implemented for areas disturbed by the Project that are no longer required. ▪ The Closure and Reclamation Plan will be implemented.	No pathway or Secondary	▪ Standard mitigation and best management practices will be implemented ▪ Effective at other developments throughout Canada ▪ Mitigation expected to be 100% effective resulting in no measurable change in surface water quality ▪ Therefore, no linkage to effects expected ▪ Considered “no pathway” and screened out unless further information becomes available during the development of DAR, in which case, it may be considered as a secondary pathway in the DAR
▪ Direct discharge of mine water, as well as surface runoff, groundwater inflow and seepage from the Project will cause changes to surface water quality, which can adversely affect the condition of upland, wetland, riparian ecosystems.	▪ The Project disturbance footprint will be limited to the extent practical, and where possible and practical, infrastructure will be built on previously disturbed sites. ▪ Areas of vegetation clearing and soil disturbance will be limited to the immediate area of the future activity at that location. ▪ Roads will be designed to the minimum possible width and follow best practices for design speeds and expected vehicle traffic. ▪ The road alignment will minimize stream crossings and alterations to existing drainage patterns. ▪ The Water Management Plan and Tailings and Waste Rock Management Plan will be implemented, including adaptive management, if required. ▪ Water that interacts with the site footprint, waste rock, and tailings management areas will be captured and managed. ▪ Studies will be undertaken to evaluate the potential use of re-injection wells as an alternative method to dispose of underground saline water that will infiltrate open pits and underground mines. ▪ If required, the mine water discharge will meet all regulatory guidelines including Effluent Quality Criteria defined in a future Type A Water Licence and the Canadian Metal and Diamond Mining Effluent Regulations – Schedule 4 limits. ▪ Depending on the location, the pumped mine water discharge to a receiving water body (river or lake system) may be directed through a properly designed diffuser system to rapidly attenuate the discharge, as appropriate ▪ Discharge water will be regularly sampled and monitored, enabling adaptive management actions if necessary. ▪ An Aquatic Effects Monitoring Program (AEMP) and Surveillance Network Program (SNP) will be developed and implemented to monitor effects of the mine on the aquatic receiving environment. Adaptive management actions as per an aquatic response framework within the AEMP will be enabled if necessary. ▪ Mineralized material and waste rock will be stored in a contained area. Waste rock will be disposed of onto constructed waste rock storage facilities, or where possible, into historical open pits. ▪ Tailings generated from the process plan will be pumped to and stored in the tailings disposal areas, which will be designed to minimize potential environmental effects by using pre-existing open pits. ▪ A blasting management plan will be developed and implemented.	No pathway or Secondary	▪ Standard mitigation and best management practices will be implemented ▪ Effective at other developments throughout Canada ▪ Mitigation expected to be 100% effective resulting in no measurable change to surface water quality ▪ Therefore, no linkage to effects expected ▪ Considered “no pathway” and screened out unless further information becomes available during the development of DAR, in which case, it may be considered as a secondary pathway in the DAR

Table A-1: Additional Screening Information for No Pathways

Effects Pathway	Environmental Design Features and Mitigation	Pathway Assessment	Rationale and Comments
▪ Changes in surface water levels, flows and drainage areas can increase soil erosion and sedimentation along waterbodies and watercourses and affect the availability, distribution, and condition of upland, wetland, and riparian ecosystems. ▪ Changes in surface water levels and flows can alter waterbodies and watercourses and affect the availability, distribution, and condition of upland, wetland, and riparian ecosystems. ▪ Changes in surface water levels, flows and drainage areas can affect soils and vegetation, and caribou and other wildlife habitat availability and distribution.	▪ The Project disturbance footprint will be limited to the extent practical, and where possible and practical, infrastructure will be built on previously disturbed sites. ▪ Areas of vegetation clearing and soil disturbance will be limited to the immediate area of the future activity at that location. ▪ Roads will be designed to the minimum possible width and follow best practices for design speeds and expected vehicle traffic. ▪ The road alignment will minimize stream crossings and alterations to existing drainage patterns. ▪ Work will be avoided in sensitive areas during the time-of-year when erosion is more likely (e.g., spring freshet). ▪ Steepness and length of slopes of disturbed areas and stockpiled soils will be limited. ▪ The Water Management Plan, Tailings and Waste Rock Management Plan, and Erosion and Sediment Control Plan will be implemented, and including the application of adaptive management, if required. ▪ Process water will be recirculated and water from tailings disposal areas will be recovered for recycling. ▪ Process water for start-up may be pumped from historical open pits if the water has suitable quality and quantity, or if not, from Great Slave Lake. ▪ Routine inspection and maintenance of containment and conveyance structures (i.e., roadside ditches and culverts) will be conducted to limit the risk of road wash-out or sediment release to the environment. ▪ Culverts will be sized to convey flows under design conditions. ▪ Water crossing structures will be constructed and installed in a manner that protects the banks from erosion and maintains surface water flows. ▪ A 30 m buffer will be established between Project components/infrastructure and permanent waterbodies and watercourses. ▪ Progressive reclamation and revegetation will be implemented for areas disturbed by the Project that are no longer required. ▪ The Closure and Reclamation Plan will be implemented.	No pathway or Secondary	▪ Standard mitigation and best management practices will be implemented ▪ Effective at other developments throughout Canada ▪ Mitigation expected to be 100% effective resulting in no measurable changes to surface water levels and flows ▪ Therefore, no linkage to effects expected ▪ Considered “no pathway” and screened out unless further information becomes available during the development of DAR, in which case, it may be considered as a secondary pathway in the DAR
▪ Blasting and associated fly rock may result in injury or mortality to caribou and other wildlife.	▪ A blasting management plan will be developed and implemented. ▪ Blasting activities will be limited to the daytime periods, where possible. ▪ Blasting activities will follow a regular schedule, where possible, and site-wide notice will be given prior to each blast. ▪ A survey of the blast area will be completed prior to the blast and caribou will be deterred from areas of risk. ▪ Wildlife will be deterred from areas of risk. ▪ Blasting operations will follow DFO’s *Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters* (Wright and Hopky 1998) for setback distances from fish bearing waterbodies, which is likely to reduce the risk to waterbirds.	No pathway	▪ Standard mitigation and best management practices will be implemented ▪ Effective at other developments throughout Canada ▪ Mitigation expected to be 100% effective resulting in no measurable changes to wildlife survival and reproduction ▪ Therefore, no linkage to effects expected
▪ Attraction of wildlife to the Project (e.g., food waste, sewage, petroleum-based products, salt, explosive powder) may increase human-wildlife interactions and alter predator-prey relationships, or result in direct removal/mortality of problem wildlife resulting in an affect to wildlife abundance.	▪ The Wildlife Protection Plan will be implemented. ▪ Littering and feeding of wildlife will be prohibited. ▪ The Waste Management Plan will be implemented ▪ Domestic (e.g., food) waste will be incinerated regularly. ▪ Industrial (e.g., used oil and lubricants) waste will be collected and incinerated and/or transported off site for recycling or disposal at a licensed disposal facility. ▪ Wastes will be stored in wildlife proof containers. ▪ Work sites will be maintained and materials (e.g., cables, wires, fencing) will be properly stored so as not to entangle caribou or other wildlife.	No pathway	▪ Standard mitigation and best management practices will be implemented ▪ Effective at other developments throughout Canada ▪ Mitigation expected to be 100% effective resulting in no measurable changes to wildlife survival and reproduction ▪ Therefore, no linkage to effects expected

Table A-1: Additional Screening Information for No Pathways

Effects Pathway	Environmental Design Features and Mitigation	Pathway Assessment	Rationale and Comments
▪ The Project could induce in-migration to the NWT from southern communities.	▪ Local labour in local study area (LSA) communities will be prioritized for employment and local businesses for contracting opportunities. ▪ Communities will be prioritized for hiring through Impact benefit Agreements (IBAs) or other agreements. ▪ Other Northern labour will be included as a second priority for hiring after local labour from LSA communities. ▪ Yellowknife will be maintained as a pick-up point community to provide a transportation hub for other Northern workers coming from the North Slave Region. ▪ Communication will occur with other mining operators in the NWT to understand their closure schedules, and opportunities for workforce transition to the Project where possible and following prioritization of local labour from LSA communities . ▪ A worker accommodation camp will be maintained as travelling from the site after a shift is a safety concern. This removes the need for relocation to the NWT to access Project employment in the event that southern workers are required to supplement Northern labour.	No pathway	▪ Standard mitigation and best management practices will be implemented ▪ Effective at other developments throughout the North ▪ Mitigation and Project workforce management approach expected to be largely effective resulting in no meaningful changes to in-migration ▪ Therefore, no linkage to effects expected
▪ Project-induced in-migration to the NWT from southern communities could increase consumer prices and result in inflation of consumer goods.	▪ Local labour in LSA communities will be prioritized for employment and local businesses for contracting opportunities. ▪ Communities will be prioritized for hiring through IBAs or other agreements. ▪ Other Northern labour will be included as a second priority for hiring after local labour from LSA communities. ▪ Yellowknife will be maintained as a pick-up point community to provide a transportation hub for other Northern workers coming from the North Slave Region. ▪ Communication will occur with other mining operators in the NWT to understand their closure schedules, and opportunities for workforce transition to the Project where possible and following prioritization of local labour from LSA communities. ▪ A worker accommodation camp will be maintained as travelling from the site after a shift is a safety concern. This removes the need for relocation to the NWT to access Project employment in the event that southern workers are required to supplement Northern labour.	No pathway	▪ Standard mitigation and best management practices will be implemented ▪ Effective at other developments throughout the North ▪ Mitigation and Project workforce management approach expected to be largely effective resulting in no meaningful changes to consumer prices and inflation ▪ Therefore, no linkage to effects expected
▪ Project workforce housing requirements could increase demand on the rental housing market in Yellowknife, Hay River and Fort Resolution.	▪ Workers, including those from outside the NWT, will be housed in full-service construction and operations camps.	No pathway	▪ Standard mitigation and best management practices will be implemented ▪ Mitigation and Project workforce management approach expected to be largely effective resulting in no meaningful changes to the rental housing market ▪ Therefore, no linkage to effects expected
▪ The Project's out-of-area workforce could increase demand for health, social, and protective services.	▪ A first responder medical station will be provided at the accommodation camp facilities to meet workers' medical needs while at site, to limit the demand for governmental health facilities for work related injuries. ▪ Pre-employment medical exams will be conducted in hometown. ▪ First aid training will be provided. ▪ Driver training will be provided and a driver code of conduct will be enforced, to control speeds and encourage considerate driving. ▪ Zero tolerance policies will be in place regarding the use of drugs and alcohol while on shift or in transit. ▪ A worker code of conduct will be developed and enforced. ▪ Access to an Employee and Family Assistance Program (EFAP) will be provided such that private fee for service organizations are used and the public or non-profit sector does not see an increase in demand. ▪ A worker accommodation camp will be maintained as travelling from the site after a shift is a safety concern.	No pathway	▪ Standard mitigation and best management practices will be implemented ▪ Mitigation and Project workforce management approach expected to be largely effective resulting in no meaningful changes to the demand for health, social, and protective services ▪ Therefore, no linkage to effects expected

Table A-1: Additional Screening Information for No Pathways

Effects Pathway	Environmental Design Features and Mitigation	Pathway Assessment	Rationale and Comments
▪ The Project's use of air and water transportation for materials, goods, and out-of-area workers during construction and operations will place additional demand on air and shipping transportation services.	▪ Liaison will occur with air and shipping service providers to ensure capacity is available to move goods, equipment, and personnel. ▪ Service agreements will be established with providers in advance, and make them aware of shipping and air transportation requirements.	No pathway	▪ Standard mitigation and best management practices will be implemented ▪ Effective at other developments throughout Canada ▪ Mitigation and service agreements expected to be largely effective resulting in no changes in the demand for air and shipping transportation services that would exceed supply ▪ Therefore, no linkage to effects expected
▪ Project construction and operations will generate demand for power and place pressure on the power supply system.	▪ Arrangements will be made with NWT Power to provide services to some extent in a manner that does not jeopardize the electricity security for other users. ▪ Diesel generators will be used as required to offset surplus and emergency demand for electricity extra to that provided by the NWT Power grid.	No pathway	▪ Standard mitigation and best management practices will be implemented ▪ Effective at other developments throughout Canada ▪ Mitigation and service agreements expected to be largely effective resulting in no changes in the demand for power supply that would exceed supply ▪ Therefore, no linkage to effects expected
▪ The Project will generate solid waste requiring disposal, thereby potentially affecting capacity of waste management services infrastructure.	▪ The Waste Management Plan will be implemented. ▪ Waste management agreements will be established with service providers capable of handling solid and hazardous waste. ▪ Inert waste may be disposed in an onsite landfill. ▪ Organic waste from the camp may be incinerated on site.	No pathway	▪ Standard mitigation and best management practices will be implemented ▪ Effective at other developments throughout Canada ▪ Standard management practices will be employed as per management plans ▪ Mitigation and service agreements expected to be largely effective resulting in no changes in the demand for waste management services that would exceed supply ▪ Therefore, no linkage to effects expected
▪ Project-induced in-migration to Yellowknife, Hay River and Fort Resolution could increase demand for waste management infrastructure beyond capacity.	▪ Local labour in LSA communities will be prioritized for employment and local businesses for contracting opportunities. ▪ Communities will be prioritized for hiring through IBAs or other agreements. ▪ Hiring priorities will be communicated to LSA communities. ▪ Other Northern labour will be included as a second priority for hiring after local labour from LSA communities. ▪ Yellowknife will be maintained as a pick-up point community to provide a transportation hub for other Northern workers coming from the North Slave Region. ▪ Communication will occur with other mining operators in the NWT to understand their closure schedules, and opportunities for workforce transition to the Project where possible and following prioritization of local labour from LSA communities. ▪ A worker accommodation camp will be maintained as travelling from the site after a shift is a safety concern. This removes the need for relocation to the NWT to access Project employment in the event that southern workers are required to supplement Northern labour.	No pathway	▪ Standard mitigation and best management practices will be implemented ▪ Effective at other developments throughout Canada ▪ Mitigation and Project workforce management approach expected to be largely effective resulting in no changes to the demand for waste management infrastructure that would exceed supply ▪ Therefore, no linkage to effects expected
▪ Project will increase demand for potable water and wastewater treatment and disposal.	▪ Water will be drawn from an appropriate potable source. ▪ Wastewater management agreements will be established with service providers capable of effectively collecting, transporting, and treating wastewater.	No pathway	▪ Standard mitigation and best management practices will be implemented ▪ Effective at other developments throughout Canada ▪ Standard management practices will be employed as per management plans ▪ Mitigation and service agreements expected to be largely effective resulting in no changes in the demand for potable water and wastewater treatment and disposal services that would exceed supply ▪ Therefore, no linkage to effects expected

Table A-1: Additional Screening Information for No Pathways

Effects Pathway	Environmental Design Features and Mitigation	Pathway Assessment	Rationale and Comments
▪ Releases of criteria air contaminants from a wildfire started by Project activities can alter air quality and greenhouse gas emissions and affect climate.	▪ A Wildfire Prevention and Preparedness Plan will be developed and implemented. ▪ All heavy equipment and fueling sites will be equipped with approved and fully charged fire extinguishers. ▪ Firefighting training will be provided to on-site personnel (as deemed appropriate). ▪ No smoking will be allowed at equipment fuelling stations or outside of designated areas at all times. ▪ Safety management systems (e.g., hot work permits) will be in place. ▪ Firebreaks and vegetation management (e.g., removal of understory fuel loads) will be implemented as required.	No pathway	▪ Standard mitigation and best management practices will be implemented ▪ Effective at other developments throughout Canada ▪ Mitigation expected to be 100% effective resulting in no measurable change to atmospheric environment ▪ Therefore, no linkage to effects expected
▪ Chemical or hazardous materials spills on site and during transport offsite may enter groundwater and affect groundwater quality. ▪ Chemical or hazardous materials spills on site and during transport offsite may adversely affect surface water quality in the local aquatic receiving environment. ▪ Chemical or hazardous materials spills on site and during transport offsite can alter fish habitat quantity and quality and affect the survival and reproduction of fish. ▪ Chemical or hazardous materials spills on site and during transport offsite may adversely affect soil quality. ▪ Chemical or hazardous materials spills on site and during transport offsite may adversely affect upland, wetland, and riparian ecosystems. ▪ Chemical or hazardous materials spills on site or during transport offsite can affect soil, vegetation, and caribou and other wildlife habitat availability and survival and reproduction of individual animals. ▪ Chemical or hazardous materials spills on site or during transport offsite can affect actual or perceive changes in water, fish, plants, and wildlife, which could affect participation in traditional activities and the consumption of traditional foods. ▪ Chemical or hazardous materials spills on site or during transport offsite can influence water, fish, and wildlife, which could affect availability or suitability of resources for outfitted and recreational hunting and fishing.	▪ The Spill Contingency Plan and Waste Management Plan will be implemented. ▪ Standard best management practices for general activities with regards to use, handling, and storage of deleterious substances will be followed. ▪ Hazardous waste will be stored in appropriate containers that will be located in a lined bermed containment pad, which will provide secondary containment of spills. ▪ No fuels, oils, or other hazardous substances will be stored within 150 m of groundwater springs or areas of upwelling, unless otherwise authorized. ▪ No equipment maintenance or refuelling will be conducted within 150 m of groundwater springs or areas of upwelling, unless otherwise authorized. ▪ No fuels, oils, or other hazardous substances will be stored within 150 m of waterbodies. ▪ No equipment maintenance or refuelling will be conducted within 150 m of waterbodies. ▪ The tailings transport pipeline will have drainage points and spill containment areas located along the route. ▪ Regular maintenance of vehicles and equipment will be conducted. ▪ Spill kits will be available at various locations throughout the site and will be maintained in good working order. ▪ Hazardous waste will be transported to a licensed hazardous waste receiving facility for disposal. ▪ Fuel and hazardous materials will be transported in approved containers in licensed vehicles. ▪ If a major spill occurs, the cleanup, treatment, and disposal of the contaminated waste and soil will be handled and disposed of using approved methods. ▪ Speed limits will be enforced. ▪ The Spill Contingency Plan and Waste Management Plan will be implemented and will consider DFO's *Measures to Protect Fish Habitat* ▪ Ongoing consultation and communication of the results of monitoring plans and programs will occur with Indigenous communities. ▪ Ongoing consultation with Indigenous communities will occur on the implementation of appropriate mitigation measures and their effectiveness.	No Pathway	▪ Standard mitigation and best management practices will be implemented ▪ Effective at other developments throughout Canada ▪ Mitigation expected to be 100% effective resulting in no measurable changes to the aquatic and terrestrial environments ▪ Therefore, no linkage to effects expected
▪ Flow over emergency spillways of water containment structures during extreme flood events may alter local hydrology, drainage and/or stream characteristics. ▪ Flow over emergency spillways of water containment structures during extreme flood events may adversely affect surface water quality. ▪ Flow over emergency spillways of water containment structures during extreme flood events may adversely alter surface water quality and affect fish habitat quantity and quality and the survival and reproduction of fish.	▪ Overflow spillways and downstream conveyance structures will be designed to be stable and maintain function, and provide sufficient erosion protection during a design flood. ▪ Routine inspections will be completed and the storm water management system will be maintained.	No pathway	▪ Standard mitigation and best management practices will be implemented ▪ Effective at other developments throughout Canada ▪ Mitigation expected to be 100% effective resulting in no measurable changes to surface water quantity and quality ▪ Therefore, no linkage to effects expected

Table A-1: Additional Screening Information for No Pathways

Effects Pathway	Environmental Design Features and Mitigation	Pathway Assessment	Rationale and Comments
▪ A wildfire started by Project activities may adversely affect surface water quality. ▪ A wildfire started by Project activities may adversely alter surface water quality and affect fish habitat quantity and quality and the survival and reproduction of fish. ▪ A wildfire started by Project activities may adversely affect soil quality and distribution. ▪ A wildfire started by Project activities may adversely affect upland, wetland, and riparian ecosystems. ▪ A wildfire started by Project activities may result in loss of wildlife and wildlife habitat. ▪ A wildfire started by Project activities may result in loss of traditional land use. ▪ A wildfire started by Project activities may result in loss of non-traditional land and resource use.	▪ A Wildfire Prevention and Preparedness Plan will be developed and implemented. ▪ All heavy equipment and fuelling sites will be equipped with approved and fully charged fire extinguishers. ▪ Firefighting training will be provided to on-site personnel (as deemed appropriate). ▪ No smoking will be allowed at equipment fuelling stations or outside of designated areas at all times. ▪ Safety management systems (e.g., hot work permits) will be implemented. ▪ Firebreaks and vegetation management (e.g., removal of understory fuel loads) will be implemented.	No pathway	▪ Standard mitigation and best management practices will be implemented ▪ Effective at other developments throughout Canada ▪ Mitigation expected to be 100% effective resulting no measurable changes to the aquatic and terrestrial environments ▪ Therefore, no linkage to effects expected
▪ Failure of storm water management features (culverts, roadside ditches) following a severe rainfall event can influence surface water levels, flows and drainage areas, which can affect soil quality and distribution. ▪ Failure of storm water management features (culverts, roadside ditches) following a severe rainfall event can influence surface water levels, flows and drainage areas, which can affect upland, wetland, and riparian ecosystems. ▪ Failure of storm water management features (culverts, roadside ditches) following a severe rainfall event can influence surface water levels, flows and drainage areas, which can affect caribou and other wildlife habitat availability and distribution. ▪ Failure of storm water management features (culverts, roadside ditches) following a severe rainfall event can influence surface water levels, flows and drainage areas, which can affect ecological services (e.g., water quality, fish, wildlife) and traditional land and resource use. ▪ Failure of storm water management features (culverts, roadside ditches) following a severe rainfall event can influence surface water levels, flows and drainage areas, which can affect ecological services (e.g., water quality, fish, wildlife) and non-traditional land and resource use	▪ Storm water features will be designed to carry/contain a suitable return rainfall event as well as provide sufficient erosion protection during those events. ▪ Routine inspections and maintenance of storm water management system will be conducted.	No pathway	▪ Standard mitigation and best management practices will be implemented ▪ Effective at other developments throughout Canada ▪ Mitigation expected to be 100% effective resulting in measurable change to surface water flows and levels ▪ Therefore, no linkage to effects expected

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Volume 6 -
Concordance Table

Environmental Assessment Initiation Package Information Request			
Guideline Section	**Description**	**Applicable Sections in EA Initiation Package**	**Applicable Sub-Section in EA Initiation Package**
4.1 Project Description			
4.1 Project Description 4.1.1 Project Overview	1. General project information: a) Project Title	Volume 1, Section 1.0	Volume 1, Section 1.1.1
	b) Name and address of the developer i) Names and contact information for responsible individual(s) in the organization	Volume 1, Section 1.0	Volume 1, Section 1.1.2
	c) Project Type i) Identify the type of project proposal • Identify the primary project type and any major accessory project components (such as open pit gold mining, all-weather road development, and truck and aircraft transportation). ii) For all resource development projects, identify: • nature of resource being proposed for exploration or extraction • proven and probable reserves and production capacity • exploration, extraction, and/or processing method(s)	Volume 1, Section 1.0	Volume 1, Section 1.1.3
	d) Project Location i) Describe the proposed project location in terms of its local and regional context. • Provide maps, photos, and other depictions to show, at minimum, the location of the proposed development relative to other developments, land use areas, wildlife and historical conservation areas, cultural areas and communities. • Include information on the political and administrative location (such as settlement areas and land use planning areas), land ownership, watershed or drainage region, traditional place names, and the developer's right to access the proposed development area. Maps should detail the project footprint (1:50,000 or more detailed), regional area, and other relevant information.	Volume 1, Sections 1.0, 2.0 Volume 5, Section 1.0	Volume 1, Sections 1.1.4, 1.2, 1.3, 1.4, 1.5, 1.6.1, 2.0, Figures 1-1 to 2-2 Volume 5, Section 1.1, Figures 1-1 and 1-2

Environmental Assessment Initiation Package Information Request			
Guideline Section	**Description**	**Applicable Sections in EA Initiation Package**	**Applicable Sub-Section in EA Initiation Package**
4.1 Project Description 4.1.1 Project Overview	e) Project Timeline i) Identify the timing of the proposed development, including any proposed or potential future phased development schedules. Details should include dates associated with all proposed project phases and seasonal operations, such as: • mobilization • construction • operations • closure and reclamation • temporary and permanent closure • other ii) Details related to the proposed project timeline should be supported by process maps and tables to demonstrate the sequencing and timing of all project activities, components, and developments for the proposed life of the project. iii) For proposed projects with indeterminate timelines (such as public all-season roads), developers should identify the phases of the project where applicable, as well as the management responsibilities that would apply to each phase.	Volume 1, Sections 1.0 and 3.0	Volume 1, Section 1.1.5, Table 1-3, Section 3.1
	f) Labour force and human resources i) Discuss the labour requirements, employee programs and policies, and workforce development opportunities for the proposed project. At minimum, details should include: • opportunities for employment and training • expected workforce requirements and timelines for employment opportunities • communities of focus for hiring opportunities and anticipated hiring policies (including hiring programs, details on work and transportation schedules) • employee assistance programs (such as career planning, employee counselling, family support, transition planning) • workplace policies and programs (such as codes of conduct, workplace safety programs, cultural training programs)	Volume 1, Sections 1.0 and 4.0	Volume 1, Sections 1.2.3, 4.1, 4.2, Appendix C

Environmental Assessment Initiation Package Information Request			
Guideline Section	**Description**	**Applicable Sections in EA Initiation Package**	**Applicable Sub-Section in EA Initiation Package**
4.1 Project Description 4.1.1 Project Overview	2. Purpose of the Project a) Objective i) Discuss project objective and the proposed use of any end-products (such as product sale as a raw material, finished material, intermediate product, or local use).	Volume 1, Section 1.0	Volume 1, Section 1.2
	b) Need for the development i) Discuss the need for the development including the benefits to local communities, the Northwest Territories, and Canada.	Volume 1, Section 1.0	Volume 1, Section 1.2.2
	c) Economic projections i) Discuss the economic projections for the proposed project, including: • capital and operating costs (by project phase, including temporary closure scenarios) • procurement strategies (including procurement priorities and sectoral breakdowns) • taxation and royalty revenues • contributions to Gross Domestic Product • economic vulnerabilities (including forecasts of commodity prices where applicable) ii) Identify any anticipated benefit agreements for the proposed project and provide non-confidential details related to their status and progress.	Volume 1, Section 1.0	Volume 1, Section 1.2.3, Appendix C
4.1 Project Description 4.1.1 Project Overview	3. Project History a) Regulatory History i) Provide details related to previous and/or related projects (such as exploration programs), associated permits or licences, mineral claims, leases, and any additional information related to relevant project history.	Volume 1, Section 1.0	Volume 1, Section 1.3.2, 1.4
	b) Site History i) Identify current site or local infrastructure and equipment that would be used as part of the proposed development (such as audits, drill holes, buildings, roads) as well as any liabilities.	Volume 1, Sections 1.0 and 3.0	Volume 1, Sections 1.3.1, 3.3, 3.4.6, 3.5.1

Environmental Assessment Initiation Package Information Request			
Guideline Section	**Description**	**Applicable Sections in EA Initiation Package**	**Applicable Sub-Section in EA Initiation Package**
4.1 Project Description 4.1.1 Project Overview	4. Project Authorizations a) Provide a list of all regulatory permits, licences, and any other authorizations required to carry out the proposed development and the status of those authorizations, as publicly available at the time of submission of the EA Initiation Package, including: i) Water licences and land use permits. ii) Status of conformity with applicable land use plan: • If the proposed project would occur in an area with an approved land use plan, the developer should demonstrate how it would comply with the land use plan. It is also helpful to clearly identify whether the proposed project conforms or conflicts with any applicable draft land use plan. iii) Surface and subsurface leases, land tenure. iv) Authorizations or permits from federal, territorial, or Aboriginal governments. For example: • Natural Resources Canada • Department of Fisheries and Oceans Canada • Environment Canada • Transport Canada • Government of the Northwest Territories • The Tłı̨cho Government • The Dél̨ı̨ne Got'ine Government	Volume 1, Section 1.0	Volume 1, Section 1.4, Table 1-6
	b) Discuss the proposed project's conformity with any current or prospective habitat management plans or protected areas in or near the development area (such as the Bathurst Caribou Range Management Plan or boreal caribou recovery strategies).	Volume 1, Section 1.0	Volume 1, Section 1.4

Environmental Assessment Initiation Package Information Request			
Guideline Section	**Description**	**Applicable Sections in EA Initiation Package**	**Applicable Sub-Section in EA Initiation Package**
4.1 Project Description 4.1.1 Project Overview	5. Description of the Developer a) Provide the following information about the developer (and its partners) responsible for the proposed project: i) A description of the developer, including any subsidiary companies, related corporations, and/or joint venture partners.	Volume 1, Section 1.0	Volume 1, Sections 1.1.2 and 1.5
	ii) Evidence of the financial viability of the developer to cover the costs associated with an EA (including providing a DAR, holding engagement meetings, responding to information requests, participating in public hearings), as well as to undertake the project including closure and reclamation.	Volume 1, Section 1.0	Volume 1, Section 1.2.1
	iii) A summary of the developer's corporate history and operational experience in Canada and the Northwest Territories.	Volume 1, Section 1.0	Volume 1, Section 1.5
	iv) Details on how the developer would ensure that its contractors and subcontractors honour commitments made by the developer throughout the EA process.	Volume 1, Section 1.0	Volume 1, Section 1.5
4.1 Project Description 4.1.1 Project Overview	v) Environmental performance records for the developer and its partners from prior exploration and development work related to the proposed project and any other projects in the Northwest Territories, or elsewhere, including discussion of regulatory compliance.	Volume 1, Sections 1.0 and 3.0	Volume 1, Sections 1.3, 1.4, 3.9
	vi) A description of any corporate policies, codes of practice, programs or plans concerning the developer's environmental, sustainable development, community engagement policies. Copies should be provided as appendices to the EA Initiation Package.	Volume 1, Sections 1.0 and 3.0	Volume 1, Sections 1.5, 1.6.2, 3.9.1, Appendix B
4.1 Project Description 4.1.1 Project Overview	6. Traditional Knowledge a) Provide a summary of the Traditional Knowledge resources identified, developed, or obtained during project planning. Include references to your engagement record, where relevant.	Volume 1, Section 1.0 Volume 2 – Management and Monitoring Plans Volume 5, Section 4.0	Volume 1, Section 1.6 Volume 2 – • Engagement and Collaboration Plan Framework, Section 8.0 Volume 5, Section 4.1.1, 4.1.4, and 4.1.5
	b) Describe how Traditional Knowledge was considered and incorporated into project planning.		
	c) Describe the steps taken to ensure that Traditional Knowledge was, and will continue to be, accessed and used in culturally appropriate ways that respect local protocols. Also describe how intellectual property would be protected as part of the proposed project's development, assessment, and undertaking.		

Environmental Assessment Initiation Package Information Request			
Guideline Section	**Description**	**Applicable Sections in EA Initiation Package**	**Applicable Sub-Section in EA Initiation Package**
4.1 Project Description 4.1.2 Project Components, alternatives and plans	Project components Developers are required to provide a description of all activities (such as transportation) and physical characteristics (such as buildings and infrastructure) required to carry out the proposed project, as well as the alternatives considered during project development. In the context of a project description, these activities and characteristics are considered components of the overall undertaking. Project component information should include: • a description of each component • the methods the developer proposes to operate and/or manage each component • any operational contingencies Standard project components a) Equipment b) Transportation c) Buildings and infrastructure d) Water and water management infrastructure e) Fuel and hazardous materials f) Power g) Waste h) Closure and reclamation activities	Volume 1, Sections 3.0 and 5.0	Volume 1, Sections 3.1 to 3.9, and 5.1 to 5.3 Standard project components: a) Section 3.6 b) Section 3.5 c) Section 3.4.6 d) Section 3.8 e) Sections 3.4.3, 3.4.7, 3.4.8 f) Section 3.7 g) Section 3.4 h) Sections 5.1 to 5.3

Environmental Assessment Initiation Package Information Request			
Guideline Section	**Description**	**Applicable Sections in EA Initiation Package**	**Applicable Sub-Section in EA Initiation Package**
4.1 Project Description 4.1.2 Project Components, alternatives and plans	Project-specific components a) Natural resource development i) the nature of the resource being proposed for extraction • Detailed description of the resource features: ○ physical nature of resource (such as characteristics of ore body or well) ○ geology and mineralogy of area ○ host rock characteristics ○ results of rock geochemical tests and methodologies • well type (such as production, injection, disposal) and classification (such as exploratory wildcat, exploratory outpost, and development) ii) type of exploration (such as drilling, bulk sampling, and trenching) activities would occur as part of the project and the exploration program plan • timeline • geophysical, geological, and environmental conditions, surveys, and sampling • drill plans (such as locations, depths, volumes, additives, and methodologies) • mobilization and personnel requirements • monitoring and management plans iii) resource development activities would occur as part of the project and the proposed resource development plan • type of development (such as open-pit, underground, and oil drilling), methods, and the life of the development • extraction and milling methods and rates of production • storage and transportation of product (such as trucked, aircraft, and pipeline) and methods • equipment, infrastructure, and personnel requirements • stockpiles, volumes, and management methods (such as overburden, ore, waste rock) • site plan (such as rigs, pits, quarries, mills, portals, ramps, associated infrastructure) iv) What are the plans to monitor and manage all exploration and extraction activities? How were they designed? How do they follow or improve on standard best practices or guidelines in the Canadian north? the proposed resource development plan?	Volume 1, Sections 1.0, 2.0, and 3.0 Volume 2 – Management and Monitoring Plans Volume 3, Section 3.0	1.1.5, 1.4, 2.1 to 2.3, 3.1 to 3.9 Volume 2 – • Spill Contingency Plan Framework • Erosion and Sediment Plan Framework • Water Management Plan Framework • Mine Waste Management Plan Framework • Tailings and Waste Rock Management Plan Framework • Closure and Reclamation Plan Framework • Wildlife Protection Plan Framework • Aquatic Effects Monitoring Program Framework Volume 3, Sections 3.1.1, 3.3.1, 3.3.7, Appendix A

Environmental Assessment Initiation Package Information Request			
Guideline Section	**Description**	**Applicable Sections in EA Initiation Package**	**Applicable Sub-Section in EA Initiation Package**
4.1 Project Description 4.1.2 Project Components, alternatives and plans	Details on project components (such as dimensions, footprints, and relative locations on a site map) should be presented with accompanying figures, maps, and photos as appropriate.	Volume 1, Section 3.0	All Figures (Figures 1-1 to 3-8)
	Consideration of alternatives For each project component, briefly describe any technically and economically feasible alternative means of carrying out the development. Alternatives may include alternative technologies, designs, management plans, timing, location, methods, and more. The developer will describe: • reasons for selecting preferred methods, designs, layout, management strategies, technologies, and other project characteristics; ○ where applicable, provide a preliminary cost/benefit analysis to further describe the rationale for the selection of the preferred alternative • differences in the impacts on the environment (human and biophysical) that could result from the options considered, including impacts from vulnerabilities related to climate change; • feedback during all engagement processes and how feedback was considered in selecting the preferred approach; and • if and how the viability of options could be improved in the future through, for example, input from public and parties, technological innovation, research findings	Volume 1, Section 3.0 Volume 2 – Management and Monitoring Plans Volume 5, Section 4.0	Volume 1, Sections 3.2.1, 3.3.2, 3.4.6, 3.5.3, 3.8.2, and 3.8.3 Volume 2 – • Engagement and Collaboration Plan Framework, Section 5.0 Volume 5, Section 4.1.4

Environmental Assessment Initiation Package Information Request			
Guideline Section	**Description**	**Applicable Sections in EA Initiation Package**	**Applicable Sub-Section in EA Initiation Package**
4.1 Project Description 4.1.2 Project Components, alternatives and plans	Monitoring and Management Programs and Plans Waste Management Plan Spill Management Plan Tailings and Waste Rocks Management Plan Wildlife Mitigation and Monitoring Plan Aquatic Effects Management Design Plan Closure and Reclamation Plan Water Management Plan Sediment and Erosion Plan	Volume 1, Sections 3.0 and 5.0 Volume 2 – Management and Monitoring Plans	Volume 1, Sections 3.9.1 to 3.9.10, and 5.0 Volume 2 – • Spill Contingency Plan Framework • Erosion and Sediment Plan Framework • Water Management Plan Framework • Mine Waste Management Plan Framework • Tailings and Waste Rock Management Plan Framework • Closure and Reclamation Plan Framework • Wildlife Protection Plan Framework • Aquatic Effects Monitoring Program Framework

Environmental Assessment Initiation Package Information Request			
Guideline Section	**Description**	**Applicable Sections in EA Initiation Package**	**Applicable Sub-Section in EA Initiation Package**
4.1 Project Description 4.1.3 Plain Language Summary and map	Developers are required to provide a plain language summary (the summary) of the project description. The summary should provide an effective snapshot of the proposed development and introduce details on the proposed project and the developer that will be further expanded in more detailed sections of the project description. Information in the summary should include, at minimum, the following: • type of project • timeline • location and proximity to communities, planning and/or conservation areas • main project components, including activities and physical infrastructure • project history and related projects • history of the developer	Volume 1	Plain Language Summary
4.1 Project Description 4.1.3 Plain Language Summary and map	Maps should identify, at minimum: • all areas of proposed development activities (such as transportation corridors, exploration sites and survey areas) • location of any proposed infrastructure (such as temporary and permanent infrastructure, as well as existing and additional infrastructure) • boundaries of the proposed land use permits, surface leases, or subsurface mineral tenure and, if applicable, identification of any other permit boundary areas • local and regional governance boundaries • common or traditional place names • proximity to conservation areas, national and territorial parks, and areas of known cultural • importance, traditional use, and recreational or other public use	Volume 1 Volume 3 Volume 5	Volume 1 – All Figures (Figures 1-1 to 3-8) Volume 3 – Figures 1-1 and 1-2 Volume 5 – Figures 1-1 and 1-2

Environmental Assessment Initiation Package Information Request			
Guideline Section	**Description**	**Applicable Sections in EA Initiation Package**	**Applicable Sub-Section in EA Initiation Package**

4.2 Description of the Existing Environment
4.2.1 Components of the biophysical environment
	The list of biophysical environmental features below includes common components that should
	be described, at minimum, for natural resource development projects:
	• geological setting and resources
	  ○ description and physical nature of resource
	  ▪ characteristics of ore body
	  ▪ structural geology including identification of faults or fractures
	  ○ geochemistry
	  ▪ ore and waste rock properties
	  ▪ geochemistry and characterization of contamination potential (such as potential acid rock drainage, metal leaching)
		Volume 1, Section 2.0
		
		Volume 3, Section 3.0
			Volume 1, Sections 2.1, 2.2, and 2.3
			
			Volume 3, Sections 3.1.1, 3.3.1, and Appendix A

	• surficial geology and soils
	  ○ characterization of soil composition and soil stability
	  ○ presence and characterization of permafrost
		Volume 3, Section 3.0	Volume 3, Sections 3.1.1, 3.1.4, 3.2, 3.3.7, and Appendix A

	• climate and meteorology (project area)
	  ○ temperature, precipitation, wind, humidity
	  ○ air quality
		Volume 3, Section 3.0	Volume 3, Sections 3.1.2, 3.3.2, and Appendix B

4.2 Description of the Existing Environment
4.2.1 Components of the biophysical environment
	• groundwater
	  ○ hydrogeology
	  ○ characterization of project area
	  ○ ground water level
	  ○ flow regime, direction, infiltration
	  ○ influences of geologic structures
	  ○ water type and quality
		Volume 1, Section 2.0
		
		Volume 3, Section 3.0
			Volume 1, Section 2.3
			
			Volume 3, Sections 3.1.3 and 3.3.3

	• surface water
	  ○ location and characteristics of water bodies (such as rivers, wetlands, lakes)
	  ○ description and uses of key waterbodies (such as aquatic life, drinking water, cultural uses)
	  ○ watersheds and water drainage patterns
	  ○ surface water balance
	  ○ water quality
		Volume 3, Section 3.0	Volume 3, Sections 3.1.3, 3.3.4, 3.3.5, 3.4.2, and Appendix C

Environmental Assessment Initiation Package Information Request			
Guideline Section	**Description**	**Applicable Sections in EA Initiation Package**	**Applicable Sub-Section in EA Initiation Package**

	• biological environment
	  ○ ecosystems
	  ▪ terrestrial
	  ▪ wetlands
	  ▪ aquatic
		Volume 3, Section 3.0	Volume 3, Sections 3.1.4, 3.3.6, and 3.3.9

	○ vegetation
	  ▪ species, abundance, distribution
	  ▪ endangered, rare, threatened species
		Volume 3, Section 3.0	Volume 3, Sections 3.1.4 and 3.3.8

	○ fish and wildlife
	  ▪ species, population, distribution, seasonal variations, migration patterns, habitat
	  ▪ endangered, threatened, rare, or game species
	  ▪ ecosystem characteristics, species interdependence
		Volume 3, Section 3.0	Volume 3, Sections 3.1.3, 3.1.4, and 3.3.6

	○ protected areas, wildlife corridors, buffer zones	Volume 3, Section 3.0	Volume 3, Sections 3.1.4, 3.3.8.1, 3.3.8.2, and 3.3.9

Environmental Assessment Initiation Package Information Request			
Guideline Section	**Description**	**Applicable Sections in EA Initiation Package**	**Applicable Sub-Section in EA Initiation Package**

4.2 Description of the Existing Environment
4.2.2 Components of the human environment
	Developers are required to describe the human environment in the area where the project would be located, as well as in other areas where project-related effects could occur (such as communities along transportation routes, where hiring would occur, or that use the project area for cultural or other uses). The developer should identify environmental conditions at both a local and regional context. Where applicable, the information provided should include both current and historical baseline data and trends.
	• general
	  ○ population demographics (including in- and out-migration)
	  ○ status of social, recreational, and physical infrastructure (including transportation)
	  ○ housing statistics
	  ○ cost of living and income levels
		Volume 3, Section 3.0
		
		Volume 1, Section 1.0
		
		Volume 2 – Management and Monitoring Plans
			Volume 3, Sections 3.1.7 and 3.4.3
			
			Volume 1, Section 1.6.2
			
			Volume 2 – Engagement and Collaboration Plan Framework, Section 6.0

	• economic
	  ○ employment statistics
	  ○ labour force characteristics
	  ○ levels of training and education (status and opportunities)
	  ○ level of existing industrial development
	  ○ levels and types of business activity
	  ○ characteristics of the traditional economy (including components, participation rates)
	  ○ stated community priorities and concerns (such as feedback from engagement, community development plan, and community resilience plans)
	  ○ economic or social development plans
		Volume 3, Section 3.0
		
		Volume 1, Section 1.0
		
		Volume 2 – Management and Monitoring Plans
			Volume 3, Sections 3.1.7, and 3.4.3
			
			Volume 1, Section 1.6.2
			
			Volume 2 – Engagement and Collaboration Plan Framework, Section 6.0

	• health and wellbeing
	  ○ general community wellness (from resources such as community wellness reports and studies, community feedback on wellbeing, and results of early engagement)
	  ○ health rates
	  ○ crime rates
	  ○ addiction rates
		Volume 3, Section 3.0	Volume 3, Sections 3.1.7 and 3.4.3

Environmental Assessment Initiation Package Information Request			
Guideline Section	**Description**	**Applicable Sections in EA Initiation Package**	**Applicable Sub-Section in EA Initiation Package**

4.2 Description of the Existing Environment
4.2.1 Components of the biophysical environment
	• culture, way of life, and historic and current land use
	  ○ places of cultural and spiritual value
	  ○ harvesting activities and their importance to the community
	  ○ harvest species, levels, and importance of the traditional economy
	  ○ traditional land or water use (including past, present, and intended future types of uses)
	  ○ heritage resources and sites in the project area (such as archaeological, historical, or burial sites, spiritual places, trails, special landscape features) described in an archaeological assessment report or traditional land use study
	  ○ recreational land or water use (including user groups, types of uses)
	  ○ other land or water use (such as tourism, resource extraction, infrastructure corridors)
	  ○ community and regional land use plans
		Volume 3, Section 3.0	Volume 3, Sections 3.1.5, 3.1.6, 3.1.8, 3.4.1, 3.4.2, 3.4.4

4.3 Identification of Potential Impacts and Proposed Mitigation Measures			

4.3 Identification of Potential Impacts and Proposed Mitigation Measures
4.3.1 Preliminary description of potential impacts and mitigations
	For each of the components of the biophysical and human environments listed in Section 4.2, the developer will:
	a) List and briefly describe potential project interactions with the environment.
	  i) Descriptions should include the consideration of potential direct and indirect impacts, including consideration of accidents and malfunctions and effects of the environment on the project (including climate change). Where applicable, provide copies of any risk assessments conducted.
	  ii) For environmental components with no identified potential impacts, provide a rationale why, and describe how changing conditions or activities could affect the determination. If there is no interaction, explain why. If there is an interaction but no potential impact, explain why.
		Volume 4, Section 2.0	Volume 4, Sections 2.1 and 2.2 , Tables 1 to 19

Environmental Assessment Initiation Package Information Request			
Guideline Section	**Description**	**Applicable Sections in EA Initiation Package**	**Applicable Sub-Section in EA Initiation Package**
4.3 Identification of Potential Impacts and Proposed Mitigation Measures 4.3.1 Preliminary description of potential impacts and mitigations	b) List and briefly describe any mitigation measures that would be used to prevent or minimize the identified impacts. i) Where applicable, developers should: • clearly indicate how the mitigation measures were developed (for example, through community engagement, best practices, regulatory standards), and how they would reliably and sufficiently mitigate the identified impacts (with references to case studies, proof of concept, relevant examples as applicable); and • refer to management and monitoring plans provided as appendices to the EA Initiation Package.	Volume 1, Section 1.0 and 3.0 Volume 4, Section 2.0 Volume 2 – Management and Monitoring Plans Volume 5, Section 4.0	Volume 1, Sections 1.6.2 and 3.10 Volume 4, Sections 2.1 and 2.2, Tables 1 to 19 Volume 2 – • Spill Contingency Plan Framework • Erosion and Sediment Plan Framework • Water Management Plan Framework • Mine Waste Management Plan Framework • Tailings and Waste Rock Management Plan Framework • Closure and Reclamation Plan Framework • Wildlife Protection Plan Framework • Aquatic Effects Monitoring Program Framework Volume 5, Sections 4.1.7 and Appendix A

Environmental Assessment Initiation Package Information Request			
Guideline Section	**Description**	**Applicable Sections in EA Initiation Package**	**Applicable Sub-Section in EA Initiation Package**
4.3 Identification of Potential Impacts and Proposed Mitigation Measures 4.3.1 Preliminary description of potential impacts and mitigations	c) List and briefly describe any cumulative impacts that could result from the proposed project. The discussion of cumulative impacts should consider the cumulative impacts from past, current, and reasonably foreseeable future developments and activities, as well as natural environmental vulnerabilities and events (such as climate change, forest fires, and flooding), that could interact with project impacts. i) Potential cumulative impacts should be discussed for each project impact identified that could add to the effects of other developments and activities, as well as any adverse impacts of natural events or indirect impacts that the project's impacts could add to. ii) For project impacts not expected to interact with potential cumulative impacts provide a rationale why and describe how changing conditions or activities could affect the determination.	Volume 4, Sections 2.0 and 3.0 Volume 5, Section 4.0	Volume 4, Sections 2.2 and 3.0 Volume 5, Section 4.1.3.3

Environmental Assessment Initiation Package Information Request			
Guideline Section	**Description**	**Applicable Sections in EA Initiation Package**	**Applicable Sub-Section in EA Initiation Package**
4.4 Public Engagement and Traditional Knowledge			
4.4 Public Engagement and Traditional Knowledge 4.4.1 Engagement record and engagement plan	**Engagement record** Developers are required to provide an up-to-date record of engagement for the proposed project. The record will include, at minimum, the following details for each party engaged: a) date, time, and location of engagement sessions; b) participants in engagement sessions (including record of attendance, roles of participants); c) materials presented (such as copies of presentations, summaries of content); d) meeting minutes or summaries of discussion points and responses; e) results of engagement sessions including; • a summary of issues raised and the identification of key issues or concerns, including project-environment interactions and potential impacts on the environment • strategies employed to address the issues raised, the status of issues (such as resolved or unresolved), proposed strategies to address unresolved issues • all other information collected f) a summary of how feedback has been incorporated into the project and the developer's assessment proposal (including any adjustments to or collaborative development of project design elements, management strategies, conceptual monitoring programs, assessment priorities and methods).	Volume 1, Section 1.0 Volume 2 – Management and Monitoring Plans Volume 5, Section 4.0	Volume 1, Section 1.6 Volume 2 – • Engagement and Collaboration Plan Framework Section 9.0, Appendix A and B Volume 5, Sections 4.1.1, 4.1.4, and 4.1.5
4.4 Public Engagement and Traditional Knowledge 4.4.1 Engagement record and engagement plan	**Engagement plan** The developer will provide a comprehensive engagement plan. Engagement plans will include details on the proponent's overall engagement strategies, objectives, and the prospective engagement schedules throughout the EA, and (at least conceptually) the life of the project. This information will further describe: a) specific engagement activities that will be undertaken; b) methods for effective engagement; c) the rationale for selecting the chosen activities and methods; and d) contingencies should the prospective schedules or methods not be sufficient.	Volume 2 – Management and Monitoring Plans	Volume 2 – • Engagement and Collaboration Plan Framework

Environmental Assessment Initiation Package Information Request			
Guideline Section	**Description**	**Applicable Sections in EA Initiation Package**	**Applicable Sub-Section in EA Initiation Package**
5. Developer's Assessment Proposal			
5. Developer's Assessment Proposal 5.1 Developer's Assessment Proposal – assessment of environmental impacts	As part of developer's assessment proposal, developers are required to provide, at minimum, the following: a) a description of the proposed valued components for the EA and rationale for selecting each valued component (biophysical and human environment);	Volume 5, Sections 2.0 and 4.0	Volume 5, Sections 2.0 and 4.1.2
	b) a description of the proposed key issues (project interactions) and questions prioritized in terms Key Lines of Inquiry or Subjects of Note; and	Volume 5, Section 3.0	Volume 5, Section 3.1 and 3.2
	c) a description of the proposed assessment methods for all valued components and the investigation of key issues, including: • general assessment approach and methodology for each valued component, including assessment techniques, study boundaries (temporal and spatial), etc. • information sources to be used including anticipated primary data collection (such as baseline and site-specific studies) • timelines, assumptions, information gaps, uncertainties, and approach to addressing information gaps and uncertainties (such as additional studies required and study details)	Volume 5, Section 4.0	Volume 5, Sections 4.1, 4,2, and 4.3, Tables 4-5 to 4-19
5. Developer's Assessment Proposal 5.2 Developer's Assessment Proposal – plain language summary	At minimum, the summary should describe: • the proposed valued components to be carried forward in the EA • the proposed key issues and questions (related to project interactions) prioritized in terms of Key Lines of Inquiry or Subjects of Note • the rationale for the selection of the proposed valued components and key issues	Volume 5	Volume 5, Plain Language Summary

Note:
Volume 1 = Project Description; Volume 2 = Management and Monitoring Plans; Volume 3 = Description of Existing Environment; Volume 4 = Identification of Potential Project-Interactions and Proposed Mitigation Measures, Volume 5 = Developers Assessment Proposal
EA = Environmental Assessment