YESAB
Yukon Environmental and
Socio-economic Assessment Board

Draft Screening Report and Recommendation

Kudz Ze Kayah Project

Project Number 2017-0083

November 20th, 2019.

Prepared by
YESAB Executive Committee
Yukon Environmental and Socio-economic Assessment Board

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Preface

BMC Minerals (No.1) Ltd. (the Proponent) is proposing the construction, operation, closure, and reclamation of an open pit and underground mine in southeastern Yukon. The mine site is approximately 115 kilometres southeast of Ross River. The Proponent proposes that the Kudz Ze Kayah Mine operate over a period of 10 years, and will process up to two million tonnes of ore per year during this time. A construction phase would occur over a period of approximately two years, while closure and reclamation would occur over a period of 26 years.

The Executive Committee of the Yukon Environmental and Socio-economic Assessment Board (YESAB) is assessing the environmental and socio-economic effects of the proposed Project pursuant to the *Yukon Environmental and Socio-economic Assessment Act*. In accordance with sections 49 and 51 of the *Rules for Screenings Conducted by the Executive Committee*, the Executive Committee has completed this Draft Screening Report and is making it available for comment.

This report, the Draft Screening Report, contains the Executive Committee's draft recommendations to the decision bodies that the project be allowed to proceed without a review, subject to the specified terms and conditions.

This Draft Screening Report is available on the YESAB Online Registry, www.yesabregistry.ca, and at the following locations:

- YESAB Head Office at Suite 200 – 309 Strickland Street, Whitehorse
- YESAB Watson Lake Designated Office – 820 Adela Trail, Watson Lake
- Whitehorse Public Library

The Executive Committee is seeking comment on these draft recommendations prior to January 20th, 2020. Comments may be submitted:

- Online via the YESAB Online Registry
- By email at yesab@yesab.ca
- By facsimile at (867) 668-6425 or toll-free at (866) 389-1633
- By mail: Suite 200-309 Strickland Street, Whitehorse, Yukon, Y1A 2J9
- By hand delivery during business hours: Suite 200-309 Strickland Street, Whitehorse

The Executive Committee will consider all comments received in preparing its recommendations for the proposed Kudz Ze Kayah Mine.

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Executive Summary

This Draft Screening Report contains the draft recommendations of the Yukon Environmental and Socio-economic Assessment Board (YESAB) Executive Committee's screening of the Kudz Ze Kayah project (the Project) proposed by BMC Minerals (the Proponent). The purpose of the proposed Project is the construction, operation, and closure of a metal mine with both an open pit and underground operations. The Project, after two years of construction, will process two million tonnes (metric) of ore annually, producing 180 000 tonnes of zinc, 60 000 tonnes of copper, and 35 000 tonnes of lead concentrates each year of operations. Operations are proposed over 10 years. From construction until the conclusion of post-closure monitoring, activities will occur over a span of approximately 38 years.

The *Yukon Environmental and Socio-economic Assessment Act* (YESAA) directs the Executive Committee to determine if the Project will have significant adverse environmental or socio-economic effects in or outside Yukon and if these effects can be mitigated by terms and conditions; and provide a recommendation to the Project's Decision Bodies – Government of Yukon, Natural Resources Canada, and the Department of Fisheries and Oceans. YESAA requires that Decision Bodies consider the recommendation, and issue a decision document, prior to taking any action that would allow a project to proceed. The purpose of this Draft Screening Report is to provide the Decision Bodies, affected First Nations, interested persons, and the public an opportunity to comment on the Executive Committee's draft recommendation with respect to the Project.

This report:

- Describes the Project and the screening process;
- Considers information relevant to the assessment and available to the Executive Committee;
- Characterizes potential Project impacts and determines if potential impacts are significant; and,
- Outlines terms and conditions that mitigate likely significant adverse environmental and/or socio-economic impacts.

The Executive Committee has employed a "valued component" assessment methodology to assess the environmental and socio-economic effects of the Kudz Ze Kayah project. The Executive Committee has identified the following environmental and socio-economic valued components for the Project: water resources, wildlife, traditional land use, economics, human health and safety, community wellbeing and heritage resources.

The Executive Committee has determined that the Project will result in significant adverse effects to water resources, traditional land use, and human health and safety. These significant adverse effects can be eliminated, controlled or reduced through the application of mitigation measures recommended by the Executive Committee. A full list of these mitigations can be found below. Consequently, the Executive Committee recommends the Project proceed under s. 58(1)(b) of YESAA.

In addition, the Executive Committee recommends that additional monitoring take place to help inform the regulatory process, future assessments, aid in adaptive management, and reduce uncertainty in later stages of the Project. These recommendations are made under s. 110 of YESAA and address wildlife and socio-economic impacts.

RECOMMENDED MITIGATION MEASURES

These recommended mitigation measures are required to control, reduce, or eliminate significant adverse effects of the Project:

1) Geochemical modelling shall be revised during licensing and operations to inform detailed design of the cover systems, with the aim of reducing acid production and COPI loadings from storage facilities.

2) Additional treatment options shall be implemented if the proposed CWTS cannot be demonstrated to reduce COPI concentrations to background levels consistently.

3) The Proponent shall revise WQOs during the Water Licence process to ensure they are based on the most recent toxicological information and guidance from CCME and BCMoE.

4) The Proponent shall establish Effluent Quality Standards for the Project based on achieving WQOs in the receiving environment in Geona Creek (KZ-37) and in Finlayson Creek (KZ-15).

5) The Proponent shall conduct ongoing investigations into WRSA liners and cover systems to ensure that the performance objectives used in the water quality model are achieved during all Project phases.

6) The Proponent shall commit to ongoing geochemical studies for WRSA A and B, and studies to optimize the performance of the proposed Constructed Wetland Treatment System, to address the potential for acidic conditions to develop in the future.

7) The Proponent shall ensure the water treatment plant remains operational until it has been demonstrated that surface water from the site meets water quality objectives for the receiving environment in Geona Creek (KZ-37) and in Finlayson Creek (KZ-15).

8) The Proponent shall provide allowance for up to 14 days of unpaid leave to all Yukon First Nation employees to allow for the exercising of Aboriginal rights related to:

    a. the pursuit of traditional land use activities. This will be 14 days to allow sufficient time on the land; and
    b. to attend culturally important events (potlaches, dances, ceremonies, culture camps).

9) Security requirements shall take into consideration the need for transition funding for workers and communities, for both scheduled and unscheduled closure.

10) Security requirements shall take into consideration the potential for early unscheduled closure.

11) The Proponent shall develop mandatory, regular harassment prevention training in consultation with a qualified expert, to be delivered to all the Proponent's employees, contractors and consultants working at the site.

12) The Proponent shall modify their proposed Mentor program for First Nations employees[1] to:

    - ensure that women have access to a mentor or supervisor who regularly checks in to address any negative experiences related to the male-dominated work environment, and who pays special attention to potential cases of abuse; and
    - develop a formal feedback process to ensure that enquiries are regularly made to First Nations employees to ensure that they are able to voice concerns and have addressed any negative experiences.

13) The Proponent shall, in consultation with a qualified expert and both LFN and RRDC, develop gender appropriate and gender- and sexuality-specific policies and processes which promote a safe, respectful and inclusive environment for women and sexual minorities.
14) The Proponent shall develop, with a qualified expert, an Anti-Harassment and Bullying Policy that outlines processes and actions to address any harassment or bullying which may take place within the Project's scope.

15) The Proponent shall work with RRDC, the community of Ross River, LFN, the Town of Watson Lake, and the Government of Yukon to provide resources to women in need in communities impacted by the Project.

16) To address and mitigate impacts to employees who are or become victims of domestic abuse, the Proponent must create a policy that:

    - outlines clear procedures for the workplace to work with affected employees and provide appropriate resources and support;
    - plans for and addresses safety concerns that affected employees may have while at work to ensure all workers are safe from threats of domestic violence; and
    - includes a personal safety plan for employees suffering from domestic violence.

[1] YOR Document 2017-0083-200-1.

RECOMMENDED MONITORING

The recommended monitoring programs or effects audits are required to address uncertainty, aid in adaptive management, or provide information for later stages of the Project:

A. Water quality monitoring of COPIs shall be implemented as early as possible beneath storage facilities and beneath their respective covers. Monitoring shall continue through operations and closure phases.

B. The Proponent shall conduct seepage monitoring for the WRSA A to detect any onset of acid conditions.

C. Environment Yukon shall implement, with the Proponent, a survey program to monitor caribou distribution in the project area during the post-calving period and to monitor caribou herd composition during the rut. This survey program shall be designed through collaboration with affected First Nations.

D. That Environment Yukon, with the Proponent, implement a survey program be instituted to monitor moose during late winter. This survey program shall be designed through collaboration with affected First Nations and Government of Yukon.

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Acronyms and Abbreviations

‘	Foot/Feet
2018 LOM WBM	2018 Life of Mine Water Balance Model
AEG	Alexco Environmental Group
AP	Acid Producing Potential
ARD	Acid Rock Drainage
BAU	Bear Assessment Unit
BC	British Columbia
BCMoE	British Columbia Ministry of Environment
BCR	Bird Conservation Region
BGQ	Baseline Groundwater Quality
BMU	Bear Management Unit
CAAQS	Canadian Ambient Air Quality Standards
CAC	Criteria Air Contaminants
$CaCO_3$	Calcium Carbonate
CCME	Canadian Council of Ministers of the Environment
CO	Carbon monoxide
CO_2	Carbon dioxide
COPI	Constituents of Potential Interest
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CPUE	Catch per Unit Effort
CRCP	Conceptual Reclamation and Closure Plan
CWTS	Constructed Wetland Treatment System
dB	Decibel
dBa	Decibels, a-weighted
DFO	Department of Fisheries and Oceans
EC	Executive Committee
ECCC	Environment and Climate Change Canada
EDI	Environmental Dynamics Incorporated
ERCB	Energy Resource Conservation Board
FCH	Finlayson Caribou Herd
FI/FO	Fly In / Fly Out
FOP	Fish Offsetting Plan
GBSA	Grizzly Bear Study Area
GHG	Greenhouse Gas
Gj	Gigajoule
GMA	Game Management Area
GMS	Game Management Sub-zone
HDPE	High-density Polyethylene
HDV	Heavy Duty Vehicle
INAC	Indigenous and Northern Affairs Canada
kg	Kilogram
km	Kilometre
km^2	Square kilometre
kt	Kilotonne
LAWS	Liard Aboriginal Women’s Socieity

LDV	Light Duty Vehicle
LFN	Liard First Nation
LGO	Low Grade Ore
LNG	Liquid Natural Gas
LWMP	Lower Water Management Pond
m	Metre
m^2	Square metre
m^3	Cubic metre
MDMER	*Metal and Diamond Mine Effluent Regulations*
ML	Metal Leaching
MMIWG	Missing and Murdered Indigenous Women and Girls
MMU	Moose Management Unit
MOE	Ministry of Environment
Mt	Million tonnes
Mtpa	Million tonnes per year
Mw	Megawatt
NAG	Not Acid Generating
NP	Neutralizing Potential
NPC	Noise Pollution Control
NPMO	Northern Project Management Office
NRCan	Natural Resources Canada
O_3	Ozone
OGC	Oil and Gas Commission
PAG	Potentially Acid Generating
PHA	Permit Hunt Authorization
$pm_{2.5}$	Particulate Matter with diameter less than 2.5 micrometers
pm_{10}	Particulate Matter with diameter less than 10 micrometers
ppbv	Parts-per Billion Volume – the concentration of units (volumetric) of parts per billion.
PPE	Personal Protective Equipment
ppm	Parts per Million
QMA	*Quartz Mining Act*
QML	Quartz Mining License
RCH	Robert Campbell Highway
ROM	Run of Mine
RRDC	Ross River Dena Council
RSA	Regional Study Area
RTC	Registered Trapping Concession
SARA	*Species at Risk Act*
SEPA	Socio-economic Participation Agreement
SO_2	Sulphur Dioxide
SSWQO	Site Specific Water Quality Objective
t	Tonne
TSP	Total suspended particles
TSS	Total Suspended Sediment
UFA	Umbrella Final Agreement
VESEC	Valued Environmental or Socio-economic Component
WHO	World Health Organization
WL	Water License

WMP	Water Management Pond
WQ	Water Quality
WQB	Water Quality Baseline
WQO	Water Quality Objective
WRSA	Waste Rock Storage Area
WTP	Water Treatment Plant
YAAQS	Yukon Ambient Air Quality Standards
YESAA	*Yukon Environmental and Socio-economic Assessment Act*
YESAB	Yukon Environmental and Socio-economic Assessment Board
YG	Government of Yukon
YG EMR	Government of Yukon Department of Energy Mines and Resources
YOIC	Yukon Order In Council
YSWC	Yukon Status of Women Council
ZOI	Zone of influence
$\mu g/m^3$	Micrograms per cubic metre

Part A

1. Introduction

1.1 Legislative Context

Project Requires Assessment under YESAA

Under s. 47(2)(c) of the *Yukon Environmental and Socio-economic Assessment Act (YESAA)*, The Project requires an assessment under YESAA as the Project:

- Is located in Yukon;
- Includes scheduled activities listed in column 1, Schedule 1 of the *Assessable Activities, Exceptions, and Executive Committee Projects Regulations,* which are not excepted in column 2; and
- Requires authorizations from government agencies to conduct those scheduled activities.

Tables 1, 2 and 3 list scheduled activities and authorizations required by the proposed Project.

Project Requires an Executive Committee Screening

When a project requires an assessment, the Proponent is to submit the project proposal to the Executive Committee for a screening, in the event that the project involves an activity listed in Schedule 3 of the *Assessable Activities, Exceptions, and Executive Committee Projects Regulations*. The Project involves an activity listed in Schedule 3, specifically item 3(a):

> 3. (the) construction, decommissioning or abandonment of
>
> (a) a metal mine, other than a gold mine, with an ore production capacity of 1500 t/day or more

Decision Bodies Based on Authorizations Triggering Assessment

To conclude the screening process, the Yukon Environmental and Socio-economic Assessment Board's (YESAB) Executive Committee (EC) produces a set of recommendations for decision bodies. Decision bodies complete the assessment process by issuing a decision document accepting, varying or rejecting the recommendations.

The authorizations or permissions required for proposed and assessable activities undertaken by the Proponent determine the decision bodies. Based on the proposed scheduled activities, there are three decision bodies for this Project: Department of Fisheries and Oceans (DFO), Natural Resources Canada (NRCan) and Government of Yukon (YG). The following tables list the scheduled activities proposed by the Project, the required authorization and the decision body for that authorization.

Table 1: Scheduled Activities Proposed by the Project and Requiring Authorizations from DFO

Department of Fisheries and Oceans	
Scheduled Activity	Act & Authorization
Schedule 1, part 10, item 2: *Destruction, disruption or harmful alteration of fish habitat.*	*Fisheries Act* s. 35(2) authorization

Table 2: Scheduled Activities Proposed by the Project Requiring Authorizations from NRCan

Natural Resources Canada	
Scheduled Activity	Act & Authorization
Schedule 1, part 2, item 1: *Construction, operation, modification, decommissioning or abandonment of, or other activity in relation to a magazine, within the meaning of section 2 of the Explosives Act.*	*Explosives Act* Explosives Permit

Table 3: Scheduled Activities Proposed by the Project and Requiring Authorizations from Government of Yukon

Government of Yukon	
Scheduled Activity	Act & Authorization
Schedule 1, part 1, item 1: *On other than an Indian reserve, construction, operation, modification, decommissioning or abandonment of, or other activity in relation to, a mine.*	*Quartz Mining Act* Quartz Mine Licence
Schedule 1, part 6, item 11: *Construction, operation, modification, decommissioning or abandonment of, or other activity in relation to, a bridge.*	*Waters Act* Water Permit
Schedule 1, part 8, item 1: *Construction, operation, modification, decommissioning or abandonment of a land treatment facility.*	*Environment Act* Land Treatment Facility Permit
Schedule 1, part 8, item 8: *On other than an Indian reserve, construction, operation, modification, decommissioning or abandonment of, or other activity in relation to, a solid waste disposal facility.*	*Environment Act* Solid Waste Facility Permit

Schedule 1, part 9, item 3: *Direct use of water.*	*Waters Act* Water Permit
Schedule 1, part 9, item 4: *Construction, modification, decommissioning or abandonment of, or other activity in relation to, a watercourse crossing, other than one that is a bridge or is across navigable water.*	
Schedule 1, part 9, item 8: *Watercourse training — such as that for the purpose of erosion control or that which is by means of a channel or bank alteration, artificial accretion, spur, culvert or dock — but not including the diversion of a watercourse.*	
Schedule 1, part 9, item 10: *Diverting a watercourse or increasing the diversion capacity of an existing diversion.*	
Schedule 1, part 9, item 12: *Other than for an electrical power undertaking, the deposit of waste into water or in any other place under conditions in which the waste, or any other waste that results from the deposit, may enter water.*	
Schedule 1, part 11, item 1: *On other than an Indian reserve, quarrying, crushing or screening of minerals.*	*Environment Act* Air Emissions Permit
Schedule 1, part 11, item 2: *Operation of equipment capable of generating, burning or using heat energy.*	
Schedule 1, part 13, item 9: *On Crown land or settlement land, the establishment of a petroleum fuel storage facility.*	*Environment Act* Authorization under storage tank regulations
Schedule 1, part 13, item 12: *On Crown land or settlement land, moving earth or clearing land using a self-propelled power-driven machine.*	*Territorial Lands Act* Land Use Permit
Schedule 1, part 13, item 16: *Operation, decommissioning, abandonment or expansion of a gravel or sand pit or stone quarry.*	*Environment Act* Air Emissions Permit
Schedule 1, part 13, item 18: *On Crown land or settlement land, cutting standing or fallen trees or removing fallen or cut trees.*	*Forest Resources Act* Forest Resources Permit
Schedule 1, part 13, item 19: *Starting an open fire to burn forest debris that has been piled or gathered using machinery.*	*Territorial Lands Act* Burn Permit

1.2 Screening Chronology

The assessment process and timelines for EC screenings are set out in the *Rules for Screenings Conducted by the Executive Committee.* All stages of the assessment have been completed within the timelines and requirements as prescribed in these rules.
The chronology of the EC assessment is set out in Tables 4 and 5, which provide an outline of key assessment dates and stages. More detailed assessment information can be found on the YESAB Online Registry at www.yesabregistry.ca, or the YESAB Document Registry located at the YESAB head office in Whitehorse.

Table 4: Assessment Chronology during the Adequacy Stage

Proposal Submission and Adequacy Review Stage	
The Proponent submits Project proposal	March 17, 2017
The Executive Committee (EC) publishes its Adequacy Review Report requesting supplementary information	May 26, 2017[2]
The Proponent submits supplementary information in response to the Adequacy Review Report	July 5, 2017
The EC publishes its Adequacy Review Report #2 requesting supplementary information	August 4, 2017
The Proponent submits supplementary information in response to Adequacy Review Report #2	November 17, 2017
The EC determines the proposal is adequate as there is sufficient information to commence the screening	January 9, 2018
The EC determines that the Proponent has met the requirements for consultation with affected First Nations and communities under s. 50(3) of YESAA	

[2] Amended June 9, 2017.

Table 5: Assessment Chronology during the Screening Stage

Screening Stage	
The EC screening commences	January 9, 2018
The EC issues the preliminary scope of the Project	January 15, 2018
The EC commences a public comment period to gather comment on the proposal	
The EC holds a public meeting in Watson Lake on the Project	March 7, 2018
The EC holds a public meeting in Ross River on the Project	March 8, 2018
The EC closes the public comment period	March 16, 2018
The EC issues a request for supplementary information, Information Request 3, delineating supplementary information needs in relation to water	April 9, 2018
The EC issues a request for supplementary information, Information Request 4, delineating supplementary information needs in relation to traditional land use and Traditional Knowledge	May 3, 2018
The Proponent submits supplementary information in response to Information Request 3	June 27, 2018
The EC determines that the Proponent's response to Information Request 3 is insufficient	July 30, 2018
The Proponent submits additional supplementary information in response to Information Request 3	October 16, 2018
The EC determines that the response to Information Request 3 is sufficient	November 27, 2018
The Proponent submits supplementary information in response to Information Request 4	December 17, 2018
The EC determines that the response to Information 4 is insufficient	January 19, 2019
The Proponent submits additional supplementary information in response to Information Request 4	July 2, 2019
The EC determines that the response to Information Request 4 is sufficient	July 23, 2019
The EC determines that it has sufficient information to draft a recommendation and commences drafting recommendations for this document, the Draft Screening Report	
The EC completes its draft recommendations for this document, the Draft Screening Report	November 20, 2019
The EC commences a public comment period to gather comment on this document, the Draft Screening Report	

1.3 Consultation by the Proponent

During the adequacy stage, the EC determined that, in its opinion, the Proponent had consulted with Ross River Dena Council (RRDC), Liard First Nation (LFN), and Town of Watson Lake and Ross River community residents in accordance with s. 50(3) of YESAA. The EC notified the Proponent in writing of its determination on January 9, 2018 (YOR 2018-0083-248-2).

First Nations and Communities Consulted

The EC examined the possible significant environmental and socio-economic effects of the Project in considering those First Nations and communities per section 50(3) requirements.

The Project, as proposed, is located within the Traditional Territories of the RRDC and LFN. The watersheds and the regional study areas identified by the Proponent are located wholly within the Traditional Territories of the RRDC and LFN. And the socio-economic effects are likely to be experienced predominantly by Ross River and Watson Lake residents, including RRDC and LFN members. Based on this consideration, the EC determined that, for the purposes of s. 50(3) of YESAA, the Proponent was required to consult:

- the LFN and RRDC, being the First Nations in whose territories the Project "will be located or might have significant environmental or socio-economic effects"; and

- the residents of the Town of Watson Lake and Ross River, being the communities in which the Project "will be located or might have significant environmental or socio-economic effects."

Consultation Requirements

Pursuant to section 50(3) of YESAA, a Proponent is required to consult any First Nation in whose traditional territory the Project will be located or may have significant environmental or socio-economic effects, as well as the residents of any community in which the Project will be located or may have significant environmental or socio-economic effects, before submitting a proposal to the EC. This duty to consult is to be exercised in the manner described in section 3 of YESAA.

> 3. Where, in relation to any matter, a reference is made in this Act to consultation, the duty to consult shall be exercised
>
> (a) by providing, to the party to be consulted,
> (i) notice of the matter in sufficient form and detail to allow the party to prepare its views on the matter,
> (ii) a reasonable period for the party to prepare its views, and
> (iii) an opportunity to present its views to the party having the duty to consult; and
>
> (b) by considering, fully and fairly, any views so presented.

The EC considered the information provided by the Proponent in the Project proposal, which included a summary of consultation efforts with LFN, RRDC, the Town of Watson Lake and

Ross River. The identified First Nations and the residents of Watson Lake and Ross River received information about the Project in an understandable manner and in enough detail to allow for participation. The Proponent provided a reasonable period in which views could be shared and offered opportunities and means by which to share these views.

1.4 Matters to Be Considered

This Draft Screening Report contains a recommendation under s. 58 of YESAA, based on the Project impacts, as determined by the Executive Committee in its effects assessment. In conducting an effects assessment and in accordance with s. 42 of YESAA, the EC considers, but does not make determinations, with respect to:

- the purpose of the project or existing project;
- all stages of the project or existing project;
- the significance of any environmental or socio-economic effects of the project or existing project that have occurred or might occur in or outside Yukon, including the effects of malfunctions or accidents;
- the significance of any adverse cumulative environmental or socio-economic effects that have occurred or might occur in connection with the project or existing project in combination with the effects of other projects for which proposals have been submitted under subsection 50(1), or any activities that have been carried out, are being carried out or are likely to be carried out in or outside Yukon;
- any studies or research undertaken under subsection 112(1) that are relevant to the project or existing project;
- the need for effects monitoring;
- alternatives to the project or existing project, or alternative ways of undertaking or operating it, that would avoid or minimize any significant adverse environmental or socio-economic effects;
- mitigative measures and measures to compensate for any significant adverse environmental or socio-economic effects;
- the need to protect the rights of Yukon Indian persons under final agreements, the special relationship between Yukon Indian persons and the wilderness environment of Yukon, and the cultures, traditions, health and lifestyles of Yukon Indian persons and other Yukon residents;
- the interests of First Nations;
- the interests of Yukon residents and other Canadian residents;
- any matter that a decision body has asked it to take into consideration;
- any matter specified by the regulations; and
- the capacity of any renewable resources that are likely to be significantly affected by the project or existing project to meet present and future needs.

1.5 Determining the Significance of Adverse Effects

In characterizing project effects and addressing what may constitute a significant adverse effect, the Executive Committee considers the following factors:

Magnitude: The intensity or amount of an effect or extent of change, where "effect" is defined as the change from existing conditions resulting from an activity. Depending on the effect, magnitude may be measured with familiar units; for example, in describing habitat loss, the change from existing conditions may be measured in hectares. For other effects, more abstract measures may be required, such as effects to heritage resources.

Probability: The likelihood that an adverse effect will occur. Some effects may be certain, while others will be unlikely.

Geographic Extent: The spatial bounds of project effects (i.e. the area in which effects are detectable). The geographic extent of effects can be local or regional, and in some cases the geographic extent may be outside the project area. For example, some effects may only occur in communities rather than the project location. The geographic extent is an important consideration in determining the receptors to an effect.

Duration and Frequency: The temporal bounds of project effects (i.e. the length of time the effect lasts and how often the effect occurs). Certain effects may persist beyond the life of the project.

Reversibility: The degree to which the effect is reversible. Effects can be reversible or permanent. Reversible effects may have lower impacts than irreversible or permanent effects. This factor is also related to duration and context.

Context: The particular environmental and/or socio-economic context within which the project occurs. Context is related to the importance of valued environmental and socio-economic components, their resiliency and vulnerability to potential effects and the extent to which those valued components may successfully adapt to change. Context also includes the acceptability of an effect.

Not all of the factors are relevant to all effects; a specific effect’s characterization and corresponding significance determination may rely on a subset of these factors.

2. Project Overview

2.1 Proponent Information

The Proponent of the Project is BMC Minerals (No. 1) Limited, a private corporation incorporated within Canada; it is a subsidiary of BMC (UK) Limited, a privately held company based out of the United Kingdom.
Where the term Proponent appears in this report, it refers to BMC Minerals (No. 1) Limited.

The contact person for the Proponent is:

Kelli Bergh
BMC Minerals (No. 1) Limited.
Environmental Manager
email: kellib@bmcminerals.com

2.2 Purpose and Description

The purpose of the Project is the construction, operation, and closure of a copper, lead and zinc mine using both an open pit and underground mining techniques. Over 10 years of mining operations, the Proponent proposes to mine approximately 5 500 tonnes of ore per day, producing approximately 180 000 tonnes of zinc, 60 000 tonnes of copper and 35 000 tonnes of lead concentrates each year. From construction until the conclusion of Proponent proposed monitoring, Project activities will span approximately 38 years.

Mining is proposed by both open pit and underground methods. Ore will be processed by sequential flotation through a processing plant that will handle approximately 2 million tonnes of ore per year. Tailings will be deposited in a dry stack storage facility, waste rock will be stored in purpose-built facilities, while strongly acid generating rock will be paste-backfilled into the underground portions of the mine.

The Project is proposed within the Traditional Territories of the Liard First Nation and the Ross River Dena Council. It is located within the Pelly Mountain Range and is about 260 km northwest of Watson Lake and 115 km south of Ross River. It lies approximately 25 km to the west of the Wolverine Mine and 24 km south of Finlayson Lake.

2.3 Stages and Schedule

The Project consists of four primary stages, which in both the proposal documents and this report are referred to as:

- Construction phase
- Operations phase
- Decommissioning, reclamation, and closure phase (also described as active closure in proposal documents)
- Post-closure phase

The Project stages and schedule are described in greater detail below.

CONSTRUCTION PHASE

The construction phase is proposed to last for two years. The primary activities of this stage will include clearing, site preparation and construction of site infrastructure.

Within proposal documentation, this period runs from year -2 to year 1.

OPERATIONS PHASE

The operations phase will begin when the Project begins to extract and process ore; it is proposed to last 10 years. Operations will begin progressively, starting with a low production rate that will increase to final capacity (two million tonnes of processed ore annually) within the first year of operations. During the first two years of operations, all ore will be sourced from the open pit, after which underground operations will also begin to produce ore.

Within proposal documentation, this period runs from year one through year 10.

DECOMMISSIONING, RECLAMATION AND CLOSURE PHASES

The decommissioning, reclamation and closure phases of the Project will commence once operations are complete and will be approximately three years in length. During this stage:

- The majority of surface facilities will be removed
- The site will be reclaimed according to the proposal's reclamation objectives.

POST-CLOSURE PHASE

The post-closure phase will begin once all closure activities are complete and will continue until monitoring is no longer required. The primary activity of this phase is monitoring of environmental conditions.

2.4 Location and Layout

PROJECT LOCATION

The Project is proposed in the Pelly Mountain foothills, near the continental divide, between the Pelly River and Liard River drainages. The Project is largely proposed within the Geona Creek valley.

The mine site is approximately 20 km from the Robert Campbell Highway via an existing road that would be upgraded to an all-season access road. The access road meets the Robert Campbell Highway near the southern end of Finlayson Lake.

The proposed Project location is approximately 115 km southeast of the community of Ross River, 185 km northwest of Watson Lake, and 260 km east of Whitehorse. The Project falls within the Traditional Territories of both the LFN and the RRDC (the Kaska Traditional Territory).

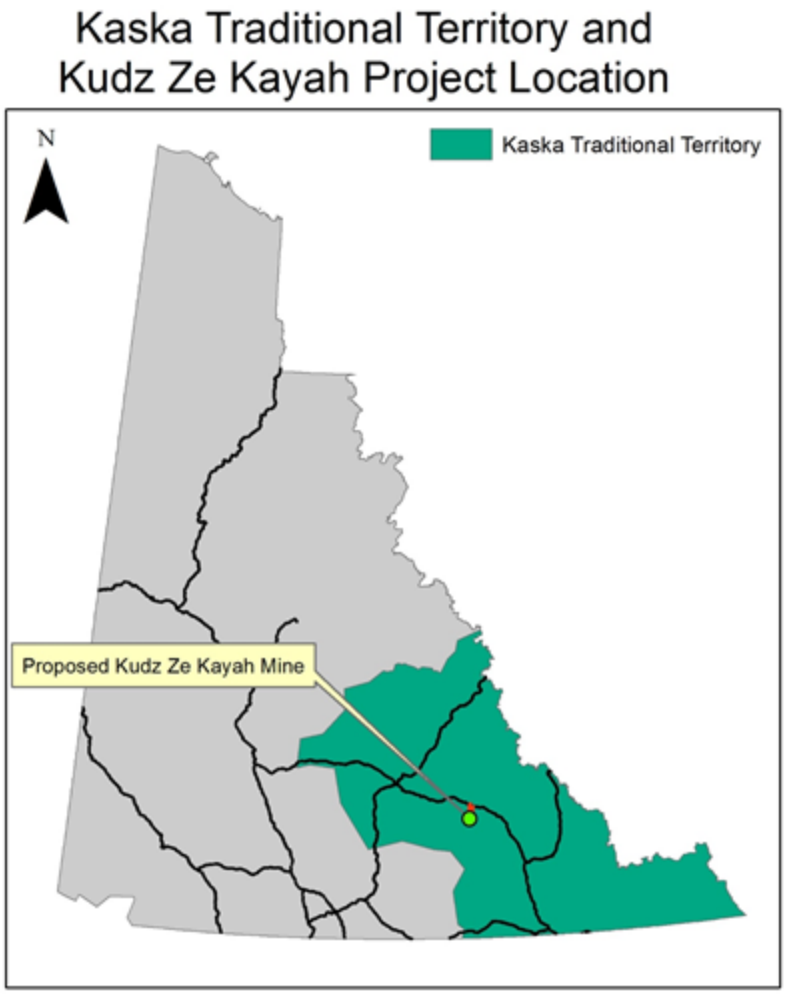

Figure 1: Project location in relation to the Kaska Traditional Territory

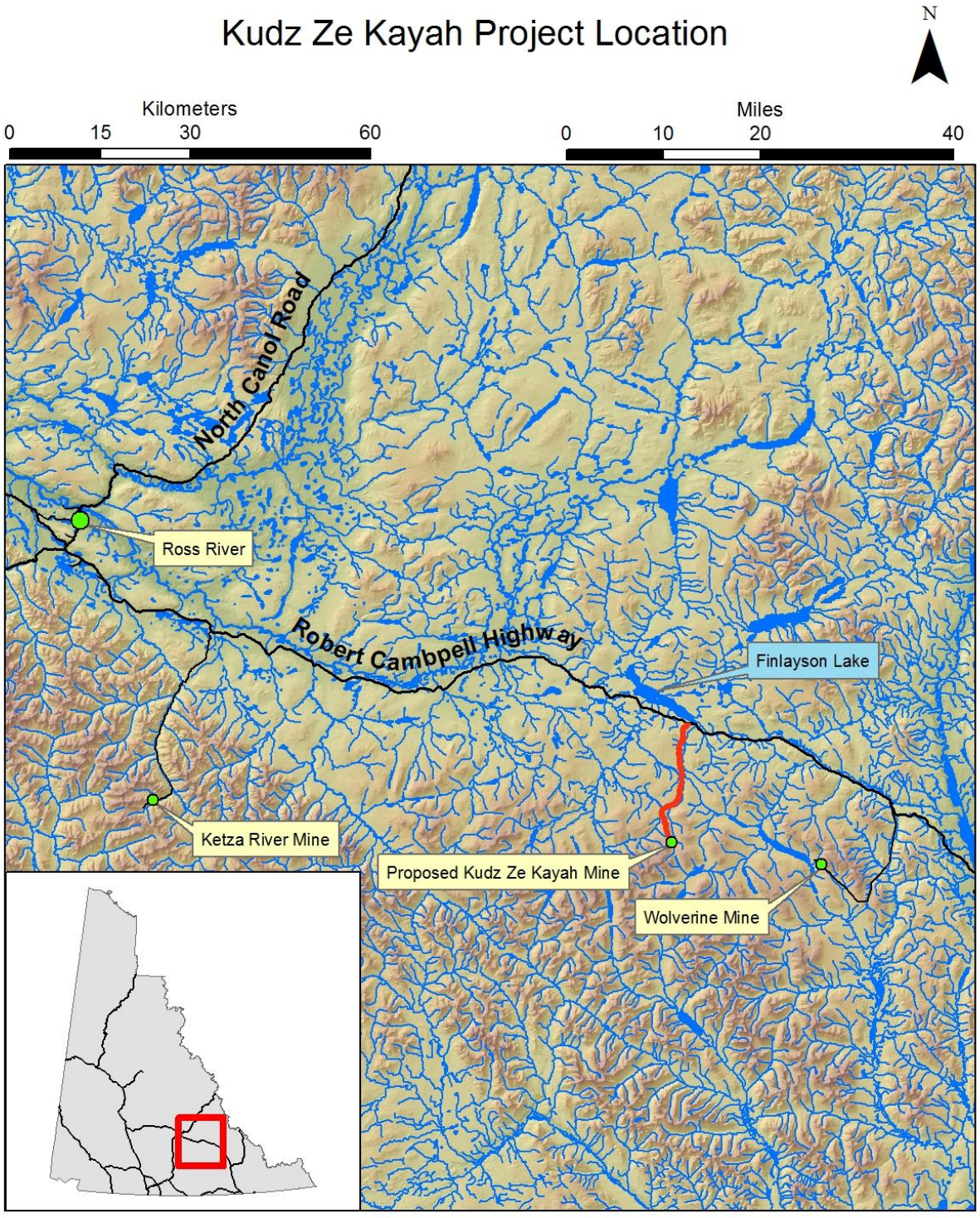

Figure 2: The Proposed Kudz Ze Kayah Project's Location

PROJECT LAYOUT

The Project is largely contained within the Geona Creek valley. The valley bottom will include water management ponds as well as the pit itself. On the sides of the valley will be the mill, rock storage facilities and overburden stockpiles. Above this infrastructure will be water diversions which are intended to reduce contact of water with mine materials and infrastructure.

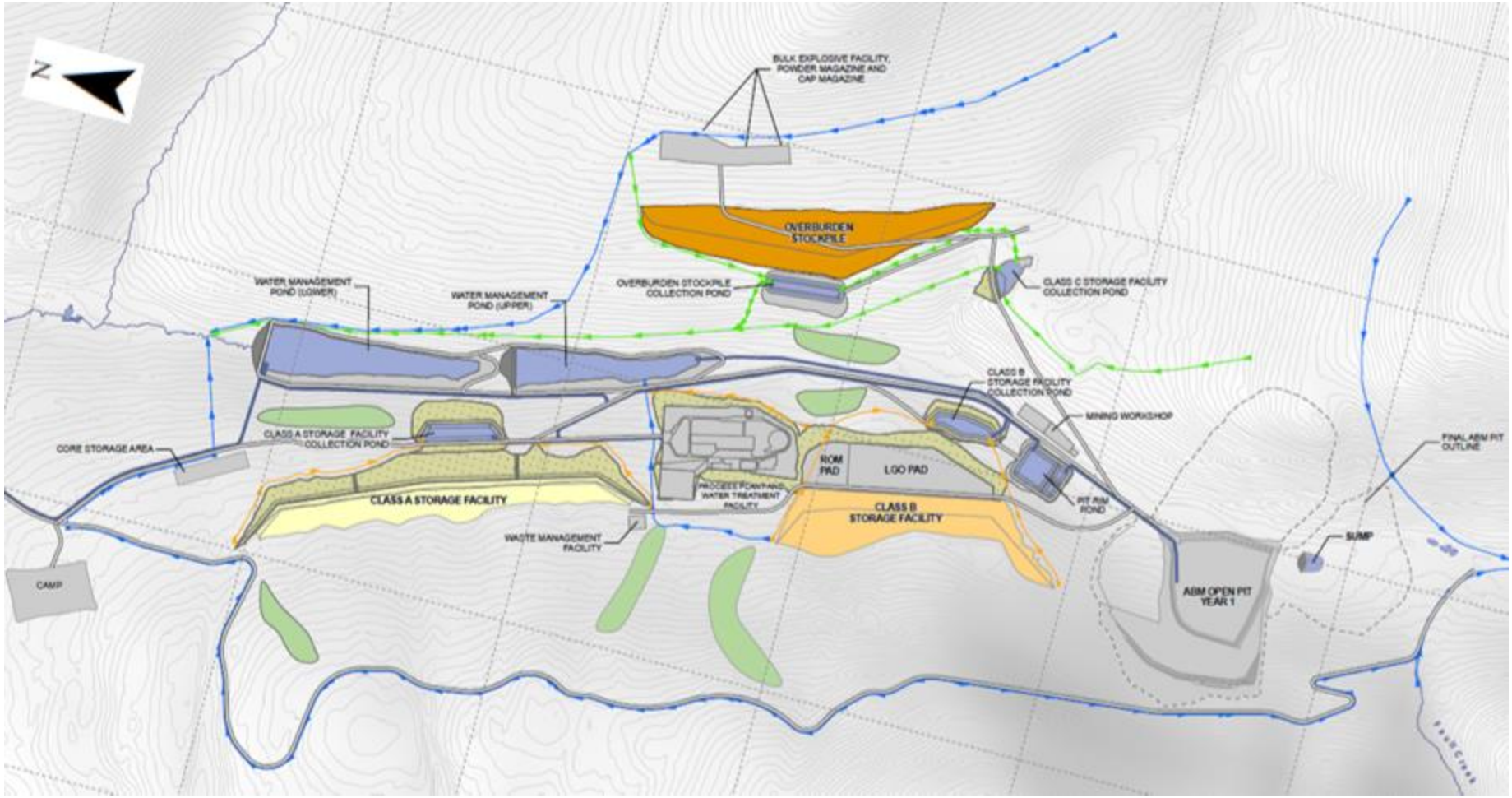

Figure 3: Project Mine Layout, Figure 4-2 of the Project Proposal (the full extent of the proposed pits is seen in the dotted outline around ABM Open Pit Year 1.

2.5 Project Scope

The project scope defines the project to be assessed and includes all activities described in the project proposal as well as in any subsequent information provided by the Proponent.

Project Component	Activities

General Project	• The construction, operation, decommissioning and closure of an open pit and underground copper, lead, gold, silver and zinc mine.
	• The mine site is approximately 115 km southeast of Ross River and approximately 260 km northwest of Watson Lake, connecting to the Robert Campbell Highway via the Tote Road.
	• Project phase duration:
	  ○ Construction: 2 years.
	  ○ Operations: 10 years.
	  ○ Active Closure: 3 years.
	  ○ Transition Closure: 13 years.
	  ○ Post-Closure: 10 years.
	• The ABM Deposit, consisting of the ABM and the Krakatoa zones, contains an estimated 20 million tonnes (Mt) of ore, which will be processed at a rate of approximately 5 500 tonnes (t) per day over an estimated 10 year life.
	• The Project includes 923 Quartz Claims.
	• Mine site is 15 km^2.
	• Approximately two hectares of fish habitat compensation ponds to be created during construction phase of the Project and to serve as mitigation for waterfowl.
	• Progressive reclamation.
	• Post-closure monitoring undertaken for 26 years.

Access Roads	• Removal of vegetation and topsoil.
	• Construction of various on-site roads for general access and to connect the mine site infrastructure and components.
	• Upgrading approximately the first 20 km of the existing 24 km Tote road to a 5 m wide, single lane all weather access road during construction (Year -2 to Year 1). Upgrading activities include:
	  ○ improving horizontal and vertical alignment;
	  ○ improving drainage;
	  ○ upgrading 10 watercourse crossings (9 culverts, 1 bridge), major upgrades/replacements to all culverts;
	  ○ and all weather surfacing.
	• Approximately 20 ha of new disturbance (excluding borrow sources).
	• Development and use of borrow sources for upgrades with approximate volumes of:
	  ○ 31 500 m^3 of subgrade material.
	  ○ 18 000 m^3 of surfacing materials.

Project Component	Activities
	○ 1 400 m^3 of riprap material. • All culverts, bridges and drainage structures will be removed. • Decommissioning, reclamation and revegetation of access road. • Use of Robert Campbell Highway and Alaska Highway in Yukon and BC Highway 37 and Highway 37A to access mine site and for transport of concentrates (copper, lead, zinc, gold, silver) to Stewart port in British Columbia. • Off-Site traffic on the roads[3]: ○ from the site travelling West on the Robert Campbell Highway (towards Whitehorse): • Approximately 6 HDV/day and 12.6 LDV/day (one way trip) during construction. • Approximately 6 HDV/day and 21 LDV/day (one way trip) during operations. • Approximately 6 HDV/day and 12.6 LDV/day (one way trip) during active closure. • Approximately 1.3 LDV/day (one way trip) during post closure. ○ from the site travelling South on the Robert Campbell Highway (towards Watson Lake): • Approximately 12 HDV/day and 2.3 LDV/day (one way trip) during construction. • Approximately 46 HDV/day and 2 LDV/day (one way trip) during operations. • Approximately 12 HDV/day and 2.3 LDV/day (one way trip) during active closure. • No traffic during post closure. ○ from Watson Lake to Stewart and other areas in BC: • Approximately 10 HDV/day (one way trip) during construction. • Approximately 46 HDV/day (one way trip) during operations. • Approximately 10 HDV/day (one way trip) during active closure. • No traffic during post closure.
Airstrip	• Use of Finlayson Lake airstrip, located at km 246 on the Robert Campbell Highway: ○ Maximum use during all phases of the Project is up-to eight weekly flights. ○ Fuel and de-icing equipment to be transported from project site for use at airstrip when required.

[3] YOR Document 2017-0083-294-1 , pg.68

Project Component	Activities

	• Additional flights may be made to/from the alternative locations of Faro and Ross River Airports.
	• Extension of the airstrip from 1 800' (549 m) to 3 000' (914 m) to the southeast. Activities include:
	  ○ removal of vegetation and topsoil;
	  ○ and construction of additional airstrip extension.

Power	• Construction and operation of approximately 25 MW LNG/Diesel power plant (6 generators in full time use and 4 generators at one time in operations) adjacent to the process plant: ○ Use of 17 MW of power during operations (4 generators). • Estimated annual maximum consumption of 981 300 GJ of LNG and 1 400 000 L of diesel. • Prior to operation of the plant, use of diesel generators near power-consumption centres. • Power distributed through buried electrical cables. • Electrical Cables – De-energized upon decommissioning, buried cables to be removed and salvaged or snipped off if not removable.

Topsoil Management	• Topsoil will be stockpiled and re-vegetated to enhance stability.
	  ○ Overburden stockpile volume at approximately 16 Mt (9.0 Mm^3) with a 2.2:1 slope.
	  ○ Topsoil stockpile volume of approximately 715 000 m^3, for use in reclamation.
	• Treatment of contaminated soil, as required.

ABM Open Pit Mining	• Removal of vegetation, topsoil, subsoil, and overburden rock. • Conventional open pit mining methods, extraction of approximately 14 600 kt of ore and 117 500 kt of waste. • Estimated 690 000 m^2 surface area. • Re-direct Fault Creek towards the open pit for filling: ○ filling of the ABM open pit to create ABM lake.
Krakatoa Pit Mining	• Removal of vegetation and topsoil, subsoil, and overburden rock. • Conventional open pit mining methods, extraction of approximately 850 kt of ore, 21 200 kt of waste. • Estimated 247 500 m^2 surface area. • The pit will extend vertically from 1 265 m above sea level (asl) at the final pit floor to a maximum of 1 460 m asl on the eastern highwall.

Project Component	Activities
Krakatoa Underground Mining	• Development of an underground mine using long hole mining methods and cut and fill methods as appropriate. • Approximate tonnages for the eight years of underground mining are 2 100 kt of ore and 400 kt of waste. • Use of emulsion style explosives for blasting. • Use of cemented paste backfill to fill voids.

Waste Rock Management	• Segregation of waste rock into three categories based on acid generating/metal leaching potential.
	• The progressive construction of a low permeability cover system above the waste rock with a seepage collection system constructed above the low permeability foundation liner.
	• Development and use of three waste rock storage facilities with approximate tonnage and surface areas of:
	  ◦ Class A Storage facility:
	  ◦ Waste rock tonnage: 11.6 Mt, strong PAG/ high metal leaching potential.
	  ◦ Filtered tailings co-disposal: approximately 15.1 Mt, strong PAG.
	  ◦ Surface area: 741 900 m^2.
	  ◦ Class B Storage facility:
	  ◦ Waste rock tonnage: 47.5 Mt of mild PAG/moderate metal leaching potential.
	  ◦ Surface area: 700 500 m^2.
	  ◦ Class C Storage facility:
	  ◦ Waste rock tonnage: 64 Mt non PAG/low metal leaching potential.
	  ◦ Surface area:1 255 000 m^2.
	• Final reclamation of Class A and B storage facilities with multi-layer low permeability cover and revegetation.
	• All unused overburden to be transported to Class C facility reclamation through sloping and revegetation.

Ore Processing	• Construction, operation, and decommissioning of a process plant to crush and grind ore, flotation processes to produce copper, lead, and zinc concentrates.
	  ◦ Approximately 2 000 000 tonnes ore processed per year.
	  ◦ Ore processed at a nominal rate of 2.0 Mtpa.
	• One or more groundwater wells installed near the Process Plant to mix reagent for ore processing.
	• Thickening, filtering, and stockpiling of concentrates prior to transport to third party smelting facilities.
	• Dewatering tailings prior to disposal at Class A Storage facility or combined with cement for backfill.

Project Component	Activities

Support Infrastructure	• Construction and use of an enclosed paste fill plant:
	  ○ Production of approximately 1 000 m^3 per day.
	• Construction of communications tower.
	• Construction and use of a workshop for maintenance of site vehicles and equipment.
	• Construction of a two-storey warehouse and administration complex
	• Development and use of a waste treatment facility:
	  ○ On site storage of waste, recyclables, and contaminated materials prior to disposal via off-site recycling/disposal or disposal via the on-site incinerator, Land Treatment Facility, or landfill.
	  ○ Approximately 500 tonnes of waste to be shipped off site per year:
	  ▪ Recyclables: approximately 3 to 4 tonnes / year to Yukon, or outside, facility.
	  ▪ Tires: approximately 25 tonnes / year to an outside facility for recycling.
	  ▪ Special wastes (e.g. batteries, chemicals): approximately 13 to 16 loads (28 tonnes/ load) / year to outside facility.
	• Infrastructure and facilities decommissioned and removed from site.
	  ○ Salvaging, recycling and landfilling of materials.

Camp and Site Administration	• Workforce (approximately):
	  ○ Year -2 to Year 1: 350 people.
	  ○ Year 1 to Year 10: 100 – 345 people.
	  ○ Year 11 to Year 13: 80 people.
	  ○ Year 14 to Year 26: 6 – 10 people.
	• Camp:
	  ○ Upgrade camp to be suitable for up to 350 people during construction.
	  ○ Permanent camp facilities for 250 personnel.
	• Waste management using the following methods:
	  ○ incineration;
	  ○ off site disposal;
	  ○ open burn;
	  ○ landfill;
	  ○ and shipment to a licensed recycle or disposal facility.
	• Water use – potable and non-potable.
	• Sewage treatment facilities designed for approximately 443.7 m^3 per day for the camp and approximately 26.4 m^3 per day for the Processing Plant and Administration complex with on-site burial of residual sludge.
	• Mine administration complex developed as part of the process plant:

Project Component	Activities
	○ Facilities will include emergency services, assay and metallurgical laboratory, storage, warehouse, and mine dry (lavatory and change room facility). • Partial decommissioning of camp.
Fuel, Chemical, and Explosives Storage	• Building of a fenced and secured bulk explosives compound adjacent to the Overburden Stockpile: ○ Ammonium nitrate prill and emulsion will be transported in 25 tonne trailers, separate storage silos on site: ▪ Total combined maximum: 80 000 kg of bulk ammonium nitrate prill and bulk ammonium nitrate emulsion. ▪ Maximum 50 t of emulsion, 25 t of ammonium nitrate. ▪ 5 tonnes of small explosives (e.g. boosters, emulsions, etc.). ▪ Maximum 6 500 tonnes/year or 540 t/month. • Fuel storage facilities: ○ The power plant facility includes: • 3 x 100 m^3 vacuum insulated tanks of LNG. • 2 x 113 500 litre diesel tanks. ○ Mine workshop: ▪ 4 x 100 000 L tanks of diesel (for mining operations). ▪ 1 x 30 000 L tank of gasoline. ○ Storage of 1 x 5 000 L of aviation fuel adjacent to the helipad at camp. ○ Fuel storage during construction: ▪ 1 tank of 28 500 L diesel. ▪ 1 tank of 30 000 L aviation fuel. ▪ Tanks will be decommissioned following early stages of construction. • Storage of waste oil in a 10 000 L tank adjacent to the mine workshop. • Use of waste oil as a fuel source for a waste oil burner. • Storage area specific for reagents. • Storage silo containing quick lime: suitable for receiving 40 t bulk loads for an approximate 6 400 t /year • De-icing equipment to be stored at project site. • Reclamation of fuel farms area. • Explosives compound to be rehabilitated through decommissioning and salvage of structures.
Water Management	• Water use during construction. • Construction and use of water management features including: ○ diversion of Fault Creek;

Project Component	Activities
	○ water diversion and ditches; 3 major diversions plus other minor/temporary diversions; ○ 7 water management ponds with a combined operating capacity of approximately 1 100 000 m^3, not including freeboard; ○ water treatment plant designed to treat Class A and B contact water and runoff from the process plant facility site as required; ○ and perimeter sump pumps to collect runoff. • Fresh water supply: ○ maximum 5.5 m^3/hour water supply for the process plant; ○ maximum 25.3 m^3/hour water supply for the camp (up to 350 people at 250 l/day); ○ two groundwater wells in use at one time, one at camp and one at the process plant location. Alternative backup wells may be drilled; ○ and process plant usage of approximately 276 000 m^3 per year (based on average precipitation conditions) (240 000 m^3 of contact water, 36 000 m^3 groundwater). • De-watering of the open-pit. • Water treatment plant with a capacity of approximately4 410 000 m^3 per year. • Water treatment plant usage during mine closure, until water quality meets required target: ○ Subsequent decommissioning and demobilizing of active water treatment plant. Passive treatment through the constructed wetland treatment system. ○ Upper Water Management Pond (WPM) and Lower WMP dams decommissioned; LWMP will be converted into a Constructed Wetland Treatment System. • Decommissioning or upgrading (to ensure stable and long-term drainage) of water retention and sediment control structures and appurtenances. • Pit Rim Pond to be decommissioned.

PROPONENT MITIGATIONS

The following proponent mitigations are considered to be part of the project scope and were considered in characterizing project effects and subsequent significance determinations. Additional detail on these mitigations may be contained within the sections of part B of this report.

The Proponent proposes to:

Construction:

- Manage pit development water in pit

- Rim pond to settle TSS and aerate water
- Line fault creek diversion ditch
- Build an energy dissipation structure at diversion outlet to South Creek catchment
- Build a diversion of Fault Creek to South Creek
- Build a diversion of Geona Catchment above Project footprint to Geona Creek at KZ-9 (North Diversions)
- Conduct pre-denning bear monitoring. If bear activity indicates they may be preparing to den in an area that could be disturbed by mining activity, the YG conservation officer and RRDC land stewards will be consulted to determine measures to prevent the bear from denning too close to the pit
- Undertake a preconstruction survey for bear dens and appropriate setback distances from the construction area will be applied until the bears leave the den
- Conduct bird surveys prior to construction that will:
    - Be led by qualified and experienced individuals, including “involvement from Kaska representatives identified by RRDC”
    - Communicate results to the on-site construction manager and clearing contractors
- Establish buffer zones around active nests with buffer distances ranging from 30 m to 200 m
- Construct water management and treatment ponds, as well as fish habitat compensation ponds (constructed wetlands), both of which are also expected to provide habitat for waterfowl species.
- Undertake a heritage resource impact assessment in areas for planned ground-disturbance that have not previously been subject to heritage investigations
- Construct Class A and B Storage Facilities with compacted low permeability till liners
- Use an impermeable HDPE liner in construction of the Class A and B Storage Facilities Water Collection Ponds

Operations:

- Use a Water Treatment Plant (WTP)
- Discharge at minimum dilution ratio to Geona Creek (3:1) and Finlayson Creek (2:1)
- Conduct progressive covering and reclamation of Class A, B and C Storage Facilities
- Capture and manage site runoff in the same drainage (Geona Creek and Finlayson Creek drainages)
- Use a crusher enclosure,
- Handle and transfer materials at the process plant facility occurring indoors
- Use a cover over the coarse ore stockpile
- Use dust collectors and proper chute design to prevent air entrainment of dust
- Use filters, scrubbers and other pollution control devices at processing facilities
- Implement dust extraction with conveyance to and processing in dust collectors
- Cover or enclose conveyors or conveyor galleries
- Install water sprays at conveyor transfers

- Use catalytic control systems on diesel engines
- Enclose crusher, grinding mills, conveyor activities.

Closure:

- Treat ABM pit water with lime and carbon source as it fills
- Construct a Constructed Wetland Treatment System
- Install low permeability covers for Class A and B Storage Facilities
- Maintain the WTP onsite and available until Storage Facilities and CWTS are meeting design objectives
- Remove diversions to return; baseline catchment boundaries
- Install low permeability covers with natural vegetation to approximate natural cover and runoff

Not necessarily attached to a Project phase:

- Conduct fish habitat replacement
    - Pond and pool habitat in Geona Creek
    - Flow/spawning habitat in Geona Creek
- Reconnect habitat in Finlayson Creek
- Create a Fisheries Offsetting Plan. Aspects of this plan include:
    - Construction windows which mitigate impacts to key life cycle phases for fish populations and sensitive ecosystems
    - The development of a water conveyance system that redirects non-contact water, to ensure ongoing water quality
    - Sediment and erosion control measures and associated structures are established and in place throughout all phases of the Project
    - Development of spawning habitat for grayling
    - Fish habitat in Finlayson Creek will be reconnected through passage enhancements under the Robert Campbell Highway, as it currently serves as a fish passage barrier.
- Create a fish habitat compensation in the form of three constructed wetlands, in order to address fish habitat impacts resulting from the Project.
- Use speed limits on project roads
- Maintain access restrictions on project roads with a staffed gate to prevent access to hunters until the road is decommissioned
- Conduct progressive and final reclamation of disturbed areas;
- Give wildlife the right-of-way
- Halt activities if ungulates, bears or wolverines are encountered during Project activities until the animal has left the area, unless halting activities would be unsafe
- Route flights in order to best avoid disturbing wildlife
- Implement appropriate measures to carry out blasting activities at the mine, in a manner that avoids disturbing wildlife during critical life cycle activities, will be established in consultation with the regional biologist

- Implement a policy which prohibits use of recreational all-terrain vehicles and snowmobiles;
- Implement a policy which states that machinery and personnel will be required to remain in the defined Project area and along defined roads
- Implement a no hunting policy
- Implement a policy stipulating no feeding or harassment of wildlife by employees, contractors and visitors
- Store all waste in bear proof containers until removed or incinerated.
- Store all food and cooking supplies in bear proof containers
- Use stack scrubbers in camp kitchens to reduce cooking odours.
- Enclose the Waste Management Facility with an electrified fence. Ancillary facilities including waste storage, camp, Upper and Lower Water Management Ponds, and all water collection ponds with engineered liners will be surrounded by wildlife-proof fences or emergency egress ramps;
- Issue personal wildlife deterrents (e.g. air horns, bear spray, bear bangers) and radios to all field personnel;
- Revegetate, with non-palatable plants, drill sites built near the gravel tote road to avoid attracting wildlife to the roadside
- Implement a Proponent-Kaska Environmental, Cultural & Heritage Management Program for the Project. The goal for the Project area post-closure is “compatible with a healthy environment and with traditional land use activities”. The Proponent indicates that “therefore, there will be no contamination of the land that will prevent the land users from returning to the KZK Project area in post-closure.”
    - A Co-management Plan developed for fish and wildlife, wherein “it is anticipated that RRDC will collaboratively design, collect, report, manage and communicate the results of the wildlife monitoring program to RRDC citizens. This program would be active through all Project phases and would collaboratively ensure any impacts to the traditional use animals are minimised.”
- Ensure that open pit placement does cross the watershed divide and that, upon mine closure, the pit water will continue to flow north and not into North Lakes, in an effort to avoid impacts to surface water quality and ground water quality in the watershed south of the Project
- Implement a winter Wildlife Monitoring Program for wolves, wolverines and other furbearers, which requires that information regarding animal presence and denning locations be collected;
- Engage all local trappers well in advance of any activities taking place in their trapline area(s) and working with them to resolve any concerns raised;
- Pay, as part of the Socio-Economic Participation Agreement (SEPA), a land use interruption supplement to mitigate the Project impacts on RRDC citizens who hold trapping rights under the RTC group trapline (RTC 405) and operated traplines (RTC 250) within the Project area
- Water roads and exposed surfaces to reduce dust

- Minimize land clearing activities (i.e. waste storage facilities will be cleared progressively through the Project construction and operations phase)
- Construct the Access Road and site roads with low silt content material
- Orientate material stockpiles so that the length is parallel with prevailing winds where practicable
- Construct wind breaks or stationary misters
- Operator incinerator for optimum combustion
- Regularly inspect and maintain equipment.
- Use noise dampening enclosures for boiler, generators and compressor
- Equip all vehicles and internal combustion engines with appropriate muffler systems
- Keep noisy equipment inside buildings or sheds and/or near ground level whenever possible
- Maintain natural cover (vegetation) between noise sources the camp
- Maintain the Project roads regularly to minimize vehicle noise associated with vibration
- Implement a dry camp, with no use of drugs or alcohol onsite. Drug testing of all new employees and random testing thereafter will exist
- Conduct an “Extensive screening of employees before hire to gauge their suitability for shift work and to help educate them on its potential effects”
- Provide for education and assistance through an Employee Assistance Program, available to all employees and their families as required. Examples of counselling services include:
    - Drug and alcohol counselling (including time off for employees who need treatment);
    - Marriage counselling
- Implement a mentor program for First Nations employees, to be expanded into a more general support program for all site personnel. The program will be a personnel management feedback loop as the Mentor is often the first point of contact for local personnel experiencing difficulties at work or at home. Mentors can propose mitigation measures.

3. Scope of Assessment

The scope of assessment identifies the matters considered in the screening. It is determined by considering the matters set out in s. 42 of *Yukon Environmental and Socio-economic Assessment Act* (YESAA) (outlined above in Section 1.4). The Executive Committee has employed a valued component-based assessment methodology to assess the environmental and socio-economic effects of the Project.

The valued environmental and socio-economic components (VESECs) are identified through consideration of:

- Views and information submitted during the adequacy review stage and the public comment period;
- Internal and external technical advice and input;
- Traditional Knowledge where it is made available;
- Previous assessments; and
- Studies and research

4. Views and Information

4.1 Comment Submissions

Adequacy Review Phase

The EC solicited comments during the adequacy review phase to determine if there was sufficient information to draft a scope of project and commence the screening.

Comments were received from:

- Ross River Dena Council (RRDC);
- Liard First Nation (LFN);
- Government of Yukon (YG);
- Environment and Climate Change Canada (ECCC),
- Health Canada (HC),
- Indigenous and Northern Affairs Canada (INAC),
- Northern Projects Management Office (NPMO);
- Fisheries and Oceans Canada (DFO);
- Transport Canada; and
- Natural Resources Canada (NRCan)

Comments received were considered in drafting the Adequacy Review Report, which outlined additional information required by the EC. The EC issued the first Information Request (Information Request No. 1) on May 26, 2017, and amended it on June 8, 2017 for administrative reasons. Based on comments received, the EC requested additional information on a number of issues, including:

- effects to outfitters, tourism operators, and trapline concession holders;
- mine design and engineering, engineering, including geotechnical stability and permafrost;
- tailings technology and ore processing;
- progressive cover design for closure and decommissioning of storage facilities;
- mine site infrastructure development;
- rock mass classification and structural geology;
- in situ stresses and possible failure mechanisms;
- air quality, Greenhouse Gas Emissions (GHGs), and Criteria Air Contaminants (CACs);
- noise levels;
- water quality and quantity, including baseline data and modeling, threshold criteria, preliminary Water Quality Objectives (WQOs), water quality predictions and management, and water treatment process;
- access road and mine site terrain analysis;
- habitat and baseline data for fish and wildlife;
- heritage resources, Traditional Knowledge and socio-economic information; and
- malfunctions, accidents and unscheduled closure

The Proponent responded by providing additional proposal information on June 30, 2017. The EC assessed the response and replied by putting forward a second Information Request (Information Request No. 2) on August 4, 2017 which asked for information on a number of issues, including:

- waste rock and tailings technology and management;
- final landform design for waste storage facilities;
- closure cover designs and mine site stability;
- rock characteristics;
- water management and hydrometric monitoring;
- future acidic conditions at closure and post-closure;
- constructed wetland treatment systems;
- water quality and quantity, including baseline data and modeling, threshold criteria, preliminary Water Quality Objectives (WQOs), water quality predictions and management, and water treatment process;
- aquatic ecosystem resources;
- terrain stability and mine site terrain analysis;
- wildlife and wildlife habitat; and
- malfunctions and unscheduled closure

The Proponent provided additional information on November 20, 2017, addressing key issues identified in the adequacy review stage. The EC extended the Adequacy Review Phase to January 15, 2018, at which point they determined that sufficient information was provided to commence the screening.

Seeking Views and Information Phase

The public comment period on the proposal was from January 16 to March 16, 2018. During this phase, written comments were received from eight parties. The EC also hosted a public meeting in Watson Lake on March 7, 2018 and Ross River on March 8, 2018, where additional comments were received. The EC received comments from governments, non-governmental organizations, interested parties and individuals. These comments formed the basis of a request for additional information (Information Request No. 3) issued on April 9, 2018. Based on comments received during the seeking views and information phase, the EC requested additional information on:

- water quality objectives, baseline information, and modelling;
- geotechnical stability and surficial geology;
- adaptive management plans;
- wildlife and wildlife habitat;
- noise and air quality;
- roads and transportation; and
- hazardous materials

While awaiting the response to Information Request No. 3, the EC put forward another request for information (Information Request No. 4) on May 3, 2018 regarding:

- traditional land use information specific to the Liard First Nation;
- the effects of the Project on traditional land uses;
- past and current environmental and socio-economic effects of previous mine closures on the LFN, RRDC and residents of Ross River and Watson Lake; and
- the impacts of additional traffic on the Robert Campbell Highway as a result of the Project

4.2 Technical Support

Reviewing the Project Proposal - Adequacy Phase

During the adequacy review phase of the assessment, the EC retained five independent consultant teams to undertake a technical review of select components of the Project proposal.

The scope of work for consultants included the following:

- Reviewed and evaluated information identified by the EC;
- Participated in discussions as needed;
- Provided professional judgement on matters identified by the EC;
- Conducted appraisals of models utilized by the Proponent where warranted; and
- Identified, described and prioritized key issues

Consultant teams produced technical memos to assist the EC in determining the adequacy of proposal documents. In addition, the consultant teams considered information gaps identified in comments received during the adequacy phase. Each consultant team provided technical memos during the adequacy phase which informed Adequacy Review Report Number 1 and

Adequacy Review Report Number 2, and the evaluation of Proponent responses to these reports. Consultant teams, their areas of focus and their technical memos are listed in Table 6.

Table 6: Consultants teams, areas of focus and technical memos reviewing the Project proposal

Focus Topic	Independent Consultant	Technical Memo YOR Document Numbers
Hydrology and Aquatic Resources	EcoMetrix Inc.	2017-0083-196-1 2017-0083-213-1 2017-0083-247-1
Wildlife and Wildlife Habitat	SLR Consulting Ltd.	2017-0083-196-1 2017-0083-214-1
Wildlife and Wildlife Habitat	Environmental Dynamics Inc.	2017-0083-247-1
Engineering and Geotechnical	SNC Lavalin Inc.	2017-0083-196-1 2017-0083-215-1
Socio-economic Effects	EEM Impact Inc.	2017-0083-196-1 2017-0083-216-1

In addition to these consultant teams, an individual consultant was recruited from Artifex Engineering Hydrology to assist in providing technical advice and support in evaluating proposal documents.

Reviewing Comments on the Proposal – Screening Phase

During the first reviewing comments phase of the screening, the period in which to provide comment on the Project proposal, the EC retained two independent consultant teams to undertake a technical review of the Project proposal focusing on concerns raised in comment submissions.

Consultants:

- Reviewed relevant comment submissions;
- Identified areas where additional information was required in order to draft a recommendation;
- Identified possible approaches to addressing information deficiencies; and
- Provided professional judgement on key aspects of the Project proposal

Consultant teams aided in the determining if the EC had sufficient information to draft a recommendation and helped inform Information Request Number 3. Consultant teams, and their areas of focus, are listed in Table 7.

Table 7: Consultants teams, areas of focus for reviewing comments on the proposal

Focus Topic	Independent Consultant
Hydrology and Aquatic Resources	EcoMetrix Inc.
Engineering and Geotechnical	SNC Lavalin Inc.

Drafting the Recommendation – Screening Phase

In order to draft this report, the EC retained two independent consultant teams to undertake a review of potential Project effects.

Consultant teams produced technical memos to assist the EC, which contained:

- Identification and characterization of potential adverse effects;
- Identification of potential mitigative measures for potential significant adverse effects;
- Concerns or agreement with proposal conclusions; and
- Technical advice in addressing issues raised in comments received

Consultant teams, their areas of focus and their technical memos are listed in Table 8.

Table 8: Consultants teams, areas of focus and technical memos for drafting the Draft Screening Report

Focus Topic	Independent Consultant	Technical Memo YOR Document Numbers
Wildlife and Wildlife Habitat	Environmental Dynamics Inc.	2017-0083-0950
Socio-economic Effects	EEM Inc.	2017-0083-8134

To further aid in the drafting of this report, the EC worked closely and directly with:

- EcoMetrix Inc.
- SNC/Lavalin Inc.
- Jen Clark
- Danette Moulé

4.3 Relevant Assessments

The EC may consider previous assessments when assessing the effects of a proposed project. Previous assessments provide an additional source of information on potential effects pathways, sources and receptors. Previous assessments may provide location specific concerns or issues relevant to an assessment in progress. The EC may consider both previous Executive Committee screenings and Designated Office evaluations. The Watson Lake Designated Office has assessed several mineral exploration and access projects on or near the Kudz Ze Kayah property, including but not limited to those listed in Table 9.

Table 9: Noted Relevant Previous Assessments

Assessment Number	Name	Proponent
2017-0002	Kudz Ze Kayah Exploration Project	BMC Minerals (No.1) Ltd.
2016-0061	Pelly Project	BMC Minerals (No.1) Ltd.
2015-0028	Kudz Ze Kayah Exploration	BMC Minerals (No.1) Ltd.
2014-0204	Fyre Lake Exploration	Merah Resources
2013-0126	Tsa Da Glisza Winter Road	True North Gems
2010-0042	Bolt Property	Strategic Metals Inc.
2008-0107	Boot Property	Strategic Metals Inc.
2006-0076	Fyre Lake	Pacific Ridge Exploration Ltd.

4.4 Relevant Studies and Research

The EC is required to consider "any studies or research undertaken under subsection 112(1) [of the *Yukon Environmental and Socio-economic Assessment Act* (YESAA)] that are relevant to the project or existing project." No research or studies have been undertaken under s. 112 of YESAA. However, in conducting its assessment, the EC may also consider other public studies and research relevant to the assessment. These references include geographic data maintained by YG, available to view on the GeoYukon platform.[4] In addition, academic journals, governmental reports and monographs that have helped inform the assessment are listed in the bibliography.

[4] GeoYukon can be found at: https://mapservices.gov.yk.ca/GeoYukon/, it is maintained by Government of Yukon.

Part B

To assess the potential effects of the Project, the Executive Committee identified valued environmental and socio-economic components (VESECs). VESECs were identified using views and information submitted, comments received during the screening, professional judgement, previous assessments, and technical input from experts. The Executive Committee selected the following VESECs:

- Water Resources (Section 5)
- Wildlife (Section 6)
- Traditional Land Use (Section 7)
- Economy (Section 8)
- Human Health and Safety (Section 9)
- Community Wellbeing (Section 10)
- Heritage Resources (Section 11)

5. Water Resources

The EC has determined that the Project is likely to result in significant adverse effects to water resources as the Project is likely to result in intermittent failures to meet water quality objectives. However, the application of recommended mitigation measures are sufficient to eliminate, reduce or control these significant adverse effects.

5.1 Water Quality

Summary & Conclusion

The Executive Committee has determined that the Project will result in significant adverse effects to water quality during closure due to intermittent failures to meet water quality objectives in the Geona and Finlayson Creek drainage. These effects can be eliminated, reduced, or controlled through the mitigation measures proposed by the Executive Committee. Uncertainty regarding the potential magnitude of impacts to water quality further warrant the implementation of monitoring efforts to minimize risks of the Project.

Importance of Water Quality

CULTURAL AND ECOLOGICAL IMPORTANCE OF WATER QUALITY

Water is highly valued by Yukon residents, and holds cultural and spiritual importance for many people. As stated in YG's Water Strategy and Action Plan,[5] "water is vital to life: it is a necessity for our natural environment, biodiversity, and economy. It is used for drinking and waste disposal. Water provides habitat for fish, plants and animals and supports basic life." Groundwater is an important contributor to surface water in headwater streams. Therefore, it too

[5] Government of Yukon. Water for Nature, Water for People. Yukon's Water Strategy and Action Plan. 2014. Available online at: www.env.gov.yk.ca

is of fundamental importance in maintaining the proper functioning of aquatic and biophysical environments.

Concerns regarding changes to surface water quality were raised during consultation (Project Proposal Chapter 2). Kaska citizens have indicated that surface water at Fault Creek is used as a drinking source, and that headwater streams, including Geona Creek, hold an important value within their Traditional Territory (Project Proposal, Section 8). Headwater values are documented in Kaska Dena Management Practices: Kaska Dena Land Use Framework[6] as follows:

> Headwater and source watersheds are important to maintain water quality and support the flow, storage, and hydrology of the adjacent watersheds. In addition, these watersheds tend to have a higher density of Kaska sites, hunting areas, traditional uses, and Kaska values. The watersheds also generally have high ecological values.

Legislative & Management Setting

The legislative and management setting for the Project with regard to water quality is set out in the *Yukon Waters Act*, *Quartz Mining Act*, and the federal *Fisheries Act.* The Project is located within the Ross River Dena Council and Liard First Nation Traditional Territories.

WATERS ACT

The purpose of the *Waters Act* is to regulate the use of water and the depositing of waste into water in Yukon. The Yukon Water Board, established by the Act, issues licences for the use of water or the deposit of waste. Under the Act, mineral exploration activities are regulated and classified according to water use and waste disposal criteria and undertakings related to Project design (water course diversion and watercourse training and crossings). The Yukon Water Board's objective is "to provide for the conservation, development, and utilization of waters in a manner that will provide the optimum benefit from them for all Canadians and for the residents of the Yukon in particular."[7]

QUARTZ MINING ACT (QMA)

Quartz mining projects in Yukon require a Quartz Mining Licence (QML) issued by Yukon's Department of Energy Mines and Resources under the *Quartz Mining Act*. A quartz mining project requires the submission of environmental protection plans and operational plans for the development, operation, and decommissioning of a mine site. These plans will describe how mining activities will be undertaken, and how they will be completed in an environmentally responsible manner. A QML sets out requirements for routine monitoring and reporting, and may include a number of adaptive management plans for different aspects of the mine, as well

[6] Dena Kayeh Institute. Kaska Dena Management Practices: Kaska Dena Land Use Framework. 2010.
[7] Government of Yukon. Waters Act. 2007. http://www.gov.yk.ca/legislation/acts/waters_c.pdf

as terms and conditions regarding reclamation of mining activities and financial security for reclamation and closure activities.

The *Yukon Mine Site Reclamation and Closure Policy for New Mines* (2006) provides guidance in implementing the *Quartz Mining Act* and *Waters Act*. According to the Policy, the goals for mine site reclamation and closure include:

- ensure a government-approved reclamation and closure plan, prepared by the mine operator, to return the mine site to a viable and, wherever practical, self-sustaining ecosystem, is in place prior to mine development;
- fully protect public and environmental health and safety and ensure that any potential discharges during mine operation and following mine closure will be managed to prevent harm to the receiving environment or to the public; and
- methods for protection of water resources during and after mine closure.

FISHERIES ACT

The federal *Fisheries Act* was established to manage and protect Canada's fisheries resources. It applies to all inland waters in Canada. Fisheries and Oceans Canada (DFO) maintains an active role in enforcing the *Fisheries Act* and has established a number of policies in the areas under their jurisdiction.

Subsection 35(1) of the Act states that any work, undertaking or activity that may results in serious harm to fish or fish habitat, is prohibited. Subsection 35(2) of the Act provides DFO with the ability to authorize such an activity.

The *Metal and Diamond Mine Effluent Regulations* (MDMER), created under the *Fisheries Act*, prescribes the maximum authorized limits for deleterious substances in metal and diamond mine effluent (e.g. arsenic, copper, cyanide, lead, nickel, zinc, radium-226 and total suspended solids), specifies the allowable acidity or alkalinity (pH) range of mine effluent, and requires that mine effluent not be acutely lethal to fish. The MDMER further requires that mine owners or operators sample and monitor effluents to ensure compliance with the authorized limits and to determine any impact on fish, fish habitat and fishery resources.

YUKON WATER STRATEGY AND ACTION PLAN

In 2014, Yukon released its Yukon Water Strategy and Action Plan which recognizes the common goal of all water managers in the territory in ensuring that Yukon always has "*water for nature and water for people*." The strategy is intended to help Yukon Government (YG) ensure

that its water management decisions maintain the quality, quantity and overall health of waters while allowing for sustainable use. The goals of the strategy are:

- Sustain water quality and quantity for aquatic and terrestrial health and ecosystem services;
- Respect the intrinsic value of water;
- Ensure accessible, safe and sufficient water for drinking and other purposes, including commercial, recreational, heritage, cultural and spiritual uses and values;
- Promote sustainable and wise use of water to support environmental, social and economic needs

Context

WATER QUALITY THE PRODUCT OF MANY FACTORS

A number of natural processes including climate (precipitation, evaporation, depositions due to winds), site geochemistry (weathering of rocks, leaching from soil, run-off), vegetation cover (evapotranspiration, organic matter in the soil), the groundwater regime and biological processes in the aquatic environment influence surface water quality.

CONSTITUENTS OF POTENTIAL INTEREST IN SURFACE WATER

In order to measure effects to water quality, the EC examined predicted changes to water concentrations of constituents of potential interest (COPIs). Constituents of potential interest for surface water quality were defined as measurable parameters that:

- Are currently present at elevated concentrations at some receiving environment locations;
- Are most likely to leach, at elevated concentrations, from mine materials; and
- Are associated with either local natural mineralization or reagents used as part of the Project (Project Proposal, Section 8.1.1).

During the Screening Process, the baseline water quality[8] and geochemistry of site materials[9] were revised. The list of COPIs was revised accordingly, and predicted changes to the COPIs in surface water in the receiving environments of South, Geona and Finlayson creeks were reported in the 2018 Water Quality Model[10] report.

[8] YOR Document 2017-0083-296-1 inclusive through YOR Document 2017-0083-304-1.
[9] YOR Document 2017-0083-321-1 inclusive through YOR Document 2017-0083-324-1.
[10] YOR Document 2017-0083-345-1.

Table 10: Constituents of Potential Interest in Surface Water

Sulphate		
Nitrogen Species		
Nitrate	Nitrite	Ammonia
Fluoride		
Metals and Metalloids (total and dissolved)		
Aluminum Antimony Arsenic Cadmium Cobalt	Copper Iron Lead Manganese	Selenium Thallium Uranium Zinc

The geochemistry of water which has contacted mine components was modelled for the Project phases by developing “source terms” for all COPIs. Source terms are the release rates or leachate concentrations of COPIs predicted to be present in water following contact with particular geological materials under site specific conditions. The results of the kinetic testing program carried out by AEG in 2018[11] were the basis for source terms predictions. Multiple sets of source terms were developed to predict neutral and acidic waste rock drainage chemistry over the course of the Project. The source terms were updated during the screening based on the most recent kinetic tests and assumptions for long-term loadings, including for acid drainage from the Class A and Class B materials.

The amplitude of changes to water quality due to the Project can be evaluated by comparing future predicted parameters, such as concentrations of COPIs with the background (natural state) and/or baseline (current state) conditions, and to ecological health-based thresholds. For this screening, predicted changes in water quality at different locations in South, Geona and Finlayson creeks in relation to baseline conditions (derived in Appendix E[12]), and in comparison

[11] YOR Document 2017-0083-321-1 inclusive through YOR Document 2017-0083-324-1.
[12] YOR Document 2017-0083-325-1 inclusive through YOR Document 2017-0083-326-1.

to proposed water quality objectives (derived in Appendix A[13]), are used to characterize potential adverse effects and to assess the significance of those effects.

WATER QUALITY OBJECTIVES

The EC considers water quality objectives in determining a threshold for significance of effects to water quality. Water quality guidelines, objectives and standards, set by federal, territorial, provincial, and municipal agencies, consist of recommended concentration limits for COPIs. They are generic values that are selected to be protective of all species present in the environment. For example, Canadian Water Quality Guidelines provide nationally endorsed science-based goals for the constituent concentrations in surface water, based on different water uses (such as the protection of aquatic life), which have been developed by Canadian Council of Ministers of the Environment (CCME). These concentrations are set at levels that should result in negligible risk to biota, their functions or any interactions that are integral to sustaining the health of ecosystems (CCME 2001). The British Columbia Ministry of Environment (BCMoE) has established similar concentration guidelines for contaminants of potential concern in surface water.

Given the diversity of natural conditions, generic water quality guidelines may not apply to all ecosystems where sensitive species are not present, where environmental conditions exist that moderate or amplify the toxic effects of certain COPIs, or where natural background conditions exceed guideline values. The Proponent has proposed WQOs for a range of COPIs associated with the Project in their 2018 Preliminary Water Quality Objectives report (Appendix A of the Proponent's response to IR No. 3). The EC is comfortable with the methodology used to select COPIs for the screening.

The derivation of the proposed site-specific WQOs was performed following the methods outlined by Canadian Council of Ministers of the Environment (CCME) (2003) and is considered to be consistent with other permitted mining projects in Yukon. The background concentration procedure, which uses the upper 95th percentile concentration of the background dataset instead of a generic guideline, was used for those COPIs for which the 95th percentile concentration at each receiving environment monitoring station within the Project study area exceeded the CCME or BCMoE water quality guidelines for protection of aquatic life.[14] A sulphate-dependent objective was developed for selenium. The Proponent presented laboratory results using Finlayson Creek water, which demonstrated that selenium uptake from Finlayson Creek water was diminished in the presence of increased sulphate concentrations, thereby suggesting that selenium uptake by fish through the food chain diminishes with increasing sulphate concentrations. YESAB is comfortable with the proposed WQOs for the purpose of determining the significance of adverse effects on water quality and aquatic resources. However, the EC notes that for those proposed site-specific WQOs that are based on environmental conditions (such as hardness, temperature, pH and/or sulphate), decision-

[13] YOR Document 2017-0083-296-1 inclusive through YOR Document 2017-0083-304-1.
[14] The 95th percentile concentration characterizes a value, for which 95 percent of the time, a water sample will fall below.

makers may consider use of non-variable WQOs in the receiving environment in order to more easily control water quality at points of compliance in the receiving environment.

The Proponent has proposed that future water quality monitoring will be conducted at the following stations and compared to the proposed WQOs: KZ-1 in South Creek; KZ-37 in Geona Creek; and KZ-15 and KZ-26 in Finlayson Creek. YESAB is comfortable that monitoring at these stations will be appropriate to confirm the performance of the water management strategies proposed by the Proponent for each of the Project phases.

Existing Conditions and Trends

The Project will affect water quality in two drainages: the south Creek Drainage and the Finlayson Creek Drainage.

BASELINE WATER QUALITY DATA GATHERING

Baseline water quality for the Project was detailed in Appendix A[15] of the Proponent's response to R3-1. This revised 2018 Water Quality Baseline (WQB) report was prepared in response to comments received during the comments period including those from public meetings, First Nations and decision bodies.

The natural background water quality described in the 2018 WQB report was based on:

- A combined data set from historical Cominco water quality surveys from 1994 to 1995;
- A subsequent water licence biannual sampling between 2002 and 2016;
- Monthly water quality sampling at twelve surface water stations located on South Creek, Fault Creek, Geona Creek, Finlayson Creek, and East Creek collected between April, 2015 and March, 2018; and
- A higher frequency sampling program, involving five samples in 30 days, which was carried out at most monitoring locations from May to June, 2017 and from February to March, 2018.

YESAB is comfortable that the 2018 baseline report, which supersedes the 2017 baseline report[16] (Appendix E-3 of the Project Proposal), has adequately characterized baseline water quality in the Project area, and is adequate to support the Proponent's 2018 water quality model for the Project, which is used to predict effects on water quality and aquatic resources in Section 5.3.

Baseline groundwater quality for the Project is detailed in Appendix C[17] of the Proponent's response to R3-1. The baseline groundwater quality (BGQ) report was revised in 2017 in response to comments received during the adequacy stage of the Screening. The 2017 BGQ report combined historical 1990s data and data from 2015, 2016 and 2017 field-sampling events. Groundwater quality data were collected for both bedrock and overburden wells.

[15] YOR Document 2017-0083-296-1 inclusive through YOR Document 2017-0083-304-1.
[16] YOR Document 2017-0083-296-1 inclusive through YOR Document 2017-0083-304-1.
[17] YOR Document 2017-0083-312-1 inclusive through 2017-0083-319-1.

BASELINE SURFACE WATER QUALITY

Surface water in the two affected watersheds, South Creek and Finlayson Creek, including tributaries Geona Creek and East Creek, is generally circumneutral to mildly alkaline (pH ranging from 6.7 to 8.7). Water hardness is lowest (moderately hard) in the headwaters of South Creek and Fault Creek, and increases with distance from the Project area to be very hard in the lower watershed of Finlayson Creek. A number of parameters naturally exceed concentrations specified in water quality guidelines for the protection of aquatic life (CCME and/or BCMoE), including:

- Fluoride;
- Phosphorus;
- Aluminum;
- Arsenic;
- Cadmium;
- Chromium;
- Copper;
- Iron;
- Selenium; and
- Zinc

Elevated metal concentrations in these creeks are generally associated with freshet and/or other periods characterized by elevated total suspended solids (TSS) levels. Elevated concentrations of fluoride, total selenium, uranium and hardness occur more frequently in late fall and winter, and appear to be associated with groundwater sources, which are the main contributor to surface water during those periods of low flow.

In comparing the older dataset from the 1990s with the newer dataset (from 2015 to 2018), it appears that the site water quality has remained largely unchanged in the past two decades of monitoring. Some localized differences between the old and new datasets were identified in Geona Creek and appear to be associated with beaver dams which have modified the flow regime of the creek.

BASELINE GROUNDWATER QUALITY

Project-wide, groundwater is generally circumneutral to slightly alkaline (pH ranging from 5.7 to 8.6). Groundwater at wells in the Geona Creek basin, upgradient of its confluence with Finlayson Creek (MW15-10D/S) and directly downgradient of the proposed Lower Water Management Pond (WMP), displayed the lowest pH levels across the Project area. The groundwater source that feeds these wells also appears to feed the nearby east KZ-9 seep, which is also characterized by water of low pH (pH 5.8 to 6.0). Groundwater from overburden and bedrock wells do not show marked differences for most anions, nutrients and metals, with the exception of sulphate and fluoride, which tend to exist at higher concentrations in bedrock wells than in the overburden. Spatially, groundwater in the proposed ABM pit area exhibits higher concentrations of anions, nutrients and metals than in other areas beneath the Project site, which is likely due to greater mineralization present in the open pit's orebody. Sulphate

concentrations are also elevated in the pit area's groundwater, which may be due to the oxidation of sulphidic minerals associated with the ore deposit.

WATER QUALITY AND OTHER ACTIVITIES

There are no other activities existing or anticipated within the affected drainages that are expected to affect water quality.

Project Design

PROJECT WILL DISCHARGE WATER

The Project will have a positive water balance; therefore, active water management, including water treatment and discharge to the receiving environment, will be required. Surplus water will be stored on-site in the Upper and Lower WMPs and used in the Process Plant as required, with the excess water being released to Geona Creek and the remainder piped directly to Finlayson Creek.

PROJECT PROPOSES ALTERATIONS IN TWO WATERSHEDS

Project activities will affect water quality in two drainages: South Creek and Finlayson Creek, including Geona and East creeks. Surface water quality in the South Creek and Finlayson Creek drainages will be affected by the re-direction of Fault Creek to the South Creek basin during construction and operations, and by dewatering activities associated with underground work and the ABM Pit development during operations. Surface water quality in Geona and Finlayson creeks will be affected by these same activities, as well as by multiple other Project activities within the drainage, including on-site water management and storage of mine rock and tailings at the surface. Following closure, water quality may continue to be affected by flooded ABM pit and run-off overflow, and seepage from the mine rock and tailings storage areas.

PROPONENT MITIGATION MEASURES

The Project includes a number of mitigation measures to reduce the potential effects of the Project on water quality. These mitigation measures are summarized in the Project proposal in Section 8.4.2 and in the proposed Water Management Plan (Project Proposal Section 18.4). The mitigation measures have been incorporated into the site water balance and water quality models, revised in 2018 to predict changes to water quality based on anticipated Project sources, during all Project phases.

Table 11: Proposed Mitigation Measures for Water Quality

Potential Effect	Project Phase	Proposed Mitigation Measures
Changes in surface water quality as a result of diversions and dewatering	Construction	• Manage Pit development water in Pit; • Rim Pond to settle TSS and aerate water; • Lined Fault Creek diversion ditch; and • Energy dissipation structure at diversion outlet to South Creek catchment
Changes in surface water quality as a result of water management and discharge	Operations	• Water Treatment Plant (WTP); • Discharge at minimum dilution ratio to Geona Creek (3:1) and Finlayson Creek (2:1); • Class A and B Storage Facilities constructed with compacted low permeability till liners; • Upper Water Management Pond, Lower Water Management Pond, Pit Rim Pond; • Class A and B Storage Facilities Water Collection Ponds constructed with an impermeable HDPE liner; and • Progressive covering and reclamation of Class A, B and C Storage Facilities
Changes in surface water quality as a result of ABM Open Pit flooding and closure and formation of ABM Lake	Closure	• ABM pit water treatment with lime and carbon source as it fills
Changes in surface water quality as a result of water management and discharge	Closure	• ABM pit water treatment with lime and carbon source as it fills; • Constructed Wetland Treatment System; • Low permeability covers for Class A and B Storage Facilities; and • WTP remains onsite and available until Storage Facilities and CWTS are meeting design objectives

WATER MANAGEMENT PLAN STRATEGIES

The goals of the Water Management Plan are to minimize the volume of contact water requiring management in the Project area, and to re-use water in the Project area to the maximum practical extent. The key strategies to achieve these goals include:

- Three main diversions (south, northwest and northeast diversions) established during construction and maintained through operations;
- Collection of runoff from Class A, Class B and Class C Storage Facilities and routing based on water quality;
- Two stage WMP (Upper and Lower WMPs) used to manage contact water and, respectively, for settling and polishing prior to discharge to the receiving environment;
- Water treatment plant to treat excess water as required to maintain dischargeable water quality in the Lower WMP;
- Water treatment plant designed to treat collection pond water from Class A and Class B Storage Facilities and ABM open pit water;
- Run-off water from Class C Storage Facility and Overburden Stockpile conveyed from collection ponds directly to Geona Creek downstream of the Lower WMP;
- Limits to discharge quantity and quality such that water will be discharged to both Geona Creek and Finlayson Creek at established water quality discharge standard concentrations, and at discharge volume ratios no less than 3:1 (receiving water volume: effluent volume) for Geona Creek at KZ-37 and 2:1 for Finlayson Creek at KZ-15, to meet water quality objectives in the receiving environment;
- Groundwater and surface water intercepted and collected during the construction and operation of the ABM open pit, and pumped to the pit rim pond. Pit rim pond water either released to Geona Creek or used on-site for dust suppression during construction, and either used for process water or stored in the Lower WMP prior to release to the environment during operations.

A schematic of the operational water management plan is provided in Figure 18-2 of the Project proposal.

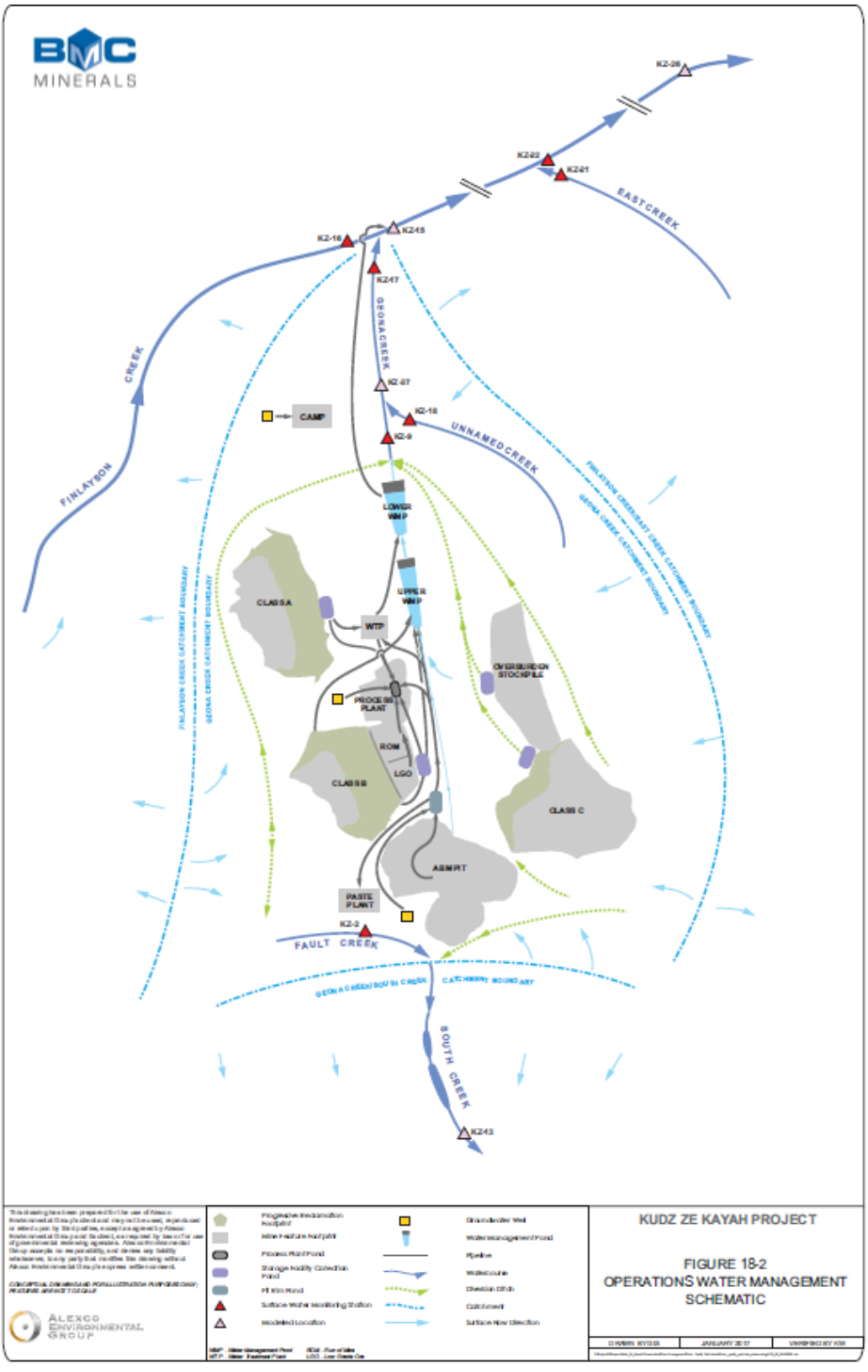

Figure 4: Operations Water Management Schematic

WATER TREATMENT PLANT

The Proponent has committed to constructing a WTP at the processing facility to treat water from the Class A and Class B Storage Facility collection ponds, the Pit Rim Pond (ABM pit dewatering) and the Process Plant Facility site runoff (from LGO/ROM sump) water that is not used in milling.[18]

The water treatment process is described as consisting of pH adjustment, clarification and any other processes that may be required to bring the water to a suitable standard for discharge to the environment. A second stage process is to treat selenium and provide polishing for other constituents. Estimated effluent concentrations, or concentrations estimated from constituent removal in similar water treatment processes in Yukon, were used as input values for the 2018 water quality model for proposed water treatment plant discharge. Treated discharge quality used as inputs were provided in Table 5-10 of the 2018 water quality model report. Treated water will be discharged to the Lower WMP for final polishing before being discharged to the receiving environment or used in the Process Plant circuit. The WTP will remain in place and will continue to treat water from the Class A and B ponds as required until the facility closure measures are meeting design objectives, or until wetlands to treat this water are commissioned.

YESAB is comfortable with the predicted performance of the WTP, understanding that the WTP design will continue to be developed as part of the Water Licence process. However, decommissioning of the WTP should be preceded by a substantial time period in which the constructed wetland independently demonstrates its ability to achieve water quality objectives.

VERY LOW PERMEABILITY COVERS FOR CLASS A AND CLASS B STORAGE FACILITIES

Class A Storage Facility is a co-disposal facility to manage filtered, dewatered tailings and strongly potentially acid generating (PAG) waste rock. It is located north of the Process Plant Facility on the western hillside of the Geona Creek valley. The co-disposal concept is based on the premise that the tailings will mitigate the acid generation in the waste rock and this will need to be demonstrated. The Class B Storage Facility will be used to manage weakly potentially acid generating waste rock. It is located on the western hillside of Geona Creek adjacent to the ABM open pit. Both facilities will require multi-layered cover systems to ensure long-term chemical stability of the site. The long-term effectiveness of the engineered low permeability covers is integral to minimizing loadings of COPIs from the Class A and Class B Storage Facilities to the Geona Creek drainage post-closure.

In the 2017 Conceptual Reclamation and Closure Plan (CRCP) for the Project (Project Proposal, Appendix H-1), the Proponent indicates that the Class A and Class B Storage Facilities will require land forms and covers that reduce net percolation by 98 percent and 75 percent, respectively. Annual monitoring and inspections of the Class A and Class B Storage Facility covers is proposed and described conceptually in the 2017 CRCP.

In response to concerns raised during the Adequacy Stage about the long-term physical integrity and longevity of engineered covers, the Proponent indicated that they will use internationally accepted practices for consolidation of earthen dams and manual compaction,

[18] YOR Document 2017-0083-345-1.

and that the design, operating methodology and method of compaction will be signed off by the design engineers prior to final granting of the QML. In addition, the Proponent committed to coupling the cover systems with short-term water treatment during operations and throughout active and transitional closure, and with constructed wetland treatment systems during post-closure, to ensure the proposed WQOs are met.

The Class C Storage Facility, located in a hanging valley on the east side of Geona Creek, will be used to manage non-potentially acid generating waste rock. The Class C waste rock is not considered to be a significant source of metal leaching, and the stockpiled rock will be used in construction, during operations, during closure and as frost protection layers on the Class A and Class B closure covers. The remaining rock in the Class C Storage Facility will be covered in a manner that will promote revegetation (it does not require a cover to reduce net percolation).

Loadings inputs to the 2018 water quality model and waste rock classification criteria, which were developed based on the potential for acid generation and metal leaching, are provided in the 2018 ARD/ML report (Appendix D[19]). The ARD/ML report provided additional information on the waste characterization and kinetic test results from several tests, and YESAB considers the information appropriate to support inputs for water quality modelling.

Table 12: Proposed Waste Rock Classification

Class	Classification Criteria	Treatment Requirements
Class A	Strongly PAG material with an associated high potential for metal leaching. Waste rock with a total sulphur content greater than 2.9 wt.% or a neutralization potential (NP) less than 10 kg $CaCO_3$/t.	Water management and treatment during operations and closure
Class B	Mildly PAG with a potential for metal leaching that is lower than that of Class A material. After clearing the Class A criteria, waste rock is Class B if it has an NP/AP ratio that is less than 1.9.	Water management and treatment during operations and closure
Class C	Non-PAG and has a relatively low potential for metal leaching. Waste rock with an NP/AP ratio greater than 1.9.	Not anticipated to require treatment

The Proponent will need to confirm that the NP used in the waste rock classification is an "effective NP" as defined in Price (2009).[20]

[19] YOR Document 2017-0083-321-1 inclusive through YOR Document 2017-0083-324-1.
[20] Price, W.A. 2009. Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials. Mine Environment Neutral Drainage Program (MEND) Report No.1.20.1. Natural Resources Canada. December 2009. 579 p.

IN SITU TREATMENT OF THE ABM PIT WATER

A single open pit will be mined which will access the ABM and Krakatoa Zones. Mining of the ABM Zone has three separate phases while the Krakatoa Zone will be mined in a single phase. Pit wall material loadings inputs to the 2018 water quality model are provided in the 2018 ARD/ML report (Appendix D[21]). The untreated ABM pit water is anticipated to contain elevated concentrations of antimony, arsenic, cadmium, copper, lead, selenium, uranium and zinc. Given that elevated COPI concentrations are estimated to be present in the ABM pit upon filling, the Proponent anticipates that treatment will be required to maintain water quality in the receiving environment. The Proponent expects that ABM pit water treatment will be amenable to in situ treatment by organic carbon (e.g., alcohol and/or molasses), which will be added to the lake to stimulate the formation of reducing conditions and will reduce COPI concentrations in the water column. In situ treatment is expected to significantly reduce the concentrations of antimony, cadmium, copper, lead, nickel, selenium, uranium and zinc in the water.

The Proponent estimated COPI removal percentages based on field case studies from the literature. The estimated percent reductions used in the water quality model serve as the basis for the effects assessment. The Proponent proposed that ongoing long-term monitoring and management of ABM pit water be conducted to ensure that treated parameter concentrations of COPI are sustained, and to inform any if additional treatments are needed, in order to maintain the desired level of COPI removal.

[21] YOR Document 2017-0083-321-1 inclusive through YOR Document 2017-0083-324-1.

Table 13: Percent reduction of COPIs resulting from in situ ABM Lake Treatment [22]

Parameter	In Situ Treatment Reduction (percent removal)
Sulphate	5
Nitrate-N	90
Nitrite-N	90
Ammonia-N	50
Antimony	50
Cadmium	90
Copper	90
Lead	50
Nickel	50
Selenium	90
Uranium	50
Zinc	90

CONSTRUCTED WETLAND TREATMENT SYSTEM (CWTS)

During the transitional closure phase, CWTSs will be established down-gradient of the ABM pit in the area of the decommissioned Pit Rim Pond, and further down-gradient in the area of the WMPs. Details on the horizontal surface flow CWTS's design is available in the *Kudz Ze Kayah Constructed Wetland Treatment System Memo*[23] and Section 8.4.1.6 of the Project proposal. Design specifications and removal coefficients for the treatment of select COPIs were provided for arsenic, cadmium, copper, lead, selenium and zinc by Contango Strategies Ltd. and in the Proponent's response to YESAB adequacy information request R108. Upon filling, the ABM Lake will start to discharge north towards Geona Creek via a CWTS.

As with other mine sites in Yukon, a reclamation and research program will be required as part of closure planning, and will include the need for demonstration scale testing. Until the test plots demonstrate that flow rates and contaminant loads can be adequately treated, alternative treatment technologies will be required.[24] During the Adequacy Phase, concerns were raised about scheduling a design and implementation plan for the proposed wetland treatment systems. In response to R2-17, the Proponent provided a conceptual completion and implementation schedule of CWTS, and confirmed that the purpose of the wetlands is to improve water quality, and that achieving water quality objectives will not rely on the proposed

[22] YOR Document 2017-0083-345-1.
[23] YOR Document 2017-0083-166-1, Appendix B, through YOR Document 2017-0083-167-1.
[24] YOR Document 2017-0083-218-1, pg.9 (R2-16).

wetlands. The Proponent has committed to ongoing active water treatment infrastructure and capacity being retained on-site until passive water treatment systems achieve performance objectives.[25]

[25] YOR Document 2017-0083-158-1 inclusive through YOR Document 2017-0083-167-1.

Table 14: Conceptual Schedule of Completion of Phased Implementation of Constructed Wetland Treatment System

Phase		Time Required	Available Time in Operational/ Closure Schedule	Earliest Period Applicable
1a	Information gathering and site assessment	3 – 6 months (completed)		Pre-operational
1b	Conceptual design and sizing			Pre-operational, once water quality predictions are available
2	Off-site bench-scale testing and optimization	3 – 6 months	2.5 years until start of construction, and another 1.5 years during mine construction	Pre-operational, once water quality predictions are updated
3	Off-site pilot-scale testing and optimization	8 – 16 months		After Phase 2 is complete
4	On-site demonstration scale implementation and monitoring	2 – 5 years	10 years during mining operation	Operational period
5	Full-scale implementation – North CWTS	1 year for construction and 2 years for commissioning	2 years during transition closure as pit is filling for construction; 10 years during transition closure as pit finishes filling for commissioning	After size refinement in Phase 4

Effects Characterization

PROJECT WILL GENERALLY DEGRADE WATER QUALITY

The Proponent's predicted changes to water quality are provided in the 2018 WQM report. Based on these predictions, the Project is generally expected to result in permanent changes to

water quality that are characterized by an increase in concentrations of COPIs above current background levels:

- In South Creek during construction due to the diversion of Fault Creek into the South Creek drainage, and a return to near baseline levels once the Fault Creek diversion is removed during active and transition closure phases;
- In Geona and Finlayson Creeks, where water is released from the site via the Lower WMP during operations (due to COPI loadings increasing as the ABM pit is excavated); and
- In Geona and Finlayson Creeks during active closure, as a result of draindown from the Class A and Class B Storage Facilities.

In contrast, COPI concentrations in Geona and Finlayson creeks are expected to be comparable to or below baseline values during construction, due to the diversion of Fault Creek to the South Creek drainage, and dilution from discharge of the ABM pit dewatering.

CONCENTRATIONS OF SOME COPIS WILL EXCEED WATER QUALITY OBJECTIVES

The EC compared the Proponent's water quality predictions to proposed WQOs at three downstream locations: Geona Creek (KZ-37) and upper and lower Finlayson Creek (KZ-15 and KZ-26, respectively). With all of the proposed mitigation measures considered, predicted concentrations of all COPIs are below their proposed WQOs at the receiving environment locations, with some exceptions.

The exceptions include intermittent exceedances for nitrate during active closure, and copper during the Transition closure phase. In the case of copper, exceedances are characterized in the 2018 water quality model report as infrequent (one or two months of the year), with a maximum concentration of 1.5 times the proposed WQO during the Transition closure phase in Geona Creek in all precipitation scenarios. Elevated copper levels in surface water during the Transition closure phase are attributed to loadings in seepage, assumed to be from liner defects from the Class A Storage Facility. Concentrations of copper decrease after closure, when water from the ABM Lake flows to Geona Creek, creating extra dilution.

Overall, YESAB is comfortable with the model and the input assumptions for each of the Project phases. To reduce uncertainties and improve confidence, the Proponent has also provided model results for wet and dry scenarios (one in 50 [1/50] wet year, and one in 10 [1/10] dry year, respectively), which indicate that the predicted changes in water quality in the South, Geona and Finlayson creeks would remain within the general spatial boundaries in the "average" scenario.

UNCERTAINTY OF PREDICTIONS

The Executive Committee recognizes that there are important uncertainties in the model that limit confidence in long-term predictions. Should Project design alter over time, then the predictions could overestimate or underestimate actual effects.

The effects characterization is contingent on the premise that mitigation measures proposed by the Proponent are consistent with best practices, will function as proposed, and modelling used

to support the effects characteristics is sufficiently robust. Given the permanence of potential adverse effects on water quality post-closure, uncertainties in the model assumptions that could affect the significance determination warrant special consideration and should continue to be refined over the life of the Project. These uncertainties, identified during the Screening, include:

- Geochemical source terms for the Class A and B WRSAs, in which acid conditions are expected to develop over time;
- Treatment performance of Constructed Wetland Treatment Systems for COPIs, especially if acidic conditions occur over the long-term;
- Water management system capture efficiency of seepage from under the Class A WRSA during all relevant Project phases and post-closure;
- Short- and long-term efficacies of the in situ ABM pit water treatment;
- Long-term performance of Class A Storage Facility liners to prevent mine-affected seepage from entering the groundwater system and discharging to Geona Creek, bypassing the CWTS; and
- Long-term performance of Class A and Class B Storage Facility engineered covers to effectively reduce infiltration into and seepage out of the facilities

Significance Determination

The effects characterization for water quality primarily considers increased concentrations of COPI above background levels and above proposed water quality objectives.

SOUTH CREEK

EFFECTS ARE LIKELY

Effects are likely to occur during construction and operation, are limited in spatial extent, and are reversible once the Fault Creek diversion has been removed. Water concentrations are expected to return to near baseline conditions post-closure.

EFFECTS ARE ADVERSE

The effects are adverse since COPI concentrations will increase above background, but are not expected to exceed proposed water quality objectives.

EFFECTS ARE NOT SIGNIFICANT

The effects are not significant because they are reversible, and any changes to water quality that remain below water quality objectives are not expected to limit other water use in the drainage. This is because no other activities which introduce changes to surface water chemistry are expected to occur in the drainage.

GEONA AND FINLAYSON CREEKS

EFFECTS ARE LIKELY

Effects are likely to occur during all Project phases, are local in spatial extent, and are permanent – although the magnitude of effects vary over the life of the Project.

EFFECTS ARE ADVERSE

The effects are adverse since COPI concentrations will increase above background and may sporadically exceed proposed water quality objectives during closure.

EFFECTS ARE SIGNIFICANT

The effects are significant during the operations and closure phases, due to increases in water concentrations of COPIs relative to background, and intermittent failures to meet water quality objectives. While proposed mitigation measures largely reduce the intermittent exceedances of water quality objectives, restrictions on water use in the drainage could occur post-closure due to the permanence of effects on water quality. Uncertainty of the efficacy of Proponent mitigation measures increases the risks associated with predicted water quality objective exceedances.

Recommended Mitigations

ONGOING CHARACTERIZATION OF WASTE MATERIALS AND WATER QUALITY MODELLING

Additional mitigation measures that focus on preventing acidic conditions from developing within the Class A and Class B Storage Facilities should be implemented, and should include ongoing characterization of ARD waste materials, geochemical modelling and effective in situ monitoring of water quality and quantity in the Storage Facilities.

1) Geochemical modelling shall be revised during licensing and operations to inform detailed design of the cover systems, with the aim of reducing acid production and COPI loadings from storage facilities.

CONSTRUCTED WETLAND TREATMENT SYSTEM

The 2018 water quality model-estimated input COPI concentrations were all below their respective WQO, but were not consistently near background levels. Additional improvements in water quality may be expected from the CWTS and this can be confirmed during pilot testing. In the 2018 WQ model report, the Proponent states that, at present the CWTS may be viewed as providing polishing treatment and redundancy to the closure plan. As with other mine sites in Yukon, a reclamation and research program will be required as part of closure planning, which will include the need for demonstration-scale testing. Until the test plots demonstrate that the flow rates and COPI loadings can be adequately treated, alternative treatment technologies will be required.

2) Additional treatment options shall be implemented if the proposed CWTS cannot be demonstrated to reduce COPI concentrations to background levels consistently.

Recommended Monitoring

Due to uncertainties regarding water quality and the high societal value placed on water quality, the Executive Committee recommends, under s.110 of YESAA, that monitoring take place.

CLASS A AND B STORAGE FACILITIES COVER INSPECTIONS AND PERFORMANCE MONITORING

Covers can degrade over time, and this can affect their performance. Reduced performance can result in increased volumes of contact water, and can ultimately affect the quality of water

released from the site to the environment. Less-than-ideal performance of the low permeability covers on the Class A and Class B Storage Facilities and/or the liners can lead to increased loadings of acidity and COPIs to the proposed CWTS, and ultimately to Geona and Finlayson creeks. To address this the EC recommends:

A. Water quality monitoring of COPIs shall be implemented as early as possible beneath storage facilities and beneath their respective covers. Monitoring shall continue through operations and closure phases.

5.2 Water Quantity

Summary & Conclusion

The Executive Committee has determined that the Project will not result in significant adverse effects to water quantity. While changes to water quantity will occur in South Creek and the Geona and Finlyason Creek watersheds, Project effects are sufficiently eliminated, reduced or controlled through the mitigations proposed by the Proponent.

Importance of Water Quantity

CULTURAL AND ECOLOGICAL IMPORTANCE OF WATER QUANTITY

As stated in Section 5.1, water is highly valued by Yukon residents, First Nations and communities. The availability of water is a defining factor for different human water uses (spiritual purposes, consumption, domestic uses, commercial and industrial activities) and ecological water uses (lotic and lentic environments, aquatic habitats, aquatic communities). Anthropogenic flow alterations are a primary contributor to the degradation of aquatic ecosystems, the loss of freshwater biodiversity, and restricted water uses for other human needs. As stated in Yukon's Water Strategy and Action Plan,[26] "water is vital to life: it is a necessity for our natural environment, biodiversity, and economy. It is used for drinking and waste disposal. Water provides habitat for fish, plants and animals and supports basic life."

Groundwater is an important contributor to surface water flows, in particular in headwater systems such as in the Project area. Therefore, changes to groundwater flows may ultimately affect surface water quantity. Discussions with local Kaska citizens during consultation (Project Proposal Section 2) confirmed that headwater streams, including Geona Creek, hold an important value within their Traditional Territory. Headwater values are documented in *Kaska Dena Management Practices: Kaska Dena Land Use Framework*[27] as follows:

[26] Government of Yukon. Water for Nature, Water for People. Yukon's Water Strategy and Action Plan. Available online at: www.env.gov.yk.ca.2014.
[27] Dena Kayeh Institute. Kaska Dena Management Practices: Kaska Dena Land Use Framework. 2010.

> Headwater and source watersheds are important to maintain water quality and support the flow, storage, and hydrology of the adjacent watersheds. In addition, these watersheds tend to have a higher density of Kaska sites, hunting areas, traditional uses, and Kaska values. The watersheds also generally have high ecological values.

Legislative & Management Setting

The legislative and management setting for the Project with regard to water quantity is set out in the *Yukon Waters Act* and *Quartz Mining Act*, and the federal *Fisheries Act*. The Project is located within the Kaska Dena First Nation (Ross River Dena Council and Liard) Traditional Territory. Although the Ross River Dena Council and Liard are not signatories to the Yukon First Nation Final Agreements, consultation is required under the *Yukon Environmental and Socio-Economic Assessment Act* (YESAA).

YUKON WATERS ACT

Direct water use, diverting a water course, and altering the flow, direction or storage of a watercourse are common triggers for a water licence (WL) under *Yukon's Waters Act* (*Waters Regulation*). The Yukon Water Board issues WLs and can set limits to direct water use and/or the deposit of waste to water to achieve their objective under the *Waters Regulation* to "...provide for the conservation, development, and utilization of waters in a manner that will provide the optimum benefit from them for all Canadians and for the residents of the Yukon in particular."

YUKON QUARTZ MINING ACT

The Project will require a Quartz Mine Licence (QML) issued by Yukon's Department of Energy, Mines and Resources (YG EMR) under section 135 of the *Quartz Mining Act*.

- QMLs consider and address mine development, operation plans and environmental protection plans for the development, operation and decommissioning of a mine site.
- The Project will require a Phase II QML (for operations). The QML will set out requirements for routine monitoring and reporting, and will include pertinent adaptive management plans for different aspects of the mine to address their potential impacts.

YG EMR produced *Yukon Mine Site Reclamation and Closure Policy for New Mines* in 2006. The policy applies to hard rock (quartz) mines in Yukon that are on mineral claims, leases and Crown grants developed pursuant to the *Quartz Mining Act*. The Policy does not specifically address water quantity but rather sets out a goal for mine site reclamation and closure to "ensure a government-approved reclamation and closure plan, prepared by the mine operator, to return the mine site to a viable and, wherever practical, self-sustaining ecosystem, is in place prior to mine development".[28] The Policy also states that a Reclamation and Closure Plan should "fully protect public and environmental health and safety and ensure that any potential

[28] YG Energy, Mines & Resources. Yukon Mine Site Reclamation and Closure Policy. January 2006.

discharges during mine operation and following mine closure will be managed to prevent harm to the receiving environment or to the public" and include "methods for protection of water resources during and after mine closure".[29]

Context

FACTORS AFFECTING WATER QUANTITY

Water quantity in a watershed is controlled by the physical characteristics of the watershed (land use, soil type, geology, vegetation, slope, and aspect), interactions with groundwater (seeps, recharge rates, shallow and deep groundwater flow patterns) and climate (precipitation, timing of freeze-up and thaw, climate change). Changes to any of these characteristics, whether introduced by natural or anthropogenic activities, can affect water quantity in the drainage.

- Short-term and seasonal variabilities are influenced by weather patterns such as precipitation events, and seasonal freeze and thaw periods;
- Longer-term variability may be caused by changes to climate, which effect weather patterns and in some cases ground water systems (changes to permafrost conditions); and
- Permanent changes may be caused by specific events, such as landslides and seismic activity, and by interactions with nature, such as beaver activity

Existing Conditions and Trends

CLIMATE

The Project is located on the east side of the divide between the Pelly River and Liard River drainage basins.[30] The Project infrastructures and the deposit lie within a valley that drains to the north through Geona Creek into Finlayson Creek and Finlayson River, and to the south through South Creek into the North River/Lakes system. Both the north and south drainages are part of the Liard basin.

In the Project area, most precipitation falls in summer (July to September) and is relatively low through the winter. Site discharge hydrographs are typically characterized by high spring snowmelt-driven flows, lower summer flows sustained by groundwater inflows, and periodic rainfall events followed by large autumn rainfall events. Winter flows are very low as a result of cold temperatures, freezing conditions and the gradual depletion of groundwater storage.[31]

[29] Ibid.
[30] YOR Document 2017-0083-112-1 inclusive through YOR Document 2017-0083-115-1.
[31] YOR Document 2017-0083-308-1 inclusive through YOR Document 2017-0083-311-1.

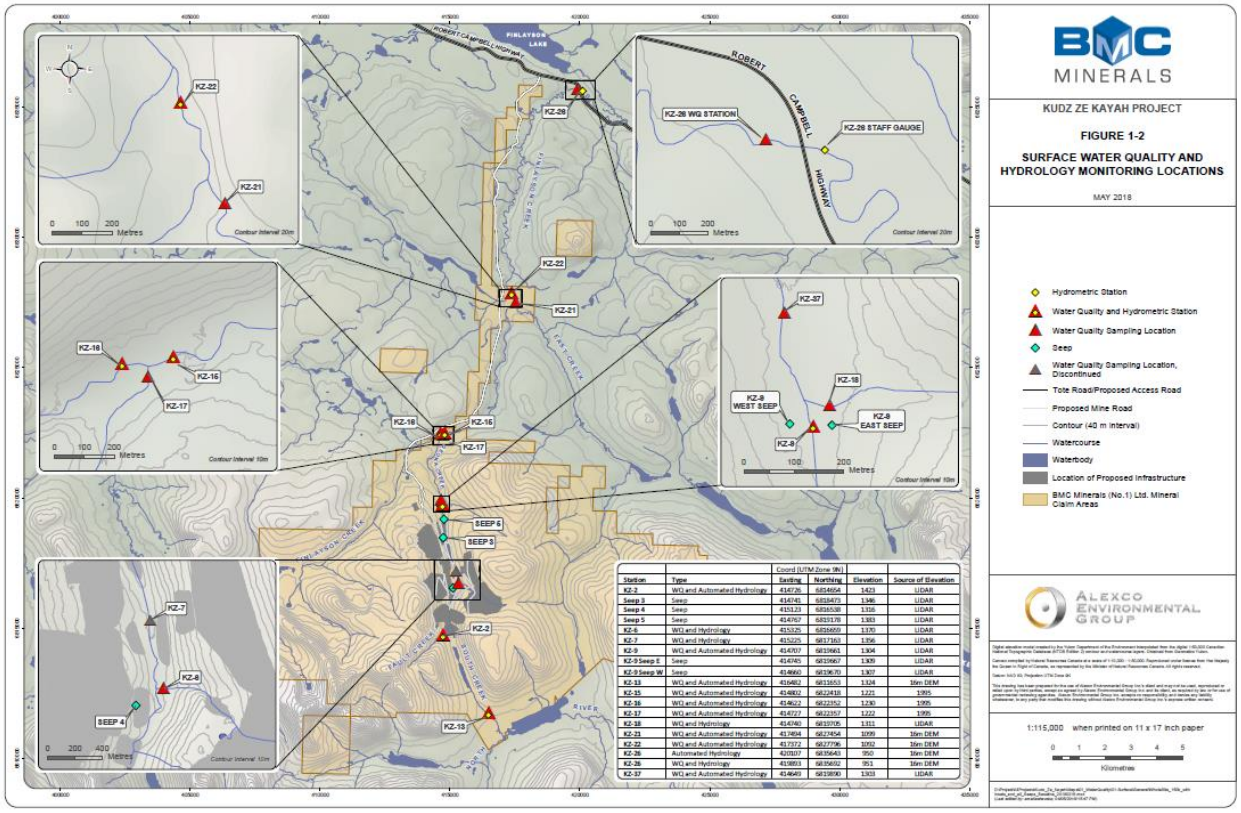

Figure 5: KZK Surface Water and Hydrology Stations (From 2018 Water Baseline)

CLIMATE CHANGE

Longer-term changes are expected to occur as a result of climate change. Long-term climate change trends are expected to manifest in an increase in short-term sudden weather events that could be relevant to the Project during operations and post-closure.[32] Climate change trends indicate that average temperature across Yukon is projected to increase by more than 2°C over the next 50 years, while winters are projected to warm faster than any other season. In addition, annual precipitation (rain and snowfall) is projected to increase from 10 percent to 20 percent over the next 50 years in Yukon, and snowfall is projected to arrive later in the fall and become more variable over the winter, with periods of little snow and intense snowfall events likely becoming more common. The anticipated results from climate change suggest that there will be changes to the timing, intensity and duration of high and low flow periods, which need to be considered in the Project's water management plan.

BIOLOGICAL FACTORS

Beaver activity has been observed in the Geona and South creeks and has resulted in the formation of localized lentic environments within these creek systems.

[32] Research Northwest and Morrison Hershfield. 2017. Yukon 'State of Play': Analysis of Climate Change Impacts and Adaptation. November 14, 2017.

SOUTH CREEK DRAINAGE[33]

South Creek is approximately 5 km long and originates upstream of two small ponds located at the watershed divide between South Creek and Geona Creek. The South Creek drainage has been modified by historical beaver activity. The creek flows south through two small ponds and then through a wetland area before entering the North River. A well-defined channel connects the outlet of the second pond to the North River.

GEONA CREEK AND FINLAYSON CREEK DRAINAGES[34]

Fault and Geona creeks are headwaters to Finlayson Creek. Fault Creek is a mountainous alpine stream confined by a narrow valley, approximately 2 km in length. Fault Creek is characterized by a highly braided reach before it converges with Geona Creek near its headwaters. Geona Creek is approximately 8 km in length, originating on the north side of the watershed divide of South Creek and Geona Creek. Geona Creek's headwaters consist of a series of small ponds that flow north for approximately 2 km before eventually entering a well-defined channel. This channel flows north for approximately 6 km through a broad valley until it eventually converges with Finlayson Creek. A few small ponds are found intermittently throughout Geona Creek, and are suspected to be the result of historical beaver activity.

East Creek is another tributary to Finlayson Creek that traverses the Project area. Originating at the southeast end of the property, East Creek is approximately 18 km in length. The creek contains a small pond midway through its reach and flows into Finlayson Creek, approximately 7 km downstream from the confluence with Geona Creek.

Finlayson Creek in its entirety is approximately 38 km in length, with 28 km of its reach located downstream of the Project's potential zone of influence. Finlayson Creek originates west of the Project area, and flows northeast until eventually draining into the Finlayson River downstream of its crossing of the Robert Campbell Highway.

SURFACE WATER - GROUNDWATER INTERACTIONS

Baseline hydrogeologic characterization of the Project area was summarized in Appendix D-3 of the Project proposal.[35] Two hydrogeologic units are present in the Project area: bedrock and overburden. Both units display similar seasonal trends in groundwater levels: groundwater levels rise during spring and summer (from May through September) and decrease during fall and winter (October through April), with a typical range of variation between two and five metres.

The groundwater contribution to surface waters is highest during winter baseflow conditions. This is when the relative contribution of groundwater seeps and other sources to the area creeks peak under winter low surface flow conditions. A number of groundwater seeps have been identified across the Project area in the Geona Creek drainage, five of which were characterized as part of the baseline water quality report.[36] The proposed ABM open pit itself is

[33] YOR Document 2017-0083-296-1 inclusive through YOR Document 2017-0083-304-1.
[34] Ibid.
[35] YOR Document 2017-0083-085-1 inclusive through YOR Document 2017-0083-091-1.
[36] YOR Document 2017-0083-296-1 inclusive through YOR Document 2017-0083-304-1.

located in the Geona Creek valley floor in a natural groundwater discharge area with a shallow groundwater table, local artesian conditions in the deeper bedrock aquifer, and vertical upward hydraulic gradients.[37]

WATER QUANTITY AND OTHER ACTIVITIES

There are no anthropogenic activities expected to occur in the Project area that would change water quantity other than the Project itself.

Project Design

The Project will be situated in the upper half of the Geona Creek watershed. Structures such as the open pit and water management ponds will be situated directly in the creek and floodplain. Overall the Project's water balance in the Geona Creek basin is positive and water will need to be released during all Project phases.

PROJECT INFRASTRUCTURE RELEVANT TO WATER QUANTITY

Key mine infrastructure that will directly affect surface flows include the following mine facilities and processes. Each of these facilities and processes have been included as mine aspects in the 2018 Life of Mine Water Balance Model[38] (2018 LOM WBM):

- **Process Plant**: Located on the western hillside of Geona Creek between the Class A and Class B Storage Facilities. Surface runoff is collected in the Process Plant Site Sump and pumped to the WTP.
- **Open Pit and Pit Rim Pond**: Situated in the Geona Creek bed, downstream of Fault Creek. During the construction phase, overburden dewatering is pumped to the Pit Rim Pond prior to discharge to Geona Creek.
- **Class A and B Storage Facilities and Collection Ponds**: Located on the western hillside of Geona Creek. Non-contact runoff is directed around the facilities to Geona Creek. Contact runoff is directed to each facility's respective collection ponds during operations and active closure. Runoff from the reclaimed facilities is directed to Geona Creek during transitional and post-closure.
- **Class C Storage Facilities and Collection Pond**: Located on the east side of Geona Creek. Runoff and toe discharge are collected in the Class C Collection Pond, which drains to Geona Creek.
- **Overburden Stockpile and Collection Pond**: Located on the eastern side of Geona Creek, to the north of the Class C Storage Facility. Surface runoff from the facility will be routed to the Overburden Collection Pond and conveyed to Geona Creek.
- **Run of Mine (ROM) Pad, Low Grade Ore (LGO) Stockpile, and Sump**: Located on the western side of Geona Creek, at the base of the Class B Storage Facility and adjacent to the Process Plant. Surface runoff and toe discharge from the ROM Pad and LGO Stockpile will be collected in a sump and pumped to the WTP. By the start of active closure, the ROM and LGO materials will be removed and the pad will be covered with an extension of the Class B Storage Facility HDPE liner and cover.

[37] YOR Document 2017-0083-027-1.
[38] YOR Document 2017-0083-344-1.

- **Upper Water Management Pond (UWMP)**: Located in Geona Creek upstream of the Lower Water Management Pond. Site contact water will be routed to the UWMP. The UWMP will also receive runoff from diverted and undiverted areas, and losses from the Class C Collection Pond and Collection Ditch. Excess UWMP volumes will be pumped to the LWMP.
- **Lower Water Management Pond (LWMP)**: Located in Geona Creek downstream of the UWMP. Water from the UWMP and the WTP will be pumped to the LWMP. The LWMP will also receive runoff from undiverted areas. LWMP water will be discharged to Geona Creek (immediately downstream of KZ-9) and to Finlayson Creek (at KZ-15). The Proponent has proposed that discharge flows from the LWMP will not exceed specific natural streamflow to discharge flow ratios in Geona and Finlayson creeks.
- **Water Treatment Plant**: The WTP will receive process water and contact water. Contact water will come from the Class A and B Facility Collection Ponds/seepage collection systems, ROM pad and LGO Stockpile sump, Pit Rim Pond and Process Plant Sump. Treated effluent from the WTP will be discharged to the LWMP during operations and directly to Geona Creek during active and transitional closure.
- **Surface Water Diversions**: A number of diversion channels will be used to capture and convey non-contact runoff around site infrastructure. All diversion channels will be decommissioned at the start of active closure.

    - Diversions to South Creek: South Diversion Channel, Fault Creek Diversion Channel, Open Pit South Diversion Channel, and Upper Access Road Diversion Channel (upslope of the Open Pit and south portions of the Class B Storage Facility);

    - Diversions to Geona Creek: East Diversion Channel, Tote Road Diversion Channel (upslope of Class A Storage Facility), Upper Access Road Diversion Channel (upslope of Class A and B Storage Facilities); and

    - Diversions to the UWMP: Open Pit North Diversion Channel, Tote Road Diversion Channel (upslope of Class B Storage Facility)

- **The North and South Wetlands**: Two constructed wetland treatment systems (CWTS) will be located within the Geona Creek drainage. The systems will be constructed and fully functioning by the start of post-closure. The South Wetland will receive surface overflow from the ABM Pit. Water from the South Wetland will flow to Geona Creek and into the North Wetland. The North Wetland will receive water from the South Wetland and runoff from the covered Class A, B, and C Storage Facilities. Water from the North Wetland will flow to Geona Creek.

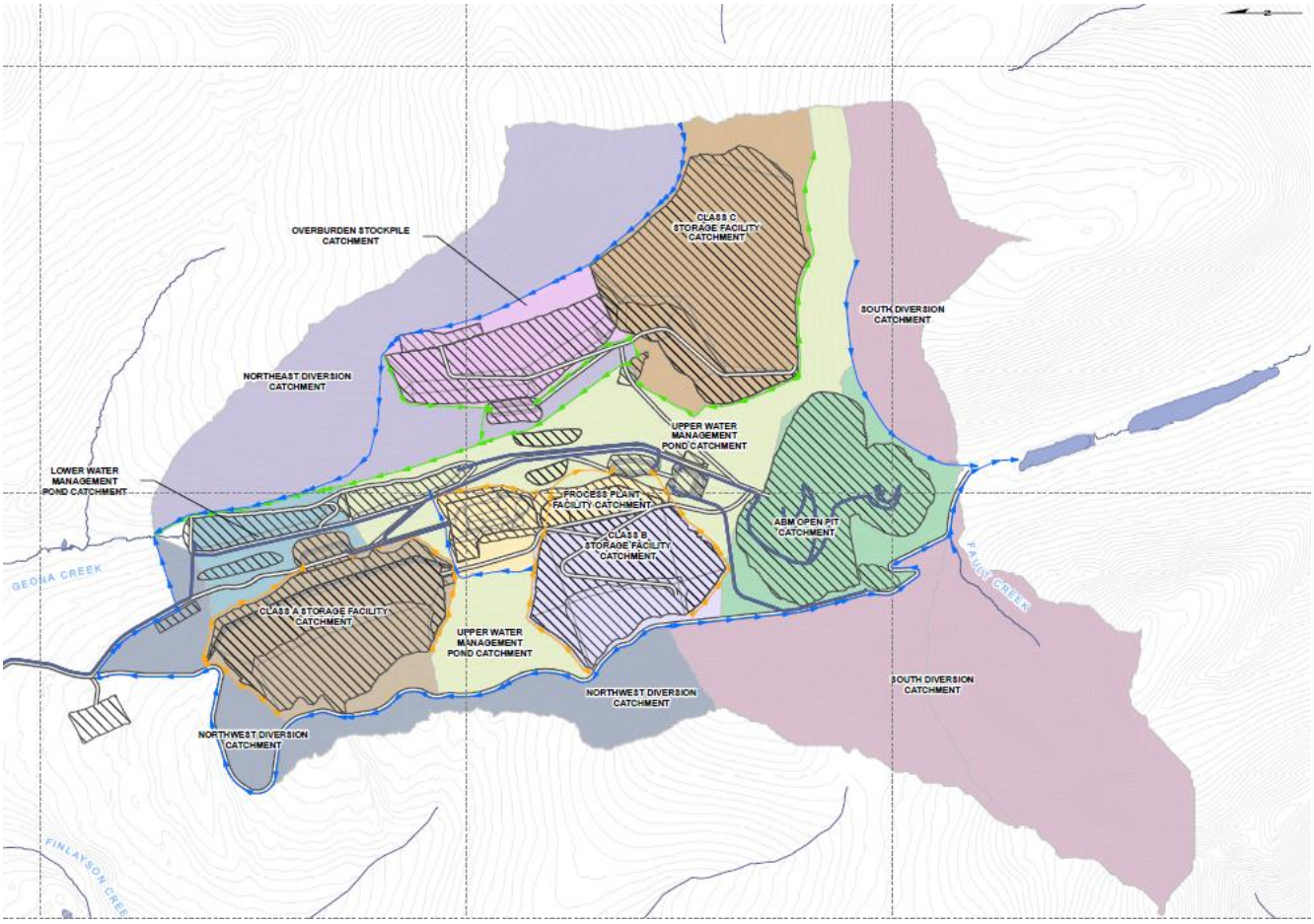

Figure 6: KZK Project Area Subcatchments (From Project Proposal Section 4.10 Water Management)

PROJECT ACTIVITIES BY PROJECT PHASE

Project activities that are expected to affect water quantity in the South Creek, Geona Creek and Finlayson Creek drainages will change over the various phases of the Project.

SOUTH CREEK DRAINAGE

- During Construction:
  - Re-direction of Fault Creek and a portion of the upper Geona Creek catchment to South Creek.
- During Operations:
  - Flows to the south from the diversions from Fault Creek and south/southwest noncontact diversions to the South Creek drainage.
- During Closure:
  - Fault Creek will be re-directed back to the Geona Creek watershed and contribute to filling the ABM open pit.

GEONA CREEK AND FINLAYSON CREEK DRAINAGES

- During Construction:

  - Re-direction of Fault Creek and a portion of the upper Geona Creek catchment to South Creek;
  - Development within upper Geona Creek watershed including construction of the UWMP and LWMP, site water diversion ditches and development/commissioning of water treatment facilities;
  - Dewatering of the ABM open pit including capture and pumping of volumes of water contained within a shallow water aquifer in the overburden to a sump.
- During Operations:
  - Discharge of water from the LWMP into Geona Creek at a maximum ratio of 3:1 (Creek Flow: Discharge);
  - Discharge from the LWMP via a pipeline into Finlayson Creek at a maximum ratio of 2:1 (Creek Flow: Discharge);
  - Discharge into Geona Creek from ditches and diversions;
  - Ongoing dewatering of the ABM open pit and underground workings.
- During Closure:
  - Dewatering of the ABM open pit will cease and the ABM open pit will be allowed to fill;
  - Re-direction of Fault Creek to the Geona Creek watershed via the ABM open pit;
  - Cessation of direct discharge to Finlayson Creek from the LWMP; and
  - Site water directed through the North and South CWTSs.

PROPONENT MITIGATION MEASURES

Proponent Mitigation measures with regard to water quantity minimize changes to flow volumes and flow timing. Because the Project's water management plan will affect two drainages, mitigation measures also attempt to minimize flow exchanges across drainage boundaries.

Table 15: Proponent's Proposed Mitigation Measures for Water Quantity

Potential Effect	Project Phase	Proposed Mitigation Measures
Changes in surface water quantity from diversions and dewatering that result in increased flows compared to baseline	Construction and Operation	• Diversion of Fault Creek to South Creek • Diversion of Geona Catchment above Project footprint to Geona Creek at KZ-9 (North Diversions)
Changes in surface water quantity from diversions and dewatering that result in decreased flows compared to baseline		
Changes in surface water quantity from water management and discharge	Operations	• Diversion of Fault Creek to South Creek • Diversion of Geona Catchment above Project footprint to Geona Creek at KZ-9 (North Diversions) • Site runoff captured and managed in the same drainage (Geona Creek and Finlayson Creek drainages)
Changes in surface water quantity as a result of flooding of ABM open pit at closure and ABM lake formation	Closure	• Removal of diversions to return; baseline catchment boundaries • Installation of low permeability covers with natural vegetation to approximate natural cover and runoff
Changes in surface water quantity as a result of water management and discharge	Closure	• Removal of diversions to return; baseline catchment boundaries • Installation of low permeability covers with natural vegetation to approximate natural cover and runoff

Effects Characterization

PROJECT WILL ALTER LOCAL HYDROLOGY

Local hydrology will be altered by the Project which will involve diversion of natural creeks, water management and storage, and dewatering activities. These activities will largely be associated with the construction, operations and active and transitional closure phases. Over these Project phases, alterations in natural drainage patterns will cause changes to runoff volumes draining to each affected drainage basin (South Creek, Geona Creek and Finlayson Creek). Dewatering activities associated with the underground and open pit developments will increase the amount of groundwater reporting to the surface. The extent of the changes related to dewatering activities will depend on other on-site water uses, such as water used for mining and ore processing, which may reduce the need to release water. The natural annual flow cycles will be altered by dewatering and water management (water storage and treatment) in general. Local changes to natural flow regimes are expected after closure, due to changes in surface features at the Site, including waste rock and tailings storage, constructed wetland features which will cause permanent changes to surface drainage, and the flooded pit which will cause permanent changes to groundwater flows.

Adverse effects from changes to water quantity include physical risks, such as increased risk of erosion, and changes to stream morphology caused by alterations to stream flow volumes and, by extension, streamflow velocities. Changes to streamflow volumes that remain within the natural range of variability would not be expected to cause erosion or adversely affect the drainages' stream morphology. The potential for biological effects (i.e. on fish and fish habitat) from flow alterations depends on the magnitude, timing and duration of the alterations, as well as the spatial extent of the changes and the habitats encountered.

WATER BALANCE PREDICTION RESULTS

Potential effects of the Project on water quantity have been estimated in the 2018 Life of Mine Water Balance Model (2018 LOM WBM) report, which was prepared in response to comments received during the Seeking Views phase of Screening (IR3-1). The revised 2018 LOM WBM combines the on- and off-site into one water balances model.

YESAB is comfortable that the water balance analyses and scenarios evaluated, including the completed sensitivity analyses, have been completed in sufficient detail to adequately characterize effects and support the determination of significance of adverse effects on water quantity. The 2018 LOM WBM is also considered sufficient to support the effects assessment for water quality and aquatic resources. YESAB understands that more detailed assessment of water balance at the Site will be required during detailed design and licencing, before finalizing the design of engineered structures such as diversions, collection ponds, the LWMP and UWMP, the WTP and the North and South CWTSs.

Overall, the Project will result in both increased and decreased flows in Geona Creek, Finlayson Creek and South Creek over the course of the Project, but the changes from baseline after closure are expected to be minimal. After the Fault Creek Diversion is removed, the drainage areas reporting to each of the drainage basins will be comparable to baseline.

CHANGES TO SOUTH CREEK HYDROLOGY

Changes to flows in lower South Creek above its confluence with North Creek (Station KZ-13, see Figure 5) over the life of the Project are presented in Figure 5.9 of the 2018 LOM WBM (reproduced herein).

During construction and operations, predicted flows increase approximately 50 percent (35 L/s) on an average annual basis, due to the Fault Creek Diversion and diversions around the Open Pit into the South Creek Drainage. Fisheries and Oceans Canada[39] expressed concerns about increased flows to South Creek, and adverse impacts on aquatic habitat during construction and operations, followed by decreased flows during active and transitional closure phases.[40] In response to these concerns, the Proponent acknowledged that flow monitoring in South Creek will need to be implemented as part of the Project: "This does flag the fact that hydrology in South Creek, during the active and transition closure phase, will need to be monitored closely. Monitoring during the operations phase may allow for validation of the flow predictions in advance of the Fault Creek re-diversion."[41] Potential for adverse effects to fish and fish habitat are further discussed in Section 5.3.

From active through post-closure, flows in South Creek are predicted to be lower than baseline flows by 5 L/s (6 percent), due to the influence of the Open Pit on groundwater flows.

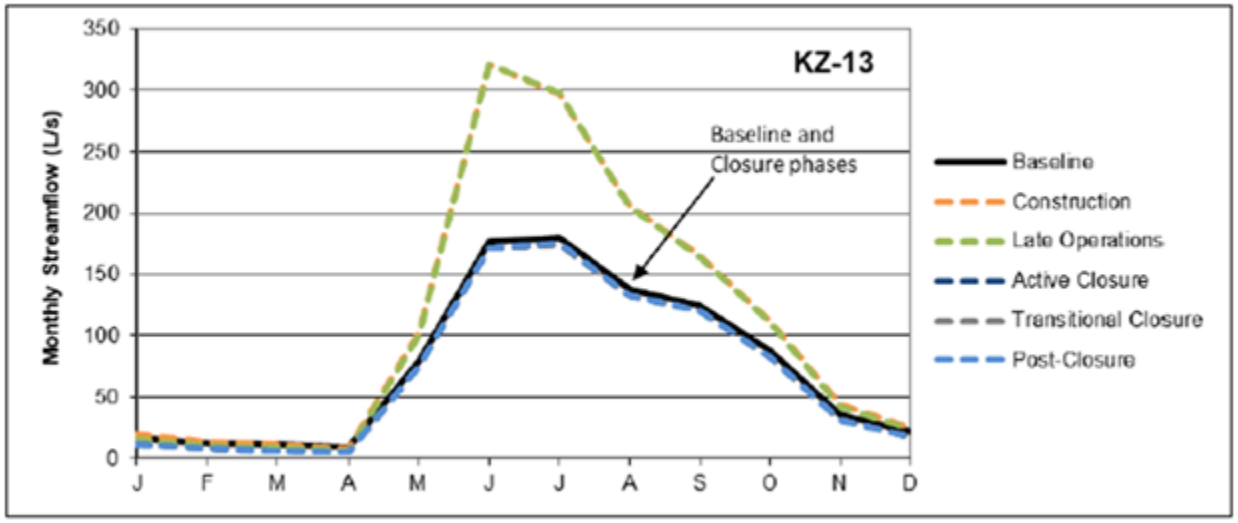

Figure 7: Predicted Flow at KZ-13 by Project Phase (from 2018 LOM Report, Figure 5.9)

CHANGES TO GEONA CREEK AND FINLAYSON CREEK HYDROLOGY

Changes to flows in Geona Creek at Stations KZ-9 and KZ-37, and in Finlayson Creek at Stations KZ-15 and KZ-26 (see Figure 5), are presented in Figures 7, 8, 9, 10, and 11, respectively (from 2018 LOM WBM, reproduced herein). These stations are described in Table 16 below:

[39] YOR Document 2017-0083-268-1.
[40] YOR Document 2017-0083-293-1, pg.36-51
[41] Ibid., pg. 49.

Table 16: Water station location descriptions

Station	Location Description
KZ-9	Geona Creek: Immediately downstream of the Project
KZ-37	Geona Creek: Located north of the Upper Water Management Pond. KZ-37 represents the beginning of the receiving environment, and includes treated flows reporting from the mine site upstream, clean non-contact water conveyed around mine infrastructure, and flow from East Creek, a small tributary located on the east side of Geona Creek, just upstream of KZ-37.
KZ-15	Finlayson Creek: Located immediately downstream of the Geona Creek confluence.
KZ-26	Finlayson Creek: Located in lower Finlayson at the Robert Campbell Highway.

During construction and operations, stream flows will decrease in the Geona Creek drainage compared to baseline, due to the Fault Creek Diversion and dewatering of the Open Pit. The greatest effects on stream flows are during operations, due to active dewatering of the Open Pit, underground workings and flow capture from Project facilities for treatment and release from the LWMP into Geona Creek and Finlayson Creek. Once discharge of mine-site water from the LWMP to Geona Creek (immediately downstream of KZ-9) and Finlayson Creek (at KZ-15) commences, the magnitude of flow reductions is expected to decrease. The average annual decrease in stream flows during construction is predicted to be greatest nearest to the Project at approximately -21 percent at KZ-9, approximately -17 percent at KZ-37, and less than -5 percent at KZ-26 relative to baseline flows.[42] During early and late operations, reduction in annual flows relative to baseline are approximately -65 percent at KZ-9, approximately -25 percent at KZ-37 and less than -5 percent at KZ-26.[43]

During active and transitional closure, the magnitude of decreased flows compared to the operations phase will decrease downstream of the site, due to the decommissioning of the UWMP and LWMP, which will result in increased runoff in the Project area Geona Creek, and due to discharge of water from the WTP directly to Geona Creek upstream of KZ-9. The largest magnitude of effect will be nearest the site (KZ-9) and will decrease with increasing distance from the site. During active and transitional closure phases reductions in annual flows relative to baseline will be approximately -42 percent at KZ-9, approximately -32 percent at KZ-37, and approximately -5 percent at KZ-26.[44]

[42] Figures 5.2, 5.4 and 5.8 from YOR Document 2017-0083-344-1.
[43] Ibid.
[44] Ibid.

During post-closure, average annual stream flows display a minor increase in flow (2 L/s) near the Project area (KZ-9) relative to baseline conditions, due to inter-basin groundwater flows from the South Creek catchment to the Geona Creek catchment. Monthly mean flows differ between post-closure relative to baseline due to differences in the physical aspects of the site, including drainage of water through the reclaimed storage facilities and evaporation from the ABM Pit Lake.

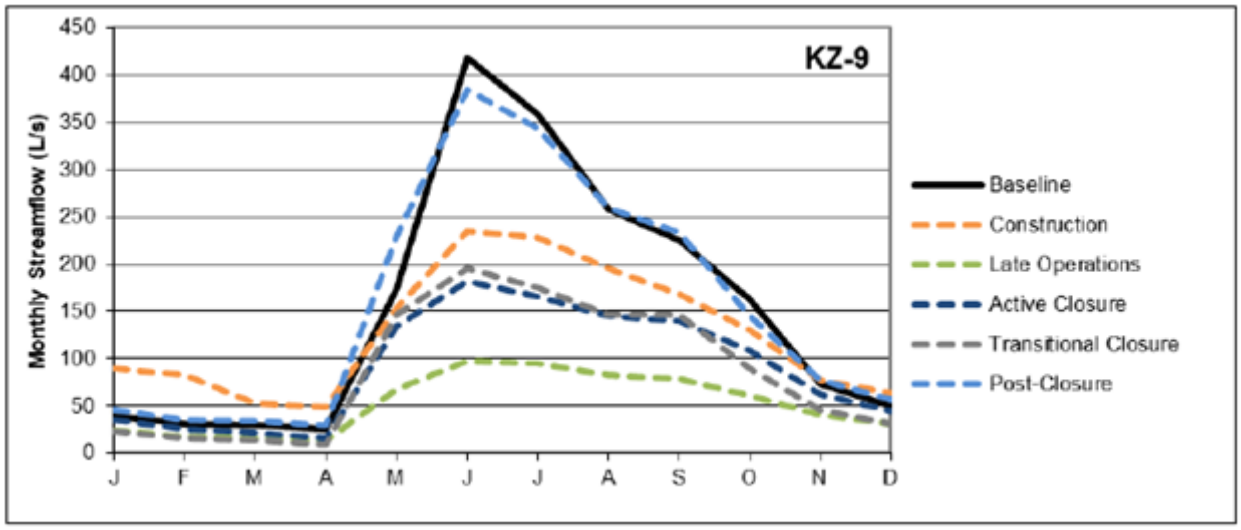

Figure 8: Predicted Flow at Geona Creek immediately downstream of the Project (KZ-9) by Project phase (From 2018 LOM WBM, Figure 5.1)

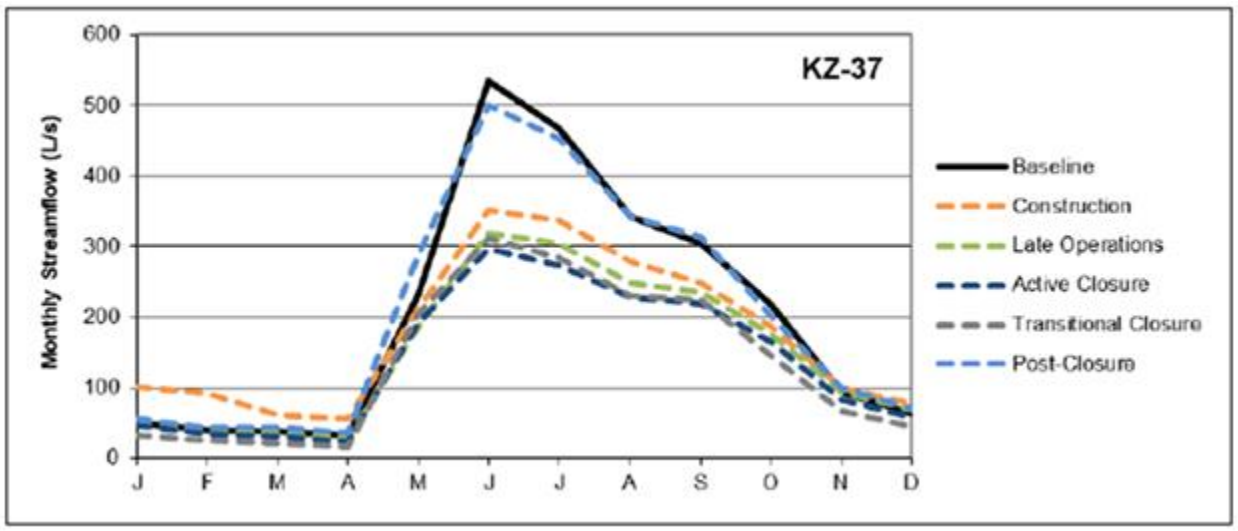

Figure 9: Predicted Flow at Geona Creek immediately upstream of its confluence with Finlayson Creek (KZ-37) by Project phase (From 2018 LOM WBM, Figure 5.3)

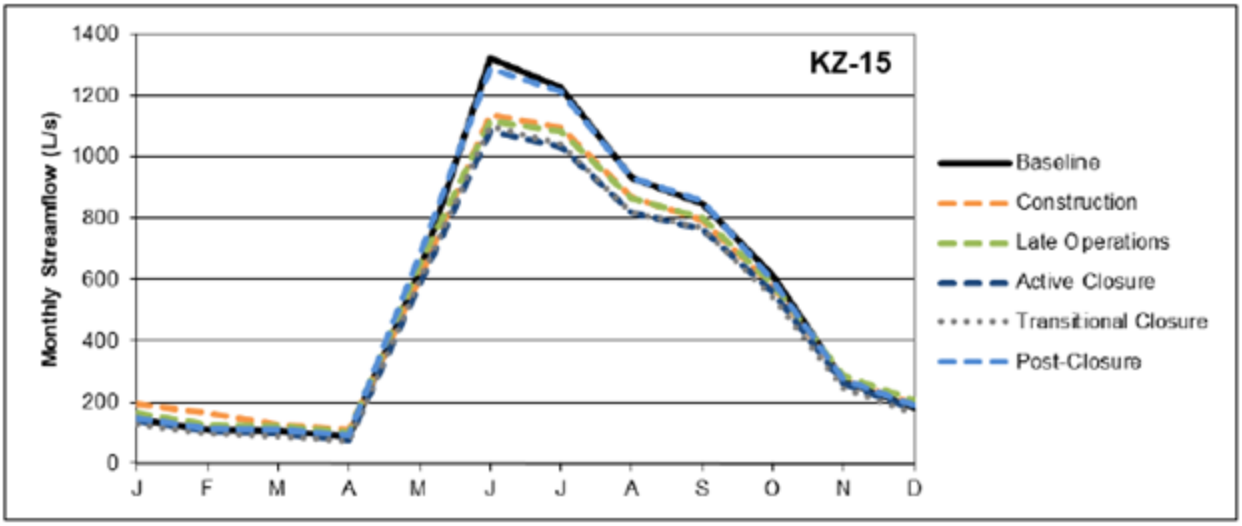

Figure 10: Predicted flow at Finlayson Creek, immediately downstream of its confluence with Geona Creek (KZ-15), by Project phase (From 2018 LOM WBM, Figure 5.5)

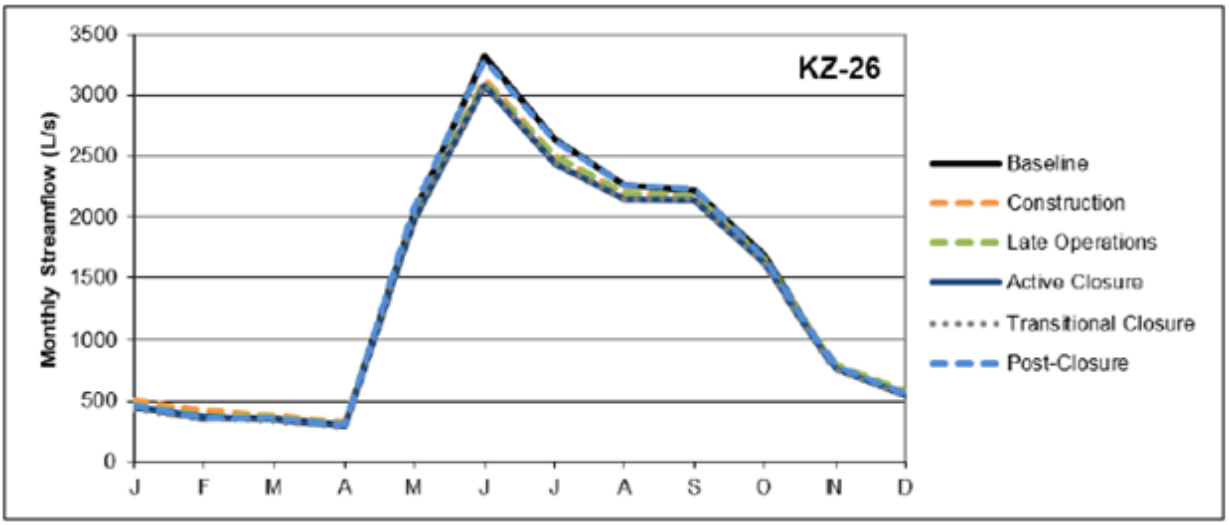

Figure 11: Predicted flow at Finlayson Creek at the Robert Campbell Highway (KZ-26), by Project phase (From 2018 LOM WBM, Figure 5.7)

SENSITIVITY TO CLIMATE AND RUNOFF VARIABILITY

The Proponent assessed the sensitivity of the model in response to YESAB's Information Request IR3-1c[45], stating that "The updated water balance model should include a sensitivity

[45] YOR Document 2017-0083-283-1

analysis."[46] Sensitivity scenarios were developed to assess the simulated flows under wet and dry climates, and different proportions of runoff generated from Project facilities.

CLIMATE SENSITIVITY

Climate sensitivity scenarios were developed by applying wet or dry climates to specific model years: A wet climate condition (1:50 year return period wet climate) and a dry climate condition (1:10 year return period dry climate) was placed into the climate model during each Project phase, resulting in twelve sensitivity scenarios. Results of the sensitivity case simulations were provided as inputs to the water quality model.

The results of the climate sensitivity scenarios demonstrate that the timing of pit filling is sensitive to wet or dry climate conditions during active closure or transitional closure, which leads to the pit filling sooner if wet conditions occur, and later if dry conditions occur.

RUNOFF SENSITIVITY

Runoff sensitivity scenarios were developed by varying the proportion of runoff from modelled facilities relative to the proportion of infiltration: Runoff sensitivity scenarios were developed to simulate a 10 percent decrease and 10 percent increase in runoff from key mine facilities.

Results of the sensitivity scenarios indicate that the volume of water stored in the LWMP was not sensitive to the proportion of runoff from the facilities. Sufficient flows exist in the receiving environment to discharge all water that flows into the LWMP during the spring, summer and fall months, even under the increased runoff scenario. The maximum volume of water held in the LWMP would be less than the design pond volume.

The WTP treatment rates were shown to be sensitive to an increase in runoff, however all predicted treatment rates remained below the design maximum treatment rate. The peak treatment rate predicted by the increased runoff scenario was about 30 percent of the maximum treatment capacity of the Class A treatment circuit.

The water balance model predicts water balance on a month by month basis. Therefore more detailed modelling will need to be conducted during detailed design and licensing to evaluate the effects of short-term events, such as the impact of a rapid melt (e.g. short duration of five to 10 days) combined with rainfall on the proposed water management infrastructure.

EROSION POTENTIAL ASSOCIATED WITH INCREASED FLOWS IN SOUTH CREEK

The Proponent provided a quantitative assessment of the potential impacts of increased flows on erosion, stream morphology and riparian vegetation in response to comments received from YG Environment.[47] The Proponent's analysis was twofold:

- The predicted range of discharge, and by extension streamflow velocities, in South Creek, Geona Creek and Finlayson Creek at key water monitoring stations was compared with the measured range of baseline observations, to evaluate the variability in proposed discharge velocity compared to natural baseline variability; and

[46] YOR Document 2017-0083-283-1.
[47] YOR Document 2017-0083-225-1 (Response to R2-45).

- The expected monthly mean streamflow velocities were modelled using modelled water balance results. Modelled streamflow velocities were then compared to erosion potential and channel stability threshold velocities found in "the velocity-depth-grain size chart, provided by the Natural Resources Conservation Service of the United States Department of Agriculture (NRCS 2007)."[48]

The Proponent determined that the modelled runoff regimes would not cause significant erosion or changes to stream morphology.

Significance Determination

EFFECT ON HYDROLOGY IN SOUTH CREEK

EFFECTS ARE LIKELY

South Creek hydrology *will* be affected during all Project phases, due to underground and ABM Pit dewatering and diversion of surface water (Fault Creek) to the South Creek drainage during construction and operations, and due to permanent alteration (reduction) of groundwater flows caused by the open pit post-closure. Effects will be spatially limited to South Creek and will not extend notably into North Creek.

EFFECTS ARE ADVERSE

The effects of an altered hydrological regime are adverse during construction and operations due to the amplitude of increased stream flows.

EFFECTS ARE NOT SIGNIFICANT

While effects of increased stream flows in South Creek are adverse, the amplitude of change is not expected to inhibit other water uses in the drainage, including aquatic habitat. The effects are limited temporally and will return to near baseline conditions post-closure.

Effects on hydrology in the South Creek drainage are therefore not considered significant during any Project phase.

EFFECTS ON HYDROLOGY IN GEONA CREEK AND FINLAYSON CREEK

EFFECTS ARE LIKELY

Geona Creek and Finlayson Creek hydrology *will* be affected during all Project phases. Hydrology within the Project footprint will be permanently altered by the development of the ABM pit and storage facilities. Stream flows downstream of the Project will decrease during all Project phases. Effects will be spatially limited to Geona Creek and Finlayson Creek. Effects will not be substantially different than baseline in Finlayson Creek at the Robert Campbell Highway crossing during any of the Project phases.

EFFECTS ARE ADVERSE

The effects of an altered hydrological regime are adverse during all Project phases.

[48] YOR Document 2017-0083-225-1

EFFECTS ARE NOT SIGNIFICANT

While the effects of altered stream flows in Geona Creek and Finlayson Creek are adverse, the amplitude of change is not expected to inhibit other water uses in the drainage, including aquatic habitat. Effects on hydrology in the Geona Creek and Finlayson Creek drainages are not considered significant during any Project phase.

5.3 Aquatic Life

Summary & Conclusion

The Executive Committee has determined that the Project is likely to result in significant adverse effects to aquatic resources during operations, closure and post-closure as a result of changes to fish habitat in Geona and Finlayson Creeks. These effects can be eliminated, reduced or controlled through Project design elements, mitigations proposed by the Proponent, compliance with relevant non-discretionary legislation, and the implementation of mitigation measures recommended by the Executive Committee.

Importance of Aquatic Resources

CULTURAL AND ECOLOGICAL IMPORTANCE

Aquatic resources encompass all aspects of the aquatic environment and ecosystem, including water quality, water quantity, biotic environment, fish and fish habitat. Aquatic resources are important in maintaining the function of aquatic and biophysical environments, and the cultural and recreational importance of fish. It is widely understood that the productivity of a fishery is linked to habitat health; therefore, fish and their habitat are both considered important aquatic resources.

The community affected by the Project is concerned about impacts to aquatic resources. During the Proponent's consultation, concerns were raised about potential effects to fish and fish habitat.

Legislative & Management Setting

In Yukon, aquatic resources are managed by Fisheries and Oceans Canada and Government of Yukon (Environment Yukon) under federal and territorial legislation and regulations. The legislative and management setting for the Project with regard to aquatic resources is set out in the *Yukon Waters Act*, the *Quartz Mining Act* and the federal *Fisheries Act*.

YUKON WATERS ACT

Sections 6(1) and 7(1) of the *Waters Act* apply to mine operations with respect to:

- the use of water and deposit of waste to surface water;
- undertakings related to project design that affect water courses, such as diversion, training and crossings

The Yukon Water Board, an independent administrative tribunal, has the authority to issue, renew, amend, assign and cancel water licences under the *Waters Act*.

YG's *Reclamation and Closure Planning for Quartz Mining Projects* Policy[49] lists requirements for both QML and WL, and provides guidance about the processes. With regards to WLs, the policy indicates that the Yukon Water Board will endeavour to "issue licences only when there is a reasonable certainty that an acceptable level of reclamation of the site can be achieved during mining and/or following cessation of mining."[50]

FEDERAL FISHERIES ACT

Management of inland fisheries has largely been delegated to Yukon, but the administration of fish and fish habitat protection provisions under the *Fisheries Act* remains with the federal government.

A Fisheries Act Authorization (FAA) is required for any work, undertaking or activity that results in harmful alteration, disruption or destruction of fish habitat. As part of the application, the Proponent of an activity documents how the impacts from their project(s) may affect fisheries management objectives, and describes any effects their project(s) may have on the achievement of these objectives. Fisheries management objectives may guide Proponents in the selection of any required avoidance, mitigation and offsetting measures. Offsetting is a measure that counterbalances any unavoidable death of fish and any harmful alteration, disruption or destruction of fish habitat which may result from project activities. DFO's offsetting policy (DFO 2019[51]) suggests that offsetting plans should support available fisheries management objectives and local restoration priorities, and should be conducted in a manner consistent with the department's policy.

The *Metal and Diamond Mining Effluent Regulation* (MDMER) prescribes monitoring and reporting requirements for aquatic resources during operations through the adoption of an Environmental Effects Monitoring Program. There is a requirement to continue this program post-closure, until the mine is designated closed by DFO.

YUKON MINE SITE RECLAMATION AND CLOSURE POLICY FOR NEW MINES

This policy applies to hard rock (quartz) mines in Yukon that are on mineral claims, leases and Crown grants developed pursuant to the *Quartz Mining Act*. According to the Policy, one of the goals for mine site reclamation and closure is to "ensure a government-approved reclamation and closure plan, prepared by the mine operator, to return the mine site to a viable and, wherever practical, self-sustaining ecosystem, is in place prior to mine development." A Reclamation and Closure Plan should "fully protect public and environmental health and safety and ensure that <u>any potential discharges during mine operation and following mine closure will be managed to prevent harm to the receiving environment or to the public."</u> [Emphasis added]. This must include "methods for protection of water resources during and after mine closure."[52]

[49] Yukon Water Board 2013 Reclamation and Closure Planning for Quartz Mining Projects. Plan requirements and closure costing guidance. August.
[50] Yukon Water Board 2013 Reclamation and Closure Planning for Quartz Mining Projects. Plan requirements and closure costing guidance. August. Section 2 Regulatory Context (p. 2)
[51] Fisheries and Oceans Canada Department of Fisheries and Oceans, 2019. Fish and Fish Habitat Protection Policy Statement August 2019.
[52] Yukon Government. Yukon Mine Site Reclamation and Closure Policy. January. 2006.

Context

Aquatic resources, characterized as fish and fish habitat, are vulnerable to changes to physical and biological components of the aquatic habitat, including[53]:

- **Habitat degradation:** may occur as a result of the removal or change of important habitat components, blocking fish passage, infilling of lakes, streams or wetlands to create dry land, or other activities in freshwater or marine environments that impair their ecological functions;
- **Habitat modification:** may alter habitat characteristics (such as flow), negatively affect spawning or rearing, or cause the death of fish, and which may be caused by dams or other impoundments, water diversion, stream crossings or water extraction for municipal, industrial or other uses;
- **Aquatic invasive species:** may threaten fish through competition, predation or habitat impacts;
- **Overexploitation of fish:** may lead to depleted or unsustainable populations;
- **Pollution of many kinds:** may adversely affect water quality and fish health; and
- **Climate change:** is causing water temperatures to increase and is changing the geographical distribution of some species, rainfall patterns, water levels, flows, water chemistry and temperature, all of which are important to support the characteristics and proper ecological function of fish habitat

Aquatic resources are supported by a complex ecological system with a certain level of resilience. Ecological resilience is often described as the capacity of a system to respond to permanent or temporary disturbance by resisting adverse effects and recovering to a stable state. In most cases, the desired stable state would serve similar ecological and/or socio-economic functions the same as before. For example, fish and other aquatic biota may tolerate some changes to water quality before effects on population, community composition or survival are measurable. Or, a stream may have enough suitable fish habitat to allow for some streambed modification before fish populations are adversely affected.

It can be assumed that changes to water quality which remain within normal and natural ranges and meet water quality guidelines for the protection of freshwater aquatic life (such as CCME and BCMoE water quality objectives) would not overcome the resilience of fish and other aquatic biota. In addition, changes to waterways that do not substantially affect or reduce the availability of spawning grounds, nurseries, rearing, food supply and migration areas which can directly or indirectly support fish life, would not overcome the resilience of fish populations.

Existing Conditions and Trends

TRADITIONAL FISHERIES

The Proponent completed traditional land use studies in the Project area for the Liard First Nation and Ross River Dena Council in 2019, without the participation of these First Nations, in

[53] Fisheries and Oceans Canada Department of Fisheries and Oceans, 2019. Fish and Fish Habitat Protection Policy Statement August 2019.

response to YESAB's Request for Supplementary Information No. 4.[54] These studies noted that there is documented history and other evidence of historical fishing in the region. Fish of particular importance to Kaska First Nation include Arctic grayling (grayling), lake trout, jackfish (pike), whitefish and suckers. Kaska fishing efforts in the Project area are mainly in Finlayson Creek, North Lakes, Money Creek and Wolverine Lake, and are typically opportunistic and usually undertaken while hunting in and around the Project area.

FISH SPECIES AND FISH HABITAT IN AND AROUND THE PROJECT AREA

Historical and recent fisheries studies have indicated the presence of grayling in the upper reaches of Geona Creek within the Project footprint, and throughout the regional drainages including South Creek, North River, Finlayson Creek and East Creek. Other fish species identified in the region include slimy sculpin, burbot and lake trout.

Results of fish studies in Finlayson Creek provided in Section 10.3.2.1 of the Project proposal indicate some level of ecological stability demonstrated by generally consistent species composition, and aquatic conditions that provide suitable fish habitat. However, the culvert at the Robert Campbell Highway crossing appears to act as a barrier to passage for fish attempting to migrate up Finlayson Creek.

Aquatic resource studies have determined the entire length of Geona Creek to be fish-bearing. As such, all of Geona Creek is considered fish habitat. Fish surveys and habitat assessment conducted in 2015 and 2016 in Fault and Geona creeks, summarized in Section 10.3.2.3 of the Project proposal, indicate that:

- Fault Creek provides very limited fish habitat, including overwintering habitat. In addition, high gradient stream profile and poor quality stream substrate inhibit fish movement into Fault Creek.
- Fish habitat in Geona Creek is influenced by beaver activity and the presence of beaver dams along the upstream reaches. Geona Creek provides suitable habitat for Arctic grayling rearing in its lower reach. Some habitat favourable for grayling spawning may be present in the upstream reaches; however, it is unlikely that Geona Creek provides overwintering habitat for this species. Slimy sculpins that may have migrated into Geona Creek over the years have not developed sustaining populations possibly due to winter die-off.

WATER QUALITY CONDITIONS

Current water quality conditions are described in Section 5.1, Water Quality.

OTHER ACTIVITIES

No other industrial activities that may affect fish take place within the Geona, Finlayson or South Creek watersheds.

[54] YOR Document 2017-0083-362-1

Project Design

The Project is located in the upper portion of the Geona Creek watershed. The open pit and water management ponds will be situated within Geona Creek floodplain, and the creek currently flows through the proposed open pit area. A portion of Geona Creek above the proposed water management ponds will not be altered in a significant way. It will, however, be permanently closed-off to fish, as the water management ponds will have a dam structure controlling water discharge. At closure, the Lower Water Management Pond will be converted to a wetland (North Wetland).

Fault Creek, a small headwater tributary of Geona Creek, will be redirected to the South Creek watershed during operations, which will result in reduced flows to Geona Creek and a corresponding increase in flows to South Creek. Baseline investigations did not identify any suitable fish habitat in Fault Creek that would be directly affected by the redirection. The reduction of flow to Geona Creek from the diversion of Fault Creek will be partially offset during mine construction and operations because dewatering of the ABM open pit will be directed to Geona and Finlayson Creeks. In addition, during active closure, a portion of the water from the water management ponds will be released directly into Finlayson Creek.

DFO requested additional information from the Proponent with regard to the anticipated effects of the Fault Creek Diversion on South Creek hydrology and aquatic habitat (R3-13). The Proponent stated in their response, that "it is important to note and as described in the FOP (Appendix E-4 of Project Proposal) Fault Creek is a non-fish bearing creek. Once diverted a barrier will be placed at its lower end to prevent fish from using the creek so that it doesn't become temporary fish habitat."[55] The Proponent also stated in their response that "This does flag the fact that hydrology in South Creek, during the active and transition closure phase, will need to be monitored closely. Monitoring during the operations phase may allow for validation of the of the flow predictions in advance of the Fault Creek re-diversion."[56]

A water management plan (Described in Section 18.4 of the Project Proposal) will be implemented and will collect mine-affected water before it is released to the receiving environment, Geona Creek and Finlayson Creek. The plan includes diversion of non-mine-affected surface water via three main diversions: collection of mine-affected run-off from Class A, Class B, and Class C Storage Facilities; a two-stage water management pond (Upper and Lower Water Management Ponds); and active water treatment to treat excess water as required to maintain dischargeable water quality in the LWMP.

PROPONENT MITIGATIONS SPECIFIC TO THE PROTECTION OF FISH AND FISH HABITAT

TRADITIONAL FISHERIES

During consultation, summarized in Section 2 of the Project proposal, it was noted that a culvert on the Robert Campbell Highway at Finlayson Creek, owned by Government of Yukon, blocks fish passage to the upper reaches of Finlayson Creek. As follow-up to the first community meetings, the Proponent assessed the reported fish barrier at the culverts and determined that

[55] YOR Document 2017-0083-293-1, pg.36-51.
[56] Ibid.

eliminating the barrier would open up Finlayson Creek fish habitat for grayling. The Proponent reported to the communities, at the second community meeting, that they will propose to remove the barrier as part of a fisheries offsetting plan. Reconnecting fish habitat in Finlayson Creek by allowing fish passage through the culverts at the Robert Campbell Highway was included as an offsetting measure in the Proponent's preliminary Fisheries Offsetting Plan (FOP) (Appendix E-4[57]).

CONCEPTUAL FISH AND AQUATIC HABITAT MANAGEMENT PLAN

The Proponent describes a Conceptual Management Plan for fish and aquatic habitat (Project Proposal Section 18.9). The conceptual plan outlines the approach to minimizing Project effects on fisheries and aquatic habitat during construction, operation and closure. In general, the management plan includes a commitment to control the Project discharges to meet water quality objectives in Geona and Finlayson Creeks, an outline of measures to protect aquatic and riparian habitat, an outline of measures to limit erosion and sediment runoff, and an outline of fish and fish habitat monitoring plans.

SITE SPECIFIC WATER QUALITY OBJECTIVES

The Project includes control of discharge water to meet defined water quality objectives at specific points in the receiving environment. The site-specific water quality objectives (SSWQO) were originally completed in 2017 and outlined in Appendix D-8 of the Project proposal. They were revised in 2018[58] in response to intervener comments and YESAB's IR 3-1.[59]

The 2018 SSWQOs were derived following the same methodology as in 2017 but using the larger dataset to define baseline water quality conditions. The Proponent generally adopted the guidelines from Water Quality Guidelines for the Protection of Aquatic Life[60], and British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture.[61,62] The derivation of preliminary SSWQOs was performed following the methods outlined by Canadian Council of Ministers of the Environment[63] for background concentration procedure. A sulphate-dependent objective was developed for selenium where, at baseline sulphate concentrations of 60 mg/L or less, the SSWQO would be set equivalent to the BCMoE guideline (0.002 mg/L). But at higher sulphate concentrations in the receiving environment, the selenium SSWQO would be calculated based on ambient sulphate concentrations.

[57] YOR Document 2017-0083-116-1 inclusive through YOR Document 2017-0083-117-1.
[58] YOR Document 2017-0083-325-1 inclusive through YOR Document 2017-0083-326-1.
[59] YOR Document 2017-0083-283-1.
[60] Canadian Council of Ministers of the Environment (CCME) (2018). Canadian Environmental Quality Guidelines, Water quality Guidelines for the Protection of Aquatic Life.
[61] British Columbia Ministry of Environment (BCMOE) (2017a). British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife and Agriculture Summary Report.
[62] British Columbia Ministry of Environment (BCMOE) (2017b). Working Water Quality Guidelines for British Columbia.

[63] Canadian Council of Ministers of the Environment (CCME) (2003). Guidance on the Site-Specific Application of Water Quality Guidelines in Canada: Procedures for Deriving Numerical Water Quality Objectives. Canadian Water Quality Guidelines for the Protection of Aquatic Life – Site Specific Guidelines.

FISHERIES OFFSETTING PLAN (FOP)

The placement of Project facilities into the upper half of Geona Creek will result in the direct loss of fish habitat and/or restriction of that habitat to fish access. Other Project activities including water diversion or direct storage will cause changes to the hydrology of Geona Creek, thereby influencing fish habitat in the area. The Proponent is required to obtain a Fisheries Act Authorization (FAA) prior to proceeding with development and construction of those facilities, as they may cause serious harm to fish or fish habitat. The Proponent has submitted a preliminary FOP[64] as part of the Project proposal. The preliminary FOP describes measures that will be implemented to avoid and mitigate harmful impacts to fish and fish habitat. Residual impacts (impacts that are not avoided or mitigated) are then addressed by offsetting. Elements of the Kaska Dena Management Practices[65] have been considered in the Proponent's plan including: establishing thresholds of fish habitat disturbance and loss, especially spawning sites, and measures that maintain the water quality to support productive fisheries resources.

Specific offsetting measures include:

- Fish habitat replacement
    - Pond and pool habitat in Geona Creek
    - Flow/spawning habitat in Geona Creek
- Habitat re-connection in Finlayson Creek

Offsetting measures that require construction activities could affect fish and fish habitat during construction. Specific mitigation measures developed to minimize further effects include:

- Erosion and sediment control;
- Fish salvage;
- Instream construction timing windows; and
- Geochemical control of construction materials for in-stream work.

SEDIMENT AND EROSION CONTROL PLAN

A conceptual sediment and erosion control plan has been proposed (Section 18.6 of the Project Proposal) to control run-off, minimize erosion on exposed slopes and substrates, and prevent input of silt or sediment into watercourses during all phases of the Project. The proposed sediment and erosion control management strategies generally follow good operating practices and federal guidance for activities where the *Fisheries Act* applies. Introduction of sediment into downstream environments will be mitigated through minimizing the generation of sediment at the source, minimizing the volume of contact runoff capable of transporting contaminants, and collecting and treating the contact runoff, as required, therefore meeting downstream water quality requirements.

[64] YOR Document 2017-0083-116-1 inclusive through YOR Document 2017-0083-117-1
[65] Dena Kayeh Institute. Kaska Dena Management Practices: Kaska Dena Land Use Framework. 2010. https://kaskadenacouncil.com/download/kaska-dena-management-practices-kaska-dena-land-use-framework-dena-kayeh-institute-2010/?wpdmdl=1647&masterkey=

SURFACE WATER MANAGEMENT PLAN

A conceptual water management plan has been proposed (Section 18.4 of the Project Proposal) for all Project phases. The Proponent acknowledges that the Project will have a positive water balance. Therefore, active water management including water treatment and discharge to the receiving environment will be required. To minimize the volume of contact water requiring management, the Project's water management strategy includes diverting clean water around the Project footprint and re-using water to the maximum practicable extent.

In the conceptual water management plan, the Proponent proposes that:

> water will be discharged to both Geona Creek and Finlayson Creek at established water quality discharge standard concentrations and at discharge volume ratios no less than 3:1 (receiving water volume: effluent volume) for Geona Creek at KZ-37 and 2:1 for Finlayson Creek at KZ-15 to meet water quality objectives in the receiving environment. Energy dissipation structures such as rip rap channels will be constructed below the discharge locations to both Geona and Finlayson Creeks.[66]

Water quality predictions for all Project phases are provided in the 2018 Water Quality Model Report. The 2018 report was prepared to include revised WQOs following comments from Government of Yukon, Department of Environment stating that the original data upon which the WQOs were derived were short-term or otherwise inadequate[67]. Also in response to comments from the Department of Environment[68] and EcoMetrix[69] that modelled concentrations of any COPI which exceed a proposed WQO should be considered as posing a significant risk to aquatic health in the receiving environment, the Project's water quality model was revised to incorporate the following mitigations as part of the water management plan:

- Very low permeability covers for Class A and B Storage Facilities, and a growth medium cover for the Class C Storage Facility to reduce precipitation and runoff infiltration to waste rock and reduce potential contaminant loading to the receiving environment;
- In situ treatment of the ABM Lake;
- CWTS to passively treat surface flow from the ABM Lake; and
- Active treatment of collected drain-down and runoff water from the Class A and B Storage Facilities during the active closure and transition phases of the Project.

Water quality predictions were provided for three scenarios: annual mean precipitation, one in 50 wet year and one in 10 dry year, for all Project phases. Water quality predictions were provided for key locations in the receiving environment including South Creek (KZ-13), Geona Creek (KZ-37) and upper and lower Finlayson Creek (KZ-15 and KZ-26, respectively) for all Project phases.

[66] YOR Document 2017-0083-050-1.
[67] YOR Document 2017-0083-265-1.
[68] Ibid.
[69] YOR Document 2017-0083-247-1.

The water quality modelling suggests that the ABM Lake water will have elevated concentrations of antimony, arsenic, cadmium, copper, lead, selenium, uranium and zinc due to contaminants entering solution from the pit floor and walls. To achieve water quality objectives in Geona Creek, the Proponent is proposing in situ treatment of ABM Lake to lower the concentrations of these contaminants. In addition, Constructed Wetland Treatment Systems will be established down-gradient of the ABM Pit in the area of the decommissioned Pit Rim Pond, and further down-gradient in the area of the Water Management Ponds.

CONSIDERATION OF ACCIDENTS AND MALFUNCTIONS

During consultations summarized in Section 2 of the Project proposal, the Proponent heard concerns about possible impacts on fish and wildlife that could be caused by a catastrophic collapse of a tailings dam, which occurred at the Mount Polley mine site in British Columbia. The Proponent responded that KZK will use a dry-stack tailings method, where the tailings are pressed dry and placed on the hillside above the creek in a progressively reclaimed facility that conforms to the existing hillside slope.

The Proponent's water management plan includes the construction and operation of two water management ponds, Upper and Lower Water Management Ponds (UWMP and LWMP, respectively) which have a total storage capacity of 750 000 m^3. The ponds will be functional during operations, and at closure the UWMP will be removed and the LWMP will be converted to a constructed wetland treatment system for site water discharge. The Proponent evaluated potential effects on fish habitat in Geona Creek and Finlayson Creek due to a catastrophic collapse of the UWMP and LWMP dams[70] in response to YESAB's R274[71], R2-124[72] and R3-14[73]. The dam breach study considered a hypothetical catastrophic failure of both WMPs, where the failure of the upstream UWMP dam caused the subsequent failure of the downstream LWMP dam. The 2018 assessment extended downstream from the ponds to include Geona Creek and the Finlayson River to about 50 km from the LWMP dam.

MONITORING PROGRAMS

The proposed aquatic effects monitoring programs incorporate monitoring requirements under the *Yukon Waters Act* and the federal *Fisheries Act*. The overall aquatic monitoring program would include monitoring sediment (particle size, metals and pH) on a two-year cycle; monitoring benthic invertebrates (tissue quality, with concurrent habitat characterization and water quality monitoring) on a two-year cycle; monitoring fisheries (health and catch metrics and concurrent habitat characterization) annually; and monitoring fish tissue (slimy sculpin, metals and selenium) on a two-year cycle. Routine monitoring will also serve to monitor the success of the offsetting measures, and support Environmental Effects Monitoring (EEM) requirements which occur on a three-year cycle.

[70] YOR Document 2017-0083-341-1.
[71] YOR Document 2017-0083-200-1, pg.282.
[72] YOR Document 2017-0083-231-1, pg.333.
[73] YOR Document 2017-0083-293-1, pg.51-52.

Fish Habitat Monitoring under the Fish and Fish Habitat Protection Regulations (Fisheries Act)

The Proponent has proposed an Aquatic Resource Monitoring Plan (ARMP)[74] as part of the FOP to monitor impacts from mining development and operations on aquatic biota in the receiving environment. The proposed monitoring program consists of a semi-quantitative fish sampling program conducted on an annual basis to monitor fish use in Geona, Finlayson and South Creeks. The proposed plan will be conducted seasonally and will follow-up on work that has been completed in previous years. Additional sampling will be conducted in the developed pond habitat in Geona Creek, and at the Finlayson Creek culverts located at the Robert Campbell Highway. The monitoring plan will include grayling spawning surveys in Geona and Finlayson Creeks, overwintering potential of constructed ponds, and success of the proposed fish passage system at Robert Campbell Highway.

Environmental Effects Monitoring (EEM) requirements under the Metal and Diamond Mining Effluent Regulations (MDMER) (Fisheries Act)

The Project will be subject to the MDMER when the operation begins discharging effluent at volumes greater than 50 m^3/day. At that time, the Proponent will submit a study design for undertaking an EEM program. The purpose of EEM is to confirm that healthy fish populations and benthic invertebrate communities are being maintained through the demonstration of no statistically significant difference in measurable parameters between exposure and reference areas and/or baseline data. The study design will follow guidance provided by the "Metal Mining Technical Guidance for EEM."[75]

Grayling has been selected as the sentinel fish species for monitoring the health of fish populations, with catch per unit effort (CPUE) and condition factor results being used as measurements to assess the difference in fish population health between reference and exposure populations. For benthic invertebrate community health, metrics of taxon richness, mean invertebrate density (average number of organisms per m^2), Simpson's Evenness Index and Bray-Curtis Index of Dissimilarity will be used. Periphyton community indicators and chlorophyll α concentrations will be used to evaluate spatial and temporal changes due to nutrient enrichment and metal toxicity, and other Project-related effects.

Acute lethality testing under the Metal and Diamond Mining Effluent Regulations (MDMER) (Fisheries Act)

In addition to monitoring the fish and benthic communities every three years, the EEM program also requires undertaking an effluent characterization program and sub-lethal toxicity testing on two plant species, an invertebrate, and fish embryos throughout each year of operation. The purpose of mine effluent toxicity testing is to prevent the release of sublethally toxic mine-affected water to the environment by demonstrating that releases meet standard toxicological tests for aquatic biota.

[74] YOR Document 2017-0083-051-1, pg.19-8.
[75] Environment Canada. Metal Mining Technical Guidance for Environmental Effects Monitoring. 2012. https://www.ec.gc.ca/esee-eem/AEC7C481-D66F-4B9B-BA08-A5DC960CDE5E/COM-1434---Tec-Guide-for-Metal-Mining-Env-Effects-Monitoring_En_02[1].pdf

Effects Characterization

THE PROJECT WILL RESULT IN DESTRUCTION OF FISH HABITAT

The Project will permanently remove a portion of Geona Creek at the immediate mine site, and will isolate the upper reach from the lower reach, primarily for development of the open pit and construction of water management structures (WMPs and constructed wetlands) (see Figure 12 for additional detail). The reach of the Geona Creek that will be removed is known to support grayling during all seasons, and is potential spawning habitat. The Project is estimated to result in the loss of approximately 5.4 km of fish habitat in Geona Creek, covering an area of 15.35 km^2, and an additional 4.85 ha of wetland/pond habitat in the headwaters of Geona Creek[76].

The Proponent has proposed to address the adverse effects caused by destruction of fish habitat in Geona Creek by implementing an offsetting plan. The conceptual offsetting measures will replace spawning and pond habitat in lower Geona Creek, will reconnect fish habitat in Finlayson Creek that was previously isolated, and will monitor success. In reconnecting fish habitat in Finlayson Creek, the FOP is expected to improve connectivity for grayling between the lower reach of Finlayson Creek and its upper drainage which includes Geona Creek, and improve access to the upper Finlayson Creek drainage for slimy sculpin (currently absent from the upper drainage).

Harmful alteration of fish habitat requires authorization and must follow the fish and fish habitat protection provisions of the *Fisheries Act*. The conceptual FOP submitted for Screening was developed taking into consideration changes to the Fisheries Protection Program that were implemented in 2013. There have been changes to the *Fisheries Act* since then, and Fisheries and Oceans Canada has recently published a Fish and Fish Habitat Protection Policy Statement.[77]

[76] YOR Document 2017-0083-292-1, pg.31-34.
[77] Fisheries and Oceans Canada Department of Fisheries and Oceans, 2019. Fish and Fish Habitat Protection Policy Statement August 2019.

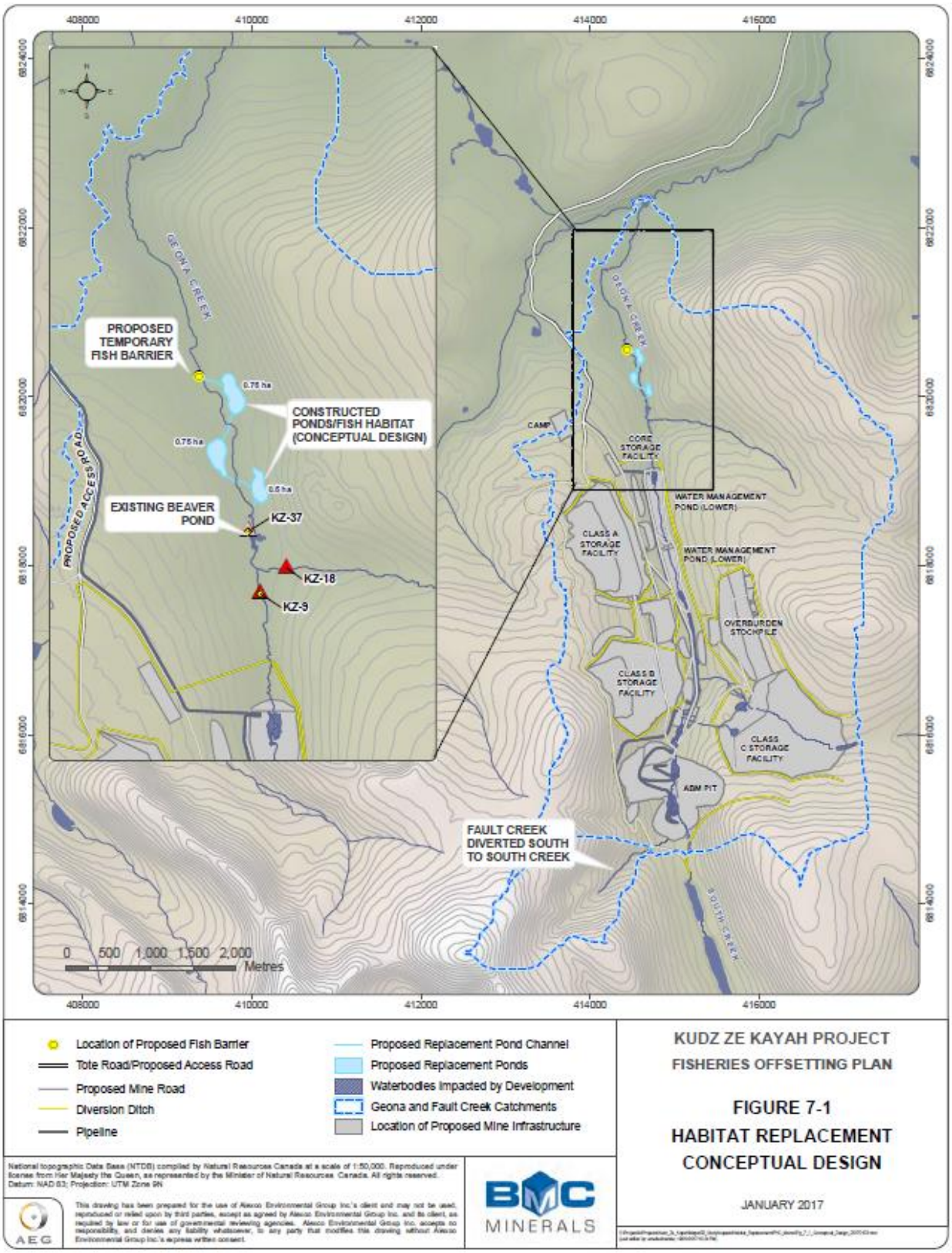

Figure 12: Fisheries offsetting plan from the project proposal.

THE PROJECT WILL TEMPORARILY DIVERT PART OF FAULT CREEK TO THE SOUTH CREEK DRAINAGE

Fault Creek upgradient of the proposed open pit mine will be temporarily diverted to the headwater lakes area of the South Creek drainage. Fault Creek, which is a headwater tributary to Geona Creek, is not known to support any fish community but diversion could affect the fish and fish habitat in the South Creek drainage due to changes in flow and water chemistry. Grayling, slimy sculpin and burbot have been observed in the headwater lakes of South Creek (KZ-13), upstream of the North River system and in the North River system.

The Proponent has modelled potential changes to water quantity and quality in South Creek for all Project phases. Flow to the South Creek drainage from the diversion will be affected by changes to natural groundwater flows caused by dewatering and filling of the ABM pit. The combined flow effects were considered in the Proponent's 2018 water balance model, which predicted that, compared to baseline, flow in South Creek (KZ-13) will increase (approximately 50 percent, or 35 L/s, on an average annual basis) during construction and operations and decrease by (-5 percent, or -5 L/s) during active and post-closure. Future water quality in the South Creek drainage for all Project phases was assessed in the Proponent's 2018 water quality model report which takes into consideration the 2018 water balance results.

Water quality for the portion of Fault Creek diverted to the South Creek drainage is considered to be unaffected by mine activities. Changes to water quality in the South Creek drainage were anticipated because of natural differences in the baseline chemistry of the two water courses. Low, median and high flow water quality predictions were produced for South Creek (KZ-13), to estimate potential changes in water quality resulting from Fault Creek, South and Southwest diversion into the South Creek drainage. The model results indicated that the Fault Creek diversion will result in increased estimated selenium, cadmium and zinc concentrations in South Creek (KZ-13) compared to baseline, but that concentrations will remain below proposed WQOs for all flow scenarios during construction and operations, and will return to baseline levels during active, transition and post-closure.

THE PROJECT WILL RESULT IN CHANGES TO FISH HABITAT IN GEONA AND FINLAYSON CREEKS

Changes to fish habitat in Geona and Finlayson Creeks are anticipated due to the combined effects of changes to surface water flow and quality, resulting from on-site water management, and release of mine-affected water to Geona Creek and Finlayson Creek via the LWMP during operations and to Geona Creek via the constructed wetland post-closure.

Flow impacts were considered in the Proponent's 2018 water balance model which predicted that, compared to baseline, flow would be lower during construction and operations due to the diversion of Fault Creek, dewatering of the pit, underground work, and other water management activities, and during active and transitional closures due to ABM pit filling. The Fault Creek basin will be redirected to the ABM pit during filling, allowing hydrology in Geona Creek to return to near baseline conditions when the outflow of ABM Lake begins to contribute flow to Geona Creek. Post-closure flow in Geona Creek is expected to be near to, but higher than, baseline flow due to permanent changes to the groundwater regime, which will cause inter-basin groundwater flow from the South Creek catchment to the Geona Creek catchment. Variations in

hydrology compared to the baseline are expected to be less than 5 percent during all Project phases in Finlayson Creek at KZ-26, upstream of the Robert Campbell Highway crossing.

The combined effects of changes to water quantity and quality were considered in the Proponent's 2018 water quality model report. Specific mitigation measures that were considered in the 2018 water quality model report include:

- Very low permeability covers for Class A and B Storage Facilities, and a growth medium cover for the Class C Storage Facility, to reduce precipitation and runoff infiltration to waste rock, and reduce potential contaminant loading to the receiving environment;
- In situ treatment of the ABM Lake;
- CWTS to passively treat surface flow from the ABM Lake; and
- Active treatment of collected drain-down and runoff water from the Class A and B Storage Facilities during the active closure and transition phases of the Project.

Water quality predictions were compared to proposed WQOs at three downstream locations: Geona Creek (KZ-37) and upper and lower Finlayson Creek (KZ-15 and KZ-26, respectively). The EC has considered that exceeding a proposed WQO poses a significant risk to aquatic health. With all the proposed mitigations considered, predicted concentrations of all contaminants of potential interest were below their proposed WQOs at the receiving environment locations, with some exceptions. The exceptions included intermittent exceedances for nitrate during active closure, and for copper during transition closure. In the case of copper, exceedances are characterized in the 2018 water quality model report as infrequent (one or two months of the year), with a maximum concentration of 1.5 times the proposed WQO during the transition closure phase in Geona Creek in all precipitation scenarios. Elevated copper levels in surface water during the transition phase were attributed to seepage loadings from the Class A Storage Facility, and assumed to be from liner defects. Concentrations of copper decrease post-closure when water from the ABM Lake flows to Geona Creek adding extra dilution to the system.

DAM FAILURE

Potential effects to fish habitat in Geona and Finlayson Creeks due to a catastrophic collapse of the upper and lower water management ponds' dams were evaluated in the Dam Breach and Fish Impact Assessment Memo[78]. The study considered a hypothetical catastrophic failure of both WMPs, where the failure of the upstream UWMP dam caused the subsequent failure of the downstream LWMP dam. The assessment concluded that the peak water discharge from the failure would cause adverse impacts on the downstream channel morphology due to the erosional force from the discharge, and fish mortalities would be expected in Geona Creek in particular, with fish flushing and stranding.

Significance Determination

The Executive Committee has determined that additional mitigations are required to minimize significant adverse effects to aquatic resources. The effects characterization for aquatic resources primarily considers effects on fish and fish habitat. The effects characterization is

[78] YOR Document 2017-0083-341-1

based on the premise that mitigation measures proposed by the Proponent are consistent with best practices, will function as proposed, and the modelling used to support the effects characteristics is sufficiently robust.

DESTRUCTION OF FISH HABITAT

EFFECTS ARE LIKELY

The Project will permanently remove a portion of Geona Creek at the immediate mine site and isolate the upper reach from the lower reach, primarily for development of the open pit and construction of water management structures (upper and lower water management ponds, constructed wetlands). The part of Geona Creek that will be removed is known to support grayling during all seasons, and is potential spawning habitat. The Project is estimated to result in the loss of approximately 5.4 km of fish habitat in Geona Creek, covering an area of 15.35 km^2, and an additional 4.85 ha of wetland/pond habitat in the headwaters of Geona Creek.[79]

EFFECTS ARE ADVERSE

In relation to aquatic resources, the effects of fish habitat destruction, and in this case complete loss of the aquatic environment and ecosystem, are adverse.

EFFECTS ARE NOT SIGNIFICANT

The Proponent has made numerous commitments that would reduce and compensate for the effects to aquatic resources due to destruction of fish habitat, rendering impacts insignificant. These include implementing:

- Conceptual Fish and Aquatic Habitat Management Plan
- Site Specific Water Quality Objectives
- Fisheries Offsetting Plan Sediment and Erosion Control Plan
- Surface Water Management Plan
- Fish Habitat Monitoring

In addition, harmful alteration of fish habitat requires authorization and must follow the fish and fish habitat protection provisions of the *Fisheries Act*. The conceptual FOP submitted for Screening was developed taking into consideration changes to the Fisheries Protection Program that were implemented in 2013. On August 28th, 2019 provisions of the new *Fisheries Act* came into force including new protections for fish and fish habitat in the form of standards, codes of practice and guidelines for projects near water. The Proponent will be required to revise all mitigations put forward in the Project proposal that are impacted by the new provisions during licensing. This includes revising the FOP and EEM plan to be consistent with the 2019 MDMER under the *Fisheries Act*.

DIVERSION OF FAULT CREEK TO SOUTH CREEK DRAINAGE

EFFECTS ARE LIKELY

Changes to aquatic resources in the South Creek drainage are likely to occur primarily due to increased stream flows during operation. The combined effects on flow are predicted to

[79] YOR Document 2017-0083-292-1, pg.31-34.

increase (approximately 50 percent, or 35 L/s, on an average annual basis) in South Creek (at KZ-13) during construction and operations, and decrease (by 5 percent, or -5 L/s) during active and post-closure.

EFFECTS ARE NOT ADVERSE

In relation to aquatic resources, the effects are not considered adverse as the Project is not expected to improve or deteriorate fish health and habitat to an extent that will be measurable. Monitoring of water quantity, quality and fish and fish habitat will be conducted during operations to validate assumptions used in this determination.

EFFECTS ARE NOT SIGNIFICANT

Effects to aquatic resources in the South Creek drainage are not significant as effects are not considered adverse, and the affected area is spatially limited to the headwater lake area of the South Creek drainage. In addition, effects will be reversible since fish habitat conditions are expected to return to near baseline conditions post-closure.

CHANGES TO FISH HABITAT IN GEONA AND FINLAYSON CREEKS

EFFECTS ARE LIKELY

Effects to aquatic resources in relation to fish habitat in Geona and Finlayson Creeks are likely to occur. Changes to fish habitat in Geona and Finlayson Creeks are anticipated due to the combined effects of changes to surface water flow and quality, resulting from on-site water management, and release of mine-affected water to Geona Creek via the LWMP during operations and the constructed wetland post-closure.

EFFECTS ARE ADVERSE

Based on the assumptions assessed in the 2018 water balance and water quality models, the effect on aquatic resources and fish and fish habitat from changes to hydrology and water quality is not adverse. However, there is sufficient uncertainty in the water quality predictions related to loadings from WSRA A (covers performance, capturing seepage under WRSA A and B and the potential for acid generation in WRSA A and B), and efficiency of in-pit treatment and constructed wetland treatments that affect both the Water Balance and Water Quality models. If assumptions are incorrect, and water balance and water quality predictions are not accurate, the effects to aquatic resources will be adverse.

EFFECTS ARE SIGNIFICANT

Effects to aquatic resources in relation to fish habitat in Geona and Finlayson Creeks are permanent. However, the magnitude and extent of effects for both water quantity and quality vary over the life of the Project. The geographic extent for changes to water quantity in Geona Creek is local and duration is long-term as changes could occur over all Project phases. Site hydrology will return to near baseline conditions only when ABM Lake begins to flow to Geona Creek.

Based on the assumptions used in water quality modeling, water quality will generally be below WQOs and consequently will frequently result in minimal effects. However, the EC considers the predicted intermittent exceedances to present a significant effect to aquatic life.

Further, there is sufficient uncertainty in the water quality predictions related to loadings from WSRA A (covers performance, capturing seepage under WRSA A and B and the potential for acid generation in WRSA A and B) and the efficiency of in-pit treatment and constructed wetland treatments, which affect both the water balance and water quality models. If assumptions are incorrect, and water balance and water quality predictions are not accurate, the effects to aquatic life will increase.

Mitigations are required during operations to improve understanding of the proposed WRSA covers and liners during detailed design, and water quality/seepage monitoring should be conducted during operations to validate geochemical studies and Water Balance and Water Quality model results. The proposed monitoring programs will allow the Proponent to confirm whether or not the proposed mitigations perform as expected.

Effluent Quality Standards should be derived to achieve Water Quality Objectives in the downstream receiving environment, consistent with the modelling that was used to support the assessment. There are some uncertainties in the WQOs that should be addressed during the Water Licence process, and the WQOs revised as necessary. For example, WQOs that are dependent on other constituents in water such as ammonia (which is dependent on fluctuations in temperature and pH) and some metals (which are dependent on fluctuations in hardness) may vary over time. In addition, the proposed SSWQO for arsenic was an interim value and the Proponent indicated that it would be updated in the fall of 2018, and some WQOs have been or may be revised before the Project is licensed (since the WQOs were revised in 2018, BCMoE has updated the WQO for copper). As copper was identified as the contaminant with the greatest potential for adverse effects, it is important that the proposed WQO be based on the most recent available information.

DAM FAILURE

EFFECTS ARE NOT LIKELY

Potential effects to aquatic resources in Geona and Finlayson Creeks due to a catastrophic collapse of the upper and lower WMP dams are unlikely. The hypothetical catastrophic failure of both WMPs was considered in a rainy-day scenario, where the failure of the upstream UWMP dam caused the subsequent failure of the downstream LWMP dam. The likelihood of this series of events occurring to produce this scenario is considered to be extremely low.

EFFECTS ARE ADVERSE

Effects to aquatic resources due to a catastrophic failure are adverse. A failure would cause peak water discharge to change the downstream channel morphology due to the discharge's erosional force, and fish mortality would be expected in Geona Creek in particular, with fish being flushed downstream and potentially stranded.

EFFECTS ARE NOT SIGNIFICANT

The effects of dam failure to aquatic resources are not significant. The Proponent has made numerous commitments that would reduce the likelihood of catastrophic collapse of the upper and lower water management ponds. In addition, the conditions where failure would occur is considered to be extremely low. The effects to the fish and fish habitat downstream of the

WMPs are considered temporary as the flood wave would be short-lived, and the downstream fish habitat has a high natural restoration potential from natural flows that would restore channel fish habitat over time. Moreover, system connectivity would allow for benthic drift from upstream reaches in Geona and Finlayson Creeks, and reintroduction of the fish communities. Technologies to accelerate restoration of fish habitat are available and well-known.

Recommended Mitigations

3) The Proponent shall revise WQOs during the Water Licence process to ensure they are based on the most recent toxicological information and guidance from CCME and BCMoE.

4) The Proponent shall establish Effluent Quality Standards for the Project based on achieving WQOs in the receiving environment in Geona Creek (KZ-37) and in Finlayson Creek (KZ-15).

5) The Proponent shall conduct ongoing investigations into WRSA liners and cover systems to ensure that the performance objectives used in the water quality model are achieved during all Project phases.

6) The Proponent shall commit to ongoing geochemical studies for WRSA A and B, and studies to optimize the performance of the proposed Constructed Wetland Treatment System, to address the potential for acidic conditions to develop in the future.

7) The Proponent shall ensure the water treatment plant remains operational until it has been demonstrated that surface water from the site meets water quality objectives for the receiving environment in Geona Creek (KZ-37) and in Finlayson Creek (KZ-15).

Recommended Monitoring

Due to uncertainties regarding aquatic life and in relation to water quality, the Executive Committee recommends, under s.110 of YESAA, that monitoring take place.

SEEPAGE MONITORING

As there will be a delay before any impacts of affected drainage/seepage in surface water (water management ponds during operation and CWTS at closure) will be observed, the EC recommends:

B. The Proponent shall conduct seepage monitoring for the WRSA A to detect any onset of acid conditions.

This monitoring requires establishing water quality triggers for drainage/seepage from the WRSA A associated with adaptive management measures to mitigate potential adverse effects to fish and fish habitat in the downstream receiving environment.

6. Wildlife

6.1 Finlayson Caribou Herd

Summary & Conclusion

The Executive Committee has determined that the Project will not result in significant adverse effects to the Finlayson Caribou Herd (FCH). The Project will primarily affect the FCH through the degradation and removal of habitat; however, mortality rates appear to be the primary limiting factor of the herd, as supported by experts recruited by YESAB, by Government of Yukon, and by the Proponent's experts. As the Project is unlikely to increase mortality rates through harvest, collisions or predation and as the Project is unlikely to degrade or remove habitat sufficiently to alter population dynamics, the Project is not predicted to result in significant adverse effects to caribou.

The Project name Kudz Ze Kayah is a rough transliteration from Kaska; the name can roughly be translated as "Caribou country".[80]

Importance of Caribou

IMPORTANT CULTURAL SPECIES

Caribou are a highly valued cultural species in Yukon and Canada. The cultural importance of this caribou has been expressed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC): "Caribou have symbolic value to Canadians, particularly to Aboriginal groups that coexisted with caribou for centuries. They are a symbol of wilderness areas and are almost mystical because most Canadians have never seen one."[81]

Within Yukon caribou are one of the most prominent symbols of wilderness and nature. More tangibly, caribou are important from a subsistence, traditional and spiritual standpoint. For the Kaska, caribou are a "cultural keystone species for hunting and cultural purposes."[82] As a cultural keystone species and symbol of wilderness, caribou are an important aspect of the special relationship between Liard First Nation and Ross River Dena Council and wilderness.

[80] Yukon College. "Scholarship program supports student success in caribou country". November 15, 2018. https://www.yukoncollege.yk.ca/blog/routes/2018-11/scholarship-program-supports-student-success-caribou-country
[81] Committee on the Status of Endangered Wildlife in Canada, COSEWIC Status Report on the Woodland Caribou *Rangifer Tarandus* Caribou in Canada. 2002, pg. xi.
[82] YOR Document 2017-0083-040-1., pg 13-2.

UMBRELLA SPECIES

Caribou are a k-selected,[83] interior[84] species dependent on climax state vegetation.[85] These characteristics make caribou an excellent species for examining effects to ecosystems as a whole: caribou are slow to reproduce, need large areas of habitat and require vegetation cover that takes considerable time to develop after disturbance. These factors make caribou relatively vulnerable, especially when compared to other cervids (members of the deer family).

As a charismatic[86] species highly valued for subsistence and cultural purposes, caribou can shape public policy and conservation measures to a greater extent than other, less charismatic species. The biological limitations of caribou and the social values associated with caribou make caribou an umbrella species; measures to protect caribou from adverse effects may help shield, to some extent, other species from those effects as well.

Legislative & Management Setting

A POPULATION OF SPECIAL CONCERN

Woodland caribou are a subspecies of caribou. The Finlayson Caribou Herd (FCH) consists of a sub-type (ecotype) of woodland caribou, the northern mountain caribou. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) has determined that the northern mountain caribou population is of special concern.[87] COSEWIC identifies the primary threats and limiting factors for the northern mountain caribou ecotype:

[83] A k-selected species is generally one with relatively low reproductive rates and slow reproductive cycles. Reproductive rates are limited to one calf per cow per year, at most, unlike other ungulates such as moose which may vary their reproductive rates.
Monte Hummel and Justina C. Ray, Caribou and the North, Dundurn Press, Toronto: 2008, pg. 233;
Steven H. Ferguson, Alan R. Bisset and Francois Messier, "The Influences of Density on Growth and Reproduction in Moose", Wildlife Biology, 6:1 (2000), pg. 32.
[84] An interior species is one which avoids edges of habitat types. Alberta Sustainable Resource Development and Alberta Conservation Association. Status of the Woodland Caribou in Alberta, Update 2010, Alberta Sustainable Development, Wildlife Status Report 30, 2010, pg. 14, 20.
[85] Climax stage vegetation is vegetation that has developed over time to best fit the physical landscape: the vegetation is in equilibrium with its surroundings and without disturbance will remain largely unchanged over time. Climax stage vegetation follows earlier stages of vegetation that occur after a disturbance.
[86] J.S. Boates and MB Fenton, "Flagship Species – Flagship Problems: recovery of species at risk and the conservation of biodiversity in Canada", *Canadian Journal of Zoology,* 89:5 (2011).
[87] A species of special concern is "A wildlife species that may become threatened or endangered because of a combination of biological characteristics and identified threats." The two other populations of mountain caribou are less secure endangered.
COSEWIC. COSEWIC wildlife species status categories and definitions. 2016.

> In the Northern Mountain [designatable unit], major threats include altered predator-prey dynamics due to habitat change. Human disturbance and habitat loss (including functional habitat loss due to avoidance) have resulted from the cumulative effects of forest harvesting, mineral exploration and development and associated access, motorized and non-motorized recreational activities, changes in forest structure due to Mountain Pine Beetle infestations and/or associated salvage logging, and impacts from climate change.[88]

EARLY SUBJECT OF CARIBOU RECOVERY PROGRAMS

Concern for the Finlayson Caribou Herd's sustainability led to intensive conservation efforts by Government of Yukon beginning in the 1980s. With the herd exhibiting unsustainable population trends, YG instituted a wolf management plan in 1982 with the intent of removing wolves to reduce predation of caribou. From 1983 to 1989, the relevant wolf population was reduced by 451 individuals, leading to a decline of wolf populations by roughly 85 percent from 1982 to 1989. Twenty-nine wolves were known to have survived the program.[89] The removal of wolves increased caribou populations from approximately 2 000 individuals to 6 000 individuals, and moose populations also tripled.[90]

In tandem with removing wolves, YG also restricted licensed harvest to one male caribou from the previous limit of one caribou of either sex from August 1 to October 10. Simultaneously, "First Nations residents of Ross River and Watson Lake also voluntarily restricted their caribou harvest and it is believed that First Nation harvest was significantly reduced during the recovery program."[91]

Despite short-term gains in population, wolf populations quickly rebounded and caribou populations resumed declining. The plan is considered a failure: "The [plan's] failure was largely owing to the lack of a comprehensive long-term management plan endorsed by the Yukon public—one that limited human harvest and land-use activities."[92]

LONG-TERM MANAGEMENT UNDER PERMIT HUNT AUTHORIZATION

In order to address declining populations after the wolf management plan had concluded, a permit hunt authorization regime was created in Yukon which introduced a lottery and overall harvest limits for licensed hunting. This regime was instituted in 1998 and was the first permit hunt authorization in Yukon. First Nations voluntarily adopted restrictions as well.

The rationale for the institution of such measures was due to substantial population declines in the 1990s, "Human harvest levels became non-sustainable as wolves fully recovered and

[88] COSEWIC. COSEWIC assessment and status report on the Caribou *Rangifer tarandus*, Northern Mountain population, Central Mountain population and Southern Mountain population in Canada, 2014.
[89] Rick Farnell. Three decades of caribou recovery program's in Yukon. Environment Yukon. 2009, pg. 1.
[90] YOR Document 2017-0083-133-1, pg. 12.
[91] Ibid.
[92] Farnell. Three decades of caribou recovery program's in Yukon, pg. 1.

greatly accelerated the caribou population decline until 1998 when strong conservation measures (outfitter quotas, permit hunt for licensed resident hunters and First Nation voluntary compliance) were put in place to reduce these effects."[93]

The permit hunt authorization regime for the Finlayson Caribou Herd remained in place from 1998 to 2018, and was one of three Yukon caribou herds with permit hunt authorizations. Permit hunt authorizations are implemented to "responsibly manage overall species populations and improve hunt quality. Where it is required to control the number of animals harvested, permit hunts limit the number of animals harvested for specific species and areas."[94]

The permit hunt authorization regime was replaced in 2018 with greater restrictions.

REMOVAL OF PERMIT HUNT AUTHORIZATION

In 2018 after drawing names for the permit hunt authorization, YG reduced licensed harvest of the FCH to zero. Outfitter harvest was reduced to zero in 2019. Currently no outfitter or licensed FCH harvest is permitted.

RRDC IMPLEMENTATION OF PERMIT SYSTEM

In 2018, and in response to concerns about caribou and moose populations, the Ross River Dena Council stated it would require non-Kaska hunters to apply for a permit from RRDC to harvest moose and caribou.[95] RRDC stated it would be issuing 15 permits for the Finlayson Caribou Herd.[96] While stating that the laws of general application would still apply for harvest in the range of the Finlayson Herd, YG encouraged compliance with RRDC requests for a shorter moose and caribou season and reduced hunting in certain areas.[97]

Context

HABITAT

CARIBOU RELIANCE ON LICHEN

Woodland caribou, including Mountain Woodland Caribou, rely heavily on lichen as a food source. This reliance is particularly pronounced in winter when lichen may make up over three quarters of the caribou's diet.[98]

[93] Ibid.
[94] Department of Environment. Government of Yukon. About Permit Hunt Authorizations. 2018.
[95] Yukon News. June 22, 2018. RRDC to require non-Kaska hunters in Ross River area to get special permit. Yukon News https://www.yukon-news.com/news/rrdc-to-require-non-kaska-hunters-in-ross-river-area-to-get-special-permit/
[96] Ibid.
[97] Yukon Government. News Release. 2018-2019 Hunting season in Ross River Area. July 31, 2018. https://yukon.ca/en/news/2018-19-hunting-season-in-ross-river-area
[98] DC Thomas, E. Janet Edmonds, W. Kent Brown. "The diet of woodland caribou populations in west-central Alberta." Rangifer 16, no. 4 (1996).
Jennifer M. Galloway et al. "Diet and habitat of mountain woodland caribou inferred from dung preserved in 5000-year-old alpine ice in the Selwyn Mountains, Northwest Territories, Canada." Arctic 65 Suppl. 1 (2012).
TA Kinley. "Characteristics of Early-Winter Caribou, Rangifer tarandus caribou, Feeding Sites in the Southern Purcell Mountains, British Columbia". Canadian Field Naturalist. 117, no. 3 (2003)

Mature forests host the lichens consumed by caribou, as these lichens are most abundant during later successional stages of forest growth. After disturbance, such as a forest fire, it can take up to fifty years for lichen to regrow. In the more immediate aftermath of disturbance, during early successional stages, disturbed sites host fast-growing plant communities which attract other ungulates such as moose.[99]

Caribou reliance on lichen and the limited availability of older growth forests supporting lichen results in limitations to caribou habitat. Disturbance, whether natural or anthropogenic, is negatively associated with lichen growth and consequently is negatively associated with caribou presence. The attraction of other ungulates to disturbed areas also risks increasing predator presence which may result in incidental increases in predation.

CARIBOU ARE RELIANT ON HIGHER ELEVATION AREAS OUTSIDE OF WINTER

While the Finlayson Caribou Herd is not migratory, the herd occupies different, but intermeshed and overlapping, ranges throughout the year. Seasonal movements include elevation changes and altered habitat preferences.

From the post-calving period through the rut,[100] caribou tend to use higher altitude areas as compared with moose. This is an evolutionary survival strategy which seeks to separate caribou from wolves, as wolves' primary prey is moose. Caribou also use snow patches at higher elevations during summer to avoid insects.

Since its quantity is fixed, higher elevation areas provide a constraint on the availability of suitable habitat from post-calving through the rut.

WINTER HABITAT GENERALLY CONSIDERED LIMITING

In general, despite a fixed amount of high elevation habitat, winter habitat is generally considered the most limiting habitat type for caribou. This holds true for the Finlayson Caribou Herd as well: "considering winter range, there is a much higher density of animals and proportion of the total population occupying that range; the relative importance of this range is therefore higher according to its seasonal use for critical life functions."[101]

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[99] In Alaska, this effect may last for upwards of 40 years. However, peaks in this effect may be felt between 11 and 30 years after disturbance.
W. James Rettie and Francois Messier, "Heirarchical Habitat Selection by Woodland Caribou: Its Relationship to Limiting Factors," Ecography, 23 (2000), 467.
Kim G. Poole and Kari Stuart Smith, "Winter Habitat Selection by Female Moose in Western Interior Montane Forests," Canadian Journal of Zoology, 84 (2006), 1829.
Jason T. Fisher and Lisa Wilkinson, "The Response of Mammals to Frest Fire and Timber Harvest in the North American Boreal Forest", Mammal Review, 35 (2005), 36;
Ecological Monitoring Committee of the Lower Athabasca, "Assessing the Influence of Industrial Development on Caribou in the Lower Athabasca Planning Region of Alberta", Alberta Biodiveristy Monitoring Institute, 2011.
Dale R. Seip, "Factors Limiting Woodland Caribou Populations with Wolves and Moose in Southeastern British Columbia," Canadian Journal of Zoology, 70 (1992);
Rehaume Courtois et al., "Demographic and Behavioural Response of Woodland Caribou to Forest Harvesting", Canadian Journal of Forest Resources, 38 (2008).
[100] Calving takes place in May and potentially into early June with post-calving surveys taking place in June. Rut surveys take place during October.
[101] YOR Document 2017-0083-6443, pg. 2.

During winter, additional demands are made of caribou. Daily caloric costs are higher as snow increases the amount of effort needed for movement and foraging. Colder temperatures require more energy to maintain body temperature and additional energy demands are made of pregnant cows. Habitat quality, in the face of these energy demands, is important. Despite temperatures at the Project site being slightly higher than those at lower elevation, the Finlayson Caribou Herd tends to occupy lower altitudes during winter, likely as a result of greater snowfall at higher elevations.[102]

CARIBOU VULNERABLE TO DISTURBANCE

Caribou are an interior species[103] - caribou tend to avoid the fringes, or edges, of habitat patches. Linear disturbance, such as roads, and non-linear disturbance, such as open pits, create edges. Likewise, caribou also avoid sensory disturbance caused by humans through human presence, noise and scent. Consequently, effects to caribou habitat have a spatial extent greater than that of a project's direct footprint; they extend across a zone of influence.

> A "zone of influence" is the difference between an activity's spatial footprint and the extent of the activity's effects on surrounding habitat and wildlife populations.[104]

Zone of influence depends on activity – a road will have a different zone of influence than an airstrip or a campsite. Caribou, including northern mountain caribou, are relatively sensitive as compared with many other species; however, literature provides a diverse set of estimates for the zone of influence for caribou. The Proponent has selected a 3 km zone of influence to apply to the Project footprint. This prediction is likely on the lower end of ZOI estimates, though is not unreasonable, when considering Northern Mountain Caribou.

MORTALITY AND RECRUITMENT

CARIBOU REPRODUCTIVE RATES RELATIVELY FIXED COMPARED TO OTHER UNGULATES

Caribou are a "classic k-selected species" – meaning that they have both a relatively rigid and low reproductive capacity. Reproductive rates are essentially limited to one calf per cow per year – which represents a lower capacity for reproduction, or fecundity, than many other species. When compared with moose, caribou have both a later breeding age and lower fecundity. Therefore, it can take considerable time for populations to recover.

CARIBOU VULNERABLE TO INCREASED PREDATION IN AREAS WITH MORE ROADS

Wolves often use roads where they exist for some of the same reasons that human use them. The primary reason being ease of movement, especially when cleared of snow. Roads increase the chances of caribou-wolf interaction both by facilitating the movement of wolves and by

[102] YOR Document 2017-0083-083-1.
[103] Alberta Sustainable Resource Development and Alberta Conservation Association. Status of the Woodland Caribou in Alberta, Update 2010, Alberta Sustainable Development, Wildlife Status Report 30, 2010.
[104] Steven F. Wilson. "Recommendations for Applying Management Buffers to Mitigate Zone-of-Influence Impacts from Oil and Gas Activities on Terrestrial Wildlife and Habitats in British Columbia" BC Oil and Gas Commission. 2016.

providing corridors with good visibility. As such, the development of linear infrastructure can increase the likelihood of predator-prey encounters, which will likely increase the chance of wolf-caribou encounters, and therefore wolf predation of caribou.

Existing Conditions and Trends

HABITAT

LIMITED POST-CALVING AND RUTTING HABITAT AVAILABILITY FOR THE FINLAYSON CARIBOU HERD

The Finlayson Caribou Herd has a fixed amount of suitable habitat for post-calving and rutting (see Figures 13, 14). The Project is proposed in an area that consists of large patches of suitable post-calving and rutting habitat. Within these large patches of suitable habitat, many individuals show site fidelity – i.e. they return to the same site every year, during the post-calving and rutting periods. While site fidelity may not indicate dependence on a specific site, it does indicate highly suitable habitat.

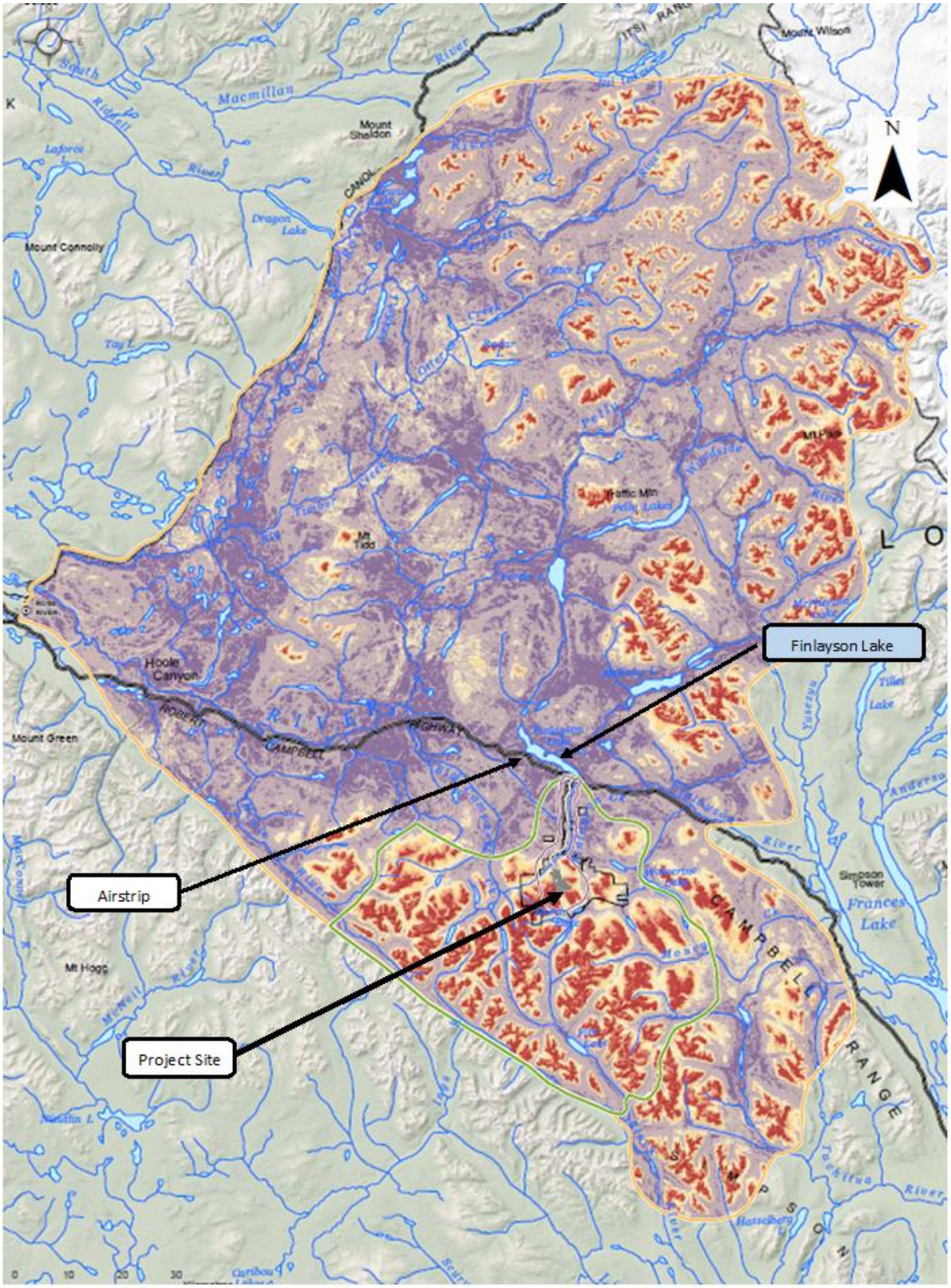

Figure 13: Post Calving Habitat in the project area, red is high suitability whereas blue is low suitability. A 3km zone of influence is shown around the project site in purple. Mineral claims associated with the project are outlined in black.

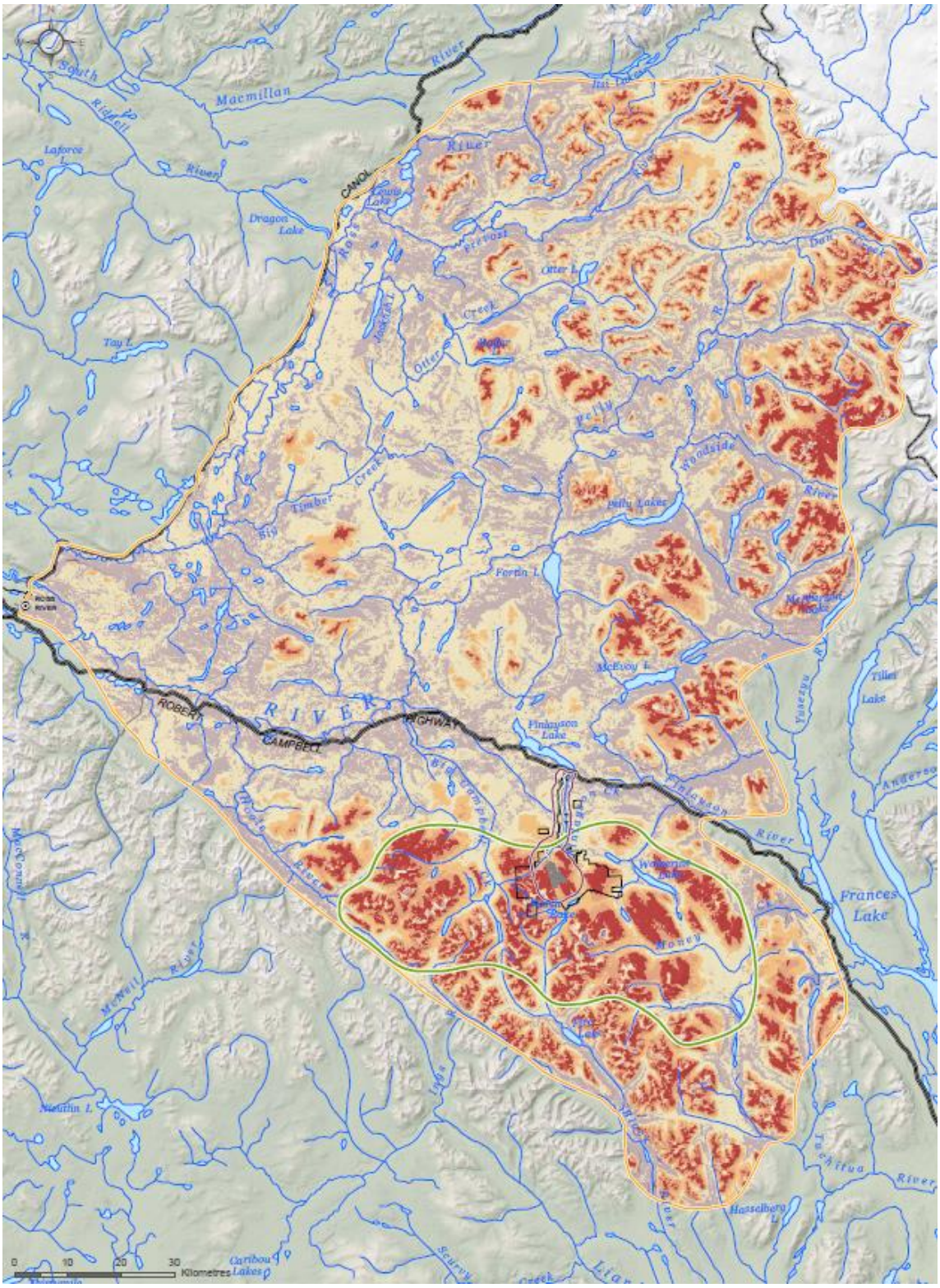

Figure 14: Rutting Habitat in the project area, red is high suitability whereas blue is low suitability. A 3km zone of influence is shown around the project site in purple. Mineral claims associated with the project are outlined in black.

PROJECT AREA NEAR WINTER HABITAT OF THE FINLAYSON CARIBOU HERD

The areas to the north of the Project site, in lower, flatter terrain around the Robert Campbell Highway and up towards Ross River, are winter habitat for the Finlayson Caribou Herd (see figure 14 below).

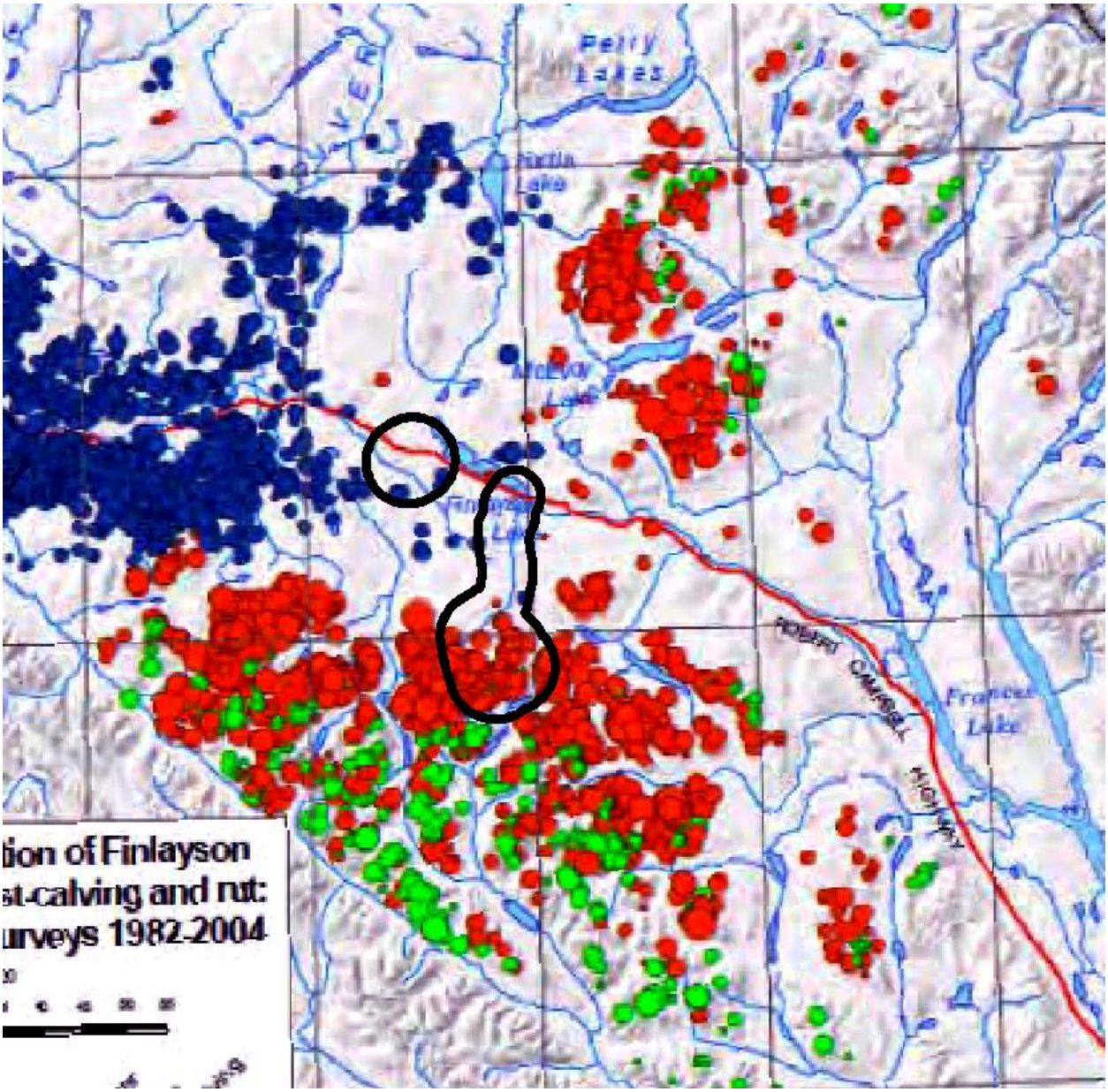

Figure 15: Project area and caribou observations from the last available YG Finlayson Caribou Survey. Red indicates rutting observations, green indicates post calving observations, and blue indicates winter observations[105]

Unlike rutting and post-calving habitat, there does not appear to be site fidelity to winter habitat. The herd displays considerable spatial variation in its winter range.

[105] Department of Environment. Government of Yukon. Finlayson Caribou Herd Late-Winter Population Survey, 2007.

FINLAYSON CARIBOU HERD RANGE RELATIVELY UNDISTURBED

Within the range of the Finlayson Caribou Herd, the Robert Campbell highway, the Wolverine Mine and mineral exploration are most likely the largest sources of habitat loss for the herd. Many historical and current exploration projects, which include trenching, drilling, and bulk sampling programs, dot the range of the Finlayson Caribou herd.

The Robert Campbell highway cuts through key winter habitat, providing both a means of access to the herd and facilitating harvest, but also fragmenting habitat. The community of Ross River also lies on the edge of the Finlayson Caribou Herd's range. Limited habitat loss through disturbance may also exist around outfitting, trapping, camp or tourism infrastructure. Despite these sources of disturbance, the FCH's range is relatively undisturbed when compared with many other Mountain Caribou herds, such as the Southern Lakes, or Klaza herds.

RECRUITMENT AND MORTALITY

HISTORICAL DEMOGRAPHICS SUGGEST POPULATION DECLINE

Rut surveys conducted by YG over the last twenty years have consistently shown an average calf to cow ratio of approximately 20 calves per 100 cows. A recruitment rate of 26 is considered to be sustainable.[106]

Rut surveys may overestimate calf numbers slightly as calf survival is not necessarily certain through the winter, though calf mortality is more likely to occur prior to the rut than after. Years in which observed recruitment is over 26 calves per 100 cows are uncommon, occurring only seven times from 1990 to 2014. These ratios are consistently below sustainable thresholds, which has manifested as downward pressure on populations.

[106] YOR Document 2017-0083-133-1, pg. 13.

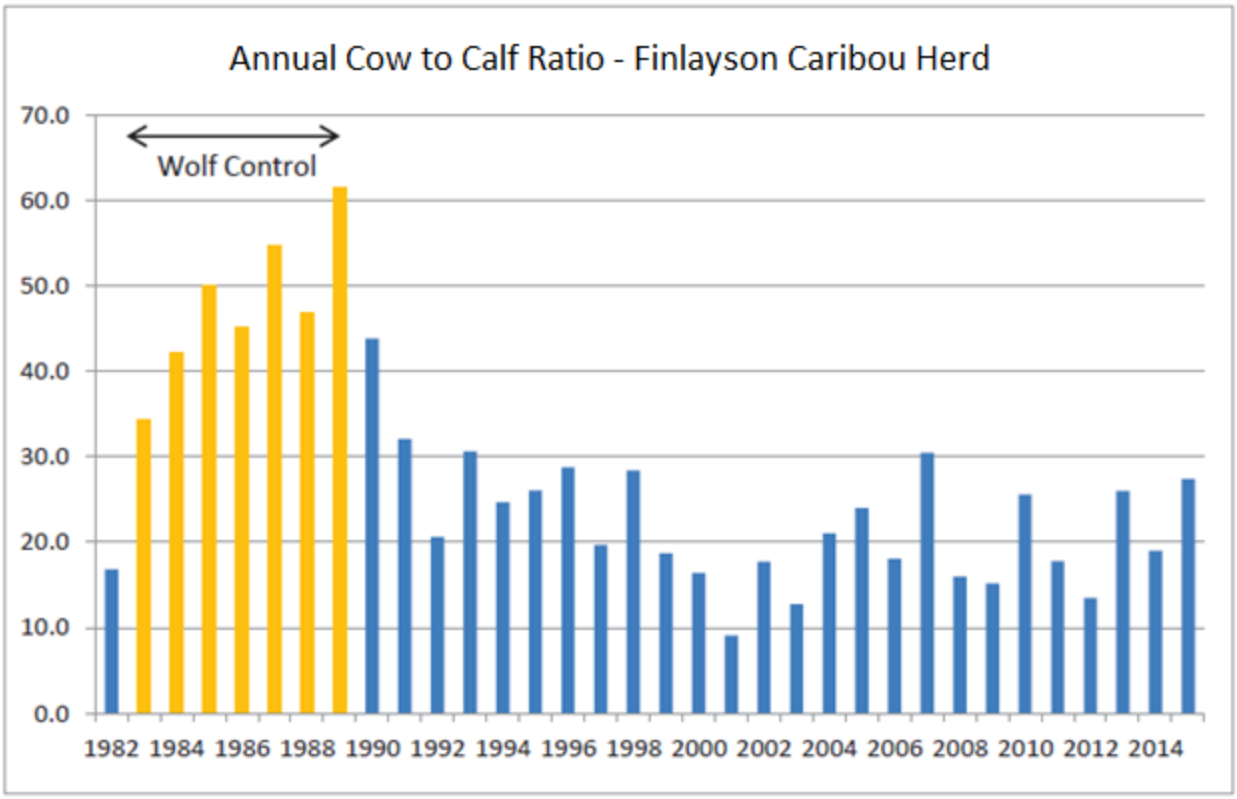

Figure 16: Calves per 100 cows based on fall rut surveys, after most calf mortality is likely to have occurred – recruitment during the wolf control period is highlighted

While recruitment levels from 1990 to recently have generally been below sustainable levels, sex ratios were likely sustainable. Aerial surveying in 2015 estimated a sex ratio of 31.2 bulls per 100 cows, while another in 2016 estimated the ratio of bulls to cows at 39 per 100, respectively. A sustainable level based on Yukon Caribou Management Guidelines is 30 bulls per 100 cows.[107]

SURVEY DATA REVEAL PERSISTENT DECLINE

Over the ten years from 2007 through 2017, YG estimates that the Finlayson Caribou Herd has declined by approximately 12 percent, with the 2017 survey estimating a population of ~2700 animals.[108] Government of Yukon states that over a period of 10 years, "the full variability in observed annual recruitment rates has typically occurred."[109] This suggests that inter-year variability is not responsible for population declines; rather, other factors are responsible for this persistent population decline.

[107] Department of Environment. Government of Yukon. Science-based Guidelines for Management of Northern Mountain Caribou in Yukon. 2016. Pg. iv.
[108] YOR Document 2017-0083-6443.
[109] Department of Environment. Government of Yukon. Science-based Guidelines for Management of Northern Mountain Caribou in Yukon. Pg iv.

LITTLE KNOWN ABOUT SOURCES OF HERD MORTALITY

Some detail of historical harvest is available. The permit hunt authorization appears to have been relatively stable at 30 permits for bulls annually, though harvester success rates are not known.[110] Amongst game management subzones 10-06, 10-07, 10-08 and 10-09 (Figure 17), which overlap and surround the Project, approximately seven caribou were harvested annually, on average, by licence from 1995 through 2016.[111]

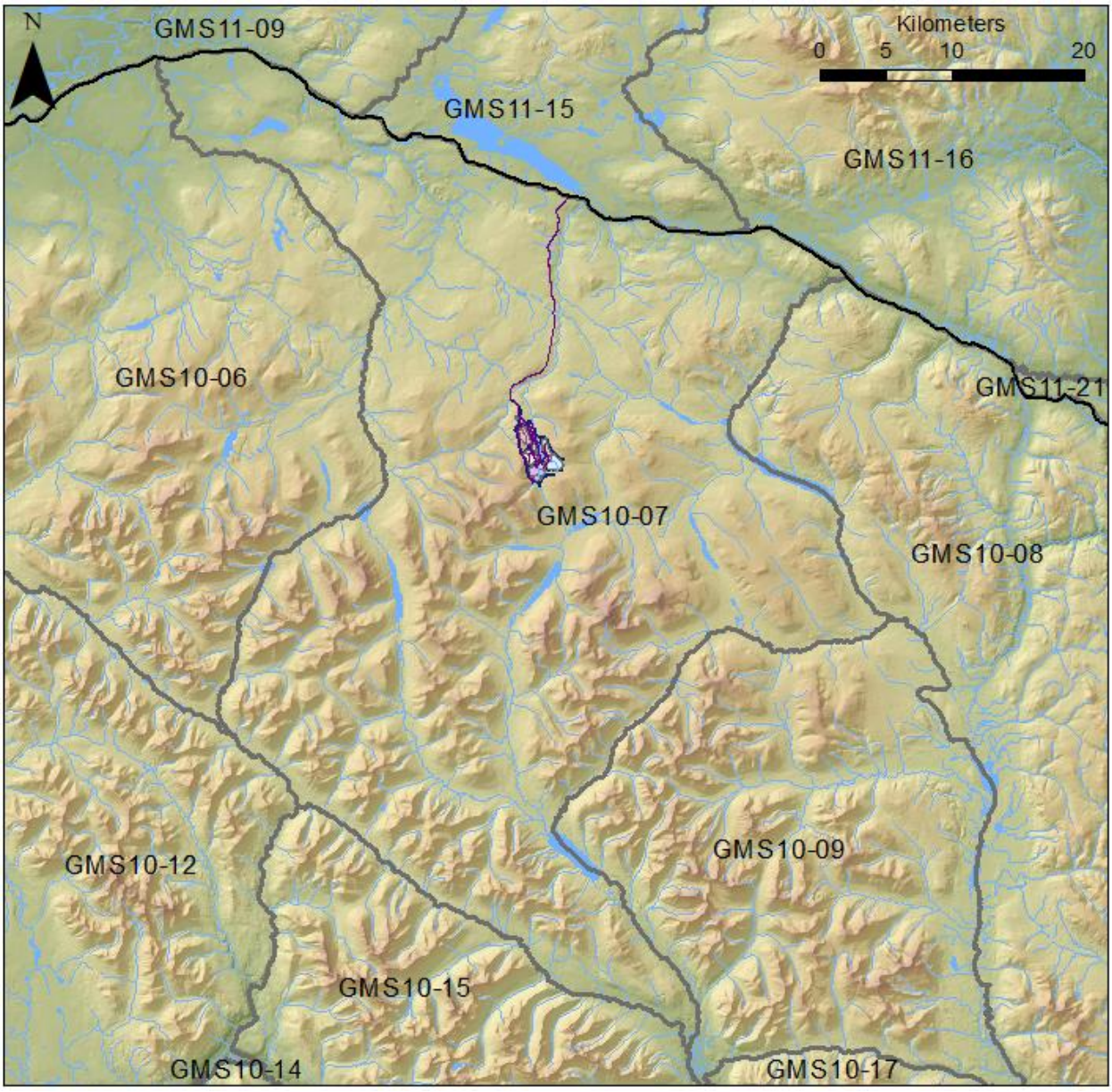

Figure 17: Game Management Subzones near and overlapping the Project. The Project footprint is seen in GMS 10-07.

[110] Ross River Dena Council v Yukon (Government of), 2015 YKSC 45. Paragraph 30.
[111] YOR Document 2017-0083-134-1, pg. 35.

Historical outfitter harvest quotas, however, are not known to the Executive Committee.

CURRENT LEVEL OF LICENSED HARVEST IS ZERO

YG reduced licensed harvest, including outfitter quotas, of the Finlayson Caribou Herd to zero.

LOW LEVEL OF WILDLIFE-VEHICLE COLLISION MORTALITY

Wildlife-vehicle collisions account for little FCH mortality. Government of Yukon data show that along the entire Robert Campbell highway, from 2003 to 2014, only one collision between caribou and vehicles occurred.[112]

LIMITED DATA ON OTHER CURRENT SOURCES OF MORTALITY

The Executive Committee has little information on other sources of potential mortality including predation, subsistence harvest, poaching, disease, terrain hazards, or other sources.

While recent surveys have suggested that the demographics of the herd "should be stable or increasing," Government of Yukon acknowledges, "there is an information gap regarding mortality, and more specifically, adult mortality."[113]

HERD LIKELY LIMITED BY MORTALITY, MORE SO THAN HABITAT AVAILABILITY AND QUALITY

Though Government of Yukon notes that the herd "should be stable or increasing" based on rut surveys, it has concerns about mortality, stating, "In the case of the Finlayson herd, Environment Yukon suspects mortality (including harvest) likely influences population demographics more than habitat availability."[114] However YG notes that, should the herd's population increase, the relative importance of habitat as a limiting factor to herd population would also increase.[115]

Government of Yukon also notes that some changes to habitat may alter harvest and mortality, "for example, new and/or improved access routes may facilitate harvest and/or result in increased mortality."[116]

The Executive Committee recruited Environmental Dynamics Incorporated (EDI) to assist in determining the relative importance of habitat and mortality. EDI states, "Considering the information in the Project proposal and EDI's experience, habitat does not appear to be the limiting factor for the FCH. Predation and hunting have a demonstrable effect on the FCH population and appear to be key limiting factors on the FCH."[117]

An understanding of the Finlayson Caribou Herd as being mortality-limited is consistent with the broader understanding of caribou in Yukon: "Generally, in Yukon, harvest (and mortality overall) tends to have more of a direct and immediate influence on population demographics."[118]

[112] Yukon Government's Preventing Wildlife Collisions Interdepartmental Working Group. "Large Mammal-Vehicle Collisions: Overview of mitigations and analysis of collisions in Yukon." Government of Yukon. 2015.
[113] YOR Document 2017-0083-6443.
[114] YOR Document 2017-0083-6443.
[115] If management objectives to increase or stabilize the herd's population are realized, reduction in habitat would become a more important factor in limiting herd size relative to predation.
[116] YOR Document 2017-0083-6443.
[117] YOR Document 2017-0083-0950.
[118] YOR Document 2017-0083-6443.

Project Design

HABITAT

The proposed Project includes an open pit mine and associated infrastructure in areas with high-quality caribou habitat. To address some of the more temporary effects of constructing the mine, the Proponent proposes to reduce habitat degradation through disturbance by scheduling construction activities during periods when the Finlayson Caribou herd will be less reliant on habitat in close proximity to the Project.

RECRUITMENT AND MORTALITY

HARVEST

The proposed Project includes maintaining access management controls on an existing road to the mine site. As such, no new road access will be created by the Project, while new road development will remain limited to the mine site itself. While restricting access along the mine access road, the Proponent will also not allow employees, contractors, or camp residents to use recreational off-road vehicles and will institute a no hunting policy. These measures will limit or eliminate the potential for mortality via increased harvest due to the Project.

COLLISIONS

Speed limits are proposed by the Proponent on the mine access road to limit the potential for wildlife-vehicle collisions.

Effects Characterization

HABITAT

PROJECT-RELATED HABITAT LOSS

The Proponent predicts that the Project will predominantly result in the loss of post-calving habitat and rutting habitat. Through habitat modelling (Figures 13, 14 above) and a 3 km zone of influence, the Proponent predicts:

- A removal of three percent of moderately high- and high-quality rutting habitat in the core of the Finlayson Caribou Herd's range during rutting;
- A removal of two percent of moderately high- and high-quality post-calving habitat in the core of the Finlayson Caribou Herd's range during post-calving; and
- The above represent "less than a one percent loss of suitable rut or post-calving habitat in the entire [Finlayson Caribou Herd] home range."[119]

The above quantities are largely due to the zone of influence, which will be reduced after mine operations are complete. Habitat loss due to the mine's footprint, including its open pit, waste storage facilities and water management ponds, will be permanent and irreversible.

Effects to winter habitat are due primarily to increased use of the Finlayson airstrip, increased use of the mine access road and increased use of the Robert Campbell highway. This increase

[119] YOR Document 2017-0083-041-1, pg. 13-37.

in the intensity of road and airstrip use will result in an increased zone of influence around the airstrip and affected road segments.

HABITAT LOSS AND DEGRADATION UNLIKELY TO RESULT IN POPULATION DECLINE

As noted, information available to the Executive Committee suggests that available habitat is not a limiting factor. Government of Yukon notes the importance of preserving winter habitat in relation to this Project (winter habitat will remain largely unaltered), and of avoiding habitat alterations that may increase accessibility (accessibility will remain largely unaltered as well).[120]

EDI, recruited by the Executive Committee to provide technical advice with regards to caribou, indicate that the herd is not limited by habitat and that the habitat loss proposed by the Project will not result in changes to population sustainability.[121]

While historical statistics indicate decline, Government of Yukon also notes that the most recent cow to calf ratios suggest the population should be stable or increasing, suggesting that availability of habitat critical to reproduction and recruitment is not a limiting factor in herd population.

The Executive Committee considers the habitat loss proposed by the Project unlikely to result in reduced populations of the Finlayson Caribou Herd.

RECRUITMENT AND MORTALITY

LIMITED OPPORTUNITY FOR INCREASED MORTALITY BY HARVEST

As no new access roads will be developed and the Project proposes to maintain access restrictions on the existing access road, the proposed Project will not increase access to caribou habitat. Combined with restrictions on the use of recreational vehicles and hunting by employees and contractors, the Project is unlikely to result in increased mortality due to harvesting.

LIMITED POTENTIAL FOR VEHICLE COLLISIONS WITH CARIBOU

Collisions involving caribou on the Robert Campbell highway are rare occurrences. As noted above, one collision has been recorded along the entirety of Robert Campbell highway over a period of 12 years, ending in 2014. While the Project proposes increased traffic, collisions involving caribou are likely to remain rare.

LIMITED POTENTIAL FOR INCREASED PREDATION OF CARIBOU

No new access roads are proposed, but the access road will be cleared in winter. This will allow easier movement for wolves. Roads already provide good sightlines, so a cleared road may allow for increased wolf predation. However, much of the access road is not located in winter habitat, reducing the potential for increases in predation to a shorter portion of the road near the Robert Campbell Highway. The limited extent of cleared road in winter habitat suggests that the effect of increased predation will be limited in nature. The presence of heavy duty vehicles will also push caribou away from the road, further limiting opportunity for caribou-wolf interaction.

[120] YOR Document 2017-0083-6443.
[121] YOR Document 2017-0083-0950.

Significance Determination

HABITAT

EFFECTS ARE LIKELY

The Project will remove habitat from the range of the Finlayson Caribou Herd. Habitat removal will take place through both the Project footprint and the creation of a zone of influence that will displace caribou from parts of their range.

EFFECTS ARE ADVERSE

The removal of habitat from the caribou herd's range is adverse, especially considering there are concerns about the sustainability of the Finlayson Caribou Herd.

EFFECTS ARE NOT SIGNIFICANT

Effects to habitat can result in effects to population. While the Project will produce adverse effects to habitat, these effects are not significant as they are unlikely to produce a noticeable change in the population of the Finlayson Caribou Herd.

No evidence available to the Executive Committee suggests that the proposed effects to habitat will lead to decreased recruitment (population change due to reproduction) or increased mortality of caribou.

RECRUITMENT AND MORTALITY

EFFECTS ARE NOT LIKELY

The Project is unlikely to increase mortality through collisions, harvest or predation beyond current levels of mortality. Collisions will remain unlikely events, and no new harvest opportunities will be created. Predation is unlikely to increase; a large human presence will largely displace caribou from areas adjacent to Project roads, reducing hunting advantages roads provide to wolves. Further, caribou winter habitat is only partially intercepted by the access road. No change to recruitment levels are expected.

EFFECTS ARE ADVERSE

Effects that increase mortality or decrease recruitment are adverse as such events can reduce the sustainability of the Finlayson Caribou Herd.

EFFECTS ARE NOT SIGNIFICANT

The Project is not predicted to lead to population changes of the Finlayson Caribou Herd that would be measurable. Based on the Project design and Proponent mitigation measures, no change to existing mortality levels is likely. As no change is likely, the Executive Committee has determined that the effects of the Project are not significant as the mine will likely not alter the population sustainability of the Finlayson Caribou Herd.

Recommended Monitoring

Due to uncertainties regarding the Finlayson Caribou Herd and that the project takes place within core rutting and post-calving habitat, the Executive Committee recommends, under s.110 of YESAA, that monitoring take place.

CARIBOU MONITORING

Government of Yukon states that annual surveys should be completed to monitor:

- Caribou distribution during the post-calving period to inform understandings of Project effects on habitat use
- Finlayson Caribou Herd composition during the rut to inform understandings of population[122]

Such monitoring could prove beneficial in future assessments related to the Project and for adaptive management of the project over time. The utility of a monitoring program is increased by concern over the Finlayson Caribou Herd's sustainability, such a monitoring program will serve to inform future assessments. As any such surveys could lead to management implications, and as Ross River Dena Council and Liard First Nation have demonstrated deep concern regarding the management of caribou within their Traditional Territory, the executive committee recommends, under s.110 of YESAA:

C. Environment Yukon shall implement, with the Proponent, a survey program to monitor caribou distribution in the project area during the post-calving period and to monitor caribou herd composition during the rut. This survey program shall be designed through collaboration with affected First Nations.

6.2 Moose

Summary & Conclusion

The Executive Committee determined that the Project will not result in significant adverse effects to moose as it will primarily displace moose in an area where there is abundant habitat.

The Project is proposed in an area of high value moose habitat. Little information is known about moose populations in this area, though harvest rates may be limiting. High-quality habitat appears to be abundant, and mortality rates are likely the primary limiting factor of local populations. Consequently, habitat lost due to the Project is unlikely to have a notable effect on moose populations.

In addition, the Project is unlikely to increase mortality rates through harvest, collisions or predation, and the Project is unlikely to degrade or remove habitat sufficiently to alter population dynamics. Therefore, the Executive Committee has determined that the Project will not result in significant adverse effects to moose.

Importance of Moose

IMPORTANT CULTURAL SPECIES

Moose are the second most abundant large mammal species in the Project area, and are a highly valued cultural and subsistence species in Yukon. As the largest member of the deer family, moose can stand over 2 m at the shoulder and weigh over 500 kg. Moose is an

[122] YOR Document 2017-0083-264-1

economically important species, with economic benefits including the sale of equipment and supplies for moose harvesting, outfitting revenue and as draw for wildlife viewing.

Moose are an important part of the traditional economy for Ross River and Watson Lake, and form part of the special relationship to the wilderness of Liard First Nation and Ross River Dena Council.

Legislative & Management Setting

MOOSE MANAGEMENT UNITS

For the purpose of managing moose populations, Government of Yukon has created 67 Moose Management Units (MMU) across the territory. The Project is proposed at the boundary of MMU 43 – the Frances Lake MMU – and MMU 42, the Pelly River MMU. Government of Yukon dedicates survey efforts to moose management units where harvest is concentrated and/or where moose populations are declining. No surveys have been conducted in the Project area since 1996. Survey efforts are generally focused on MMUs where there is greater conservation concern.

Government of Yukon has indicated that the Pelly River MMU, where the Project is located, has an estimated moose density of 241 moose/1000 km^2.[123] Based on the Scientific-based guidelines for moose management in Yukon, allowable harvest is recommended to be no more than "a bull only harvest rate of 3 percent of total estimated population size."[124] Annual licensed harvest from 2014 through 2018 has been 0.8 percent.[125]

NO PERMIT HUNT AUTHORIZATION INSTITUTED

Permit hunt authorizations are implemented to "responsibly manage overall species populations and improve hunt quality. Where it is required to control the number of animals harvested, permit hunts limit the number of animals harvested for specific species and areas."[126]

Government of Yukon has not instituted a permit hunt authorization in the Project area, suggesting that Government of Yukon does not have information that suggests that moose populations require measures such as permit hunt authorizations. However, the Executive Committee believes that the threshold for implementing permit hunt authorization is quite high and therefore not a great indicator of moose population sustainability. The Executive Committee notes that proposed changes to the Wildlife Regulation be designed to allow easier implementation of conservation measures and allow for the implementation of a range of conservation measures.

While not a permit hunt authorization, within the Faro area reporting requirements have been instituted in order to limit harvest in this area. Licensed moose harvest in the Faro area is closed

[123] YOR Document 2017-0083-6124.
[124] Environnent Yukon. "Scientific-based guidelines for the management of moose in Yukon". Government of Yukon. 2016, pg. v.
[125] YOR Document 2017-0083-6124.
[126] Environment Yukon. About Permit Hunt Authorizations. 2018. Accessed March 2019.

after licensed harvesters have harvested fifteen moose in this region. This region does not overlap the Project area.

RRDC IMPLEMENTATION OF PERMIT SYSTEM

In 2018, the Ross River Dena Council stated it would require non-Kaska hunters to apply for a permit from them, for moose and caribou harvest, in response to concerns about caribou and moose populations.[127] RRDC stated it would be issuing 43 permits for moose within its Traditional Territory.[128] While stating that YG legislation would still apply for harvest within the RRDC Traditional Territory, Government of Yukon encouraged compliance with RRDC requests for a shorter moose and caribou season, and reduced hunting in certain areas.[129]

While RRDC concerns regarding moose harvest appear to be particularly concentrated along the North Canol Road,[130] there is no reason to suggest that similar concerns do not apply to the Project area.

Context

HABITAT

Moose are generalist species that forage largely on deciduous browse. Such browse can be found in a wide variety of habitats, from riparian areas and floodplains to disturbed ground with early successional growth and sub-alpine late successional willow stands.[131] Moose consume "large quantities of a wide variety of plant material of a relatively low nutritional value."[132] Consumption of food can be as high as roughly 20 kg of forage per day for a 450 kg animal.[133]

The distribution of deciduous browse throughout the Project region means that moose also are present throughout the region; however, they are generally less likely to be found in alpine areas.[134] In the South Canol Moose Management Unit, moose have been primarily observed within 500 m of elevation from valley bottoms.[135] Moose prefer shrub-dominated habitat, with riparian and wetland habitats being particularly well-suited for moose.

Shrubs, including willows, are early successional stage plants that grow quickly after disturbances such as forest fires; because of this, disturbed areas can quickly be established as moose habitat.

[127] Yukon News. June 22, 2018. RRDC to require non-Kaska hunters in Ross River area to get special permit. Yukon News https://www.yukon-news.com/news/rrdc-to-require-non-kaska-hunters-in-ross-river-area-to-get-special-permit/
[128] Ibid.
[129] Yukon Government. News Release. 2018-2019 Hunting season in Ross River Area. https://yukon.ca/en/news/2018-19-hunting-season-in-ross-river-area
[130] CBC News. September 28, 2018. 'It's our way of life': Ross River Dena defend hunting permit plans. https://www.cbc.ca/news/canada/north/ross-river-dena-hunting-permits-1.4841907.
[131] Environment Yukon. "Scientific-based guidelines for the management of moose in Yukon".
[132] HR Timmermann and JG McNichol. "Moose Habitat Needs". The Forestry Chronical. June 1988, pg. 1.
[133] Alice M. McCulley. "Ranges and movements of moose in Yukon." Alces 53 (2017)
[134] YOR Document 2017-0083- 134-1, pg. 39. However, large bulls are more likely to remain all summer in the sub alpine and alpine areas.
[135] Alice M. McCulley. "Ranges and movements of moose in Yukon." Alces 53 (2017)

The Proponent indicates that Traditional Knowledge relating to habitat requirements show that moose use the area around Finlayson Lake for overwintering. Further, the Proponent notes that greater snow depth is correlated with greater forage effort and increased predation.[136]

MORTALITY AND RECRUITMENT

Wolves often use roads where they exist for some of the same reasons that humans use them. The primary reason being ease of movement, especially when cleared of snow. Roads increase the chances of moose-wolf interaction, both by facilitating the movement of wolves and by providing corridors with good visibility. As such, the development of linear infrastructure, such as roads, can increase the likelihood of predator-prey encounters, which will likely increase the chance of wolf-moose encounters, resulting in increased wolf predation of moose.

Existing Conditions and Trends

HABITAT

PROJECT OVERLAPS HIGH VALUE WINTER HABITAT

The Project overlaps high-quality winter habitat for moose in the region. The lower elevations around Finlayson Lake, including much of the access road, the Robert Campbell Highway and the Finlayson airstrip all overlap this high-quality habitat (Figure 17).

[136] YOR Document 2017-0083-040-1, pg. 13-19. Increased snow depth means increased forage effort and increased predation.

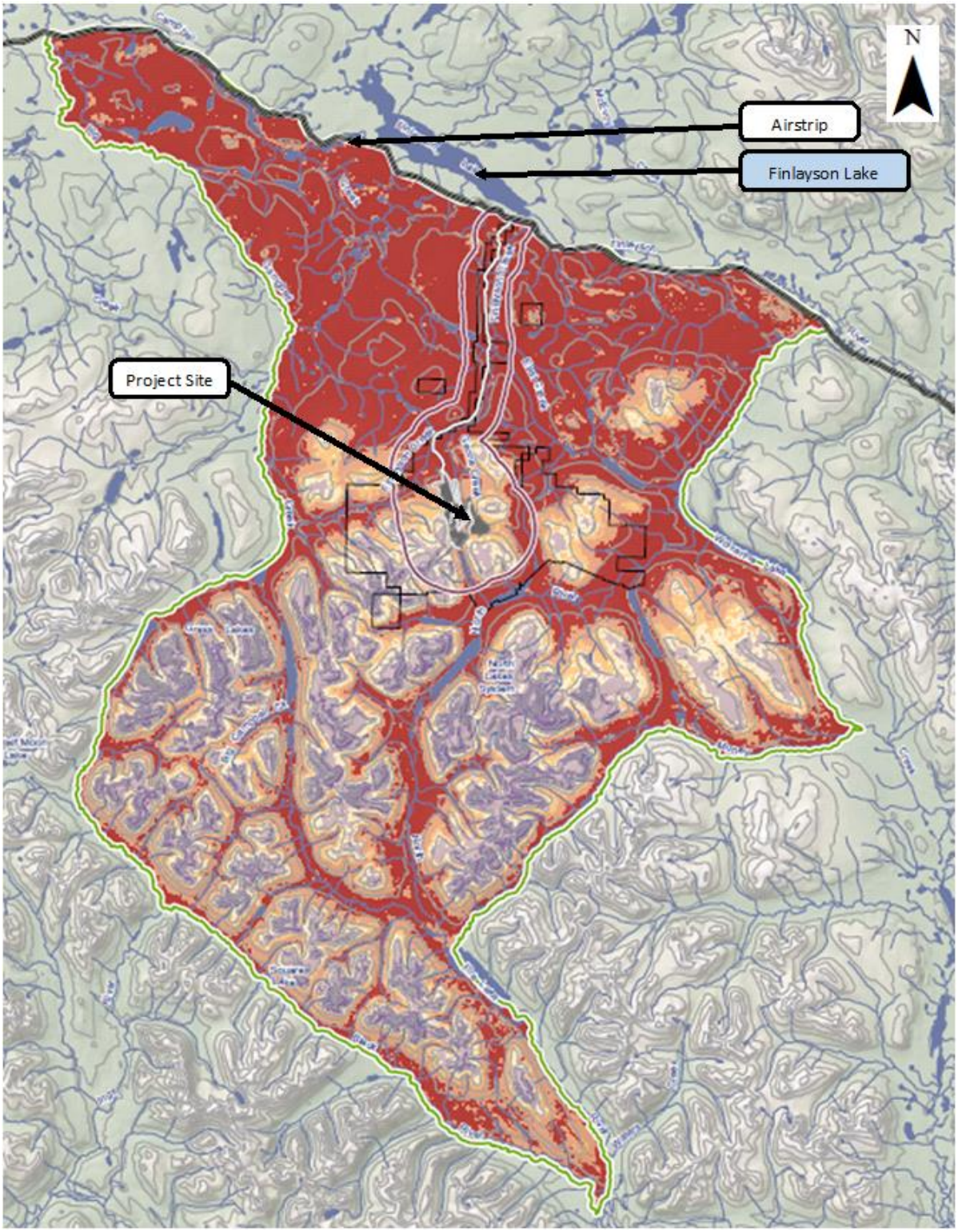

Figure 18: Winter Habitat modelling in game zone 10-7. Red indicates high-quality winter habitat, blue indicates low-quality. The Project is buffered by a 3km for the purple outline around the Project.

Winter habitat is abundant around the Project footprint. However, in moose management zone 10-7, where the Project is located, winter habitat is limited by alpine areas, which overlap the mine site itself.

The Proponent's habitat modelling suggests that approximately 69 percent of game management zone 10-7 consists of moderately high- or high-quality winter habitat.

PROJECT OVERLAPS HIGH VALUE POST-RUTTING HABITAT

High-quality post-rutting habitat extends above winter habitat into the sub-alpine and alpine. The Project area overlaps some of the largest patches of high-quality post-rutting moose habitat in game management zone 10-7 (Figure 18 above). The Proponent's habitat modelling suggests that approximately 50 percent of game management zone 10-7 consists of moderately high- or high-quality post-rutting habitat.

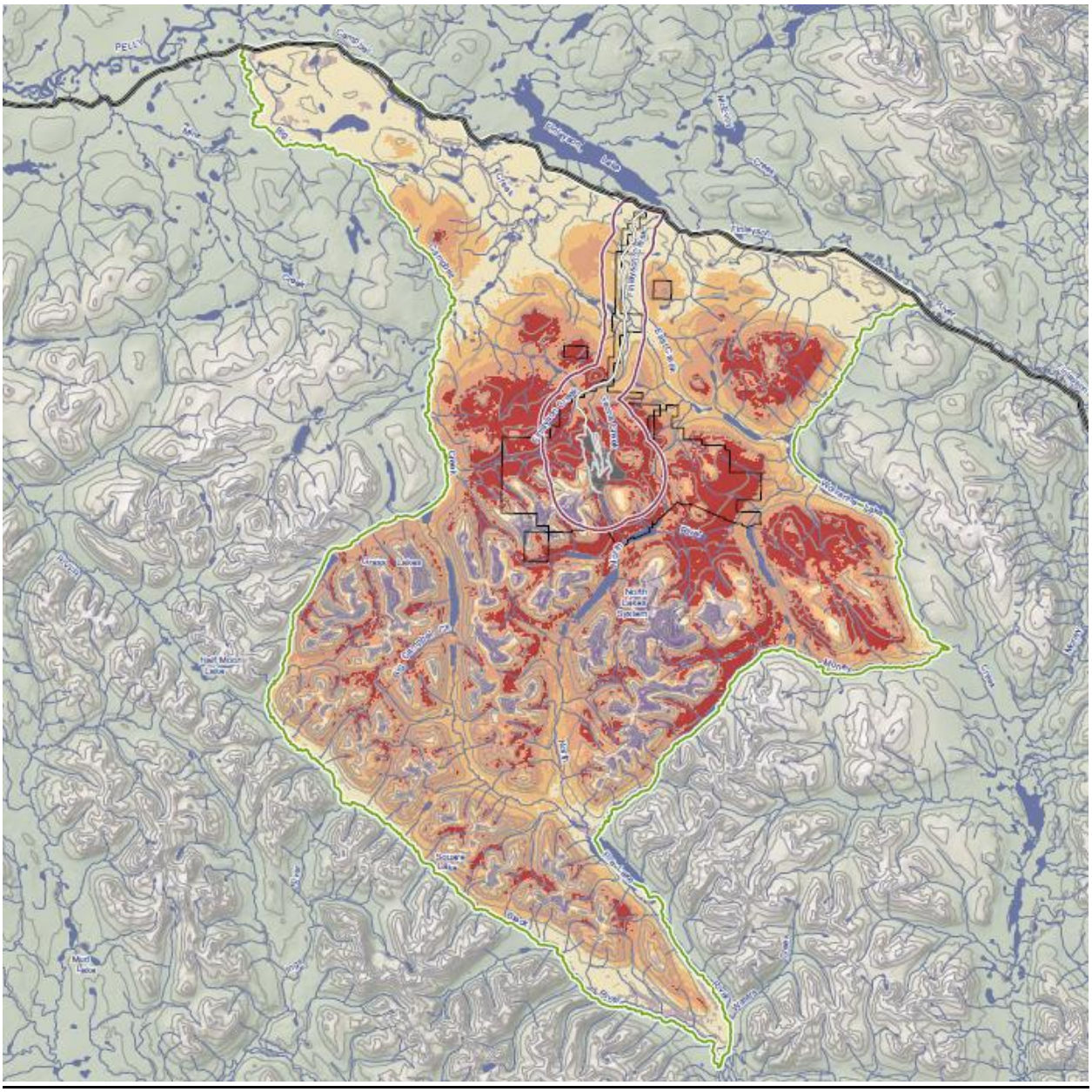

Figure 19: Post-rutting habitat modelling in game zone 10-7. Red indicates high-quality habitat, blue indicates low-quality. The Project is buffered by a 3km for the purple outline around the Project.

AFFECTED MOOSE MANAGEMENT UNITS RELATIVELY UNDISTURBED

Within the affected Moose Management Units, the Robert Campbell highway and mineral extraction form the largest sources of habitat loss for local populations of moose. The Wolverine Mine, for example, is located near the proposed Project. Many historical and current exploration projects, including trenching, drilling and bulk sampling programs, exist within the Project region.

The Robert Campbell highway cuts through key winter habitat, providing both a means of access to moose, facilitating harvest, but also fragmenting habitat. Limited habitat loss through

disturbance may also exist around outfitting, trapping, camp, or tourism infrastructure. Despite these sources of disturbance, the Project region is relatively undisturbed when compared with many Moose Management Units.

HABITAT NOT LIMITING

Based on the abundance of late winter and post-rutting habitat, suitable habitat does not appear to be a limiting factor for moose in the region. This is supported by EDI, whom the Executive Committee retained to assist in evaluating proposal materials and characterizing effects. In their technical memo, they state that, "Considering the information presented, habitat is not the limiting factor for moose in [Game Management Sub-Zone] 10-07. It appears that mortality (e.g. by predation, hunting) have a demonstrable effect on moose populations and appear to be key limiting factors on moose populations in GMS 10-07."[137]

RECRUITMENT AND MORTALITY

LITTLE KNOWN ABOUT MOOSE DEMOGRAPHICS IN PROJECT REGION

Licensed harvest data suggest roughly an average of nine moose harvested per year within game management sub-zones 10-6, 10-7, 10-8 and 10-9. Wildlife-vehicle collision data collected by Government of Yukon indicate that vehicles struck five moose along the entire Robert Campbell highway over twelve years ending in 2014. However, little other data exist in terms of moose population levels, recruitment or mortality in the region.

Government of Yukon indicates that moose population levels are estimated at 241 moose/1000 km^2 of moose habitat.[138] These appear to be relatively high in Yukon, which has populations that tend to be between 100 moose/km^2 of moose habitat and 250 moose/1000 km^2 of moose habitat.[139]

Project Design

HABITAT

The proposed Project includes an open pit mine and associated infrastructure located in moose habitat. To reduce the temporal duration of habitat degradation, the Proponent proposes progressive reclamation.

RECRUITMENT AND MORTALITY

HARVEST

The proposed Project includes maintaining access management controls on an existing road to the mine site. As such, no new road access will be created by the Project, while new roads around the mine site itself will remain limited to the Project site. While restricting access along the mine access road, the Proponent will also not allow employees, contractors or camp residents to use recreational off-road vehicles and will institute a no hunting policy. These

[137] YOR Document 2017-0083-0950.
[138] YOR Document 2017-0083-6124.
[139] Environment Yukon. "Scientific-based guidelines for the management of moose in Yukon", pg. iii.

measures will limit or eliminate the potential for mortality via increased harvest as a result of the Project.

COLLISIONS

Speed limits are proposed by the Proponent on the mine access road to limit the potential for wildlife-vehicle collisions.

ACCIDENTAL DEATH

To avoid mortality through animal entrapment in Project infrastructure (e.g. HDPE lined facilities) and to prevent moose entrance into the pit area, fencing will be installed to prevent access to these facilities. The proposed fence is electrified.

Effects Characterization

HABITAT

PROJECT-RELATED HABITAT LOSS

Within the moose regional study area (game management sub-zone 10-7), the Project proposes to remove or affect:

- one percent of moderately high- to high-quality post-rutting moose habitat due to Project infrastructure footprint (9.4 km^2)
- two percent of moderately high- to high-quality late winter moose habitat due to Project infrastructure footprint (8.4 km^2)
- 16 percent of moderately high- to high-quality moose habitat, if applying a 3 km zone of influence around the Project footprint[140]
- 12 percent of moderately high- to high-quality moose habitat, if applying a 3 km zone of influence around the Project footprint

However, zone of influence effects do not result in the removal of this habitat, but rather its progressive degradation as one gets closer to the Project infrastructure. Further, alternative habitat appears to be available for both post-rut and late winter habitat in game management sub-zone 10-7, and within adjacent game management zones. The availability of alternative habitat, however, does not mean that displacement will be without effect.

The Proponent notes that reclamation will result in the removal of most zone of influence effects because human presence will be diminished after closure and reclamation. Reclamation efforts can reverse reductions in habitat due to ground disturbance, as early successional growth can provide effective moose habitat.

HABITAT LOSS AND DEGRADATION UNLIKELY TO RESULT IN POPULATION DECLINE

Given the amount of available alternative habitat in the affected MMU, moose do not appear to be limited by habitat and the Project's effect on habitat is unlikely to lead to a population decline.

[140] A Zone of Influence is "the difference between an activity's spatial footprint and the extent of the activity's effects on surrounding habitat and wildlife populations". Steven F. Wilson. "Recommendations for Applying Management Buffers to Mitigate Zone-of-Influence Impacts from Oil and Gas Activities on Terrestrial Wildlife and Habitats in British Columbia" BC Oil and Gas Commission. 2016.

This is supported by EDI, whom the Executive Committee retained to assist in characterizing Project effects in relation to moose populations. EDI reported that any effects to moose populations would be limited and that for population level effects, “adult mortality would have to increase and/or calf recruitment decrease.”

RECRUITMENT AND MORTALITY

LIMITED OPPORTUNITY FOR INCREASED HARVEST

As no new access roads will be developed and the Project proposes to maintain access restrictions on the existing access road, the proposed Project will not increase access to moose habitat. Combined with restrictions on the use of recreational vehicles and hunting by employees and contractors, the Project is unlikely to result in increased mortality due to harvesting.

LIMITED POTENTIAL FOR VEHICLE COLLISIONS WITH MOOSE

Collisions involving moose on the Robert Campbell highway are rare occurrences. As noted above, five collisions have been recorded along the entire Robert Campbell highway over a period of 12 years ending in 2014. While the Project proposes increased traffic, collisions involving moose are likely to remain rare events and unlikely to result in measurable changes to moose populations.

LIMITED POTENTIAL FOR INCREASED PREDATION OF MOOSE

No new access roads are proposed, but the access road will be cleared in winter. This will allow easier movement for wolves. Roads provide good sightlines, so a cleared road will allow for increased wolf predation. The limited extent of cleared road in winter habitat suggests that the effect of increased predation will be limited. The regular presence of heavy duty vehicles will also push moose away from the road, further limiting opportunities for moose-wolf interaction.

Significance Determination

HABITAT

EFFECTS ARE LIKELY

The Project will remove habitat available for moose in the Project region. Habitat removal will take place through both the Project footprint and the creation of a zone of influence that will displace moose from parts of their range.

EFFECTS ARE ADVERSE

The removal of habitat from the range of moose is adverse as habitat is required to support moose populations.

EFFECTS ARE NOT SIGNIFICANT

Effects to habitat can result in population effects. While the Project will produce adverse effects to habitat, these effects are not significant as they are unlikely to produce a noticeable change in moose populations within the Project region.

No evidence available to the Executive Committee suggests that the proposed effects to habitat will lead to decreased recruitment or increased mortality of moose.

RECRUITMENT AND MORTALITY

EFFECTS ARE LIKELY

While the Project is unlikely to increase mortality through harvest or collisions, the Project is likely to increase mortality through predation as wolves take advantage of the cleared access road during winter.

EFFECTS ARE ADVERSE

Effects that increase mortality or decrease recruitment are adverse as such events can reduce the sustainability of moose populations.

EFFECTS ARE NOT SIGNIFICANT

The Project is not predicted to lead to measurable changes in regional moose populations. Predation increases, which are likely, will be moderated by the limited portion of the access road which crosses moose winter habitat, and high levels of traffic. Based on the Project design and proposed mitigation measures, notable changes to existing mortality rates is unlikely. As notable changes are unlikely, the Executive Committee has determined that the effects of the Project are not significant.

Recommended Monitoring

Due to uncertainties regarding the regional moose populations and that the project takes place within core rutting habitat, the Executive Committee recommends, under s.110 of YESAA, that monitoring take place.

MOOSE MONITORING

Government of Yukon states that annual surveys should be completed during construction and that surveys be conducted every two years during operations to better understand the changes to late-winter moose distribution.[141] Such a monitoring program could prove beneficial in future assessments related to the Project or the implementation of adaptive management plans. As any such surveys could lead to management implications, and as Ross River Dena Council and Liard First Nation have demonstrated deep concern regarding the management of moose within their Traditional Territory, the executive committee recommends, under s.110 of YESAA:

D. That Environment Yukon, with the Proponent, implement a survey program be instituted to monitor moose during late winter. This survey program shall be designed through collaboration with affected First Nations and Government of Yukon.

6.3 Grizzly Bears

Summary & Conclusion

The Project is not likely to result in significant adverse effects to grizzly bears. The assessment considered the potential for the Project to result in direct and indirect habitat loss, as well as the

[141] YOR Document 2017-0083-264-1

potential to increase grizzly bear mortality. Project design elements and mitigation measures committed to by the Proponent, as well as compliance with applicable legislation and regulations, are sufficient to mitigate the Project's adverse effects.

Importance of Grizzly Bears

Grizzly bears are an iconic species, a common symbol of Canadian wilderness. They are important from a cultural, ecological and economic perspective, and are vulnerable to human disturbance. Between 6 000 and 7 000 grizzly bears are estimated to live in Yukon, representing about one quarter of Canada's population. While Yukon's grizzly bear population is considered healthy, populations are known to be declining in the southern extent of their Canadian range. Grizzly bears are slow to reproduce, making it difficult for the population to recover from human disturbances and mortalities.

Throughout the course of the assessment, Ross River Dena Council Elders identified the grizzly bear as an important cultural species that may be adversely affected by the Project. The Proponent explains that many Yukon First Nations avoid killing or eating grizzly bears because they believe they possess great spiritual powers and have ascribed human attributes to them.[142] The Yukon Conservation Plan for Grizzly Bears also indicates that

> Indigenous cultures in Yukon and transboundary communities are diverse, and their relationships with grizzly bears mirror this diversity. While these relationships varied across the territory, Indigenous people consistently spoke of how people should behave in a respectful manner towards grizzly bears.[143]

In addition to their cultural importance, bears are also harvested by Yukoners and non-residents, and provide an important source of revenue for guided outfitters throughout the territory. Yukon harvest trends, from 1980 to 2014 show that, on average, licensed hunters purchase 995 grizzly bear seals each year in Yukon.[144] Of those seals, 64 percent are obtained by resident hunters, however only four percent (annual average) of resident hunters were successful in harvesting a grizzly bear.[145] Comparatively, on average 15 percent of non-resident hunters were successful. An average of 76 grizzly bears were harvested annually.[146]

Grizzly bears are often considered a flagship or umbrella species for conservation planning, which means that protections put in place for grizzly bears help safeguard other species in their habitat. For this assessment, methods undertaken to avoid interactions with grizzly bears should

[142] YOR Document 2017-0083-135-1.
[143] Department of Environment. Government of Yukon. Draft Conservation Plan for Grizzly Bears in Yukon. June 2018. https://yukon.ca/sites/yukon.ca/files/env/engage-draft-conservation-plan-grizzly-bears.pdf
[144] Department of Environment. Government of Yukon. Licensed Harvest Trends in Yukon 1980 – 2014. 2018. https://yukon.ca/sites/yukon.ca/files/env/env-licensed-harvest-trends-yukon.pdf
[145] Ibid.
[146] Ibid.

also help avoid interactions with black bears. As such, a separate effects assessment for black bears was not undertaken.

Legislative & Management Setting

The following legislative and regulatory framework helps to moderate effects to grizzly bears by controlling attractants and reducing exposure to harmful substances:

Yukon *Wildlife Act:*

- Section 92(1) prohibits the harassment of wildlife
- Section 93(2) and 93(3) prohibit a person from encouraging wildlife to become a public nuisance. This includes the prohibition of feeding wildlife or leaving food or garbage in places where potentially dangerous wildlife (including grizzly bears) may have access to it. Reasonable precautions must be taken to prevent wildlife from accessing garbage and/or any other attractants in the area.

Yukon *Environment Act:*

- Sections 94 and 95 prohibit the disposal of solid wastes and special wastes contrary to the *Solid Waste Regulations* and *Special Waste Regulations*
- Section 135 requires that spills that are abnormal in quantity or above reportable thresholds (as specified in the *Spill Regulations*) are effectively dealt with (i.e. confined, removed and sites rehabilitated)

Context

CONSERVATION STATUS

The western population of grizzly bear is designated by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as a species of special concern, and was added to Schedule 1 of the federal *Species at Risk Act* (SARA) in 2018.[147] Special concern status refers to a species with special characteristics that make it particularly sensitive to human activities or natural events. Under SARA, a management plan for grizzly bears will be required by 2021 and will aim to identify conservation measures to preserve the species and avoid population decline.[148] The COSEWIC Assessment and Status Report for grizzly bears identifies human-caused mortalities as the main factor affecting grizzly bear distribution and abundance (i.e. from direct mortality, such as collisions and killing in protection of human life, as well as from functional habitat loss).[149]

In Yukon, the grizzly bear has a conservation status of S3-Vulnerable, as they are vulnerable to threats which have resulted in their population declines elsewhere, and have low reproductive rates, making it difficult for them to recover from population declines. The Government of Yukon

[147] Government of Canada. Species at Risk Act: order amending Schedule 1 (volume 152, number 12, June 13, 2018). https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/orders/amend-schedule-1-volume-152-number-12-june-2018.html
[148] Ibid.
[149] Committee on the Status of Engendered Wildlife in Canada. COSEWIC Assessment and Status Report on the Grizzly Bear Ursus arctos Western Population Ungava Population in Canada. 2012. https://wildlife-species.canada.ca/species-risk-registry/virtual_sara/files/cosewic/sr_ours_grizz_bear_1012_e.pdf

and the Yukon Fish and Wildlife Management Board are in the process of jointly preparing a conservation plan for grizzly bears in Yukon.

HABITAT CONCERNS

Grizzly bears are omnivores and habitat generalists (i.e. they can live in many different environments and have varied diets), and require large, intact and relatively undisturbed ecosystems. Their habitat use and distribution typically follows available food sources, ranging from ground squirrels and marmot in alpine areas, to berries in shrublands, and/or following moose and caribou.[150] Grizzly bears are major predators to moose and caribou calves. Habitat selection is governed by forage availability and changes with seasons to make use of seasonal foods. Dens are primary habitat for grizzly bears. They can spend up to eight months of the year in their dens and typically return the same denning areas each year (though only ~25 percent are reused).[151] Bears normally select dens in high-elevation areas that are sloped and have dry, stable soil conditions which remain frozen during winter.

One area of concern for grizzly bear conservation is activities which result in direct and functional habitat loss throughout their range. Bears may avoid areas of high habitat value due to human activities, such as resource extraction, residential development and transportation corridors.[152] Increased resource extraction in the northern part of the grizzly bear's North American range, which is relatively undisturbed compared to parts in the southern range, is also causing increased concern for cumulative effects to grizzly bears.[153]

MORTALITY RISK

Grizzly bears have higher rates of mortality in human-dominated landscapes which can affect their distribution and abundance throughout their range.[154] Human-caused grizzly bear mortality may occur as a result of human-bear conflicts (where bears are killed in defense of property or life, often as result of poor attractant management practices), harvesting and through vehicle collisions. The Proponent reports that grizzly bear mortality in Yukon from human-bear conflict ranges from 10 to 15 bears annually.[155]

In Yukon, hunting of grizzly bears is permitted for residents and non-residents. Grizzly bear harvest management in Yukon "is guided by the objective of maintaining grizzly bear populations while providing sustainable harvest opportunities."[156] Harvest across the territory is managed within 29 Bear Management Units, and the Project overlaps the Cassiar Bear Management Unit. Game Management Subzones (GMSs) are also used to manage wildlife

[150] YOR Document 2017-0083-200-1.
[151] Mining and Petroleum Environmental Research Group. Guidelines for Industrial Activity in Bear Country, for the mineral exploration, placer mining and oil & gas industries. 2008. http://www.bearsmart.com/docs/Guidelines_for_Industrial_Activity_in_Bear_Country.pdf
[152] Committee on the Status of Engendered Wildlife in Canada. COSEWIC Assessment and Status Report on the Grizzly Bear Ursus arctos Western Population Ungava Population in Canada. 2012. https://wildlife-species.canada.ca/species-risk-registry/virtual_sara/files/cosewic/sr_ours_grizz_bear_1012_e.pdf
[153] Ibid.
[154] Ibid.
[155] YOR Document 2017-0083-083-1.
[156] Department of Environment. Government of Yukon. Draft Conservation Plan for Grizzly Bears in Yukon. June 2018. https://yukon.ca/sites/yukon.ca/files/env/engage-draft-conservation-plan-grizzly-bears.pdf

species; these are areas within which authorities can make specific regulations for managing large wildlife for harvesting purposes. The Project overlaps GMS 10-07.

To ensure a sustainable harvest, the Government of Yukon tracks grizzly bear mortalities from hunting and non-hunting activities, but does not track First Nations harvest. The total sustainable mortality rate is four percent of the grizzly bear population in a given BMU, which can include up to two percent of the female population, and six percent of the males. This encompasses all sources of recorded mortality, including harvest, road kills, and defence of life or property kills.[157]

Existing Conditions and Trends

GRIZZLY BEAR HABITAT

Grizzly bears are known to occupy the subalpine valleys and alpine plateaus of the Regional Study Area[158] (RSA) and Local Study Area (LSA).[159] Results of the Proponent's baseline studies (i.e. review of recorded observations since 1995 and aerial surveys in 2015 and 2016) show that grizzly bears are denning within a 5 km radius of the Project footprint, and multiple grizzly bears (including females with cubs) are using the LSA for foraging and as a movement corridor to access other habitats.[160] In addition to recorded sightings, the Proponent undertook habitat modelling to better understand the distribution of important grizzly bear habitat within the Project area. The habitat modelling was used to characterize the baseline grizzly bear habitat potential in the area, which will then be used to measure Project-induced changes (i.e. direct and indirect habitat loss). The types of models run and key results (before the Project effects are considered) are presented here:

> ***Denning Habitat Suitability Model:*** The purpose of this model is to identify areas of low, moderate and high denning habitat suitability within the RSA. The results show that approximately 10 percent of the RSA contains high denning habitat suitability, 30 percent is moderate habitat suitability and 59 percent is low habitat suitability.[161]
>
> ***Cumulative Effects Model***: This modelling comprises three separate habitat models and considers existing human disturbances within the Grizzly Bear Study Area (GBSA). The GBSA encompasses GMS 10-07 and extends beyond land height to include entire valley systems, which is more relevant to bear habitat use than the GMS divisions (see Figure 1 for GBSA boundaries). The GBSA was further divided into seven Bear Assessment Units (BAU), each approximately the size of a female grizzly bear's average range. The boundaries of the GBSA and BAU relative to the Project location are shown in Figure 20: Bear Assessment Units (BAU) in relation to the Project.

The Proponent noted that disturbances are generally limited within the GBSA and are attributed primarily to the Wolverine mine, exploration activities at Fyre Lake, the Finlayson airstrip,

[157] Ibid.
[158] The RSA is GMS 10-07.
[159] The LSA is 3 km buffer surrounding the Project footprint and 1.5 km buffer around the Tote Road.
[160] YOR Document 2017-0083-137-2.
[161] YOR Document 2017-0083-135-1.

highway pull-off and a few residences near Finlayson Lake. The models and results, before Project effects are considered, are as follows:

> ***Habitat Effectiveness Model****:* This model measures the potential habitat available to grizzly bears and quantifies the extent of landscape available to them. Overall, the habitat effectiveness of the GBSA was 96.6 percent for all seasons. Within BAU 5, which overlaps the Project, 98 percent is predicted to be effective habitat for all seasons before the Project is applied (i.e. the majority of BAU 5 provides quality foraging habitat for grizzly bears).
>
> ***Security Areas Model****:* This model identifies and quantifies areas where female grizzlies can forage for 24-48 hours without being disturbed by human activity. Results showed that 83 percent of the GBSA is considered secure for foraging bears.
>
> ***Linkage Zones Model****:* This model assesses the availability of movement corridors in valley bottoms by identifying and quantifying areas of potential grizzly crossing and use in mountainous environments. The output of this model is the ability for grizzlies to move through the landscape in danger score classes (high, moderate, low and minimal). The areas with a low or minimal danger scores are potential movement areas or linkage zones. The results of modelling show that 73 percent of the GBSA is considered low danger for travelling grizzlies.

Denning habitat modelling conducted by the Proponent was subject to review by assessment participants. The cumulative effects monitoring was submitted following the public comment phase, and was not subject to the same level of scrutiny as the denning model. However, the Proponent indicated that the modelling approach and methods were developed in consultation with Yukon Environment. The Executive Committee is satisfied that modelling conducted by the Proponent represents a suitable basis upon which to measure the Project's effects.

GRIZZLY BEAR MORTALITY

Specific population data was provided to the Proponent by Yukon Environment for the Cassiar BMU, the GMSs overlapping and surrounding the Project and the BAUs. See Table 17 for current population estimates and Figure 20 for delineation of the various grizzly bear assessment units. The estimated density of grizzly bears in the Cassiar BMU is roughly 14.1 bears/1000 km^2.[162]

[162] YOR Document 2017-0083-292-1.

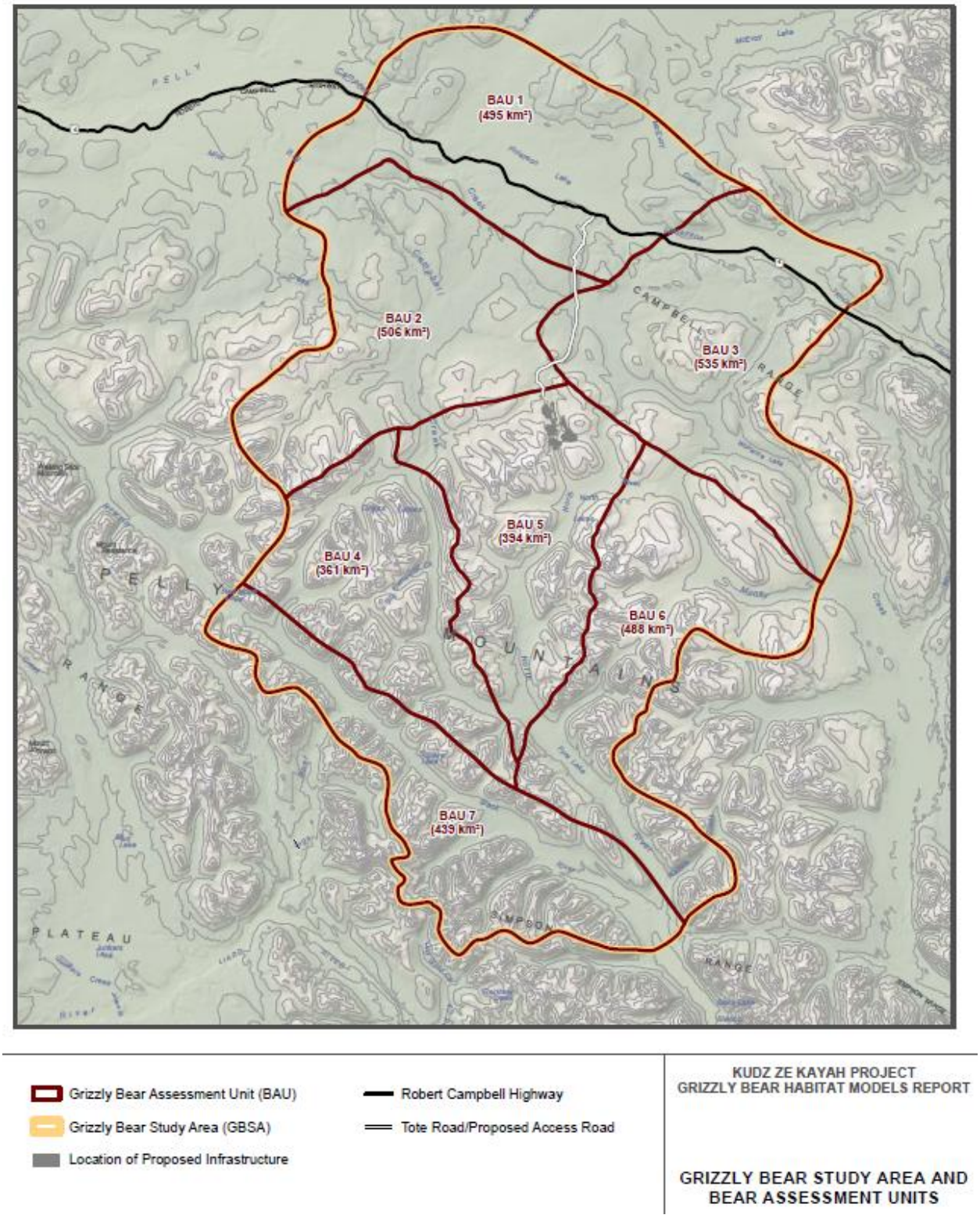

Figure 20: Bear Assessment Units (BAU) in relation to the Project.

Table 17: Estimated Population of Grizzly Bears in Various Management Units

Management Unit	Estimated Population
Cassiar BMU	502
GMS 10-06 to 10-09, 10-12, 11-09, and 11-15 to 11-16	191
Bear Assessment Unit 1-7	45.4
Bear Assessment Unit 5 (overlapping the Project)	5.6

Grizzly bear mortality in the Project area is currently influenced by harvesting activities, and non-harvesting activities such as vehicle collisions and human protection or property. The Proponent has indicated that there have been no adverse grizzly bear interactions during the Proponent's exploration work on the KZK Project.[163]

Bear mortality data from 1995 to 2017 was provided to the Proponent by Yukon Environment for the Cassiar BMU and the GMSs that overlap and are in close proximity to the Project. Bear mortality includes harvest and non-harvest data, but does not account for First Nations harvest. As previously mentioned, sustainable harvest rates established for grizzly bears are two percent for females and up to six percent for males, or four percent of the total population within the Cassiar BMU.

The mortality data from 1995 to 2017 for the Cassiar BMU shows that mortality is 0.6 percent for females and 1.2 percent for males, with an average number of 4.6 bears killed per year. This is below the sustainable harvest threshold identified by Yukon Environment. There was a total of 106 bears killed during this period of time; 89 of these were from harvesting and 17 were non-harvesting mortalities. In GMS 10-07, which overlaps the Project area, there were a total of 17 grizzly bear deaths, averaging 0.7 bears killed per year. The mortality ratio was 1.8 percent for females and 3.3 percent for males, which is below, but approaching, the sustainable mortality ratio for females. GMS 10-07 had the highest mortality pressure compared to other GMSs surrounding the Project area.[164]

Project Design

The Proponent has proposed a number of Project design features and mitigation measures that will reduce potential habitat loss and mortality-related effects to grizzly bears. These are primarily found in the Project proposal, the Wildlife Management Plan, the Waste Management

[163] YOR Document 2017-0083-200-1.
[164] YOR Document 2017-0083-292-1.

Plan and other company policies. Key measures or Project design features committed to by the Proponent that eliminate, reduce or control the adverse effects to grizzly bears include the following:

Best practices implementation:

- Guidelines for Industrial Activity in Bear Country;
- How You Can Stay Safe in Bear Country; and
- Proponent's Guide: Assessing and Mitigating the Risk of Human-Bear Encounters

For minimizing direct and indirect habitat loss:

- The Project footprint was designed to cover as little area as practicable to minimize habitat loss and disturbance;
- Pre-denning monitoring will take place. If bear activity indicates they may be preparing to den in an area that could be disturbed by mining activity, the YG conservation officer and RRDC land stewards will be consulted to determine measures to prevent the bear from denning too close to the pit;
- A preconstruction survey will be undertaken for bear dens and appropriate setback distances from the construction area will be applied until the bears leave the den;
- Progressive and final reclamation of disturbed areas;
- Giving wildlife the right-of-way;
- Halting activities if ungulates, bears or wolverines are encountered during Project activities until the animal has left the area, unless halting activities would be unsafe;
- Flight path routes will be determined to best avoid disturbing wildlife;
- Appropriate measures to carry out blasting activities at the mine, in a manner that avoids disturbing wildlife during critical life cycle activities, will be established in consultation with the regional biologist;
- A policy which prohibits use of recreational all-terrain vehicles and snowmobiles;
- Machinery and personnel will be required to remain in the defined Project area and along defined roads

Mortality Reduction

- A no hunting policy;
- No feeding or harassment of wildlife by employees, contractors and visitors;
- Staffed gate to prevent access to hunters until the road is decommissioned;
- To reduce wildlife collisions, enforcement of vehicle speed limits for employees and contractors, and use of radios to report wildlife sightings on roads;
- The Proponent will provide bear awareness training to all employees and contractors;
- All waste will be stored in bear-proof containers until it is removed from Project area or incinerated. Food waste will be incinerated daily;
- All food and cooking supplies will be stored securely in containers or removed from the site when the camp is closed;

- Camp kitchens will contain stack scrubbers in the venting system to reduce cooking odours;
- The Waste Management Facility will be enclosed by an electrified fence. Ancillary facilities including waste storage, camp, Upper and Lower Water Management Ponds, and all water collection ponds with engineered liners will be surrounded by wildlife-proof fences or emergency egress ramps;
- Personal wildlife deterrents (e.g. air horns, bear spray, bear bangers) and radios will be issued and carried by all field personnel;
- Drill sites built near the gravel tote road will be revegetated with non-palatable plants to avoid attracting wildlife to the roadside.

Effects Characterization

THE PROJECT RESULTS IN DIRECT AND INDIRECT GRIZZLY BEAR HABITAT LOSS

Grizzly bears are known to den within 4-5 km of the Project boundary and use the LSA for foraging and movement between habitats. Project activities, such as land clearing and earthworks, will directly remove grizzly bear habitat from the area. Indirectly, the Project may result in the loss of much a greater area (functional habitat loss) if bears are displaced as a result of auditory and visual disturbances, including during key life cycles such a growing/feeding and denning. Disturbances to bears from Project activities can displace them from preferred habitat types into less desirable habitats and can impact growing efforts and overwintering success. Repeated disturbances during denning can result in den abandonment which, for females and their cubs in particular, can lead to cub mortality. Bears tend to den in the same areas as previous years but typically do not reuse dens, so den locations are not static. Grizzly bears might avoid selecting dens closer to Project activities as a result of human disturbances or may be pushed further from existing denning locations.

Habitat modelling undertaken by the Proponent serves to quantify potential habitat loss resulting from the Project. Modelling showed that less than one percent of highly suitable denning habitat and four percent of moderately suitable denning habitat will be lost from the RSA. The results of habitat effectiveness modelling showed an overall change of 0.6 percent in the GBSA once the Project was applied to the model. Within BAU 5, which overlaps the Project area, the predicted loss was three percent summer and fall habitat, but no change for spring. For security areas (areas of sufficient size, and without disturbances, to allow relatively uninterrupted animal behaviour), there was a predicted loss of one percent in the GBSA, and for BAU 5, unsecured areas (due to human presence) increased from one percent to five percent once the Project was applied to the model. Linkage modelling showed no changes once the Project was applied, but for BAU 5, the Project results in a reduction of safe linkage zones (areas where bears can safely travel) of 2 percent. Overall, the results of this modelling suggest that there are extensive areas of high-quality habitat which is considered safe for bears to forage undisturbed and to travel without being affected by human activities, both within the GBSA and the individual BAUs. Predicted habitat loss from the Project are all under 10 percent of the overall habitat available, which the Proponent characterized as a low magnitude effect (greater than 15 percent would represent a high magnitude effect). The Proponent has provided adequate justification for the selection of habitat loss thresholds and the EC accepts these conclusions.

Overall, the majority of the habitat loss effects are reversible once mining ceases and disturbed areas are rehabilitated, though some loss is permanent (e.g. the open pit). Permanent loss, however, represents only a very small portion of overall grizzly bear habitat in the area.

THE PROJECT MAY RESULT IN INCREASED GRIZZLY BEAR MORTALITY

The Proponent indicates that the Project aims to prevent grizzly bear mortalities.[165] The death of one bear is not likely to affect population, but due to the low reproductive rates of grizzly bears and their limited distribution within the Cassiar BMU, the death of multiple bears, especially females, can result in the sustainable mortality threshold, established by Yukon Environment, being exceeded. The Proponent indicates that up to five females and 15 males (assuming a 50:50 sex ratio) can be killed every year in the Cassiar BMU while still maintaining a sustainable bear population.[166] While the sex ratio is not likely to be 50:50, the expected Project-related mortality rate is expected to be far below the thresholds of five female and 15 male bears. Nevertheless, the Project may result in increased grizzly bear mortality as a result of human-bear conflict and vehicle collisions, as discussed below.

Project development and increased human presence may result in increased grizzly bear deaths beyond the sustainable threshold. To reduce the potential for increased harvest in the area, the Proponent will implement a no-hunting policy for its employees, contractors and visitors. Furthermore, access to the site is controlled at the gatehouse and the access road will be decommissioned once reclamation is complete. Comments submitted by Yukon Environment note the challenges in successfully decommissioning access roads unless there is an effective pinch point along the route where a necessary structure is removed (e.g. a bridge).[167] They suggest that there would likely be residual effects from increased hunting due to increased access in the short- and long-term.[168]

The Project involves the generation and storage of wildlife attractants such as food, waste and fuel. The presence of attractants in the Project area may increase the probability of bear visitations. Improperly handled garbage and debris will further attract bears and other wildlife to the Project area and increase the risk of human-bear encounters, ultimately resulting in bear mortalities. The probability of bears repeatedly visiting the Project site is directly linked to their ability to obtain food or garbage resulting from inadequate garbage management, and the deterrents put in place. Bears constantly assess risk and reward situations and when adequate deterrents are applied, bears will usually stay away from camps.

The measures committed to by the Proponent, as well as the applicable regulatory and legislative requirements around waste management and spills, will reduce the likelihood that bears will be attracted to the site.

Another source of grizzly mortality is the risk of increase vehicle collisions as a result of increased traffic at the mine site. The Proponent has committed to using non-palatable vegetation along roads to reduce grizzly bear attraction to these areas. Wildlife will be given the

[165] YOR Document 2017-0083-137-2.
[166] YOR Document 2017-0083-292-1.
[167] YOR Document 2017-0083-265-1.
[168] Ibid.

right-of-way and speed limits will be enforced on Project roads. These measures will reduce the likelihood of collisions.

Project design features, Proponent mitigation and applicable legislation and regulations will reduce the likelihood of bear mortalities. Regardless of best efforts, there remains a risk of grizzly bear mortality from human-bear encounters, increased harvest and vehicle collisions. The risk of mortality is greatest during construction and operations, but may continue following closure if decommissioning of access roads is not effective. Within GMS 10-07, which overlaps the Project area, female grizzly bear mortality may be approaching the sustainable harvest limit, suggesting that further death of female grizzly bears within GMS 10-07 could result in local population declines. However, with Project design features and commitments made by the Proponent, it is unlikely that the Project will exceed the sustainable mortality thresholds within the Cassiar BMU.

Significance Determination

HABITAT LOSS

EFFECTS ARE LIKELY

Habitat loss is considered a likely effect of the Project. Earthworks and land clearing activities will result in the direct removal of grizzly bear habitat, and the Project may result in the functional (indirect) loss of habitat as a result of habitat avoidance (due to human activity). Modelling undertaken by the Proponent confirms habitat loss (denning and seasonal foraging habitat) as a result of the Project.

EFFECTS ARE ADVERSE

The effects of habitat loss to grizzly bears are adverse. Habitat loss and disruptions during critical life cycles, such as feeding and denning, can impact grizzly bear health, reduce overwintering success and result in grizzly bear mortalities.

EFFECTS ARE NOT SIGNIFICANT

The effects of the Project on habitat loss are not significant. Overall, predicted habitat loss is below identified significance thresholds (i.e. less than 10 percent). Furthermore, habitat effectiveness, security and linkage modelling suggest that sufficient important habitat will be maintained in the grizzly bear study area during all Project phases, even when considering other human disturbances in the area. The Proponent has committed to a number of measures which will ensure sensitive (e.g. denning) habitat is avoided and habitat loss is minimized. Overall, habitat loss is low and is mostly reversible upon cessation of Project activities.

MORTALITY

EFFECTS ARE NOT LIKELY

There is a low likelihood that the Project will result in grizzly bear mortalities. The Proponent has designed the Project to prevent grizzly bear mortalities. No-hunting policies and access restrictions will ensure that the Project will not result in increases in grizzly bear harvest in the area. The Proponent's mitigation measures for waste and other attractants will reduce the likelihood that a bear will be killed in defense of life or property. Limiting traffic speeds and

providing wildlife with the right-of-way on roads will also reduce the likelihood of vehicle-bear collisions.

EFFECTS ARE ADVERSE

Grizzly bear mortalities are adverse. Grizzly bears have high cultural, ecological and economic value.

EFFECTS ARE NOT SIGNIFICANT

The Proponent has made numerous commitments that will reduce the likelihood of grizzly bear mortalities arising from the Project. It is impossible, however, to completely eliminate all risk that a bear will be harvested, killed in defense of life, or killed from vehicles collisions. Any such mortalities are unlikely to exceed the sustainable mortality threshold within the Cassiar BMU.

6.4 Birds

Summary and Conclusion

The Executive Committee has determined that the Project will not result in significant adverse effects to birds due to Proponent mitigations, the limited removal of generic habitat types within the wider region, and the limited risk of mortality due to the Project. Effects to birds will still include mortality, interrupted nesting, and reduced habitat availability. However, within the context of individual bird species populations, these effects are not significant, nor are effects significant within the context of the Bird Conservation Region 4, within which the Project is located.

Effects will be most pronounced during construction, as clearing may disrupt nesting and cause mortality. During operations, birds will be displaced from the Project area, minimizing risk of Project-related mortality. Water management features will potentially lead to contamination concerns post-operations.

Importance of Birds

IMPORTANT CULTURAL SPECIES GROUP

Birds hold symbolic values across a wide range of cultures, including cultures found in Yukon. In addition to symbolic values, within Yukon and Canada birds form an important spiritual, ceremonial and subsistence species group.[169] In addition, Yukon First Nations continue to use birds for a wide variety of purposes, from food to clothing and bags to pillows.[170] Birds figure prominently in First Nations mythology and ways of knowing.

BIRDS AN IMPORTANT TARGET OF CONSERVATION EFFORTS

Birds, as a diverse species group, represent a wide range of biological niches. The wide diversity of the species group, in terms of habitat, food and migration patterns means that there are also a wide variety of factors that may affect bird populations. Certain species, especially

[169] Martin Weinstein. "The Ross River Dena: A Yukon Aboriginal Economy". Royal Commission on Aboriginal Peoples Aboriginal Economy Case Study Project. 1993.
[170] Pamela H. Sinclair et al. Birds of the Yukon Territory. UBC Press, 2003. 40,41.

specialists, can be important environmental indicators. These factors make birds an important environmental indicator.

The importance of birds in terms of both culture and conservation is seen through the popularity of birding, or bird watching, in Yukon. Birds draw large numbers of birders to Yukon and is one of the more organized wildlife viewing activities in Yukon.[171] In addition, high cultural value with high conservation concern is reflected in the Society of Yukon Bird Observatories, which maintains three observatories and conducts considerable banding, educational and observation activities.

Legislative and Management Context

PROJECT TAKES PLACE IN BIRD CONSERVATION REGION

The Project takes place in Bird Conservation Region (BCR) No. 4, which is home to 211 regularly occurring species.[172] Environment and Climate Change Canada (ECCC) note a number of conservation concerns specific to this BCR.

FEDERAL PROHIBITIONS

Legislation to protect and manage bird populations further supports the importance of birds as a highly valued species group. The *Migratory Birds Convention Act*, first passed in 1917, originated in response to concerns over substantial population declines, including species extinction. The *Act* protects 170 of 211 bird species found in BCR No.4,[173] the region in which the Project takes place. *The Migratory Bird Regulations*, under the Act, specifically prohibit, unless authorized:[174]

- The disturbance, destruction or taking of a "nest, egg, nest shelter, eider duck shelter or duck box of a migratory bird;"
- The possession of a "live migratory bird, or a carcass, skin, nest or egg of a migratory bird."[175]

ECCC considers the "inadvertent harming, killing, disturbance or destruction of migratory birds" as "incidental take":

[171] eBird.org holds records of over 45 000 bird viewing checklists (bird watching session summaries) submitted online or by mobile app by users in Yukon. Yukon also has three bird banding stations.
[172] Environment and Climate Change Canada. "Bird Conservation Strategy for Bird Conservation 4 in Canada: Northwestern Interior Forest." Government of Canada. 2013, pg. 7.
[173] Ibid.
[174] Subsistence harvest is not prohibited under the MBCA
[175] Government of Canada. May 30, 2018. Migratory Birds Regulations, C.R.C., c.1035. https://lois-laws.justice.gc.ca/eng/regulations/C.R.C.,_c._1035/page-2.html#h-5

> Under certain circumstances, incidental take of a migratory bird, nest or egg has the potential to result in investigation and potentially prosecution under the general prohibitions of the Act and its regulations. This possibility is elevated if no reasonable attempt was made to avoid or reduce the risk of impact when the action or decision that led to the incidental take was carried out with reasonable knowledge of the potential harm, and/or with reasonable knowledge of the potential presence of migratory birds, nests and eggs in the area to which the action or decision is applied.[176]

In addition to the *Migratory Birds Convention Act* and the *Migratory Birds Regulation,* a small number of species also are protected under the *Species at Risk Act*. Five species of bird found in Yukon are listed as threatened under the *Species at Risk Act*:

- Bank Swallow
- Barn Swallow
- Canada Warbler (range does not overlap with Project)
- Common Nighthawk
- Olive-sided Flycatcher

For these species, the *Species at Risk Act* prohibits:

- The killing, harming, harassing, capturing, or taking of an individual;
- The damaging or destruction of a residence of an individual.[177]

TERRITORIAL PROHIBITIONS

Territorial legislation, the *Wildlife Act*, prohibits the harassment of wildlife, specifically prohibiting the capturing, handling or manipulation of wildlife and the operation of any vehicle in a manner that might harass wildlife, including birds.

In addition, the *Wildlife Act* regulations name peregrine falcon, gyrfalcon and trumpeter swan as specially protected wildlife; this status includes prohibitions against the possession and killing of these species. These species occur within the Project area.

PRESENCE OF BIRD CONSERVATION STRATEGIC PLAN

Environment and Climate Change Canada (ECCC) has led in the development of bird conservation strategies in BCR No. 4. ECCC states that “these integrated all-bird conservation strategies will serve as a basis for implementing bird conservation.”[178]

[176] Environment and Climate Change Canada. Avoiding Harm to Migratory Birds. https://www.canada.ca/en/environment-climate-change/services/avoiding-harm-migratory-birds/overview.html. Accessed March 6, 2018.
[177] With the exception of subsistence harvest.
[178] Environment and Climate Change Canada. “Bird Conservation Strategy for Bird Conservation 4 in Canada: Northwestern Interior Forest.”, pg. iii.

The Bird Conservation Strategy for BCR No. 4 notes that the region has low levels of disturbance to natural habitats, but that this "also means that available information … is very limited." The strategy states that development from mining and energy production[179] are collectively of low magnitude, as compared with residential and commercial development, agriculture, biological resource use,[180] human intrusions and disturbance,[181] natural systems modifications,[182] and climate change and severe weather.[183]

The strategy identifies 77 priority species in BCR No. 4. These species are used to "focus implementation efforts on the issues of greatest significance for Canadian avifauna."[184] Tables 18 and 19 list identified objectives and associated recommended actions in relation to mines and transportation corridors:

[179] Placer mining, specifically.
[180] Biological resource use refers to the hunting of birds, logging, etc.
[181] Human intrusions and disturbance refers to, recreational activities, work and other activities leading to disturbance at nest sites.
[182] Natural systems modifications refers to fire and fire suppression.
[183] Climate change and severe weather refers to: habitat shifting and alteration due to climate change (loss of spruce forest), bird vulnerability to increasing severity of temperatures.
[184] Environment and Climate Change Canada. "Bird Conservation Strategy for Bird Conservation 4 in Canada: Northwestern Interior Forest.", pg. 9.

Table 18: Bird Conservation Region No. 4 Conservation Strategy Recommended Actions Related to Mining

Recommended Actions Due to Threats from Mining[185]			
Threats Addressed	Objectives	Recommended Actions	Priority Species Affected
Encroachment on/degradation of breeding habitat from mining.	Maintain the quantity and quality of wetland and lake/pond habitat within BCR 4 for nesting waterbirds.	Incorporate exclusion zones into mining plans to protect habitat. Incorporate habitat recovery into post-mining site clean-up.	• American Wigeon • Barrow's Goldeneye • Blue-winged Teal • Bufflehead • Canada Goose • Canvasback • Common Goldeneye • Greater White-fronted Goose • Green-winged Teal • Lesser Scaup • Long-tailed Duck • Mallard • Northern Pintail • Northern Shoveler • Surf Scoter • Trumpeter Swan (Pacific Coast) • Trumpeter Swan (Rocky Mountain) • White-winged Scoter
		Incorporate habitat recovery into post-mining site clean-up.	
	Maintain the quantity and quality of alpine streams and associated riparian habitat within BCR 4 for nesting birds.	Incorporate exclusion zones into mining plans to protect habitat. Incorporate habitat recovery into post-mining site clean-up.	• Harlequin Duck • Wandering Tattler
Habitat degradation from mining.	Maintain the quantity and quality of alpine tundra habitat within BCR 4 for nesting birds.	Incorporate habitat recovery into post-mining site clean-up.	• White-tailed Ptarmigan

[185] Excluding placer, which contains additional provisions for Rusty Blackbird. Extracted from: Environment and Climate Change Canada. "Bird Conservation Strategy for Bird Conservation 4 in Canada: Northwestern Interior Forest.".

Table 19: Bird Conservation Region No. 4 Conservation Strategy Recommended Actions Related to Transportation

Recommended Actions Due to Transportation and Service Corridors [186]			
Threats Addressed	Objectives	Recommended Actions	Priority Species Affected
Mortality from collisions with vehicles.	Reduce vehicle collision mortality of birds	Increase public awareness of birds and vulnerability to high-speed traffic.	• Northern Shrike • Short-eared Owl • Common Nighthawk • Bohemian Waxwing • Northern Hawk Owl • Pine Grosbeak • White-winged Crossbill
Degradation of habitat from road construction	Maintain the quantity and quality of wetland habitat within BCR 4 for nesting waterbirds.	Limit construction of roads in and near wetland areas.	• Lesser Yellowlegs
	Maintain the quantity and quality of forested wetland habitat within BCR 4 for nesting birds		
	Maintain the quantity and quality of dwarf shrub tundra and riparian shrub habitat within BCR 4 for nesting birds.	Limit construction of roads in alpine areas.	• White-tailed Ptarmigan
		Reclaim old unused roads.	
		Limit construction of roads in and near wetland areas.	• American Wigeon • Blue-winged Teal • Canada Goose • Greater White-fronted Goose • Green-winged Teal • Lesser Scaup • Lesser Yellowlegs • Mallard • Northern Pintail • Northern Shoveler • Surf Scoter • White-winged Scoter
	Maintain the quantity and quality of alpine tundra habitat within BCR 4 for nesting birds.	Limit construction of roads in alpine areas.	• White-tailed ptarmigan

Context

REGION HAS SMALL HUMAN FOOTPRINT

The Project area occurs within a large area of minimal industrial development. The Bird Conservation Strategy for BCR No. 4 states: “The human population is very small, and many

[186] Environment and Climate Change Canada. “Bird Conservation Strategy for Bird Conservation 4 in Canada: Northwestern Interior Forest.”

parts of the region are remote and difficult to access."[187] The most notable footprints in the region which reduce bird habitat through disturbance include:

- The Robert Campbell Highway (also a source of collision mortality)
- The Faro Mine site
- The Wolverine Mine site
- The communities of Ross River, Faro and Watson Lake

BREEDING GROUNDS UNLIKELY TO BE LIMITING

Migratory birds in the Project area either migrate through the Project area to breeding grounds or use the Project area to breed. Data suggest that migratory bird population changes are related to where birds overwinter, specifically how far south birds migrate. Bird species that migrate to other parts of Canada have been trending upwards, and bird species that migrate to South America have been faring poorly compared with birds that migrate to other destinations (Figure 18).

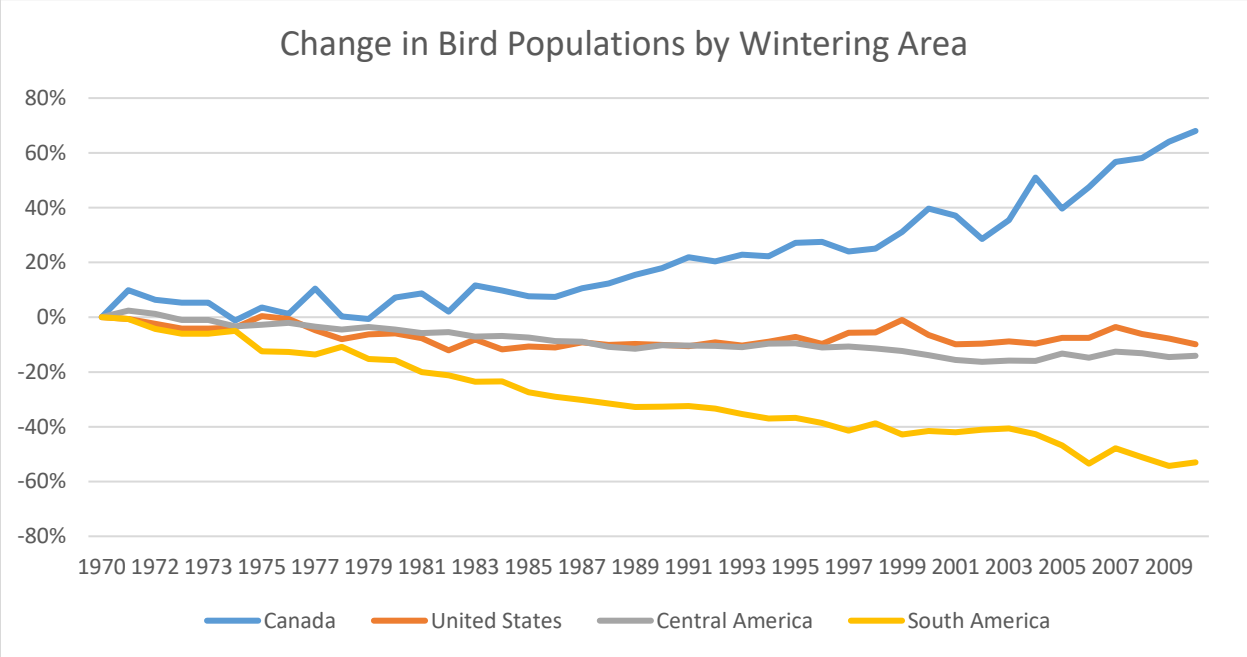

Figure 21: State of the birds. Graph shows the change in bird populations since 1970 (percentages) for groups of species, grouped by where species overwinter

Reasons for their decline, indicated by the yellow line in Figure 18, are likely linked to the following in the south:

- Habitat loss
- Pollution
- Incidental take
- Uncontrolled hunting

[187] Environment and Climate Change Canada. "Bird Conservation Strategy for Bird Conservation 4 in Canada: Northwestern Interior Forest.", pg. 1.

- Climate change

The low level of industrial development in BCR No. 4, and near the Project itself, suggests minor impacts from cumulative effects. Further, bird population trends based on overwintering destinations suggest that the human footprint in Canada is not a major factor in limiting bird populations, in general.[188] However, this is not necessarily true for specialist species. Habitat types used by specialists are not abundant within the project area.[189]

BIRD POPULATIONS DECLINING

Despite overall population increases in birds that both breed and overwinter in Canada, populations in that group declined between 1970 and 2010 by, on average, 12 percent.[190] Certain species have suffered major population declines, including specialist grassland birds, aerial insectivores and shorebirds. Other groups, such as waterfowl and raptors, are generally increasing in population.

Existing Conditions and Trends

PROJECT ADJACENT TO TINTINA TRENCH

The Project is approximately 30 km from the Tintina Trench, a "critical bird migration corridor for many species of song birds and waterfowl." The Tintina Trench is a northern extension of the Rocky Mountain Trench.

PROJECT AREA HOSTS DIVERSE SPECIES ACROSS DIVERSE HABITATS

The Project area includes five major habitat types including riparian, wetland, boreal forest, subalpine forest and alpine.[191] With such diverse habitats, a wide range of species are expected, including both habitat specialists and generalists.

The Proponent conducted breeding bird surveys in 2015 and 2016 within the Project area and at nearby reference sites, observing a total of 67 species, including five species of concern:

- Olive-sided flycatcher (threatened)[192]
- Bank swallow (threatened)
- Barn swallow (threatened)
- Red-necked phalarope (special concern)[193]
- Rusty blackbird (special concern)

[188] Populations of birds that overwinter in Canada are increasing as a group.
[189] While populations of birds that overwinter in Canada are generally increasing, specialist species may follow different trajectories as their environmental niches are more restricted and are therefore more sensitive to certain types of disturbance.
[190] North American Bird Conservation Initiative Canada. The State of Canada's Birds, 2012. Environment Canada, Ottawa, Canada. 2012.
[191] YOR Document 2017-0083-140-1, pg. 116.
[192] A "threatened" species is "A wildlife species that is likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction," where "endangered" refers to "A wildlife species facing imminent extirpation or extinction."
[193] A "special concern" species is "A wildlife species that may become threatened or endangered because of a combination of biological characteristics and identified threats."
COSEWIC. COSEWIC wildlife species status categories and definitions. 2016.

The olive-sided flycatcher was the most observed of the above, with four observations in 2015 and nine in 2016.

Several species of raptor, including golden eagle and gyrfalcon, have been documented in the Project area, including two active raptor nests in close proximity to the mine site. There is also limited capacity for shorebirds and waterfowl in the small lakes and wetlands within the Project area.

FINLAYSON LAKE SUPPORTS A WIDE VARIETY OF SPECIES

The Proponent notes that a North American Roadside Breeding Bird Survey route exists for Finlayson Lake, which is about 30 km north of the mine site itself, near the northern terminus of the access road. From 1992 to 2014, 70 species were recorded, with an average of 37 species observed in any given year.

PROJECT AREA DOES NOT INCLUDE WILDLIFE KEY AREAS OR MAJOR WETLANDS

Despite the diverse presence of species within the Project area, YG has not identified any wildlife key areas for bird species in the Project area. This may indicate limitations of data as opposed to unexceptional habitat values. National Topographic System data also does not indicate the presence of large wetland complexes in the Project area, though the Proponent has indicated the presence of wetland habitats in the area.

PROJECT AREA DOES NOT CONTAIN UNIQUE HABITAT TYPES IN REGION

The Project area does not contain locally unique habitat types. Surrounding areas host a wide variety of habitat, including those found overlapping with the Project. Habitat within the Project footprint is typical of the wider region.

Project Design

Mitigations proposed by the Proponent include a variety of actions. The most relevant, and one of the more effective mitigation measures, requires nest surveys prior to any clearing during the nesting season. The Proponent notes that this is required by the *Migratory Birds Convention Act*. Bird surveys will:

- Be led by qualified and experienced individuals, including "involvement from Kaska representatives identified by RRDC"[194]
- Communicate results to the on-site construction manager and clearing contractors
- Establish buffer zones around active nests with buffer distances ranging from 30 m to 200 m

If no nests are found during surveys, clearing activities will be completed within one week of survey conclusion. Environment and Climate Change Canada notes that it "does not recommend the use of active nest searches, including those proposed by the Proponent. It is well known that active nest searches have a low success of detection and may disturb nesting

[194] YOR Document 2017-0083-043-1, pg 13-68.

birds."[195] However, ECCC also notes that "Non-intrusive methods are unlikely to result in the discovery of nests."[196]

Project Effects

HABITAT

Reduction in Riparian and Wetland Habitat

Approximately 4 km of the Geona Creek valley will be removed and replaced with mine infrastructure, with much of it located near or overlapping Geona Creek. The Project will remove riparian and wetland habitat. Fault Creek will be diverted around the mine site and other diversions will affect other water courses, further reducing riparian habitat.

The removal of natural riparian and wetland habitat areas will reduce suitable habitat for species which rely on these habitat types. However, adjacent areas host similar, unaltered habitat types, which will reduce the impact of wetland and riparian habitat removal in the Project area.

Contamination Risk in Mine Waterbodies

Seven water management ponds will be constructed during operations, and all will have varying levels of water quality. If the ponds are used by birds, there is risk of contamination in the WMPs.

The Proponent notes that "wildlife is unlikely to access the water management and water collection ponds due to fencing around ponds with unsuitable water quality, as well as a general deterrence from general human and equipment activity around the ponds."[197] However, fencing is unlikely to be successful in preventing bird access.

The Proponent notes that if water quality falls below drinking water guidelines for livestock, the Proponent will implement adaptive management plan actions; however, these actions have not yet been drafted and consequently cannot be considered as mitigating effects for this assessment.

During operations, the WMPs are unlikely to be used widely as habitat, given the intensive human presence. During closure the pit will likely remain poor habitat, though it may be used for short durations by migrating birds.

MORTALITY AND REPRODUCTIVE SUCCESS

EXTENSIVE VEGETATION CLEARING

The Project requires the clearing of vegetation for mine infrastructure across a wide range of habitat types: sub alpine, wetland, riparian and, to a limited extent, boreal forest. Land clearing undertaken during the bird nesting can result in nest abandonment, mortality or loss of eggs, all of which reduce species productivity. Disturbance during nesting can also impact the health of

[195] YOR Document 2017-0083-281-1, pg. 23.
[196] Ibid. pg. 24.
[197] YOR Document 2017-0083-043-1, pg 13-73.

the individual. Although the Proponent's proposal to conduct surveys prior to clearing will help mitigate negative impacts, the extent of clearing required for the Project will likely lead to some nest abandonment, mortality and loss of eggs. These impacts will be exacerbated by the territorial nature of most nesting species in the Project area.[198]

VEHICLE-BIRD COLLISIONS

The Project will also lead to increased risk of mortality for birds along the Robert Campbell Highway and the access road. In addition, and to a more limited extent, there will be risk from aircraft servicing the mine.

Significance Determination

HABITAT

EFFECTS ARE LIKELY

The Project will result in habitat loss through the removal of wetlands, riparian areas and watercourses in the Project area.

EFFECTS ARE ADVERSE

Habitat reduction can harm bird populations, and is in general associated with bird population decline across North America and beyond.

EFFECTS ARE NOT SIGNIFICANT

The mine site is in an area with a small human footprint, in a bird conservation area that is amongst the most undisturbed. Breeding birds do not appear to be limited by a lack of breeding habitat. The Project site does not contain important colonial nesting sites, migration staging areas or special habitat types (such as tors or expansive wetlands). In addition, the habitat types available at the Project site currently are present in areas adjacent to the Project. The Project is also largely in line with the strategic plan for BCR No. 4, as it:

- Incorporates exclusion zones into mining plans to protect habitat;
- Incorporates habitat recovery into post-mining site clean-up; and
- Limits construction of roads in and near wetland areas.

Consequently, the removal of habitat at the Project site will not result in significant adverse impacts to birds.

MORTALITY AND REPRODUCTIVE SUCCESS

EFFECTS ARE LIKELY

Clearing for Project infrastructure and an expanded access road, despite the provided mitigation to conduct bird surveys, is likely to interrupt nesting. Collisions with vehicles are also likely to occur given the reliance on long distance transportation along the Robert Campbell Highway and frequent flights.

[198] Most species that overlap with the Project are territorial: during nesting a territory will typically host only one nesting pair.

EFFECTS ARE ADVERSE

Land clearing impacts bird breeding and can result in bird mortality through incidental take. Reduction in bird productivity is adverse as it limits or reduces bird populations, especially at a time when many bird species are declining considerably.

Water contamination is adverse as it reduces bird health and fitness. Pollution, including contamination, is also a contributing factor to bird population declines in North America.

EFFECTS ARE NOT SIGNIFICANT

With surveys conducted prior to clearing, bird mortality and nesting impacts will be largely averted. The territorial nature of most nesting birds in the Project area will also reduce the extent of potential effects, as bird densities for territorial species are naturally limited during nesting. Clearing will primarily pose a risk of mortality and reduced reproductive rates during bird nesting season (spring through summer), and only when clearing occurs during that time.

As residency times of migrating birds is expected to be low within the pit lake, and due to the territorial nature of many Yukon birds during nesting, exposure to contaminants is expected to be minimal.

Collisions are a major cause of bird mortality in North America; however, speed limits and mine site supply of 52 trucks per day are unlikely to be a notable source of mortality.

The Project is unlikely to result in significant effects to birds through mortality or reduced nesting success as it will likely result in unobservable population changes of affected bird species.

6.5 Furbearers

Project effects to furbearer species are considered in Section 7, Traditional Land Use.

7. Traditional Land Use

Summary & Conclusion

The Project is likely to result in significant adverse effects to traditional land uses based on the information available to the Executive Committee throughout the assessment. Traditional land use in this section includes traditional harvest, trapping, cultural continuity and passing on Traditional Knowledge. It was determined that adverse project impacts to traditional land sses can adequately be addressed through adhering to relevant legislation and applying mitigative measures committed to by the Proponent, in addition to YESAB's recommended mitigation measures.

The EC recognizes that land uses, both historically and currently, are carried out by non-First Nations people in the Project area as well. However, the emphasis of this section is to examine the traditional land use activities of the Ross River Dena Council (RRDC) and Liard First Nation

(LFN) citizens in their Traditional Territories within which the Project is located. Mitigations to eliminate, control, or reduce significant effects to RRDC and LFN citizens are likely to address significant effects to other land users as well.

Importance of Traditional Land Use

The Project occurs in the Traditional Territories of the RRDC and LFN, who have a long history of land use and resource management within their territories. Knowledge of the area and associated customs have been passed down through the generations. RRDC and LFN cultural traditions are deeply connected to the landscape, and their ability to continue on with these traditions depends on land use within their territories. Land and resource development within the traditional territories has altered traditional land use patterns and has changed First Nations' relationship with the landscape over time. Despite this, RRDC and LFN still have a strong reliance on the land and its resources for sustenance, economic gain and the continuation of their cultural identity. Traditional land uses and cultural practices include many Aboriginal rights protected under the Canadian Constitution.

Comments and information provided during the course of the assessment, either by the Proponent or through comment submissions, identify the potential for the Project to affect important ecological and cultural values within the Project area that are of historical and contemporary importance to both RRDC and LFN. However, the Executive Committee acknowledges that this assessment would have benefited from additional first-hand accounts of potential Project effects from RRDC and LFN, to further clarify the important values and traditional land uses associated with the area.

For the purposes of this assessment, the Executive Committee considers traditional harvest, trapping, cultural continuity and passing on of Traditional Knowledge as components of traditional land use which may be adversely affected by the Project.

Legislative & Management Setting

There is no specific legislation that would directly mitigate effects to traditional land use. There are, however, several laws and regulations which manage and regulate elements that are components of, or important to, traditional land use. Some examples, relevant to the components of traditional land use examined in this report include, but are not limited to:

Traditional Harvest

ENVIRONMENT ACT AND REGULATIONS

- Provides a general framework for the protection and wise management of natural resources including fish, wildlife and vegetation.
- Regulations under the Act (e.g. *Solid Waste Regulations, Special Waste Regulations, Spills Regulations*) also prohibit the release of contaminants to the environment which protects the soil, water and vegetation upon which traditionally harvested resources (e.g. plants and wildlife) depend.

WILDLIFE ACT*[199] *AND WILDLIFE REGULATIONS

- Provide the regulatory framework for licensed harvest of wildlife in Yukon and prescribe rules related to licensing and permitting, hunting activities, reporting and wildlife care.

MIGRATORY BIRDS CONSERVATION ACT AND THE MIGRATORY GAME BIRD HUNTING REGULATIONS

- Provide frameworks for the protection of migratory birds, nests and their eggs
- The regulations identify limits for possession of bird species, methods and restrictions on hunting and associated permits.

FISHERIES ACT AND REGULATIONS

- Provides a framework for protecting and managing fish and fish habitat in Canada.
- The *Yukon Territory Fishery Regulations* outline closed fisheries, sport fishing and associated prohibitions. They further elaborate on specific waterbodies (e.g. special management waters), and discuss specific species and associated restrictions such as closed areas or harvest limits. Yukon Department of Environment, in conjunction with the Yukon Fish and Wildlife Management Board and local First Nations, enacted these regulations.[200]

WATERS ACT

- Provides a framework for the protection and management of water, including water quality and quantity in Yukon waterbodies upon which fish and other aquatic resources depend.

Trapping

WILDLIFE ACT AND TRAPPING REGULATIONS

- Establishes the regulatory requirements and measures for trapping in Yukon.
- The Act and supporting *Trapping Regulations* and *Trapping Concession Area Boundary Regulations* establish and manage Registered Trapping Concessions (RTCs) for individuals and groups across the territory. As s. 62 of the Act outlines, the holder of a trapline concession is reserved the “exclusive opportunity” to “trap fur bearing animals in the area described in the trapping concession.” It should be noted that s. 126 of the *Wildlife Act* states that a concession, in this case a trapping concession, “is not and does not operate as a demise, lease or transfer of any title to or interest in land or wildlife.”

Traditional Knowledge and Cultural Continuity

The above regulatory frameworks also help to maintain Traditional Knowledge and cultural continuity with relation to harvest and trapping. In addition, the following legislation are also relevant:

[199] Government of Yukon. 2019. Wildlife Act. http://www.gov.yk.ca/legislation/acts/wildlife_c.pdf
[200] Government of Yukon. 2019. Yukon fishing regulations summary 2019-2020. https://yukon.ca/en/yukon-fishing-regulations-summary

HERITAGE RESOURCES ACT AND ARCHAEOLOGICAL SITES REGULATIONS

- Prohibits the alteration or destruction of heritage resources

CONSTITUTION ACT (1982)

- Section 35 provides constitutional protection for Aboriginal rights and treaty rights. Neither RRDC nor LFN have a land claim agreement in place, and harvesting and traditional activities by members of RRDC and LFN are based on the exercise of Aboriginal rights

Context

Kaska Way of Life

RRDC and LFN have occupied and used the lands, waters and resources within their Traditional Territories throughout history. The Kaska traditionally were semi-nomadic and followed seasonal movements/availability of wildlife, fish and plants; summers and winters were spent by lakes with plentiful fish resources, and fall and spring were spent in the mountains hunting larger game, drying meat and collecting berries for winter.[201] Trapping and trading were important components of the traditional economy between families and with other First Nations. The knowledge of movements and abundance of wildlife and other important seasonal resources were the result of many years of observations by the Kaska people, which has been passed down through generations. Subsequently, RRDC and LFN cultures and traditions are deeply rooted in the landscape of their traditional territories, and their cultural identity is largely defined by this relationship.

The Heritage Resource Protection Plan for the Wolverine Mine notes that:

> Elders teach respect for the land through Kaska traditional law, known as "aiee." The laws teach one how to conduct and respect themselves, others, and the land that sustains them. These teachings build and strengthen the ties between the Kaska, the land, the water, the plants, the animals, and the spirits of the Kaska Dena before them.[202]

To understand the potential Project impacts to traditional land use, one must understand how the Kaska view their traditional territory: as a whole with distinct yet interdependent parts.[203] As explained in documents pertaining to previous land claim negotiations:

[201] YOR Document 2017-0083-157-1.
[202] Yukon Zinc Corporation. 2007. Wolverine Project Heritage Resource Protection Plan. Version 2007-01, pg. 1. http://www.emr.gov.yk.ca/mining/pdf/mml_wolverine_heritage_resource_protection_plan_version_2007_01.pdf
[203] YOR Document 2017-0083-157-1.

> It is difficult to view the lands used by the Kaska Dena as being in some way divisible. Rather, the image that comes across most clearly is that the Yukon area harvested by the Kaska Dena form as a whole an integral and integrated part of the resource base upon which their sociocultural integrity relies (HDC, 1982:58 in Exhibit 3).[204]

Within RRDC and LFN Traditional Territories, land uses and cultural practices have significantly shifted over the years. The influx of Europeans to the area (beginning in the 1820s), establishment of trading posts, gold rushes, development of roads (Robert Campbell Highway, Alaska Highway), collapse of the fur trade, entry of First Nation citizens into the labour market, and introduction of schools pushed RRDC and LFN into more permanent settlements, affecting traditional land use patterns.[205] Regardless, RRDC and LFN citizens still maintain deep connections to traditional areas and continue to rely heavily on harvesting for subsistence and economic purposes.

Harvesting, within one's traditional territory is an Aboriginal right. The *Constitution Act,*[206] specifically s. 35, provides the foundational legislative framework for which Aboriginal Rights and Treaty Rights are recognized.

Traditional Harvest

There is a long-standing history of harvest in the Ross River Dena Council and Liard First Nation Traditional Territories. The harvesting of large and small animals has been and continues to be a traditional subsistence and economic activity, particularly in the informal economy of trading and bartering, for citizens of RRDC and LFN. It has been identified as essential to the way of life and the cultural identity of the Kaska people: "In general, despite substantial outside pressures and influences to shift away from subsistence hunting, this is still an integral part of Kaska way of being and connecting to the land. They have done so more than other Aboriginal groups across Yukon."[207]

A number of species have been identified as important staples to the diet and subsistence of the Kaska, including moose, caribou, sheep and waterfowl. More specifically, Kaska land management practices identify caribou as a cultural keystone species and moose as a focal species, both having high cultural value for the Kaska First Nations.[208]

[204] YOR Document 2017-0083-157-1.
[205] Ibid.
[206] Government of Canada. Constitution Act. Part II S. 35 Rights of the Aboriginal Peoples of Canada. https://laws-lois.justice.gc.ca/eng/const/page-16.html#docCont
[207] YOR Document 2017-0083-9170, pg. 3-16, this cites (43):
M. Morrell. Indian Land use in the Ketza River Valley and the impact of the Ketza River Mine. Ross River Dena Council, 1992.
[208] YOR Document 2017-0083-040-1, Table 13-1.

Fish are also a staple in the RRDC and LFN diet. Ethnographic work carried out by the Proponent identifies culturally important species including grayling, lake trout, jackfish (pike), whitefish, suckers[209] and salmon.[210] This work also identified important regional and Project-specific sites related to fishing, which include Frances Lake and River, Pelly River's Hoole Canyon, and Finlayson Creek, Money Creek and Wolverine Lake, the latter three being within the Project area.[211]

Plants are also important to the RRDC and LFN diet. Plants are harvested for food and medicinal purposes, and are used for tools or products (e.g. firewood). They're also culturally and spiritually important for ceremony and health/healing practices. Iceton (2019)[212] demonstrates that these uses occurred historically, and comments received from LFN indicate that there continue to be contemporary use and reliance on plants.[213] Plants identified as culturally important to Kaska include blueberries, raspberries, strawberries, currants, salmonberries, cranberries, soapberries, wild rhubarb, rose petals, spruce, birch and willow.[214]

In general, local wild food remains important to First Nations and contributes to healthy communities.[215] The Project proposal states that, [216]

> Yukon Indian people continue to depend heavily upon traditional foods, especially moose, caribou, salmon and berries as shown by the high frequency of household consumption. This is particularly so in remote and traditional villages, where wage opportunities are few, and marketed food costs are extremely high; however, hunting and fishing remain important social and economic activities in all Yukon Indian communities.

Trapping

Trapping is an integral traditional subsistence and economic activity for RRDC and LFN citizens. The Proponent acknowledges the value of trapping, stating, "for Kaska citizens, trapping is not just an effort to earn part of an individual's income. It also plays an important role in continuing the individual and collective connection to, and stewardship of, the land."[217] Prior to the registration of traplines in Yukon, traditional traplines were traditional family areas, wherein

[209] YOR Document 2017-0083-157-1
[210] Weinstein, M. 1993. The Ross River Dena: A Yukon Aboriginal Economy. Royal Commission on Aboriginal Peoples, Aboriginal Economy Case Study Project.
[211] YOR Document 2017-0083-157-1, pg. iii.
[212] YOR Document 2017-0083-5717;
YOR Document 2007-0083-4777;
YOR Document 2017-0083-9170.
[213] YOR Document 2017-0083-282-1.
[214] YOR Document 2017-0083-157-1, pg. 3-9.
[215] Wein, E.E. and Freeman, M.R. Frequency of Traditional Food Use by Three Yukon First Nations Living in Four Communities. *Arctic* 48(2): 161-171, 1995. http://pubs.aina.ucalgary.ca/arctic/Arctic48-2-161.pdf
[216] Ibid.
[217] YOR Document 2017-0083-046-1, pg. 15-30.

ancestral values, cultural practices and a stewardship way of life were shared through the generations.

The 19th century saw a change in fur trading activities as the Hudson's Bay Company established trading posts across Yukon, including a number in RRDC and LFN Traditional Territories (e.g. trading posts at Frances Lake and Pelly Banks). Reliance on the growing fur trade saw some changes in First Nations' land use with a greater focus on trapping, which continued to evolve into the 20th century. Fluctuations in fur prices during the middle to late 20th century led to economic challenges. Trapping by Yukon First Nations continued throughout market fluctuations, partly for subsistence and partly for trade and sale. In the mid to latter part of the century, many trading posts closed, as highways were constructed changing transportation patterns, which resulted in locally available services and supplies disappearing from communities. Trapping, nevertheless, remained an important way of life, both for subsistence and economic purposes.

Registered traplines were introduced into the trapping economy during the mid 20th century. The early 1950s saw Yukon create Registered Trapline Concession (RTCs), and in the early 1960s RRDC was successful in establishing a group trapline (RTC 405). This group trapline was an amalgamation of the registered Ross River Dena Council family traplines within the territory.

Statistics from 2012[218] identify that 42 percent of Indigenous youth (aged 15 to 24) and 55 percent of Indigenous adults (25-54) were participating in some form of traditional activity such as hunting, fishing and trapping. While this statistic is territory-wide, it demonstrates a correlation between traditional trapping and land use activities, and community connectivity and cultural history across generations. Trapping for subsistence and economic purposes continues in RRDC and LFN Traditional Territories.

Traditional Knowledge and Cultural Continuity

Culture and Traditional Knowledge are the accumulated teachings of ancestors. For First Nations, they connect a person or people to their community, ancestors, and to the land.[219] This traditional and cultural knowledge is transmitted and continued through language, customs,

[218] Statistics Canada. Yukon: Beautiful, Complex, and Changing. Statistics Canada, 2018. https://www150.statcan.gc.ca/n1/pub/11-631-x/11-631-x2018006-eng.htm;
Statistics Canada. Aboriginal Peoples Survey, 2012. Statistics Canada, 2015. https://www150.statcan.gc.ca/n1/en/daily-quotidien/150330/dq150330g-eng.pdf?st=G394ReOW

[219] National Collaborating Centre for Aboriginal Health. 2016. Culture and Language as Social Determinants of First Nations, Inuit and Metis Health. https://www.ccnsa-nccah.ca/docs/determinants/FS-CultureLanguage-SDOH-FNMI-EN.pdf;
Government of Canada. Yukon Environmental and Socio-economic Assessment Act. S. 2(1), 2019. https://laws-lois.justice.gc.ca/PDF/Y-2.2.pdf

norms, ways of life, traditional activities (e.g. sewing, harvesting, fishing, gathering, trapping, dancing, storytelling, games, etc.), values and other social interactions.[220]

Research shows that culture is an important factor in the well-being of First Nations communities, especially in conditions of rapid social change.[221] First Nations need access to certain things to transmit their knowledge and culture, such as trails,[222] culturally important sites,[223] time to pursue traditional and cultural activities and be on the land, physical space to pursue activities, freedom from industrial sounds and sights while on the land, and healthy wildlife, fish, berries and plants that are free of toxins. The loss or degradation of culture and Traditional Knowledge can be "experienced as a form of trauma that extends across generations".[224] Its loss can also contribute to the breakdown of health and wellbeing.[225] The ability to continue traditional land uses practices, such as harvesting, is therefore an integral part of transferring Traditional Knowledge and culture, and preserving cultural identity.

The RRDC and LFN Traditional Territory (in Yukon) has been subject to several major mineral developments that are now in closure or have been abandoned, including the Faro Mine, Ketza River Mine, Wolverine Mine, Se Dena Hes Mine and the Cantung Mine. Unplanned closures and/or abandoned mines, in particular, have left a legacy of mistrust and traditional land use impacts. These experiences shed understanding into how RRDC and LFN may be affected by the proposed Project, either through actual or perceived impacts.

Weinsten (1993), in his retrospective report on the impacts of the Faro Mine to the traditional economy of the RRDC, notes that although the RRDC and other Kaska value employment and economic benefits from mines, "each new development results in a shrunken subsistence land base."[226] The report specifies that the overall effects of the Faro mine shifted RRDC's land use further east from the Anvil Range to Ross River and beyond, including the area in and around the proposed Project. Also noted in Weinstein (1992), on the loss of the traditional lands as a result of the Faro mine:

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[220] National Collaborating Centre for Aboriginal Health. Culture and Language as Social Determinants of First Nations, Inuit and Metis Health, 2016. https://www.ccnsa-nccah.ca/docs/determinants/FS-CultureLanguage-SDOH-FNMI-EN.pdf

[221] Angell, A.C. and Parkins, J.R. Resource Development and Aboriginal Culture in the Canadian North. 2010. *Polar Record* 47(240), pg. 67-79;
Chandler, M.J and Lalonde, C. Cultural Continuity as a Hedge against Suicide in Canada's First Nations. *Transcultural Psychiatry*, 1998;
Duhaime, et al. Social Cohesion and Living Conditions in the Canadian Arctic: From Theory to Measurement. *Social Indicators Research* 66(3), 2004;
Notzke, C. Aboriginal peoples and natural resources in Canada. North York: Captus Press Inc, 1994.

[222] Includes, but not limited to: walking, hiking, hunting, harvesting, and travelling trails.

[223] Includes, but not limited to: harvesting areas, ceremonial and/or spiritual sites, campsites, traplines, and cabins.

[224] National Inquiry into Missing and Murdered Indigenous Women and Girls. 2019. Reclaiming Power and Place: Executive Summary of the Final Report. https://www.mmiwg-ffada.ca/wp-content/uploads/2019/06/Executive_Summary.pdf, pg.23.

[225] Angell, A.C. and Parkins, J.R. Resource Development and Aboriginal Culture in the Canadian North. 2010. *Polar Record 47*(240), 2011.

[226] Weinstein, M. The Ross River Dena: A Yukon Aboriginal Economy. Royal Commission on Aboriginal Peoples, Aboriginal Economy Case Study Project. 1993. pg. 66-67;
Dreyer, D. Impact and Benefits Agreements; Do the Ross River Dena Benefit from Mineral Projects? University of Northern British Columbia, 2004.

> The camp and harvesting areas in the valley were no longer available. Families used to camping in this area returned to a scene of devastation on habitually used lands. The loss was (and still remains) heartfelt.[227]

Morell (1992)[228] examined the effects of the Ketza River Mine on RRDC land use:

> Many people are not willing to drink the water [from Cache Creek and the Ketza River, approximately 90 km west of the Project]. None of the interviewees has fished in the system since the mine has been in operation, although many did so in the past. Several interviewees expressed concern that the health of the game animals may be threatened by contaminated water of food, and some people worried that the game meat may be hazardous to human health.[229]

The Proponent provided an analysis of how unplanned mine closure impacts certain values, including those of First Nations, in response to the IR No. 4B. In reviewing this information, LFN noted:

> The history of mining in Kaska territory … treats each development in a singular fashion. There is no analysis included of the ways the interactions of multiple developments have resulted in a larger impact on Kaska communities, limited potential resiliency, created a traumatized population or limited the Traditional Land Uses that are essential to both Kaska health and cultural sustainability (land-based education).[230]

In relation to mine-related industrial traffic on the Robert Campbell Highway, LFN notes:

> Reference is made [in proposal information] to roads increasing access to Traditional Land Use activities. LFN's experience is the opposite. Increased

[227] YOR Document 2017-0083-157-1.
[228] Morrell, M. Indian land use in the Ketza River Valley and the impact of the Ketza River Mine. Prepared for the Ross River Dena Council, 1992.
[229] YOR Document 2017-0083-157-1.
[230] YOR Document 2017-0083-3867.

> industrial traffic has resulted in reduced use of roads by LFN citizens wanting to exercise Kaska rights due to their justified fear of motor vehicle accidents… many of those roads have exploited the presence of existing, ancient Kaska trails resulting in specific displacement.[231]

The above information demonstrates how development, mines in particular, have influenced traditional land use patterns in the past. This information shows how traditional land uses, and subsequently the transfer of Traditional Knowledge and culture, have already been affected by past developments, and how they may be further impacted in the future.

Existing Conditions and Trends

Traditional Harvest

Specific information about the locations, timing, intensity and nature of contemporary land uses in and around the Project area is limited. However, the Executive Committee is satisfied that sufficient information has been received to confirm that the Project area is traditionally important, and that RRDC and LFN citizens continue to exercise their harvesting rights, including hunting, trapping, fishing, and gathering of plant foods and medicines, in the project area. Harvesting occurs throughout all seasons and coincides with Project activities. As mentioned, RRDC and LFN citizens are reliant on subsistence harvesting as part of their livelihoods, the continuation of which has been identified by RRDC and LFN as essential to their way of life.

In its comments from March 2018,[232] LFN notes that "along with other Kaska people, LFN citizens continue to use and occupy their traditional lands, including those lands in and around the Project Area. The exercise of their seasonal harvesting activities, include hunting, trapping and fishing, gathering plant foods and medicines, both in the immediate Project Area and in the surrounding area at Frances Lake, Finlayson Lake and Wolverine Lake" further demonstrates this. RRDC, as noted in the Project proposal, has requested that its hunters be allowed to access the Tote road.[233]

LFN and RRDC consistently articulate the importance of the Finlayson Caribou Herd (FCH), and caribou in general, in comment submissions to YESAB. Most recently, LFN identified "deep concerns about the impacts of the Project on all of their traditional harvesting rights, and in particular on the Finlayson Caribou Herd, on which they have traditionally relied and which they understand has been in significant decline for the last three decades."[234]

Little information exists that speaks to the contemporary harvest of waterfowl and fish in the immediate Project area. The Proponent identified grayling in Geona creek, which is within the

[231] YOR Document 2017-0083-3867.
[232] YOR Document 2017-0083-282-1.
[233] YOR Document 2017-0083-010-1.
[234] YOR Document 2017-0083-282-1, pg. 3.

Project footprint. This fish is also found in associated drainages including South creek, North River, Finlayson Creek and East Creek.[235] "Other fish species identified in the regional area include slimy sculpin, burbot and lake trout."[236] It is reasonable to assume that fish is harvested to some degree from the watershed, or may be in the future.

Chapter 12 of the Project proposal discusses vegetation composition throughout the site. There are a number of different Ecosites throughout the Project site, of which a number appear to support harvestable plants, such as blueberry, cloudberry, Labrador tea, lowbush cranberry and willow. Little information is available regarding harvesting areas for plants and plants which specifically exist in the Project area. RRDC Elders, however, did identify large berry patches as well as a number of medicinal plants at the Project site,[237] suggesting that the site has good plant harvest potential. The Proponent however cited that specific harvest sites, and medicinal plants, were not presented to YESAB due to confidentiality agreements with RRDC.[238] It is unclear if contemporary plant harvest occurs at the site.

Trapping

The Project overlaps with Registered Trapping Concession (RTC) 405 and RTC 250. RTC 405 is the RRDC group trapline and RTC 250 is an individual trapline, held by two RRDC citizens. The Proponent indicates that LFN citizens are not known to hold any traplines in the broader project region.[239] There is no available primary data related to trapping activities for the Project site and the broader Regional Study Area. It is clear by comments received from LFN,[240] and through public information sessions held in the communities of Ross River[241] and Watson Lake,[242] that traditional use activities, including trapping, by both LFN and RRDC citizens has historically occurred, and continues to occur, across their traditional territories. Specifically, RRDC citizens benefit economically from trapping within the proposed Project site.

Observational data collected by the Proponent, through field surveys, camp log recordings and incidental observations identified a variety of furbearing species inhabiting the Project site and in areas surrounding, including snowshoe hare, weasel, American marten, red fox, red squirrel, lynx, ermine, muskrat and beaver. While there are a variety of furbearing species within the RSA, grey wolf and wolverine were used as indicator species by the Proponent. These species have broad habitat ranges, specific habitat requirements and are more vulnerable to disturbance than other species. Tracking, modelling and understanding the Project in relation to these species will serve as a proxy for other furbearing species found in the Project area.

Traditional Knowledge and Cultural Continuity

[235] YOR Document 2017-0083-031-1, pg.10-12.
[236] Ibid.
[237] YOR Document 2017-0083-046-1, pg. 15-57.
[238] YOR Document 2017-0083-356-1, pg. 50.
[239] YOR Document 2017-0083-356-1 inclusive through YOR Document 2017-0083-360-1.
[240] YOR Document 2017-0083-282-1 and YOR Document 2017-0083-3867.
[241] YOR Document 2017-0083-277-1.
[242] YOR Document 2017-0083-275-1.

The Project occurs in an area of traditional and cultural importance to both the RRDC and LFN. Archaeological evidence, discussed in Section 11, indicated prehistoric use of the Project footprint and tote road. Information submitted during the assessment, including the ethnographic overview of the KZK Project, the independent studies of LFN and RRDC traditional land uses commissioned by the Proponent, as well as the independent study of traditional land uses along the Robert Campbell Highway, provide well-documented accounts of traditional land uses within a 100 km buffer of the Project and along the Robert Campbell Highway. These uses include, but are not limited to, hunting, trapping, trading, fishing, plant and medicine harvesting, camping and cultural and spiritual uses.

Culturally important areas (e.g. Money Peak, North Lakes, Wolverine Lake, Finlayson Lake, Frances Lake), as well as an extensive network of trails between these and other traditional use areas, occur within 100 km of the Project. There are two main routes to the proposed Project area, including from the west starting at Frances Lake along Money Creek, as well as from the north at Pelly Banks through Finlayson Creek.[243] In addition, there are several Kaska cabins in the region, including nearby locations along North Lakes, Money Peak, and Wolverine Lake with more distant locations along Frances Lake, Pelly Banks and Money Creek.[244]

RRDC and LFN have interim protected lands (RRDC-R-15A, RRDC-S-127B and LFN-S-103B, as well as others along the route of the RCH) which were selected for various reasons by the First Nations. Reasons for selection vary but can be represented by the following: the presence of existing structures or sites of importance, development potential, or a family or Elder recommended selection and harvesting uses. RRDC-R-15A occurs immediately adjacent/south of the proposed Project site.

Very little information was provided during the assessment directly from the RRDC and LFN that speaks to contemporary uses of the Project area for traditional purposes (e.g. the intensity of use of the Project area, types of use and locations). However, the transfer of Traditional Knowledge and culture may be affected in areas of particular significance to First Nations, even where/if traditional land use activities are not currently being practiced there. As discussed in the above harvesting and trapping sections, a variety of traditional land uses have occurred and likely continue to occur in the Project region.

Thus, while limited land use information was available for the assessment, sufficient information was presented to determine that the Project region has high cultural significance for RRDC and LFN, and that a variety of land uses still occur to this day. Furthermore, the preservation of traditional use areas for future generations has also been identified by both First Nations as an important consideration for this Project.

Project Design

The Proponent has proposed a number of Project design features and mitigation measures that will reduce potential impacts to traditional harvesting. These are primarily found in the Project proposal, Wildlife Management Plan, Fish and Aquatic Habitat Management Plan and other

[243] YOR Document 2017-0083-275-1.
[244] YOR Document 2017-0083-046-1, pg. 15-11.

company policies. Key measures or Project design features committed to by the Proponent that eliminate, reduce or control the adverse effects to wildlife, fish and plant harvest include the following:

GENERAL PRACTICES AND COMMITMENTS FOR MINIMIZING IMPACTS TO HARVESTING

- Rock management facilities have been sighted and placed away from water bodies, water courses and associated water collection ponds in order to manage contamination. These facilities will be capped at their end of life to further reduce contaminants from entering water courses.
- A closure plan has been developed which contains a key objective to "Return the mine site and affected areas to viable and, wherever practicable, self-sustaining ecosystems that are compatible with a healthy environment and with traditional land use activities."[245]

SPECIFIC MITIGATIONS AND PROJECT DESIGN THAT MINIMIZE IMPACTS TO WILDLIFE

- The Tote Road will see continued access controls, as has been ongoing since the 1990s. Use of the road "during Project operations to access recreational areas for ATV and snowmobile use will be strictly prohibited."[246]
- Staffed gate to prevent hunting access until the road is decommissioned.
- No-feeding, harassment or hunting of wildlife by employees, contractors and visitors.
- A no hunting and no fishing policy will be instated for all employees.
- A Proponent-Kaska Environmental, Cultural & Heritage Management Program for the Project. The goal for the Project area post-closure is "compatible with a healthy environment and with traditional land use activities". The Proponent indicates that "therefore, there will be no contamination of the land that will prevent the land users from returning to the KZK Project area in post-closure."[247]
    - A Co-management Plan developed for fish and wildlife, wherein "it is anticipated that RRDC will collaboratively design, collect, report, manage and communicate the results of the wildlife monitoring program to RRDC citizens. This program would be active through all Project phases and would collaboratively ensure any impacts to the traditional use animals are minimised."[248]
- Construction of water management and treatment ponds, as well as fish habitat compensation ponds (constructed wetlands), both of which are also expected to provide habitat for waterfowl species.

A SUITE OF FISH AND FISH HABITAT MITIGATIONS TO AVOID AND OFFSET IMPACTS TO FISH AND THEIR HABITAT

The list below highlights some of the key fish and fish habitat mitigations, however it is not an exhaustive list. More specific details are laid out in Section 5.3 – Project Design.

- Water management facilities will be operated throughout the life of the mine and into the closure period, until long-term constructed wetlands are developed and functional.

[245] YOR Document 2017-0083-356-1, pg. 55.
[246] Ibid. pg. 127.
[247] YOR Document 2017-0083-356-1, pg. 18.
[248] Ibid. pg. 55.

- A dry-stack tailings facility has been sited outside of creek alignment in order to mitigate impacts to water quality and fish habitat.
- The Proponent commits to developing a Fisheries Offsetting Plan. Aspects of this plan include:
    - Construction windows which mitigate impacts to key life cycle phases for fish populations and sensitive ecosystems
    - The development of a water conveyance system that redirects non-contact water, to ensure ongoing water quality
    - Sediment and erosion control measures and associated structures are established and in place throughout all phases of the Project
    - Development of spawning habitat for grayling
    - Fish habitat in Finlayson Creek will be reconnected through passage enhancements under the Robert Campbell Highway, as it currently serves as a fish passage barrier.
    - Fish habitat compensation in the form of three constructed wetlands, in order to address fish habitat impacts resulting from the Project.
- The Project has been designed to ensure that open pit placement does cross the watershed divide and that, upon mine closure, the pit water would continue to flow north and not into North Lakes, in an effort to avoid impacts to surface water quality and ground water quality in the watershed south of the Project.
- A Co-management Plan, as part of the broader Proponent-Kaska Environmental, Cultural & Heritage Management Program, has been developed for fish and wildlife, wherein "it is anticipated that RRDC will collaboratively design, collect, report, manage and communicate the results of the fish monitoring program to RRDC citizens. This program would be active through all Project phases and it is anticipated that it will provide a forum to incorporate culturally relevant mitigation measures to the fish and aquatic resources monitoring and adaptive management programs."[249]

A PROGRAM AIMED TO MINIMIZE IMPACTS TO PLANTS AT THE SITE AND FUTURE HARVEST

- A reclamation research program initiated in 2017 by the Proponent, involving RRDC Elders, is to become a component of the Proponent's Co-management program, seeing the research continue through all phases of the Project. "The program will ensure that the vegetation used in reclamation is culturally appropriate and/or is approved by RRDC."[250]

TRAPPING COMMITMENTS

The Proponent has proposed a number of design components and mitigation measures that will reduce potential impacts to furbearers and trapping. These are found throughout the Project proposal, the Wildlife Management Plan, and company policies, and include:

- The Project footprint was designed to cover as little area as practicable to minimize habitat loss and disturbance;

[249] YOR Document 2017-0083-356-1, pg. 35.
[250] Ibid. pg. 52.

- Ensuring progressive and final reclamation to disturbed areas;
- Appropriate measures to carry out blasting activities at the mine in a manner that avoids wildlife disturbance during critical life cycle stages will be established in consultation with the Yukon Regional Biologist;
- A company policy which restricts the recreational use of all-terrain vehicles and snowmobiles;
- Machinery and personnel will be required to remain within the Project site and roadways and along defined roads;
- A company policy that feeding, harassment or hunting of wildlife by employees, contractors and visitors is prohibited;
- Enforcement of vehicle speed limits and the use of radios to report wildlife on roads to reduce collisions;
- Ensuring minimum traffic levels are maintained along the access road and the application of vehicle convoys to reduce periods of sensory disturbance;
- A winter Wildlife Monitoring Program for wolves, wolverines and other furbearers, which requires that information regarding animal presence and denning locations be collected;
- Engaging all local trappers well in advance of any activities taking place in their trapline area(s) and working with them to resolve any concerns raised;
- As part of the Socio-Economic Participation Agreement (SEPA), the Proponent has agreed to pay a land use interruption supplement to mitigate the Project impacts on RRDC citizens who hold trapping rights under the RTC group trapline (RTC 405) and operated traplines (RTC 250) within the Project area.

Effects Characterization

Traditional Harvest

Comments received as part of this assessment from LFN highlight concerns with Project impacts to traditional harvest: “Many LFN concerns with the Project are around impacts on caribou and moose, although we are also concerned about impacts on fur-bearing species and medicinal plants, and spiritual relationships with all of those things.”[251] As subsistence harvesting is an integral component of RRDC’s and LFN’s culture and socio-economic needs, these concerns must consider not only the impacts to the accessibility of harvestable goods, but also the continued ability to fulfill these needs. In general, traditional RRDC and LFN harvesting activities, including hunting, fishing and plant harvesting, may be adversely affected by the Project through direct and indirect habitat loss, and animal avoidance or complete removal of harvesting areas.

Section 6 identifies habitat disturbance and loss (leading to avoidance) for various wildlife species during all phases of the Project. Construction activities remove areas of wildlife habitat, create fragmentation and disturbance, and may lead to changes in landscape use, disruptions to life cycle stages and alterations to movement patterns. Permanent habitat loss for all species is an unavoidable side effect of creating the waste rock storage facility and pit. Habitat removal and wildlife avoidance in and around the Project area will result in a reduction of land available

[251] YOR Document 2017-0083-3867, pg. 9.

for traditional harvesting, and that could extend beyond the Project footprint (e.g. wildlife avoidance of the area, or First Nations avoidance due to disruptions from mine activities, such as increased traffic and noise). Changes to wildlife distribution as a result of the Project may reduce the abundance of wildlife species within the area, which will affect harvest rates.

Section 6.2 (Moose) notes that direct and indirect habitat loss is low in magnitude and reversible, while Section 6.1 (Caribou) notes that, while habitat loss will occur, it is not the limiting factor to the population and is reversible. Generally, the effects to wildlife are temporary, as the majority of the habitat loss is reversible through reclamation and road decommissioning. Furthermore, the impacts are mostly limited to the Project's lifespan, and temporally the effects will be low to moderate in magnitude.

Waterfowl and small mammals are adaptable species with generalist habitat requirements; however, habitat loss will occur during all phases of the Project, albeit there will be suitable habitat readily available elsewhere within the Project's vicinity. Waterfowl habitat is specifically enhanced in later phases of the Project (to achieve closure objectives) through the creation of constructed wetlands.

Concerns were raised specific to fish, fish habitat and water quality at both the Ross River[252] and Watson Lake[253] Community Meetings hosted by YESAB, during the Seeking Views and Information Phase. Water quality monitoring requirements, water treatment, and fish offsetting will mitigate impacts to fish and fish habitat in the vicinity of the Project. The Proponent characterized water quality impacts as low in magnitude and will not impact fish populations. This is supported by EcoMetrix, a consultant retained by YESAB, as discussed in Section 5.3 – Effects Characterization. Section 5.3 more specifically identifies that grayling habitat will be locally and permanently affected in upper Geona Creek. However, fish impact offsetting measures will see habitat replacement in lower Geona Creek and reconnection of fish habitat in Finlayson Creek, overall resulting in limited impacts to fish and fish habitat. Outside of the Project site, there is a low risk of impacts to fish and fish habitat due to Project design, water quality management and treatment, and fish impact offsetting commitments made by the Proponent. Fish harvest outside of the Project area is not likely to be impacted by the Project.

Based on the above characterization of impacts to fish and fish habitat, the EC concludes that fish harvest will be minimally impacted, as fish impact offsetting, and ongoing habitat and water quality safeguards and enhancements will be made, resulting in continued fish availability.

The Project footprint will result in the clearing and loss of vegetation. Ecosites supporting harvestable plants (e.g. berries) will be cleared during the construction, operation and closure phases of the Project. In addition, the Project site will be inaccessible during the life of the mine, eliminating the accessibility to vegetation communities and harvestable plants. However, the Project footprint is relatively small, and vegetation communities that comprise the Project site are common throughout the regional area, suggesting readily available potential for harvestable

[252] YOR Document 2017-0083-277-1.
[253] YOR Document 2017-0083-275-1.

plants outside of the Project area. Furthermore, commitments for progressive rehabilitation and site reclamation through the Co-management Plan, with the identified goal of returning the site to "viable…self-sustaining ecosystems…compatible with traditional land use activities,"[254] indicate that plant harvest will be limited in geographic extent, of a low magnitude and reversible.

Trapping

The Project may impact traditional trapping activities in the Project area. Mine construction and operations, coupled with habitat loss, will alter furbearers' land use and movement patterns, and may alter furbearer numbers throughout the Local and Regional Study Areas, as described in the Project Proposal. The Project will result in direct and indirect effects to all furbearing species. Habitat disturbance, fragmentation and loss will occur, as the Project footprint will remove suitable furbearer habitat and this could reduce hinder trapping success. The majority of the habitat loss will be interim, occurring for the life of the Project and until reclamation has been achieved. A small portion of habitat loss will occur in perpetuity, specifically with the creation of the pit and waste rock storage facility.

Increased road density in the Project area may result in increased mortality of furbearing species generally, potentially leading to local population declines for some species, which could negatively affect trapping. An analysis of the impacts to wolverines and wolves showed that predicted road density for the Project falls within the bottom range of the low-to-moderate magnitude threshold of 0.3 to 0.6 km/km^2. EDI, retained by YESAB, has identified that because effects are predicted to be low to moderate in magnitude and may only adversely impact a limited number of individuals, "these effects are expected to not affect the regional population of furbearer species." [255]

Trapping will be impacted by access restrictions around the mine site. Noise, dust and mine site activities may also directly and indirectly impact trapping, as individuals may not wish to trap in areas that have been altered, impacted by mining activities, or are perceived to no longer be healthy environments. As a result, the ability for RRDC group trapline members to carry out their trapping in this area will be affected during all phases of the Project.

Despite this, the large size of RTC 405 and the relatively small percentage of this trapline area covered by the Project suggest that minimal effects will be experienced by trappers. In addition, the Proponent has committed to providing the holders of RTC 405 and RTC 250 with a land use interruption supplement. The details of the SEPA are confidential and not known by the EC. The land use supplement will therefore mitigate effects experienced by these trapline concession holders.

Traditional Knowledge and Cultural Continuity

For the purposes of this section, the effects to Traditional Knowledge and cultural continuity consider the impacts to land-based activities, practices and traditions, as well as the associated cultural identity of RRDC and LFN. As previously noted, existing developments within RRDC's

[254] YOR Document 2017-0083-356-1, pg. 55.
[255] YOR Document 2017-0083-0950.

and LFN's Traditional Territory, namely the operation and closure of several mines as well the construction of roads within the traditional territory, have affected RRDC and LFN traditional land use patterns. Effects from these developments, real or perceived, have shifted land uses away from mine sites for fear of contamination, have resulted in increased non-First Nations presence accessing traditional resources and culturally important sites, and industrial traffic on roads, in particular, has created fear of collisions among traditional land users. These activities, as well as other land and resource developments within the Kaska territory, have already altered the relationship with the landscape, and provide important context for how RRDC and LFN may perceive the effects of the proposed Project. Both RRDC and LFN have expressed concern for the ability to continue with traditional land use into the future.

The proposed Project overlaps a culturally important area within the RRDC and LFN traditional territory, and these First Nations maintain a deep connection to the land. For this project, the transfer of Traditional Knowledge and culture may be adversely affected by:

- The removal of the Project area and Tote Road from traditional land use, including hunting, trapping, fishing, plant harvesting and cultural/spiritual practices, for the life of the Project. This is combined with effects from exploration activities that have, and continue to occur on site.
- Indirectly, traditional land use areas and important cultural sites may be avoided around the Project footprint due to industrial noise and/or human disturbance, which might interfere with enjoyment and connection to the area, and/or disturbances that result in displacement of wildlife.
- Avoidance of traditional land use areas could also result from real or perceived contamination of water quality, plants, fish and wildlife in the Project area.
- Physical alteration of the region's natural character, such that the memory of the former landscape and its use is eventually lost.
- Destruction or degradation of unprotected culturally important sites (e.g. trails, graves, gathering sites, hunting areas, undiscovered heritage resources).
- Reduced access to traditional use areas due to fear of collisions with mine traffic, restricting First Nations citizens "ability to move freely and safely about [their] lands."[256]
- Compromised ability to be effective stewards of the land for current citizens and future generations.
- Reduced opportunities for transfer of Traditional Knowledge and culture as a result of reduced opportunities to meaningfully engage with traditional, spiritual or cultural ceremonies due to limited vacation leave for employees.

All of the above considerations can negatively alter how First Nations feel about and use the area for generations to come, adversely affecting both individual and collective relationships with the land. Such impacts are difficult, and in many cases, impossible to quantify. Effects to cultural continuity are most likely to occur during the construction and operation phases of the Project, when activity at the site and along the Robert Campbell highway will be greatest. However, long-term presence of mine infrastructure during the closure phase may extend the

[256] YOR Document 2017-0083-282-1, pg. 9.

impacts. In addition, should there be concerns, real or perceived, about contamination of waterways or the area from mining activities, land use may be reduced or abandoned altogether. In this scenario, effects to Traditional Knowledge and cultural continuity related to the area would continue into the future.

The Proponent has committed to ongoing communication with RRDC and LFN throughout the Project, and has supported independent effects assessments of the Project, Traditional Knowledge collection and traditional land use studies. Unfortunately, none of this information was available at the time this report was prepared. The Proponent has also committed to financial support/compensation which covers, in part, land use disruptions. These measures, while providing some indication of positive and productive working relationships with RRDC and LFN, do not guarantee that negative impacts will not occur.

Experience with past mines in the traditional territory indicate that disruptions to land use, and therefore cultural connection, are considered likely. Whether these effects are experienced on an individual or collective basis will depend on how well-informed First Nations are about the mine's operations and Project impacts to the land. The magnitude of the effects will vary depending on the number of people affected, and may be disproportionate if, for example, several members of one family are disrupted (e.g. due to avoidance by one family of an area it typically uses).

Overall, the Proponent has designed the Project to ensure that significant adverse effects do not result to land, air, water, vegetation, heritage and land uses. Further measures have been recommended in this report that would reduce impacts. These measures, combined with ongoing communication between the Proponent and RRDC/LFN should help ensure that effects are minimized.

Significance Determination

Wildlife Harvest

EFFECTS ARE LIKELY

The Project is likely to result in adverse effects to traditional harvest through habitat loss, wildlife avoidance, a loss of harvestable areas and effects to fish-bearing waters. Project activities will result in the loss of use of the Project site and likely a greater area due avoidance of the area by wildlife and hunters. Vegetation clearing and ongoing Project activities will also remove the Project area from plant harvesting for the duration of the Project.

The Project is certain to impact fish and fish habitat on site, specifically the loss of habitat in Upper Geona Creek. Outside of the Project site, there is limited likelihood for impacts to fish and fish habitat, and therefore traditional harvest, due to Project design, water quality management and treatment, and fish impact offsetting commitments.

EFFECTS ARE ADVERSE

The effects to traditional harvesting activities are adverse. Project activities will result in loss of use of the Project site, and likely a greater area for the duration of the Project. As traditional

harvesting is an integral component of RRDC's and LFN's culture and socio-economic needs, the loss of harvestable areas is adverse.

EFFECTS ARE NOT SIGNIFICANT

While specific information is lacking concerning the use of the Project site for traditional and contemporary harvesting activities, it contains harvestable wildlife, plants and fish that will not be accessible for the duration of the Project or longer. Traditional harvesting activities are also likely to be avoided beyond the direct Project footprint due to disturbances arising from industrial activity, though this effect is expected to cease once mining stops.

For wildlife, the loss and disturbance (leading to avoidance) of habitat will occur through all phases of the Project. This loss and disturbance is predominantly interim. Other than the pit and waste rock storage facility, the site will be progressively rehabilitated and reclaimed, restoring it to useable wildlife habitat. While the likely effects of the Project are adverse, they are not significant due to low to moderate wildlife impacts, and the interim nature and reversibility of impacts. Proponent mitigations and designs proposed to address wildlife impacts, such as a commitment to progressive rehabilitation, habitat compensation measures, full site reclamation and the Co-management Plan, will eliminate or control the Project's impacts. Wildlife populations and habitat are not anticipated to be significantly affected by the Project.

Project impacts to fish and fish habitat will be limited to the Project site. While the loss of suitable fish habitat in Upper Geona Creek represents a permanent loss of habitat, offsetting measures committed to by the Proponent include replacement of spawning and pond habitat in lower Geona Creek, which will provide suitable and accessible habitat for fish, grayling in particular. Section 5.3 determined that the Project would not result in significant adverse effects to fish and fish habitat. With measures proposed by the Proponent, fish harvest is not anticipated to be significantly affected by the Project.

While plant harvest is also likely to be affected by the Project, the Proponent has committed to as little clearing as possible through all phases of the Project, progressive rehabilitation across the Project site, and ongoing co-management with Kaska citizens to "return the mine site and affected areas to viable and, wherever practicable, self sustaining ecosystems that are compatible with a healthy environment and with traditional land use activities."[257] These measures will eliminate, control or minimize the Project's impacts. As such, the effects to plants, more specifically plant harvest, are not significant.

Trapping

EFFECTS ARE LIKELY

The Project is likely to impact the ability to carry out traditional trapping within the Project footprint and the surrounding region. The ability for RRDC members to carry out trapping in this area will be affected for the lifespan of the Project, including during reclamation and road decommissioning. There is also a moderate likelihood that trapping will be adversely affected as

[257] YOR Document 2017-0083-356-1, pg. 55.

a result of changes to furbearer habitat and distribution within and surrounding the Project footprint, including the Tote road.

EFFECTS ARE ADVERSE

Trapping is an important traditional economic activity for First Nations. Loss of trapping area, and the associated impacts to furbearers for the duration of the Project, is an adverse effect.

EFFECTS ARE NOT SIGNIFICANT

Progressive rehabilitation and road decommissioning will result in reversing, controlling and eliminating habitat loss and mortality resulting from the Project. Reclamation will return much of the Project site, including the Tote Road, to suitable furbearer habitat. In addition, following closure, human disturbance will be limited in the area, resulting in the site returning to furbearers. A small portion of the site, specifically the pit and the waste rock storage facility, will be perpetually altered due to the permanence of that infrastructure. However those structures occupy a relatively small area, and as a result habitat loss will not be significant. Due to the abundance of furbearers in the Project area, it is not anticipated that trapping will be significantly impacted in the long-term. Short-term disruptions to trapping are anticipated, due to the loss of the Project area, but this area is relatively small. Furthermore, the Proponent has negotiated a land use supplement with RRDC, which will compensate for disruptions to trapping. As such, the Project is not anticipated to result in significant adverse impacts to trapping.

Traditional Knowledge and Cultural Continuity

EFFECTS ARE LIKELY

The Project is likely to result in effects to activities that support the transfer of Traditional Knowledge and culture. The Project will result in the removal of the Project footprint from traditional land use activities. First Nations are also likely to avoid areas surrounding the Project footprint due to a desire to avoid industrial activity (e.g. increased mine traffic along the Robert Campbell Highway or areas where noise from mine operations are perceptible). It is also likely that some First Nations will avoid the area for traditional pursuits in the long-term due to the perception of contamination. This is due to experience with past mines, and associated long-term effects to traditional land use within RRDC's and LFN's traditional territories. Structures left on site following mine closure will be permanent physical reminders of industrial development, and that association is likely to persist through generations.

It is likely that many RRDC and LFN members will be employed by the mine, removing a significant portion of Traditional Knowledge holders and traditional land ssers from communities. This will likely result in individual impacts, such as reduced opportunities to carry out traditional activities, and collective impacts, such as fewer people transferring Traditional Knowledge to others. Collectively, these effects can disrupt cultural practices into the future.

As discussed in Section 11, there is a low likelihood that heritage resources will be adversely affected by the Project, due to mitigation measures proposed by the Proponent, and ongoing communication between the Proponent and RRDC/LFN.

EFFECTS ARE ADVERSE

Continuation of cultural practices, described above, supports the transfer Traditional Knowledge between generations and cultural continuity, which is essential to the identity of RRDC and LFN. The disruption to traditional land use is thus considered adverse.

EFFECTS ARE SIGNIFICANT

Little information was provided during the assessment that speaks to the importance of the area to First Nations. However, there is sufficient information to confirm that the region has both historical and contemporary importance, and traditional land use occurs to some extent in the Project area. That being said, it is likely that traditional practices have already been impacted by existing site infrastructure and exploration activities over the past 20 years.

As discussed in this report, traditional land use activities such as harvesting and trapping will be impacted by the Project through the loss of land upon which these activities may occur. No information was submitted during the assessment that would suggest that the Project footprint has specific spiritual/cultural importance, though it is acknowledged that some land use information may have been confidentially shared with the Proponent. While disruptions to land use are likely, they are expected to cease following mine closure and reclamation. Furthermore, land use disruptions are limited to in and around the Project footprint, as well as along the Robert Campbell Highway. Longer-term avoidance of the area, due to perceptions of land and resource impacts, is also a very real possibility. The magnitude of this effect will largely depend on the relationship developed between the Proponent and First Nations, and whether there is open, regular and meaningful sharing of information (regarding operations, effects and response), and a willingness to address concerns raised by RRDC and LFN. The Proponent has negotiated a SEPA with both communities that addresses communications, knowledge sharing and capacity issues for the life of the Project. This provides some assurance that there will be ongoing and meaningful dialogue between the Proponent and First Nations should the Project move forward. Moreover, the proposed mitigation measures are considered sufficient to reduce or control the short-term adverse effects to traditional land use, Traditional Knowledge transfer and cultural continuity.

However, the EC believes that with the rotational work schedule of 2 weeks in/1 week out and four weeks of vacation leave per year (this amounts to two 1-month breaks), First Nation employees will not have sufficient time to attend culturally important events and/or partake in traditional land use activities. This, in turn, impacts the ability of these employees to learn and experience activities on the land and to partake in culturally important events, thus negatively impacting their ability to both share and learn Traditional Knowledge. This is particularly significant to both the RRDC and LFN as traditional land use activities and the teaching/learning of this knowledge is one of the most important determinants of cultural transmission and indicators of a healthy culture, potentially having negative implications to the communities', to cultural continuity, and to individuals' mental health and physical well-being.

Recommended Mitigations

The following mitigation addresses the likely, adverse, and significant effects to Traditional Knowledge transmission and cultural continuity as a result of the limited ability for Yukon First

Nation employees to pursue cultural activities due to limited vacation leave and rotational schedules.

8) The Proponent shall provide allowance for up to 14 days of unpaid leave to all Yukon First Nation employees to allow for the exercising of Aboriginal rights related to:

    c. the pursuit of traditional land use activities. This will be 14 days to allow sufficient time on the land; and
    d. to attend culturally important events (potlaches, dances, ceremonies, culture camps).

The EC recommends that the Proponent consult the *Canada Labour Code*, p.262 entitled "Leave for Traditional Aboriginal Practices" when drafting this policy.

8. Economy

8.1 Tourism

Summary & Conclusion

The Executive Committee has determined that the impacts of the Project on tourism are not significant. The assessment identified that there is limited spatial overlap between tourism activities in the region and Project activities. Furthermore, several measures were committed to by the Proponent which are considered adequate to eliminate, reduce or control the adverse impacts of the Project on tourism.

Importance of Tourism

Tourism is a significant economic driver in Yukon. The Yukon Bureau of Statistics reports that $117.2 million (or 4.4 percent) of Yukon's total Gross Domestic Product was attributable to tourism in 2016.[258] In 2015, there were approximately 3 500 jobs in the tourism industry, which is equivalent to approximately 13.5 percent of the territory's jobs.[259] Much of Yukon's tourism is based on its vast landscapes, wildlife viewing opportunities and its rich culture. Many tourism operators within Yukon are fully dependent on tourism for their livelihoods. Comments submitted by the Government of Yukon, Tourism Branch as well as a business offering wilderness tours in the Pelly River area identified concerns that the Project could negatively affect tourism in the area.

Legislative & Management Setting

There is no regulatory framework that deals directly with protecting tourism in Yukon. Indirectly, legislation exists that helps protect and preserve air quality, water quality, fish, wildlife and heritage upon which tourism in Yukon is often based. These are described in sections 5, 6, 7 and 11 of this report.

[258] Department of Tourism. Government of Yukon. Tourism statistics and reports. 2019. https://yukon.ca/en/tourism-statistics#economic-impact-of-tourism-in-yukon
[259] Ibid

Tourism involves all levels of government and various tourism-based associations. A Yukon Tourism Development Strategy (2018 to 2028) was prepared by a multi-stakeholder steering committee, and outlines the goals, values and strategic actions to achieve the sustainable tourism vision in Yukon over a 10 year period. The goals of the strategy are to:

1. Double revenue to Yukon businesses from tourism to $525 million in 2028;
2. Establish a framework within two years that measures the sustainability of tourism development;
3. Ensure at least 80 percent of Yukoners have a positive attitude towards tourism.[260]

These goals are broadly considered in the effects of the Project on tourism.

Yukon is experiencing a yearly growth in its number of visitors.[261] The majority of visitors (78%) travel to Yukon in the summer months, between June and September.[262] A comparison of the 2017-18 and the 2012 Visitor Exist Survey shows a tourism increase of 25%. A selection of the top activities completed by visitors in 2017-2018 are provided in Table 20 below: [263]

Table 20: Selected top activities completed by all visitors

Activity	Number of activities completed
Visit a Visitor Information Centre	278 300
Visit a historic site, park or building	267 900
Wildlife viewing or birdwatching without a guide	205 500
Camping without a guide	169 100
Visit a cultural centre	103 500

Tourism growth and development over the next 9 years will be largely guided by the Yukon Tourism Development Strategy 2018-2028.

[260] Department of Tourism. Government of Yukon. Yukon Tourism Development Strategy. *Sustainable Tourism. Our Path. Our Future. 2018-2018.* 2018. yukon.ca/sites/yukon.ca/files/tc/tc-yukon-tourism-development-strategy.p df
[261] Yukon Bureau of Statistics. Government of Yukon. Visitor Exit Survey 2017/18. 2017. https://yukon.ca/sites/yukon.ca/files/tc/tc-visitor-exit-survey-2017-18.pdf
[262] Ibid.
[263] Ibid.

Existing Conditions and Trends

The Project is accessible by the Robert Campbell Highway, which provides a scenic alternate route from Watson Lake to Whitehorse, although much of the road surface is gravel and conditions can be poor. The Project overlaps the Robert Campbell Tourism Region, which includes the communities of Faro and Ross River. According to Government of Yukon, Tourism Branch, popular activities in this region include canoeing, hiking, sport fishing, hunting and wildlife viewing.[264] Tourism Branch also identifies the following tourism infrastructure in proximity to the project: fishing on Finlayson Lake (30 km from the Project), Frances Lake and Frances Lake Lodge (50 km from the Project) and McEvoy Lake with Inconnu Lodge (40 km from the Project).[265] Additionally, there are several smaller lakes and rivers with canoe put-in locations throughout the region.

There may also be wilderness tourism operators operating in the area, though none were specifically identified during the assessment. The Wilderness Tourism Association of the Yukon identifies 20 registered wilderness tourism companies that offer services in the Campbell Region.[266]

There are four Yukon Government-run campgrounds near the Robert Campbell Highway (between the Project site and Watson Lake, the area of heaviest expected mine-related vehicle traffic): Simpson Lake (km post 81, Frances Lake (km post 171), Watson Lake (km post 984), and Liard Canyon (km post 971) Campgrounds.

The Project also overlaps Outfitting Concession #20, owned by Yukon Big Game Outfitters, which is the largest outfitting concession in the Yukon, covering 5.7 million Ha. The outfitter offers guided hunting for sheep, moose, caribou, grizzly and black bear, and wolf and wolverine. Guided hunts usually occur between the start of August through to the end of October, though some spring (bear) and winter (wolf) hunts may also occur. During the summer months, the outfitter also offers non-hunting trips, including multi-day backpacking trips, day hikes, lake-side cabin rentals, river trips (canoe or rafting), lake canoeing, horseback safaris, and ATV tours.[267] Within their own areas, outfitters maintain hunting camps, airstrips, float plane bases, horse grazing areas, trails and corrals that are necessary to provide a quality guided hunting service. Yukon Government, Tourism Branch notes that the outfitter has a number of leases and camps in the surrounding area.[268]

Project Design

The Proponent has designed the Project and made additional commitments to reduce impacts to air quality, water quality, heritage, wildlife and soil quality, and to reduce impacts from noise. These are outlined in their respective sections in this assessment (Sections 5, 6, 7, and 10). Generally, these measures and design features serve to reduce impacts to tourism, which relies

[264] YOR Document 2017-0083-264-1.
[265] Ibid
[266] Wilderness Tourism Association of the Yukon (WTAY). 2019. https://wtay.com/regions/campbell-region/?wtay_activity
[267] Yukon Big Game Outfitters (YBGO). 2013. http://yukonbiggame.com/wilderness-adventures.php
[268] YOR Document 2017-0083-264-1.

on clean air and water, healthy wildlife populations and a quiet environment free from industrial noise.

The Proponent has included Yukon Big Game Outfitters in their Consultation and Engagement Plan and has committed to including Inconnu Lodge and Frances Lake Lodge in the Plan. The Proponent will work with these parties to resolve any concerns, should they be raised.

Effects Characterization

THE PROJECT MAY RESULT IN REDUCED VISITOR EXPERIENCE AND TOURISM IN THE PROJECT AREA
Tourism in the Campbell Region is largely dependent on undisturbed landscapes and healthy wildlife populations. An increase in people, traffic, and noise in the area during construction and operation, or a reduction in air and water quality as a result of the Project has the potential to negatively affect visitor experience, which in turn could result in reduced tourism opportunities in the area and adversely affect those who depend on it for their livelihood.

Vehicle traffic along the Robert Campbell Highway is expected to increase to 52 vehicles per day during the operations phase (10 years). Noise from vehicles could disrupt campground users at the Frances Lake and Simpson Lake Campgrounds, which are located approximately 1.7 km and 1.4 km from the highway respectively. Those travelling the highway for scenic views may also have a reduced experience due to the increase in industrial traffic on the highway. However, overall traffic volumes are still relatively low due to poor road conditions and vegetation buffers between the highway and campgrounds should minimize noise-related disturbances to campground users.

Noise generated from the Project, including blasting, ore processing, heavy equipment use, and aircraft overflights may disturb those who are seeking a remote wilderness experience in the surrounding project area, either on their own, as part of a guided wilderness tour or those occupying nearby lodges. Noise modelling undertaken by the Proponent (discussed in Section 9.2) predicted that noise is mainly limited to the project footprint. Some disturbances from aircraft flyovers might be experienced, though there are no known wilderness operations in that overlap the project footprint, and any use is expected to be infrequent and short-term. The closest lodge is located 30 km away on McEvoy Lake, which is far enough from the Project that there should be no perceptible noise-related effects.

The Yukon Big Game Outfitter, however, has a number of leases and camps in the surrounding area that have a greater potential to overlap with noise generated from the Project. In addition to disrupting wilderness experiences of visitors, project activities that displace or disturb wildlife can affect the success of guided hunts or wilderness viewing opportunities. The Proponent has indicated that they have been in regular communication with the outfitter and will continue to provide them with project updates with a view to minimizing interference with the outfitter's business.

The Project also has the potential to impact air, water, and wildlife. Effects to these valued components are discussed in sections 9.3, 5 and 6 respectively. Negative impacts to the environment could alter the pristine landscape that tourists are seeking to experience, affecting

amounts of visitors travelling to the area. The Lynx Track Farm, located close to Faro along the Pelly River, noted concerns regarding potential water contamination and the resulting negative effects to their wilderness business.[269] However, with proponent mitigation measures and measures addressed in this report, it is unlikely that the Project will affect air, water, soil and vegetation quality such that wilderness experiences will be altered.

Significance Determination

EFFECTS ARE LIKELY

The Project is likely to result in some disturbances to campground users, highway travellers, and those seeking a wilderness experience in the area over the life cycle of the Project. Effects are most likely to occur during the construction phase (two years) and operation phase (10 years) when workers, equipment and vehicles will be most active.

EFFECTS ARE ADVERSE

Visitors to the region are looking for remote wilderness experiences, including enjoying pristine landscapes and wildlife viewing and harvesting opportunities. Project activities that interfere with a visitor's experience have the potential to reduce tourism in the area, negatively affecting the economic viability of local businesses that rely on tourism.

EFFECTS ARE NOT SIGNIFICANT

Tourism impacts are primarily limited to visitor experience impacts along the Robert Campbell Highway (campground users and highway travellers), and those enjoying the landscape, lakes and rivers for hiking, fishing, canoeing and guided hunts closer to the Project area. There are generally low volumes of traffic on the Robert Campbell Highway, and campgrounds are located sufficiently far away from the Project area that noise will be minimal for campers. There are no known wilderness tourism operators in the local Project area other than the local outfitter, and use of the area for wildness tourism is expected be infrequent.

In general, there are limited tourism activities that overlap with Project footprint. As a result, any disruptions are expected to be infrequent and short-term. Any effects to tourism are also reversible once construction and operations cease (12 years). As such, the effects to tourism are not considered significant.

8.2 Financial Security

Summary and Conclusion

The Executive Committee has determined that the Project poses significant financial risk to the Government of Yukon. These risks can be controlled, reduced or eliminated through application of the recommended mitigations.

[269] YOR Document 2017-0083-267-1.

Importance of Financial Security

Appropriate financial security for mine projects is important as it ensures that mining can be undertaken in a responsible way, minimizing the extent to which government underwrites the risks of mine closure. The absence of appropriate financial security can lead to large and long-term liabilities for governments.

Legislation and Regulatory Setting

QUARTZ MINING ACT

Under the *Quartz Mining Act* (QMA), the *Security Regulation* stipulates requirements for financial security. Security requirements are determined considering a number of factors:

- the risk of any significant adverse environmental effects resulting from development and production
- the estimated cost to implement a plan addressing reclamation of the site during and post-development and production, approved pursuant to issuance of a licence
- the costs that would be incurred by YG if it was required to reclaim the site of development and production, including costs associated with post-closure measures, monitoring and ongoing maintenance to address mitigation of any significant adverse environmental effects from development and production; and
- any security furnished or deposited pursuant to the *Waters Act* or other Yukon enactment.

These regulations require that regulators set financial security requirements to cover potential environmental costs of reclaiming mine sites. These regulatory requirements do not directly address potential social impacts of mine closure.

Context

Following mining operations, certain closure requirements exist to reduce or eliminate environmental and socio-economic liabilities associated with the cessation of operations. Government of Yukon requires a financial assurance (security) from mine operators to ensure that closure activities are funded in the event that market or other factors force a mine operator into bankruptcy. Even if financial assurance is provided, closure may cost more than anticipated, as was the case with the Wolverine Mine (2015).

Without sufficient financial security, long-term financial liabilities may be passed onto governments.

To reduce environmental impacts, extensive measures must be undertaken in a mine's closure phase. Closure measures must achieve chemical containment and physical stability of land or any infrastructure left behind. Chemical containment generally includes efforts to separate either water or air from contaminants, and often involves moving large amounts of rock. Physical stability is required to ensure integrity of chemical containment. Landforms left during closure must be stable over the very long-term. Loss of physical stability generally results in chemical leaching, and either event will result in additional costs.

Mine closure generally results in social impacts. While workers often expect the mine will eventually close, many are unprepared when it does.[270] Social impacts can include:

- stress and anxiety to mine workers and their families;
- fluctuations in housing prices, which may leave some workers owing more on their mortgage than the asset is worth;
- the non-payment of accounts owing to local businesses in the event of unscheduled closure;
- large reductions in community populations and abandonment of houses; and
- a longer-term and persistent locally depressed economy

Closure activities which address social impacts are generally not as prominent in closure plans, though they are likely most pronounced when closure is unscheduled.

Current Conditions and Trends

HISTORY OF EARLY MINE CLOSURES

Yukon has a history of unexpected mine closures due to shifting economic conditions or other factors. Examples of such closures include:

- Wolverine Mine (2015)
- Bellekeno (2013) (temporary closure due to commodity prices)
- Brewery Creek (2001) (early closure due to commodity prices)
- Mount Nansen Mine (1999) (bankruptcy)
- Faro (1998) (bankruptcy)
- Faro (1993) (bankruptcy)
- Sa Dena Hes (1992) (closure due to commodity prices)
- Elsa (1989) (closure due to commodity prices)
- Whitehorse Copper Mines (closure due to commodity prices)
- Faro (1982) (temporary closure due to commodity prices)

Despite security requirements, many of these mines have resulted in long-term liabilities. The most notorious liability is that of the Faro Mine, where costs have already exceeded 500 million dollars and major reclamation works have not yet begun.[271] The Executive Committee is currently assessing the government-funded closure plan for the Faro Mine, which is expected to cost a considerable amount and take decades to implement.

Regardless of operational plans, economics appears to have been the major driver of mine lifespans in Yukon. Changes in our understanding of geology may also be a large factor in pro-longing or shortening a mine's life. The Executive Committee acknowledges that the Proponent

[270] Conference Board of Canada. "Future of Mining in Canada's North". January 2013, pg. 66.
[271] Whitehorse Star. "Cost of Faro Project Forecast to Exceed $500 Million This Year". May 23, 2019. https://www.whitehorsestar.com/News/cost-of-faro-project-forecast-to-exceed-500-million-this-year

intends to operate the Project as scheduled, but that other factors make alterations to Project lifespan and design likely.

LIMITED SOCIAL SUPPORTS IN AFFECTED COMMUNITIES

Despite historical colonial impacts,[272] high crime rates[273] and issues with substance abuse,[274] the communities of Ross River and Watson Lake have few governmental social services available. In Ross River, a few resources exist to address substance abuse, with detox programs only available in Whitehorse, a five-hour drive away. Furthermore, with the collapse of the Many Rivers Counselling Services in 2018, there are fewer counselling services in the community, with only one YG mental wellness and substance use counsellor and one YG child and youth counsellor.[275] Lastly, a Christian safe house has existed since 2004, but no funds exist to offer programs[276] such as a soup kitchen or recreational programs for women, and the Liard Aboriginal Women Society (LAWS)[277] has inconsistent funding.[278]

The community of Watson Lake also has a finite amount of resources available, with no local detox services (closest are in Whitehorse), and fewer counselling options due to the closure of the government-funded Many Rivers Counselling Service, leaving the community with YG's two mental wellness and substance use counsellors, a clinical counsellor, a mental health nurse, and a child and youth counsellor.[279] Along with services provided by the Liard Aboriginal Women Society, Help and Hope for Families offers transition home services and shelter.[280]

Project Design

The Project proposal estimates reclamation and closure liability at roughly $90.5 million. This estimate is a high-level estimate for closure costs following operations. This figure covers predicted environmental reclamation activities only. Details of predicted closure costs are highlighted in the proposal in Appendix H-1 Conceptual Reclamation and Closure Plan.

Yukon Conservation Society notes that "YCS is impressed that the Proponent has arrived at a financial security figure that is somewhere in the realms of reality for a Yukon mining operation."[281]

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[272] Within this section, "colonial impacts" refers to the following: residential school legacies, effects of displacement and disenfranchisement from the Indian Act, and the Sixties Scoop.
[273] Yukon Bureau of Statistics. Government of Yukon. *Police-reported Crime Statistics in Yukon 2016*. August 2017. http://www.eco.gov.yk.ca/stats/pdf/crime_2016.pdf
[274] YOR Document 2017-0083-046-1, pg.15-10;
Hrenchuk, Charlotte. Strong Women's Voices Rural Choices, Report on the Northern Women's Issues Through a Rural Lens Project, Whitehorse: Yukon Status of Women Council, 2004, pg. 16.
[275] Department of Health and Social Services. Government of Yukon. *Mental Wellness and Substance Use Services across Yukon.* 2019. http://www.hss.gov.yk.ca/mwsu_communities.php
[276] Ibid.
[277] The Liard Aboriginal Women's Society (LAWS) provides services to both Ross River and Watson Lake.
[278] Ibid.
[279] Department of Health and Social Services. Government of Yukon. *Mental Wellness and Substance Use Services across Yukon.* 2019. http://www.hss.gov.yk.ca/mwsu_communities.php
[280] Help and Hope for Families Society (HHFS). Help and Hope for Families Society, HHFS, s.d.. http://www.helpandhopeforfamilies.ca/.
[281] YOR Document 2017-0083-265-1.

Effects Characterization

SCHEDULED CLOSURE

The proposed security (financial assurance) appears to be considerable and reasonable when compared with the closure costs of other projects within Yukon. While this level of security will likely ensure funding for chemical containment and physical stability, social effects were not considered in the estimating security requirements. Scheduled closure will likely result in social impacts to Ross River and Watson Lake as the mine will play a disproportionate role in local economies when compared to Whitehorse.

Closure in general is expected to possibly "have significant adverse effects on local economies, contribute to impoverishment, trigger the loss of key services, and lead to out-migration. Poorly managed closure processes exacerbate these impacts and can damage corporate reputations, where operators are held responsible for the impacts that they have left behind."[282]

UNSCHEDULED CLOSURE

Unscheduled closure is likely to be more disruptive than a scheduled closure, and its effects likely more adverse than those of scheduled closure.

In the event of unscheduled closure, the costs of achieving chemical containment and physical stability may be different than predicted closure costs after scheduled operations. However, social impacts will likely be much greater than during scheduled closure – unexpected job losses, business losses and changes to local economies are likely to be disruptive and lead to adverse social impacts.

As unscheduled closure is often linked to depressed economic conditions, and often overlaps periods where government finances are stretched more thinly, reducing the government's ability to address the social impacts of mine closure.

Significance Determination

EFFECTS ARE LIKELY

The Project's financial security estimate does not include the costs of addressing social effects. If financial security does not include consideration of all possible closure costs, negative impacts are likely. In the case of this Project, those impacts would be either social or related to public expenditure.

Further, the Project's financial security does not consider different closure scenarios, such as unscheduled closure due to adverse economic conditions. As unscheduled closures are common, impacts due to unscheduled closure are likely.

EFFECTS ARE ADVERSE

Where closure costs are borne by the public or closure plans do not address the social effects of closure, impacts are adverse.

[282] Nicholas A. Bainton and Sarah E Holcombe. "A critical review of the social aspects of mine closure". Resources Policy, September 2018.

EFFECTS ARE SIGNIFICANT

The social effects of mine closure are considerable in communities that are heavily tied to mining projects. The magnitude of effects is amplified in communities with a lack of social support services and lower levels of economic opportunity, such as Ross River and Watson Lake. In these communities the social effects of closure are likely to be significant, especially if those effects are not incorporated into closure planning and financing. These significant adverse effects will be exacerbated in the event of unscheduled closure, especially if the government is unable to provide funding to assist with adverse impacts.

Recommended Mitigations

The significant effects of the Project, with respect to financial security, can be reduced, controlled or eliminated through the application of the following mitigations:

9) Security requirements shall take into consideration the need for transition funding for workers and communities, for both scheduled and unscheduled closure.

10) Security requirements shall take into consideration the potential for early unscheduled closure.

8.3 Business Environment

Summary

The Executive Committee considered potential Project effects in relation to Yukon's economic diversity. By economic diversity, the Executive Committee means a level of economic vibrancy that allows for the provision of a diverse range of goods and services, an environment that fosters business activity, and a lack of reliance on a single sector of the economy. The Executive Committee, however, did not consider that the Project was likely to decrease economic diversity.

Importance of Economic Diversity

Economic diversity is important for a number of reasons. A diverse economy is more resilient to economic changes and fosters a wider range of businesses which provide important services and meet cultural and social demands. Consequently, economic diversification can provide better buffers against economic downturns, and contributes to a community's vibrancy.

Yukon Unemployment Rate Very Low

Yukon's unemployment rate is extremely low at under three percent, the lowest in Canada. Combined with a high participation rate (the highest in Canada), Yukon has a very tight labour market.[283] The unemployment rate in Yukon is currently below predicted unemployment rates which may be seen during full employment.[284] The most recent data also suggest a net level of

[283] Yukon Bureau of Statistics. "Survey of Employment, Payrolls, and Hours 2018." Government of Yukon. 2019.
[284] As there will always be people switching jobs, economic sectors contracting while others expand, the "full employment unemployment rate" is generally predicted to be over 3 percent.
Summers, L.H. 1986. Why is the unemployment rate so very high near full employment? Brookings Papers, Harvard University. https://www.brookings.edu/wp-content/uploads/1986/06/1986b_bpea_summers_abraham_wachter.pdf

outmigration in Yukon, further tightening the labour market.[285] Yukon businesses are facing difficulties in recruiting and maintaining sufficient numbers of staff.[286] This challenge is particularly pronounced in the low skilled service industry labour market. In Yukon, accommodations and food services have the highest rates of job vacancy of all industries.[287]

Where unemployment levels are very low, the introduction of a large employer may cause disruption to businesses as labour costs increase and labour becomes scarce.

Unemployment Rates Higher Outside Whitehorse, Among First Nations Citizens

While unemployment rates are exceptionally low in Yukon, First Nations unemployment rates remain higher, at 8.8 percent. This is likely partially attributable to higher unemployment in communities outside of Whitehorse – communities with greater First Nations populations – and to historic and systemic marginalization.

While unemployment data is not available at the community level, employment rates are lower outside of Whitehorse. In Watson Lake, the employment rate is under 60 percent compared with over 70 percent in Whitehorse.[288]

Project Will Require Large Workforce

The Project will require a large number of workers, mostly skilled, but some low skilled. While many of these workers will be sourced from outside the territory, some will be recruited from the territorial labour force. As Project employment will largely be full-time, many in the territorial labour force may be unable or unwilling to work on this Project.[289] This additional source of demand in the labour market may increase pressure on businesses if the available labour force does not grow in step with the number of jobs available.

Using the Minto Mine's Socio-economic Monitoring Program as an example:

- underground workers appear to be almost wholly recruited from outside the territory;
- the surface mining workforce is mostly recruited from within the territory; and
- the camp contractor workforce is mostly recruited from within the territory, and largely from First Nations populations.[290]

Hall, R.E. 1970. Why is the unemployment rate so high at full employment? Massachusetts Institute of Technology. http://www.web.stanford.edu/~rehall/Why-Is-BPEA-1970.pdf

[285] For the last five quarters for which data is available, net outmigration from the territory is about 200 individuals. Yukon Bureau of Statistics.

[286] Yukon Bureau of Statistics, "Labour Demand Survey, 2018". Government of Yukon. 2019; City of Whitehorse. "Downtown Retail and Entertainment Strategy". 2016.

[287] Yukon Bureau of Statistics, "Labour Demand Survey, 2018". Government of Yukon. 2019.

[288] Statistics Canada. Yukon: Beautiful, Complex, and Changing. 2018 https://www150.statcan.gc.ca/n1/pub/11-631-x/11-631-x2018006-eng.htm

[289] Many part time workers chose to or cannot work full time hours. Yukon Bureau of Statistics, "Labour Demand Survey, 2018". Government of Yukon. 2019

[290] Minto Explorations Ltd, Selkirk First Nation and Yukon Government. 2015. Minto Mine Socio-Economic Monitoring Program – Annual Report 2015. Minto Mine Socio Economic Monitoring Plan. http://www.selkirkfn.com/files/2115/3419/3625/MintoMine_Socio-EconReport-2015_FINAL_July_30_2018.pdf

It is reasonable to expect a similar pattern of hiring for the Project as compared with the Minto Mine; therefore, many jobs are likely to be filled by First Nations citizens.

While the mining workforce is largely comprised of skilled labourers, the camp workforce is typically lower skilled labourers, with lower rates of pay.

Project Unlikely to Result in Reduced Economic Diversity Outside of Whitehorse

Outside of Whitehorse, where employment levels are lower and unemployment rates higher, the Project is unlikely to stress existing businesses. Rather the Project is likely to aid existing and new businesses by creating demand for local services and increasing disposable income.

Using the Minto Socio-economic monitoring data, expected levels of local recruitment for the Project are not expected to be large enough to disrupt local businesses. The Executive Committee predicts that the Project will positively impact economic diversity outside of Whitehorse.

Project Unlikely to Result in Reduced Economic Diversity in Whitehorse

Many challenges for "Main Street" Businesses

Labour shortages are one of many challenges faced by Whitehorse businesses. For downtown businesses, availability of parking is the primary concern identified by 42 percent of respondents in the City of Whitehorse's 2016 Downtown Retail Strategy. Operational challenges, including freight costs, high leases and employee recruitment/retention was identified as the most significant barrier to growth by 23 percent of respondents.[291]

Systemic challenges for "Main Street" businesses are common in Canada.[292] Online retailing is changing consumer habits, bars and pubs are increasingly disappearing as people socialize elsewhere, large big box districts enjoy low land and lease costs, and people move to quick service restaurants and chains, all of which place structural challenges on independent small businesses in the food and service sectors.[293]

Whitehorse Business Sector Healthy

Despite challenges, small independent retailers, service providers and food vendors in Whitehorse appear to be doing well. Retail spending per capita is 25 percent higher than in the rest of Canada.[294] Further, for the last two years, Whitehorse has been named the most entrepreneurial city in Canada by the Canadian Federation of Business.[295] The City of Whitehorse, in its 2016 Downtown Retail Strategy, notes that "Main Street is healthy, showing a reasonable level of vacancy (particularly given the downturn in mining activity that has occurred

[291] City of Whitehorse. "Downtown Retail and Entertainment Strategy". 2016.
[292] Soans, R. Towards Vibrancy: Overcoming Path Dependence to Revitalize Traditional Retail Areas in Edmonton. University of Alberta, 2018. https://era.library.ualberta.ca/items/903101e8-77df-4e6a-8794-7c70ebed799b
[293] Grant, J. and Perrott, K. 2011. Where is the Café? The Challenge of Making Retail Uses Viable in Mixed-use Suburban Developments. Urban Studies, 48(1) 177-195.
[294] Statistics Canada. "Retail Trade Sales by Province and Territory". Government of Canada. 2019.
[295] Canadian Federation of Business. "Canada's Top Cities for Entrepreneurship: Whitehorse, Winkler and Victoriaville lead the Way". April 3, 2019. https://www.cfib-fcei.ca/en/media/canadas-top-cities-entrepreneurship-whitehorse-winkler-and-victoriaville-lead-way

since 2012) and offering a strong mix of specialty retail, restaurant, recreation, arts/cultural and service uses." Whitehorse residents enjoy a wide diversity of service offerings for a city of its size, despite residents valuing retail and services as less important than any other factor in relation to the decision to reside in Whitehorse.[296]

NO EFFECTS PREDICTED

Many of the jobs that will be created due to the Project would be skilled positions in trades and professions. The creation of these jobs will not alter the retail, accommodation or food business landscape. The part-time labour force is unlikely to be affected, and the Project represents potential employment for First Nations citizens. Considering the above and the robustness of the local business environment, the Executive Committee does not predict that the Project will result in a reduction in the vibrancy of the territorial private sector or will reduce economic diversity.

9. Human Health and Safety

9.1 Respiratory Health

Summary & Conclusion

The EC has determined that the Project is not likely to result in significant adverse effects to the respiratory health of off-duty workers and local land users. Air contaminant modelling identified the potential for air contaminant concentrations to increase above applicable territorial and/or federal standards intermittently during the life of the Project. Project design and measures committed to by the Proponent, however, will effectively eliminate, reduce or control the adverse respiratory health effects of the Project.

Importance of Respiratory Health

The Proponent identifies air quality as an affected Valued Environmental and Socio-economic Component (VESEC), stating that "[air] quality was selected as a Valued Component due to its importance to the health and well-being of humans, wildlife, vegetation and other biota. The atmosphere provides a pathway for the transport of contaminants to the biophysical environment."[297]

The World Health Organization suggests that air pollution presents the biggest environmental risk to human health.[298] The Government of Canada estimates that 14 600 premature deaths per year in Canada can be linked to air pollution from fine particulate matter, nitrogen dioxide and ozone.[299] The total economic valuation of the health impacts attributable to air pollution in Canada is $114 billion per year.[300]

[296] City of Whitehorse. "Downtown Retail and Entertainment Strategy". 2016.
[297] YOR Document 2017-0083-021-1 pg.6-1
[298] Canadian Council of Ministers of the Environment. Air Quality. 2019. http://airquality-qualitedelair.ccme.ca/en/
[299] Government of Canada. Health Effects of Air Pollution. 2019. https://www.canada.ca/en/health-canada/services/air-quality/health-effects-indoor-air-pollution.html
[300] Ibid.

Mining and associated activities can introduce a suite of chemicals and fugitive dust into the environment which can have potential effects on human health. Comments received during the assessment expressed concern that the Project's air emissions may result in adverse health effects to workers. Therefore, the Executive Committee has examined the potential effects to respiratory health, a component of human health, as it relates to changes to air quality resulting from the Project.

Legislative & Management Setting

ENVIRONMENT ACT AND AIR EMISSIONS REGULATIONS

Part 9(1) of Yukon's *Environment Act* prohibits the release of a contaminant in a manner contrary to the Act or Regulations. Yukon's *Air Emissions Regulations* prohibits the release of emissions for certain industrial activities unless authorized by a permit. Section 6 of the regulations prohibits the release of any air contaminant that may "(a) cause or be likely to cause irreparable damage to the natural environment; or (b) […] cause actual or imminent harm to public health or safety."[301]

AIR QUALITY STANDARDS

Canadian Ambient Air Quality Standards (CAAQS) have been developed which establish standards specifying maximum desirable, acceptable and tolerable concentration levels for specified contaminants in the air.[302] They are part of a larger joint federal/provincial/territorial air quality management system which aims to ensure the CAAQS are not treated as pollute-up-to levels. CAAQS are reviewed every five years to ensure they are stringent enough to protect human health. CAAQS currently exist for fine particulate matter ($PM_{2.5}$), ozone (O_3), sulphur dioxide (SO_2) and nitrogen dioxide (NO_2).

Provinces and territories have also established air quality standards that take into account their own specific circumstances. Yukon's Ambient Air Quality Standards (YAAQS) were most recently updated in 2014 and identify standards for SO_2, O_3, NO_2, carbon monoxide (CO), fine particulate matter ($PM_{2.5}$ and PM_{10}) and Total Suspended Particles (TSPs).

The CAAQS and YAAQS have been used as a threshold for significance in this effects analysis.

OCCUPATIONAL HEALTH AND SAFETY ACT AND REGULATIONS

The *Occupational Health and Safety Act and Regulations* contain specific provisions related to worker health and safety. Sections 3-11 of the Act outlines duties of employers and workers with respect to health and safety in the workplace. Sections 1.25 to 1.33 of the general safety regulations specifies the protective equipment and clothing required for workers when they may be exposed to an air contaminant, and requires that proper ventilation systems and testing/inspections of protective equipment are in place.

[301] Yukon Government. Air Emission Regulations O.I.C 1998/20. Environment Act. 1998. http://www.gov.yk.ca/legislation/regs/oic1998_207.pdf
[302] Wood, J. Canadian Environmental Indicators – Air Quality. Studies in Environmental Policy. Fraser Institute. January 2012. https://www.fraserinstitute.org/sites/default/files/canadian-environmental-indicators-air-quality-2012.pdf pg. 10/72

Context

CRITERIA AIR CONTAMINANTS

Mining and associated activities can introduce a suite of chemicals and fugitive dust into the environment, which can negatively impact human health.[303] These contaminants can lead to short-term impacts as well as chronic disease. Table 21 identifies Criteria Air Contaminants (CACs) that were selected for the Project effects analysis, as they are known to be associated with human health impacts, and have measurable parameters linked to Yukon and Canadian air quality standards.

[303] Health Canada. Supplemental Guidance on Human Health Risk Assessment of Air Quality, Version 2.0. Federal Contaminated Site Risk Assessment in Canada. Government of Canada. March 2017.

Table 21: Criteria Air Contaminants

CAC	Source	Health Effects
Sulphur dioxide (SO_2)[304]	Emitted when fossil fuels or raw materials containing sulphur are burned or used in industrial processes	Reduced lung function, respiratory problems and airway inflammation
Nitrogen dioxide (NO_2)[305]	Formed primarily through the burning of fossil fuels	Reduced lung function, respiratory problems, airway inflammation, allergic responses, asthma and increased susceptibility to respiratory infections
Total suspended particulates (TSP)[306]	TSP refers to all airborne solid and liquid particles (save for water) that are microscopic in size, and can be suspended in the air momentarily or indefinitely. TSP can result from both natural and human sources (e.g. industrial emissions, agriculture, forest fire smoke, dust).	Respiratory tract effects, asthma, bronchitis and heart attacks.
Coarse particulate matter less than 10 microns (PM_{10})[307]	PM_{10} is predominantly a result of unpaved road dust, construction activities, mining and quarrying.	Upper respiratory tract effects, such as cough, phlegm, rhinitis and asthma[308]
Fine particulate matter, less than 2.5 microns ($PM_{2.5}$)	$PM_{2.5}$ originates primarily from combustion processes – transportation, industrial processes and burning.[309]	Increased frequency of asthma attacks, chronic bronchitis and heart attacks.[310]
Carbon Monoxide (CO)	The greatest sources of CO to outdoor air are cars, trucks and other vehicles or machinery that burn fossil fuels.	May result in reduced oxygen, chest pain, dizziness and confusion

The Proponent modelled air quality changes during the various phases of the Project, specific to the above contaminants.

[304] Canadian Council of Ministers of the Environment. Air Quality. 2019. http://airquality-qualitedelair.ccme.ca/en/
[305] Ibid.
[306] Alberta Environment and Parks. Alberta Government. Air Data – Total Suspended Particulates (TSP). http://airdata.alberta.ca/aepContent/Pollutants/TotalSuspendedParticulates.aspx
[307] Health Canada. Human Health Risk Assessment for Coarse Particulate Matter. January 2016. http://publications.gc.ca/collections/collection_2016/sc-hc/H144-30-2016-eng.pdf
[308] Ibid.
[309] Ibid.
[310] Canadian Council of Ministers of the Environment. Air Quality. 2019. http://airquality-qualitedelair.ccme.ca/en/

LAND USE CONTEXT

The Project site is located within the Traditional Territories of the Ross River Dena Council and the Liard First Nation. The Project proposal identifies traditional activities in the area, and cabins have been identified near the Project boundary at North Lakes, Wolverine Lakes, Money Peak, Frances Lake, Pelly Banks and Money Creek.[311] Traditional land use activities, such as hunting, fishing and trapping may occur in the vicinity of the proposed Project. These land users may be exposed to CACs or other air quality disturbances resulting from construction, operation and closure of the mine. The Proponent's air dispersion model examined effects within an area of 1 600 km^2, centred around the mine footprint (i.e. the regional study area). The assessment considered how respiratory health of land users could be impacted by the Project.

OFF-DUTY WORKER CONTEXT

The *Occupational Health and Safety Act* applies to workplaces. Section 3(1) of the Act states that the employer shall ensure that workplace, machinery, equipment and processes under the employer's control are safe and pose no risk to health. The ways in which this requirement would be achieved should be outlined in the company's health and safety policies.

The EC has assumed that off-duty workers are not subject to the same Personal Protective Equipment (PPE) requirements as on-duty workers, despite being in the workplace while on-shift but off-duty. The PPE requirements clearly apply to "workers" as defined by the Proponent: "shift workers will work 12 hour shifts while on-site and will not be permitted access to the mine site when off-shift for recreational purposes."[312] With respect to the schedules of off-duty workers, the Proponent notes that "workers are not expected to be continuously present at the camp (i.e. 2 weeks on and 1 week off and only present during non-shift hours where they will spend the majority of their time in the camp sleeping rather than outside in the camp yard) such that this further ameliorates these marginal exceedances."[313] It is unclear what the schedules will be for off-duty workers, but the EC assumes that workers will remain at the project site, whether at work or off-duty, for the full two weeks of their rotation. Because 24-hour exceedances are being examined, it is reasonable to expect that off-duty workers will be outside at times, and may therefore be exposed to air contaminants.

Existing Conditions and Trends

Little data is available for the existing air quality regime in the Project area. The Proponent expected that air contaminant concentrations would be low given the remote Project location and minimal sources of air pollution.[314] The Proponent did not collect baseline air quality data for the Project.

The proposed Casino Mine Project, for which baseline air quality data was collected, was used by the Proponent as a proxy for baseline conditions since the Casino Mine Project is also in a

[311] YOR Document 2017-0083-046-1.
[312] YOR Document 2017-0083-295-1, pg. 95.
[313] YOR Document 2017-0083-255-1, pg. 99
[314] YOR Document 2017-0083-021-1 pg. 6-8

remote area of Yukon with minimal air contaminants expected. Table 22 outlines the Proponent's assumed CAC baseline concentrations for the KZK Project site.[315]

Table 22: Assumed Air Contaminants Baseline Concentrations

Contaminant	Unit	Baseline Concentration	
		24-hour Maximum	Mean Annual
TSP	µg/m^3	7	1
PM_{10}	µg/m^3	6	1
$PM_{2.5}$	µg/m^3	4	1
CO	ppm	0	0
SO_2	ppbv	0	0
NO_2	ppbv	0	0

The Executive Committee is comfortable using the baseline values from the Casino Mine Project as a proxy for baseline conditions at the proposed KZK site. The EC concurs with the reasonable assumption that the Kudz Ze Kayah Project has low air contaminants at baseline; ergo the respiratory health of current land users is unimpacted by the natural environment. These baseline conditions will be used to characterize the potential impacts of the Project on respiratory health, by identifying contaminant concentrations in relation to baseline and comparing concentrations against the CAAQS and YAAQS thresholds.

Project Design

The Project proposal identifies a number of mitigation measures which aim to reduce effects to air quality (through minimizing and controlling the release of CACs), which will also help control potential adverse effects to respiratory health. Table 23 below summarizes the Proponent's proposed mitigation measures to reduce Project ambient air contaminant concentrations.[316]

[315] Ibid. pgs 6-9.
[316] YOR Document 2017-0083-021-1, pg. 6-28.

Table 23: Proposed Mitigation Measures for Air Quality

Potential Effect	Project Phase	Proposed Mitigation Measures
Increase in Ambient Concentrations of Particulate Matter (TSP, PM_{10}, $PM_{2.5}$) at receptor	Operations	Crusher enclosure, material handling and transfers at the process plant facility occurring indoors
		Cover over the coarse ore stockpile
	Construction, Operations, Closure	Progressive reclamation of disturbed areas
		Watering roads and exposed surfaces
	Operations	Use of dust collectors and proper chute design to prevent air entrainment of dust
		Dust extraction with conveyance to and processing in dust collectors
		Covering or enclosure of conveyors or conveyor galleries
		Installation of water sprays at conveyor transfers
	Construction, Operations, Closure	Minimizing land clearing activities (i.e. waste storage facilities will be cleared progressively through the Project construction and operations phase)
		Construction of the Access Road and site roads with low silt content material
		Low speed limits for all mobile equipment
		Orientation of material stockpiles so that the length is parallel with prevailing winds where practicable

		Revegetate waste rock storage area as early as is practicable
		Construction of wind breaks or stationary misters
		Visual inspection to identify and address potential dust emission
Increase in Ambient Concentrations of Criteria Air Contaminants (TSP, PM_{10}, $PM_{2.5}$, CO, NO_2, SO_2) at receptor	Operations	Use filters, scrubbers and other pollution control devices at processing facilities
	Construction, Operations, Closure	Ensure vehicles and equipment are maintained according to manufacturers' guidelines
		Use catalytic control systems on diesel engines
		Waste reduction at source and recycling
		Waste segregation
		Incinerator operation for optimum combustion
		Regular inspection and maintenance of incinerator

Furthermore, the Proponent has proposed an Air Quality Management Plan that outlines the above dust abatement and emission control measures, as well as contingency measures for air quality. In addition to dry or windy weather conditions, triggers for contingency dust-abatement (or other) measures may include complaints or reduced visibility, and will be based on physical observations and professional judgement. No air quality monitoring has been proposed.

Effects Characterization

THE PROJECT WILL RESULT IN AIR QUALITY STANDARD EXCEEDANCES FOR TSP, PM_{10} AND NO_2

The Proponent undertook air dispersion modelling for the following Criteria Air Contaminants (CACs): SO_2, TSP, CO, $PM_{2.5}$, PM_{10} and NO_x. Estimated emission rates were combined with meteorological and terrain data to produce ambient concentration predictions during the construction, operation and closure phases of the Project. The Proponent selected the camp as

the receptor because the ambient concentrations at camp would be representative of exposure to off-duty workers and serve as a proxy for land users (on-duty workers would be subject to the *Occupational Health and Safety Act* and *Occupational Health and Safety Regulations* requirements).

Potential sources for the contaminants modelled include stationary and mobile sources of air contaminants, and fugitive dust. During the construction and operations stages of the Project, the main contributors to fugitive dust and contaminant emissions include open pit extraction operations (e.g. blasting and drilling), rock crushing, fossil fuel combustion emissions (e.g. generators and vehicle exhaust), vehicle traffic on access and mine-site roads, wind erosion of waste rock stockpiles road maintenance activities (e.g. grading).

Project design activities aimed at reducing fugitive dust were also factored into air dispersion modelling, including: the crusher enclosure, indoor material transfers, covering the coarse ore stockpile, progressive reclamation, and road and exposed surfaces watering. The results of the Proponent's air dispersion modelling are presented in Table 24. Generally, CAC concentrations will increase at the receptor site (camp) overall during construction, operations and closure, and will exceed YAAQS for TSP and PM_{10} during operations for the 24-hour average threshold. Comparison of the Proponent's predicted concentrations with CAAQS also shows an exceedance of the one-hour average NO_2 threshold for 2020 throughout the Project's lifetime.

Table 24: Comparison of Predicted CAC Concentration with Ambient Air Quality Guidelines

CAC	YAAQS	CAAQS 2015	CAAQS 2020	Baseline	Predicted Concentrations		
					Construction	Operations	Closure
SO_2 (pub)							
1 hr avg	172		70		<1	<1	<1
24 hr avg	5			0	<1	<1	<1
Annual mean	11		5	0	<1	<1	<1
TSP (µg/m³)							
24 hr avg	120			7	43	148	8
Annual mean	60			1	2	15	1
CO (ppm)							
1 hr avg	13				<1	<1	<1
8 hr avg	5				<1	<1	<1
24 hr				0			
Annual mean				0			
$PM_{2.5}$ (µg/m³)							
24 hr avg	28	28	27	4	4	6	4
Annual mean	10	10	8.8	1	<1	<1	<1
PM_{10} (µg/m³)							
24 hr avg	50			6	15	67	5
Annual mean				1	1	5	1
NO_2 (ppbv)							
1 hr avg	213		60		161	120	149
24 hr avg	106			0	56	14	56
Annual mean	32		17	0	5	1	2

The Proponent notes that predicted ambient concentrations for TSP and PM_{10} are conservative in that they assume the simultaneous operation of all non-continuous sources, and represent the worst-case meteorological and operational conditions. These short-duration (24 hour) exceedances are expected to occur less than one percent of the time (i.e. three to four days every year).

The Proponent's ambient air quality modelling results for nitrogen oxides (NO_x) are likely not representative of actual predicted results for NO_2. Modelled NO_2 concentrations were measured against YAAQS: "to provide a conservative estimate and to enable comparison with the YAAQS, a 100 percent conversion ratio from NO_x to NO_2 was assumed."[317] The results presented in Table 24 above are for NO_x, of which NO_2 represents only a small fraction. Since no exceedances of YAAQS were found, no further refinement of the NO_x to NO_2 conversion factor was carried out by the Proponent (the Proponent did not compare results to CAAQS, which have a much more restrictive NO_2 threshold for 2020). The Proponent further notes that actual NO_2 concentrations are expected to be well below concentrations predicted for NO_x, and could range from five percent (within one km of the source) to 37 percent (at seven km from the source) of NO_x concentrations.[318] Using this information, 37 percent of the maximum predicted NO_x concentration (i.e. one-hour average for the construction phase, or 161 ppbv) would result in a maximum predicted NO_2 concentration of 59.57 ppbv, which is just below the 2020 CAAQS for NO_2 (60ppbv). Proponent mitigation measures aimed at reducing air contaminants will also likely contribute to further reduction of the predicted value. Given this, the Executive Committee does not believe that the Project will result in exceedances of YAAQS or CAAQS 2020 standards for NO_2.

AIR QUALITY STANDARD EXCEEDANCES ARE LIKELY TO RESULT IN HUMAN RESPIRATORY HEALTH EFFECTS

Off-duty workers and land users may experience adverse impacts to respiratory health when CACs are inhaled. The degree to which respiratory effects are experienced depends on the concentration and type of CAC present, the duration of exposure and any pre-existing respiratory issues of the affected person(s). Health Canada highlights that NO_2, $PM_{2.5}$ and PM_{10} are non-threshold contaminants and are therefore harmful at any concentration.[319] While some individuals may experience adverse respiratory issues at concentrations below established standards, the YAAQS and CAAQS represent the thresholds where CACs will typically affect the health of an average individual.

The Proponent's air quality modelling indicates that short-duration concentrations of TSP and PM_{10} will exceed YAAQSs. Correspondingly, off-duty workers and land users may experience short-term respiratory health issues (such as cough, phlegm, rhinitis, bronchitis and asthma) from contaminant inhalation if they are present within the affected area when exceedances occur. This is considered a likely scenario for off-duty workers occupying camp, and less likely

[317] YOR Document 2017-0083-021-1 pg 6-22.
[318] Ibid.
[319] YOR Document 2017-0083-266-1.

for land users who use the affected areas intermittently and may even avoid the area due to the presence of industrial activity.

While short-term respiratory effects are likely to occur for off-duty workers in particular, the effects will be infrequent. Exceedances in TSP and PM_{10} are predicted to occur less than one percent of the time and likely less frequently given that modelling results were for the worse-case scenario. Any impacts experienced will be temporary and reversible once the exposure level has been reduced.

The Proponent has proposed a suite of mitigation measures and an Air Quality Management Plan, which serve to control and reduce concentrations of CACs, some of which were included in air dispersion modelling. These will also serve to minimize exposure to off-duty workers and other land users.

Significance Determination

EFFECTS ARE LIKELY

The Project is likely to result in short-term impacts to the respiratory health of off-duty workers when ambient concentrations of TSP and PM_{10} exceed YAAQS. There is a lower likelihood that land-based users would be adversely affected since there is low likelihood that their land use activities in the Project area would overlap temporally and spatially with TSP and PM_{10} exceedances, predicted to occur three to four days per year.

EFFECTS ARE ADVERSE

The effects to off-duty workers are adverse. The inhalation of air contaminants which are above air quality standards can have short-term impacts on human respiratory health, such as increased respiratory irritation and cough, and long-term impacts, such as chronic disease.

EFFECTS ARE LIKELY NOT SIGNIFICANT

The Project will likely not result in significant impacts to the respiratory health of off-duty workers. While exceedances of TSP and PM_{10} are likely to result in short-term respiratory effects to workers through contaminant inhalation, exceedances are predicted to occur only one percent of the time (i.e. three to four days per year), and this estimation is based on conservative modelling undertaken by the Proponent. Exposure to contaminants will thus be infrequent and short in duration (e.g. 24 hours). Effects are reversible once contaminant concentrations are reduced.

9.2 Noise

Summary & Conclusion

The EC has determined that the Project will not result in significant adverse impacts to human health resulting from an increase in ambient noise generated by the Project. The Proponent's noise prediction modelling showed that noise levels are not predicted to exceed set standards. Project design elements and mitigation measures proposed by the Proponent will further reduce the significance of any noise-related effects.

Importance of Ambient Noise Conditions

Elevated noise levels have been shown to lead to a variety of health issues, including hearing loss, sleep disturbance, interference with communication and annoyance.[320] In the worst case scenario, reduced concentration and communication from noise can lead to serious workplace accidents and injuries.

During the 10 years of proposed Project operations, mining activities such drilling, blasting, excavating, crushing, loading/unloading and vehicular traffic will occur 24-hours per day for the Project's lifespan. In the Project's remote setting, workers are particularly susceptible to the repeated impacts of noise, specifically the off-duty workers residing at camp due to their proximity to mining operations (on-duty workers will be equipped with appropriate personal protection equipment). This section therefore examines the health effects to workers from the generation of elevated and sustained noise from Project activities.

Legislative & Management Setting

Occupational Health and Safety Act and Regulations

The *Occupational Health and Safety Regulations* (Part 1 – General, Section 1.25) requires that workers wear appropriate hearing protection devices when they are required to work in an area where the noise level cannot be controlled below the permissible values established in the *Occupational Health Regulations*. The *Occupational Health Regulations* (Section 4 – Noise Control) set limits for maximum daily exposure to different noise levels, requires that workers be provided with appropriate hearing protection, requires that signage be posted in areas with elevated noise, and requires that every worker who is exposed to excessive noise be given hearing tests.

Noise Standards

No noise standards have been developed for Yukon. As such, the Proponent referred to the British Columbia Oil and Gas Commission's[321] and the Energy Resource Conservation Board's[322] standards for maximum, permissible daytime and nighttime noise levels, which are 50 dBA during the day and 40 dBA at night.

Health Canada (2017) recommends using the World Health Organization's (WHO) Guidelines for Community Noise (1999) for estimating the likelihood of sleep disturbance on any given night, which is an indoor sound level of no more than 30 dBA L_{eq}[323] for continuous noise during the sleeping period.[324]

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[320] Health Canada. Guidance for Evaluating Human Health Impacts in Environmental Assessment: Noise. Government of Canada. January 2017. http://publications.gc.ca/collections/collection_2017/sc-hc/H129-54-3-2017-eng.pdf

[321] BC Oil and Gas Commission. British Columbia Noise Control Best Practices Guidelines. Version 2.1. December 2018. https://www.bcogc.ca/node/11095

[322] Alberta Energy Regulator. Directive 038: Noise Control. February 16, 2017. https://www.aer.ca/documents/directives/Directive038.pdf

[323] Leq: is the equivalent continuous sound levels in decibels; the total sound energy measured over a period of time.

[324] Health Canada. Guidance for Evaluating Human Health Impacts in Environmental Assessment: Noise. Government of Canada. January 2017. http://publications.gc.ca/collections/collection_2017/sc-hc/H129-54-3-2017-eng.pdf

The Proponent evaluated noise from blasting (as modelled for the site) against the Ontario Ministry of the Environment's (MOE) 1978 guidelines for blasting, Noise Pollution Control (NPC) NPC-119 Blasting, which specifies a cautionary limit of 120 decibels (dB). Environment Canada's *Environmental Code of Practice for Metal Mines* (2009) suggests that mines should design their blasts so that concussion noise of a maximum of 128 dB is not exceeded at or beyond the boundaries of the mine property. These MOE guidelines, while dated, remain relevant, and as recently as 2013 were re-evaluated and continue to be considered appropriate guidelines for blasting.

The EC is satisfied with the standards applied by the Proponent and has used the above standards as thresholds by which to measure the significance of effects on human health, as it relates to noise.

Context

Noise adds energy to the air in the form of acoustic waves.[325] Guidance prepared by Health Canada indicates that noise can cause potential health impacts, such as noise-induced hearing loss, sleep disturbance and/or long-term high annoyance, which can be an indicator of potential health impacts (that is, if the noise is experienced over a long period of time, it could potentially increase the risk of negative health impacts).[326] The impacts of sleep disturbance have been shown to include increased fatigue, irritability and decreased concentration and performance. Other impacts may also exist. Furthermore, ongoing sleep disturbance has been linked to a wide variety of health impacts, including cardiovascular issues, mental health issues and accidents (WHO 2009; Zaharna and Guilleminault 2010).[327] Government of Yukon's Health and Social Services highlights that the loss of concentration associated with disturbed sleep may put workers at greater risk of accident and injury.[328]

The Project involves activities that increase ambient noise levels in the Project area for the duration of the Project, with most noise being generated during operations (expected to last a minimum of 10 years). Sources of noise, during the life of the Project, include (but are not limited to) drilling, blasting, crushing, heavy equipment use, material transfer, generators and fans.

The Proponent identified the camp as the sensitive receptor for its noise prediction modelling scenarios. The camp is located near mine infrastructure and is a minimum of 4 km from blasting locations. The mine will be active 24 hours per day during operations, and thus workers will be sleeping during the day and night in camp. On-duty workers who are exposed to excessive noise are required to wear appropriate hearing protection devices as per the *Occupational Health and Safety Act and Regulations*. Thus, the assessment focusses on potential impacts to off-duty workers from ongoing and elevated noise levels over the life of the Project.

[325] Ibid.
[326] Ibid.
[327] Health Canada. Guidance for Evaluating Human Health Impacts in Environmental Assessment: Noise.
[328] YOR Document 2017-0083-264-1, pg.29

Existing Conditions & Trends

The Project is located in a remote area of Yukon where baseline noise levels are expected to be low and dominated by natural sounds (wind, wildlife and creeks).[329] The Proponent did not collect baseline sound level data for the Project. Instead, the Proponent used the average ambient sound level for rural areas as established by the Energy Resource Conservation Board (ERCB 2007) and the BC Oil and Gas Commission (BC OGC 2007), since no ambient sound levels exist for Yukon. The baseline ambient sound levels are 45 dBA L_{eq} for daytime (07:00 to 22:00) and 35 dBA L_{eq} for nighttime (22:00 to 07:00), according to both BC OGC and the ERCB.

To verify whether these ambient noise levels were appropriate to use as the Project's baseline, the Proponent compared them to measured noise levels from the Casino Mine Project, which is in a remote setting comparable to the KZK Project. Noise monitoring was carried out for the Casino Mine Project in August 2011, and the average ambient sound levels were found to be just below the values of 45 dBA and 35 dBA established by the BC OGC and the ERCB for daytime and nighttime, respectively. The Executive Committee is therefore satisfied that the use of the ERBC and BC OGC recommended values as baseline sound levels for this assessment are appropriate.

Project Design

The following measures have been incorporated into the Project design and/or have been committed to, and will eliminate, reduce or control noise generated by the Project, and subsequently any adverse health effects from noise:

[329] YOR 2017-0083-022-1

Table 25: Proponent mitigation measures for noise

Potential Effect	Project Phase	Proposed Mitigation
Increase in Daytime and Nighttime Noise Level at Camp Receptor	Construction, operations, closure	Noise dampening enclosures for boiler, generators and compressor
	Operations	Crusher, grinding mills, conveyor shielding (in an enclosed building)
	Construction, Operations, Closure	Equipping all vehicles and internal combustion engines with appropriate muffler systems
		Ensuring regular equipment maintenance including lubrication
		Keeping noisy equipment inside buildings or sheds and/or near ground level whenever possible
		Imposing speed limits for all vehicles (30km/hr on internal roads and 50km/hr for mine access roads)
		Maintaining natural cover (vegetation) between noise sources and sensitive receptors (camp)
		Maintaining the Project roads regularly to minimize vehicle noise associated with vibration
Blasting Noise Perceptible at Camp Receptor	Operations	Adhering to the Proponent's Blasting Plan which implements controlled blasting procedures, optimizes blasting operations and minimizes non-productive noise

Effects Characterization

THE PROJECT WILL NOT RESULT IN AN INCREASE IN AMBIENT NOISE LEVELS ABOVE RELEVANT STANDARDS

The Proponent undertook noise prediction modelling to assess the potential noise effects of the Project using applicable ambient noise standards from other jurisdictions. Noise modelling examined the predicted daytime and nighttime noise levels at the sensitive receptor (i.e. camp) throughout the Project's construction, operation and closure phases. Modelling took into account meteorological data, terrain data and sound pressure values from anticipated noise sources. Modelling was undertaken for the worst-case scenario, where all equipment expected to be in operation on an as-needed or non-continuous basis was assumed to operate at the

same time. Modelling also took into account the first two mitigation measures proposed by the Proponent, listed in Table 25 above (i.e. shielding and enclosure). Separate modelling was undertaken for blasting noise predictions, with the worst-case scenario factoring in peak blasting activity occurring during open pit development at ground level (as the pit progresses, the bench walls would act as a sound barrier).

The results of the Proponent's modelling showed that the Project would not exceed BC OGC and ERCB standards at the camp (i.e. 45 dBA and 35 dBA for daytime and nighttime noise, respectively) during any phase of the Project. Furthermore, modelling showed that noise from blasting will be below the limit of 120 dB established by the MOE.

INCREASE IN AMBIENT NOISE LEVELS IS NOT LIKELY TO SIGNIFICANTLY AFFECT HUMAN HEALTH

Modelling results showed that ambient noise levels are not expected to exceed the applicable BC OGC and ERCB guidelines. The Proponent notes that "under the loudest scenarios, daytime and nighttime noise levels differ from baseline by more than 1 dBA over a maximum extent of approximately 4 km in the east-west direction and 8 km in the north-south direction centered on the Project footprint. One dBA is the lower end of the typical threshold for an increase in sound level that is considered to be 'barely perceptible' by the human ear (Health Canada, 2011)."[330] As such, there is a low likelihood that changes in ambient noise level will cause hearing loss, annoyances or interfere with speech comprehension.

To measure the potential for noise to result in sleep disturbance to off-duty workers, the Proponent applied a building attenuation factor to the predicted outdoor noise levels, as recommended by Health Canada's Guidance for Evaluating Human Health Impacts in Environmental Assessment: Noise (2017). The results show that for night shift workers sleeping during the daytime, the maximum indoor noise level would be slightly above the 30 dBA standard recommended by WHO (0.4 dBA and 0.6 dBA for construction and operations phases, respectively). However, the Proponent notes that a 0.4 to 0.6 dBA change in noise level is not perceptible to the human ear. Furthermore, since modelling took into account the worst-case scenario, predicted values are more likely to fall below the 30 dBA standard. As such, noise generated from the Project is not likely to result in sleep disturbance to off-duty workers.

While blasting noise modelling fell below the MOE standard of 120 dB, YG's Health and Social Services notes that sleep disturbances may occur if blasting frequency is greater than 10 to 15 times when camp workers are trying to sleep. In response, the Proponent clarified that blasting would occur on average once every two days and at the end of the day shift, prior to night shift. For underground blasting, which will occur more frequently (up to two times per day), blasting will be scheduled at the end of each shift. The blasting schedule overall will avoid periods when workers are sleeping, and thus has a low likelihood of disturbing the sleep of off-duty workers.

[330] YOR Document 2017-0083-022-1.

Significance Determination

EFFECTS ARE NOT LIKELY

Overall, noise prediction modelling showed changes in ambient noise levels of just over one dBA for all phases of the Project, which is considered barely perceptible to the human ear. No ambient noise standard exceedances were expected. As a result, adverse effects, such as hearing loss, sleep disturbance and interference with speech comprehension, are not anticipated.

EFFECTS ARE ADVERSE

Effects from elevated noise, including disturbance to sleep and interference with speech comprehension, can result in adverse effects to the health of workers, and also potentially result in accidents or injury.

EFFECTS ARE NOT SIGNIFICANT

While the Project will result in a slight increase in noise from Project activities, the predicted increase in ambient noise levels will not exceed applicable standards and are not likely to cause sleep disturbance, hearing loss or annoyance. The Proponent has proposed additional measures which could further reduce any negative impacts.

9.3 Personal Safety

Summary & Conclusion

This section examines effects to personal safety, with respect to violence against women and sexual minorities. Violence against women and sexual minorities is likely to also result in impacts to families and children. By mitigating negative impacts to women and sexual minorities, related effects to families and children may also be addressed.

The Executive Committee has determined that the Project is likely to result in significant adverse effects to personal safety, with respect to workplace harassment and community violence (the term “violence” is inclusive of harassment and all types of abuse) against women and sexual minorities within the Kudz Ze Kayah Project site, and within nearby communities (Ross River, Watson Lake and Whitehorse). These effects can be reduced, controlled or eliminated through the application of the recommended mitigation measures.

This section focuses on two themes:

- Community impacts, focusing on abuse towards women and the impacts to families and community wellbeing; and
- Workplace impacts, focusing on harassment and abuse towards women and sexual minorities (2SLGBTQQIA[331]).

With regards to community impacts, case studies of analogous resource extraction projects have demonstrably linked industrial camps and projects with violence (inclusive of abuse)

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against women.[332] The potential effects are wide-ranging as this violence affects not only the individuals themselves, but also children and communities, sometimes resulting in intergenerational trauma. Case studies also suggest that communities that are geographically close to resource extraction projects are highly vulnerable to violence against women.

Second, with respect to workplace impacts, studies and news articles have shown that women and sexual minorities disproportionally experience workplace harassment, assault, etc.[333] It is important to note that despite a lack of data regarding the impacts of natural resource development on sexual minorities, research shows that this population is particularly vulnerable to abuse, harassment and discrimination in most contexts.[334] Consequently, sexual minorities have been addressed in this section.

The Kudz Ze Kayah Project contains no notable provisions to prevent the pattern of violence against women and sexual minorities which occurs consistently as a result of other resource extraction projects in Canada's north. Given Ross River and Watson Lake's low level of social support, low income, high rates of substance abuse, and low trust in law enforcement,[335] potential Project impacts are likely to be magnified. Moreover, social tolerance for violence against women and sexual minorities is low. Therefore, the expected impacts of a large resource extraction project, combined with the vulnerable nature of affected communities, indicates that effects will likely be significant and adverse.

Definitions for terms used within this section:

2SLGBTQQIA (Referred to in this section as "Sexual Minorities"): Two-Spirit, lesbian, gay, bisexual, transgender, queer, questioning, intersex and asexual.

Abuse: includes physical, domestic, sexual and psychological abuse.

Harassment: "a form of discrimination. It includes any unwanted physical or verbal behaviour that offends or humiliates you. Generally, harassment is a behaviour that persists over time. Serious one-time

[332] Bowes-Lyon, L.-M., Richards, J.P., and McGee, T.M. "Socio-Economic Impacts of the Nanisivik and Polaris Mines, Nunavut, Canada." In Mining, Society, and a Sustainable World, by J. P. Richards, 371-396. London; New York: Springer, 2009;
Gibson, G. and Klinck, J. "Canada's Resilient North: The Impact of Mining on Aboriginal Communities. *Pimatisiwin: A Journal of Aboriginal and Indigenous Community Health 3(1)* (2005): 116-139.
[333] Gibson, G. and Klinck, J. "Canada's Resilient North: The Impact of Mining on Aboriginal Communities.", p. 133; Gibson, G. and Scoble, M. ""Regenderneering" the mining industry: A survey of women's career experiences in mining.";
Tallichet, S.E. "Barriers to Women's Advancement in Underground Coal Mining." *Rural Sociology* 65(2) (2000): 234-252.
[334] Statistics Canada. Government of Canada. "Violent victimization of lesbians, gays and bisexuals in Canada, 2014", Statistics Canada, 2014. https://www150.statcan.gc.ca/n1/pub/85002-x/2018001/article/ 54923-eng.htm.
[335] Hrenchuk, Charlotte. Strong Women's Voices Rural Choices, Report on the Northern Women's Issues Through a Rural Lens Project, p. 14; p.16.

incidents can also sometimes be considered harassment."[336]

Personal Safety: the condition of being safe from physical harm and also psychological harm. It "involves freedom from worry about physical safety as well as being victimized by hostility, aggression, and harassment."[337]

- Vulnerable Populations: Women, sexual minorities (2SLGBTQIA), children and seniors

Importance of Personal Safety

Personal safety focuses on the value and importance of a person's freedom from violence and harassment in all aspects of their life. Sexualized violence, sexism, racism, harassment, and bullying of and against vulnerable populations and all people is unacceptable. Society has demonstrated low tolerance for such behaviour through legislation, such as the Canadian Criminal Code and the Yukon's Human Rights Act. In addition, academic literature has shown a trend of resource extraction projects, similar to this Project, resulting in sexualized violence and abuse towards women.[338] Recently, non-academic organizations, such as the Firelight Group, the Missing and Murdered Indigenous Women and Girls (MMIWG) Inquiry, Amnesty International, MiningWatch Canada, and the National Aboriginal Health Organization (NAHO) have released reports specifically addressing this issue.[339] The MMIWG went as far as to

[336] Canadian Human Rights Commission. Canadian Human Rights Commission. s.d. https://www.chrc-ccdp.gc.ca/eng/content/what-harassment-1.
[337] Thomson Rivers University (TRU). Personal Safety. TRU, 2019. https://www.tru.ca/safety/workinglearningsafely/personal.html
[338] National Inquiry Into Missing and Murdered Indigenous Women and Girls (MMIWG). Reclaiming Power and Place: The Final Report of the National Inquiry into Missing and Murdered Indigenous Women and Girls, Volume 1a. National Inquiry Report, MMIWG, 2019. https://www.mmiwg-ffada.ca/wp-content/uploads/2019/06/Final_Report_Vol_1a-1.pdf, pg. 593;
Bowes-Lyon, L.-M., Richards, J.P., and McGee, T.M. "Socio-Economic Impacts of the Nanisivik and Polaris Mines, Nunavut, Canada."; Gibson, G. and Klinck, J. "Canada's Resilient North: The Impact of Mining on Aboriginal Communities;
Stockwell, A. M. "Capturing Vulnerability: Towards a Method for Assessing, Mitigating, and Monitoring Gendered Violence in Mining Communities in British Columbia.", Master's thesis, University of British Columbia, 2012;
Shandro, J. A., Marcello, M. V., Shoveller, J., Scoble, M., and Koehoorn, M. "Perspectives on community health issues and the mining boom-bust cycle", Resources Policy 36 (2011): 178-186.
[339] National Inquiry into Missing and Murdered Indigenous Women and Girls (MMIWG). Calls for Justice. Inquiry Report, MMIWG Inquiry, 2019. https://www.mmiwg-ffada.ca/wp-content/uploads/2019/06/Calls_for_Justice.pdf;
National Inquiry Into Missing and Murdered Indigenous Women and Girls (MMIWG). Reclaiming Power and Place: The Final Report of the National Inquiry into Missing and Murdered Indigenous Women and Girls, Volume 1a;
National Aboriginal Health Organization (NAHO). Resource Extraction and Aboriginal Communities in Northern Canada, Cultural Considerations. NAHO, 2008. https://www.saintelizabeth.com/getmedia/7efe95d2-e85b-4908-add65dca7bf850bf/Cultural_EN.pdfaspx;
Gibson, G., K. Yung, L. Chisholm, and H. Quinn with Lake Babine Nation and Nak'azdli Whut'en. Indigenous Communities and Industrial Camps: Promoting healthy communities in settings of industrial change. Victoria, B.C.: The Firelight Group, 2017;
Amnesty International. Out of Sight, Out of Mind: Gender, Indigenous Rights, and Energy Development in Northeast British Columbia, Canada. London: Amnesty International, 2016. https://www.amnesty.ca/sites/amnesty/files/Out%20of%20Sight%20Out%20of%20Min%20EN20FINAL%20we b.pdf;

recommend the following: “We call upon all resource-extraction and development industries to consider the safety and security of Indigenous women, girls, and 2SLGBTQQIA people.”[340] Lastly, during this Project's Seeking Views and Information (SV&I) phase, the Executive Committee received comments from the Liard First Nation (LFN)[341] and the Government of Yukon (YG)[342] outlining concerns that women's personal safety will be negatively affected by this Project. LFN stated: "LFN cannot consent to a project that will place Kaska women at further risk of violence and trauma; our community has seen enough of such violence.”[343]

Legislative & Regulatory Setting

YUKON'S HUMAN RIGHTS ACT

The Act specifies that harassment, including sexual harassment, is prohibited in Yukon:

> 14(1) No person shall
> (a) harass any individual or group by reference to a prohibited ground of discrimination;
> (b) retaliate or threaten to retaliate against an individual who objects to the harassment.

14(2) In subsection (1), “harass” means to engage in a course of vexatious conduct or to make a demand or a sexual solicitation or advance that one knows or ought reasonably to know is unwelcome.[344]

YUKON'S OCCUPATIONAL HEALTH AND SAFETY ACT

The Act defines “occupational injury” as “an illness, disease, disablement or physical or **psychological** injury, arising out of and in the course of employment.”[345] It goes on to state that employers are required to ensure a safe workplace in section 3, subsection (1):

> 3(1) Every employer shall ensure, so far as it is reasonably practicable, that
> (a) the workplace, machinery, equipment, and processes under the employer's control are safe and without risks to health; [emphasis added]
> (c) workers are given necessary instruction and training and are adequately supervised, taking into account the nature of the work and the abilities of the workers. [346]

CCGS Associates. *Overburdened: Understanding the Impacts of Mineral Extraction on Women's Health in Mining Communities.* Ottawa: MiningWatch Canada, 2004. https://miningwatch.ca/sites/default/files/Overburdened_ 0.pdf.
[340] APTN News. “Read the national MMIWG's inquiry Calls for Justice here”, APTN National News, June 3, 2019. https://aptnnews.ca/2019/06/03/read-the-national-mmiwg-inquirys-callsfor-justice-here/, pg.13.1.
[341] YOR Documents 2017-0083-3867; 2017-0083-282-1.
[342] YOR Document 2017-0083-264-1.
[343] YOR Document 2017-0083-282-1, pg. 9-10.
[344] Human Rights Act (RSY). C.116, 2002. http://www.yukonhumanrights.ca/documents/YHRA_current.pdf, pg.7.
[345] Occupational Health and Safety Act (RSY). C.159, 2002. http://www.gov.yk.ca/legislation/acts/ochesa_c.pdf, pg. 2.
[346] Ibid. pg 5.

Furthermore, employers must make employees aware of workplace hazards, as stated in section 3, subsection 2:

> 3(2) Without limiting the generality of subsection (1), every employer shall, so far as is reasonably practicable,
>
> (a) ensure that workers are made aware of any hazard in the work […];
>
> (b) cooperate with and assist safety and health representatives and committee members in the performance of their duties;
>
> (c) ensure that workers are informed of their rights, responsibilities, and duties under this Act; and
>
> (d) make reasonable efforts to check the well-being of a worker when the worker is employed under conditions that present a significant hazard of disabling injury, or when the worker might not be able to secure assistance in the event of injury or other misfortune.[347]

FEDERAL CRIMINAL CODE

With regards to personal safety, the *Criminal Code* specifies that the following acts are unlawful: assault,[348] crimes of a sexual nature (e.g. sexual assault),[349] uttering threats,[350] murder,[351] manslaughter,[352] disorderly conduct (i.e. indecent acts including nudity, causing disturbance, indecent exhibition, loitering, etc.),[353] offences against private property (i.e. theft, robbery, extortion, breaking and entering, etc.),[354] and criminal harassment.[355]

YUKON EMPLOYMENT STANDARDS ACT

No provisions exist within this Act regarding harassment prevention within the workplace. The section on “sex discrimination”[356] focuses solely on the right of men and women to equal pay for similar work performed.

[347] Occupational Health and Safety Act (RSY). C.159, pg.5-6.
[348] Criminal Code, R.S., c. C-34, s.1.
[349] Ibid.
[350] Ibid.
[351] Ibid.
[352] Ibid.
[353] Criminal Code, R.S., c. C-34, s.1.
[354] Ibid.
[355] Ibid.
[356] [356] Occupational Health and Safety Act (RSY). C.159, pg. 28-29.

Context

IN COMMUNITIES

Victims of abuse often have great difficulty seeking help and speaking out. Abuse is often unreported, which increases the likelihood of its continuation. For victims in Yukon communities with larger than average amounts of people living with trauma related to colonialism[357] and fewer social services and police resources, the culture of silence and a lack of trust in law enforcement further affect the chances of reporting abuse. Factors, such as substance abuse have also been found to increase or exacerbate abuse.[358] Moreover, case studies have found an increase in substance abuse linked to natural resource development.[359] Furthermore, victims of domestic abuse generally struggle to leave their abuser. Additional barriers exist for women in small, remote communities as they have limited or no opportunities to leave situations of domestic violence.

The proposed mine's workforce, which is likely to be largely male, will potentially increase women's financial dependence on men. Couples with children are unlikely to have both parents working at the mine, which means that the father is most likely to work in the male-dominated industry, therefore controlling the income. This influx of income can lead to increases in substance abuse, which increases the risk of violence. The financial dependence will also make it difficult for the victim of abuse to leave.

In terms of Whitehorse, the increased temporary presence of large numbers of young men without ties to a community may increase chances of violent interactions with vulnerable populations, including sex workers.[360]

[357] Within this section, “trauma related to colonialism” and “colonialism” refer to the following: residential school legacies, effects of displacement and disenfranchisement from the Indian Act[357], and the Sixties Scoop.
[358] CCGS Associates. Overburdened: Understanding the Impacts of Mineral Extraction on Women’s Health in Mining Communities, pg. 32;
Byford, J. One day rich: community perceptions of the impact of the Placer Dome Gold Mine, Misima Island, Papua New Guinea. In: Macdonald I, Rowland C, eds. Tunnel Vision: Women, Mining, and Communities. Victoria, Australia: Oxfam Community Aid Abroad, 2002: 30–35;
Downing, T.E. Avoiding New Poverty: Mining-Induced Displacement and Resettlement. International Institute for Environment and Development and World Business Council for Sustainable Development, 2002. https://pubs.iied.org/pdfs/G00549.pdf;
Simatauw, M. The polarization of people and the state on interests of the political economy and women’s struggle to defend their existence: a critique of mining policy in Indonesia. In: Macdonald I, Rowland C, eds. Tunnel Vision: Women, Mining, and Communities. Victoria, Australia: Oxfam Community Aid Abroad; 2002: 35–40;
World Health Organization (WHO). Violence against women. WHO, 2017. https://www.who.int/news-room/fact-sheets/detail/violence-against-women;
Eckford, C. and Wagg, J. The Peace Project: Gender Based Analysis of Violence against Women and Girls in Fort St. John. Status of Women Canada and Fort St. John Women’s Resource Society, 2014. https://thepeacepro jectfsj.files.wordpress.com/2014/03/the_peace_project_gender_based_analysis_amended.pdf
[359] Bowes-Lyon, L.-M., Richards, J.P., and McGee, T.M. “Socio-Economic Impacts of the Nanisivik and Polaris Mines, Nunavut, Canada.", pg. 384.
[360] Gibson, G. and Klinck, J. "Canada’s Resilient North: The Impact of Mining on Aboriginal Communities.", pg. 124.

AT THE WORKPLACE

Mines create industrial camps that tend to have a unique hyper-masculine and sexist culture that is apathetic towards self-care.[361] These camps are large and male dominant and may foster unhealthy work environments for women, with Indigenous women being particularly vulnerable to negative interactions. Research has shown that women are more likely to face workplace sexism and have limited career advancement within the mining industry.[362]

AT BOTH THE WORKPLACE AND IN COMMUNITIES

Violence against women is persistently a major issue with large-scale natural resource development activities,[363] with First Nations women being particularly vulnerable.[364] Though little data exists regarding sexual minorities, it is assumed that a similar situation exists for this population. Research has shown that rotational schedules (fly-in, fly-out, or FI/FO) disrupt family and community life, adding stressors that may contribute to the initiation or continuation of violence against women.[365]

Within both the workplace and in communities, harassment, abuse, assault and bullying can cause physical and psychological harm with long-term effects. Yukon communities experience a higher level of vulnerability as a result of direct or indirect trauma experienced through residential schools and other colonial legacies, due to its greater population of First Nations compared to other parts of Canada.[366]

Current Conditions and Trends

2016 statistics of reported crime show that Yukon experiences violent crime and criminal traffic offences causing death or bodily harm at three times the national rate. Furthermore, the majority of victims are women (82 percent).**[367]**

[361] Eckford, C. and Wagg, J. The Peace Project: Gender Based Analysis of Violence against Women and Girls in Fort St. John.
[362] Gibson, G. and Klinck, J. "Canada's Resilient North: The Impact of Mining on Aboriginal Communities.", pg. 133; Gibson, G. and Scoble, M. ""Regenderneering" the mining industry: A survey of women's career experiences in mining."; Tallichet, S.E. "Barriers to Women's Advancement in Underground Coal Mining.".
[363] National Inquiry Into Missing and Murdered Indigenous Women and Girls (MMIWG). Reclaiming Power and Place: The Final Report of the National Inquiry into Missing and Murdered Indigenous Women and Girls, Volume 1a.
[364] Eckford, C. and Wagg, J. The Peace Project: Gender Based Analysis of Violence against Women and Girls in Fort St. John.
[365] CCGS Associates. Overburdened: Understanding the Impacts of Mineral Extraction on Women's Health in Mining Communities, pg. 10;
Archibald, L., Crnkovich, M., and Canada, G. If Gender Mattered: A Case Study of Inuit Women, Land Claims and the Voisey's Bay Nickel Project, 1999. http://publications.gc.ca/collections/Collection/SW21-39-1999E.pdf, pg. 13;
Eckford, C. and Wagg, J. The Peace Project: Gender Based Analysis of Violence against Women and Girls in Fort St. John.
[366] National Inquiry Into Missing and Murdered Indigenous Women and Girls (MMIWG). Reclaiming Power and Place: The Final Report of the National Inquiry into Missing and Murdered Indigenous Women and Girls, Volume 1a;
Eckford, C. and Wagg, J. The Peace Project: Gender Based Analysis of Violence against Women and Girls in Fort St. John.
[367] Statistics Canada. Government of Canada. Victims of police reported violent crime in Yukon, 2016. Government of Canada, 2016. https://www150.statcan.gc.ca/n1/pub/85-002-x/2018001/article/54960/s12-eng.htm

ROSS RIVER

The community of Ross River has a population of 290 residents with a median age of 40.5 years.[368] Its population is largely made up of First Nations, accounting for 83 percent of residents,[369] most of which are members of the Ross River Dena Council. Consequently, the community continues to experience the effects of historical colonialism, such as residential schools,[370] displacement and disenfranchisement as a result of the *Indian Act*,[371] and the Sixties Scoop.[372]

Statistics show a high crime rate in Ross River relative to the rest of the territory, with 52 instances of violent crime in 2016.[373] In comparison, Dawson City experienced a similar number of violent crimes, despite having a population of 1 375.[374] In addition, the Project proposal notes a high rate of substance abuse within the community.[375]

In 2004, the Yukon Status of Women Council (YSWC) interviewed women in Ross River in what was the last study conducted on the wellbeing of women in remote Yukon communities. Some respondents stated that they "do not feel safe and protected," and showed a distrust of law enforcement.[376] Furthermore, interviewees requested that new RCMP members receive cross-cultural training specific to Yukon and Ross River Dena,[377] acknowledging the contextual importance of policing in Ross River.

Despite historical colonial impacts, high crime rates and issues of substance abuse, Ross River has few social services within the community. Few resources exist to address substance abuse, with detox programs only available in Whitehorse, a five-hour drive away. Furthermore, with the collapse of the Many Rivers Counselling Services in 2018, there are fewer counselling services in the community, with only one YG mental wellness and substance use counsellor and one YG

[368] Yukon Bureau of Statistics. Government of Yukon. Ross River, Population by Sex and Age Group Census 2016. Government of Yukon, 2016. http://www.sewp.gov.yk.ca/data?regionId=YK.RR&subjectId =POPCOM&groupId=POPCOM.POP&dataId=CENSU_2016_POP_AGE&tab=region
[369] Yukon Bureau of Statistics. Government of Yukon. Ross River, Aboriginal Population Census 2016. Government of Yukon, 2016. http://www.sewp.gov.yk.ca/data?regionId=YK.RR&subjectId=POPCOM&groupId=POPCOM.ABOR&dataIdCENSUS_2016_ABOR_POP&tab=region
[370] National Inquiry Into Missing and Murdered Indigenous Women and Girls (MMIWG). Reclaiming Power and Place: The Final Report of the National Inquiry into Missing and Murdered Indigenous Women and Girls, Volume 1a.
[371] Hrenchuk, Charlotte. Strong Women's Voices Rural Choices, Report on the Northern Women's Issues Through a Rural Lens Project, pg. 14
[372] The "Sixties Scoop" marks a period between the late 1950s and 1990, in which a large-scale amount of Indigenous children were removed from their homes and adopted into predominantly non-Indigenous, middle-class families across Canada and the United States. Source: National Inquiry Into Missing and Murdered Indigenous Women and Girls (MMIWG). Reclaiming Power and Place: The Final Report of the National Inquiry into Missing and Murdered Indigenous Women and Girls, Volume 1a, pg. 280.
[373] Yukon Bureau of Statistics. Government of Yukon. Police-reported Crime Statistics in Yukon 2016. Government of Yukon, 2017. http://www.eco.gov.yk.ca/stats/pdf/crime_2016.pdf
[374] Statistics Canada. Dawson, T [Census subdivision], Yukon and Nova Scotia [Province] (table). Census Profile. 2016 Census. Statistics Canada Catalogue no. 98-316-X2016001. Ottawa. Released November 29, 2017. https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/index.cfm?Lang=E
[375] YOR Document 2017-0083-046-1, pg.15-10.
[376] Hrenchuk, Charlotte. Strong Women's Voices Rural Choices, Report on the Northern Women's Issues Through a Rural Lens Project, p. 14.
[377] Ibid.

child and youth counsellor.[378] Lastly, a Christian safe house has existed since 2004, but no funds exist to offer programs[379] such as a soup kitchen or recreational programs for women, and the Liard Aboriginal Women Society (LAWS) has inconsistent funding.[380]

WATSON LAKE

The community of Watson Lake has a population of 1 100 residents and a median age of 44.1 years.[381] Its population has a large proportion of First Nations, accounting for 54 percent of residents,[382] most of which are members of the Liard First Nation. Similar to Ross River, Watson Lake experiences the effects of historical colonialism, such as residential schools,[383] displacement resulting from the *Indian Act* (Bill C-31),[384] and the Sixties Scoop.

Statistics show a high crime rate relative to the rest of the territory, with 126 instances of violent crime in 2016.[385] For comparison purposes, despite having nearly the same population, Dawson City experienced less than half as many instances of violent crime.[386] Research by Hrenchuk (2004)[387] found that women in Watson Lake reported that young women were being preyed upon by older, violent and abusive men.[388] They added that there was a high rate of substance abuse in the community.[389]

Similar to Ross River, female residents of Watson Lake have previously outlined a distrust of law enforcement, stating in Hrenchuk's 2004 study that women "feel insecure with the RCMP and do not feel comfortable calling [police] in instances of family violence,"[390] and that First Nations women feel that they are treated differently by police.[391] Interviewees also discussed the lack of transportation options, which results in a reliance on hitchhiking.

[378] Department of Health and Social Services. Government of Yukon. Mental Wellness and Substance Use Services across Yukon. 2019. http://www.hss.gov.yk.ca/mwsu_communities.php
[379] Ibid.
[380] LAWS provides services to both Ross River and Watson Lake.
[381] Yukon Bureau of Statistics, Government of Yukon. Whitehorse (City of), Population by Sex and Age Group Census 2016. Government of Yukon, 2016. http://www.sewp.gov.yk.ca/data?regionId=YK.WH&subjectId=POPCOM&groupId=POPCOM.POP&dataId=CENSUS_2016_POP_AGE&tab=region
[382] Yukon Bureau of Statistics. Government of Yukon. Watson Lake, Aboriginal Population Census 2016. Government of Yukon. 2016. http://www.sewp.gov.yk.ca/data?regionId=YK.WLR&subjectId=POPCOM&groupId=POPCOM.ABOR&dataId=CENSUS_2016_ABO_POP&tab=region
[383] National Inquiry Into Missing and Murdered Indigenous Women and Girls (MMIWG). Reclaiming Power and Place: The Final Report of the National Inquiry into Missing and Murdered Indigenous Women and Girls, Volume 1a.
[384] Hrenchuk, Charlotte. Strong Women's Voices Rural Choices, Report on the Northern Women's Issues Through a Rural Lens Project, pg. 14.
[385] Yukon Bureau of Statistics. Government of Yukon. Police-reported Crime Statistics in Yukon 2016. Government of Yukon, 2017. http://www.eco.gov.yk.ca/stats/pdf/crime_2016.pdf
[386] Statistics Canada. Dawson, T [Census subdivision], Yukon and Nova Scotia [Province] (table).
[387] It is important to note that this section relies heavily on a 15 year old study. Though it may be dated, no substantial changes have taken place within Ross River nor Watson Lake that would alter the validity of the findings within this study.
[388] Hrenchuk, Charlotte. Strong Women's Voices Rural Choices, Report on the Northern Women's Issues Through a Rural Lens Project, pg. 16.
[389] Ibid.
[390] Ibid.
[391] Ibid.

As with Ross River, the community of Watson Lake also has few social services despite high crime rates, historical colonial legacies, and substance abuse issues. A finite amount and variety of resources are available, with detox services only available in Whitehorse, and fewer counselling services due to the closure of the Yukon Government funded Many Rivers Counselling Service, leaving the community with two mental wellness and substance use counsellors, one clinical counsellor, one mental health nurse, and one child and youth counsellor.[392] Along with services provided by LAWS, Help and Hope for Families offers transition home services and shelter.[393]

WHITEHORSE

As of 2016, the City of Whitehorse has a population of 25 085 residents and a median age of 37.4 years.[394] Its population is highly varied with the largest immigrant population in Yukon. First Nations make up a smaller portion of the population with 18 percent of people self-identifying as First Nations in the 2016 Census.[395] Unlike Ross River and Watson Lake, which both have populations largely made up of one First Nation, the urban centre of Whitehorse has a variety of First Nations, as many move to Whitehorse from other Yukon communities. Though historical colonial factors[396] are still present, the overall impacts are reduced due to the larger, heterogeneous nature of the city and the variety of social services.

As the largest community in Yukon, Whitehorse has the greatest amount of services available and acts as a hub to other communities. The city has a larger police presence, with larger numbers of resources available than in smaller Yukon communities. There are many public transit options and affordable flights to outside destinations. Though substance abuse exists, it is not as prevalent or concentrated as in Ross River and Watson Lake. Furthermore, Whitehorse has many social services, such as Victoria Faulkner Women's Centre,[397] Center of Hope Shelter, the Whitehorse Emergency Shelter, Betty's Haven Second Stage Housing,[398] Kaushee's Place Women's Shelter,[399] Skookum Jim Friendship Centre,[400] Yukon Legal Services Society,[401] and more accessible mental health and counselling services.

[392] Department of Health and Social Services. Government of Yukon. Mental Wellness and Substance Use Services across Yukon. 2019. http://www.hss.gov.yk.ca/mwsu_communities.php
[393] Help and Hope for Families Society (HHFS). Help and Hope for Families Society.
[394] Yukon Bureau of Statistics. Government of Yukon. Ross River, Aboriginal Population Census 2016. Government of Yukon, 2016. http://www.sewp.gov.yk.ca/data?regionId=YK.RR&subjectId=POPCOM&groupId=POPCOM.ABOR&dataIdCENSUS_2016_ABOR_POP&tab=region
[395] Yukon Bureau of Statistics. Government of Yukon. Ross River, Aboriginal Population Census 2016.
[396] National Inquiry Into Missing and Murdered Indigenous Women and Girls (MMIWG). Reclaiming Power and Place: The Final Report of the National Inquiry into Missing and Murdered Indigenous Women and Girls, Volume 1a
[397] Victoria Faulkner Women's Centre (VFWS). The Victoria Faulkner Women's Centre. VFWS, 2019. http://www.vfwomenscentre.com/
[398] Kobayashi + zedda (KZ). Betty's Haven Second Stage Housing. Kobayashi + Zedda, 2019. https://kza.yk.ca/projects/bettys-haven-second-stage-housing/
[399] Women's Transition Home (WTH). Emergency Shelter. WTH, n.d. https://www.womenstransitionhome.ca/kaushees-place/
[400] Skookum Jim Friendship Centre (SJFC). Skookum Jim Friendship Centre. SJFC, n.d.. https://skookumjim.com/
[401] Yukon Legal Services Society (YLSS). Yukon Legal Services Society. YLSS, 2019. https://legalaid.yk.ca/

Whitehorse has the largest homeless population in the territory. As a hub, there is a documented sex work industry within the capital.[402] The city's transience also creates a sense of anonymity, with many residents lacking community ties (partially due to mineral development activities and construction projects). Whitehorse acts as a transfer point for FI/FO workers.

Project Design

The Project would establish a large, mainly male worker camp located 160 km from the community of Ross River. It proposes to build a worker camp for 80 to 350 people over 15 years (this includes the construction, operations and active closure phases).[403] During construction, the Proponent estimates their staff will be made up of 10 to 30 people (mostly men) from Ross River, 35 to 55 people from Watson Lake, and 200 to 250 people from Whitehorse, with the rest coming from outside the territory.[404] It is not clear the proportion of workers who will be male or female. However, similar mining projects suggest it will be a male-dominated workforce. The Proponent has not proposed any hiring approach to change this outcome.

The Project operates on a FI/FO rotational model, whereby employees work two weeks on with one week off. Employees have a maximum of four weeks of annual holiday available after the first year of employment.[405] Employees will be transported from Whitehorse by chartered plane to the Finlayson Airstrip (approximately 255 km away from Whitehorse) and by bus from Watson Lake (235 km) and Ross River (135 km). Many workers will be third party workers (truckers, caterers, contractors, etc.), and may be subject to different disciplinary and harassment policies.

PROPOSED PROPONENT MITIGATIONS

The Proponent proposes:

- A dry camp, with no use of drugs or alcohol onsite. Drug testing of all new employees and random testing thereafter will exist.[406]
- An "Extensive screening of employees before hire to gauge their suitability for shift work and to help educate them on its potential effects;"[407]
- The provision of education and assistance through an Employee Assistance Program, available to all employees and their families as required.[408] Examples of counselling services include:
    - Drug and alcohol counselling (including time off for employees who need treatment);
    - Marriage counselling
- A mentor program for First Nations employees, to be expanded into a more general support program for all site personnel. The program will be a personnel management

[402] Yukon Status of Women Council (YSWC). Our Publications. YSWC, 2019. https://www.yukonstatusofwomen.org/index.php/publications
[403] YOR Document 2017-0083-012-1, pg. 4-4; 4-7; and 4-129.
[404] YOR Document 2017-0083-046-1
[405] Ibid.
[406] YOR Document 2017-0083-046-1.
[407] YOR Document 2017-0083-046-1.
[408] Ibid.

feedback loop as the Mentor is often the first point of contact for local personnel experiencing difficulties at work or at home. Mentors can propose mitigation measures.[409]

Effects Characterization

IN WHITEHORSE, ROSS RIVER AND WATSON LAKE

Based on case studies of analogous projects,[410] the EC reasonably predicts an increased likelihood of violence towards vulnerable populations, specifically women (especially First Nations women) and sexual minorities. Furthermore, the Project shares similarities with other case studies, such as an increase of an employee's average income, which can lead to negative impacts. The Proponent assumes an average income of $82 730 per year for each employee,[411] which would be a large increase from the 2015 median one-person household incomes[412] in Ross River ($21 867/year), Watson Lake ($39 552/year) and Whitehorse ($47 019/year). Consequently, due to findings from analogous studies,[413] the EC foresees an increase in violent crimes.[414]

IN ROSS RIVER AND WATSON LAKE

The EC predicts that the sudden increase in income for employees from Ross River and Watson Lake, coupled with previous legacies and current social issues, may lead to or exacerbate substance abuse, income disparities within communities and households, and cause financial stress. It is also anticipated that FI/FO rotational work will lead to or exacerbate substance abuse, social disconnection (especially difficult for families, with one parent away for large amounts of time), cultural alienation and/or mental health issues. This predicted increase and/or instigation in/of substance abuse, income disparities, social disconnection and current social issues and historical legacies is likely to increase domestic abuse, most likely affecting women and children.[415]

With regards to domestic abuse, it is reasonable to predict an increase in financial dependency of women on men (especially in Ross River and Watson Lake where unemployment levels are high), as mine workforces are predominantly male and women with children are less likely to gain or maintain employment when their spouse works a FI/FO rotational shift, as childcare would be required. This dependency is likely to decrease a victims' ability to leave abusive relationships, which increases the likelihood of longer-term household violence. Domestic abuse

[409] YOR Document 2017-0083-200-1
[410] Bowes-Lyon, L.-M., Richards, J.P., and McGee, T.M. "Socio-Economic Impacts of the Nanisivik and Polaris Mines, Nunavut, Canada."; and Gibson, G. and Klinck, J. "Canada's Resilient North: The Impact of Mining on Aboriginal Communities.".
[411] YOR Document 2017-0083-046-1.
[412] Yukon Bureau of Statistics (YBS), Government of Yukon. Income Census 2016. YBS, 2016. http://www.eco.gov.yk.ca/stats/pdf/Income.pdf
[413] Bowes-Lyon, L.-M., Richards, J.P., and McGee, T.M. "Socio-Economic Impacts of the Nanisivik and Polaris Mines, Nunavut, Canada.";
Gibson, G. and Klinck, J. "Canada's Resilient North: The Impact of Mining on Aboriginal Communities.".
[414] "Violent Criminal Code Violations" include: homicide, attempted murder, sexual assault, assault, robbery, forcible confinement or kidnapping, abduction, extortion, criminal harassment, uttering threats, threatening or harassing phone calls, etc.
[415] Gibson, G. and Klinck, J. "Canada's Resilient North: The Impact of Mining on Aboriginal Communities.", p. 131.

has physical and emotional impacts on spouses and their children, while also emotionally affecting extended family and negatively impacting community dynamics. These impacts are difficult to halt or reverse due to limited social services and historical legacies within communities, as well as the remoteness and small population size. The impacts of violence are persistent after they have taken place, and may lead to intergenerational trauma and increased risk of violence in the future (low reversibility and longer duration than the mine's life). The limited social services in Ross River and Watson Lake exacerbate these problems.

IN WHITEHORSE

Due to findings from analogous studies,[416] the EC predicts a likely increase in violent crime within Whitehorse. This increase in crime occurs along with an increase in the solicitation of sex work, which has been shown to exist in Whitehorse.[417] These sex workers are particularly vulnerable to assault and murder and are less likely to reach out to police due to the nature of their work. They are often vulnerable women who have experienced childhood trauma who become sex workers out of necessity. Though Whitehorse has greater access to social supports than Ross River and Watson Lake, and therefore more societal resilience, this still remains a high magnitude effect.

AT THE WORKPLACE

The Project is likely to have a predominantly male work force, which easily breeds a toxic male culture within the camp.[418] Considering case studies of analogous projects, there is a high likelihood of sexual harassment and abuse against women and sexual minorities. Moreover, due to insufficient mitigations proposed by the Proponent, such as a high-level Employment & Anti-Discrimination Policy which states that "Managers and staff at every level of the organisation shall ensure they and the people around them do not engage in discriminatory behaviour",[419] it is likely that these negative effects will occur and persist. In addition, the Personnel Management Policy[420] and the Fitness for Work Policy[421] are both high-level, stating general visions without providing processes or tangible actions. Within the workplace, the magnitude of effects is likely to be less than in communities (less violent), though low reversibility impacts and long-term emotional impacts would still result. The effects are likely to occur over the mine's lifespan, and are likely to continue post-closure.

[416] Bowes-Lyon, L.-M., Richards, J.P., and McGee, T.M. "Socio-Economic Impacts of the Nanisivik and Polaris Mines, Nunavut, Canada.";
Gibson, G. and Klinck, J. "Canada's Resilient North: The Impact of Mining on Aboriginal Communities.".
[417] Hrenchuk, Charlotte. Not Your Fantasy 101. Yukon Status of Women Council, 2018.
[418] Vella, H. "#MeTooMining: tackling sexual misconduct in the mining industry." *Mining Technology,* April 30, 2018. https://www.mining-technology.com/features/metoomining-tackling-sexual-misconduct-mining-industry/
[419] YOR Document 2017-0083-056-1
[420] YOR Document 2017-0083-0060-1
[421] YOR Document 2017-0083-058-1

Significance Determination

IN COMMUNITIES

EFFECTS ARE LIKELY

Case studies in similar recent northern, remote contexts, have demonstrated that natural resource extractive operations lead to negative impacts to women,[422] and in particular Indigenous women.[423] Specific impacts include an increase in sexual assault, increases in domestic violence, and other forms of abuse. Based on the insufficient mitigations put forward by the Proponent in the Project proposal (see above for a description of the policies and their deficiencies), it is likely that negative impacts will occur.

EFFECTS ARE ADVERSE

Domestic violence, sexual assault, and other forms of abuse often lead to negative impacts, such as anxiety, PTSD, substance abuse, major depression, panic disorder, physical injury, etc.[424] These impacts affect women, children, and broader family networks. The effects are generally long-term (sometimes lasting multiple generations) and can be irreversible.

EFFECTS ARE SIGNIFICANT

The EC has determined that the Project's effects are significant within communities because they occur in communities with social issues and high current levels of violence, which is likely to lead to additional violence against women and sexual minorities. Given low social tolerance for sexual crimes and violence against women and sexual minorities, this predicted increase in violence is significant, especially considering existing conditions. This determination is supported by a large body of research which suggests the likelihood of effects is high and that impacts to individuals are negative, long-term and often irreversible.[425] These long-term effects to individuals are likely to weaken communities, culture, and social connections, while creating conditions that are conducive to future violence. LFN's comment submission singling out women's personal safety as one of their key concerns adds to the significance of this VESEC.

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[422] Bowes-Lyon, L.-M., Richards, J.P., and McGee, T.M. "Socio-Economic Impacts of the Nanisivik and Polaris Mines, Nunavut, Canada."; and Gibson, G. and Klinck, J. "Canada's Resilient North: The Impact of Mining on Aboriginal Communities.".

[423] National Inquiry Into Missing and Murdered Indigenous Women and Girls (MMIWG). Reclaiming Power and Place: The Final Report of the National Inquiry into Missing and Murdered Indigenous Women and Girls, Volume 1a; Gibson, G., K. Yung, L. Chisholm, and H. Quinn with Lake Babine Nation and Nak'azdli Whut'en. Indigenous Communities and Industrial Camps: Promoting healthy communities in settings of industrial change; Stockwell, A. M. "Capturing Vulnerability: Towards a Method for Assessing, Mitigating, and Monitoring Gendered Violence in Mining Communities in British Columbia.".

[424] World Health Organization (WHO). Violence against women; Public Health Agency of Canada. The Chief Public Health Officer's Report on the State of Public Health in Canada 2016: A Focus on Family Violence in Canada. Government of Canada. October 2016. https://www.canada.ca/content/dam/canada/public-health/migration/publications/department-ministere/state-public-health-family-violence-2016-etat-sante-publique-violence-familiale/alt/pdf-eng.pdf; and Wathen, N. Health Impacts of Violent Victimization on Women and their Children. Research and Statistics Division, Department of Justice Canada, 2012. https://www.justice.gc.ca/eng/rp-pr/cj-jp/fv-vf/rr12_12/rr12_12.pdf

[425] Public Health Agency of Canada. The Chief Public Health Officer's Report on the State of Public Health in Canada 2016: A Focus on Family Violence in Canada; and Wathen, N. Health Impacts of Violent Victimization on Women and their Children.

AT THE WORKPLACE

EFFECTS ARE LIKELY

Academic studies, news articles and reports show 50 years of history of women being the targets of harassment, assault and inappropriate advances within the mining workplace.[426] Based on the lack of targeted, tangible mitigations (as described in the Effects Characterization – At the Workplace subsection above) put forward by the Proponent in the Project proposal, it is likely that negative impacts will occur.

EFFECTS ARE ADVERSE

Workplace bullying, sexual assault, harassment, inappropriate and unhealthy workplace behaviours have long-term negative impacts. Sexual violence can have psychological, emotional and physical effects which can negatively impact a person's future. Impacts within the workplace may lead to women quitting and/or altering career paths and may reduce the number of women working in the mining sector.[427]

EFFECTS ARE SIGNIFICANT

The EC has determined that the Project's effects are significant at the workplace because the effects of sexualized violence or harassment on individuals can be lifelong, and for some victims, irreversible without suitable counselling and supports. In addition, there are no substantial mitigations in place which will help this Project reduce workplace sexual violence and harassment. These effects also leave women with negative work experiences, which are then shared with others, disincentivizing other women from working in mining. This consequently results in the reduction in the number of women who work in mining in the short- and long-term.

Recommended Mitigations

At the Workplace

11) The Proponent shall develop mandatory, regular harassment prevention training in consultation with a qualified expert, to be delivered to all the Proponent's employees, contractors and consultants working at the site.

The Executive Committee suggests that the training program include training specific to employees in a supervisory role, teaching preventative approaches and providing tools to address issues that may arise. In addition, the Executive Committee suggests that all employees be educated on the appropriate policies and be empowered with tools to address any harassment or abusive behaviours which may take place around them or towards them. As

[426] Gibson, G. and Klinck, J. "Canada's Resilient North: The Impact of Mining on Aboriginal Communities.", pg. 133; Gibson, G. and Scoble, M. ""Regenderneering" the mining industry: A survey of women's career experiences in mining."; Tallichet, S.E. "Barriers to Women's Advancement in Underground Coal Mining.".
[427] Gibson, G. and Klinck, J. "Canada's Resilient North: The Impact of Mining on Aboriginal Communities.", pg. 133; Gibson, G. and Scoble, M. ""Regenderneering" the mining industry: A survey of women's career experiences in mining.";
Tallichet, S.E. "Barriers to Women's Advancement in Underground Coal Mining.".

First Nations women are more likely than others to experience negative effects within the workplace and outside of the workplace with respect to personal safety, it is important that supervisory training pay special attention to this.

12) Proponent shall modify their proposed Mentor program for First Nations employees[428] to:

    - ensure that women have access to a mentor or supervisor who regularly checks in to address any negative experiences related to the male-dominated work environment, and who pays special attention to potential cases of abuse; and
    - develop a formal feedback process to ensure that enquiries are regularly made to First Nations employees to ensure that they are able to voice concerns and have addressed any negative experiences.

13) The Proponent shall, in consultation with a qualified expert and both LFN and RRDC, develop gender appropriate and gender- and sexuality-specific policies and processes which promote a safe, respectful and inclusive environment for women and sexual minorities.
14) The Proponent shall develop, with a qualified expert, an Anti-Harassment and Bullying Policy that outlines processes and actions to address any harassment or bullying which may take place within the Project's scope.

15) The Proponent shall work with RRDC, the community of Ross River, LFN, the Town of Watson Lake, and the Government of Yukon to provide resources to women in need in communities impacted by the Project.

Both at the Workplace and in Communities

16) To address and mitigate impacts to employees who are or become victims of domestic abuse, the Proponent must create a policy that:

    - outlines clear procedures for the workplace to work with affected employees and provide appropriate resources and support;
    - plans for and addresses safety concerns that affected employees may have while at work to ensure all workers are safe from threats of domestic violence; and
    - includes a personal safety plan for employees suffering from domestic violence.

To aid in the development of this policy, see: www.worksafebc.com/domesticviolence.

Other

The Executive Committee recognizes the Proponent's limitations with respect to its ability to adequately mitigate the Project's social impacts to communities. However, Government of

[428] YOR Document 2017-0083-200-1.

Yukon plays an integral role in developing and adding to a community's resilience as the provider of social services and supports. Consequently, to effectively mitigate and control negative social impacts of the Project, the Executive Committee strongly suggests that YG allocate additional resources in the following areas within Ross River and Watson Lake: childcare, rehab/detox services, counselling services, shelters for victims of abuse, medical services, etc.

9.4 Project Engineering and Infrastructure

Summary & Conclusion

The Executive Committee has determined that the Project will not result in significant adverse effects to human heath and safety due to project engineering and infrastructure. The term of "project engineering and infrastructure" refers to project design in relation to human safety and geohazards.

While there is always some amount of risk associated with an open pit, underground mine, storage of tailings and waste rock, construction of water impoundments and diversion channels, the adverse effects of the Project will be controlled by contemporary engineering design of infrastructure, engineered mitigations, adaptive management during operations, and instrumentation and monitoring committed to by the Proponent. Additionally, there will be the application of regulatory safety legislation by way of inspections and enforcement.

While a determination of significance is possible with available information, to reduce the uncertainty of project effects, the Executive Committee will be pursuing additional information to inform the drafting of a final screening report. This additional information may change the conclusions presented in this section.

Importance of Effects of the Project Engineering and Infrastructure on Worker Safety and the Environment

Health and safety and protection of the environment are primary guiding principles of all levels of government and are key priorities for citizens. There is an expectation that mining companies work continually to improve their health and safety practices and to minimize their impacts on the environment from design through operations to closure. Accidents, injuries, fatalities, disease, and releases to the environment are considered unacceptable by government, the public and industry.

Legislative & Management Setting

The *Occupational Health and Safety Regulations* (Part 15 – Surface and Underground Mines or Projects) requires:

- That drawings, plans, specifications and other information required for an engineering review be provided to the director prior to mining, alterations to mining methods, construction of tailings dams, construction of a mine or mining plant, etc. (Section 15.03);
- A design report shall be prepared and maintained assessing ground stability of active and proposed workings, include engineered drawings and plans, based on

geotechnical engineering practices that assess geology and stability and specify measures and designs. The report must be updated and assessed at least annually and before alterations are made which could affect stability (Section 15.06);

- Tailings Dams and stacked tailings must be designed in good engineering practice, constructed in accordance with the engineer's design, and maintained so that the structure is stable against static and dynamic loading such as earthquakes (Section 15.07);
- Excavation of soils have specifications for heights and slopes and worker access to ensure safety (Sections 15.39 and 15.40);
- Open pit benches and faces have safety and access and requirements (Section 15.41);
- Mine haul roads require specified widths, safety berms and runaway lanes (Section 15.43);
- Dump areas and dumping have specifications and dumping procedures to promote worker safety (Section 15.44 and 15.45);
- Underground mining is also regulated in regards to managing water, drilling of holes, support of the rock (i.e. steel support, casing, lining, rock bolts, etc.), inspections by competent persons, suppressing dust, etc. (Section 15.48);
- Sections 15.53 through 15.63 prescribe procedures and specifications for haulage underground and operation of equipment and vehicles, managing fuel, providing safety stations, etc.

The Proponent will need to comply with Yukon Minerals' Branch requirements ordered by their inspectors and officers, the Yukon OHS Regulations as described above, and mining associations' and Canadian Dam Association's guidelines and best practices.

Context

The operation of an open pit and underground mine is a significant undertaking that involves the construction of large excavations and stockpiles of earth materials along with impoundment of water and management of watercourses. These facilities and infrastructure can pose a risk to human health and safety for workers and to the receiving environment. Clearly, any substantive failures arising from design, operation or closure can adversely impact the safety and health of site workers, visitors, and nearby members of the public as well as result in releases that damage the environment.

Mining projects in Yukon have resulted in accidents that have injured or killed workers. The sector has a reputation for being relatively hazardous, owing to the large scale of equipment, slopes, material volumes and environmental working conditions. Open pit and underground mining accidents, failures of embankments and impoundments, and vehicle crashes are examples of incidents. Some incidents are caused by design flaws or by operational problems or by human error.

Mining requires clearing of vegetation and soils; it can affect permafrost regimes, typically with degradation of permafrost which may or may not already be occurring at a site. Thawing of

permafrost weakens its host soil or bedrock which could affect its ability to resist loading by rock and soil if not accounted for in design or removed from a foundation.

Stockpiles of tailings and waste rock and soil, dams holding back fluids and tailings, and water diversion channels have failed due to construction practices or design flaws or environmental loads such as extreme weather events. Frequently, a combination of these factors contribute to failures. These events can result in coverage of the landscape, water bodies, even roads and buildings by flows and landslides carrying mining waste and natural soils and rock. The consequences include injuries and mortality to humans, wildlife and plants along with damage to water quality and availability.

Regulatory agencies, professional practice associations, industry associations and other organizations have implemented legislation, regulations, operating procedures and guidelines for most aspects of designing, building, operating, monitoring and closing mine sites. Numerous studies and research have contributed to understanding the causation and consequences of past incidents, and to analyze the issues, impacts and mitigation strategies for managing the risks of mining. Yukon Territory is a more advanced jurisdiction for regulation and oversight of mining where a high standard of care is required for engineering, operation, monitoring and continual improvement.

Existing Conditions and Trends

The Project area has not yet been developed into a mine site and has been largely undisturbed with the exception of exploration and development activities. There is some discontinuous permafrost within the Project footprint, along with forests, tundra and water bodies. Some of the terrain is presently subject to geohazards such as slope deformation, both in permafrost and thawed conditions.

Discontinuous, localized permafrost was encountered in the Project area. It was generally observed to be degrading due to past and current climate change patterns. The location of the Project is at a relatively southern latitude, far south of the zone of continuous permafrost. Very little, if any, permafrost was identified by the Proponent within the majority of the areal footprints of the proposed rock and soil storage facilities and the open pit. Evidence of thawing and degrading permafrost was observed during terrain hazard and terrain/soil baseline mapping assessments.

This encountered permafrost was generally observed to be in a state of thaw and degradation. Very little, if any, permafrost was identified within the footprints of the proposed rock and soil storage facilities. Thawing permafrost results in a moisture-rich soil or rock having lower strength. This condition results in slope instability in some natural slopes, and a common type of permafrost-related slope movement is known as solifluction, where ice-rich terrain (both in stable and thawing permafrost) moves slowly downslope at rates of a few millimeters to centimeters per year. The Proponent noted that solifluction is widespread and active on the valley sides and in the upper basins above the proposed mine site.

Recent debris floods have impacted an active alluvial fan at Fault Creek in the proposed open pit location.

The Proponent and predecessor mining companies have completed Pre-Feasibility Studies and subsurface soil and rock investigations as part of mineral exploration and preliminary design of open pit and underground mining. The characteristics of the bedrock and surficial geology are partially understood.

Project Design

Geohazard, terrain, earthquake and failure issues are expected to be managed through the engineering design work completed to date along with planned future detailed design which will be used to develop increasingly comprehensive operation and mitigation plans. Mitigations have been proposed such as engineering design for increased safety factors, monitoring during construction and operations, and adaptive management during operations.

PROPOSED MINE FACILITIES AND UNDERTAKINGS

The Project plan includes construction of storage facilities for waste rock and dried tailings and overburden and salvaged topsoil. There will be an open pit, potential future underground mine, water management ponds and channels, and other mine infrastructure such as buildings, paste backfill plant, landfill and staging areas. There will be a Class A Storage Facility for waste rock having higher acid generating potential which will be encapsulated within filtered tailings; Class B waste with mild acid generating potential will be stored in a separate pile; Class C material that has none to low acid generating potential will be stored in its own stockpile.

The Proponent included statements in the application documents about ongoing and supplementary investigations to be undertaken to refine geotechnical and engineering designs to the waste storage facilities and the open pit and underground mining, including continuing investigations of the foundation soil conditions for the Class A and B storage facilities.

CLASS A STORAGE FACILITY

The Class A Storage Facility is underlain by localized glaciolacustrine (lake-bed) clay deposits; no permafrost was observed in test pits or thermistor instruments. Glaciolacustrine sediments can be sensitive to changes in applied stress.

- The Proponent plans to remove all soils overlying bedrock to mitigate potential slope instability related to foundation soils.
- Overall slope angle of the pile's face is 25%.
- As well, a rock fill supporting toe buttress is proposed at the downslope limit of the storage facility to improve its stability and the interface of the Class A facility with the underlying bedrock incorporates a drainage bedding layer to reduce the chance of water build-up in the foundation and in the Class A material
- The Class A material will be compacted as it is placed to increase its strength.

CLASS B STORAGE FACILITY

The Class B Storage Facility is proposed in an area originally thought to be underlain by some permafrost; however, recent drilling did not encounter permafrost. Permafrost presence or absence is not yet verified in the upper zones of the proposed footprint of this fill storage area. Localized glaciolacustrine sediments are expected to exist.

- A design face angle of 33 % has been proposed.
- The Proponent plans additional permafrost exploration and mapping.
- The Proponent plans to remove the overburden down to bedrock.

CLASS C STORAGE FACILITY

This facility is proposed in an area underlain by glaciofluvial (river deposits) and colluvium. Permafrost was encountered in the northern area of the footprint, below a depth of 3 m. The depth to bedrock ranged from 3 m in the south portion to 19 m in the north portion.

- A design face angle of 33 % has been proposed.
- The facility is to be located in a confined valley with a shallow basing grade.

OVERBURDEN STOCKPILES AREA

It was determined that this area is underlain by glaciofluvial sediments containing permafrost at least 1 to 2 m deep and the depth to bedrock was typically 3 to 5 m with groundwater levels 10 to 19 m deep.

- A design face angle of 45 % has been proposed.

A, B AND C STORAGE FACILITIES AND OVERBURDEN STOCKPILE

Stability modeling was performed using industry standard software; the results indicated adequate Factors of Safety against failure in both the static situation and the scenario involving a severe design earthquake with a 1:2,475 year annual exceedance probability.

The Class B and C and overburden stockpiles would be founded on coarse grained sand and gravel soils which would compress at the same rate approximately as permafrost thaw would occur and retain most of their strength through the process.

OPEN PIT

The Proponent assumed a minimum design bench width of 5 m. No advanced numerical analysis has been performed to evaluate the adequacy of the bench width or pit slope. The Proponent indicated that since the project is in Pre-Feasibility Study (PFS) level, such analysis may not yet be required and will be done at the Feasibility Study level. In a feasibility study, it is anticipated that the Proponent would likely use the laboratory test results presented in its current submission and update its slope stability evaluation. Therefore, final bench configurations may be slightly different than proposed.

PROPOSED PROPONENT MITIGATIONS

FAULT CREEK DEBRIS FLOOD

The Proponent plans to mitigate the risk of a worsening debris flood by constructing a diversion of Fault Creek and a deflection berm to protect the open pit and a local road.

SLUMPING

A berm has been proposed to for construction between the rim of the open pit and the excavation limits of overburden soils, to prevent soft and wet slumping soils from entering the pit.

UNDERGROUND MINING

Underground mining plans have been designed on a preliminary basis using a relatively limited amount of subsurface information at this time. However, a number of commitments such as the use of remote controlled mucking help provide a bounds to project effects. Preliminary opening widths and heights and lengths have been proposed for stopes. The Proponent is planning to support the rock underground using techniques such as rock bolting and shotcrete. As well, paste backfill (cemented tailings returned underground from surface) is proposed to be placed in mined out openings and stopes to fill voids and stabilize the ground. Ventilation, safety refuge, haulage and other aspects of underground mining operation have been planned, and the Proponent acknowledges the specifications and requirements of the Occupational Health and Safety Regulation.

WATER MANAGEMENT

Water Management Water management facilities include seven ponds and connecting diversion channels, which have been designed to accommodate a 1:200 year return period flood event during operation. The ponds were designed to maintain a 1 m freeboard. Five of the ponds were designed to accommodate precipitation and runoff resulting from a 1:200 year return period, 24-hour duration storm event. Two of the ponds (Class C Storage Facility runoff pond and Overburden Stockpile Pond) were designed to accommodate the 1:10 year return period 24-hour duration storm event, freshet inflow, and 30 days of storage capacity. The Ponds were designed with 2H:1V slope angles on the impounding dykes, which are to be constructed using zones of angular waste rock and compacted soils having impermeable properties. The two largest ponds will contain greater volumes of water and have flatter design slope angles of 2.5H:1V along with synthetic liners and impermeable soil types.

The water management facilities were designed to convey and store runoff from typical and severe flood events. Dam safety is accounted for in design of the facilities with anticipated construction methods and quality control. During operation, routine and event-driven surveillance will be undertaken. Facilities will be managed by adhering to Operations, Maintenance and Surveillance Manuals that prescribe procedures and training requirements for personnel. Deficiencies would be identified for mitigation and repair or upgrades.

TOTE ROAD

The existing Tote road will be upgraded for the main access to the mine. The Proponent proposed a conventional unfrozen road building design for the access road widening and upgrades. The Proponent provided a list of hazards and mitigation opportunities by 21 separate segments along the route. Road performance and damage due to permafrost can be minimized by various techniques, many of which are proposed to be employed. The present conceptual designs and mitigation option proposals appear to satisfactorily manage the geotechnical hazards, based on the available information.

SITE INFRASTRUCTURE

Buildings for the mine operation will require stable foundations. Geotechnical investigations were completed for key buildings such as the processing plant. Suitable foundation conditions were encountered and preliminary designs created. The Proponent plans to complete

supplementary geotechnical work as part of final design of buildings. If permafrost were to be encountered below a building in upcoming supplementary design or construction, the Proponent plans to remove it to avoid thaw settlement processes.

Effects Characterization

THE PROJECT IS NOT EXPECTED TO HAVE A LONG TERM INCREMENTAL EFFECT ON PERMAFROST.
The Kudz-Ze-Kayah mine site is located in the discontinuous permafrost zone and a small portion of the footprint is presently hosting permafrost. Where permafrost has been observed, the terrain is exhibiting signs of active thawing and degradation.

In cases where permafrost material is present at the foundation of structures and fills, where it may not be degrading or the onset will be delayed, long term creep could be anticipated, if the permafrost is left in place. Thawing permafrost has a reduced ability to support the weight of embankments, although this effect is prevalent in silt and clay soils but less problematic in clean gravel and sand soils. Without mitigation or removal of the degrading permafrost under a structure or fill deposit, there could be a failure in foundation or slope stability modes.

As mentioned, thawing permafrost can also result in solifluction, which the Proponent identified as being widespread and active throughout parts of the site. The site roads will be constructed through natural slopes in the geography, which can also be affected by and promote solifluction. This is trigged typically through nuisance maintenance requirements and repairs. Mitigations techniques are available to reduce the impacts for locations where solifluction can cause greater road damage.

Additionally, the presence of permafrost material within the Tote road corridor can pose risks of cut and fill slope failures. The Proponent acknowledged that glaciofluvial sand and gravel covers over ice-rich till along the central to northern portion of the access corridor, giving the appearance at surface of stable, permafrost-free ground, but it cannot fully buffer the effects of ground disturbance. Disturbance of the permafrost material or its covering soil layers can alter its regime (i.e. trigger or accelerate thawing) and its behavior and lead to possible slope movements or subgrade failure. Such damage is normally not very catastrophic and has a low consequence to safety; however, access can be temporarily cut off, resulting in repair and maintenance requirements, operations shutdowns, inconvenience and potential blockages to site evacuation.

The Fault Creek debris flood is another area where the situation may worsen by alteration in the permafrost regime as it degrades and thaws. A debris flood is normally a catastrophic, short-duration incident rather than a long-term hazard. It can have a major impact to the workers and equipment in the open pit if debris and floodwaters were to spill down the pit walls, and might not be easily captured by instrumentation and monitoring. Mitigations proposed by the proponent to establish a diversion and berm are expected to be effective measures to address impacts.

Based on current climate patterns and anticipated climate change, no reversal of permafrost degradation overall however is expected. Some of the proposed activities include complete

removal of permafrost-hosted soils and stockpiling the material in overburden storage for use in progressive reclamation during mining and at closure. The purpose of the permafrost removal is to improve stability and reduce the risk of damaging failures of waste rock and tailings storage facilities and water impoundments. As well, some buildings may have permafrost first removed before construction so as to prevent thaw settlement from occurring.

In the short term, excavation of permafrost material will remove permafrost faster than is presently occurring; however, in the longer term this permafrost will be lost as part of background warming trends. Elsewhere on the site, outside the footprints of storage facilities, road prisms, buildings and the open pit, any pockets of permafrost are expected to degrade at similar rates as is occurring regionally.

THE PROJECT'S ENGINEERED INFRASTRUCTURE AND EXCAVATIONS MAY RESULT IN ADVERSE EFFECTS TO WORKER SAFETY AND THE ENVIRONMENT.

Accidents and malfunctions are credible in most components of the proposed mining Project.

Operation of open pits and underground mining can be dangerous working environments owing to the uncertainty of rock behaviour and the use of heavy equipment and the large scale of slopes and walls. Worker injuries and fatalities occur annually at mine sites worldwide.

OPEN PIT HAZARDS

The potential for slumping of soils over bedrock at the crest of the open pit can be caused by thawing permafrost. The Proponent acknowledged this process could result in material moving over the rim of the pit wall to areas below. Inadequate bench width can also increase the risk of slope failure, toppling and other structural failure that can impact the safety of workers and equipment in the mine. The failure in open pit slopes can be catastrophic if occurring in large scale. The magnitude and extent of failures is difficult to predict and depends on unique zones in the open pit along with how the mining is conducted. Hence, in mining projects a detailed instrumentation program is needed to monitor slope movement. As well, individual benches are inspected upon exposure, and if potential instability is identified in specific locations, stabilization efforts such as drilled drains, rock bolts, slope mesh and other methods would be applied.

Additionally, the Proponent observed that a recent debris flood impacted an active fan at Fault Creek in the proposed open pit site area. The situation may worsen by alteration in permafrost regime as it degrades and thaws. A debris flood is normally a catastrophic, short-duration failure rather than a long-term hazard. It can have a significant impact to the workers and equipment, specifically in the open pit if debris and floodwaters were to spill down the pit walls. Such remediation can bring the likelihood of debris flood to low or negligible.

The Executive Committee understands the project design is at a Pre-Feasibility Study level; consequently, there is a degree of uncertainty in predicting project effects. However, the Executive Committee notes that project impacts are likely not to be substantial as knowledge of geology improves and mine plans move through the regulatory process. In a feasibility study, it is anticipated that the Proponent would likely use the laboratory test results presented in its

current submission and update its slope stability evaluation. Therefore, the final results may adjust the currently proposed bench configurations.

UNDERGROUND MINING HAZARDS

Water could flood the tunnel and underground openings rapidly if such zones encountered during the mining. Water flooding into the tunnel can occur in varying rates going from low flow to flood, depending on the permeability of the water bearing layer(s). Flooding underground may pose a risk to personnel and equipment working underground. Other rock stability hazards may also pose a risk to safety if not mitigated in design and operation.

Similar to the open pit slopes, it is understood that the underground mining design is at the prefeasibility level and the decision on performing an underground excavation is a process that will actually be concluded at a later stage of the 'Open Pit' excavation/production. Additionally, the presence of deep groundwater in the bedrock is only partially understood. Water can seep from open pit walls and seep into or flood underground tunnels and openings. Water inflow can pose risks to workers and cause rock failures. It is anticipated as the open pit excavation proceeds, more information becomes available to assist the decision making process and also clarify the anticipated geotechnical risks such as weak zones or high groundwater flow regions.

Stored waste rock and filtered, dried tailings, along with water impoundments are capable of failing due to design flaws, operational practices, unforeseen events and circumstances, other factors, or a combination of these elements. If a worker is situated in an impact zone downstream, they can be injured or killed. Releases of soil, rock and water can damage the environment, including covering over the landscape or water bodies and impacting water quality. Some environmental damage can be partially or fully reversed and repaired, while it can also be irreversible and permanent. With respect to tailings storage, the Project plan includes a dry-stack method of tailings that does not involve storage of saturated tailings behind a dam. The effects of a failure of dry-stacked tailings is generally lower than that of a tailings dam.

Significance Determination

EFFECTS ARE LIKELY

The Project's effects on human health and safety are likely and its effects on the environment related to accidents and malfunctions of infrastructure, roads, water management facilities, waste storage facilities, open pit mine are also likely.

There is a broad spectrum of effects from minor to severe; however, virtually every mining operation experiences some injuries or even deaths to workers during the life of the mine. As well, it is not uncommon to experience even small incidents of accidental releases of sediment, or an open pit bench slope to fail, or small underground break-out to occur. The overall probability of various incidents occurring may well be low, facilitated by undertaking quality designs and operating with excellence; however, the probability is non-zero.

EFFECTS ARE ADVERSE

The effects to human health and safety are adverse; society places very high value on worker safety and well-being. The effects to the environment are adverse; degradation of habitat resulting from malfunctions and accidental releases can disrupt plant and wildlife success.

EFFECTS ARE NOT SIGNIFICANT

The Project is not likely to result in significant adverse effects to human health and safety or the environment in relation to the assumed safe design, construction and operation of mine infrastructure. The mitigations and design parameters proposed by the Proponent will eliminate, reduce or control the effects of terrain stability, geohazards and failures on human health and safety. It is important to consider that the low significance of effects is predicated on ensuring that:

- ongoing detailed engineering designs will be competent and adhere to standards and guidelines;
- construction will be performed in accordance with designs;
- engineering input and quality control during construction will occur;
- management plans and operations, maintenance and surveillance manuals will all be produced and adhered to during the life of the Project;
- unforeseen, extreme events or loadings beyond those anticipated in the designs will not occur; and,
- the application of the Occupational Health and Safety Regulation will be inspected and enforced.

10. Community Wellbeing

10.1 Emergency Services

The Executive Committee considered the potential for effects to community wellbeing within Ross River and Whitehorse due to increased demand on emergency services. Industrial accidents can place additional stress on emergency medical, rescue, fire and law enforcement services.

The Proponent predicts no net effect on the emergency services of Ross River, Faro or Watson Lake, unless there is a considerable influx of new residents. The Executive Committee agrees that population levels for these communities are unlikely to change to the point where emergency services are stressed. In the event of medical emergencies at the Project site, health facilities in Ross River, Faro or Watson Lake would generally not be used, as patients would be evacuated to Whitehorse by air, though in some cases the Watson Lake hospital may be used in the event of non-air transport. The Executive Committee does not foresee impacts to emergency services resulting from the Project.

10.2 Traffic

The Executive Committee considered the potential for traffic-related impacts to community wellbeing. Traffic can decrease livability and safety within communities. Most traffic will be routed via Watson Lake, with up to 52 trucks per day (one-way trips, or 26 round-trips) travelling between the mine site and Watson Lake, and beyond.

The Executive Committee notes that speed limits in communities are generally 50 km/h, although in Watson Lake the Robert Campbell Highway passes through a school zone with a 30 km/h speed limit. Based on both low overall daily traffic levels and current speed limits, the Executive Committee does not foresee traffic-related impacts to community wellbeing.

10.3 Housing

The Executive Committee considered the potential for effects on housing availability, affordability, and quality. However, based on information available, did not consider the project as providing a likely pathway to significant adverse effects. The Executive Committee acknowledges that there is uncertainty regarding this conclusion and will be working to acquire additional information prior to drafting its final recommendations in order to validate or modify its conclusion.

11. Heritage Resources

Summary & Conclusion

The Project will not result in significant adverse effects to heritage resources. While cultural materials and archeological sites have been found in the LSA, the adverse impacts of the Project will be adequately eliminated, reduced or controlled through the application of relevant legislation and mitigation measures committed to by the Proponent.

Importance of Heritage Resources

For the purposes of this assessment, the Executive Committee used the definition of Heritage resources from YESAA,[429] though other definitions exist in the Umbrella Final Agreement (UFA) and the Government of Yukon's (YG) *Historic Resources Act.*

Heritage resources exist throughout the Yukon landscape in all terrains. They provide a link between the past and the present; for many, this is a vital cultural link pertinent to a society and

[429] (a) a moveable work or assembly of works of people or of nature, other than a record only, that is of scientific or cultural value for its archaeological, palaeontological, ethnological, prehistoric, historic or aesthetic features;
(b) a record, regardless of its physical form or characteristics, that is of scientific or cultural value for its archaeological, palaeontological, ethnological, prehistoric, historic or aesthetic features; or
(c) an area of land that contains a work or assembly of works referred to in paragraph (a) or an area that is of aesthetic or cultural value, including a human burial site outside a recognized cemetery.

its future. The recording of heritage resources helps improve an individual's understanding of the relationship between people, the land and other resources.

The Project area falls within the Traditional Territories of the Liard First Nation (LFN) and the Ross River Dena Council (RRDC). Heritage resources within these Traditional Territories are unique and irreplaceable and important to the identity of these First Nations.

Heritage resources are fragile and may be difficult to locate. They are susceptible to the impact of mining development, particularly from land clearing and earth moving. As such, the Executive Committee will assess the potential Project impacts on heritage resources.

Legislative & Regulatory Setting

The following legislation includes provisions which mitigate potential significant adverse effects to heritage resources:

- *Historic Resources Act*:
    - Section 25(1): Prohibits undertaking an activity that will alter a historic site without a permit
    - Section 64: Prohibits the destruction or alteration of a historic object
- *Archaeological Sites Regulation*:
    - Section 4: Prohibits activities that may affect an archaeological object or site
    - Section 11: Controls impacts to archaeological resources through stipulations around the reporting of work undertaken with permits
- *The Quartz Mining Regulation* (YOIC 2003/64), Schedule 1, under the *Quartz Mining Act:*
    - Section E(8): Establishes a 30 m buffer surrounding known archaeological or paleontological sites, requiring all activities to cease upon the discovery of a site
    - Section E(9): Requires that any findings be immediately marked, protected, then reported

Context

Heritage resources exist throughout Yukon's landscape. The value of a heritage resource is based on its physical and material properties, as well as its symbolic attributes. The heritage resources in the project area may include movable or immovable resources above ground or buried, on land or in water.

Heritage resources are vulnerable to destruction in earth moving operations, an activity that is necessary throughout the mining process. Conversely, land altering activities can lead to the discovery of new heritage sites. The location of heritage resources are often difficult to predict, making avoiding them challenging. Avoiding damaging or destroying heritage resources before they can be properly recorded/protected is a key management strategy used to protect the value of heritage resources. This is generally accomplished through the conduct of heritage resource overview assessments and heritage resource impact assessments, whereby heritage resources are identified prior to land clearing activities taking place.

Current Conditions and Trends

The project area fall within the Traditional Territories of the RRDC and the LFN. As a result, this area could contain heritage resources from one or both of these First Nations.

Various heritage investigations have taken place within the Project's Local Study Area over the years (in 1995, 1996, 2015, and 2016). The Local Study Area encompasses the development footprints of all project infrastructure, including the access road. Heritage resources were found at two test shovel sites during the 2015 heritage resource impact assessment, both of which consisted of prehistoric, subsurface, lithic scatters. These archaeological sites have been recorded as JiTp-1 and JjTp-1. Both sites were recommended for avoidance, and if avoidance was not feasible, systematic data recovery consisting of additional shovel testing and test unit excavation was required.

The 2015 heritage resource impact assessment also found three ice patch areas containing wood fragments in high elevation areas planned for exploration activities. Two wood fragments were recovered and a third, which contained a wire attachments similar to a snare, was left in place as no work was proposed that would threaten it.

Follow-up assessments at JiTp-1 were undertaken in 2016 based on the recommendations made during the 2015 assessment, since this site overlapped the Class B Storage Facility footprint. Three additional shovel tests were positive for heritage resources, and the excavation blocks yielded 88 lithic artifacts. Data recovery was completed, and the adverse effects to site JiTp-1 have been mitigated. No new additional heritage sites were found during the 2016 heritage assessment.

Project Design

The Proponent has submitted a Heritage Resources Management Plan which identifies a number of actions the Proponent will take in terms of managing known heritage resources on site (e.g. reflagging sites, when necessary) and potentially undiscovered heritage resources (e.g. ceasing all work in the immediate area), as well as communication protocols (i.e. who to contact if a heritage resource is found). Of critical importance for the management of adverse effects to heritage resources, the Proponent has committed to undertaking heritage resource impact assessments prior to undertaking any and all ground-disturbing activities in areas that were not previously subject to heritage investigations.

Effects Characterization

LAND CLEARING ACTIVITIES MAY RESULT IN ADVERSE EFFECTS TO HERITAGE RESOURCES

Five heritage sites have been recorded within the LSA and heritage resources within those areas have either been recovered in accordance with the *Heritage Resources Act* or will not be impacted by any proposed development, and have been flagged for buffering purposes. There remains the potential, however, for unrecorded/unknown heritage resources to be present in the project area, in particular should the proposed development footprint expand or change from revisions to the Project. For example, the proposed borrow pits or improvements along the Tote

Road have not been the subject of past heritage resource investigation efforts but will be subject to an HRIA prior to any and all ground-disturbing activities.

Land clearing activities and earthworks to be carried out as part of the Project may result in inadvertent effects to heritage resources in areas of unknown heritage potential. Project activities may result in the alteration and/or loss of a resource (all or part of a resource), isolation from its natural setting, or the introduction of physical, chemical or visual elements that are out of character with the heritage resource and its setting. The effects to heritage resources are irreversible; once damaged or lost, the value of a heritage resource cannot be determined. The effects of such a loss are permanent.

The Proponent has prepared a Heritage Resource Management Plan and has committed undertaking heritage resource impact assessments in areas for planned ground-disturbance that have not previously been subject to heritage investigations. This, combined with the requirements of the *Historic Resources Act* and *Archeaological Site Regulations* will reduce the likelihood that heritage resources will be adversely affected by the Project.

Determination of Significance

EFFECTS ARE NOT LIKELY

The Project is not likely to result in effects to heritage resources. Previous heritage resource impact assessments identified five heritage resource sites that were recovered under the *Heritage Resources Act* or were identified and buffered for protection. While there may still be undocumented heritage resources in areas that may be disturbed by the project, the Proponent's commitment to undertaking additional heritage resource impact assessments where necessary, coupled with the requirements of applicable legislation, will reduce or mitigate impacts to heritage resources.

EFFECTS ARE ADVERSE

Effects to heritages resources are adverse. Land clearing and earth moving can alter or destroy unknown heritage resources, and the value of such resources can never been determined.

EFFECTS ARE NOT SIGNIFICANT

The Project will not result in significant adverse effects to heritage resources. The current territorial legislation and regulations, combined with the Proponent's Heritage Resources Management Plan and commitment to undertaking additional heritage resource impact assessments, reduce the risks of significant adverse effects to heritage resources.

Part C

12.Conclusion of the Assessment

12.1 Assessment Outcome

Under s. 58(1)(a) of the Yukon Environmental and Socio-economic Assessment Act, the Executive Committee recommends to the Decision Bodies, Government of Yukon, the Department of Fisheries and Oceans, and Natural Resources Canada, that the Project be allowed to proceed, subject to the specified terms and conditions. The Executive Committee has determined that the project will have significant adverse environmental and socio-economic effects in or outside Yukon, but that those effects can be mitigated by the specified terms and conditions.

12.2 Recommended Mitigations

1) Geochemical modelling shall be revised during licensing and operations to inform detailed design of the cover systems, with the aim of reducing acid production and COPI loadings from storage facilities.

2) Additional treatment options shall be implemented if the proposed CWTS cannot be demonstrated to reduce COPI concentrations to background levels consistently.

3) The Proponent shall revise WQOs during the Water Licence process to ensure they are based on the most recent toxicological information and guidance from CCME and BCMoE.

4) The Proponent shall establish Effluent Quality Standards for the Project based on achieving WQOs in the receiving environment in Geona Creek (KZ-37) and in Finlayson Creek (KZ-15).

5) The Proponent shall conduct ongoing investigations into WRSA liners and cover systems to ensure that the performance objectives used in the water quality model are achieved during all Project phases.

6) The Proponent shall commit to ongoing geochemical studies for WRSA A and B, and studies to optimize the performance of the proposed Constructed Wetland Treatment System, to address the potential for acidic conditions to develop in the future.

7) The Proponent shall ensure the water treatment plant remains operational until it has been demonstrated that surface water from the site meets water quality objectives for

the receiving environment in Geona Creek (KZ-37) and in Finlayson Creek (KZ-15).

8) The Proponent shall provide allowance for up to 14 days of unpaid leave to all Yukon First Nation employees to allow for the exercising of Aboriginal rights related to:

    e. the pursuit of traditional land use activities. This will be 14 days to allow sufficient time on the land; and
    f. to attend culturally important events (potlaches, dances, ceremonies, culture camps).

9) Security requirements shall take into consideration the need for transition funding for workers and communities, for both scheduled and unscheduled closure.

Security requirements shall take into consideration the potential for early unscheduled closure.

10) The Proponent shall develop mandatory, regular harassment prevention training in consultation with a qualified expert, to be delivered to all the Proponent's employees, contractors and consultants working at the site.

11) The Proponent shall modify their proposed Mentor program for First Nations employees[430] to:

    - ensure that women have access to a mentor or supervisor who regularly checks in to address any negative experiences related to the male-dominated work environment, and who pays special attention to potential cases of abuse; and
    - develop a formal feedback process to ensure that enquiries are regularly made to First Nations employees to ensure that they are able to voice concerns and have addressed any negative experiences.

12) The Proponent shall, in consultation with a qualified expert and both LFN and RRDC, develop gender appropriate and gender- and sexuality-specific policies and processes which promote a safe, respectful and inclusive environment for women and sexual minorities.
13) The Proponent shall develop, with a qualified expert, an Anti-Harassment and Bullying Policy that outlines processes and actions to address any harassment or bullying which may take place within the Project's scope.

14) The Proponent shall work with RRDC, the community of Ross River, LFN, the Town of Watson Lake, and the Government of Yukon to provide resources to women in need in communities impacted by the Project.

[430] YOR Document 2017-0083-200-1.

15) To address and mitigate impacts to employees who are or become victims of domestic abuse, the Proponent must create a policy that:

    - outlines clear procedures for the workplace to work with affected employees and provide appropriate resources and support;
    - plans for and addresses safety concerns that affected employees may have while at work to ensure all workers are safe from threats of domestic violence; and
    - includes a personal safety plan for employees suffering from domestic violence.

12.3 Recommended Monitoring

A. Water quality monitoring of COPIs shall be implemented as early as possible beneath storage facilities and beneath their respective covers. Monitoring shall continue through operations and closure phases.

B. The Proponent shall conduct seepage monitoring for the WRSA A to detect any onset of acid conditions.

C. Environment Yukon shall implement, with the Proponent, a survey program to monitor caribou distribution in the project area during the post-calving period and to monitor caribou herd composition during the rut. This survey program shall be designed through collaboration with affected First Nations.

D. That Environment Yukon, with the Proponent, implement a survey program be instituted to monitor moose during late winter. This survey program shall be designed through collaboration with affected First Nations and Government of Yukon.

13.Signatory Page

[signature redacted] November 20, 2019

Laura Cabott
Chair

Date

[signature redacted] November 20, 2019

Dale Eftoda
Executive Committee Member

Date

[signature redacted] November 20, 2019

Lawrence Joe
Executive Committee Member

Date

[signature redacted] November 20, 2019

Wendy Randall
Executive Committee Member

Date

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