FOR PUBLIC COMMENT

Comprehensive Study Report
Pursuant to the
Canadian Environmental Assessment Act

For the Proposed:
Mount Milligan Gold-Copper Mine
in
North-Central British Columbia
Proposed by:
Terrane Metals Corporation

Prepared by:
Fisheries and Oceans Canada
and
Natural Resources Canada

September 18, 2009

Canadian Environmental Assessment Registry Reference Number 08-03-39778

EXECUTIVE SUMMARY

Background

Terrane Metals Corporation (the Proponent) proposes to construct and operate a conventional truck-shovel open pit gold-copper mine, located approximately 155 km north of Prince George, British Columbia, between the communities of Mackenzie and Fort St. James. It is expected to extract and process on average 60,000 tonnes of ore per day (21.9 million tonnes per year) over a 15 year mine life.

The proposed mine site is located within the area covered by the Province of British Columbia's Mackenzie Land and Resource Management Plan, Philip Enhanced Resource Management Zone. This zone has a management objective of promoting development of high mineral values and recognizing the significance of the mineral potential.

The total disturbance area of the proposed mine and associated infrastructure, including off-site facilities, will be approximately 1,820 hectares. The proposed Mount Milligan Gold-Copper Mine components include: open mine pits, a tailings impoundment area, stream diversions, a water supply pond, an upgraded access road, a concentrate mill, a 92 km long 230 kV power line, borrow pits, overburden and topsoil stockpiles, associated site drainage and water management structures, worker facilities, an explosives factory and magazine facilities, fuel storage, maintenance and warehousing facilities.

Federal Regulatory Responsibilities

This report has been prepared by Fisheries and Oceans Canada (DFO) and Natural Resources Canada (NRCan) in consultation with Environment Canada (EC) and Health Canada (HC) as federal authorities (FAs) having specialist and expert information or knowledge needed to conduct the environmental assessment (EA).

Fisheries and Oceans Canada

Fisheries and Oceans Canada has determined that the proposed Mount Milligan Gold-Copper Mine would cause the harmful alteration, disruption or destruction of fish habitat, and will therefore require an Authorization under subsection 35(2) of the *Fisheries Act,* (R.S., 1985, c. F-14). Furthermore, amendments to regulations by the Governor in Council are contemplated to list the headwaters of King Richard Creek and Alpine Creek as a tailings impoundment area on Schedule 2 of the *Metal Mining Effluent Regulations*, pursuant to paragraphs 36(5) (a) to (e) of the *Fisheries Act*. Both the Authorization and the proposed amendment trigger a requirement to conduct an environmental assessment under Section 5 of the *Canadian Environmental Assessment Act* (*CEAA*)(S.C., 1992 c. 37).

Natural Resources Canada

Based on the need for an explosives factory and magazine facilities during the construction and operation of the Project, Natural Resources Canada may issue a factory licence pursuant to subsection 7(1)(a) of the *Explosives Act*, (R.S., 1985, c. E-17), which is also a trigger under Section 5 of the *Canadian Environmental Assessment Act.*

Scope of the Proposed Project

The federal scope of the proposed Mount Milligan Gold-Copper Mine considered within this Comprehensive Study Report (CSR) includes the construction, operation, modification, and decommissioning of the following:

- The open mine pit (approximately 2.5 x 1.5 km);
- The process plant (mill site);
- The TIA, containment dams and other associated structures (including the deposition of tailings into the TIA);
- The site water management facilities (diversion channels, tailings and reclaims water pipelines, and sediment control ponds);
- The water supply pond;
- The ore stockpile, waste rock dumps, overburden and topsoil storage areas,
- The explosives factory and magazine facilities requiring factory licence under subsection 7(1)(a) of the *Explosives Act*;
- The watercourse crossings associated with the installation of the transmission line requiring Authorizations under subsection 35(2) of the *Fisheries Act*;
- The watercourse crossings associated with the onsite mine haul roads requiring Authorizations under subsection 35(2) of the *Fisheries Act*; and
- Any works or undertakings that are required as compensation for the harmful alteration, disruption or destruction of fish habitat, that require an Authorization under subsection 35(2) of the *Fisheries Act.*

The scope of the proposed Mount Milligan Gold-Copper Mine, for the purposes of the federal environmental assessment, was posted to the Canadian Environmental Assessment Registry (CEAR) May 15, 2009, and can be accessed at: http://www.ceaa.gc.ca/050/details-eng.cfm?CEAR_ID=39778

Scope of the Assessment

The assessment under the *CEAA* considered the potential environmental effects of the proposed Mount Milligan Gold-Copper Mine, as it is scoped (the Project), including physical, biological, and human environments, taking into account measures that are technically and economically feasible to prevent or reduce any potential adverse effects of the Project to an acceptable level.

The scope of assessment also includes a consideration of: alternatives to the Project; alternative means of carrying out the Project that are technically and economically feasible and the environmental effects of any such alternative means; the effects of the environment on the Project; environmental effects related to malfunctions or accidents; potential CEE; measures that would mitigate adverse environmental effects, the significance of the environmental effects; the capacity of renewable resources likely to be affected; and, a Follow-Up Program to verify the accuracy of the Project's environmental assessment (EA), and to determine the effectiveness of any measures taken to mitigate the adverse environmental effects of the Project.

This CSR fulfills DFO's and NRCan's obligations as Responsible Authorities (RAs), to conduct an assessment of the Project's environmental effects in consultation with other federal authorities who have the appropriate expertise. This CSR presents the assessment of the Project's effects on the following components:

- *Biological Components:* Fish, Fish Habitat and Aquatic Resources; Wildlife and Wildlife Habitat, Species at Risk; Vegetation and Plant Communities;
- *Physical Components*: Surface Water Quality and Sediment Quality; Hydrology and Hydrogeology; Air quality and Climate; Metal Leaching and Acid Rock Drainage; and Terrain, Soils and Geology; and
- *Human Components*: Current Use of Lands and Resources for Traditional Purposes by Aboriginal Persons; Effects on Sustainable Use of Renewable Resources; Navigable Waters; Fisheries; Human Health; Archaeological Sites and Cultural Heritage; Visual and Aesthetic Resources; and Noise.

A detailed description of each component and the key ways in which the Project would affect each component are identified and rated for significance in Section 5.0.

Potential Effects of the Project on the Environment, Mitigation Measures and Significance

Following an analysis of the nature of the Project, the description of work and infrastructure, and the proposed changes to the environment, DFO and NRCan have assessed the potential impacts that the Project is likely to have on the environment. This review was completed on the basis of the information provided by the Proponent in its Environmental Impact Statement (EIS) and supplemental filings, expert advice provided by FAs, results of discussions with provincial regulatory agencies, advice from provincial experts provided through the cooperative review process, and comments provided by Aboriginal groups, stakeholders, and the public through engagement and consultation.

The significance of the residual effects of the Project on biological, physical and human components was rated and categorized according to criteria developed by the Federal Environmental Assessment Review Office (FEARO, 1994). This method was found to be acceptable by RAs. Effects were rated as *Not Significant (Negligible), Not Significant (Minor), Not Significant (Moderate) or Significant.*

Although the Project was found to interact with the environment and human components in various ways, through the implementation of mitigation measures (Appendix C-Amalgamated Table of Proponents Commitments, Mitigation Measures and Best Management Practices), none of the residual effects are considered to be *Significant*. The RAs have reviewed the Proponent's assessment, and support the findings of the EIS.

With regard to Fish, Fish Habitat and Aquatic Resources, the RAs conclude that the proposed Project will likely cause harmful alteration, disruption or destruction of fish habitat (HADD) due to the alteration of fish habitat in Meadows Creek, Alpine Creek, and King Richard Creek. This is associated with the construction of the mine infrastructure, including the proposed tailings impoundment area, as well as potential residual effects through flow reductions in Alpine and Meadows Creek. Pending the outcome of the Ministerial determination on this CSR, the HADD will necessitate a regulatory decision under subsection 35(2) of the *Fisheries Act* and an amendment to Schedule 2 of the *Metal Mining Effluent Regulations* pursuant to paragraphs 36(5) (a) to (e) of the *Fisheries Act* prior to the Project proceeding. The RAs have determined that based on successful implementation of the Proponent's proposed Fish Habitat Mitigation and Compensation Plan (FHMCP) that it is likely that the productive capacity of fish habitat will be maintained. Consequently, the adverse environmental effects on Fish, Fish Habitat and Aquatic Resources have been rated as *Not Significant (Minor)* or *Not Significant (Negligible).*

Stakeholder Engagement and Public Participation

A program of stakeholder engagement and public participation was carried out during the various stages of the EA process, which included components lead by the Proponent, the British Columbia Environmental Assessment Office (BC EAO), RAs and the Canadian Environmental Assessment Agency (CEA Agency).

The Proponent provided numerous opportunities for public involvement in the review of the Project and the environmental assessment including several open houses, forums, comment periods, maintenance of a project website and presentations to local government and community representatives.

Through the cooperative EA process, RAs, the CEA Agency and the BC EAO provided for public comment periods on key EA documents. The opportunities to comment were advertised and made known through a variety of means, including newspaper, website posting and local viewing locations and were accompanied by community open houses attended by both federal and provincial government representatives. The RAs considered the comments from the Public and First Nations in the process for establishing the scope and level of federal EA and in the identification of issues during the review of the Proponent's EIS.

Aboriginal Engagement

Aboriginal engagement was undertaken during the EA process by the Proponent, the BC Environmental Assessment Office, Responsible Authorities, and the Canadian Environmental Assessment Agency. The RAs considered the information provided by Aboriginal groups in making a determination of the significance of effects in relation to areas of federal interest within the federal scope of assessment.

Follow-Up Programs and Monitoring

The Proponent has proposed a Follow-Up Program, and Monitoring program which will address compliance and effectiveness monitoring for each stage of the Project development, as well as long-term Follow-Up monitoring requirements. During the BC environmental assessment of the Project, the Proponent committed to carrying out all proposed Follow-Up Programs and Environmental Monitoring as outlined in Section 6.4 of the EIS.

In accordance with the *CEAA,* the Follow-Up Program will be designed to verify the accuracy of the EA predictions for the Project, determine the effectiveness of measures taken to mitigate the adverse environmental effects of the Project, and to support the implementation of adaptive management measures applied to address unanticipated adverse environmental effect. Environmental monitoring will likely be required under permits, licences and authorizations that may be issued upon completion of the EA. If any unforeseen adverse effects should arise during the life of the project, measures will be taken to correct these effects and prevent them from occurring again in the future.

Conclusion

The following CSR provides background on the biological, physical and human components, the potential effects of the Project on these components, measures designed to mitigate effects and the conclusions of the federal RAs on the significance of the residual effects.

Taking into account the results of the provincial Environmental Assessment, the content of the EIS, comments submitted by Aboriginal, stakeholder and public groups, implementation of all mitigation measures that have been presented in this CSR (Appendix C: Amalgamated Table of Proponents Commitments, Mitigation and Best Management Practices), the proposed Fish

Habitat Mitigation and Compensation Plan, implementation of environmental monitoring programs and the Follow-Up Programs, Fisheries and Oceans Canada and Natural Resources Canada have determined that the Project, is not likely to cause significant adverse environmental effects.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS AND ACRONYMS

Acronym/Term	Definition
ABA	Acid base accounting
AIUS	Aboriginal Interest and Use Study
Application	Application for an environmental assessment certificate under the British Columbia *Environmental Assessment Act*
ARD	Acid Rock Drainage
BC *EAA*	British Columbia *Environmental Assessment Act*
BC EAO	British Columbia Environmental Assessment Office
Baseline information	A description of existing environmental, social and economic conditions at and surrounding an action
CEA	Cumulative Effects Assessment
CEAA	*Canadian Environmental Assessment Act*
CEA Agency	Canadian Environmental Assessment Agency
CEAR	Canadian Environmental Assessment Registry
CEE	Cumulative Environmental Effects
Concentrate	The concentrated form of the valuable minerals from which most of the waste (gangue) minerals have been removed which becomes the raw material for smelting
COPC	Contaminant of Potential Concern
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CSR	Comprehensive Study Report
DFO	Fisheries and Oceans Canada
EA	Environmental Assessment
EC	Environment Canada
EIS	Terrane Metals Corporation. July 2008. Mount Milligan Copper-Gold Project Environmental Assessment.
EMP	Environmental Management Plan
EMS	Environmental Management System
Environment	The sum of the total of the elements, factors and conditions in the surroundings which may have an effect on the development, actions or survival of an organism or group of organisms, including humans
EPA	Environmental Protection Agency (USA)
FA	Federal Authority
FEAC	Federal Environmental Assessment Coordinator
FSR	Forest Service Road
FHMCP	Fish Habitat Mitigation and Compensation Plan
GIS	Geographic Information System

Acronym/Term	Definition
GOC	Government of Canada
HADD	Harmful alteration, disruption or destruction (of fish habitat)
HC	Health Canada
HCA	*Heritage Conservation Act* (BC)
ICP/MS	Inductively Coupled Plasma Mass Spectrometry
IEM	Independent Environmental Monitor
INAC	Indian and Northern Affairs Canada
LRMP	Land and Resource Management Plans
LSA	Local study area[1]. The spatial area within which local effects are assessed (i.e., near where direct effects are anticipated)
MCWSP	Meadows Creek Water Supply Pond
MEMPR	Ministry of Energy, Mines, and Petroleum Resources
Mitigation	Under *CEAA*, mitigation is *"the elimination, reduction or control of the adverse environmental effects of the project, and includes restitution for any damage to the environment caused by such effects through replacement, restoration, compensation or any other means"*
MDC	Mine Development Concept
ML/ARD	Metal Leaching/Acid Rock Drainage
MMER	*Metal Mine Effluent Regulations* (Federal)
MOE	BC Ministry of Environment
Monitoring	A continuing assessment of conditions at and surrounding the action. This determines if effects occur as predicted or if operations remain within acceptable limits, and if mitigation measures are as effective as predicted
NRCan	Natural Resources Canada
OPS	Fisheries and Ocean's Pacific Region Operational Statements
PAG	Potentially Acid Generating
Project	The Proposed Mount Milligan Gold-Copper Mine (2006), as defined by the federal scope of assessment
Proponent	Terrane Metals Corporation
RA	Responsible Authority
RSA	Regional study area[1]. The spatial area within which cumulative effects are assessed (i.e., extending a distance from the project footprint in which both direct and indirect effects are anticipated to occur)
Regionally important wildlife	Species that are not at-risk provincially, but considered important to a region of British Columbia, rely on habitats that are not protected under the Forest and Range Practices Act, and may be adversely impacted by forest or range practices

Acronym/Term	Definition
Residual effects	Effects that remain after mitigation has been applied
RIC	Resources Inventory Committee
Risk management	Risk management is the process of measuring, or assessing, risk and developing strategies to manage it.
SAR	Species at Risk
SARA	*Species at Risk Act* (federal)
SMP	Sustainability Management Plan
SOP	Standard Operating Procedures
TC	Transport Canada
t/d	tonnes per day
TEM	Terrestrial Ecosystem Mapping
Temporal boundary	The period of time examined in the assessment
Terrane	Terrane Metals Corporation
TIA	Tailings Impoundment Area (the proponent refers to Tailings Storage Facility in the EIS)
TK	Traditional Knowledge
TLU	Traditional Land Use
TOR	Terms of Reference
TSA	Timber Supply Area
TSP	Total suspended particulates
TSS	Total suspended solid
TWG	Technical Working Group, assembled for the BC Environmental Assessment Review Process
US EPA	United States of America Environmental Protection Agency
Valued ecosystem component	Any part of the environment that is considered important by the Proponent, public, scientists or government involved in the assessment process. Importance may be determined on the basis of cultural values or scientific concern.
VEC	Valued Ecosystem Component
WG	Working Group
WQG	Water Quality Guidelines
WQO	Water Quality Objectives

1.0 INTRODUCTION

Fisheries and Oceans Canada (DFO) and Natural Resources Canada (NRCan) have prepared this Comprehensive Study Report (CSR) for the proposed Mount Milligan Gold-Copper Mine. This report fulfills DFO's and NRCan's obligations as Responsible Authorities (RAs), established under the *Canadian Environmental Assessment Act*, to conduct an environmental assessment (EA) of the Project, with input from Federal Authorities (FAs) who have the appropriate expertise.

This CSR includes a summary of the proposed Mount Milligan Gold-Copper Mine and the environment in which it is proposed to be built and operated. The results of public consultations are discussed and include consultations conducted by the Government of Canada, the Proponent Terrane Metals Corporation, and the Province of British Columbia, as well as written input received during the review of the Environmental Impact Statement (EIS) (Terrane Metals Corporation, 2008a). As per Section 16 of the *Canadian Environmental Assessment Act* (*CEAA),* 1992, ch37), this document includes a summary of the environmental effects of the Project the cumulative effects and the effects caused by accidents or malfunctions that might occur, an outline of the associated mitigation and Follow-Up measures, the determination of the significance of the effects, approval conditions and a conclusion on the environmental acceptability of the Project.

The documents listed below were used extensively in the writing of this report. These documents contain detailed information that has been used to fulfill the requirements of an environmental assessment under the *CEAA*.

- Terrane Metals Corporation, July 2008. Mount Milligan Copper-Gold Project Environmental Assessment. *Referred to herein as the Environmental Impact Statement (EIS).*
- Fisheries and Oceans Canada and Natural Resources Canada, October 2008. Comprehensive Study Scoping Document for the Proposed Mount Milligan Gold-Copper Mine. *See Canadian Environmental Assessment Registry, ref: 08-03-39778, http://www.ceaa-acee.gc.ca/050/documents/29641/29641E.pdf*
- British Columbia Environmental Assessment Office, February 2009. Mount Milligan Copper-Gold Project Assessment Report.
- AMEC, February 2009. Mount Milligan Copper-Gold Project Fish Habitat Mitigation and Compensation Plan (Version 2.0), submitted for Terrane Metals Corporation.

2.0 PROJECT OVERVIEW

2.1 Proponent Description

The Proponent for the proposed Mount Milligan Gold-Copper Mine is Terrane Metals Corporation (referred to herein as "the Proponent"); a mineral resource company with its head office in Vancouver, British Columbia.

The Mount Milligan Gold-Copper Mine property is covered by 80 mineral claims with a combined area of 34,144 ha. The claims are on provincial Crown land in the Omineca Mining Division of British Columbia. All of the mineral claims are wholly owned by Terrane.

Contact information:

Terrane Metals Corporation
Suite 1500-999 West Hastings Street,
Vancouver, BC, V6C 2W2

Tel: 604-681-9930 Email: info@terranemetals.com
Fax: 604-630-2090 Web: www.terranemetals.com

2.2 Mine location

The Proponent proposes to develop a gold-copper mine approximately 155 km northwest of Prince George, British Columbia, between the communities of Mackenzie and Fort St. James (Figure 2.2-1) The proposed Mount Milligan Gold-Copper Mine site is located in the Omineca Mining Division of North Central British Columbia (NTS map sheets 94N/1 and 93O/4). The property center is at 55'06'06" north latitude and 123'57'11" west longitude (UTM Zone 10, NAD 83 coordinates 6,106,525 m east, 439, 198 m north). Four sizeable communities are located within 160 km of the proposed mine site: Mackenzie, Prince George, Vanderhoof, and Fort St. James.

The proposed Mount Milligan Gold-Copper Mine is located within the area covered by the Province of British Columbia's Mackenzie Land and Resource Management Plan. Within that plan, the mine site is located within the Philip Enhanced Resource Management Zone which has a management objective of promoting development of high mineral values and recognizing the significance of the mineral potential of this zone.

2.3 Purpose of the Proposed Mount Milligan Gold-Copper Mine/ Project Rationale

The Proponent has stated that the purpose of the proposed Mount Milligan Gold-Copper Mine is to mine copper-gold ores at Mount Milligan to produce a metal concentrate for shipment to overseas smelters. Copper is used in industrial development worldwide. Mining is the principal source of world copper supply, with recycling of copper scrap accounting for between 11 and 13% of the annual world demand for copper. The current annual world demand for copper is 20,020 tonnes. Gold used in industrial and medical fields but it is mainly used for the production of jewellery and as a store of wealth. The current annual world demand for gold is approximately 3,700 tonnes.

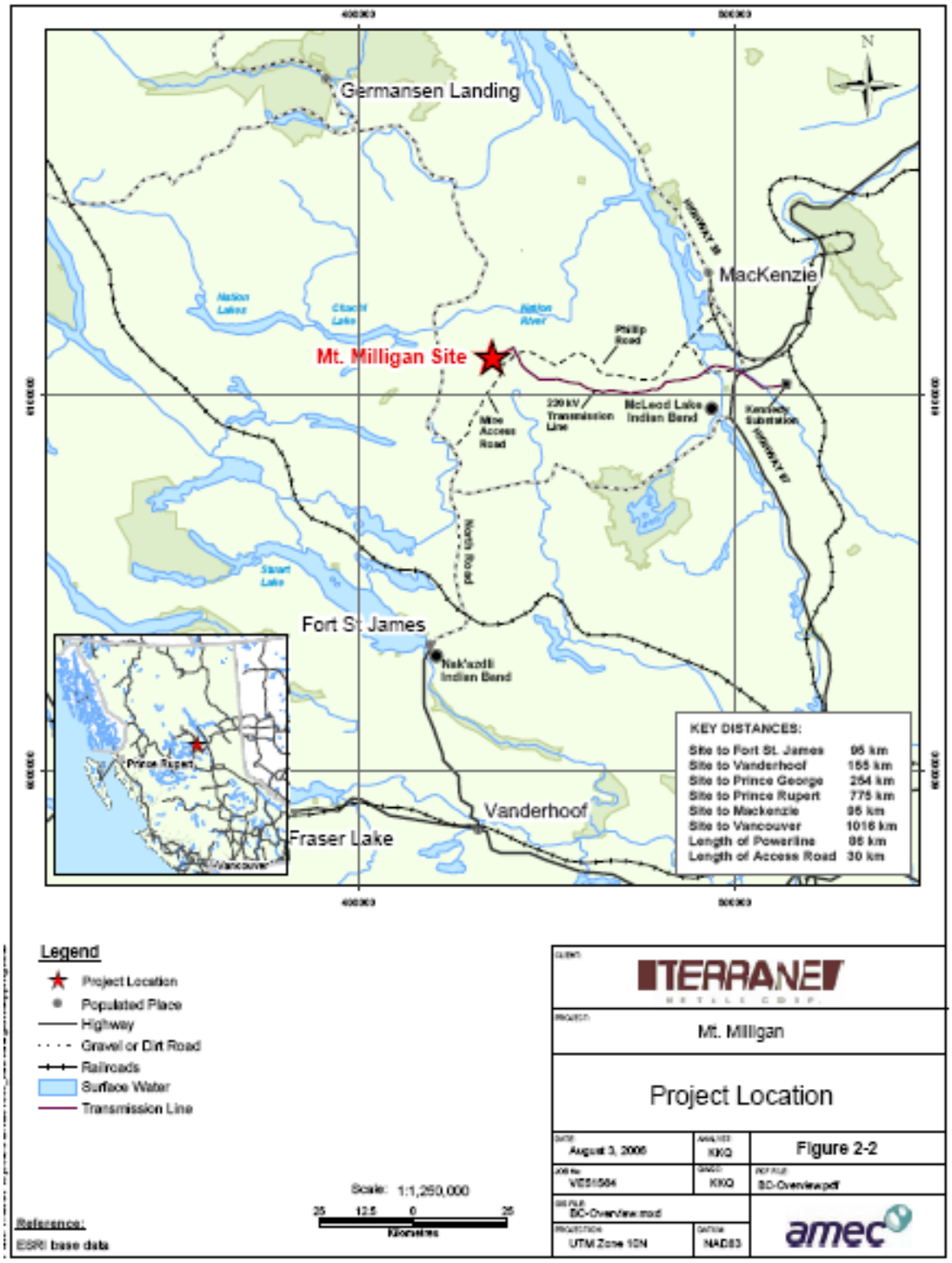

Figure 2.2-1 Location Map for the proposed Mount Milligan Gold-Copper Mine
Figure reproduced courtesy of Terrane Metals Corporation.

The Proponent indicates that in addition to supplying copper and gold to help meet worldwide demands, the proposed Mount Milligan Gold-Copper Mine will bring training, employment opportunities, and increased investment in services. The Proponent estimates that significant direct, indirect and induced employment effects of the construction phase will accrue to residents in the regional study area (including Fort St. James, Mackenzie, McLeod Lake, Vanderhoof and Prince George) and to BC as a whole.

On a national level, the Proponent suggests that development of the proposed Mount Milligan Gold-Copper Mine will contribute to Canada's role as a producer of copper and gold in the world economy and is consistent with Canada's overall strategy of encouraging private corporations to generate national export commodities and tax revenues from natural resource development.

2.4 Mine Description and Components

The proposed Mount Milligan Gold-Copper Mine is based on a conventional truck and shovel open pit mine and copper flotation process plant and is expected to process on average 88 million pounds of copper and 217,000 ounces of gold per year over a projected 15 year mine life, based on a production capacity of approximately 60,000 tonnes of ore per day (t/d).

Mineral Resource, Mineral Reserve Estimates

The Mount Milligan copper-gold porphyry deposits contain a Measured and Indicated Mineral Resource of 590.8 million tonnes at 0.193% Cu and 0.352 g/t Au containing 2.52 billion lb copper and 6.70 million oz gold. The Proven and Probable Mineral Reserve totals 333.7 million tonnes at 0.217% Cu and 0.428 g/t Au containing 1.60 billion lb Cu and 4.59 million oz gold. Both the Mineral Resource and Mineral Reserve take into consideration metallurgical recoveries, concentrate grades, transportation costs, and smelter treatment charges in determining Net Smelter Return (NSR) values. The Mineral Reserve incorporates allowances for grade dilution, mining dilution, and ore losses. The Mineral Reserve estimate has been classified as 64% Proven and 36% Probable. For more information refer to Section 3.3 of the EIS (Terrane Metals Corporation, 2008a).

Mine Components

The proposed Mount Milligan Gold-Copper Mine consists of the following on-site and off-site components and activities. For a more detailed description of the proposed Mount Milligan Gold-Copper Mine components the reader is referred to Volumes 1 and 3 of the EIS.

On-site mine components include:

- Three open pits: MBX, 66 and Southern Star. At the end of mine operations MBX and 66 will comprise one open pit;
- Processing plant (mill);
- Tailings impoundment area (TIA) which includes embankment dams (west separator berm), cleaner and scavenger tailings cells, potential acid generating (PAG) waste Separator dyke, pipeline corridor/ causeway, and supernatant recycle barge;
- Borrow pits, crusher and ore stockpiles, waste rock dumps, overburden and topsoil stockpiles, and laydown areas;
- Meadows Creek water supply pond (MCWSP);

- Site drainage and water management facilities including seepage collection, recycle pond, Rainbow Creek pump station, diversion channels, tailings and reclaim water pipelines and erosion and sediment control ponds;
- Mine site facilities including a temporary camp, administration buildings, maintenance complexes, warehouses, assay lab, fuel storage;
- Explosives facility and compound (explosives manufacturing facility and magazine facilities); and,
- Mine site haul roads.

Off-site mine components include:

- Access roads, including upgrade of the 29 km access road to the site from Highway 27;
- A 92 km transmission line connecting the mine site to the Kennedy substation south-east of Mackenzie; and,
- A concentrate load-out facility.

Mine Area

The total disturbance area of the proposed mine and associated infrastructure, including off-site components, will be approximately 1,820 hectares (a reduction of 29% from the previously permitted 1993 plan). Approximate dimensions of select mine site components are as follows:

- mine site (open pit, waste rock dumps, offices, mill, camp etc.): 367 hectares
- MBX and 66 open pit(s): 216 ha
- Southern Star open pit: 28 ha
- TIA: 813 ha
- Meadows Creek Water Supply Pond: 48 ha

The mine footprint will expand during mine operations and will reach its maximum size at approximately Year 15. At the end of operations, the MBX/66 open pits will be approximately 1800 m long, 1200 m wide and 375 m deep from the top of the highwall to its deepest point. The Southern Star pit will be approximately 1400m long, 200m wide and 300m deep from the top of the high wall to its deepest pit. The crest elevation (top of highwall) of the MBX/66 pit will be connected to the MBX pit via a sill.

All of the mine infrastructure will be located in the King Richard Creek watershed, with the exception of the northern arm of the TIA, which will extend into the headwaters of Alpine Creek. The proposed Mount Milligan Gold-Copper Mine will require stream diversions as well as use of Meadows Creek for the construction and operation of the water supply pond.

Mine Operations

Large-scale open pit mining will provide process plant feed at a nominal rate of 60,000 tonnes per day or 21.9 million tonnes per year. Annual mine production of ore and waste will peak at 44 million tonnes per year with a life-of-mine stripping ratio of 0.82/1.

Mineral Processing and Metallurgy

The 60,000 t/d process plant will use conventional crushing, grinding, rougher and cleaner flotation to produce a marketable gold-rich copper concentrate. Key process equipment will consist of:

- Primary crushing plant with a 153 x 287 mm gyratory crusher

- A 40,000 t (live) coarse ore stockpile
- SAG/ball mill/crusher grinding circuit:
  - One 12.20 m diameter x 6.71 m EGL 20-MW SAG mill
  - Two 7.62 m diameter x 12.20 m EGL 13-MW ball mills
  - Two 750 kW pebble crushers
- Flotation circuits:
  - Rougher flotation: fourteen 200 m3 tank cells in two trains
  - First cleaner flotation: seven 100 m3 tank cells
  - Second and third cleaner flotation: six 30 m3 tank cells
- Regrinding and gravity concentration circuits:
  - Five 1.1 MW (1500 hp) tower mills
  - One centrifugal concentrator
  - Concentrate dewatering circuit

Run-of-mine ore will be crushed to 80% passing 150 mm and then ground to 80% passing 220 microns (μm) before flotation. The rougher/scavenger flotation circuit will produce a high-grade rougher concentrate and a lower-grade rougher/scavenger concentrate. These concentrates will be separately re-ground in a tower mill circuit and then upgraded by three cleaner flotation stages to produce a final flotation concentrate grading on average 27% Cu.

To recover coarse metallic gold, a gravity circuit consisting of a centrifugal concentrator and shaking table will treat a portion of the cyclone underflow from the rougher concentrate regrinding circuit. The gravity concentrate will be combined with the thickened final flotation concentrate, pressure-filtered to 8% moisture and stockpiled and trucked to the rail load-out facility just north of Fort St. James. Based on a metallurgical test work program carried out on composited samples to represent process plant feed, metallurgical parameters over the 15 year mine life will be:

- Copper recovery - 84.6%
- Gold recovery - 72.3%
- Copper concentrate grade - 27% Cu and 45.4 g/t Au

Tailings Impoundment Area (TIA) and Embankment Dams

The open mine pit will yield 334 million tonnes of ore, 87 million tonnes of overburden, 188 million tonnes of waste rock and 330 million tonnes of tailings (295 Mt of scavenger tailings and 35 Mt of cleaner tailings) during a projected mine life of 15 years. Open pit overburden and non-acid generating waste rock materials will be used to construct the TIA which will impound the tailings and potentially reactive waste materials. The TIA will be located adjacent to the open pit in the King Richard Creek valley. All of the mine waste will be stored within the TIA, with the exception of a small amount of tailings and waste rock that will be back-filled into one of the open pits at the end of operations. Runoff, contact water and any spills from the mine operations area will be directed into the TIA.

Approximately 52,800 tonnes per day of low sulphur scavenger tailings and 7,200 tonnes per day of higher sulphur cleaner tailings will be deposited in separate cells within the TIA via conventional slurry delivery and distribution piping. Potentially acid-generating waste rock will be stored in the cleaner tailings cell area of the TIA; oxide and weathered waste rock material types will be segregated and placed in a causeway within the TIA.

The tailings embankments will be made from low permeability glacial till, alluvial overburden and non-acid generating rock obtained from the open pit and sand and gravel (for filter zones) from an esker borrow area near the north-east dam. The embankment dam will be about 7,300 m long and about 75 m high, and will extend from the headwaters of Alpine Lake through the King Richard Creek valley. The main embankment will be constructed and operated as a water-retaining structure, with the tailings beaches providing additional separation of the pond from the dam after an initial period of tailings deposition. A berm is required along the western edge of the impoundment across King Richard Creek to provide containment between the TIA and open pit. The west separator berm will be constructed and operated as a water-retaining structure, with the tailings beaches providing additional separation of the pond from the dam after an initial period of tailings deposition. The maximum tailings embankment height of 80 m (at 1095 m elevation) will be at the South embankment.

Seepage from the facility will be minimized by creating a compacted till cutoff trench under the dams, using extensive tailings beaches, basin underdrain towers and toe drains. Near surface seepage and runoff from the tailings dam will be collected in a network of toe ditches and seepage recycle ponds and sumps. Seepage water will be returned to the TIA. Contingency measures for deeper seepage recovery and recycle are incorporated into the design.

Process water from the Meadows Creek Water Supply Pond (MCWSP) will be reclaimed for re-use in the mill to the maximum extent possible.

Site Water Management facilities

Approximately 10 million m^3 of water will be required in the TIA for mill start-up. Water will be collected from a number of sources such as the runoff from King Richard Creek, Meadows Creek and from the disturbed catchment areas from mine construction activities. During operations, mill process water will be supplemented with water from a water supply pond to be constructed in Meadows Creek (i.e., the MCWSP).

The MCWSP will require a 20 m high dam across the Meadows Creek valley adjacent to the TIA to impound a total of approximately 2.6 million m^3 of water. The area of the pond will be about 44 ha. A pump station and pipeline will be constructed to transfer water from the pond to a process water head tank located above the mill or to the TIA.

Water balance analysis shows there would not be a discharge of excess surface water effluent from the TIA, open pit or plant site during operations as water will be collected in the TIA and used in the mill process. The minimum water volume maintained in the TIA in conjunction with MCWSP storage will be sufficient to maintain water balance in the system for a 10 year return period dry year.

However, during an extended multi-year dry period (i.e., extreme drought conditions), the Proponent has identified that additional make-up water from Rainbow Creek might be required. Due to the unlikely need for this, the RAs have not assessed potential impacts to Rainbow Creek that may result from the additional water withdrawal. Should the Proponent proceed with plans to withdrawal additional water from Rainbow Creek, an EA of the impacts may be required, subject to appropriate Acts and Regulations, or other permitting processes.

With regard to surface water management, the natural topography is incorporated into the design such that mine contact water will be directed towards the TIA and the mine pits. Surface water from disturbed areas will be managed in erosion and sediment control ponds.

Road Access

Ore concentrate will be transported from the mine site along mine site access road to the Heidi Lake exploration road junction, then along the Rainbow Creek Forest Service Road (FSR), approximately 29 km in length, to Highway 37 – Germansen North Road (approximately 58 km). The entire length of the Rainbow Creek FSR from the Germansen North Road to the mine will be upgraded and partially realigned. The re-alignment will divert traffic about 400 m south of the existing Heidi Lake Junction and would require two new crossings of Meadows Creek.

The portion of the road to be upgraded includes 33 potential stream crossings: 26 crossings in the Rainbow Creek watershed (I.e., within the Local Study Area) and 7 in the adjacent Tezzaron Creek watershed to the south (Figure 2.4-1). In addition the proposed realignment at the mine site may result in two further stream crossings within the Rainbow Creek watershed.

Mine Site Facilities/ Temporary Construction Camp

On-site accommodations for up to approximately 700 workers will be provided during the 30 month construction phase. The camp and facilities are likely to consist of: 711 single occupancy rooms in a dormitory building, kitchen and lunch room, recreation complex, administration/ truck shop/ warehouse complex, sewage treatment and potable water system. The temporary on-site construction camp accommodations (i.e., dormitory building, kitchen/ lunch room and recreation complex) will be dismantled and removed when no longer needed, prior to the mine operations phase.

There will be no on-site camp during mine operations as buses will be used to transport employees to and from the site on a daily basis. However, emergency accommodation will be provided during operations for up to 200 people within the administration/ truck shop/ warehouse building in the event that daily transport is not possible due to the possibility of severe weather conditions at the mine site or along the access road.

Explosives manufacturing facility and magazine facilities

The explosives manufacturing facility and magazine facilities will be a 200 meter by 300 meter fenced compound with infrastructure which will be located a minimum of 1000 m from other facilities. The explosives manufacturing facility and magazine facilities will include an emulsion plant, emulsion storage, two ammonium nitate silos, an office trailer, truck storage and shop, fuel storage and parts storage. There will also be three explosives magazines, two of which will hold a maximum of 7, 500 kilograms of boosters, cord and packaged explosives and one a maximum of 5, 000 detonators.

Explosives to be manufactured on site will be approximately 90% ammonium nitrate fuel oil and 10% emulsion. The mine site will store ammonium nitrate and explosives in conformance with the *Explosives Act* administered by the Explosives Regulatory Division (ERD) of NRCan.

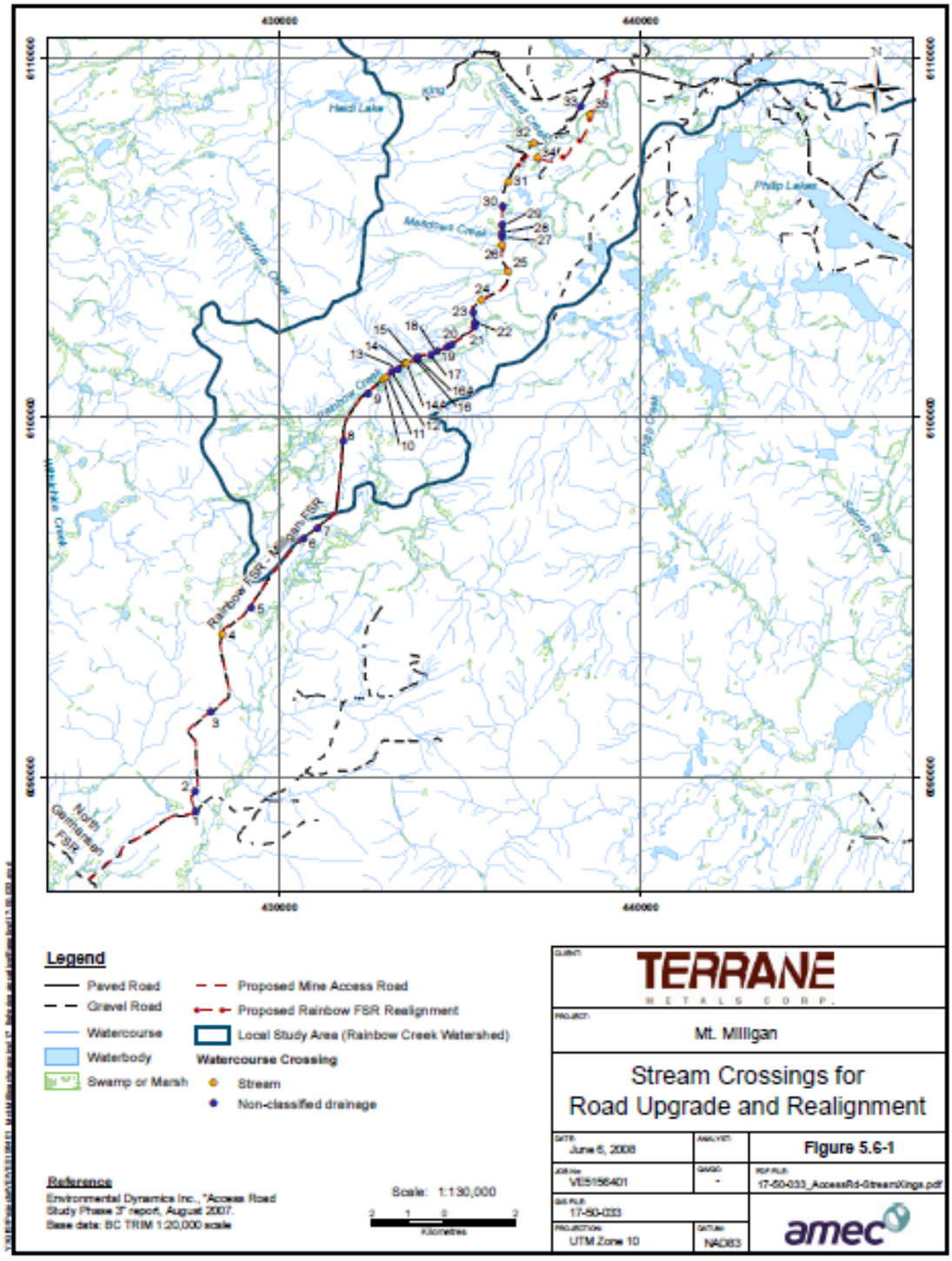

Figure 2.4-1 Stream crossings for road upgrades and realignment
Figure reproduced courtesy of Terrane Metals Corporation.

Power Line Right of Way (ROW)

Electrical power for the proposed Mount Milligan Gold-Copper mine site will be obtained from the existing Kennedy BC Hydro utility transformer station located south of Mackenzie. The transformer station will reduce the power supply voltage to 230 kV for transmission to the Mount Milligan Gold-Copper Mine site. The proposed power line will be approximately 92 km long. From the utility transformer station, it will parallel the transmission line to the Kemess Mine for 30 km, cross the Parsnip River, Pack River, Lignite Creek and Robinson Creek, then partially follow the Philips Forest Service Road and cross Philips Creek to the mine site.

The transmission line will terminate at the site main substation next to the process plant. The transmission line will be constructed of both cable-stayed steel towers and H-frame wooden structures, depending on span lengths and tangential loads. The right-of-way will be 50 m wide, with clearing of vegetation to 63 m, except where the Kemess line is parallel allowing additional clearing to be reduced to 40 m.

Off-site Concentrate Load Out Facility

Concentrate will be transported from the mine site to a rail load-out facility located 6 km north of Fort St. James, between Tachie Road and the rail line, known as the KDL site. Infrastructure will include rail siding, a warehouse and spur road to the property. The load-out facility will be developed on previously-disturbed industrial land which is predominantly cleared, except for a small treed area in the southeast corner of the site. The property will require minimal earthworks to level and is accessible by paved road; therefore, land disturbance is minimized. Ore concentrate will be transported to processing facilities off-site[1].

Decommissioning and Reclamation

The Proponent has indicated that the end land use for the reclaimed site is for wildlife, recreation and re-establishment of opportunities for traditional use of the land by First Nations. After the completion of mining, water will flow to the open pits from the tailings pond. Direct precipitation, runoff from the catchment area, regional groundwater flow and runoff from a portion of the West Separator Berm will contribute water to the former mine pits. The pits are expected to fill with water in approximately 22 years.

The Proponent proposes to establish a wetland above the cleaner tailings cell in the TIA which will be planted with native plants. As well, bog wetlands will be established over much of the central/western portion of the TIA. These wetlands are expected to create reducing conditions in the bottom sediments over the cleaner tailings and PAG waste rock thereby preventing oxygen transfer to the potentially acid generating materials.

The saturated scavenger tailings, wetlands and water cover are expected to prevent acid production and minimize metal leaching. With respect to water cover, the TIA will not have free-standing water covering all the tailings, but rather the tailings will be kept saturated by a small permanent pool, wetland and saturated (non-acid generating) scavenger tailings. For the majority of the TIA area, the water cover that keeps underlying potentially acid-generating materials saturated is the entrained pore water in the scavenger tailings.

[1] The off-site concentrate load-out facility is excluded from the scope of Project for the federal EA. However, the facility is discussed in the CSR, where appropriate for context, to describe the Proponent's assessment of fish habitat in the area surrounding the facility.

The wetlands will also polish surface runoff over the scavenger tailings surface, and after the pit lake fills, will polish the pit lake overflow. Approximately 23 ha of submergent wetland, 40 ha of emergent wetland and 299 ha of bog wetland will be created.

The upper one third of the tailings dam will be re-sloped to 3:1 and contoured to blend into the natural topography as much as is feasible. The bottom 30 m of the TIA dams will be armoured with rock to reduce erosion. Approximately 2.1 million m^3 of topsoil materials will be salvaged during construction. A total of 1.8 million m^3 of topsoil will be required for reclamation of disturbed lands. Additional surplus overburden is available from the West Separator Berm if required.

According to the Proponent, the construction camp site, road borrow pits, power pole hole spoilage and final pit bench flats above the ultimate pit lake level will be reclaimed during mine operations. All other mine site facilities including the mill, maintenance shop, explosives plant, and administrative buildings will be removed at the conclusion of mine operations. The powerline and poles (except some poles left for raptor nests) will also be removed.

The Proponent has determined that the mine will close between 2025 and 2027 with decommissioning occurring over two years. Decommissioning activity includes:

- Topsoil and overburden salvage
- Creation of landforms and revegetation of the landforms
- Implementation of the reclamation plan targeting the re-establishment of productive habitat for wildlife use
- Decommissioning of the open pit
- Waste rock use and disposal
- Closure of the TIA including: tailings materials and surface reclamation; closure and reclamation of TIA dams; wetland performance and seepage management; and, decommissioning of tailings appurtenances
- Reclamation of borrow areas, water courses (e.g. culvert removals)
- Closure and revegetation of the non-hazardous site landfill

The Proponent has indicated that all facilities relevant to closure will be maintained during the reclamation period, until they are no longer required or they become self-sustaining. Post-closure maintenance and monitoring activities are likely to require:

- Power system to the mine;
- TIA seepage recovery pumps and pipelines;
- Ditches and swales; and
- Site access roads.

2.5 Alternatives Assessment

The following sections are based on material from Sections 5.16 of the EIS, as well as supplemental information supplied during the EA review process.

Sections 2.5.1 and 2.5.2 pertain to the RAs assessment of alternatives to the Project and alternative means of carrying out the Project per the requirements under Section 16 of the *Canadian Environmental Assessment Act.* To fulfill this requirement the Proponent has identified

potential alternatives and assessed the viability of alternatives that would minimize effects to the environment.

2.5.1 Alternatives to the Project

Alternatives to the Project as determined by the Proponent included:

- Proceeding with the project in the near-term, as planned;
- Delaying the project until circumstances for its development are more favourable; and,
- Abandoning the project.

The Proponent suggests that mines are unique because ore bodies are a fixed location requiring mining of the ore body in situ; therefore, there are relatively few alternatives to the Project location. The Proponent determined that the alternative of mining the ore body on site and transporting the ore to another location for processing was not economically feasible due to the low grade of the Mount Milligan deposit, the weight and bulk-of-run-of mine ore, as well as the distance to the nearest milling operation that could conceivably handle gold-copper ores (i.e., Kemess).

The Proponent also determined that underground mining was not economically feasible due to the low grade of the deposit relative to viable operating underground mines (Terrane Metals Corporation, 2009a). This is due to much higher mining costs on a unit basis relative to open pit mining. Since underground mining methods were determined to not be feasible at the earliest stage of the Proponent's preliminary assessment, no further assessment of environmental effects of underground mining methods was conducted.

The three project alternatives that were considered by the Proponent were based on cost-effectiveness, minimizing the effects on the natural environment, minimizing the effects on the socio-economic environment, and amenability to reclamation.

Proceeding with the proposed Mount Milligan Gold-Copper Mine in the near term

The Proponent determined that the potential for adverse effects from project-related activities on the natural environment can largely be controlled. While the Proponent identified permanent and long-term temporary losses of Valued Ecosystem Components (VECs) within the King Richard, Alpine and Meadows Creek catchments, on closure the drainage areas will be restored to the extent practical and fish habitat losses will be addressed though the Fish Habitat Mitigation and Compensation Plan (FHMCP) which is summarized in Appendix D. While land disturbances resulting from the Project cannot be avoided, the proponent indicated that it will be minimized to the extent practical through a compact mine site and progressive reclamation.

Delaying the Development of the Mine

The alternative of delaying the proposed Mount Milligan Gold-Copper Mine until circumstances for its development are more favourable was determined by the Proponent to be possible, depending on future project economics, further project investigations and permitting processes. However, delaying the project does pose a risk because there is no certainty that the conditions necessary to enable the project to proceed will be present in the medium-term future.

Abandoning the Proposed Project

The Proponent determined that abandoning the proposed Mount Milligan Gold-Copper Mine would not fulfill the project purpose and would not provide for a competitive return on investment. Employment, tax and royalty revenues would be foregone as would business opportunities for communities and BC in general. Project abandonment is considered an

unacceptable alternative. While the alternative of abandoning the project would limit the amount of reclamation required to only those areas that have been impacted to date as a result of exploration and other project investigations, the Proponent has indicated that the "no project" alternative would mean the loss of economic, employment, business and training opportunities.

Taking the above perspectives into consideration, the Proponent proposes to proceed with seeking the necessary approvals to enable the development of the proposed Mount Milligan Gold-Copper Mine in a timely manner, as described in the Project Description in Volume 3 of the EIS.

2.5.2 Alternative Means of Carrying out the Project

The Proponent discusses alternative means of carrying out the Project in Volume 5, Section 5.16.10 of the EIS. Under Section 16 (2)b of the *CEAA* a comprehensive study must consider alternative means of carrying out the project that are technically and economically feasible and the environmental effects of any such alternative means. Examining alternative means of carrying out a project involves answering the following four questions:

1. What are the alternatives?
2. Are these alternatives technically and economically feasible?
3. What are the environmental effects associated with the feasible alternatives?
4. What is the rationale for selecting the preferred alternative?

Several alternative means of carrying out the proposed Mount Milligan Gold-Copper Mine were considered by the Proponent and are described below. The alternatives considered were:

- Mine size;
- Waste rock and TIA;
- Metallurgical process;
- Water management;
- Road access;
- Power line right-of-way;
- Concentrate load-out facility; and
- Construction camp.

The performance objectives for the alternatives were rated as preferred (i.e., minimizes adverse effects without mitigation), acceptable (i.e., minimizes adverse effects with mitigation) or unacceptable (i.e., likely to cause significant or irreversible adverse effects that can not reasonably be mitigated) and were based on the following performance objectives:

- Adverse effects on the natural environment;
- Adverse effects on the socio-economic environment;
- Amenability to reclamation;
- Cost-effectiveness; and
- Technical applicability and/or system integrity and reliability.

Mine Size

The size of the proposed Mount Milligan Gold-Copper Mine (i.e., ore reserve and mill throughput) was optimized for economic return by the Proponent. A reduction of mill throughput would diminish the effects of economy of scale, thereby increasing costs per unit of production. Since the basic elements of design for environmental protection and worker and community health and safety would not change significantly with changes in mine size, the Proponent did not conduct a broad multi-attribute assessment of alternatives in mine size.

Waste Rock Disposal and Tailings Impoundment Area

For further details regarding the Waste Rock Disposal and Tailings Impoundment Area refer to Section 5.16.3 of the EIS as well as the Knight Piésold Mine Waste Alternatives (2007). Two types of mine tailings require disposal during operations (i.e., cleaner tailings and scavenger tailings).

Six potential mine development concepts (MDC) for tailings and waste rock disposal options were considered:

MDC1: scavenger and cleaner tailings storage at King Richard Creek

1. MDC2: scavenger and cleaner tailings storage at Upper Rainbow Creek
2. MDC3: scavenger tailings storage at Upper Rainbow Creek and cleaner tailings storage at King Richard Creek
3. MDC4: scavenger tailings storage at Limestone Creek and cleaner tailings storage at King Richard Creek
4. Heidi Lake
5. A site located north of the open pit as proposed by Nak'azdli First Nation

Heidi Lake and the site north of the open pit were not deemed feasible by the Proponent as they did not have satisfactory storage capacity for the tailings. As well, the site suggested by the Nak'azdli First Nation was rejected because:

- It would not provide adequate spill containment and posed more problematic PAG waste disposal, being further from the mine pits and plant site; and,
- It had less favourable closure characteristics because it could not be easily integrated with pit closure.

After these two sites were eliminated, the Proponent examined the MDC1 to MDC4 alternatives. The waste rock and tailings alternatives were evaluated against the performance objectives listed above. Other factors that were considered included operational, geotechnical, environmental and land tenure issues. Water management was also a key consideration as was the size of the diverted catchment area due to the potential complexity and cost of water management structures and tailings impoundment sites. On behalf of the Proponent, Knight Piésold Consulting developed a comparative economic assessment using unit costs including: initial capital costs, ongoing capital costs and annual operating costs for each alternative. They determined that the costs for MDC1, MDC2 and MDC3 were comparable and acceptable, with MDC1 being the least expensive alternative.

It was determined that the MDC1, MDC3 and MDC4 sites had a location advantage of gravity tailings discharge; which is less costly than pumping. Because the MDC2, MDC3 and MDC4 sites would require long pipelines and extensive pumping requirements, costs would increase. The costs for MDC4 were considerably higher than they were for the three other sites and thus this was deemed unacceptable. A summary of the Proponent's evaluation is provided below in Table 2.5-1.

While all the alternatives assessed would have some adverse environmental effects, a TIA on King Richard Creek (MDC1) was considered by the Proponent to have less significant environmental effects than the three others examined. Knight Piésold determined that that storing both the cleaner tailings and scavenger tailings at the King Richard Creek location was the preferred option due to the lower cost for tailings storage, the compact mine development footprint and its location below the mine. MDC1 is at a lower elevation than the plant site and so gravity flow of tailings could be used in the early stages of mine development, though pumping would be required in the later stages. Further, the tailings pipeline would not need to be under high pressure so potential for leaks or pipeline bursts and the associated environmental risks are reduced. In addition, any unexpected discharges to surface water would flow by gravity into the TIA, which would contain any site runoff (and therefore pose a lower risk to the environment).

In addition, at MDC2 there is potential for seepage to affect water bodies and watersheds other than those within the Rainbow Creek watershed (i.e., Tezzeron Creek - Wittsichia Creek - Nation River). In the proposed MDC2 area, the western portion of the Rainbow Creek basin is underlain by high permeability, pressurized glacial outwash deposits that would necessitate complex seepage control measures with multiple levels of protection to prevent seepage water from entering Rainbow Creek. The complexity of these barriers would increase environmental risks. Further, this site has a large catchment area and there is an increased potential for water management issues.

Site MDC2 is located at distance from the plant site which would necessitate pressurized tailings and reclaim pipelines that may present a higher spill risk. As a result of these risks, this site was deemed to be unacceptable. Site MDC3 is also located at distance from the mine site and presents the same risks as MDC2. This site was also deemed to be unacceptable. Site MDC4 was deemed to be unacceptable because of operational complexities which are due to operating two separate facilities. Long, pressurized tailings and reclaim pipelines would be required therefore the Proponent determined this site was generally considered to have higher environmental effects. Both MDC2 and MDC3 have significant technical and environmental concerns that ruled them out of further consideration and MDC4 was the most expensive alternative.

MDC1 has been identified by the Proponent as the preferred option for the following reasons:

- the compact mine development footprint maximizes operational flexibility and reduces environmental effects (PAG waste rock management)
- the location below the mine facilities allows gravity flow of tailings and capture of run-off, seepage and spills from pits and plant site, resulting in lower environmental risks
- the Proponent considers King Richard Creek to have lower fish habitat values than Rainbow or Limestone Creeks
- closure concepts are simpler at MDC1 than for the other options with routing of final tailings pond supernatant into the nearby mined-out pits
- MDC1 has the lowest total costs for tailings storage

Table 2.5-1: Waste Rock Disposal and TIA Alternatives Evaluation and Rating by Proponent

Performance Objective	Alternatives			
	MDC1	**MDC2**	**MDC3**	**MDC4**
Cost-effectiveness	Deemed to have comparable costs to MDC2 and MDC3 **Proponent's Rating: Acceptable**	Deemed to have comparable costs to MDC1 and MDC3 **Proponent's Rating: Acceptable**	Deemed to have comparable costs to MDC1 and MDC3 **Proponent's Rating: Acceptable**	Costs deemed to be considerably higher than other alternatives **Proponent's Rating: Unacceptable**
Minimize effects on the natural environment	Site has lower fish habitat quality, is close to the mine site, is at a lower elevation than the mine site **Proponent's Rating: Preferred**	Site has high quality fish habitat, is some distance from the mine site, would need pressurized tailings and reclaim pipelines, seepage could enter watersheds other than Rainbow Creek **Proponent's Rating: Unacceptable**	Site has high quality fish habitat, is some distance from the mine site, would need pressurized tailings and reclaim pipelines, seepage could enter watersheds other than Rainbow Creek **Proponent's Rating: Unacceptable**	Operational complexity due to operation of two separate facilities, one site is far from the mine site, pressurized tailings and reclaim pipelines increase environmental risk **Proponent's Rating: Unacceptable**
Minimize effects on the socio-economic environment	No socio-economic effects foreseen. King Richard Creek is unlikely to be used by local fishers **Proponent's Rating: Preferred**	No socio-economic effects, positive or negative, foreseen **Proponent's Rating: Acceptable**	No socio-economic effects, positive or negative, foreseen **Proponent's Rating: Acceptable**	No socio-economic effects, positive or negative, foreseen **Proponent's Rating: Acceptable**
Amenability to reclamation	Reclamation to is possible, closest to the open pit **Proponent's Rating: Preferred**	Reclamation is possible **Proponent's Rating: Acceptable**	Reclamation is possible **Proponent's Rating: Acceptable**	Reclamation is possible **Proponent's Rating: Acceptable**
Technical Applicability and/or System Integrity and Reliability	Embankment built to withstand seismic activity **Proponent's Rating: Acceptable**	Embankment built to withstand seismic activity **Proponent's Rating: Acceptable**	Embankment built to withstand seismic activity **Proponent's Rating: Acceptable**	Embankment built to withstand seismic activity **Proponent's Rating: Acceptable**
Summary Evaluation by the Proponent	**Rating: Preferred**	**Rating: Unacceptable**	**Rating: Unacceptable**	**Rating: Unacceptable**

Metallurgical Process

Flotation is the proposed metallurgical process and, according to the Proponent, is the most common milling process used in the world. It generally uses biodegradable reagents and can produce relatively benign tailings solutions and solids.

Three other metallurgical processes were studied by the Proponent:

- Cyanidation of a pyrite concentrate for gold recovery as bullion;
- Pressure oxidation (autoclave) of a copper concentrate to produce cathode grade copper; and,
- Heap leaching using cyanide.

In assessing the metallurgical processes, the proponent evaluated the options based on cost-effectiveness and minimizing the effects on the natural environment. In its assessment of processing methods, the Proponent determined that flotation was the most appropriate process because it poses lower environmental risks compared to cyanidation, pressure oxidation and heap leaching processes. According to the Proponent, lab scale gold recoveries were considered relatively low and processing using heap leaching with cyanide in winter was considered too difficult. In addition, while initial estimates of freshwater requirements for the mill suggested approximately 150 m^3/hour might be needed for the process, further metallurgical evaluation showed that a higher proportion of recycle water from the TIA could be used for the process. Therefore, the quantity of freshwater required for the mill (e.g., reagent make-up water and gland water) could be reduced to approximately 20m^3/hr. The Proponent found that this change reduced the potential adverse effects on stream flow volumes further making the flotation process the preferred option.

Water Management

The proposed Mount Milligan Gold-Copper Mine will require the collection of 10 million m^3 of freshwater for start-up of mill processing. Six alternatives were examined as a source of process water: upper Rainbow Creek, Meadows Creek, Limestone Creek, Philip Lakes, Limestone Lake, and groundwater. A detailed analysis was carried out and the preferred alternative was a pond on Meadows Creek; the results of which are provided in Table 2.5-2.

The Proponent determined that the Meadows Creek pond option had the lowest environmental effects of the feasible options. It would be smaller in area, result in a smaller overall project footprint and require a much shorter pipeline than the Upper Rainbow Creek and Limestone Creek options. Although the Philip Lakes or Limestone Lake alternatives would not require a dam to raise water levels, they would result in a larger project footprint and need long pipelines to reach the mine, and in the case of Limestone Lake, a road would have to be built to reach the pump station.

The Proponent determined that the Meadows Creek pond option had the lowest environmental effects of the feasible options. It would be smaller in area, result in a smaller overall project footprint and require a much shorter pipeline than the Upper Rainbow Creek and Limestone Creek options. Although the Philip Lakes or Limestone Lake alternatives would not require a dam to raise water levels, they would result in a larger project footprint and need long pipelines to reach the mine, and in the case of Limestone Lake, a road would have to be built to reach the pump station.

Table 2.5-2 Water Management Evaluation

Performance Objective	Alternatives					
	Upper Rainbow Creek	**Meadows Creek**	**Philip Lakes**	**Limestone Lake**	**Limestone Creek**	**Groundwater**
Cost-effectiveness	Long pipeline; pump station and dam needed **Proponent's Rating: Acceptable**	Shortest pipeline; pump station and dam needed **Proponent's Rating: Preferred**	No dam needed, pipeline and pump station needed; no road needed **Proponent's Rating: Acceptable**	No dam needed; pipeline and pump station needed; road needed **Proponent's Rating: Acceptable**	Long pipeline, pump station and dam needed **Proponent's Rating: Acceptable**	Multiple wells and pipelines needed. Questionable if enough water could be obtained. **Proponent's Rating: Acceptable**
Minimize effects on the natural environment	Pond would have large surface area; large watershed to provide water **Proponent's Rating: Acceptable**	Pond would have small surface area and most compact project footprint. **Proponent's Rating: Preferred**	Pipeline along road right-of-way; minimal site disturbance; may have potential downstream effects **Proponent's Rating: Unacceptable**	Need a road to be built; long pipeline; minimal site disturbance **Proponent's Rating: Unacceptable**	Long pipeline, pump station and dam needed **Proponent's Rating: Acceptable**	Multiple pipelines needed; may affect regional groundwater supplies **Proponent's Rating: Unacceptable**
Amenability to reclamation	Can be successfully reclaimed **Proponent's Rating: Acceptable**	Can be successfully reclaimed **Proponent's Rating: Acceptable**	Would not need reclamation being an existing waterbody **Proponent's Rating: Preferred**	Would not need reclamation being an existing waterbody **Proponent's Rating: Preferred**	Can be successfully reclaimed **Proponent's Rating: Acceptable**	Would not need reclamation **Proponent's Rating: Preferred**
Summary Evaluation	**Proponent's Rating: Acceptable**	**Proponent's Rating: Preferred**	**Proponent's Rating: Acceptable**	**Proponent's Rating: Acceptable**	**Proponent's Rating: Acceptable**	**Proponent's Rating Acceptable**

The Proponent determined that the Meadows Creek pond option had the lowest environmental effects of the feasible options. It would be smaller in area, result in a smaller overall project footprint and require a much shorter pipeline than the Upper Rainbow Creek and Limestone Creek options. Although the Philip Lakes or Limestone Lake alternatives would not require a dam to raise water levels, they would result in a larger project footprint and need long pipelines to reach the mine, and in the case of Limestone Lake, a road would have to be built to reach the pump station.

According to the Proponent, all water supply alternatives assessed were judged to be amenable to reclamation. Alternatives that would utilize existing lakes were rated higher since they would not need significant reclamation to be returned to their pre-project form and function. Similarly, groundwater wells would have a minimal surface footprint and thus were rated higher with respect to this objective; however, the predicted groundwater yield was insufficient to supply process needs and therefore this alternative was deemed not technically feasible and discarded. The Proponent rated the Meadows Creek alternative as so preferable over the other alternatives with respect to cost-effectiveness and minimizing effects on the natural environment both due to its proximity to other project facilities and its relatively small size, that the difference between alternatives with respect to the amenability to reclamation objective was not a determining factor.

Meadows Creek Water Storage Pond will require a 20 meter high dam across Meadows Creek Valley and will impound a total of 2.6 million m^3 of runoff (~44 ha). A pump station and pipeline will be constructed to transfer the water from the pond to a process water head tank located above the mill, or to the TIA.

Road Access

Three road access alternatives were assessed:

- From Fort St. James: Highway 37 (Germansen North Road) (58 km) – Rainbow FSR (29 km) to the Heidi lake exploration road junction, a total distance of about 87 km. The Germansen North road is a gravel public road maintained by the Ministry of Transportation and the Rainbow FSR is an existing all-weather industrial forestry haul road about 5 m wide with an average grade of approximately 8%.
- From Mackenzie: Causeway forest service road – Philip FSR – Philip North FSR network of forestry roads to the Heidi Lake exploration road junction, a total distance of 89 km. This route consists of all-weather industrial forestry roads about 7 m wide with an average grade of 8 %. The present use of the FSR network is commercial forestry, mineral exploration and recreational light vehicle use.
- A new road from Germansen North road at about kilometre post 88 which would run easterly for approximately 18 km to connect with the Heidi Lake exploration road junction with Philip North FSR.

The Proponent's assessment of road access options considered environmental concerns, public safety, constructability, creek crossings, capital cost for the road upgrade, replacement or upgrade of watercourse crossings, road maintenance costs, cycle times for buses and concentrate haul trucks, as well as load-out location; the results of which are provided in Table 2.5-3.

The Fort St. James-Rainbow FSR option utilizes existing roads and disturbance corridors and therefore requires less upgrading than the Mackenzie option. Due to the pre-existing disturbance associated with the current road, the Proponent considered it to have less environmental effects than the Mackenzie option. The Mackenzie route would require considerable upgrading, including improvements to 12 major stream crossing structures. The option of a new road from Germansen North would require construction of a bypass around the mine site through difficult terrain in order to

connect the new road to the Philip North FSR. Several potential bypass alignments were examined but all posed considerable technical challenges.

The Proponent determined that the new road alternative would result in adverse environmental effects because it would cross previously undisturbed forested land. Additionally, it would have a greater impact on forest harvesting and cause additional land fragmentation (associated with adverse affects on fish and wildlife, increased hunting and fishing pressures, as well as general human access). The Proponent has therefore determined that for these reasons, the Fort St. James-Rainbow FSR option is the preferred option.

Table 2.5-3 Road Access Alternatives Evaluation

Performance objective	**Alternatives**		
	Mackenzie Road	**Fort St. James Road**	**New Road**
Cost-effectiveness	Upgrade costs would range from $4.2 million to $6.8 million, maintenance costs would be $3.52 per tonne hauled **Proponent's Rating: Acceptable**	Upgrade costs would range from $2.2 million to $3.3 million, maintenance costs would be $0.84 per tonne hauled **Proponent's Rating: Acceptable**	Construction cost would be approximately $2.2 million, maintenance costs would be approximately $0.47 per tonne hauled **Proponent's Rating: Acceptable**
Minimize effects on the natural environment	Would upgrade an existing road, some widening required, watercourse crossings can be installed with acceptable environmental consequences **Proponent's Rating: Acceptable**	Would upgrade and existing road, some widening required, watercourse crossings can be installed with acceptable environmental consequences **Proponent's Rating: Preferred**	Would disturb previously undisturbed forest land, remove land from production and open the area to hunters and fishers **Proponent's Rating: Unacceptable**
Minimize effects on the socio-economic environment	No significant effects, positive or negative, foreseen. Potentially less direct economic benefit to Fort St. James, but difficult to estimate. **Proponent's Rating: Acceptable**	No significant effects, positive or negative, foreseen. Potentially less direct economic benefit to Mackenzie, but difficult to estimate. **Proponent's Rating: Acceptable**	No significant effects, positive or negative, foreseen. Potentially less direct economic effect to Mackenzie, but difficult to estimate. **Proponent's Rating: Acceptable**
Amenability to reclamation	Can be reclaimed, all watercourse crossings removed, the road sloped, rip rapped and seeded follows standard decommissioning practices **Proponent's Rating: Acceptable**	Can be reclaimed, all watercourse crossings removed, the road sloped, rip rapped and seeded, follows standard decommissioning practices **Proponent's Rating: Acceptable**	Can be reclaimed. All watercourse crossings removed, road sloped, rip rapped and seeded following standard decommissioning practices **Proponent's Rating: Acceptable**
Summary Evaluation	**Proponent's Rating: Acceptable**	**Proponent's Rating: Preferred**	**Proponent's Rating: Unacceptable**

Powerline Right-of-Way

Electrical power for the Mount Milligan Gold-Copper Mine site will be obtained from the existing Kennedy BC Hydro utility transformer station located south of Mackenzie. The transformer station will reduce the power supply voltage to 230 kV for transmission to the Mount Milligan Gold-Copper Mine site. The Proponent considered two alternative power line routes: An 88 km long route (initially proposed in 1991) and a 92 km long 'refined' option. The refined route avoids an area between KM

35 and KM 41 identified by First Nations as having high value. The route parallels the existing Kemess line right-of-way for approximately the first 35 km and partially follows the Philips FSR thereafter. The Proponent has identified that following the Kemess line right-of-way, the area of new disturbance is decreased. Similarly the power line would cross the Pack and Parsnip rivers, Highway 93 and BC Rail tracks at the same locations as the Kemess line, which avoids establishment of new crossings. The 'refined' routing also follows existing roads and clearcuts (i.e., areas that have previously been disturbed) as much as possible. The Proponent has determined that the refined route is the preferred option. A summary of the Power Line Right-of-way Alternatives Evaluation is provided in Table 2.5-4.

Table 2.5-4 Power Line Right-of-Way Alternatives Evaluation

Performance objective	**Alternatives**	
	Original Routing	**Refined Routing**
Cost-effectiveness	Cost per km to construct $265,405 **Proponent's Rating: Acceptable**	Cost per km to construct $275,770 **Proponent's Rating: Acceptable**
Minimize effects on the natural environment	Does not follow a disturbed area, crosses the Pack and Parsnip rivers independent of the Kemess power line, shorter line **Proponent's Rating: Acceptable**	Follows the Kemess power line, crosses the Pack and Parsnip rivers close to the Kemess power line, Highway 93 and the rail line with the Kemess power line; avoids areas with adverse soil conditions, longer line (by 3.4 km) **Proponent's Rating: Preferred**
Minimize effects on the socio-economic environment	Passes through an area identified as having high value to First Nations **Proponent's Rating: Unacceptable**	Avoids an area between KM 35 and 41 identified by First Nations as having high value **Proponent's Rating: Preferred**
Amenability to reclamation	ROW will be reclaimed and planted with approved seed mixes and wildlife habitat created, following accepted decommissioning practices **Proponent's Rating: Acceptable**	Right-of-way will be reclaimed and planted with approved seed mixes and wildlife habitat created, following accepted decommissioning practices **Proponent's Rating: Acceptable**
Evaluation	**Proponent's Rating: Unacceptable**	**Proponent's Rating: Preferred**

Construction Camp

The Proponent is proposing to provide on-site accommodations for up to approximately 700 workers during the 30 month construction phase. The temporary camp will be dismantled and removed when no longer needed. Two alternate locations for the construction camp, one 2.5 km east-southeast of the mine pit and one 250 m directly south of the plant site were examined by the Proponent the results of which are provided in Table 2.5-5.

The preferred camp site is located closer to the plant site and is within the TIA containment area, so any runoff or spills would be captured in the TIA. The Proponent identified that this option would result in a smaller overall mine footprint and would minimize the bussing of workers from the camp to the work areas, thereby reducing vehicle emissions.

Table 2.5-5 Construction Camp Alternatives Evaluation

Performance Objective	Alternatives	
	Site 1 (2.5 km from plant site)	**Site 2 (250 m from plant site)**
Cost-effectiveness	Camp site has 711 beds, sewage, potable water and waste management system **Proponent's Rating: Acceptable**	Camp site has 711 beds, sewage, potable water and waste management system **Proponent's Rating: Acceptable**
Minimize effects on the natural environment	Buses would be used to transport workers, site lies outside TIA containment area. **Proponent's Rating: Acceptable**	Buses would not be needed to transport workers reducing effects on air quality, camp lies within TIA containment area **Proponent's Rating: Preferred**
Minimize effects on the socio-economic environment	Conditions would be the same for both camps **Proponent's Rating: Acceptable**	Conditions would be the same for both camps, provision will be made for people working at night to ensure they get proper rest **Proponent's Rating: Acceptable**
Amenability to reclamation	At the end of construction, buildings and utilities, walkways, sewer, water piping and external electrical equipment etc will be removed and the camp site reclaimed, levelled, and seeded **Proponent's Rating: Acceptable**	At the end of construction, buildings and utilities, walkways, sewer, water piping and external electrical equipment etc will be removed and the camp site reclaimed, levelled, and seeded **Proponent's Rating: Acceptable**
Summary Evaluation	**Proponent's Rating: Acceptable**	**Proponent's Rating: Preferred**

2.6 Development Schedule

The start of construction may be subject to change due to market conditions and/or permitting requirements. The commencement of construction activities was originally scheduled for the second quarter of 2009 with the start of mill operations by the first quarter of 2012. At the time of writing this Comprehensive Study Report, the predicted timing of the various phases of mine construction, operations and closure is shown in Table 2.7-1. The references (in calendar years) to timing of the stages of mine development in this document have been changed from the original project execution plan, to reflect current timing of project stages

Table 2.6-1 Development of Project Components by Project Phase

EA Schedule	Current Proposed Schedule	Project Stage
2009	2010	First year of construction (year -2) Q3 2010
2010	2011	Second year of construction (year -1)
2011	2012	Third year of construction (year -0)
2012	2013	Start of operations (year 1)
2017	2018	Year 6 of operations
2027	2028	Final year (year 16) of operations
2030	2031	Closure (three years after ceasing operations, pit lake filling)
2047	2048	Post-closure (approximately twenty years after ceasing operations, pit lake filled)

3.0 REGULATORY OVERVIEW

3.1 Federal Legislation and Policy

Under Section 5 of the *Canadian Environmental Assessment Act*, a federal environmental assessment may be required when, in respect of a project, a federal authority proposes to:

- Be the Proponent;
- Make or authorize payment or any other form of financial assistance to a Proponent;
- Sell, lease or otherwise dispose of land; or
- Issue a permit, or licence or other form of approval pursuant to a statutory or regulatory provisions identified in the *Law List Regulations*.

A federal authority may be any agency or department of the Government of Canada, or Minister of the Crown in right of Canada. A federal authority that proposes to undertake one of the above actions is a responsible authority (RA) and is required to ensure that a federal environmental assessment is conducted in accordance with the *CEAA*.

In relation to the proposed Mount Milligan Gold-Copper Mine, Fisheries and Oceans Canada and Natural Resources Canada have identified themselves as responsible authorities and have determined that an environmental assessment is required. Specifically, DFO may issue an Authorization pursuant to subsection 35(2) of the *Fisheries Act* for the harmful alteration, disruption or destruction of fish habitat. Further, regulations to be made by the Governor in Council are contemplated to list the headwaters of King Richard Creek and Alpine Creek as a Tailings Impoundment Area on Schedule 2 of the *Metal Mining Effluent Regulations*, pursuant to paragraphs 36(5) (a) to (e) of the *Fisheries Act*. NRCan may issue a licence pursuant to Section 7(1) (a) of the *Explosives Act*.

As RAs, DFO and NRCan have determined that certain components of the proposed Mount Milligan Gold-Copper Mine, that are included within the proposed scope of project, are subject to a comprehensive study, pursuant to paragraphs 16(a), (b) and (c) of the Comprehensive Study List Regulations of *CEAA*, as follows:

S. 16. The proposed construction, decommissioning or abandonment of:

a) *a metal mine, other than a gold mine, with an ore production capacity of 3 000 t/d or more;*

b) *a metal mill with an ore input capacity of 4 000 t/d or more;*

c) *a gold mine, other than a placer mine, with an ore production capacity of 600t/d or more.*

Resulting from the Minister of Environment's Notice of Decision undertaken May 15, 2009, DFO and NRCan are required to ensure that a comprehensive study is conducted in relation to the development proposal: Mount Milligan, Gold Copper Mine. The Canadian Environmental Assessment Agency (CEA Agency) is the Federal Environmental Assessment Coordinator (FEAC) for this environmental assessment regarding matters of interpretation of the *CEAA* and the assessment methodology.

A comprehensive study under *CEAA* is conducted based upon a self-assessment approach in which the responsible authorities consider a project's environmental effects as presented by the Proponent before making any irrevocable decisions allowing the project to proceed. DFO and NRCan have ensured that the environmental assessment process and the comprehensive study report are in compliance with the requirements of the *CEAA*.

3.2 Expert Federal Authorities

Expert federal authorities are federal authorities (FAs) that are identified through the Federal Coordination Regulations process as having existing knowledge or expertise relevant to the environmental assessment of the project. Federal authorities are consulted during the scoping process and during review of environmental assessment information submitted by the Proponent and any other material relating to the Comprehensive Study Report. Each federal authority is consulted prior to the submission of the CSR to the Minister of the Environment. Federal authorities do not however have decision making responsibilities in relation to a comprehensive study.

The other federal departments consulted to determine whether they have interests with regard to the project or to obtain comments on their respective requirements concerning the environmental assessment under the *CEAA*, are the Department of Indian and Northern Affairs Canada (INAC), Environment Canada (EC), Transport Canada (TC) and Health Canada (HC).

Environment Canada and Health Canada are FAs that have provided specialist or expert advice in support of the environmental assessment process for the proposed Mount Milligan Gold-Copper Mine. EC's areas of interest include mine waste and tailings management, water quality, hydrology and wildlife. HC's areas of interest are human health impacts due to changes in the biophysical environment, including air quality, drinking water quality, noise and country foods.

3.3 Other Federal Agencies

TC reviewed the Proponents draft EIS and determined that no approval would be required under the *Navigable Waters Protection Act.*

3.4 Canada-BC Agreement for Environmental Assessment Cooperation

Under the terms of the Canada-BC Agreement for Environmental Assessment Cooperation (2004), projects that require an environmental assessment by both the Government of Canada and the Government of British Columbia undergo a single, cooperative assessment, where possible, to meet the environmental assessment requirements of both governments. Each government then makes project-related decisions on matters within its own legislative authority. The CEA Agency, in its role as the FEAC, facilitated the coordination of the federal review process in cooperation with the BC Environmental Assessment Office (BC EAO).

Efforts to coordinate meeting the requirements of British Columbia's *Environmental Assessment Act (*BC *EAA)* and the *CEAA* were harmonized until the Government of British Columbia granted an Environmental Assessment Certificate on March 16, 2009. Since then, the federal RAs have continued the comprehensive study process, as required by *CEAA*.

The EIS has been subject to review by both federal and provincial agencies through the technical working groups which were led by the BC EAO as part of the provincial process. This CSR incorporates the results of the harmonized process and fulfills the legal responsibilities of the federal RAs.

3.5 Provincial Process

In October 2006, the Proponent submitted a Project Description to the BC EAO. Based on a review of the Project Description, the BC EAO determined that the proposed Mount Milligan Gold-Copper Mine was reviewable under the BC *EAA* pursuant to Part 3 of the Reviewable Project Regulation

(B.C. Reg. 370/02), because the proposed mine would have a production capacity greater than or equal to 75,000 tonnes per year of mineral ore.The CEA Agency, DFO, EC, HC and NRCan participated in the Working Group meetings held by the BC EAO during the provincial review process. The process and working group membership is further described in the BC EAO Assessment Report (2009). Henceforth the term "Working Group" will be used to refer to the federal government agencies, provincial agencies, First Nations and stakeholders that participated in these meetings. Public participation and First Nations engagement occurred during the provincial review process through the Working Group (with the exception of Nak'azdli First Nation). This is further discussed in Section 6.0 of this report (Stakeholder Engagement and Public Participation). On March 16th, 2009, the BC government issued an environmental assessment certificate pursuant to the BC *Environmental Assessment Act* (BC *EAA*) for the proposed Mount Milligan Gold-Copper Mine.

3.6 Provincial/Regional/Municipal Governments Consulted Within the Process

In addition to the formal input received as part of the cooperative environmental assessment as described in the BC EAO Assessment Report (BC EAO, 2009), DFO has consulted with the Environmental Stewardship Division Fish and Wildlife Section of the Ministry of Environment (MOE) Omineca Region on the proposed fish and fish habitat impacts, mitigation and the fish and Fish Habitat Mitigation and Compensation Plan.

3.7 Species at Risk

The purposes of the *Species at Risk Act (SARA*) of *SARA* are to: prevent Canadian indigenous species, subspecies and distinct populations of wildlife from being extirpated or becoming extinct; to provide for the recovery of wildlife species that are extirpated, endangered or threatened as a result of human activity; and to manage species of special concern to prevent them from becoming endangered or threatened. The RAs are required to consider impacts to federally listed Species-at-Risk (SAR) and whether any other federal permits may be required. The RAs are also required to consider whether impacts to the SAR can be sufficiently mitigated as proposed by the Proponent, have been sufficiently addressed through other regulations or processes (e.g., BC *EAA*), or whether additional mitigation measures may be required.

If a species is listed under Schedule 1 of *SARA* as extirpated, endangered or threatened, that species has legal protection related to the species' residence and critical habitats as well as recovery planning. Critical habitats are those habitats identified as necessary for the survival or recovery of a listed aquatic or wildlife species, as identified through a recovery strategy or action plan. For Species of Special Concern, there is not a similar legal prohibition per se; however, recovery planning is likely to include the development of a management plan specific to that species.

Provincially, species and ecological communities are designated a Conservation Status Rank by the BC Conservation Data Center which are based on colour-coded listings by the MOE. A Red, Blue or Yellow listing indicates ecological communities that have particular threats, declining population trends, or restricted distributions that would require special attention, as follows:

- The Red list includes any ecological community, and indigenous species and subspecies that is extirpated, endangered, or threatened;
- The Blue list includes any ecological community, and indigenous species and subspecies considered to be of special concern; and,
- The Yellow List includes uncommon, common, declining and increasing species.

4.0 SCOPE OF THE ENVIRONMENTAL ASSESSMENT AND IMPACT ASSESSMENT METHODOLOGY

Environmental Assessment is a process for predicting, evaluating, mitigating, monitoring and managing environmental effects of a proposed project. It is used as a planning tool to help guide decision making, as well as project design and implementation. Fundamentally environmental assessment is a process whereby:

- Interactions between a project and various components of the environment are identified;
- Environmental effects of the interaction are predicted;
- Mitigation is recommended to eliminate or minimize environmental effects;
- The significance of residual effects is evaluated;
- A report documenting the analysis is prepared; and,
- Environmental monitoring and Follow-Up Programs are designed and implemented, where appropriate.

Achieving these outcomes includes the following phases of an EA:

- Determination of the scope of Project and scope of assessment;
- Determination of Valued Ecosystem Components;
- Describing the environmental effects and mitigation measures;
- Describing the residual environmental effects that exist after the mitigation measures have been applied;
- Determining the significance of the residual environmental effects; and
- Determining the need for a Follow-Up Program and, if one is needed, determining which mitigation measures will be included in the Follow-Up Program.

The following sections of the CSR describe how the federal review team implemented the EA process.

4.1 Scope of the Project

The term "Project" refers to those components of the proposed Mount Milligan Gold-Copper Mine that are subject to an EA under the *CEAA*. The scope of Mount Milligan Gold-Copper Mine Project was determined pursuant to Section 15 of the *CEAA*, and was posted May 15, 2009 on the Canadian Environmental Assessment Registry (CEAR). The scope includes the construction, operation, modification, decommissioning and, where appropriate, abandonment of:

- The open mine pits (overall, approximately 2.5 x 1.5km);
- The process plant (mill site);
- The tailings impoundment area, containment dams and other associated structures (including the deposition of tailings into the TIA);
- The site water management facilities (diversion channels, tailings and reclaim water pipelines, and sediment control ponds);
- The water supply pond;

- The ore stockpile, overburden and topsoil storage areas;
- The explosives factory and magazine facilities;
- The watercourse crossings associated with the installation of the transmission line;
- The watercourse crossings associated with the onsite mine haul roads;
- Any works or undertakings, which are required as compensation for the harmful alteration, disruption or destruction of fish habitat, that require an Authorization under subsection 35(2) of the *Fisheries Act.*

4.2 Scope of the Assessment

Pursuant to the *CEAA*, Responsible Authorities are required to consider the factors specified in Section 16, taking into consideration the definitions of the environment and the environmental effects of the Project, prior to making a decision regarding whether to take action (e.g., grant funding, dispose of land, or issue a permit, authorization or licence) that would permit the Project to proceed. Factors considered in the environmental assessment are as follows:

- The environmental effects of the project, including the environmental effects of malfunctions or accidents that may occur in connection with the project and any CEEthat are likely to result from the project in combination with other projects or activities that have been or will be carried out in the foreseeable future;
- The significance of the environmental effects referred to above;
- Comments from the public and Aboriginal groups that are received in accordance with the Act and its regulations;
- Measures which would mitigate any significant adverse environmental effects that are technically and economically feasible;
- The purpose of the project;
- Alternative means of carrying out the Project that are technically and economically feasible and the environmental effects of any such alternative means;
- The need for, and the requirements of, any Follow-Up Program in respect of the Project;
- The capacity of renewable resources that is likely to be significantly affected by the Project to meet the needs of the present and those of the future;
- Consideration of the need for the Project and alternatives to the Project that the RAs may require to be considered; and,
- Specialist or expert advice received from other federal authorities (FAs) and/ or provincial departments participating in the review process.

As defined under the *CEAA*, "environmental effect" means, in respect to a project:

- any change that the Project may cause in the environment, including any change it may cause to a listed wildlife species, its critical habitat or the residences of individuals of that species, as those terms are defined in subsection 2(1) of the *Species at Risk Act*;
- any change to the Project that may be caused by the environment, whether any such change or effect occurs within or outside Canada; and
- any effect of any change referred to in paragraph (a) on:
    i. health and socio-economic conditions;
    ii. physical and cultural heritage;

iii. the current use of lands and resources for traditional purposes by aboriginal persons; or

iv. any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.

4.3 Scope of the Factors to be Considered

The scope of factors to be considered during the assessment of the Project was developed with public input, and is described in the Comprehensive Study Scoping Document (DFO and NRCan, 2008). For the purpose of this comprehensive study, the scope of factors to be considered has been addressed under the following headings:

Biological Environment

- Fish, fish habitat and aquatic environment (including wetlands)
- Wildlife and wildlife habitat (including migratory birds and their habitats, and species at risk and their habitats)
- Vegetation and plant communities

Physical Environment

- Surface water quality and sediment quality (water quality)
- Hydrology and hydrogeology (including groundwater quality and quantity)
- Air quality and climate
- Metal leaching and acid rock drainage (water quality)
- Terrain, soils and geology

Human Environment (i.e., indirect effects resulting from a direct change in the environment)

- Current use of lands and resources for traditional purposes by Aboriginal persons
- Effects on sustainable use of renewable resources
- Fisheries
- Human health
- Archaeological sites and cultural heritage
- Visual and aesthetic resources
- Noise

In addition the CSR presents a summary of, and consideration of, the effects of decommissioning and mine closure activities as well as the effects of the Project on the following components as required under the *CEAA*.

Navigable Waters

Navigable waters in Canada are protected by the *Navigable Waters Protection Act* which is administered by Transport Canada. In its review of the draft EIS provided by the Proponent, TC

determined that no Approval would be required in association with the proposed Mount Milligan Gold-Copper Mine, based on the following works:

- King Richard Creek – Proposed location for mine site facilities and mine open pit;
- Meadows Creek – Construction of dam for water supply pond;
- Rainbow Creek – Bridge crossing for access road;
- Headwater Creeks to Alpine Lake and Esker Lake – Tailings Impoundment Area; and
- Tributary to Tezzaron Creek – Bridge crossing for access road.

Effects of the Environment on the Project

In addition to evaluating the effects of the Project on the environment, the effects that the environment may have on the Project are considered. The assessment of the effects of the environment on the Project included identifying the environmental factors deemed to have possible consequences on the proposed Project, the likelihood and severity of their occurrence and mitigation measures planned to minimize their impact.

Environmental Effects of Accidents and Malfunctions

Pursuant to the *CEAA*, consideration of the environmental effects of any potential project-related accidents or malfunctions is required. The Proponent's assessment includes consideration of the potential accidents, malfunctions and unplanned events that could occur in any phase of the project, the likelihood and circumstances under which these events could occur, and the environmental effects that may result from such events, assuming contingency plans are not fully effective.

Capacity of Renewable Resources

Under the *CEAA*, the comprehensive study EA includes consideration of the capacity of renewable resources that are likely to be significantly affected by the Project to meet the needs of the present and those of the future. An analysis shows how the Project may affect the capacity of these resources to support future and present uses.

Cumulative Effects Assessment

Under *CEAA*, the comprehensive study EA must consider 'cumulative environmental effects that are likely to result from the Project in combination of other projects or activities that have been or will be carried out'. CEEare changes to the biophysical environment or socio-economic setting (resulting directly from a biophysical change) caused by an activity in association with other past, present and future human activities. Cumulative effects assessments (CEA) are performed to ensure the incremental effects resulting from the combined influences of various anthropogenic actions are considered. These effects, when combined, may be significant, even though the effects of each individual action are considered insignificant. CEAs determine possible effects that are likely to result from the Project in combination with other projects or activities that have been or will likely be present in a reasonable temporal or spatial scale. The project contribution to the cumulative environmental effect is scored as either not *Significant (Negligible, Minor, Moderate)* or *Significant*. A rating of confidence (low medium or high) in the scoring of the assessment for each VEC is also presented.

4.4 Spatial Scale

Local Study Areas

Local study areas (LSA) have been defined for each component; these are described below in Section 5.0 of this CSR. A LSA is defined as the area that may be affected by the mining activities, including project infrastructure (e.g., mine site and associated facilities, and access road and power line right-of-ways), plus a 500 m buffer zone. The Proponent considers that this provides a representative area that allows the assessment of all potential direct effects from project-related activities.

Regional Study Area

Regional study areas (RSA) have also been defined, and are based on specific rationale for each anticipated effect of the Project on the environment. The RSA for the fisheries and surface water assessments were defined primarily by the Rainbow Creek watershed. The rationale for the selection of the terrestrial and biological RSA boundaries was based on specific project considerations (i.e., a thorough review of potential direct and indirect affects) and/or ecological factors identified as being a concern (i.e., migration of sensitive wildlife species). The RSA selected to address potential effects on non-traditional land use was primarily based on the Land and Resource Management Plans for Fort St. James and Mackenzie because they overlap the LSA for non-traditional land use.

4.5 Temporal Boundaries

The temporal boundaries of the Project are referred to in Section 4.1.2 of the EIS. These include three phases: the Construction Phase, which will last 30 months; the Operations Phase, which will continue for approximately 15 years; and the Closure and Post-Closure Phase, which will continue from cessation of mining activity until mine site reclamation is complete and there is verification that on-site water quality has stabilized and monitoring indicates no material future adverse effects on local receiving waters.

4.6 Environmental Assessment Methodology

The assessment method consisted of identifying the Project's impacts on Valuable Ecosystem Components (VECs). The identification of the Project's environmental effects and the determination of their significance are based on information provided by the Proponent and the expert advice of the RAs and FAs. Input was also provided by provincial reviewers that participated in the Working Group, as well as comments received through the provincial and federal public comment periods. The EA methodology assesses the significance of residual effects remaining after taking into account the application of mitigation measures proposed by the Proponent or recommended by the RAs or FAs. The EA also establishes the implementation of a Follow-Up and Environmental Monitoring program.

Valued Ecosystem Components

In the Proponent's EIS VECs were selected by identifying potential project-environment interactions, taking into account the expertise of various federal experts, scientific and traditional knowledge, and the concerns of communities and stakeholders. The VECs evaluated were related to biological (e.g., fish, wildlife and vegetation), physical (e.g., hydrology, air quality, and terrain, soils and geology) or human (e.g., traditional use of lands and resources, human health, archaeology, noise) components as

reflected by the scope of the factors assessed in this CSR. The VECs were selected as the key indicators of the direct and indirect effects of development and were the focus of the EA because any impacts to the VECs would adequately reflect the Project effects.

VECs can represent species or processes of the biophysical and human environment which are vital to a healthy functioning ecosystem or of key importance to people (e.g., northern caribou or water quality). They can also represent the characteristics, sensitivities, or management requirements of a broad range of species, communities, landscapes and the associated physical environment or processes. The VECs for biological, physical and human environment components are introduced at the beginning of each section, as further discussed in Section 5.0 (Anticipated Effects of the Project on the Environment, Mitigation and Significance) of this CSR.

As RAs, DFO and NRCan consider that the VECs, as identified by the Proponent, are adequate for the scope of the assessment of the environmental effects of the Project.

Significance of Effects

The Proponent's assessment for the proposed Mount Milligan Gold-Copper Mine was structured to address the categories and types of environmental effects set out in the EIS Terms of Reference (TOR) (i.e., effects at distinct phases of the Project such as site preparation and construction, operation and maintenance) and the effects on VECs related to biological, physical and human resources. The EIS reports the results of the Proponent's EA related to project design, identification of issues, potential environmental effects due to the Project and the application of proposed mitigation measures. The Proponent has used this information to establish the significance of residual effects and in turn identify cumulative effects and appropriate monitoring and Follow-Up measures. 'Significance of effect' ratings established by the Proponent are based on the magnitude, geographic scale, duration, frequency, reversibility, and ecological context of the effect. The general criteria ratings and their definitions are provided below in Table 4.5-1. Specific significance rating criteria were developed for each anticipated effect of the Project on the environment (Section 5.1 of the EIS). The method used by the Proponent to assess cumulative effects for the Project has been broadly drawn from the cumulative effects guidance document prepared for the CEA Agency (Hegmann et al., 1999), as follows:

Table 4.6-1 Significance Rating Definitions

Criteria	Definition[1]
Not Significant (Negligible)	Effects are of no magnitude, any geographical extent, any duration, occur at all frequencies (occur once or intermittently), and their effects are indistinguishable from natural physical, chemical and biological characteristics and processes.
Not Significant (Minor)	Effects are low magnitude, any duration, occur at all frequency, and their effects can be distinguished at the level of individual organisms or subpopulations.
Not Significant (Moderate)	Effects are medium magnitude, site-specific or local, short-term or medium-term, occur at all frequencies, and their effects and consequences are distinguishable at the level of populations, communities, and ecosystems.
Significant	Effects are medium or high magnitude, local to regional in scope, long-term to chronic, occur at all frequencies, and are consequential in structural and functional changes in populations, communities and ecosystems.

[1] For a description of significance rating criteria definitions (magnitude, geographic scale, duration, frequencies, reversibility, and ecological context) refer to Table 5.1-10 in Volume 5 of the Proponent's EIS.

5.0 ANTICIPATED EFFECTS OF THE PROJECT ON THE ENVIRONMENT, MITIGATION MEASURES AND SIGNIFICANCE

The following section provides background on the biological, physical and human components, the potential effects of the Project on these components, measures designed to mitigate effects and the conclusions of the federal RAs on the significance of the residual effects. The information in the following sections is summarized from Volumes 4 and 5 of the EIS (Terrane Metals Corporation, 2008a), where more detailed information is available.

5.1 Biological Environment

This section presents the assessment of the Project's effects on the following biological environment components: Fish, Fish Habitat and Aquatic Resources; Wildlife and Wildlife Habitat, Species at Risk; Vegetation and Plant Communities A description of the impact assessment methodology and determination of significance is provided in Section 4.5 (Environmental Assessment Methodology) of this CSR.

5.1.1 Fish, Fish Habitat and Aquatic Resources

The Proponent summarizes the existing fish biology, quality and habitat in Section 4.6 of the EIS and in supplemental information (AMEC; 2008b, 2008c, 2009a, 2009b). Anticipated impacts on fisheries and aquatic resources, mitigation measures, and the significance of residual effects are discussed in Section 5.6 of the EIS.

5.1.1.1 Background

For the purpose of the Proponent's baseline studies of fisheries and aquatic resources, five study areas were designated: the local study area, power line right-of-way, access road ROW, the concentrate load-out facility and the regional study area. The LSA is defined by the Rainbow Creek watershed and includes all of the stream and lakes therein. The LSA boundary defines the area containing the mine site and its components, is the downstream extent of potential project effects, and represents the area where studies indicated that upstream fish migration from the Nation River is likely to be low. The RSA includes the Rainbow Creek watershed as well as the Nation River from the outlet of Chuchi Lake downstream to a series of cascades, situated about 33km upstream from Williston Lake, that inhibit upstream migration of fish. The RSA boundary was defined by the distribution, movement, and life history requirements of fish species known to exist in the Nation River as is described in the EIS.

Rainbow Creek is a tributary of the Nation River, located approximately 35 km downstream of Chuchi Lake and 60 km upstream from Williston Lake. With the exception of the power line, concentrate load out facility and access roads, which are linear components that extend beyond the mine site itself, the mine site footprint occupies areas of the King Richard, Alpine, and Meadows Creek drainages, and will have effects on these tributaries of Rainbow Creek. A detailed description of the watershed and its hydrology is presented in Section 5.2.2 of this report (Hydrology, Hydrogeology and Groundwater Quality).

In the LSA, eleven species of fish have been captured or observed in studies undertaken in the Rainbow Creek watershed including: Burbot, Slimy sculpin, Rainbow trout, Bull trout, Pygmy whitefish, Mountain whitefish, Redside shiner, Longnose dace, Longnose sucker, Lake chub and Arctic grayling. Lake chub were captured only in Limestone Lake (unaffected by the Project) and

most of the fish species are restricted to the lower 8 km of the Rainbow Creek watershed with the general exception of Rainbow trout, Slimy sculpin, Mountain whitefish and Bull trout. Rainbow trout and Slimy sculpin comprised at least 90% of the total catch in all years.

The Proponent identified Rainbow trout as the VEC for its fish, fish habitat and aquatic resources assessment. Rainbow trout were chosen because they are considered to be sensitive to alterations in habitat and water quality, are widely distributed in the watershed, and are important due to their potential recreational fishery value as well as their spiritual, cultural and subsistence value to First Nations. Protection of Rainbow trout was considered sufficient to also protect other aquatic species (e.g., Slimy sculpin).

The objectives of the fish habitat assessments in the mainstem and major tributaries of Rainbow Creek were to evaluate the extent, quality and location of spawning gravels, assess habitat quality and quantity for Rainbow trout, identify barriers to fish migration, identify potential over-wintering habitats, and to collect representative benthic invertebrate periphyton and fish tissue samples. Fish habitat is generally described via systems of habitat classification that follow a combination of morphological habitat types (i.e., riffle, run (glide), pool, headwater, stream fen) and abundance of cover (i.e., depth, boulder presence, wood debris, overhanging vegetation). The Proponent suggests that the habitat types within the watershed have remained in a state of dynamic equilibrium since the first baseline studies were conducted 1989 (i.e., there is a balance between gradient, water discharge and velocity and stream channel roughness) that has kept the relative amount of habitat types throughout the watershed constant.

The objectives of the fish population assessments (i.e., sampling) were to confirm fish species composition and determine sport fish population densities, age structure and length classes and distribution in Rainbow, Meadows, and King Richard creeks**.**

Potentially Impacted Areas

A brief summary of the fish and fish habitat areas that may be affected by the Project is provided below:

Rainbow Creek

Overall, Rainbow Creek is a low gradient meandering stream with relatively erodible soils that are subject to fluvial influences during rainfall events and late spring freshet. Throughout much of Rainbow Creek, riparian cover is intact to the top of bank or edge of wetland complexes; however, stream channels are somewhat de-coupled from hillslope processes (e.g., sediment delivery, landslide events) due to the broad valley floor and low relief. Rainbow Creek itself is relatively undisturbed by industrial activity. Broadly classified, Rainbow Creek consists of riffle-run-pool habitats with riffle substrates dominated by gravels and cobbles and pool habitat having predominance of fines. In the upper and middle reaches of the system the riparian forest is set back from the wide floodplain; overhead cover for fish is provided mainly by under-cut banks and low overhanging riparian floodplain vegetation whereas large woody debris features are infrequent. In the lower reaches, downstream of the confluence of Limestone Creek, riparian forests have a greater influence, gradient is steeper and boulders and large woody debris is more abundant.

Rainbow Creek is utilized by all the species of fish identified in the study, except for Lake chub. Rainbow trout and Slimy sculpin are the most abundant and widely distributed fish species in the Rainbow Creek watershed and are found throughout the mainstem. Upstream of the Limestone Creek confluence, Mountain whitefish and Bull trout are the only other species that have been found. Bull trout were found to occur in relatively small numbers.

Based on its study results, the Proponent has deduced that there are both Nation River migrant and stream-resident populations of Rainbow trout. Stream resident trout are considered to be typically less

than 150 mm long and reach sexual maturity early at 1+ or 2+ years of age; comparable to stream-resident populations in other parts of British Columbia, such as the "dwarf-resident" Rainbow trout populations which have been observed in Suschona and Sylvester Creeks, as well as other Nation River tributaries. These stream-resident trout generally do not make extensive pre- or post-spawning migrations, typically moving less than 500 m from their established territories. Rainbow trout from the Nation River are also found in the Rainbow Creek watershed. These fish are larger (> 200 mm) than stream-resident Rainbow trout and analysis of DNA suggests there may be genetic differentiation between these two groups. In 2007, Nation River "migrants" were found as far upstream as King Richard Creek and in Rainbow Creek upstream of the Meadows Creek confluence (distances of at least 30 km) when higher than normal spring flows likely allowed greater upstream access past beaver dams than in most years. Overwintering habitat for these larger Rainbow trout is limited by the lack of large, deep (> 2 m) pools in Rainbow Creek and it is likely that most Nation River "migrant" Rainbow trout would move back downstream to the Nation River in summer or fall.

Rainbow trout spawn and rear in all sections of Rainbow Creek. Studies indicate that the primary spawning location is the riffle-pool habitat immediately downstream of the Meadows Creek confluence as the highest densities of young-of-the-year have been captured in this reach. In some reaches, beaver activity may impact available spawning habitats.

In fish presence studies conducted, or relied on, by the Proponent there were five Arctic grayling adults captured in Rainbow Creek in the lower section to a point 50m upstream of its confluence with the Nation River. Several factors provide a strong indication that Arctic grayling are likely to use the lower reaches of the Rainbow Creek for spawning. These indicators include the presence of young-of-the-year Arctic grayling in the Nation River directly downstream of the Rainbow Creek confluence, the presence of suitable gravel substrates in the lower sections of Rainbow Creek, and the temperatures in Rainbow Creek, which are cooler than in the Nation River, as is preferred by this species for spawning. Because few Arctic grayling have been captured in Rainbow Creek, it is suspected that use by this species is low; however, it is likely that Arctic grayling are attracted to the cold water plume of Rainbow Creek. Arctic grayling are provincially red-listed (i.e., critically imperiled) in the Nation River but are not expected to be impacted by the mine.

The Proponent suggests that the Rainbow Creek supports a very limited resident population of Bull trout and that it is unlikely that Rainbow Creek is used extensively by Bull trout for spawning. Five Bull trout have been captured in the Rainbow Creek watershed and two of these fish were captured upstream of the Limestone Creek confluence. With regard to their uppermost distribution, one Bull trout has been captured in Meadows Creek and another upstream of Meadows Creek in the mainstem of Rainbow Creek. No young-of-the-year Bull trout were caught by the study teams during sampling. Bull trout are provincially blue-listed (i.e., a species of concern) in British Columbia but are also not expected to be impacted by the mine.

Meadows Creek

Meadows Creek is approximately 3m wide near its confluence with Rainbow Creek and the first 700m upstream is dominated by alternative riffle-pool complexes which provide high-quality spawning habitat for Rainbow trout. The presence of deep, slow flowing pools also contributes to the high fish value and functionality associated with the lower Meadows Creek habitat. Farther upstream, beyond the confluence with King Richard Creek, Upper Meadows Creek is generally classified as a headwater stream, less than 1 m wide and 0.5m deep. Upper Meadows Creek is characterized by alternating pool and riffle complexes owing to its 3% gradient and higher alpine nature. Undercut banks and overhanging riparian vegetation provide fish habitat throughout the system. The uppermost channel reaches of Meadows Creek (i.e., about 6 km) are unconfined and are likely a barrier to fish movement.

Field studies conducted, or relied on, by the Proponent show that Meadows Creek is utilized by both stream resident Rainbow trout and Slimy sculpin. The high gradient riffle-pool habitat in lower Meadows Creek is identified as an important spawning area for Rainbow trout. Rainbow trout densities in Meadows Creek upstream of the King Richard Creek confluence are low, suggesting less active use of this habitat for spawning or rearing. In 2007, one Bull trout and six Mountain whitefish were found present in Meadows Creek; however, the proponent suggests that these fish likely had greater access to the upper watershed than in most years because freshet flows were high (i.e., greater than a 37 year simulated average) making this stream condition a rare occurrence.

King Richard Creek

Starting at its confluence with Meadows Creek, the lower 2 km of King Richard Creek is largely a series of deep, slow-flowing pools with small areas of pool-riffle-run habitat having cobble and gravel substrates. The lower section has four minor tributaries approximately 1.5 m wide and shallow, 0.3 m deep pools (on average). Riparian vegetation is dominated by willows with conifer trees limited to the edge of beaver ponds. The mid-sections of King Richard Creek are heavily influenced by beaver dams, some of which are decades old and which have caused the formation of extensive stream-fen habitats, which are typically poor quality fish habitat characterized by unconsolidated fine sediments and anaerobic decomposition. The steepest portion of King Richard Creek is the 2 km long headwater reach that cuts through a narrow, steep-sided valley starting at its source, east of Heidi Lake. Much of the land base around King Richard Creek has been influenced by forest-harvest activity (i.e., clear cuts) but riparian vegetation is generally intact with leave strips of varying widths extending landward.

Rainbow trout and Slimy sculpin are also found in King Richard Creek. The Proponent indicates that spawning in King Richard Creek is likely limited to the lower 1 km of the stream and, within this section, spawning is further limited to the short gravel riffles found immediately downstream of the beaver dams. Large beaver impoundments in the upper 6 km of King Richard Creek generally provide unfavourable habitat for any life-stage of Rainbow trout. Upstream of lower King Richard Creek there is a general absence of young-of-the-year trout. Within the mine footprint, the number of Rainbow trout captured is very low (i.e., 20 total in year 2006; 11 total in 2007) despite fairly extensive fishing effort (i.e., number of sample events, hours of minnow trapping and seconds electro-fishing).

Alpine Creek

Alpine Creek is 4 km long and is generally characterized by undefined channels and the presence of beaver impoundments. The lower 200 m of the stream is less than 2.5m wide, with some riffle-run habitat and cover provided by overhanging vegetation, undercut banks and large woody debris. In the mid reaches, Alpine Creek transitions from marshy low gradient wetland areas and undefined channels to higher gradient riffle-run habitat with large woody debris as cover and riffle sections with predominately cobble substrates. The outlet of Alpine Lake is beaver-dam controlled which may periodically impede fish access into the lake under certain flow conditions. Alpine Lake is a 7.4 ha water body located immediately north of the proposed tailings impoundment area and approximately 2700 m upstream of Rainbow Creek. Inflows to Alpine Lake are via groundwater seeps and high gradient headwater streams up to 1200 m long which ephemerally drain into the lake. Its shoreline is characterized by willow and alder with sedge meadows at the north end of the lake. Shoreline substrates are small, comprised largely of sands and gravels, with organics and silt dominating bottom substrates.

Field assessments indicate that stream resident Rainbow trout utilize Alpine Creek for spawning and rearing. Headwater streams to Alpine Lake may have some reproductive success; a juvenile fish was

captured along the lake margin via minnow trapping and young-of-the-year Rainbow trout were electro-fished in an inlet tributary as well as at the outlet of the lake. Adult Rainbow trout were caught via angling in Alpine Lake and the lake may support a self-sustaining population of Rainbow trout, although the Proponent suggests that (some) winter-kill is probable due to the very low winter dissolved oxygen levels that were measured below the ice.

Aquatic Baseline Studies

Periphyton

Periphyton are benthic assemblages which may consist of algae, cyanobacteria, heterotrophic microbes, and detritus that are attached to submerged surfaces in most aquatic ecosystems. The periphyton assemblage serves as a good biological indicator because it is benthic and thus integrates physical and chemical disturbances to the stream reach. It has a naturally high number of species (individual organisms and diversity) and sampling is relatively easy. Periphyton also have a rapid response time to both exposure to and recovery from disturbances.

The Proponent proposes that community composition, density and chlorophyll *a* concentration can be used to predict potential effects to primary production and will be used to provide a basis for comparison for Follow-Up monitoring programs. It should be noted that periphyton vary widely and that concentrations of chlorophyll *a* vary seasonally and by location and are dependent upon light, temperature and nutrient variability (e.g., phosphorous and nitrogen); to reduce the effects of seasonal variability late summer peak concentration is used for sample timing.

In the Rainbow Creek watershed periphyton assemblages on natural rock substrates are dominated by diatoms, both in terms of species diversity and in total density. In terms of bio-volume, Chlorophyta (green algae) and diatoms are the dominant periphyton taxa at all sites in the watershed. Periphyton density and species diversity have been consistently higher at Site 5 in Rainbow Creek (immediately downstream of Meadows Creek confluence) than other sites in the watershed.

Benthic Invertebrates

Benthic invertebrates are a diverse group of organisms without back bones that live on or in the substrates at the bottom of lakes and streams. Benthic invertebrates include aquatic insect larvae (e.g., mayflies, dragonflies and blackflies), flatworms, nematodes, aquatic worms, crustaceans and molluscs (e.g., snails), etc. They are important food sources for fish and provide one of the linkages between potential changes in stream flow and water quality with effects on fish health and abundance.

The benthic invertebrate community of the Rainbow Creek watershed is diverse and includes a high number of taxa which were found throughout the watershed. Dominant taxa on erosional (rocky) substrates included water mites (Acari), the mayflies *Baetis* sp. and *Epeorus* sp., the stoneflies *Zapada* sp. and *Yaroperla* sp., the caddisfly *Micrasema* sp. and larval stages of the true fly families Chironomidae (midge) and Simuliidae (blackflies). The taxa most widely distributed within the watershed were mayfly *Baetis* sp. and the midge larva *Eukiefferiella* sp.

The wide diversity of taxa present suggests a high diversity of microhabitats are available in the Rainbow Creek watershed. Large differences in the relative abundance of major taxonomic groups between sites, even those located within the same tributary, suggests local conditions have a large influence on benthic invertebrate community structure within the watershed.

The taxonomic diversity, ecological relevance, ubiquitous distribution, varied life span (1-3 years) and relatively sedentary nature of benthic invertebrates enables their use as bioindicators for changes

in overall stream health[2] (i.e., a means by which to assess indirect project effects on fish through changes to their food source). Biotic indices can be useful for monitoring stream health (i.e., the presence of certain invertebrate groups in freshwater can be awarded a score on a scale of 1 to 10 that indicates the quality of the water, or stream "health"). In using biotic indices, generally speaking the sampling of a high numbers of aquatic organisms and clean water indicator species indicates a healthy stream. Contrary to that, if sampling produces few organisms and few clean water indicator species, there may be adverse effects with water quality. However, benthic macro-invertebrates were not selected as a VEC because they are not an end-point valued by society, and represent an indirect pathway by which the Project can affect Rainbow trout.

Fish Tissue Metal Burden

Metal concentrations in fish tissue were analyzed for Rainbow trout, Bull trout, Longnose sucker, Mountain whitefish and Burbot in 1989 and 1990, and for Rainbow trout and Slimy sculpin in 2007. Fish tissue analysis included the collection of fish muscle and liver tissues, which were analyzed for moisture content and metal contaminants such as copper, iron, zinc, arsenic, silver, cadmium, molybdenum, lead, mercury, aluminum, antimony, barium, beryllium, bismuth, calcium, chromium, cobalt, lithium, magnesium, manganese, nickel, selenium, strontium thallium, tin, uranium and vanadium.

In 1989 to 1990, only arsenic and mercury concentrations exceeded United States Environmental Protection Agency (US EPA) risk-based criteria (0.0021 µg/g and 0.143 µg/g, respectively) for the protection of human health. All other metals concentrations in all locations were either below detection limits or below risk-based criteria. With the exception of arsenic, all metals burdens in 2007 were below US EPA risk-based criteria, often by several orders of magnitude. Average mercury concentrations in 2007 were below the US EPA risk-based criteria and Health Canada guideline of 0.5 µg/g in 2007. Similar to 1989 to 1990, arsenic concentrations in Rainbow trout from all sites exceeded the US EPA arsenic criterion of 0.0021 µg/g in 2007.

With the exception of Pinchi Lake where an old mercury mine exists, mean mercury concentrations in Rainbow trout collected from the Rainbow Creek watershed in 1989 and 1990 were higher than in Rainbow trout collected from lakes elsewhere within the region. Mercury was also the only metal that showed a positive correlation between muscle tissue concentrations and fish size in 1989 and 1990. This relationship is consistently found for mercury in fish tissues because mercury is metabolized very slowly and becomes increasingly concentrated as a fish grows and ages.

Selenium is a bioaccumulative metal of potential concern for fish-eating birds and mammals. The BC MOE has established tissue residue guidelines for both mercury and selenium as a means of protecting the health of piscivorous wildlife in BC. The baseline concentrations of selenium in Rainbow trout (1.9 µg/g) and Slimy sculpin (1.1 µg/g) at Mount Milligan exceed this selenium guideline. However, the Proponent states these results should be interpreted cautiously in that only liver and muscle from Rainbow trout were analyzed for selenium, and selenium, like mercury, preferentially accumulates in these two tissues due to their high protein contents. The total selenium concentration reported for Rainbow trout is thus likely to be an overestimate of the true total body burden of selenium in this fish. Also, there is much debate with regards to the concentration of selenium in aquatic organisms that may pose a risk to wildlife health. For example, the US EPA's draft tissue quality criterion for selenium is 7.91µg/g (dry weight), which, when adjusted for an assumed 80% moisture content, is roughly equivalent to 2 µg/g (wet weight). The concentrations of selenium in Rainbow trout and Slimy sculpin at Mount Milligan do not exceed the draft US EPA criterion.

The Proponent will monitor selenium in whole body tissues of Rainbow trout and Slimy sculpin in the Rainbow Creek watershed on a schedule to be agreed upon with the BC MOE. If tissue selenium levels in either species increase beyond two standard deviations of the background mean tissue levels during operations or post-closure, a literature review will be conducted to review the state of the science with respect to whole body tissue threshold levels that are protective of these species. Based on findings, the need for additional site specific studies, which may include reproductive and/or stock assessments, will also be determined. The application of any threshold levels will consider the current applicable government guidelines for the metals in media (water, sediment and fish tissue). Selenium will be monitored by the Proponent in its Follow-Up Program and the contingency plans have been developed by the Proponent should selenium releases from the mine represent a potential concern.

5.1.1.2 Potential Project Effects

In the EIS, the Proponent identified seventeen potential effects related to fish and aquatic habitat. These effects were classified as "Invalid Pathways", "Minor Pathways" or "Major Pathways", based on their likelihood of producing a significant or measurable effect. The pathways are described in the sections below.

Invalid and Minor Pathways

Invalid and minor pathways for the potential effects from the Project were screened out of the in-depth effects assessment because they were either 'invalid' and would not occur (e.g., effects of cyanide, effects on the Stuart River, effects on One-Mile Creek, and release of domestic waste water) or they were unlikely to have a measurable effect and were therefore classified as a minor pathways. The minor impacts, as identified by the Proponent, and which were considered independently by DFO include:

- Use of Xanthate in Ore Processing
- Use of Flocculants
- Increase in Fish Harvesting
- Use of Explosives
- Effects on Wetlands
- Effects on Rare, Sensitive or Endangered Species
- Effects due to Upgrading and Realignment of the Access Road
- Effects of the Powerline Corridor Right-of-Way
- Effects of the Concentrate Load-out Facility
- Effects of Chemical Spills during Transport
- Changes to the Nation River.

Major Pathways

Major pathways for the potential effects from the Project on fish and fish habitat were considered with regard to their impacts on VEC. As mentioned previously in this section, Rainbow trout were chosen as the VEC for the purpose of the EA because they are sensitive to alterations in habitat and water quality, they are widely distributed in the watershed, and they are considered important because of their potential recreational fishery value as well as their spiritual, cultural and subsistence value to First Nations. The Proponent has asserted that the protection of Rainbow trout is likely to also protect other aquatic species.

According to the Proponent, there are six potentially significant major pathways for potential effects of the Project. The greatest considerations focused on the effects of the Project on aquatic life, fish and fish habitat from:

- Changes in Water Quality;
- Alteration/Loss of Fish Habitat and its Productive Capacity**;**
- Increase in Sedimentation;
- Changes in Stream Flows;
- Changes in the Rainbow Creek Thermal Regime; and
- Mercury Methylation in the Meadows Creek Water Supply Pond.

Minor Pathways

Minor pathways are effects identified as a source of potential effect and a valid linkage to fish, fish habitat and aquatic resources but are considered by the Proponent to be unlikely to result in a measurable effect. Minor pathways are assessed below:

5.1.1.2.1 Use of Xanthate in Ore Processing

Flotation is the most common milling process used and potassium amyl xanthate is generally considered a preferred flotation agent for copper extraction. The use of xanthate is expected to have a negligible effect on fish and aquatic resources because:

- All the xanthate will be discharged into the TIA and the TIA supernatant will not be discharged to receiving waters during mine operations (Volume 3, Project Description).
- Potassium amyl xanthate is biodegradable (Senmin, 2004) (Section 5.16 Alternative Means of Carrying out the Project).

Further, the Proponent indicates that in the unlikely event of xanthate escaping into the receiving environment, there is little chance of it having any adverse effects on fish health or survival.

5.1.1.2.2 Use of Flocculants

Flocculants will be used in the milling process and may be used in the TIA and possibly, in the MCWSP. The purpose of flocculant use in the mill and TIA is to remove suspended sediments from process and mine contact water. Use of flocculants in the MCWSP is a contingency in the unlikely event that turbidity levels are above site-specific guidelines while the south starter dam and the King Richard basin liner are being constructed.

Use of flocculants at Mount Milligan Gold-Copper Mine is expected to have a negligible effect on fish and aquatic resources for the following reasons:

- Only the anionic flocculent Magnafloc 333 would be used. This flocculent, like other anionic and non-ionic flocculants, is much less toxic than cationic flocculants and results of bioassays of fish exposed to anionic and non-ionic flocculants show very low toxicity (Liber et al., 2005);
- Flocculent dosages in the MCWSP are not expected to exceed 7 mg/L and the toxicity of Magnafloc 333 at this concentration is well below the 96 hour, LC50 concentration of 4,220 mg/L for fish (*Brachydanio reria*, a minnow species from Asia) and the 48 hour, LC50 concentration of 1,733 mg/L for aquatic zooplankton (*Daphnia magna*, a water flea species commonly used for toxicity testing) (Volume 6, Appendix B);
- Flocculant used in the mill and the TIA would not be released into fish-bearing waters; and,

- Any flocculants used in the MCWSP would be removed from the sediments prior to decommissioning.

5.1.1.2.3 Increased Fish Harvesting

During mine operations and construction, the number of workers is expected to range from 400 to 700. A proportion of the workforce may be anglers; therefore, there may be increased recreational fishing pressure on sport fish populations in the lakes and streams near the mine site. The construction and operation of the proposed Mount Milligan Gold-Copper Mine is not expected to facilitate access to existing or, previously inaccessible, streams or lakes.

Heidi Lake is currently used for recreational fishing and is the primary sport fishing location in the vicinity of the proposed Mount Milligan Gold-Copper Mine. This lake is located about 3 km west of the proposed mine site and is located adjacent to the current exploration camp. The current access road to Heidi Lake will not be accessible during construction or operation of the mine but a new access trail will be created to allow continued recreational fishing.

Any potential increase in fishing pressure and associated increases in fish harvesting due to the presence of the mine workforces will be mitigated by:

- Implementation of a company policy that prohibits employees and contractors from engaging in fishing while present at the mine site or while travelling to and from the mine on company business; and,
- Busing all personnel from Fort St. James at the start and end of each shift during mine operations (i.e., there will be no camp facilities located at the mine site after mine construction).

The Proponent indicates that as a result of the above measures, the potential effect on fish populations in lakes and streams near the mine is expected to be negligible.

5.1.1.2.4 Use of Explosives

The use of explosives can kill fish, cause harm to the auditory system of fish, alter the behaviour of fish, or increase the mortality of incubating eggs and alevins. These effects occur because of sudden pressure changes and increased peak particle velocities.

Heidi Lake and Alpine Lake are the closest fish-bearing waterbodies to the mine pits where blasting would occur. Heidi Lake is about 3 km from the nearest mine pit while Alpine Lake is about 2.5 km from the nearest mine pit. There will be no fish in King Richard Creek during mine operations when blasting would occur because it would be lost to mine infrastructure or the TIA. The use of explosives in the mine pits is not expected to affect fish or incubating fish eggs or alevins in Heidi Lake or Alpine Lake because both lakes are two orders of magnitude further away than the minimum setback distances (50.3m) required to achieve the 100kPa instantaneous pressure guideline or 13 mm/sec peak particle velocity guideline (150.9m), necessary when detonating a 100 Kg charge in solid rock (Wright and Hopky, 1998).

The Proponent has indicated that explosives will be used during the construction and operation of the mine, and that most blasting will be completed in the dry. As per commitments made by the Proponent during the provincial EA process, the "Guidelines for the Use of Explosives in or near Canadian Fisheries Waters" (DFO 1998) will be followed and there is not expected to be any effect on fish, fish habitat or aquatic resources.

5.1.1.2.5 Wetlands

Wetlands that will be permanently affected by the mine are located within King Richard and Meadows Creek. Most of the permanently affected wetlands have been classified by the proponent as stream fens, which are characterized by low very water velocities, shallow water depth, lack of defined stream channel, and deep accumulations of unconsolidated organic sediments. Because of microbial decomposition, these fens typically become oxygen depleted (< 1 mg/L) in winter and are generally less suitable for fish and benthic invertebrates than stream or pond habitats. Beaver presence is a strong influence on stream morphology in these habitats. Very low numbers of Rainbow trout have been sampled in the stream fen areas (i.e., less than 20 in any year). Arctic grayling and Bull trout have not been found in King Richard Creek for any part of their life history. Therefore, the Proponent expects the loss of the wetlands/ stream fens to result in negligible effects on VEC fish species in the Rainbow Creek watershed and in the Nation River. However, the loss of the wetlands/ stream fens will be compensated for by creating or enhancing habitat for Rainbow trout within the Rainbow Creek watershed though implementation of a Fish Habitat Mitigation and Compensation Plan, which is summarized in Appendix D (AMEC, 2009c).

5.1.1.2.6 Effects on Rare, Sensitive, or Endangered Aquatic Species

There are no federally-listed aquatic species at risk in the LSA. However, there are two provincially-listed at risk fish species that exist in the Nation River and in low numbers in Rainbow Creek that were considered in the EIS as potentially being affected by the Project. The Nation River Arctic grayling (*Thymallus arcticus*) are part of the endangered Williston Lake population and are red-listed (i.e., critically imperilled) largely due to historical adverse population effects from the construction of the WAC Bennett Dam but also industrial activities. Bull trout (*Salvelinus confluentus*) are blue-listed (i.e., a species of special concern) in British Columbia because they are generally rare and often occur as distinct populations that are sensitive to changes in groundwater and riparian habitat in the small headwater streams where they spawn. A population of Bull trout is known to exist in the Nation River but have not been sampled in numbers sufficient to suggest that a population exists in Rainbow Creek.

The proposed Mount Milligan Gold-Copper Mine is expected to have a negligible effect on Arctic grayling and Bull trout because the downstream extent of potential changes in habitat, stream flow and water quality caused by the Project will not overlap with habitat used by Arctic grayling or Bull trout.

Changes to physical habitats due to the mine will be restricted to the King Richard Creek watershed and to Meadows Creek; these streams confluence with Rainbow Creek at least 28 km upstream from the Rainbow Creek mouth. The Proponent expects that changes to stream flow and water quality will meet provincial guidelines and/or fall within the range of natural variability in Rainbow Creek.

The proposed Mount Milligan Gold-Copper Mine is expected to have a negligible effect on Arctic grayling and Bull trout because:

- Arctic grayling have only been found present at the mouth of Rainbow Creek, which is not expected to be impacted in any way by the Project.
- Fish sampling did not indicate the presence of a resident Bull trout population in the Rainbow Creek watershed and the use of Rainbow Creek by Nation River Bull trout is rare (i.e., only five have ever been sampled).
- Physical changes to habitat is not expected to affect any habitat preferred by Bull trout for spawning, rearing, or foraging (i.e., no small groundwater-fed streams accessible to bull trout will be lost).

5.1.1.2.7 Effects due to Upgrading and Realignment of the Access Road

To facilitate transport of ore concentrate, the entire length of the 30 km Rainbow Forest Service Road (FSR) spur from the Germansen North Road to the mine will be upgraded and partially realigned. This re-alignment would divert traffic about 400 m south of the existing Heidi Lake Junction and would require two new crossings of Meadows Creek.

The portion of the road to be upgraded includes 33 potential stream crossings: 26 crossings in the Rainbow Creek watershed (i.e., within the LSA) and 7 in the adjacent Tezzaron Creek watershed to the south (refer to Figure 2.5-1). A re-alignment of the Rainbow FSR is proposed to enhance safe vehicular movement at the mine site. With realignment, there would be two additional stream crossings within the Rainbow Creek watershed to total 35; however, two of the proposed road upgrade crossings on Meadows Creek would then be redundant.

Of these 35 crossings, twenty-two of the access road crossings are designated as non-classified drainage (NCD) and were not considered fish habitat (Ministry of Forestry, 1998). Non-embedded culverts were recommended for crossings at these drainages (Section 4.6, Appendix D). Thirteen drainages crossed by the road were classified as streams. Most of the crossings are at streams designated as S6 (non-fish-bearing, channel width < 3m) or S4 (fish-bearing, channel width <1.5 m). The Proponent suggests these streams have marginal or no fish habitat and embedded culverts were recommended at most of these crossings (Section 4.6, Appendix D).

Mitigation Measures and Significance of Effects

The Proponent has committed to follow DFO's Pacific Region Operational Statements (OPS) for "Clear-Span Bridges" and "Bridge Maintenance". Therefore, clear-span bridges will be installed at stream crossings that are fish-bearing and include potentially important fish habitat for Rainbow trout and other stream-dwelling fish species[3]. Further, fish-stream crossing structures will retain the pre-installation stream conditions to prevent restriction of the cross sectional area and maintain streambed characteristics. Provided the Proponent follows the conditions and measures set forth in the OPS, the works will be in compliance with subsection 35(1) of the *Fisheries Act* and no further review by DFO is required for effects due to upgrading and realignment of the access road.

Further details on the Proponents commitments, mitigation strategies and best management practices are presented in Appendix C (Amalgamated Table of Proponents Commitments, Mitigation and Best Management Practices).

5.1.1.2.8 Effects of the Powerline Corridor Right-of-Way

The proposed 92km 230 kV power line transmission corridor is expected to cross 168 streams (Figure 4.6-3, Section 4.6, Fisheries and Aquatic Resources). The large river crossings include the Parsnip and Pack Rivers and Lignite, Rainbow, Robinson, Colbourne, Fast and Philips Creeks. Fifty of the crossings are considered fish-bearing (S1 to S4), four were classified as non-fish bearing (S5 or S6), six were classified as "fish sensitive zone" (FSZ) and 108 were classified as "no-visible-channel" (NVC) or "no-defined-channel and were therefore not considered fish habitat. Most (67%) of the streams to be crossed by the ROW are small (<3 m) and classified as non-fish-bearing S6 (i.e., stream class S6) or did not have a defined channel so did not meet the definition of a stream and were classified as NVC or NVD.

Mitigation Measures and Significance of Effects

The Proponent notes that no significant erosion concerns were noted at any of the power line crossings and that standard construction measures to mitigate sedimentation at the stream crossings are expected to eliminate potential effects to fish habitat, water quality, fish and other aquatic

[3] Stream-dwelling fish species including, but not limited to, Burbot, Slimy sculpin, Rainbow trout, Bull trout, Pygmy whitefish, Mountain whitefish, Redside shiner, Longnose dace, Longnose sucker, Lake chub and Arctic grayling.

organisms. However, construction activities and vegetation maintenance at stream crossings within the powerline ROW may increase sedimentation downstream and increase water temperature if mitigation measures are not strictly implemented.

Effects on fish, fish habitat, and other aquatic resources due to construction or maintenance of the powerline ROW is expected to be negligible because the powerline will be constructed and maintained according to DFO's Pacific Region Operational Statements "Overhead Line Construction" and "Maintenance of Riparian Vegetation in Existing Rights-of-Way". Further, all temporary stream crossings at fish-bearing streams along the proposed transmission line will be constructed per DFO's Pacific Region Operational Statement for "Clear Span Bridges". A listing of the Proponents commitments, mitigation strategies and best management practices is presented in Appendix C (Amalgamated Table of Proponents Commitments, Mitigation and Best Management Practices).

5.1.2.9 Effects of the Concentrate Load-out Facility

The concentrate load-out facility has been sited north of Fort St. James between Tachie Road and the rail line that will carry ore concentrate to processing facilities off-site (Figure 4.6-5, Section 4.6, Fisheries and Aquatic Resources). Fish habitat does not occur directly adjacent to the concentrate load-out facility as only a small wetted area exists on the north side of the existing rail line grade, the same side of the rail line as the concentrate load-out facility. There is no connectivity between this wetted area and the small stream that exists directly south of the rail line, thus it has not been considered to be fish habitat. Although the concentrate load-out facility is described herein for the purpose of a fulsome discussion of all potential effects as identified by the Proponent, the concentrate load-out facility has not been considered by the RAs as within the federal scope of Project.

Prairie Meadow Creek is the only potential fish-bearing watercourse near the concentrate load-out facility. Prairie Meadow Creek is tributary to Nahounli Creek which drains into the south end of Stuart Lake near Fort St. James. Although there are no records of fish in Prairie Meadow Creek, Rainbow trout, prickly sculpin, suckers, and sockeye salmon (in the lower reaches only) are present in Nahounli Creek and it is assumed that Prairie Meadow Creek is fish-bearing. The small wetland located adjacent to the concentrate load-out facility was created by construction of the rail line grade was assessed and determined to be surficially isolated from Prairie Meadows Creek and any other fish-bearing waters, and did not contain fish.

The potential effects of the concentrate load-out facility on fish and aquatic resources considered were:

- Fugitive dust from trucking and loading/unloading train cars with ore and ore concentrate, which may increase the likelihood of fugitive dust escapement to adjacent streams and therefore increase the potential for elevated total suspended solid (TSS) concentrations and/ or sedimentation of fish-bearing streams and lakes near the site.
- Ore or ore concentrate spills, or contaminated drainage run-off to fish-bearing waters.
- The proximity of potential fish-bearing streams that could be impacted by the construction of the concentrate load-out facility or from property drainage.

The Proponent has determined that the concentrate load-out facility will have a negligible effect on fish, fish habitat and aquatic resources in Prairie Meadow Creek because:

- Prairie Meadow Creek is located on the opposite side of the rail line grade from the concentrate load-out facility and this rail-line would act to contain spills or contaminated run-off from reaching Prairie Meadow Creek in the highly unlikely event that a spill did occur.
- All loading of train cars and unloading of trucks will occur inside the concentrate load-out facility building. Levels of fugitive dust are expected to be minimal as a result.

Further, and in accordance with the Project Certification by the BC EAO, the Proponent committed to implementation of Environmental Management Plans (EMPs), which include a Spill and Emergency Response Plan and a Hazardous Materials Plan. A listing of the Proponent's commitments, mitigation strategies and best management practices is presented in Appendix C (Amalgamated Table of Proponents Commitments, Mitigation and Best Management Practices).

5.1.1.2.10 Effects of Chemical, Fuel or Other Hazardous Material Spills during Transport

Chemicals, fuels, and other hazardous materials will be used at the mine site during construction and operations, such as ore processing. Incidents during transport, such as the spill of fuel or other hazardous materials into fish-bearing watercourses has the potential to result in fish injury or mortality as well as the temporary or permanent alteration of fish habitat and its productive capacity. A set out in the EIS, the Proponent considers the likelihood of a spill occurring along the access road to be low due to mitigation measures that will be incorporated into the Project (e.g., maximum truck speeds, road traffic control measures, and road upgrading). Further, the Proponent has committed to implementing the following Environment Management Plans (EMPs) during the life of the Project:

- Spill and Emergency Response Plan (EIS; Section 6.3.5)
- Hazardous Materials Management Plan (EIS; Section 6.3.8)
- Petroleum Management Plan (EIS; Section 6.3.12)
- Transport and Access Management Plan (EIS; Section 6.3.14)

The probability of a chemical, fuel or hazardous material spill occurring cannot be eliminated; however the Proponent expects the EMPs will minimize the potential for spills. Should an event occur, effective clean up response will be rapid, as per EMPs. As a result, the Proponent views the potential effect of spills on fish, fish habitat and aquatic resources is considered to be negligible.

5.1.1.2.11 Changes to the Nation River

Although included as a potential minor pathway, the Proponent states that the Project will not affect fish or aquatic resources in the Nation River. Potential changes in habitat, temperature, stream flow, and water quality are expected to be limited to Rainbow Creek. The downstream effect of any detectable change is expected no further than 28 km upstream from the mouth of Rainbow Creek.

Major Pathways

Major pathways are effects identified that have a valid linkage to fish, fish habitat and aquatic resources. These pathways are considered by the Proponent as likely to effect the environment, and may result in significant adverse effects to fish, fish habitat and aquatic resources. The major pathways of effects are assessed below:

5.1.1.2.12 Changes in Water Quality

Changes in water quality can significantly impact fish and aquatic resources. Water quality was assessed by comparing water quality concentrations predicted by the mass balance model to the BC Water Quality Guidelines, the CCME guidelines for the protection of aquatic life, the results of acute and chronic (30-day) toxicity tests, and the results of toxicity testing available in published literature.

The predicted water quality changes are expected to have a negligible effect on Rainbow trout because all water quality parameters modeled, with the exception of dissolved aluminum, are predicted to meet BC Water Quality guidelines or site-specific water quality objectives even under

low flow conditions. During closure and post-closure all water quality parameters modeled at reference sites in Alpine and Meadows creek are predicted to meet BC Water Quality Guidelines or site-specific water quality objectives. Water quality parameters in Rainbow Creek at Site 5 and downstream at Site 26 are predicted to be near baseline and within the range of natural variability that would be observed during the 22 year closure period and beyond. Water quality at these sites will be measured as part of the Proponent's Follow-Up program.

It should be noted that there is a small risk that during construction, surface run off from the TIA may enter Meadows Creek and or Alpine Creek and affect water quality; however the TIA is designed as a closed system. The Proponent defines the expected effects of water quality changes in all of the Project phases as low in magnitude, local in spatial scale and medium term. The effect of water quality changes is considered *Not Significant (Negligible)*. Since changes in water quality are predicted to be negligible, the effects of changes of water quality on Rainbow trout in Meadows Creek, Alpine Creek, Rainbow Creek or the Nation River are also expected to be negligible.

5.1.1.2.13 Alteration/ Loss of Fish Habitat and its Productive Capacity

The effects of permanent loss and temporary alterations of fish habitat and its productive capacity were assessed qualitatively and quantitatively. GIS (geographic information system) technology was used to overlay the maximum project footprint onto a generalized habitat classification system of the Rainbow Creek watershed. Habitat classification was generally based on morphologic habitat types which are standard to habitat assessment methods: riffle, run (glide), pool, headwater, and stream-fen. The Proponent used the fish Habitat Evaluation Procedures (HEP) methods, to quantify habitat using "habitat units", a dimensionless unit based on quantity of each habitat class affected and the quality of each habitat class for spawning, rearing foraging and overwintering; each habitat unit was then rated on a scale of 0-1. This methodology was used by the Proponent as a tool to enable a comparison of like-for-unlike compensatory fish habitat types via a "unit" measure in order to meet DFO's "no net loss" guiding principle, as per DFO's *Policy for the Management of Fish Habitat*. The methodology is further explained in Section 5.5.6 of the Proponent's EIS (Terrance Metals Corporation, 2008), as well as in its FHMCP which is described in Appendix D.

If the Ministerial determination on the EA determines that a significant environmental effect resulting from the Project is unlikely, the Proponent will need to obtain a subsection 35(2) Authorization under the *Fisheries Act* for the harmful alteration, disruption or destruction (HADD) of fish habitat (refer to Figure 5.1-1). The Proponent has drafted a FHMCP document for the purpose of discussing the impacts (quality and quantity) and compensatory options during the federal EA process. Finalization of this plan will be necessary prior to the issuance of an Authorization under subsection 35(2) of the *Fisheries Act* and any amendment to Schedule 2 of the *Metal Mining Effluent Regulations (MMER)* for the listing of the headwaters of King Richard Creek and Alpine Creek as a TIA. The FHMCP that is a requirement under Section 27.1 of the *MMER* will be considered by DFO, in consultation with EC, during the review of the Project per these regulations.

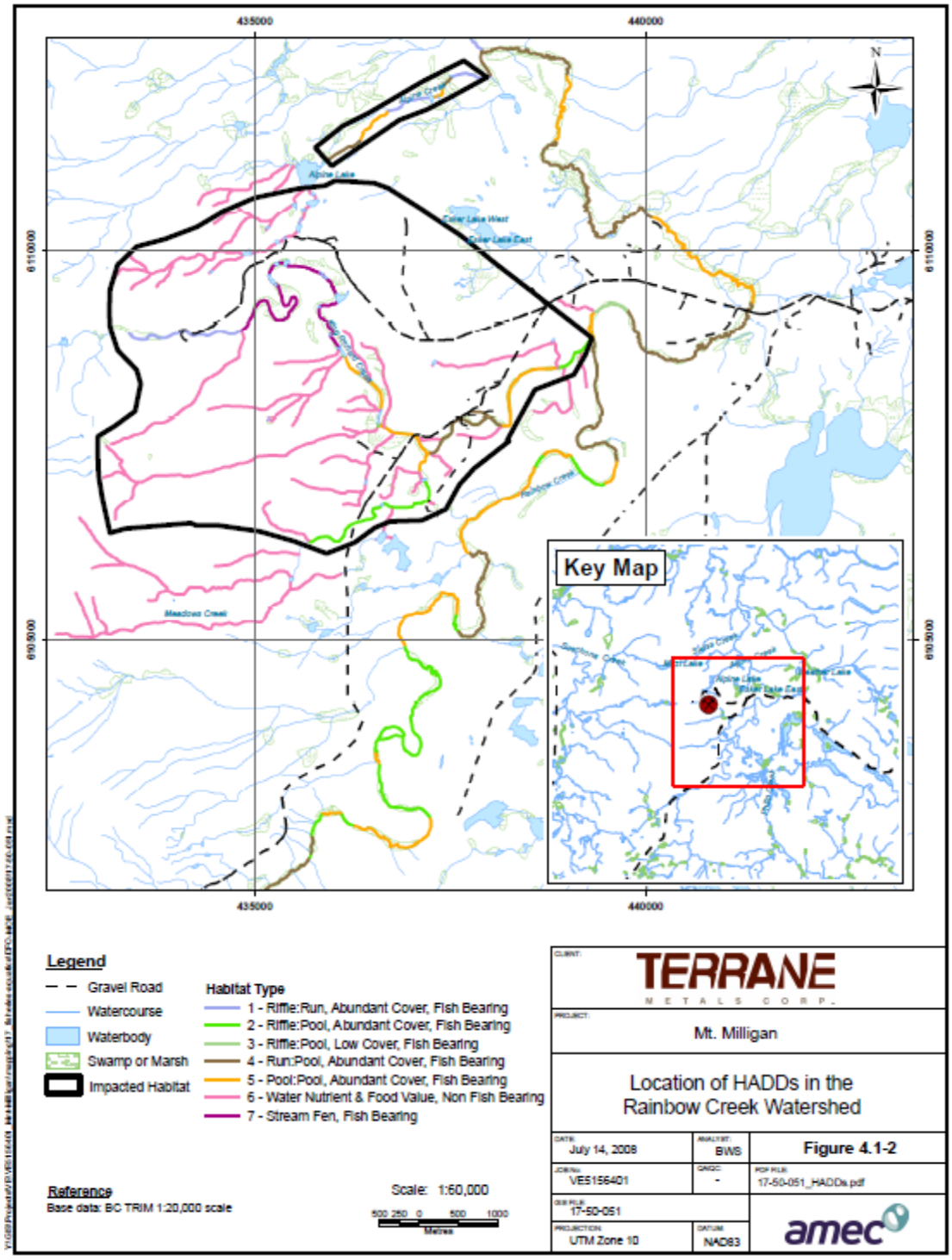

Figure 5.1-1 Location of HADDs in the Rainbow Creek Watershed
Reproduced courtesy of Terrane Metals Corporation.

Effects to each of the affected creek drainages are described below:

Meadows Creek

The construction of the Meadows Creek Water Supply Pond (MCWSP) will cause the harmful alteration, disruption and destruction (HADD) of fish habitat in Meadows Creek. The MCWSP will be formed by the construction of a 20 m high dam on Meadows Creek which will be situated about 1.5 km upstream from its confluence with Rainbow Creek and will impound Meadows Creek water for use in mine processing. The Proponent plans to construct the MCWSP during the first construction season and it will remain in operation until its decommissioning after 15 years of mine operations. The location of the MCWSP was chosen by the Proponent to avoid high quality riffle-pool habitat in the lower reaches of Meadows Creek. However, the MCWSP will eliminate fish habitat under the MCWSP footprint (approximately 1250 m long) and access to approximately 3 linear km of fish habitat in Meadows Creek upstream of the MCWSP. It will also reduce flow to habitat downstream of the MCWSP, thereby affecting lower Meadows Creek.

During operations, there is some potential for fish utilization of the MCWSP; it will have an average width of 700m, mean and maximum depth of 5m and 19m respectively, and will flood an area of approximately 44 ha. Although flows in seasonally wet years may be higher, water releases to lower Meadows Creek during mine operations are predicted to be as low as 0.030m^3/sec (30 L/sec), which will be lower than the average annual flows by up to 73%. The reduction of flow is expected to result in a partial loss of available fish habitat downstream of the MCWSP which is used by Rainbow trout for spawning, rearing, foraging, and overwintering. As a result of its construction and operation, it is expected that the MCWSP will impact 20, 802 m^2 of instream habitat, of which 1, 401 m^2 is headwater habitat.

At the conclusion of mining, the MCWSP will be drained, the dam will be decommissioned, the Meadows Creek channel will be reconstructed and the area reclaimed. A wetland will be constructed in the former MCWSP area between the TIA and the re-established Meadows Creek channel. Post-closure, the mine pits will fill and the pit lake and TIA will overflow back into Meadows Creek and ultimately into Rainbow Creek. Flows in Meadows Creek are predicted to return to near baseline conditions post-closure and fish use of habitat in Meadows Creek and the former MCWSP area is expected to return to baseline levels.

As part of the post-closure re-establishment of the Meadows Creek channel, the Proponent has also committed to remediate any project-related fish habitat impacts that may have occurred due to additional or subsequent adverse alterations that occur over the long term. This includes any adverse effects resulting from the change in flow volume in Meadows Creek, as well as any subsequent adverse alteration to the quality or quantity of spawning habitat for Rainbow trout (located downstream of the MCWSP to the confluence with Rainbow Creek).

King Richard Creek

The Project will result in the permanent loss of fish habitat within King Richard Creek, as the entire length of the creek is affected due to the mine footprint. Fish habitat loss is attributed to the construction of the open pits, the TIA, processing facilities, stockpiles, site water management facilities, mine site facilities, explosives manufacturing facility and magazine facilities and due to site clearing activities. As a generalization, habitat loss in King Richard Creek is about 48% stream fen, 24% headwater, 23% pool and 5% riffle-run habitat. Habitat loss is calculated to be 95, 627 m^2 of instream habitat. Once closure is complete, all run-off in the former King Richard Creek watershed will be channeled to the pits and the TIA where water will overflow to constructed wetland complexes and into Meadows Creek.

Alpine Creek

The construction of the northern arm of the TIA will result in the permanent loss of some of the headwater tributaries of Alpine Creek. The loss of these tributaries is expected to result in an approximate 60% reduction in the mean annual flow of Alpine Creek, which will likely reduce, and may eliminate the use of Alpine Creek by Rainbow trout. Alpine Creek habitat is generally evenly distributed between riffle-run-pool. It is expected that a total of 10, 155 m^2 of fish habitat will be lost or altered in Alpine Creek and of that 7, 001 m^2 is calculated to be headwater habitat and 3, 154 m^2 of creek mainstem habitat located downstream of Alpine Lake, in Alpine Creek. Alpine Lake itself is not expected to be significantly impacted by the Project.

5.1.1.2.14 Erosion and Sedimentation

Potential effects of increased total suspended solid (TSS) concentrations on fish habitat and aquatic resources were assessed quantitatively by comparing TSS concentrations predicted in the water quality assessment to the CCME guidelines for the protection of aquatic life (CCME, 2002). Qualitative assessment was also undertaken by estimating the likelihood of sediments accumulating in fish habitats.

The Proponent indicates that activities associated with the proposed Project have the potential to erode instream and upland sediments thereby increasing TSS concentrations and sedimentation in streams downstream of the Project. Rainbow trout and benthic invertebrates tolerate elevated TSS concentrations for short periods but adverse direct and indirect effects can occur if TSS concentrations are elevated frequently or are persistent.

Through the implementation of erosion and sedimentation control measures as well as other mitigation measures, the Proponent considers the potential for suspended or deposited sediments to adversely affect Rainbow trout or any other aquatic biota in Meadows, Alpine, or Rainbow Creeks during the Project to be negligible because releases are unlikely. Sediment inputs during all phases of the Project are rated to have a very limited spatial scale, with geographic extent limited to the vicinity of the mine footprint where control measures will be in place. Additionally, the Proponent committed to implementation of guidelines and EMPs that will be followed during all phases of the mine. These guidelines and EMPs include:

- BC MOE Standards and Best Practices for Instream Works
- Reduced Risk Timing Windows for Fish and Wildlife in the Omineca Region

The Proponent concludes that the any effects from increased sedimentation are of low magnitude, local scale and medium to long term but *Not Significant (Minor)* defined as '*Effects of low magnitude, any duration, occur at all frequency, and effects can be distinguished at the level of individual organism or sub populations*'.

5.1.1.2.15 Changes in Instream Flows

Changes in stream flow were assessed in two ways:

1. Changes in monthly discharge during all project phases, which was calculated by comparing creek flow measurements predicted by the groundwater-discharge model, and comparing them with the range of natural variability of creek flows at specific sites under baseline conditions. This change was calculated for stream flow during mine operations (Year 1-16), during mine closure (Year 17-20) and at the end of the post-closure phase (~Year 37-40, approximately twenty years after ceasing operations, when the pit lake is filled).
2. Changes in modeled monthly discharge at two Rainbow Creek sites (5 and 26), compared with various instream flow threshold techniques available in published literature including

the BC "Instream Flow Thresholds for Fish and Fish Habitat" which are used by DFO as guidelines for proposed flow reduction acceptability. The other methods (Tennant, 1976; Tessman, 1980) are noted in the EIS.

The Project is likely to affect stream flows in Meadows Creek, Alpine Creek, and ultimately Rainbow Creek during mine construction, operations and until the pits overflow during the post-closure period (Year 37). Potential impacts to Rainbow trout include: changes in suitability of spawning, rearing and foraging habitats in lower Meadows, Alpine and Rainbow Creeks; changes in benthic invertebrate drift entering Rainbow Creek from both Meadows and Alpine Creeks; and, changes in the availability of access to Meadows and Alpine Creeks as a result of flow reductions.

Since the Proponents' previous application for a British Columbia Mine Development Certificate in 1991, the project has been redesigned to reduce the effects of instream flow reduction on Rainbow trout by re-locating the entire mine within the King Richard Creek watershed to create as small a project footprint as possible. The demand for freshwater is reduced to the maximum extent possible by recycling water in the TIA for mine processing; it follows, therefore, that major changes in stream flow volumes within Rainbow Creek have also been minimized.

The Proponent has determined that the stream flow changes in Rainbow Creek will be reduced by a maximum of 27% of peak spring discharge and 17% in mean annual flow and will generally fall within most recommended flow guidelines, with the exception of the BC "Instream Flow Thresholds for Fish and Fish Habitat" that define the low risk threshold; but those guidelines will still be met under most conditions. The Proponent used values for calculating flows that were conservative, as a course filter, and the minimum flow volumes fall with in the range of natural variability; therefore, the HADD of fish habitat is not expected (AMEC, 2008c). The expected fish habitat losses in Meadows, King Richard and Alpine Creeks are accounted for in the proposed FHMCP (AMEC, 2009c).

Because the Proponent has calculated the loss of fish habitat in both Meadows and Alpine Creeks in their entirety and proposes to compensate for such losses in the FHMCP, the subsequent use by fish of the reduced-flow-habitat within these systems and return of use post-closure is expected to represent less than the net loss than has been calculated.

The Proponent concludes that the any effects from change of stream flows are of low magnitude, local scale and long term but are *Not Significant (Minor)* defined as '*Effects of low magnitude, any duration, occur at all frequency, and effects can be distinguished at the level of individual organism or sub populations.*'

5.1.1.2.16 Changes in Rainbow Creek Thermal Regime

Potential changes in groundwater seepage, reductions in surface flows, and discharge from the MCWSP on water temperatures in Rainbow Creek were assessed using a mass-balance model to predict changes based on instantaneous mixing of tributary and groundwater contributions with different volumes and water temperatures. There are two identified pathways by which the mine could cause changes in water temperature in Rainbow Creek: though changes in groundwater seepage from the mine pits, or changes in the volume and temperature of water discharged into Rainbow Creek by Meadows Creek due to the MCWSP and/ or loss of King Richard Creek. In general, temperature change effects on fish may directly affect their rates of feeding, metabolism, energy conversion efficiency, and growth and indirectly affect dissolved oxygen levels, production of invertebrate prey and interactions with other species. Fish may alter their behaviour due to instream temperature changes, and may not be able to avoid such changes in small streams if limited thermal refugia exists.

The Proponent has predicted that decreases in temperature of up to 1.5ºC may occur, however decreases in temperature of this magnitude are expected to have a negligible effect on Rainbow trout

in Rainbow Creek. The Proponent rates the changes of thermal regime in Rainbow Creek as low in magnitude, local in spatial scale but potentially long term but *Not Significant (Minor)* defined as '*Effects of low magnitude, any duration, occur at all frequency, and effects can be distinguished at the level of individual organism or sub populations*'.

5.1.1.2.17 Mercury Methylation/ Selenium

Mercury Methylation

Methyl mercury is the toxic form of mercury that can be assimilated by aquatic biota and can bio-accumulate in higher trophic level organisms such as fish. Methyl mercury can damage the central nervous system, endocrine system and kidneys of fish, and in high concentrations can lead to death. In concentration, it can have the same effect on humans; therefore consumption of fish with high methyl mercury concentrations can lead to human health risks and these are further discussed in Section 5.3.4.2 of this CSR. The mechanism by which methyl mercury is created can result from flooding the land, particularly when there is a substantial amount of inorganic mercury naturally available in soils and sediments and is dependent on the amount of available carbon as a food source for microbial activity (e.g., wetlands, and aquatic vegetation), the size of the reservoir, the location of the reservoir in the watershed, reservoir operations (i.e., fluctuation of water levels) and the type and quantity of uplands or wetland flooded.

There is a very low risk that the construction of the MCWSP has the potential to produce methyl mercury. To mitigate the potential formation of methyl mercury formation, the Proponent proposes to remove all organic soils and vegetation prior to allowing its inundation with water. As well, the MCWSP will be lined with low-permeability till to minimize seepage; the liner will also cap underlining material to further prevent bacterial and microbial activity (Terrane Metals Corporation, 2008b).

Overall mercury in the surface water of Meadows Creek was determined to be low, as were the concentrations of mercury in fish collected within Meadows Creek and in nearby streams, rivers and lakes. Mercury levels were determined to be comparable to concentrations found in other uncontaminated BC water bodies. Based on modeling the Proponent predicts that without pre-stripping of organics, methyl mercury concentrations in fish would increase up to four times baseline (0.4 μg/g from 0.1 μg/g); with pre-stripping the Proponent does not expect any significant increase in methyl mercury in Rainbow trout. Since baseline mercury naturally exceeds BC guidelines in fish tissue any future increases will be evaluated against site specific objectives agreeable to BC MOE or other relevant agencies.

The Proponent rates the effects from methyl mercury as being low magnitude and having low ecological context. Changes will be local in spatial scale and medium term in duration. Effects of methyl mercury are considered *Not Significant (Negligible)* defined as *'Effects are of no magnitude, any geographical extent, any duration, occur at all frequencies (occur once or intermittently), and their effects are indistinguishable from natural physical, chemical and biological characteristics and processes"*.

Selenium

Metal leaching assessments and water quality modeling indicated that significant leaching of selenium will not occur, thus no residual effects on fish and aquatic resources are expected from any of the facilities. However, the Proponent has committed to monitor selenium in the body tissues of Rainbow trout and Slimy sculpin within various mine components (e.g., MCWSP and TIA) and undertake additional studies or mitigation if necessary. Near closure, if the risk of fish uptake of selenium is deemed to be a concern, the proposed MCWSP and TIA wetlands will be reduced in size

or eliminated to minimize creation of lentic environments in which selenium might become bio-available.

5.1.1.3 Mitigation

Mitigation has been discussed for the minor and major pathways of effects, as applicable and relevant to the subject. The Proponent has committed to implementation of appropriate guidelines and operational statements, and have ensured that they will be adhered to Best Management Practices during all phases of the Project. A listing of the Proponents commitments, general mitigation strategies and Best Management Practices related to minimizing effects to fish, fish habitat and aquatic resources are presented in Appendix C (Amalgamated Table of Proponents Commitments, Mitigation and Best Management Practices).

As discussed, some losses of fish habitat are expected as a result of the Project which can not be mitigated or otherwise avoided. The Proponent has developed a Fish Habitat Mitigation and Compensation Plan to offset the impacts and nullify any potential residual effects. The FHMCP will become part of an Authorization for HADD resulting from the Project, if one is appropriate following the EA. A summary of the review of the FHMCP pertaining to the EA period is briefly described below.

Fish Habitat Mitigation and Compensation Plan

A conceptual FHMCP was submitted in the Appendices of Volumes 5 and 6 of the EIS. After discussions that occurred during the BC EA process, a revised draft FHMCP was prepared by AMEC on behalf of the Proponent (AMEC, 2009c). A summary of the revised draft FHMCP is attached in Appendix D.

For information purposes, this section presents a brief overview of the FHMCP, to date. It should be noted that the conceptual FHMCP which was submitted during the BC EA process differs from the revised draft FCMP (AMEC, 2009c) in the following ways:

- The Proponent has recalculated the spatial areas of habitat loss using high-resolution LiDAR imagery and has included calculation of upper Meadows Creek as a HADD;
- A qualitative screening of the available compensation options has been undertaken using various biological, engineering, regulatory, and socio-economic criteria, as well as the results from the September 2008 field program to assess the compensation options;
- Descriptions and habitat summaries of the compensation options determined to best attain no net loss of the productive capacity of fish habitat are provided after vetting of options with DFO and BC MOE staff;
- The Proponent advised the RAs that Nak'azdli First Nation initial review comments on the conceptual FHMCP were incorporated;
- A summary of the proposed mitigation measures to be used prior to and during construction of the various compensation options is provided; and,
- A conceptual monitoring plan has been developed.

In brief, after undertaking screening and assessment of a larger set of options, including focused field data collection and considering habitat compensation necessary to achieve "no net loss" of the productive capacity of fish habitat, the Proponent has determined that the preferred compensation options include:

1. Construction of overwintering pools in upper Rainbow Creek;
2. Enhancement of habitat in middle Rainbow Creek with habitat complexing;
3. Construction of off-channel rearing/overwintering pools in middle Rainbow Creek;

4. Construction of off-channel spawning/rearing channels in lower Rainbow Creek; and,
5. Crossing structure upgrades via replacement of improperly installed culverts (which prevent fish passage to upstream habitat) within the Nation River watershed.

5.1.1.4 Residual Effects and Discussion

Based on the information provided by the proponent and gathered in the course of the participation of the RAs in the BC EAO Environmental Assessment review process, DFO concluded that there will be unavoidable harmful alteration, disruption or destruction of fish habitat in Meadows Creek, Alpine Creek and King Richard Creek. The RAs concur with the Proponent's assessment that contingent to the successful implementation of the measures outlined in the proposed Fish Habitat Mitigation and Compensation Plan (FHMCP), the adverse environmental effects of the Project to fish and fish habitat will be *Not Significant*, defined as *'Effects of low magnitude, any duration, occur at all frequency, and effects can be distinguished at the level of individual organism or sub population'.*

Contingent to the environmental assessment decision of the Minister of Environment, DFO may issue an authorization under subsection 35(2) of the *Fisheries Act* and recommend that the Governor in Council amend the MMER in order to permit the project to be carried out. In that instance these effects will be addressed by the FHMCP through the creation and enhancement of fish habitat in order to meet the guiding principle of "No Net Loss" per DFO's *Policy for the Management of Fish Habitat* and the requirements of Section 27.1 of the MMER. Terrane Metals Corporation will continue to revise the FHMCP to meet the guiding principle in consultation with DFO, MOE and interested First Nations.

5.1.1.5 Conclusions

In reaching a conclusion on the significance of the potential environmental effects on fish, fish habitat and aquatic resources the RAs have taken into account:

- The EIS, which includes a description of potential project effects on fish, fish habitat and aquatic resources, and the Proponent's evaluation of the significance of residual effects;
- Mitigation measures described within this section;
- The requirement for a S.35 Authorization under the Fisheries Act and the Fish Habitat Mitigation and Compensation Plan proposed by the Proponent; and,
- Mitigation measures that the RAs are satisfied will be implemented by the Proponent as described in Appendix C (Amalgamated Table of Proponents Commitments, Mitigation and Best Management Practices).

Provided that the Proponent successfully implements the required mitigation measures, the Fisheries Management Plan, and the FHMCP, the RAs are satisfied that Project is not likely to cause significant adverse environmental effects to fish, fish habitat, and aquatic resources.

The Proponent will conduct environmental (compliance) monitoring as per their commitments to the BC EAO, identified in Appendix C of this CSR, as well as those required under permits, licences and Authorizations. Pursuant to the *CEAA*, the Proponent is responsible for conducting Follow-Up Programs to determine the accuracy of the EA conclusion and the effectiveness of the mitigation measures. Follow-Up Programs relating to fish, fish habitat and aquatic resources are described in Section 7.0 of this CSR.

5.1.2 Wildlife and Wildlife Habitat

The Proponent discusses the background and anticipated impacts on wildlife in Section 4.8.1 to 4.8.6, and Section 5.8.4 of the EIS. According to the Proponent, the residual negative effects of the Project to wildlife (including migratory bird and species at risk) after mitigation are expected to be long-term, local, and small.

5.1.2.1 Background

"Wildlife" is defined in the Proponent's EIS as wildlife habitat, dragonflies and butterflies, amphibians, reptiles, birds and mammals. For the purposes of field sampling and assessing effects to wildlife, the LSA was set at 500 m beyond the footprint of the proposed Mount Milligan Gold-Copper Mine and its facilities and includes the power line, access road corridors and concentrate load-out facility. Some assessment work was completed beyond this boundary given the large home ranges of a number of key wildlife species such as moose and northern caribou. The RSA boundary was set 20 km beyond that of the LSA, with an additional area appended to the RSA associated with the northern caribou Kennedy Herd. Generally, field surveys focused on federal and provincial lists of wildlife species considered to be at risk (i.e., those listed federally on Schedule 1 of the *Species at Risk Act* and provincially by the BC Conversation Data Centre (CDC) as red or blue-listed.

The Proponent assessed that the Project area is, or is suspected to be, utilized by 13 butterfly species, 46 dragonfly species, 4 amphibian, 2 reptile, 118 bird and 22 mammal species. Of these species, eighteen have been identified as federally or provincially-listed species-at-risk. Species at risk requirements are also discussed in Section 3.7 of this report (Regulatory Overview for Species at Risk).

5.1.2.2 Potential Project Effects

The following wildlife VECs were assessed in the Application. A summary of information regarding on the status of the species, their presence within the LSA or RSA, as well as the potential impacts to the VECs is presented below in Table 5.1-1. Eighteen wildlife species-at-risk were identified as potentially occurring in the LSA, including five dragonfly species, one amphibian species, eight bird species and four mammal species. Eight of the eighteen potentially occurring species were confirmed by the Proponent through field studies, the others are presumed to occur based on other assessment data, discussions with First Nations, and through other sources as referenced in the EIS.

Table 5.1-1: List of Wildlife VECs, Species at Risk Information, Effects and Residual Effects

VEC	Information	Species Status and Presence within LSA/ RSA	Potential Effects	Significance/ Residual Effect
Insects: Butterflies/ Dragonflies	Of the 13 butterfly and 46 dragonfly species confirmed in the Fort St. James area during field investigations conducted in 2001, five dragonfly species are provincially blue-listed species at risk.	Hagen's Bluet, Beaverpond Baskettail, Quebec Emerald, Forcipate Emerald, Kennedy's Emerald are presumed to occur in the LSA.	Likely affected by disturbances to freshwater aquatic habitats (total losses of wetland approximately 104 ha). Ponds are necessary for dragonfly breeding, and vegetation is used as cover and ovipositor sites. There are also potential exposure related impacts due to degraded water quality/ pollution in the TIA.	- Incidental dragonfly mortality - Change in habitat availability

VEC	Information	Species Status and Presence within LSA/ RSA	Potential Effects	Significance/ Residual Effect
Amphibians/ Reptiles: Western Toad	Four amphibians and two reptiles are suspected to occur within the LSA. Western toad is nationally designated as a COSEWIC species of special concern. Provincially Western Toad are yellow-listed.	Western toad was the only amphibian/ reptile confirmed by field studies. It was found to occur along the access road/ power line corridors during wetland surveys conducted in June 2007.	Breeding areas are considered critical habitat for Western toad. Potential impacts related to permanent alteration/ loss of approximately 36 ha of available habitat of high quality which is characterized by permanent, non-flowing shall waterbodies for breeding and most, shaded terrestrial sites with abundant leaf litter and coarse woody debris.	- Changes in habitat availability
Raptors	Fourteen raptor species were confirmed in the LSA by targeted surveys conducted in 2007, including five species at risk.	Northern goshawks (provincially regionally significant) and Broad-winged hawk (provincially blue-listed), Swainson's hawk (provincially red-listed) and Peregrine falcon (provincially blue-listed and COSEWIC status of Special Concern) were confirmed. Short-eared Owl (provincially blue-listed) and Common Nighthawk (provincially yellow-listed and COSEWIC status of Threatened – *Schedule 1*) are potentially present but were unconfirmed.	Vegetation removal and landscape alteration may disturb raptor feeding, breeding and nesting habitat and behaviour. Potential impacts related to permanent alteration/ loss of 464 ha of mature and old growth forest.	- Change in habitat availability and structure - Reduction of suitable tracts of intact forest (i.e., fragmentation) and displacement from nests - Change in raptor species predominance
Songbirds	Sixty-nine songbird species were confirmed in the LSA, including two provincially listed species.	Barn swallow (provincially blue-listed) and Rusty blackbird (provincially blue-listed and COSEWIC Status of Special Concern) were confirmed. Sandhill Crane (provincially blue-listed) were unconfirmed.	Vegetation removal may disturb songbird feeding and nesting habitat and behaviour. Potential impacts related to permanent alteration/ loss of habitat.	- Decline (temporary) in passerine populations - Alteration in species composition from fragmentation/ edge effects - Change in habitat availability

VEC	Information	Species Status and Presence within LSA/ RSA	Potential Effects	Significance/ Residual Effect
Waterfowl:	Twenty-five species were confirmed in the LSA.		Permanent alteration/ loss of wetlands in King Richard and Meadows Creek are anticipated and will affect local waterfowl.	- Changes in habitat availability - Loss of wetland and terrestrial foraging habitat
Furbearers: General	Seven furbearers were recorded in the LSA, including: American marten, weasel species, American mink, northern river otter, wolverine, fisher and beaver (below).	The presence of Wolverine (provincially blue-listed and COSEWIC Status of Special Concern) and Fisher (provincially blue-listed) were confirmed in the LSA through the observation of tracks along access and powerline corridors.	Potential effects on traditional/ non-traditional use of lands for wildlife hunting with related increase of hunting pressures. Potential increase of mortality due to increased road traffic.	- Change in habitat availability to wolverine and fishers related to removal of 180 ha of upland mature and old-growth forest; generally to 1060 ha of upland habitat - Change in denning sites - Changes in food sources - Potential mortality
Furbearer: Beaver	Beavers are significant to First Nations, and an economically important furbearer to trappers, and are therefore treated as a separate VEC.	Presence of beavers is confirmed through trapping which is common within the RSA.	Direct loss of beaver habitat and beaver removal during construction may affect trapping activities.	- Change in habitat availability from loss of King Richard and Meadows Creeks - Degradation of habitat - Displacement - Mortality associated with destruction of dens/lodges during construction
Ungulates: General	Four ungulate species were recorded in the LSA: moose, Rocky Mountain elk, white-tailed deer and mule deer. All species are a food source for First Nations.	Presence is confirmed.	Some wetland habitat, particularly sedge fens, which provide important habitat for moose, deer and elk, will be eliminated by the Project. Potential effects on traditional/ non-traditional use of lands for wildlife hunting with related increase of hunting pressures. Potential increase of mortality due to increased road traffic.	- Changes in habitat availability through a loss of 1060 ha of upland habitat - Displacement from habitat, though limited winter range for moose is available - Sensory disturbance - Potential mortality
Ungulates: Northern Caribou	Northern caribou are considered at risk. The northern caribou Kennedy Herd range (Kennedy Siding Ungulate Winter Range) overlaps the far easter portion of	The presence of northern caribou (provincially blue-listed and COSEWIC Status of Threatened/ Special Concern – *Schedule 1*). The presence of the	Terrestrial lichens as a food source are considered critical during the winter. Winter range habitat overlaps the proposed powerline corridor, but habitat will still be available to caribou for	- Loss of habitat within alpine and subalpine forests during winter for lichen foraging - Alteration in species composition if other ungulate

VEC	Information	Species Status and Presence within LSA/ RSA	Potential Effects	Significance/ Residual Effect
	the LSA and is considered important. The range of the northern caribou Wolverine Herd ends near the northern boundary of the RSA.	Kennedy Caribou Herd was unconfirmed by field studies.	winter forage.	populations have responsive increase - Potential increased illegal poaching
Carnivores: Grizzly Bear/ Black bear	Six species of large and medium-sized carnivores have been documented in the LSA: grizzly bear, black bear, coyote, grey wolf, red fox, and Canada lynx.	Grizzly bear populations are provincially blue-listed. Presence of both grizzly bear and black bear is likely though denning habitat was rated as nil in the LSA	High value security and thermal habitat will be affected by the Project.	- Minor displacement due to extensive home ranges (up to 8000 km2) but likely avoidance of roads; mine site physical barrier to migration - mortality due to human-bear conflicts resulting from habituation to human presence and food-conditioning

In general, the Proponent identifies six key potential effects for wildlife VECs associated with the proposed Project. These potential effects include the following:

Changes in Wildlife Habitat Availability

Changes to the form, function and use of habitat by wildlife is likely to result from habitat alteration or removal during construction activities and for operations. Direct effects are likely to occur in areas where habitat is permanently altered and indirectly in areas immediately adjacent to those permanently altered. Wildlife use patterns may change in response to habitat edge effects and/or in areas of close proximity to land disturbances or other anthropogenic (human-caused) effects. Post-closure, reclamation efforts may restore the site such that it provides productive wildlife habitat; however, the habitat composition will likely be permanently altered.

Alteration or loss of habitat (temporary or permanent) is likely to impact wildlife, particularly those with limited mobility, small home ranges, territories or dens, or those wildlife species having other site-specific habitat requirements located at or close to the mine footprint. The degree of effect will be dependent on the species, population or sub-population, mobility, home range and territorial behaviour.

Habitat/ Water Quality Degradation

The degradation of habitat in and around the LSA may result from dust generation, emissions caused by vehicle or equipment operations and other associated activities in the mine site, hazardous material spills and forest/brush fires. Water quality is predicted to meet the BC Water Quality Guidelines and site specific water quality objectives.

Disruption of Movement

The most significant changes in movement patterns are predicted to occur on lands that are currently in a natural condition (i.e., unaltered or undeveloped) within the proposed mine site. Infrastructure and linear corridor construction can create barriers to wildlife movement. As a result existing travel corridors, or feeding and nesting sites access may be bisected or lost, and migratory species may adjust their movement patterns to avoid open or fragmented lands. Travel corridors are important as they provide connectivity between different habitat types, and optimal conditions for seasonal movements between summer and winter ranges. They provide for the sheltered dispersal of species to new territories which in turn, provides genetic diversity for breeding stock.

Displacement

The presence of humans and their associated activities at the mine site may disturb or displace wildlife. Disturbances from noise impacts (e.g., blasting or equipment operations), olfactory impacts (e.g., odours from fuels, lubricants and humans), or visual impacts (e.g., vehicle traffic, mine site personnel, large equipment, infrastructure) may affect wildlife by distracting them from feeding or breeding, or cause their abandonment of the area. Wildlife avoiding key habitat sites (e.g., ponds and creeks adjacent to the proposed mine site) because of continued disturbances, may suffer a reduction in health, survival or reproductive capacity from displacement.

Effects are predicted to range from minimally detectable metabolic changes (e.g., accelerated heart rate) to vocalizations (e.g., warning calls) to movement away from the disturbance (i.e., displacement, either temporary or permanent). Sensory related disturbances are considered reversible once the disturbance ceases. Some wildlife species may become acclimated to re-occurring sensory disturbances.

Features Acting as an Attractant

Features or materials that interest or provide resources to wildlife are considered to be wildlife attractants. Wildlife may be attracted to the young shoots of early seral stage or regenerating vegetation at road edges as well as newly reclaimed sites or right-of-ways that may serve as travel corridors. Buildings and structures may be used as roosting/nesting sites. Smells associated with human activities may act as an attractant (e.g., food and garbage areas), resulting in habituation and food conditioning of wildlife. This may lead to wildlife- human conflicts with "problem" animals.

Wildlife Mortality

Vehicular traffic on the proposed mine access road may result in an increase in wildlife mortality because of collisions. The removal of "problem" wildlife, to protect workers, may also represent a direct project-related increase in wildlife mortality.

5.1.2.3 Mitigation

The Proponent has concluded that through the implementation of commitments, mitigation measures and best management practices (Appendix C: Amalgamated Table of Proponents Commitments, Mitigation and Best Management Practices) that all impacts of the Project on VECs will be *Not Significant (Minor)*, defined as '*Effects of low magnitude, any duration, occur at all frequency, and effects can be distinguished at the level of individual organism or sub population*'.

Other project specific mitigation strategies proposed by the Proponent to effectively manage potential effects on wildlife include:

- Locating the proposed power transmission line on or adjacent to existing roads or clear cuts and minimizing the construction of new access road corridors though the use of existing roads and access routes;
- Mitigating impacts to northern caribou, specifically the Kennedy Siding Ungulate Winter Range, by avoiding disturbances within this area for construction of the power transmission line between 15 October and 28 February and removal of overhead vegetation canopy while avoiding the underlying ground-layer lichen mats in the corridor expansion construction area (refer to EIS Table 5.8-29);
- Reduction of potential effects to beavers and beaver traplines through avoidance of riparian areas and creeks, accomplished by: moving the TIA away from Rainbow Creek and other waterbodies; and implementation of the Wildlife Management Plan and a Transportation and Access Management Plan (which specify that input will be sought from appropriate stakeholders and First Nations on any active removal of beavers from wetlands in mine site area);
- Implementation of the Wildlife Management Plan to minimize direct and indirect adverse effects on wildlife including, for example, establishing landscape buffers for raptors and wildlife, exclusion fencing and the removal of attractants such as garbage and sewage wastes (Section 6.3.16 of the EIS);
- Implementation a "no fishing and hunting" policy for all Terrane employees and contractors while on company business or commuting to and from the mine; and,
- Reclamation of wildlife habitats upon decommissioning and post-closure including dismantling of facilities and re-vegetation of the site to restore productive habitat in the mine area in accordance with the Decommissioning, Closure and Reclamation Plan.

5.1.2.4 Residual Effects and Discussion

With the implementation of the mitigation measures put forth in the Proponent's Application including the Wildlife Management Plan, the Proponent has identified that there are no anticipated residual effects expected for wildlife or wildlife habitat in the post-closure phase; however, the Proponent states that the composition and structure of the restored habitats are likely to be substantially different from those which pre-existed. The Proponent rates the residual effects of the Project on all of the identified wildlife VECs as Not *Significant (Minor),* defined as *'Effects of low magnitude, any duration, occur at all frequency, and effects can be distinguished at the level of individual organism or sub population.'*, or N/A (not applicable). The Proponent points to the avoidance of impacts (e.g., minimizing the mine footprint), the creation of temporary habitats near the affected areas, as well as reclamation and remediation following site closure as having high reversibility of impacts in their conclusions that residual impacts to wildlife and wildlife habitat are '*Not Significant (Minor)*'. The Proponent determined that the potential effects potential effects to wildlife resources associated with the proposed Project are spatially limited, relatively short term in duration, and largely reversible through site reclamation.

In accordance with the findings of the BC EAO Assessment Report, the BC EAO was satisfied that no significant residual adverse effects associated with wildlife would be anticipated based on:

- proposed project design commitments and other mitigation measures that have been agreed to by the Proponent;
- further requirements and obligations that will be imposed by permitting agencies; and
- ongoing monitoring of operations and enforcement of commitments that will occur following the issuance of the required permit(s).

The federal RAs and FAs participated in the BC EAO Environmental Assessment review process and provided input related to their respective mandates to support that process.

5.1.2.5 Conclusions

In reaching a conclusion on the significance of the potential environmental effects on wildlife and wildlife habitat the RAs have taken into account:

- The EIS, which includes a description of potential project effects on wildlife and wildlife habitat, and the Proponent's evaluation of the significance of residual effects;
- Mitigation measures described within this section;
- the Implementation of the Wildlife Management Plan; and,
- Mitigation measures that the RAs are satisfied will be implemented by the Proponent as described in Appendix C (Amalgamated Table of Proponents Commitments, Mitigation and Best Management Practices).

Provided that the Proponent successfully implements the required mitigation measures and the Wildlife Management Plan, the RAs are satisfied that Project is not likely to cause significant adverse environmental effects to wildlife or wildlife habitat.

The Proponent will conduct environmental (compliance) monitoring as per their commitments to the BC EAO, identified in Appendix C of this CSR, as well as those required under permits, licences and Authorizations. Pursuant to the CEAA, the Proponent is responsible for conducting Follow-Up Programs to determine the accuracy of the EA conclusion and the effectiveness of the mitigation measures. Follow-Up Programs relating to wildlife and wildlife habitat are described in Section 7.0 of this CSR.

5.1.3 Vegetation and Plant Communities

The Proponent discusses the background and anticipated impacts on vegetation and plant communities in Section 4.8.1 to 4.8.2 and Section 5.8.4 of the EIS.

5.1.3.1 Background

The LSA for the purposes of field sampling and assessing effects to vegetation and plant communities was set at 500 metres beyond the footprint of both on-site and off-site facilities. Owing to the large home ranges of a number of key wildlife species dependent on the habitat attributes (e.g., moose and northern caribou), the RSA was set at 20 km beyond that of the LSA plus the area of the Kennedy caribou herd. The Proponent identified 11 biogeoclimatic subzones within the RSA and five biogeoclimatic subzones within the LSA. Most of the forested lands within the proposed Project area are comprised of lodgepole pine and spruce, with balsam (at higher elevations) and scattered areas of aspen. The Proponent characterizes the area as a mosaic of forest stands of different ages, owing to a history of wildfires and logging. Based on ecosystem mapping conducted for the proposed Project, immature forests comprise 41.6% of the access road corridor, 43.4% of the mine area, and 30.0% of the power line corridor. Four VECs were identified by the Proponent for the purpose of assessing the effects of the Project on vegetation and plant communities including:

- plant species used traditionally by First Nations;
- biodiversity and plant community structure and composition;
- rare plant species; and,
- plant communities at risk.

Plant Species Traditionally Used by First Nations

Forty-one plant species traditionally used by First Nations are distributed throughout the LSA (refer to Section 4.7.5 of the EIS for a complete list of plant species traditionally used by First Nations). The Proponent identified that effects would mostly occur within the footprint of the proposed mine site area and power line corridor. The Proponent further determined that because the species traditionally used by First Nations occur widely, effects in the mine area or the power line are not expected to alter their availability.

Biodiversity and Plant Community Structure and Composition

Effects experienced during the construction and operations period are predicted to be reversed during the decommissioning and closure phase when the area will be revegetated using plants native to the area, and in particular those species of cultural significance to First Nations. Effects on biodiversity and plant community structure and composition were predicted to be greatest on the mine site where the original plant community will be permanently altered.

Rare Plants

According to the Proponent, no rare plants were found in the mine area; however, the Proponent recognizes that it is possible that mine activities associated with the Project could affect unrecorded rare plants and mitigation measures will be implemented in the event rare plants are found.

Plant Communities at Risk

Federal listing by the COSEWIC relate to plant species at risk, whereas the provincial listing relates to plant communities at risk. No federally listed species at risk were observed at the mine site during field observations by the Proponent; however, fifteen plant species at risk were identified as 'potentially occurring' in the LSA.

Two provincially red-listed plant communities (or ecosystems) are found in the RSA and are classified as being at risk (defined as critically imperiled by the BC Conservation Data Center (CDC)):

- Timber Oatgrass - Reindeer Lichen Grassland ecosystem – an upland forest community along the power line corridor which is widespread east of the Parsnip River; and,
- Slender Sedge- Common Hook-moss ecosystem - a wetland community in the mine area which is extensively distributed along the floodplain of Rainbow Creek and is found at 22 sites within the LSA.

Five provincially blue-listed communities at risk (defined as threatened by the BC CDC) were identified within the Project footprint during the Proponent's detailed habitat mapping assessment. The main communities affected are shown in Table 5.1-2 and further described in Section 5.7.4.4 of the EIS. The Proponent states that the plant communities at risk will be restored at closure to the degree possible.

Table 5.1-2: Provincially Blue-listed Plant Communities at Risk

Plant Community	Area and Extent
Slender sedge – Common hook-moss	55.2% of 126.8 ha mapped within the LSA lies within the Project footprint
Hybrid White spruce – Pink spirea – Oak fern	22.3% of 16.4 ha mapped within the LSA lies within the Project footprint
Lodgepole pine – Huckleberry – Cladina	7.8% of 1054.2 ha mapped within the LSA lies within the Project footprint
Hybrid White spruce/ Douglas-fir – Knight's plume	6.8% of 368.8 ha mapped within the LSA lies within the Project footprint
Lodgepole pine – Huckleberry – Velvet-leaved blueberry	6.1% of 121.6 ha mapped within the LSA lies within the Project footprint

5.1.3.2 Potential Project Effects

In the Proponent's application, the loss of forest/vegetated land (i.e., habitat alteration & plant mortality) and the introduction of invasive species were identified as adverse impacts to vegetation and plant communities. These effects are discussed below and are further described in Section 5.7 of the EIS.

Loss of Forest/Vegetated land

The Proponent has indicated that there will be effects on vegetation and plant VECs due to the direct loss of vegetated land associated with site clearing and grading as well as construction of berms, dykes and diversion channels, the TIA, and mine infrastructure (1,224 ha), construction of the access road corridor (25 ha), and the power line corridor (568 ha). The proposed project may also alter plant community structure and habitat through fragmentation associated with the site clearing. The Proponent identifies that direct plant mortality is expected to occur from site clearing, soil salvage and stockpiling activities, as well as dust generation. The loss of individual plants may be an issue in the instance of rare plants, where the number of individuals comprising a population may be quite small. No plant species at risk were found during rare plant surveys, but their potential occurrence was acknowledged and 17 such species were identified as possibly occurring within the LSA. Of the five plant communities at risk within the Project footprint of the mine area only one plant community is likely to be affected, the Slender sedge – Common hook-moss community, of which 55.2% of the 126.8 ha mapped within the LSA lies within the Project footprint, most of it within the mine area. This plant community also exists outside of the RSA.

Introduction of Invasive Species

Disturbed areas that lack trees or species redistribution capability (e.g., seed base) from the previous ecosystem are vulnerable to colonization by invasive species, some of which can out-compete native species. The Proponent has indicated that ground disturbance due to construction at the proposed mine site and along the power line and access road corridors may introduce exotic or invasive plant species.

5.1.5.3 Mitigation

To mitigate the effects on plant species traditionally used by First Nations, the Proponent proposes (per their Decommissioning and Closure Plan) that reclamation will include replanting with native plants, including those plant species used for traditional purposes by Aboriginal persons.

Two specific mitigation measures will be implemented to avoid the loss of any rare plant species. These relate to monitoring and equipping the Environmental Monitor with species-specific plant identification information and salvaging and relocating any rare plants according to the Landscape, Soils and Vegetation Management Plan.

The Proponent states that the loss of forest/ vegetated land can be mitigated through project footprint minimization, limiting ground disturbance, and site reclamation, while employing best management practices to prevent the spread of invasive plants. Further, the Proponent has determined that through the implementation of various commitments and mitigation measures which are outlined in detail in Appendix C (Amalgamated Table of Proponents Commitments, Mitigation and Best Management Practices) that most impacts of the Project on VECs will be *Not Significant (Minor),* defined as *'Effects of low magnitude, any duration, occur at all frequency, and effects can be distinguished at the level of individual organism or sub population'.*

5.1.5.4 Residual Effects and Discussion

The Proponent anticipates that residual effects will occur with regard to 'biodiversity and plant community structure and composition' and 'plant communities at risk', which are defined as VECs. With regard to 'biodiversity and plant community structure and composition', reclamation and remediation following site closure is proposed to restore the area affected. However, the Proponent acknowledges that the composition and structure of restored habitats are likely to be substantially different from those which existed prior to the mine.

For the 'plant communities at risk' VEC, the Proponent has identified that the loss of the slender sedge-common hook-moss wetland plant community may not be successfully restored to pre-project conditions. Although there may be a residual effect, the Proponent determined this to be *Not Significant (Moderate)*, defined as: *"Effects are medium magnitude, site-specific or local, short-term or medium-term, occur at all frequencies, and their effects and consequences are distinguishable at the level of populations, communities, and ecosystems."*

The BC EAO concluded that the proposed Project will cause residual effects to the vegetation resources of the Project area, but that these effects would be mitigated through project footprint minimization, limiting ground disturbance, employing best management practices to prevent the spread of invasive plants, and site reclamation. Furthermore, BC EAO concluded that the effects to vegetation and plant communities would be largely reversible and relatively short-term in duration. Consequently the BC EAO was satisfied that no significant residual adverse effects associated with vegetation and plant communities were anticipated based on:

- proposed project design commitments and other mitigation measures that have been agreed to by the Proponent,
- further requirements and obligations that will be imposed by permitting agencies; and,
- ongoing monitoring of operations and enforcement of commitments that will occur following the issuance of the required permit(s).

The federal RAs and FAs participated in the BC EAO Environmental Assessment review process and provided input related to their respective mandates to support that process.

5.1.5.5 Conclusions

In reaching a conclusion on the significance of the potential environmental effects on vegetation and plant communities the RAs have taken into account:

- The EIS, which includes a description of potential project effects on vegetation and plant communities, and the Proponent's evaluation of the significance of residual effects;

- Mitigation measures described within this section; and,
- Mitigation measures that the RAs are satisfied will be implemented by the Proponent as described in Appendix C (Amalgamated Table of Proponents Commitments, Mitigation and Best Management Practices).

Provided that the Proponent successfully implements the required mitigation measures and the Landscape, Soils and Vegetation Management Plan, the RAs are satisfied that Project is not likely to cause significant adverse environmental effects to vegetation or plant communities.

The Proponent will conduct environmental (compliance) monitoring as per their commitments to the BC EAO, identified in Appendix C of this CSR, as well as those required under permits, licences and Authorizations. Pursuant to the *CEAA*, the Proponent is responsible for conducting Follow-Up Programs to determine the accuracy of the EA conclusion and the effectiveness of the mitigation measures. Follow-Up Programs relating to vegetation and plant communities are described in Section 7.0 of this CSR.

5.2 Physical Environment

This section presents the assessment of the Project's effects on the following physical environment components: Surface Water Quality and Sediment Quality; Hydrology and Hydrogeology; Air quality and Climate; Metal Leaching and Acid Rock Drainage; and Terrain, Soils and Geology. A description of the impact assessment methodology and determination of significance is provided in Section 4.5 (Environmental Assessment Methodology) of this CSR.

5.2.1 Surface Water Quality and Sediment Quality

The Proponent discusses the background and anticipated impacts on surface water quality and sediment quality in Section 4.5 and Section 5.8.4 of the EIS.

5.2.1.1 Background

The Regional Study Area for the assessment of effects to surface water and sediment quality includes the 238 km^2 Rainbow Creek watershed from its headwaters to its discharge point at Nation River, an approximate distance of 47 km. The local study area boundaries include the King Richard, Meadows and Alpine Creek catchments which are further described in this report in Section 5.1.1 (Fish Habitat and Aquatic Resources). Water quality was also considered for activities associated with the transmission power line right-of-way, concentrate load-out facility, and access roads.

Surface Water and Sediment Quality Assessment

The objectives of the surface water and sediment quality assessment identified by the Proponent were to:

- provide a database of physical and chemical parameters that can be used to predict and/or monitor the significance of effects of mining on the surrounding aquatic receiving environment
- quantify and assess the significance of residual and cumulative effects (with respect to water quality)

- develop mitigation strategies related to mine construction, operations, and closure/post-closure (with respect to water quality)
- develop a sufficient overview of local surface water to allow the setting of site-specific water quality objectives

The Proponent used BC Ministry of Environment Water Quality Guidelines for the Protection of Freshwater Aquatic Life (2006) to assess surface water quality field data collected for the proposed project. An extensive database of baseline water quality measurements has been undertaken in previous studies (1989-1993) as well as by the Proponent (2006, 2007). The water quality monitoring program is comprised of two components: water and sediments. Samples collected were analyzed for physical parameters (i.e., pH, conductivity, turbidity, total suspended solids (TSS), total dissolved solids (TDS), alkalinity) and chemical parameters (i.e., nutrients, cyanide, total metals and dissolved metals.

Sediment quality was collected through grab samples and compared against the federal Interim Sediment Quality Guidelines. Samples were analyzed for texture (i.e., sand, silt and clay), metals (by ICP) and total organic carbon (TOC).

Baseline Data Results

Analyses of the samples taken indicate that the baseline water quality of streams is generally within the current BC MOE water quality guidelines. Slightly elevated metal concentrations were noted in the pre-project background water quality data, which is not uncommon in mineralized areas. These included aluminum, cadmium, copper, lead, mercury, zinc and iron. As a general trend, presence of trace metals was less evident between 1989 and 2007, possibly as a result of re-vegetation in previously logged areas.

Sediment quality was also generally within guidelines, with the exception of nickel, selenium, copper and arsenic. The provincial sediment guideline for selenium is 5 mg/kg and for nickel is 16 mg/kg; the guidelines were exceeded or only just met at most sites, but were typically below detection levels in water samples taken from the same locations; this may indicate nickel and selenium are bound within the sediment and unlikely to be leaching into the water column in measurable amounts. Both copper and arsenic were elevated at a few sites but below Presumed Effects Levels.

5.2.1.2 Potential Project Effects

Surface water quality and sediment quality were identified by the Proponent as VECs for assessing potential impacts associated with surface water runoff from the proposed mine site. The Proponent's rationale for the selection of these VECs included:

- Acceptable surface water quality is critical to sustaining the health of wildlife and aquatic organisms, as well as humans;
- If deposited or bound by instream organic material, metals and other contaminants may be accumulated in stream sediments. Since aquatic sediments are a link between the abiotic and biotic aquatic systems, ensuring that sediment quality is acceptable is an important for maintaining healthy aquatic ecosystems; and,
- Project construction, operation, and closure has potential to affect both VECs therefore, assessment and safeguards are required to ensure their integrity in project area streams and waterbodies.

Surface Water Quality by Project Phase:

The Project could potentially affect the surface water and sediment quality. Predictions of potential effects on these VECs are required to develop appropriate mitigation measures and safeguards. The potential effects of mine construction, operation and closure on the VECs were assessed using mathematical modeling. The potential effects identified by the Proponent are described by project phase, as follows:

Construction

During construction, there is a risk that sediment may enter waterbodies, increase sedimentation and turbidity, and negatively impact aquatic life and habitats. Mine site contact water will be contained on the mine site, initially in the MCWSP and then in the TIA. Some contact water during construction will be released to groundwater via exfiltration ponds along the base of the TIA dams and at the sand and gravel borrow site near the North dam. The Proponent expects the exfiltration ponds will remove suspended sediment before the release of contact water to groundwater. For the construction activities associated with building mine infrastructure, including the power transmission line, concentrate load-out facility, and/ or access roads, near stream or necessary instream work has a risk to result in some sediment export to waterbodies.

Operations

According to the water balance proposed by the Proponent, there will be no discharge of surface water from the proposed Project mine site during the operation phase; therefore, there is little risk of impacts to surface water quality and sediment quality due to operations. In addition, water quality modeling completed by the Proponent concludes that water quality parameters in the TIA during operations are predicted to meet drinking water and wildlife guidelines.

During operations, concentrate trucks will be covered and a truck wash will be installed at the mine to clean trucks of fugitive concentrate that could be deposited along the route if left on the trucks.

Closure and Decommissioning

During the closure and decommissioning phase, TIA water will be discharged into the open pit and any surface contact water infiltrating to groundwater will be addressed as per in operations. The Proponent does not expect there will be any surface discharge from the mine site, though indicates that groundwater seepage from the TIA will discharge to surface water. Consequently both near surface groundwater and surface water will continue to be intercepted and returned to the TIA. The Proponent has identified that water quality guidelines are predicted to be met in both the pit lake and TIA after closure (i.e., drinking and wildlife water quality guidelines, except for TSS) and are expected to typically be comparable to mean background concentrations at Site 5 on Rainbow Creek as is further described in Section 5.5.

On closure, the Proponent will re-convert the MCWSP to a wetland-stream complex. Upper Meadows Creek and any overflow from the TIA will flow through the wetland which as a contingency plan, the Proponent expects to further remove any particulates and metals from seepage from the closed TIA. Further, a minor amount of seepage from the mine site is expected to surface via the inter-till sand and gravel above the MCWSP. Although not modeled, the wetland has the potential to absorb metals from the water into sediment and wetland plants. Both impounded surface contact waters and groundwater are forecast by the mass balance model to be near or below receiving water quality objectives for receiving streams. Thus, the effects of surface and groundwater releases are not expected to be significant and the additional contingency of the wetlands would be expected to further remove particulates and metals. Conversion of the MCWSP to wetland-stream complex

will be considered in the context of selenium mobilization if, during monitoring, it is identified as posing a significant concern.

Although the Proponent has observed that there are no waterbodies present directly adjacent to the concentrate load-out facility, soil testing for contaminant loading will be undertaken upon decommissioning of the concentrate load-out facility. If contaminated soils are present, they will be excavated and trucked to the mine site for disposal in the TIA or open pit.

Post Closure

About 22 years after mine closure (Year 37), the Proponent forecasts the open pit to fill and commence overflow to Meadows Creek. Flow will be channeled into the TIA and discharge into Meadows Creek over a constructed spillway during periods of high precipitation. At that time, depending on the surface water quality, there may be some risk of effects to the VECs including metals export (in solid and liquid phases) which could affect areas downstream of the mine site. Effects related to methyl mercury generation are discussed in Section 5.1.1.2.16 of this report.

The Proponent has determined that metals export is unlikely to be an issue given that mitigation measures will be employed to limit sediment export from the mine site during all phases of the Project. The only route of export of metal contaminants during operations would be through dissolved metals in groundwater seepage which will be reduced to the extent practical through seepage management. The seepage of groundwater through soils is expected to remove the solid phase of metals from groundwater, eliminating the solid phase source.

5.2.1.3 Mitigation

With regard to surface water quality, the export of metals to surface waters will be mitigated as described above for each phase of the Project.

The Proponent has also concluded that, though the use of clean water diversions around construction sites and other disturbed areas, construction of coffer dams in series, and the use of exfiltration/ sediment holding ponds during construction (including the MCWSP), water quality is not expected to exceed the 2006 BC MOE water quality guidelines for total suspended solids or turbidity in Rainbow Creek at any time. In addition, the Proponent will avoid construction related impacts to water quality and sediment, and employ standard best management practices for erosion and sediment control.

The Proponent's commitments, mitigation strategies and best management practices are listed in Appendix C (Amalgamated Table of Proponents Commitments, Mitigation and Best Management Practices).

5.2.1.4 Residual Effects and Discussion

The Proponent has determined that with the implementation of mitigation measures that residual effects of the Project on all of the identified VECs will be *Not Significant (Minor)*, defined as *'Effects of low magnitude, any duration, occur at all frequency, and effects can be distinguished at the level of individual organism or sub population,' Not Significant (Negligible)*, or Nil.

The BC EAO Assessment Report concluded that residual effects on water quality from mining activities were predicted to be negligible because receiving water sites during all phases of mining were predicted to meet BC MOE or site specific water quality guidelines (Rainbow Creek) and/or water quality objectives (Meadows and Alpine Creeks). The proposed Project has been designed to completely contain contaminants and surface contact water, other than a relatively small amount of seepage which is addressed by a seepage collection and monitoring system.

Based on the conclusions within the BC EAO Assessment Report, TWG reviewers concluded that the water quality modeling and calculations the Proponent undertook as part of the proposed Mount Milligan Gold-Copper Mine EA were sufficient to provide reasonable estimates of water quality in the pit lake and the receiving environment. Modeling results for water quality did not include chemical or biological removal mechanisms but were based purely on loading and dilution. The assumptions and source terms used in the construction of the model were considered reasonable and conservative and all major source inputs were considered to have been incorporated into the model.

The BC Ministry of Energy, Mines, and Petroleum Resources (MEMPR) concluded that the model adequately addressed the effects of downstream water quality effects of the proposed Project at all phases of mining, and that water quality estimates provided through modeling appeared to establish reasonable upper limits on the concentrations to be expected from the proposed Project. Further, based on additional analyses of the data provided by the Proponent in the EIS, MEMPR considered the loading estimates used for selenium (Se) for the various source terms to the pit lake model and the site-wide water quality model to be reasonable and, in a number of instances, very conservative. The use of more conservative release rates is not expected to result in elevated Se concentrations in the pit overflow prior to discharge to the environment.

The BC EAO concluded that the potential effects to surface water and sediment quality associated with the proposed Project would be spatially limited, and measures were adequate to reduce risks to the downstream aquatic environment. The BC EAO was satisfied that no significant residual adverse effects associated with surface water and sediment quality would be anticipated based on:

- Proposed project design commitments and other mitigation measures that have been agreed to by the Proponent;
- Further requirements and obligations that will be imposed by permitting agencies; and,
- Ongoing monitoring of operations and enforcement of commitments that will occur following the issuance of the required permit(s).

The federal RAs and FAs participated in the BC EAO Environmental Assessment review process and provided input related to their respective mandates to support that process.

5.2.1.5 Conclusions

In reaching a conclusion on the significance of the potential environmental effects on surface water quality and sediment quality, the RAs have taken into account:

- The EIS, which includes a description of potential project effects on surface water quality and sediment quality, and the Proponent's evaluation of the significance of residual effects;
- Mitigation measures described within this section; and,
- Mitigation measures that the RAs are satisfied will be implemented by the Proponent as described in Appendix C (Amalgamated Table of Proponents Commitments, Mitigation and Best Management Practices).

Provided that the Proponent successfully implements the required mitigation measures and applicable EMPs, the RAs are satisfied that Project is not likely to cause significant adverse environmental effects to surface water quality and sediment quality.

The Proponent will conduct environmental (compliance) monitoring as per their commitments to the BC EAO, identified in Appendix C of this CSR, as well as those required under permits, licences and Authorizations. Pursuant to the *CEAA*, the Proponent is responsible for conducting Follow-Up Programs to determine the accuracy of the EA conclusion and the effectiveness of the mitigation measures. Follow-Up Programs relating to surface water quality and sediment quality are described in Section 7.0 of this CSR.

5.2.2 Hydrology and Hydrogeology

The Proponent discusses the background and anticipated impacts on hydrology and hydrogeology in Section 5.5 of the EIS.

5.2.2.1 Background

The RSA for the assessment of effects to hydrology and hydrogeology include the Rainbow Creek catchment from its headwaters to its confluence with the Nation River. The LSA boundaries include the Meadows Creek, the King Richard Creek and the Alpine Creek catchments which are further described in this report in Section 5.1.1 (Fish, Fish Habitat and Aquatic Resources).

Hydrology

The proposed Project lies within the Rainbow Creek watershed, which flows into the Nation River. The Rainbow Creek drainage basin has an area of 238 km^2 and has an elevation range from 1,100 m above sea level (ASL) to 850 m ASL at the creek's confluence with the Nation River. Rainbow Creek has a wide floodplain and is relatively low gradient (<1%) over its approximately 47 km in length. Rainbow Creek has two major tributaries: Meadows Creek and Limestone Creek that confluence Rainbow Creek at approximately kilometer 8 and 28, respectively (distance from the Nation River). King Richard Creek is tributary to Meadows Creek and provides approximately two-thirds of its total discharge. Meadows Creek contributes about 10% of the winter low flow volume to Rainbow Creek at Site 5 (existing conditions). It is approximately 9 km long with an overall gradient of 2.5%. Upstream of the King Richard Creek confluence it is very small (i.e., averaging less than 1 meter wide and 0.5 m in depth). King Richard Creek is 8 km long with an overall gradient of 1.5% and is predominated by wide stream fens.

The annual hydrographs of streams in the proposed Mount Milligan Gold-Copper Mine project area are typically characterized by a pronounced period of high flows in the spring freshet resulting from snowmelt and rainfall, followed by steady low flows that persist until the spring freshet in the following year. In general, relative to most other areas in BC, low flows in Rainbow Creek are high, and peak flows are low. These conditions are attributed to the area's moderate terrain and the large glacio-fluvial outwash deposits contained in the basins, which have high infiltration rates and consist chiefly of deep, well to excessively drained sands and gravels. All creeks are affected by ice formation in winter and the smaller systems typically freeze over for extended periods.

Hydrogeology

The Proponent used borehole and test pit logs with an understanding of the surficial and bedrock geology to prepare several cross sections throughout the mine site area. Piezometer response tests and derived hydraulic conductivities were used to assign approximations of material types to the various geologic units. Water level measurements were tabulated and contoured so that the groundwater surface elevation throughout the mine site area was established. Thus, a three-dimensional (3-D) understanding of the hydrogeological setting was developed as a conceptual model. The understanding derived from the conceptual model was then used to prepare numerical groundwater flow models.

Groundwater flow regime and Groundwater Quantity

Hydrogeology refers to the overall groundwater flow regime which includes: groundwater recharge, the groundwater flow path and groundwater discharge. Typically groundwater recharge occurs on higher ground, groundwater discharge occurs on lower ground and these zones of recharge and discharge are connected by groundwater flow pathways, such as high permeability zones.

In the area of the proposed Project, groundwater recharge/seepage provides significant contributions to Rainbow Creek. Overall the groundwater flow pathway is considered to be from the Mount Heidi North and Mount Heidi South Mountain slopes, which are west of the Project site, towards the King Richard Creek and Heidi Lake valleys. Groundwater contributions are significant in the King Richard catchment upstream of the Meadows Creek confluence of Rainbow Creek, and in the headwaters of Meadows Creek above the King Richard Creek confluence. Groundwater seepage contributes to base flows in summer and to regulating water temperatures in both summer and winter.

Groundwater Quality

The Proponent has undertaken baseline studies of groundwater quality to monitor for potential future impacts due to the Project. Groundwater chemistry analysis included physical parameters (i.e., pH, conductivity, turbidity, suspended solids, dissolved solids and hardness), dissolved anions, total metals, dissolved metals, nutrients and cyanides. The Proponent determined that groundwater was characterized by low to medium total dissolved solids (TDS), near-neutral pH and low concentrations of trace metals. Calcium, Mg-HCO_3 hydro-chemical water type dominates. The presence of the ore body affects groundwater quality in several wells with higher content of TDS, sulfate, sodium and trace metals in several (mostly bedrock) wells. Shallow overburden wells exhibit low TDS and sulfate and trace metals were typically measured below detection limits.

Further details on groundwater quality including specific parameters can be found in Section 4.5.10 of the EIS.

5.2.2.2 Potential Project Effects

The Proponent has identified surface water quality, surface water quantity, groundwater quality, and groundwater quantity and flow direction as the VECs related to hydrology and hydrogeology. Surface water quality is addressed in Section 5.2.1 but due to its linkages to groundwater, is also referred to here. The Proponent has identified that the proposed Project has potential to affect the VECs, as follows:

- Seepage of mine process contact water from the TIA dam shell, which could adversely affect surface and subsurface water quality;
- Changes to the LSA groundwater regime may occur, which may affect groundwater quantity and flow direction; and
- Changes in surface flow volumes associated with the interception and diversion of overland and channelized flow in the Meadow and Alpine Creek drainages, which may cause flow reductions in Rainbow Creek.

The Proponent does not expect that there will be issues related to keying in the dam core to underlying till. The contact between the core and the natural till will be examined and mapped when the trench is excavated. If there are any seepage issues identified, the trench will be over-excavated.

During operations, dam shell runoff will be collected by a ditch along the ridge of the Meadows Creek Valley and directed downslope of the TIA dam west to a series of collection/recycle ponds. The dam shell runoff and shallow seepage will be pumped from the collection ponds back into the TIA. Groundwater that enters the open pit will be pumped from sumps in the open pit into the TIA. Mine process contact water is discussed in Section 5.2.1 (Surface Water and Sediment Quality); however, it is noted that existing groundwater flow pathways have the potential to carry contaminants from mine process contact water if it is released or escapes to groundwater. This is avoided through seepage collection and pumping to the TIA, as further described in the proposed mitigation below.

After mine closure, the pit will be allowed to fill, thereby forming a pit lake and reducing exposure and mineralization of the open pit slopes. The Proponent predicts that the pit lake will fill

approximately 22 years after closure. Water collected in the pit during closure will mix with inflows from the TIA, surface water, groundwater and direct precipitation. In Year 37, the pit lake discharge will flow by gravity into the TIA and thence via a constructed spillway into Meadows Creek.

According to the Proponent's water model predictions, Year 37 winter low flow volumes from the Meadows Creek drainage are expected to be decreased by < 0.5% under average conditions. Over the long term, the Proponent has determined that no significant change in the temperature or ice regime in Rainbow Creek is expected post-closure.

5.2.2.3 Mitigation

Generally, mitigation measures are designed to:

1. control and minimize seepage from the mine site; and
2. limit the volume of contact water and the groundwater flowing through it.

During construction, upstream till blankets will be placed in areas of the TIA where inter-till sand and gravels may occur, particularly along the slopes of King Richard Creek Valley. To minimize seepage along the sand and gravel veneer that exists on the surface of the till plain, the tailings dam will be keyed into the till material. This cut-off will be complete along the entire dam alignment.

In general, the surface water and groundwater upstream of the TIA, including the pit, will be directed towards the supernatant pond. The only water that could potentially escape to areas outside the mine site footprint during operations is runoff or seepage from the tailings dam shell and seepage from the TIA that cannot be collected by the toe collection ditches and recycle ponds.

To assist dewatering of the tailings and recovery of seepage, a series of six pump towers will pump water from the base of the TIA into the tailings pond during operations. The pump towers will be located inside the perimeter of the tailings dams and will pump water from surficial sand and gravel layer that is relatively continuous throughout the TIA footprint. The pump towers will act as an underdrain and reduce the hydraulic head along the perimeter of the TIA, thereby reducing the amount of seepage exiting the TIA.

As a contingency, to reduce the amount of potential seepage loss into Meadows Creek during operations, a seepage collection system will be constructed parallel and upslope of the MCWSP. This system will collect seepage flowing through the deeper inter-till sand and gravel layer and direct it to a sump for pumping back to the TIA, if required. During decommissioning, a wetland will be constructed in the former MCWSP basin that will collect seepage. The Proponent predicts that the wetland would store seepage during the low flow winter months as ice which would then be released and flushed through the watershed drainage during high flow freshet months.

A network of monitoring wells will be situated along the down-gradient boundary of the TIA and groundwater will be sampled to monitor the groundwater quality. If the results of groundwater monitoring indicate the need for adaptive management, then groundwater flowing towards Meadows Creek, Rainbow Creek, and Alpine Creek will be collected in a constructed seepage collection ditch and/or pumping wells and be pumped back into the TIA.

During closure and post closure, pumping from the underdrain will be stopped. However, the Proponent proposes that placement of scavenger tailings cover material over the cleaner tailings, coupled with surface drainage from the TIA, will reduce the volume of water that will enter the tailings and any seepage from the tailings area will be similarly reduced.

Meadows Creek Water Supply Pond

During the application review period associated with the BC EA review process, the Proponent identified an amendment to the Project design with respect to the MCWSP. The MCWSP is intended to intercept and store Meadows Creek water for use in mine processing, and was detailed in the EIS

as a conventional flow-through reservoir. The proposed Project amendment involved changing this design to a closed pond with a diversion channel and road bypassing the pond. The primary reason for the amended design was to further isolate the pond and thereby reduce the risk of Project generated TSS from reaching lower Meadows Creek and the downstream reaches of Rainbow Creek.

A listing of the Proponent's commitments, mitigation strategies and best management practices are presented in Appendix C (Amalgamated Table of Proponents Commitments, Mitigation and Best Management Practices).

5.2.2.4 Residual Effects and Discussion

The Proponent has determined that, with the implementation of mitigation measures, residual effects of the Project on all of the identified VECs will be *Not Significant (Minor)*, defined as *'Effects of low magnitude, any duration, occur at all frequency, and effects can be distinguished at the level of individual organism or sub population.'*, *Not Significant (Negligible)*, or Nil.

As set out in the BC EAO Assessment Report, the BC MEMPR concluded that water management planning described in the EIS had been developed in an iterative manner with full consideration and understanding of the site specific climate, hydrology, and hydrogeological conditions and geophysical characteristics of the Project area. Further, it was concluded that the water management plans appeared to be supported by the water balance modeling and hydrogeological modeling at a level of detail and complexity consistent with expectations for mine development applications similar to the proposed Project.

The BC EAO Assessment Report concluded that residual effects on water quality from mining activities would be negligible because receiving water sites during all phases of mining were predicted to meet BC MOE or site specific water quality guidelines (Rainbow Creek) and/or water quality objectives (Meadows and Alpine Creeks). The proposed Project has been designed to completely contain contaminants and surface contact water, other than a relatively small amount of seepage which is addressed by a collection and monitoring system.

The BC EAO further concluded that potential effects to hydrology, hydrogeology, and groundwater quality associated with the proposed Project are spatially limited, relatively short in duration, and largely reversible. The BC EAO, having regard to the above comments, was satisfied that there would not be significant residual adverse effects associated with hydrology, hydrogeology and groundwater quality. This was based on:

- proposed project design commitments and other mitigation measures that have been agreed to by the Proponent;
- further requirements and obligations that will be imposed by permitting agencies; and,
- ongoing monitoring of operations and enforcement of commitments that will occur following the issuance of the required permit(s).

The federal RAs and FAs participated in the BC EAO Environmental Assessment review process and provided input related to their respective mandates to support that process.

5.2.2.4 Conclusions

In reaching a conclusion on the significance of the potential environmental effects on hydrology and hydrogeology, the RAs have taken into account:

- The EIS, which includes a description of potential project effects on hydrology and hydrogeology, and the Proponent's evaluation of the significance of residual effects;
- Mitigation measures described within this section; and,

- Mitigation measures that the RAs are satisfied will be implemented by the Proponent as described in Appendix C (Amalgamated Table of Proponents Commitments, Mitigation and Best Management Practices).

Provided that the Proponent successfully implements the required mitigation measures and applicable EMPs, the RAs are satisfied that Project is not likely to cause significant adverse environmental effects to hydrology or hydrogeology.

The Proponent will conduct environmental (compliance) monitoring as per their commitments to the BC EAO, identified in Appendix C of this CSR, as well as those required under permits, licences and Authorizations. Pursuant to the *CEAA*, the Proponent is responsible for conducting Follow-Up Programs to determine the accuracy of the EA conclusion and the effectiveness of the mitigation measures. Follow-Up Programs relating to hydrology and hydrogeology are described in Section 7.0 of this CSR.

5.2.3 Air quality and Climate

The Proponent discusses the background and anticipated impacts on air quality and climate in Section 4.3 and Section 5.3 of the EIS.

5.2.3.1 Background

Air quality is a determinant of quality life for humans and wildlife species, and thus was chosen as a VEC. Effects on air quality from mining activities are important in a regional context, as some substances emitted by mine activities, can be transported well beyond the immediate mine site and can potentially contribute to acid deposition (acid rain). Climate change was also selected as a VEC given that the proposed Project will be a net emitter of greenhouse gases (GHGs), which are linked to climate change.

The climate of the Project area is characterized by short, cool summers and long, cold winters. Mean monthly temperatures range from a high of 13.4°C in July to a low of -10.9°C in January. On average, 50% of the annual precipitation at the proposed Mount Milligan Gold-Copper Mine falls as snow, which typically occurs from September to May, inclusive. The remaining 50% of the annual precipitation falls as rain (770 mm), which may occur in any month of the year, but largely falls from May to October, inclusive. Current wind monitoring data shows winds from the southwest and south are predominant while historical measurements show a higher incidence of winds from the east-southeast. The reason for the difference is unknown but the comparison is based on temporally limited data sets.

The Proponent considered the boundaries of their LSA assessment as an east-west extent of 23 km and a north-south extent of 27 km from the proposed mine site. The RSA covers the local air shed and is defined by an east-west extent of 86 km and a north-south extent of 82 km. Factors that influenced the size included:

- Location and strength of emission source;
- Potentially sensitive receptor locations;
- Terrain and distance scales associated with air quality processes; and,
- Location of the nearest population centers including the McLeod Lake Indian Band, the Halfway River First Nation, the West Moberly First Nation, the District of Mackenzie, the Nak'azdli First Nation and the District of Fort St. James.

Air Quality

The proposed Project is located in a remote area of the province with little or no anthropogenic sources of air contaminants. Consequently environmental concerns expressed by regulatory, First Nations, and stakeholder interests have directed attention to ensuring that emissions from the proposed Project do not adversely impact the existing relatively good air quality within the area. Particulate matter was identified by the BC MOE regional office as the air contaminant of concern. The Proponent has instigated a field program for inhalable particulate (PM10) and respirable particulate (PM2.5); however, until a monitoring database is available, a more conservative baseline of 10 µg/m3 for both PM10 and PM2.5 has been adopted from the literature. The use of the literature search value is substantiated by the highest 24-hour average monitored concentration of PM10 to date of 7.0 µg/m3. Considering the spatial distribution of potential sources, particulate matter is generally emitted by area or volume sources rather than specific point sources.

Climate Change

Greenhouse gases (GHGs) emitted to the atmosphere by the Project as a result of fuel burning, electricity consumption, blasting and reductions in sizeable carbon sinks because of site clearing (deforestation), are identified for their potential to contribute to the total volume of planetary GHG emissions, which may be a contributing factor of climate change.

5.2.3.2 Potential Project Effects

In the Proponent's EIS, an increase in particulate matter and GHGs were identified as impacts which may negatively impact air quality and climate. For further details refer to Section 5.3 of the EIS.

Change in Air Quality

The main potential sources of particulate matter include open pit operations (including blasting), ore and dam construction haul truck operations, ore crushing, crushed ore stockpile operations, activity around the ore processing plant, concentrate hauling, vehicle traffic along the mine site access road and on-mine site road network, road grading and from TIA construction.

The proposed Project is expected to generate atmospheric emissions (oxides of nitrogen and sulphur, dust and other fine particulates), primarily from fossil fuel combustion and fugitive dust sources during construction, operations, decommissioning, and reclamation.

Primary combustion products are carbon dioxide (CO_2) and water vapor (H_2O), small amounts of oxides of nitrogen (NOx), particulate matter (PM), carbon monoxide (CO) and volatile organic compounds (VOCs) are likely to be produced. Further, if the fuel consumed by equipment and vehicles contains sulphur compounds, small quantities of sulphur dioxide (SO_2) will be emitted. Mining equipment and haul trucks powered by diesel engines will also emit gaseous contaminants such as nitrogen oxides (NOx), volatile organic compounds (VOCs), particulate matter mainly small sizes, less than 10 micrometres (PM10) and 2.5 micrometres (PM2.5) of aerodynamic diameter, carbon monoxide (CO) and carbon dioxide (CO_2).

The Proponent has calculated predicted ambient incremental concentrations of air contaminants (As, Cd, Cr, Hg, Ni, HC and Dioxins and Furans) from various project components over the life of the Project, and found that ambient air quality is likely to be affected. Increased PM concentration and ambient gaseous contaminant concentrations are expected as long-term residual effects, persisting after mine closure, however this impact is rated as *Not Significant (Minor)* defined as *'Effects of low magnitude, any duration, occur at all frequency, and effects can be distinguished at the level of individual organism or sub population'.*

Change in Climate

The primary GHGs from project sources are predicted to be CO_2, CH_4 (HC) and N_2O which will be released during blasting and other mine activities. It is not possible to estimate specific project effects on the climate due to the complexity of that assessment and the limitation of available resources and information, therefore the Proponent has focused on determining the amount of GHGs emitted to the atmosphere by the Project. This net project GHG balance is based on the emissions from fuel consumption, electricity consumption and large-scale carbon sink reductions, and is predicted to equal 1540 kilotonnes (1,541,000 tonnes) of CO_2 emissions over an 18 year period. The Proponent considers this contribution of GHG as 'likely' to have a negative effect on climate change. However, contributions to global GHGs are rated *Not Significant*, on the basis that the Project will contribute an insignificant amount to the provincial and Canadian annual GHG emissions (0.015% and 0.017% respectively) (Environment Canada, 2007).

5.2.3.3 Mitigation

The Project will be required to adhere to the requirements of the BC *Environmental Management Act* (2004) and the *Canadian Environmental Protection Act* (1999). Air quality objectives are set for regulated compounds including sulphur dioxide (SO2), hydrogen sulphide (H_2S), nitrogen dioxide (NOx), carbon monoxide (CO), oxidants expressed as ozone (O_3) and total suspended particulates (TSP). The Government of Canada (GOC) has established four levels of objectives defined as: maximum desirable, maximum acceptable, maximum tolerable, and reference level. For the Project, the Proponent has adopted Canada-wide standards, per the recommendation of the CCME, which are further defined in the EIS as "desirable" and can be referenced in Section 6.3.3.6 (Review of Regulatory Requirements) of the EIS. In addition, the Proponent has committed to comply with specific technical requirements and emissions standards as outlined in applicable regulations for heavy-duty vehicles and fuel.

The Proponent identified mitigation strategies such as energy conservation, emission reduction, and progressive reforestation to manage climate change effects from the Project. Strategies to manage air quality effects included dust suppression and containment measures, meeting Canada emissions standards for vehicles and development and implementation of an Air Quality Management Plan. To ensure protection of air quality, the proponent will maintain on-site weather station for daily collection of baseline parameters. Dust fall measurements will be undertaken downslope of the TIA at four locations. It will start during construction and will continue annually until the third year after closure. A list of the Proponent's commitments, mitigation strategies and best management practices are further described in Appendix C (Amalgamated Table of Proponents Commitments, Mitigation and Best Management Practices).

5.2.3.4 Residual Effects and Discussion

The Proponent has determined that through the implementation of various mitigation measures the contributions of the Project to airborne particulate matter, global GHGs and climate change will be *Not Significant (Minor)*, defined as *'Effects of low magnitude, any duration, occur at all frequency, and effects can be distinguished at the level of individual organism or sub population.'*

During the Provincial EA, the Emissions Research and Measurement Division of Environment Canada provided specific comments on the following effects which were incorporated into commitments in the BC EAO Project Certificate:

- oil and absorbent pad wastes
- hazardous and domestic waste incineration
- disposal of batteries, solvents, paints and treated wood

- Standard Operating Procedures for vehicular maintenance and operations
- type of fuel use

Based on the conclusions within the BC EAO Assessment Report, potential effects to climate and air quality will be limited in extent, short term and largely reversible. The BC EAO was satisfied that no significant residual adverse effects associated with air quality and climate would be anticipated. This was based on:

- proposed project design commitments and other mitigation measures that have been agreed to by the Proponent,
- further requirements and obligations that will be imposed by permitting agencies; and,
- ongoing monitoring of operations and enforcement of commitments that will occur following the issuance of the required permit(s).

The federal RAs and FAs participated in the BC EAO Environmental Assessment review process and provided input related to their respective mandates to support that process.

5.2.3.4 Conclusions

In reaching a conclusion on the significance of the potential environmental effects on air quality and climate, the RAs have taken into account:

- The EIS, which includes a description of potential project effects on air quality and climate, and the Proponent's evaluation of the significance of residual effects;
- Mitigation measures described within this section; and,
- Mitigation measures that the RAs are satisfied will be implemented by the Proponent as described in Appendix C (Amalgamated Table of Proponents Commitments, Mitigation and Best Management Practices).

Provided that the Proponent successfully implements the required mitigation measures and the Air Quality Management Plan, the RAs are satisfied that Project is not likely to cause significant adverse environmental effects to air quality or climate.

The Proponent will conduct environmental (compliance) monitoring as per their commitments to the BC EAO, identified in Appendix C of this CSR, as well as those required under permits, licences and Authorizations. Pursuant to the *CEAA*, the Proponent is responsible for conducting Follow-Up Programs to determine the accuracy of the EA conclusion and the effectiveness of the mitigation measures. Follow-Up Programs relating to air quality and climate are described in Section 7.0 of this CSR.

5.2.4 Metal Leaching and Acid Rock Drainage

The Proponent discusses effects and impacts related to metal leaching and acid rock drainage in Section 3.4.11 (Tailings Storage Facility – Waste Material Management), Sections 5.5 (Water Resources) and Section 5.13 (Environmental Health) of the EIS.

5.2.4.1 Background

The RSA for assessing the effects of metal leaching and acid rock drainage as identified in the EIS is the Rainbow Creek watershed from its headwaters to its confluence with the Nation River. Metal leaching and acid rock drainage (ML/ARD) result when sulphide minerals are exposed to air and water. Acid rock drainage is caused when the naturally acid-consuming minerals contained within rock (such as carbonates) are not present in sufficient quantities to offset acids produced by the

weathering of sulphide minerals. Under acidic conditions, inorganic contaminants can be highly soluble (although this can also occur in neutral or alkaline drainage conditions). Dissolved elements such as copper, zinc, cadmium and selenium can be toxic to fish and animals and can adversely affect ecosystem heath. Metals can also be absorbed and accumulate in plant and animal tissue.

According to the Proponent, the potential for metal leaching and acid rock drainage (ML/ARD) has been studied in considerable detail for the Mount Milligan copper-gold deposit, owing in part to the extensive baseline information and testing available from studies beginning in the early 1990's during the previous EA and from studies to address data gaps and address contemporary issues, such as neutral pH metal leaching, and geochemical leaching rates for water quality modeling, which were conducted for the July 2008 EIS. Both the historic and current characterization programs included numerous tests to examine metal leaching and metal release from different materials at Mount Milligan. The compilation database includes over 1800 acid base accounting (ABA) assays, over 5000 multi-element scans, 59 shake flask extractions, 56 Net Acid Generation tests, 23 tailings solution assays from metallurgical studies, 7 columns and 16 humidity cell tests[4].

When assessing the results of ABA, the neutralization potential ratio (NPR) is used to assess the acid-generating potential of material excavated. For the Project, a NPR cut off of 2 will be used to segregate non-acid generating (NAG) and potentially acid generating waste rock during mining. The best estimate of the proportion and location of waste rock within the Acid Rock Drainage (ARD) categories is provided by a geostatistical block model prepared by the Proponent, and this will be used to classify materials for use by operators in segregating waste rock in the mine pits.

The proposed Project is expected to produce four types of material that have the potential to be sources for ARD and ML, these are:

1. Overburden: soils overlying the ore deposit, stripped prior to mining;
2. Waste Rock: non ore-bearing rock removed during the mining process;
3. Scavenger Tailings: lower sulphide waste material from the ore concentration process; and,
4. Cleaner Tailings: higher sulphide waste material from the ore concentration process.

5.2.4.2 Potential Project Effects

According to the results reported by the Proponent, the overburden generally has a NPR well in excess of 2 (i.e., the neutralization potential is more than two times the acid-generation potential). Therefore, combined with the low hydraulic permeability of glacial till and alluvium, the overburden is not expected to be a significant source of ML/ARD.

Mineralogical investigation of the waste rock indicated that pyrite was the primary sulphide mineral and calcite was the primary carbonate mineral. Pyrite in the waste rock is considered slow-weathering; the neutralizing potential of other minerals may be sufficient to inhibit acid generation. However, geochemical assessment work also indicated that a significant portion of the waste rock had the potential to generate ML/ARD.

Scavenger tailings also had an NPR well in excess of 2 and are therefore not predicted to generate acid. Testing of leachate from the scavenger tailings produced slightly alkaline pH values with low metal concentrations.

Cleaner tailings had a NPR significantly less than 1 and kinetic testing indicated they could produce acid in about 2.6 years. Cleaner tailings, therefore, have a clear and significant potential for ML/ARD.

[4] Humidity cell tests measure the long term release of metals and shake flask extractions measure the readily soluble components of a sample

5.2.4.3 Mitigation

All pit materials will be characterized for their potential to generate acid and leach metals. The Proponent has committed that any potentially acid generating materials (i.e., cleaner tailings and waste rock) will be placed in the TIA, or the open pit towards the end of operations (approximately the last 8 months of operations), and stored underwater to prevent oxidation of mineral components. Overburden and non-acid generating (NAG) rock that will be used for construction purposes will be visually inspected for the presence of mineral clasts and tested for ABA and metal content prior to use. Rock with high density clasts will be handled as oxide/ weathered rock and stored in the TIA.

Since the geochemical assessment work indicated that a portion of the waste rock had the potential to generate ARD, it will be managed by disposing of this waste rock in the flooded impoundment. Waste rock that is tested and shown not to be a ML/ARD concern will be separated and may be used for the tailings dam construction. A detailed examination of selenium showed that it generally occurs with pyrite and chalcopyrite and that selenium concentration in waste rock generally decrease as the NPR increases; therefore, managing rocks for their acid generation potential (NPR) is likely to also manage for potential selenium release.

The Proponent has assessed that the lag time to onset of ARD conditions established from kinetic test results (i.e., 2.6 years for the cleaner tailing) indicates that the disposal plan is adequate to prevent the generation of ARD from potentially acid generating waste materials, as flooding of PAG mine wastes will occur before the onset of ARD. Further, measures to prevent acid generation and metal leaching from the cleaner tailings and waste rock with a NPR of less than two and oxide/weathered waste rock were incorporated into the design of the tailings impoundment area.

The Proponent identified the following specific mitigation strategies to prevent ML/ARD:

- Waste rock will be segregated and potentially acid generating rock and oxide/ weathered rock will be placed in interior locations in the TIA and flooded;
- Cleaner tailings will be placed in a separate cell within the TIA and kept underwater;
- During the last 8 months of operation, the cleaner tailings cell and PAG waste rock in the TIA will be covered with approximately 2 m of scavenger tailings. The scavenger tailings will further isolate the potentially acid generating wastes from oxidation, prevent potential re-suspension of the cleaner tailings due to wave action and/ or currents within the submerged cleaner tailings cell, and will also provide alkalinity through the dissolution of carbonate minerals; and,
- In the event of premature closure when scavenger tailings may not be available as a cover over the cleaner tailings and PAG waste rock, overburden will be processed through the mill and discharged via the tailings pipeline to create a 1 meter layer over the PAG wastes. The invert elevation of the TIA spillway would be established at a suitable level to maintain PAG wastes fully saturated.

5.2.4.4 Residual Effects and Discussion

The Proponent does not anticipate any residual effects related to ML/ARD. In addition to the mitigation measures outlined above, a list of the Proponent's commitments, mitigation strategies and best management practices are presented in Appendix C (Amalgamated Table of Proponents Commitments, Mitigation and Best Management Practices).

Based on submissions made during the BC EA review process by federal authorities (NRCan and EC) and provincial authorities (MEMPR and MOE), the RAs have considered the following information:

- Management strategies developed by the Proponent to handle ML/ARD;

- NRCan's conclusion that the segregation of potentially acid generating and non acid generating (NAG) material in the TIA proposed by the Proponent is sufficient to prevent and mitigate ARD potential;
- BC MEMPR's assessment that the proposed criterion for ARD management (NPR <2) was adequately conservative for the purposes of waste rock segregation and tailings management[5]; and,
- EC's conclusion that the proposed project presents very low risks of ARD reaching receiving waters, and that the assessment benefited from a large geochemical database which provided a high level of certainty to interpretations of ARD potential.

The BC EAO was satisfied that no significant residual adverse effects associated with ML/ARD would be anticipated based on:

- proposed project design commitments and other mitigation measures that have been agreed to by the Proponent;
- further requirements and obligations that will be imposed by permitting agencies; and,
- ongoing monitoring of operations and enforcement of commitments that will occur following the issuance of the required permit(s).

The federal RAs and FAs participated in the BC EAO Environmental Assessment review process and provided input related to their respective mandates to support that process.

5.2.4.5 Conclusions

In reaching a conclusion on the significance of the potential environmental effects due to metal leaching and acid rock drainage, the RAs have taken into account:

- The EIS, which includes a description of potential project effects on metal leaching and acid rock drainage, and the Proponent's evaluation of the significance of residual effects;
- Mitigation measures described within this section; and,
- Mitigation measures that the RAs are satisfied will be implemented by the Proponent as described in Appendix C (Amalgamated Table of Proponents Commitments, Mitigation and Best Management Practices).

Provided that the Proponent successfully implements the required mitigation measures and applicable EMPs, the RAs are satisfied that Project is not likely to cause significant adverse environmental effects due to metal leaching and acid rock drainage.

The Proponent will conduct environmental (compliance) monitoring as per their commitments to the BC EAO, identified in Appendix C of this CSR, as well as those required under permits, licences and Authorizations. Pursuant to the *CEAA*, the Proponent is responsible for conducting Follow-Up Programs to determine the accuracy of the EA conclusion and the effectiveness of the mitigation measures. Follow-Up Programs relating to metal leaching and acid rock drainage are described in Section 7.0 of this CSR.

[5] This assessment was further supported by the fact that the time to flooding of PAG waste will be less than the lag time to onset of acidic weathering conditions. BC MEMPR concluded that the ARD potential of the proposed Project was sufficiently considered and that the Proponents characterization formed a reasonable foundation on which project waste management plans could be based and that the PAG material disposal plan presented by the Proponent is sufficient to prevent and mitigate ARD potential. BC MEMPR further concluded that the geochemistry assessment work appropriately considered the range of selenium concentrations that would be expected and that the potential for selenium release has been adequately assessed.

5.2.5 Terrain, Soils and Geology

The Proponent characterizes the baseline setting of terrain, soil and geology in the RSA and LSA in Section 4.2 of the EIS.

5.2.5.1 Background

The terrain conditions in the area of the proposed mine site are characterized by bedrock controlled, medium textured basal till on the upper to mid slopes and glaciofluvial outwash sediments on the lower to valley bottom slopes. The higher elevation slopes contain localized bedrock outcroppings and areas of colluviated slopes. Slope gradients are generally moderately sloping (>27%) with bedrock controlled bench areas with lower slope gradients (<27%). Soils at the mine site are the Alix Soil Association with lesser amounts of the Stellako, Tsiloch River and Amy Lake Soil Associations.

The access road corridor follows valley bottom and lower slope positions. Localized areas of glaciofluvial outwash occur in valley bottoms where extensive coarse textured sediments have accumulated. Soils Associations along the corridor are the Deserters, Causqua and Alix. Stellako, Tsiloch River and Amy Lake Soil Associations also occur.

The power line corridor follows valley bottom and lower elevation slopes. Soil Associations along the corridor are dominated by the Causqua and Deserters Soil Associations. Alix Soil Associations dominate the western end. Muscovite Lakes Soil Association represents the soil development on the coarse textured outwash sediments. Localized occurrences of the Stellako, Tsiloch River, and Amy Lake Soil Associations also occur.

The concentrate load-out facility is likely situated in an area of glacial till with localized glaciofluvial sediments. Slopes north and south of the site are till. Soil associations include the Barrett Association on glacial till, Crystal Association on glaciofluvial overlying till, Nechako Association on the fluvial sediments, and the Kloch Lake Association on the organic deposits.

5.2.5.2 Potential Project Effects

Potential impacts identified in the Proponents EIS were considered in relation to their effect on the following six VECs: Physiography and Topography, Surficial Geology, Soil Cover, Soil Quality, Natural Hazards, and Terrain Stability. The EIS outlines the potential for the proposed Project to affect these ecosystem components via the following mechanisms:

Soil disturbance

Soil disturbance is the physical removal of soil, commonly associated with the salvage and stockpiling of topsoil during the construction phase. Stripping and stockpiling, necessary for the proposed construction of the TIA, the open pit, the concentrate loud-out facility and other mine-site infrastructure, will result in disturbance of the soil and soil cover.

Soil re-distribution

Soil redistribution refers to the re-distribution of salvaged soils. This will occur during the construction phase of the Project, and re-occur during the closure phase of the Project. Soil redistribution can affect the soils with respect to their ability to support vegetation cover, especially when topsoil is mixed with or placed beneath mineral soil upon reclamation. The Project has the potential to affect soil cover and soil quality though disturbance and subsequent redistribution.

Chemical and physical alteration of baseline soils

Mechanisms identified for the chemical alteration of soils include accidental spills or releases and contaminated seepage from the TIA, potentially occurring during each project phase. Physical alteration of baseline soils, including compaction or admixing, may directly occur by equipment or machinery operation during each project phase. Water collection was also identified as a mechanism which may result in chemical and physical alterations of baseline soils. The proposed Project has the potential to affect soil quality through the chemical and physical alteration of baseline soils.

Suitability of reclamation material

Chemical and physical alteration to salvaged or cover soils may alter their reclamation suitability. These effects are generally due to compaction, puddling, rutting and accidental spills or releases. Admixing of upper subsoil horizons with topsoil during salvage may reduce impacts or mitigate these effects. The proposed Project has the potential to affect soil quality and its suitability for use in reclamation.

Changes in surficial geology

Development of the mine pits, TIA and borrow source areas involves the removal and re-distribution of surficial deposits, throughout all phases of the proposed Project. Changes in surficial geology, such as the excavation of the open pits, have the potential to affect the area's physiography and topography and terrain stability.

Slope instability and accelerated erosion

The potential for slope instability or accelerated erosion has been identified through direct mechanisms in a variety of project components in each project phase. Examples include: general construction activity; overburden slope failure or accelerated erosion in constructed features such as soil stockpiles, berms, and dams, or in the mine pit or borrow areas; and, instability of reclaimed terrain.

Alteration of baseline landscapes

The development of the Project will require recontouring and grading of the baseline physiography. Alteration of the baseline landscape will continue throughout all Project phases and beyond the Project lifespan, until fully reclaimed.

Geochemistry ML/ARD key issues

The mining and exposure of sulphide-bearing rock and the creation of sulphidic tailings on the Project creates the potential for ML/ARD. The potential for ML/ARD is present at each project phase. The geochemical characteristics of mine wastes are important factors in waste management and provide information used to assess effects on VECs, including water quality and geology. For information about the application of ML/ARD characterization used to develop site specific waste rock segregation criteria and field segregation methods and the ABA block model the reader is referred to the Proponent's ML/ARD Assessment (Appendix C in Volume 5 of the EIS). The potential effects of ML/ARD on biological components are addressed in Section 5.2.4 (Metal Leaching and Acid Rock Drainage.

5.2.5.3 Mitigation

The Proponent proposes that effects to surficial geology will be mitigated by minimizing the overall project footprint, utilizing the overburden removed from the mine pits and other facilities as

construction material and by reclaiming the facilities associated with the mine. Soil quality effects will be minimized by minimizing the footprint size, salvaging the soil and storing it until closure and then re-distributing the salvaged soil during reclamation. Best management practices will also be used to mitigate the physical effects (e.g., rutting, compaction and puddling) and chemical alteration of soils (e.g., admixing) on soil quality.

The EIS addresses each of the interactions with regards to the phase of the Project in which they will occur and finds that most surface disturbance will be during the construction phase. During the operations phase additional direct disturbances to soil, landscape and surficial materials will become periodic and localized to the mine pits and TIA development, and the primary issue will be the chemical alteration of baseline soils. The Proponent will undertake landscape and soil reclamation activities during the closure and decommissioning phase of the Project although, as with all project phases of the Project, the potential for accidental spills and releases incurring chemical alteration of soil is possible. For the post closure phase only two interactions were identified: slope instability or accelerated erosion of the reclaimed terrain and chemical alteration of the soil from contaminated seepage originating from the reclaimed TIA. While reclamation suitability was generally rated as fair to good for the upper lift of the soils, the lower lift reclamation suitability is generally rated as fair to poor for the LSA and RSA; hence, reclamation may be more difficult in some areas.

5.2.5.4 Residual Effects and Discussion

The Proponent has determined that through its commitments and the implementation of various mitigation measures, which are outlined in detail in Appendix C (Amalgamated Table of Proponents Commitments, Mitigation and Best Management Practices), that most impacts of the Project on VECs will be *Not Significant (Minor)*, defined as *'Effects of low magnitude, any duration, occur at all frequency, and effects can be distinguished at the level of individual organism or sub population'.* However, residual effects are expected for two VECs, 'physiography and topography' and 'soil cover'. These effects are rated by the Proponent as *Not Significant (Moderate)*, defined as '*Effects of medium magnitude, point-like or local, short-term or medium- term at all frequencies and their effects and consequences are distinguishable at the level of populations, communities and ecosystems.'*

It is noted by the Proponent (Section 5.2.2 of the EIS), that VECs do not necessarily exist as independent units within the environment. Physiography and topography are directly related to the underlying parent materials, or surficial geology, as a result of sedimentation and erosion processes. Soil development is strongly influenced by the physical and chemical properties of these same parent materials. Further, this interconnectivity extends beyond the terrain, soils and geology discipline.

To mitigate the residual impacts to physiography and topography, the Proponent has identified measures to develop the irreversible alterations in landscape into new features which are integrated in the post-closure landscape, and have the potential to provide recreational opportunities and wildlife habitat. Examples of this include the pit lake and the wetland component of the decommissioned TIA.

Soil cover residual effects will be minimized through a compact project footprint and the use of salvaged topsoil in reclamation. The Proponent indicates that reclaimed soils are expected to result in a cover soil which is similar in physical and chemical properties to the baseline and surrounding undisturbed conditions, and is expected to be ecologically functional and consistent with the surrounding landscape.

The BC EAO concluded that the proposed Project will cause residual effects to the physiography, topography, and soil cover of the Project area. However, it also concluded these effects will be mitigated through project footprint minimization, provision of site features that will function as wildlife habitat, and site reclamation. The BC EAO was satisfied that no significant residual adverse

effects associated with terrain, soils and geology would be anticipated based on proposed Project design commitments and other mitigation measures that have been agreed to by the Proponent including:

- Proposed project design commitments and other mitigation measures that have been agreed to by the Proponent;
- Further requirements and obligations that will be imposed by permitting agencies; and,
- Ongoing monitoring of operations and enforcement of commitments that will occur following the issuance of the required permit(s).

The federal RAs and FAs participated in the BC EAO Environmental Assessment review process and provided input related to their respective mandates to support that process.

5.2.5.5 Conclusions

In reaching a conclusion on the significance of the potential environmental effects on terrain, soil and geology, the RAs have taken into account:

- The EIS, which includes a description of potential project effects on terrain, soil and geology, and the Proponent's evaluation of the significance of residual effects;
- Mitigation measures described within this section; and,
- Mitigation measures that the RAs are satisfied will be implemented by the Proponent as described in Appendix C (Amalgamated Table of Proponents Commitments, Mitigation and Best Management Practices).

Provided that the Proponent successfully implements the required mitigation measures and the Landscape, Soils and Vegetation Management Plan, the RAs are satisfied that Project is not likely to cause significant adverse environmental effects to terrain, soil or geology.

The Proponent will conduct environmental (compliance) monitoring as per their commitments to the BC EAO, identified in Appendix C of this CSR, as well as those required under permits, licences and Authorizations. Pursuant to the *CEAA*, the Proponent is responsible for conducting Follow-Up Programs to determine the accuracy of the EA conclusion and the effectiveness of the mitigation measures. The RAs determined that under the *CEAA,* a Follow-Up Program relating to terrain, soil and geology is unnecessary.

5.3 Human Environment

This section presents the assessment of the Project's effects on the following human environment components: Current Use of Lands and Resources for Traditional Purposes by Aboriginal Persons; Effects on Sustainable Use of Renewable Resources; Fisheries; Human Health; Archaeological Sites and Cultural Heritage; Visual and Aesthetic Resources; and Noise. A description of the impact assessment methodology and determination of significance is provided in Section 4.5 (Environmental Assessment Methodology).

5.3.1 Current Use of Lands and Resources for Traditional Purposes by Aboriginal Persons

The RAs assessment of potential effects of the Project on the current use of the lands and resources for traditional purposes by Aboriginal persons has been informed by Part C of the BC EAO Assessment Report (2009). It has also been informed by comments received from First Nations during the federal EA review process, and by the Proponent's description of the potential effects of

the Project on current use of lands and resources for traditional purposes by Aboriginal persons as described in Volume 2 of the EIS.

5.3.1.1 Background

The potential effects of the proposed Project on the current uses of lands and resources for traditional purposes by Aboriginal persons were considered during the harmonized provincial/federal EA review process, led by the BC Environmental Assessment Office. The following First Nations were invited to participate in the EA process, due to the potential impacts or effects that the development of the proposed Mount Milligan Gold-Copper Mine may have on identified traditional territories or Treaty rights:

- McLeod Lake Indian Band
- West Moberly First Nations
- Halfway River First Nation
- Nak'azdli First Nation

Multiple sources were utilized to compile information on the current use of lands and resources for traditional purposes by Aboriginal Persons in the region of the proposed Project, and the potential effects of the Project on those uses. The Proponent conducted site visits, held community open houses, met with First Nations, funded studies of traditional and contemporary uses of the area by First Nations and reviewed previous research and documentation. First Nations were invited to provide information about their historical connections to the region and to identify continuing traditional use of the lands and resources.

In addition, the RAs understanding of the Nak'azdli First Nation's views with respect to their use of the lands and resources, and potential effects associated with the Project, has been informed by the Nak'azdli First Nation Aboriginal Interest and Use Study (AIUS) and input received from the Nak'azdli First Nation regarding the Proponent's EIS.

5.3.1.2 Overview of Current Use of Lands and Resources for Traditional Purposes

Current Use for Traditional Purposes by the Treaty 8 First Nations

The proposed Project is situated within the claimed traditional territory of the McLeod Lake Indian Band, pursuant to the McLeod Lake Indian Band Adhesion and Settlement Agreement to Treaty No. 8.

The proposed Project is also situated within the area that is the subject of litigation among certain First Nations that are signatories to Treaty 8, Canada and the Province (in which the parties take differing positions as to the western boundary of Treaty No. 8). In recognition of this ongoing litigation, two additional Treaty 8 First Nations (West Moberly First Nations and the Halfway River First Nation) were also invited to participate in the BC EAO review process.

Based on the ethnographic research presented by the BC EAO, the McLeod Lake Indian Band are members of a larger Sekani cultural group, which refers to all tribes that speak an Athapaskan dialect called Beaver-Sarcee-Sekani. This language is also used by the Beaver Indians. The West Moberly and Halfway River First Nations are descendants of the Beaver Indians. The western Beaver Indians mixed with the Sekani in the area around Hudson Hope and historical writers noted it was difficult to draw a sharp line between the Sekani and Beaver Indian people.

Research regarding the use of lands and resources for traditional purposes describes the Sekani as hunters and trappers throughout most of the year. Venison and game comprised the majority of the Sekani diet, supplemented with birds, and in the summer, and with berries and fish which were often

cached for later consumption. Wood, bark and boughs are described as being essential to supporting their nomadic lifestyle: for canoes, shelters, utensils and tools. Summer was a time for gathering together at lakes to fish and socialize with neighbouring First Nations. According to the BC EAO, the above description of the traditional use of lands and resources is generally consistent with the rights granted under Treaty No. 8. It is therefore considered to be reflective of the nature of asserted traditional use of the area by other Treaty 8 members.

The traditional use of lands and resources for traditional purposes by First Nations has persisted well into the twentieth century, and elements of traditional use continue today. According to the BC EAO, interviews with the McLeod Lake Indian Band elders confirm that their members continue to use the Nation River and Mount Milligan area, up to the Arctic-Pacific divide, for hunting, fishing, trapping, berry picking and camping. Section 2.4.1.1 of the EIS provides details on the animal and plant species that are currently used by members of the McLeod Lake Indian Band in the Project area.

During the harmonized EA review the West Moberly and Halfway River First Nations did not provide any additional information on their current occupation and use of the proposed Project area. If these First Nations currently use the area for traditional purposes, they are expected to be similar to those of the McLeod Lake Indian Band.

Current Use for Traditional Purposes by the Nak'azdli First Nation

The Nak'azdli First Nation, a member of the Carrier Sekani Tribal Council, asserts that the site of the proposed Project is within their traditional territory. In particular, the Nak'azdli First Nation asserts traditional territory over lands covered by the proposed mine site, the concentrate load-out facility and the majority of the power line route (excluding the easternmost end near the Kennedy sub-station). The main settlement of the Nak'azdli First Nation is located at the south end of Stuart Lake, near Fort St. James.

According to the BC EAO assessment report, the Nak'azdli First Nation is associated linguistically with the Carrier or Dalkeh tribes. Ethnographers have written that the Carrier subtribes, including the Nak'azdli First Nation, were distinguished by use and occupation of a particular region and that by time of contact, Carrier individuals were identified by subtribal affiliations as well as through clan membership. Clan Chiefs were regarded as having sole authority over the tribe's hunting grounds.

Resources were owned, produced and exchanged within a social network involving a matrilineal descent clan structure. The Nak'azdli First Nation clans owned and managed resource areas, called Keyohs, which were controlled at the local level by matrilineal descent groups and by the collective of groups making up a village. The ceremonial networking system of potlatching (or bahlats) affirmed rightful ownership of land through the distribution of wealth gathered from the Keyoh. The Nak'azdli First Nation and other Dalkeh people place great significance on a Keyoh as an ancestral land and as land used for hunting, gathering, fishing, trapping and clan identity. The Nak'azdli First Nation assert that Mount Milligan, known as Shus Nadloh to the Nak'azdli First Nation, is of key significance in the Keyoh of that area and that multi-generational resource use and traditional activities have been engaged in, on and around Shus Nadloh, including berry picking, fishing, hunting, plant gathering and trapping. Historic trails are still in use and lead through traditional use areas to the summit. The Nak'azdli First Nation also assert historic connections to the Nation River.

Dalkeh clans were exogamous, meaning that marriage was forbidden within one's own clan. As a result, intermarriage with neighbouring clans or other First Nations was common. The Nak'azdli First Nation AIUS cites key marriages between Sekani men and Carrier women in relation to use and ownership of lands in the vicinity of Mount Milligan (Shus Nadloh) and the Nation River. It notes historical records describing the Carrier marriages to Sekani as a means to gain access to Sekani lands and states that this practice was central to the relationship between the Carrier and Sekani. Sekani Sam (born in 1872) and his family are noted as key individuals linking Carrier and Sekani use of the

Nation Lakes area through intermarriage. A Nak'azdli First Nation man applied for five acres of land on the north arm of Tchentlo Lake, one of the Nation Lakes, to the McKenna-McBride Commission in the early 1900s to use as a base for hunting and fishing. Subsequent applications for land in the Nation River area were also made by children of Sekani Sam (e.g., Michel Sam, born in 1896), who indicated that they had been born there and lived there all their life. The Sam family use of this area continues today and the Sam family has been the primary contact for the BC EAO and GOC with regard to the Mount Milligan Gold-Copper Mine project.

The Nak'azdli First Nation AIUS describes their seasonal hunting and gathering activities as: salmon fishing in the fall; trapping in the winter and spring; summer hunting, gathering and lake fishing. The AIUS also states that interviews with Nak'azdli First Nation elders indicate that the Shus Nadloh, Philip Lakes and Nation River areas were used extensively through all seasons for hunting (including moose, caribou, bear and marmot), trapping, fishing, and berry picking. Volume 2 of the Proponent's EIS details the Carrier calendar and their seasonal activities, and provides details on the wildlife, fish and plants used by the Carrier people.

According to the BC EAO assessment report, studies have shown that salmon was the staple food of the Carrier who occupied villages during the summer to intercept salmon runs. Once salmon had been dried and stored for use during fall and winter, Carrier families dispersed to hunt and trap. Plants were widely harvested for both food and medicinal purposes during summer and fall. Migrating birds were a food source during spring. Carrier caught freshwater fish during all seasons from the numerous lakes and rivers in their territory.

According to the BC EAO, during an initial meeting between BC EAO and Nak'azdli First Nation, the Sam family members spoke of hunting, fishing and plant gathering in the Mount Milligan (Shus Nadloh) area and of traplines, cabins and sacred sites. Volume 2 of the EIS notes that there are two Nak'azdli First Nation cabins in the area, one located 10 km east of the proposed mine site and another located near the confluence of the Nation River and Rainbow Creek. The BC EAO was advised that the proposed Project area is located in the Sam family Keyoh and that the area is currently used by Nak'azdli First Nation people to hunt, fish, trap and gather plants.

Current Use for Traditional Purposes by the Tsay Keh Dene Band

The Tsay Keh Dene Band enquired about participation in the EA review process. A portion of the southern edge of their asserted traditional territory was found to be located greater than 50 km downstream from the proposed mine site. Concerns raised by the Tsay Keh Dene Band centered on the downstream effects on water quality and wildlife. Given the distance from the mine site to the edge of their asserted territory, the risk of impacts to their asserted rights is considered to be low.

Summary

The current uses of lands and resources for traditional purposes by Aboriginal persons that have been identified include hunting, fishing, trapping and the use of vegetation for sustenance, medicinal and ceremonial purposes.

The information obtained on these uses significantly informed the Environmental Assessment process, by informing conclusions of whether or not the Project had the potential to affect the lands and resources on which those practices depend. For example, traditional use of plants for nutritional, medicinal or ceremonial purposes was identified as a VEC for the purposes of assessing potential impacts on Vegetation and Plant Communities. The potential impacts of the Project on the specific plant species used for traditional purposes was integrated into the Proponent's environmental impact assessment, and measures for mitigating any impact have been proposed, and will be implemented (E.g., native plant species used by First Nations will be used in reclamation activities). Similarly, the potential effects of the Project on hunting have been carefully analyzed in the section of the EIS on

Wildlife through the identification of moose as a VEC and a careful examination of the potential effects of the Project on habitat availability as well as mortality or displacement.

5.3.1.3 Potential Project Effects

Summary of the key issues and concerns identified by First Nations

The following issues were identified by First Nations during the EA process. The RAs note that not all of the issues below are related to the current use of land and resources for traditional purposes; however, they have been instructive in guiding the federal EA process. The following list provides the general categories under which concerns were raised by the First Nations.

McLeod Lake Indian Band

- aquatic resources (primarily water quality)
- fish and fish habitat
- wildlife and wildlife habitat
- vegetation (particularly plants gathered by Band members)
- cultural heritage and archaeological values
- visual and aesthetic values
- hunting, fishing and trapping rights in the proposed Project area

Nak'azdli First Nation

- aquatic resources (including water quality and aquatic habitat)
- hydrologic changes to rivers, creeks and wetlands (including flow volumes)
- fish and fish habitat
- endangered species
- vegetation and plant communities
- wildlife and wildlife habitat
- cultural heritage and archaeological values
- visual and aesthetic values
- traditional land use (due to noise and light pollution)
- effects on Nak'azdli First Nation communities (due to ore transport and handling at the load out facility)

In addition, the Nak'azdli First Nation AIUS identified the following potential issues, including:

- impacts from the use of chemicals such as cyanide and xanthate in the proposed Project's ore processing facilities;
- contamination from acid rock drainage, leakage from the TIA, dust escapement, and spillage from mine vehicle traffic;
- fragmentation of wildlife habitat and effects on wildlife use in the area due to road construction and use;
- impacts to future economic growth (e.g., from the sale of plant material or from tourism);
- impacts to archaeological resources; and,

- socio-cultural impacts.

5.3.1.4 Mitigation, Residual Effects and Discussion

The specific measures taken to mitigate the potential impacts on the lands and resources currently used for traditional purposes are described throughout this document; notably in the sections on Fish, Fish Habitat and Aquatic Resources (5.1.1), Wildlife and Wildlife Habitat (5.1.2), Vegetation and Plant Communities (5.1.3).

Below are examples of mitigation measures which the Proponent has committed to implementing, which will minimize adverse effects of the Project hunting, fishing, trapping and the use of vegetation for sustenance, medicinal and ceremonial purposes.

Protection of Fish and Aquatic Resources:

The proponent will:

- minimize the risk of impacts on water quality by ensuring all domestic waste, mine site contact water, runoff and TIA seepage is discharged, or collected and discharged, into appropriate facilities (e.g., a till lined lagoon or the TIA) during construction, operations and post-closure;
- separate and maintain potentially acid generating rock and oxidized/weathered rock under water cover in a managed tailings storage facility;
- remove the MCWSP as part of mine closure;
- develop habitat compensation plans for impacts to fish and fish habitat, consistent with the requirements of DFO;
- reduce fishing pressure by implementing a policy that prohibits employees and contractors from fishing while on the proposed Project site or travelling to and from the site on company business;
- use clear span bridges for new roadways or upgrades of stream crossings with potentially important fish habitat;
- employ reduced risk timing windows for fish and wildlife when working in and near streams;
- ensure that erosion and sediment control (ESC) measures are utilised; and
- implement related EMPs (refer to Appendix B).

Protection of wildlife resources

The Proponent will:

- reclaim and revegetating disturbed areas to restore habitat at mine closure;
- conduct pre-clearing surveys for specific species and habitats of interest (dens, nests, etc.) and establish buffer zones around key habitat features where practical;
- impose a no hunting ban at the mine site area;
- take measures to reduce wildlife mortality on roadways;
- adhere to vegetation best management practices for rights-of-way management (power line and roadways) for the preservation of wildlife habitat; and
- implement related EMPs (refer to Appendix B).

Protection of Vegetation:

The Proponent will:

- minimize vegetation clearing needed for the proposed Project;
- salvage topsoil and replant with native plant species used by First Nations during reclamation activities;
- limit introduction of invasive species;
- salvage and relocate rare plants; and
- implement related EMPs (refer to Appendix B).

5.3.1.5 Conclusion

In reaching a conclusion on the significance of the potential project effects on the current use of lands and resources for traditional purposes by Aboriginal persons, the RAs have taken into account:

- The EIS, which includes a description of the current use of lands and resources for traditional purposes by Aboriginal persons, and the Proponent's evaluation of the significance of residual effects;
- Additional information and comments received from First Nations on their current use of lands and resources for traditional purposes and how those uses may be affected by the Project;
- Mitigation measures described within this section;
- Mitigation measures that the RAs are satisfied will be implemented by the Proponent as described in Appendix C (Amalgamated Table of Proponents Commitments, Mitigation and Best Management Practices).

Provided that the Proponent successfully implements the required mitigation measures, the RAs are satisfied that Project is not likely to cause significant adverse effects to current use of lands and resources for traditional purposes by Aboriginal persons.

The Proponent will conduct environmental (compliance) monitoring as per their commitments to the BC EAO, identified in Appendix C of this CSR, as well as those required under permits, licences and Authorizations. Pursuant to the *CEAA*, the Proponent is responsible for conducting Follow-Up Programs to determine the accuracy of the EA conclusion and the effectiveness of the mitigation measures. The Follow-Up Program (Section 7.0) will be conducted in consultation with First Nations and will verify the prediction the Project will have impact on current use of the Project study area for traditional purposes by Aboriginal persons.

5.3.2 Effects on Sustainable Use of Renewable Resources

The Proponent discusses Renewable Resource Use in Section 5.11.4.3 and Renewable Resources in Section 5.19.5.1 of the EIS.

5.3.2.1 Background

Under subsection 16(2)(d) of the *CEAA*, the environmental assessment for a Comprehensive Study of the Project shall consider the capacity of renewable resources that are likely to be significantly affected by the Project to meet the needs of the present and those of the future.

The Proponent considered the potential effects on the following valued ecosystem components for renewable resources: loss of available timber and non-timber forest resources, reduced recreational

sport fishing opportunities and reduced hunting, guide outfitting and trapping activities. The Proponent also identified soils, vegetation, water and aquatic and terrestrial species as VECs as they affect the capacity of the resources (i.e., forestry, fishing, hunting, trapping and traditional land use activities) to support future and present uses.

The overall environmental effects assessment methodology was used to address sustainability. The criteria used to describe potential effects included "duration" and "reversibility", which together assessed the ability of a renewable resource to regenerate to baseline conditions, and the length of time that this regeneration would take. The sustainability of terrestrial ecosystems was assessed by analyzing ecosystem fragmentation and regeneration potential. The sustainability of aquatic resources and fish and wildlife populations were assessed by considering how the Project may affect carrying capacity, population persistence, and productivity.

5.3.2.2 Potential Project Effects

The Proponent indicates that a substantial proportion of the LSA is composed of immature forests as a result of logging activities and that these immature forests comprise 41.6% of the access road corridor, 43.4% of the mine area, 30.0% of the power line corridor, and most of the proposed concentrate load out facility. The Proponent identifies, however, that there will be a loss of available timber and non-timber resources due to the removal of all vegetation within the footprint of the mine site and support facilities.

Waterbodies directly affected by the Project are King Richard, Meadows and Alpine Creeks. There is expected to be a loss of fisheries resources resulting from the mine construction and operations. This is discussed in further detail in Section 5.1.1.

The Project may directly and indirectly affect the populations and distribution of wildlife species that inhabit or migrate through the mine area, which in turn may affect the success of hunting (non-traditional and traditional uses), guiding and trapping opportunities. However, the Proponent states that the total percentage of traplines that will be affected by overlapping with the mine site LSA is approximately 3%. The area of the mine site itself will be inaccessible to any hunting, trapping or guide outfitting activities during all phases of the Project. The Proponent also recognizes that habitat along the power transmission line right-of-way may be altered and that changes in access and human activity may also affect the aquatic and terrestrial VECs.

5.3.2.3 Mitigation

Effects on renewable terrestrial resources during construction and operations are described in Sections 5.2 (Terrain, Soils and Geology), 5.7 (Vegetation and Plant Communities), 5.8 (Wildlife) of the EIS. Mitigation measures proposed to reduce the environmental effects on those renewable resources are described in Appendix C (Amalgamated Table of Proponents Commitments, Mitigation and Best Management Practices). Mitigation measures pertaining specifically to the protection of aquatic renewable resources during construction and operations are described in Section 5.20 of the EIS. Further measures to reduce impacts to renewable resources will be included in EMPs (e.g., Landscape, Soils and Vegetation Management Plan Wildlife and Management Plan).

The Proponent's approach during the planning of the Project was to "design for closure". The Proponent has committed, following the mine closure, to reclaim, re-vegetate, reforest and restore access to the mine site. In addition, the Proponent will conduct ongoing monitoring and management through its Environmental Management System and associated Environmental Management Plans and Standard Operating Procedures to ensure that the mine is operated to the highest environmental standards.

Residual impacts are expected on Meadows Creek, King Richard Creek and Alpine Creek related to the harmful alteration, disruption and destruction of fish habitat for which a subsection 35(2)

Authorization under the federal *Fisheries Act* will be required are described in Section 5.1.1. If Authorization is considered appropriate following the EA, these impacts will be addressed by the FHMCP through the creation and enhancement of fish habitat in order to meet the guiding principle of No Net Loss per DFO's *Policy for the Management of Fish Habitat*.

5.3.2.4 Residual Effects and Discussion

The Proponent suggests that project effects on the capacity of renewable terrestrial and aquatic resources will be avoided or minimized by the compact footprint of the mine site facilities, which are largely restricted to the King Richard Creek valley. Further, since forests are abundant in the area and commercial forestry activities will continue around the Project site during and after mine operations; the portion of Project area that currently supports commercial forestry, but will not do so after mine closure, will have a negligible effect on the regional availability of renewable timber harvesting.

The Proponent considers that following closure, the losses of timber and non-timber resources as well as losses of hunting, guiding and trapping opportunities associated with the mine site are considered reversible because birds and wildlife will be will be able to move back into reclaimed (replanted) areas. Based on the mine closure plan (including permanent subaqueous storage of PAG waste rock and tailings) and within-acceptable-guideline results for water quality in the post-closure period as defined in the EIS and proposed Follow-Up Program, the Proponent expects that there will not be constraints to the capacity or sustainable use of renewable resources.

5.3.2.5 Conclusion

In reaching a conclusion on the significance of the potential project effects on the current sustainable use or renewable resources, the RAs have taken into account:

- The EIS, which includes a description of the current sustainable use or renewable resources, and the Proponent's evaluation of the significance of residual effects;
- Mitigation measures described within this section; and,
- Mitigation measures that the RAs are satisfied will be implemented by the Proponent as described in Appendix C (Amalgamated Table of Proponents Commitments, Mitigation and Best Management Practices).

Provided that the Proponent successfully implements the required mitigation measures, the RAs are satisfied that Project is not likely to cause significant adverse effects to the current sustainable use or renewable resources. The Proponent will conduct environmental (compliance) monitoring as per their commitments to the BC EAO, identified in Appendix C of this CSR, as well as those required under permits, licences and Authorizations. Pursuant to the *CEAA*, the Proponent is responsible for conducting Follow-Up Programs to determine the accuracy of the EA conclusion and the effectiveness of the mitigation measures. The RAs have determined that under the *CEAA,* a Follow-Up Program relating to effects on sustainable use of renewable resources is unnecessary.

5.3.3 Fisheries

Fisheries were identified as a factor of the Human Environment to be considered during the Environmental Assessment, as described in the Mount Milligan Gold-Copper Mine Comprehensive Scoping Document (DFO and NRCan, 2008). However, the only adverse impact of the Project on Fisheries is associated with increased fish harvesting. This potential effect is addressed under subsection 5.1.1.2.3 of the Fish, Fish Habitat and Aquatic Resources section.

5.3.4 Human Health

Impacts to human health during construction and operation of the Project are discussed in Sections 4.13 and Section 5.14 of the EIS. Fish Quality, is discussed in 5.1.1.2.16 (Mercury Methylation/ Selenium) of this CSR, and in Section 5.6.5.6 and Section 5.6.6.6 of the EIS.

5.3.4.1 Background

The objective of the human health study undertaken by the Proponent was to provide a measure of the current health of the residents in the area of the proposed Project, to set a benchmark against which the potential effects of the proposed Project could be assessed, and to identify and assess health-related effects to the Project workforce and others interacting with all components of the proposed mine.

The definition of health used by the Proponent in the EIS followed World Health Organization (WHO) guidance which defines health as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity." For the purpose of the EA, the Proponent examined human health in the context of the Determinants of Health model adopted by Health Canada, and a newer model from the Public Health Agency of Canada (PHAC, undated) that recognizes three additional determinants of health categories: social environments, gender, and culture. Both the Health Canada and the PHAC models recognize that the health and well-being of an individual depends on the person's social and physical environment, as well as biological factors. Accordingly, determinants of health can be broadly classified into three categories: social, physical, and biological determinants.

Consistent with the *Canadian Environmental Assessment Act*, only health determinants that are the result of changes in the biophysical environment have been assessed in the federal EA and reported in this CSR.

5.3.4.2 Potential Project Effects

Based on the EIS, the following are identified as having the potential to affect human health in the LSA and RSA:

- Air quality
- Drinking water quality
- Country foods
- Noise (Noise is discussed in Section 5.3.8 of this CSR)

Air Quality

With mitigation measures in place, the Proponent does not anticipate there will be impacts to air quality related to human health. The subject of air quality for both wildlife and humans is described in Section 5.2.3 (Air Quality and Climate).

Drinking Water Quality

Potable water for the construction camp and mine site will be supplied by ground water wells, which will be located over a kilometre south of the treated sewage effluent holding pond and TSF south dam, at a depth of 30-35 m. The location of the drinking water well was changed from that described in Section 3.6.9.1 of the EIS. This new location is expected to provide a higher water yield and is further from the TIA, thus reducing the risk of effects from potential deep seepage.

The Proponent proposes to install a network of groundwater monitoring wells around the perimeter of the TIA as well as upstream of the domestic water well to identify any groundwater plumes. If changes in groundwater quality attributable to TIA seepage are detected, the Proponent will either install an alternative water supply or provide bottled water. Testing and monitoring of the potable water system with appropriate treatment will be carried out to meet the requirements of the BC Water Quality Guidelines for Drinking Water Use, as well as meeting the requirements of the Northern Health Authority as required per the BC Drinking Water Protection Regulation.

No communities currently utilize the Project area as a source of drinking water, and the Proponent does not predict there will be any project effects relate to drinking water quality.

Country Foods

"Country foods" may be defined as edible plants, wild game or fish. Potential long-term health risks to human health from chronic exposure to certain metals that may be associated with edible plants, fish and wild game were evaluated by the Proponent. Based on the Proponents initial analysis, the metals identified as contaminants of potential concern (COPCs) were cadmium, chromium, copper, nickel, thallium, and vanadium. Arsenic was screened out as a COPC because its maximum concentrations were less than the screening values. Hypothetical worst-case scenarios were constructed for a quantitative risk assessment using the conservative assumption that each receptor would be exposed to the maximum concentration of COPC for its entire frequency and duration of exposure. Exposure to COPCs via ingestion, dermal contact and inhalation were considered. Human receptors included residents, potential future residents of the area, and transient visitors from outside communities participating in activities such as hunting, trapping and fishing.

The assessment results showed there are no predicted unacceptable incremental non-carcinogenic risks to human health in the vicinity of the proposed Project due to the assessed metals in the mine wastes or contact waters. The Proponent therefore determined that no measures are required to mitigate effects to human health beyond those already incorporated into the Project.

The Proponent conducted a human health risk assessment to evaluate potential long-term health risks from chronic exposure to certain metals associated with the Project. Health risks were assessed using risk assessment guidance from Health Canada (2004) and CCME, and using conservative assumptions in a hypothetical worst-case scenario constructed from assessments in previous sections of the EA. No metals were identified as COPCs in water for the human health risk assessment because the maximum predicted concentration of each metal was below its respective human health risk-based water screening guideline. The maximum-predicted concentrations of metals in water represent pit lake and/or TSF supernatant concentrations, where no fish will be present. It was therefore concluded by the Proponent that the fish ingestion pathway will not pose unacceptable risk to environmental or human health in the vicinity of the Project. No effects on surface water or fish are predicted, and no bioaccumulative COPC in fish was identified.

5.3.4.3 Mitigation, Residual Effects and Discussion

In the Proponent's discussions with stakeholders and regulators during the provincial regulatory process, the potential that mercury may be a COPC was raised, as it could potentially be associated with increased methylation of inorganic mercury in the environment and subsequent bioaccumulation of methyl mercury in fish and fish-eating predators, including humans. Azimuth Consulting Group investigated the potential for this project impact on behalf of the Proponent and determined that there will be little or no increase in tissue concentrations in Rainbow trout.

However, the Proponent has committed to monitoring arsenic and methyl mercury in fish tissues. If tissue mercury and/or arsenic levels in Rainbow trout increase beyond two standard deviations of the background mean tissue levels during operations or post-closure, a literature review will be will be

conducted to review the state of the science with respect to safe consumption levels. Based on findings, the need for additional site specific studies, including human health risk assessment, will be determined.

The BC EAO Assessment Report was informed by the members of the TWG, including representatives from Health Canada and the Northern Health Authority. The BC EAO was satisfied that the Proponent had completed a sound assessment of the potential effects to human health and identified sufficient mitigation to prevent any significant adverse effects to human health.

The federal RAs and FAs participated in the BC EAO Environmental Assessment review process and provided input related to their respective mandates to support that process.

5.3.4.4 Conclusions

In reaching a conclusion on the significance of the potential project effects on human health, the RAs have taken into account:

- The EIS, which includes a description of environmental effects that may negatively impact human health;
- Mitigation measures described within this section; and,
- Mitigation measures that the RAs are satisfied will be implemented by the Proponent as described in Appendix C (Amalgamated Table of Proponents Commitments, Mitigation and Best Management Practices).

Provided that the Proponent successfully implements the required mitigation measures, the RAs are satisfied that Project is not likely to cause significant adverse effects to human health.

The Proponent will conduct environmental (compliance) monitoring as per their commitments to the BC EAO, identified in Appendix C of this CSR, as well as those required under permits, licences and Authorizations. Pursuant to the *CEAA*, the Proponent is responsible for conducting Follow-Up Programs to determine the accuracy of the EA conclusion and the effectiveness of the mitigation measures. Follow-Up Programs relating to metal leaching, water quality and fish tissue contamination will be carried out pursuant to the *CEAA,* and are described in Section 7.0 of this CSR.

5.3.5 Archaeological Sites and Cultural Heritage

The Proponent discusses Archeological Sites and Cultural Heritage in Section 5.9 of the EIS.

5.3.5.1 Background

Archaeological sites and cultural heritage resources were considered by the Proponent as the VECs in relation to the Project. The BC *Heritage Conservation Act* (BC *HCA)*, which protects and conserves archaeological resources and the heritage of BC, states that archaeological sites may not be destroyed, excavated, or altered without a permit.

To assess the mine site VECs, an archaeological impact assessment was conducted that examined the mine site, power line right of way concentrate load-out and related facilities in accordance with BC's Archaeological Impact Assessment Guidelines. The assessment reviewed existing research, traditional knowledge studies and documentation of known archaeological resources in the area. The Proponent has advised that the Nak'azdli First Nation and McLeod Lake Indian Band were engaged in field assessment work.

5.3.5.2 Potential Project Effects

The Proponent determined that there were no previously identified resources protected by the BC *HCA* within any proposed development areas. However, one new archaeological lithic site and 74 historical features were identified during the assessment, and are located throughout the area. All of the identified sites were considered to have a low rating for overall significance and are not subject to protection requirements under the Act. There were two potential environmental effects identified by the Proponent for archaeological sites and cultural heritage: possible ground disturbing effects on VEC sites and the potential for findings of previously unrecorded archaeological sites to be affected. The proponent states that some of the post-1846 resources (not protected under the BC *HCA*) will be impacted but that none of the existing cabins used by First Nations will be impacted by the Project.

5.3.5.3 Mitigation

The Proponent has stated that if any previously unrecorded sites are identified during construction, they will be managed through implementation of an Archaeological and Heritage Resource Management Plan and that there are mitigation measures and commitments in place to address concerns with archaeological resources. In addition, the company will implement a "Chance Find" process for construction, operation and closure of the mine where any unidentified archaeological or cultural heritage remains encountered during development activities will result in cessation of work and notification to the Archaeology Branch and relevant First Nations.

5.3.5.4 Residual Effects and Discussion

The Proponent has stated that there will be no residual effects that will affect archaeological sites or cultural heritage and that the proposed Project design includes measures to either avoid or mitigate the risk of impacts to archaeological resources.

5.3.5.5 Conclusions

In reaching a conclusion on the significance of the potential project effects on archaeological sites and cultural heritage, the RAs have taken into account:

- The EIS, which includes a description of archaeological sites and cultural heritage, and the Proponent's evaluation of the significance of residual effects;
- Mitigation measures described within this section; and,
- Mitigation measures that the RAs are satisfied will be implemented by the Proponent as described in Appendix C (Amalgamated Table of Proponents Commitments, Mitigation and Best Management Practices).

Provided that the Proponent successfully implements the required mitigation measures and the Archaeology and Cultural Heritage Resources Management Plan, the RAs are satisfied that the Project is not likely to cause significant adverse effects to archaeological sites or cultural heritage.

The Proponent will conduct environmental (compliance) monitoring as per their commitments to the BC EAO, as identified in Appendix C of this CSR, as well as those required under permits, licences and Authorizations. Pursuant to the *CEAA*, the Proponent is responsible for conducting Follow-Up Programs to determine the accuracy of the EA conclusion and the effectiveness of the mitigation measures. The RAs have determined that a Follow-Up Program relating to archaeological sites and cultural heritage is not necessary under the *CEAA*.

5.3.6 Visual and Aesthetic Resources

The Proponent discusses the background and anticipated impacts on visual and aesthetic resources Section 4.12 and Section 5.12 of the EIS.

5.3.6.1 Background

The proposed Mount Milligan Gold-Copper Mine site has been designated as a scenic area under BC's Forest Planning and Practices Regulation. The Nation Lakes Canoeing and Fishing Camp, located about 22 km west of the mine site is the nearest formally designated Tourism Use Area. Philip Lake North, a provincial Forest Recreation Site, is about 10 km east of the site, and two others, Gideginga Lake and Philip Lake South are about 13 km west and 15 km southeast, respectively from the propose mine site. There are no full time residents living within 10 km of proposed Mount Milligan Gold-Copper Mine. There are two cabins in the area, one of which is occupied on a regular basis (located approximately 10 km north of the proposed mine), the other is occupied sporadically (located approximately 10 km east of the proposed mine site).

The LSA was selected to ensure that a representative viewshed was reviewed in regards to the Project components. In addition to the proposed mine site, the LSA included the FSR from the west via Fort St. James, the FSR from the east via Mackenzie, the power line corridor from the Kennedy substation near Mackenzie and the concentrate load-out facility about 6 km north of Fort St. James. To ensure that potentially affected scenic areas were adequately addressed, the RSA was defined broadly based on the Land Resource Management Plan for the Fort St. James and Mackenzie areas because they overlap the LSA.

5.3.6.2 Potential Project Effects

Indirect effects of the proposed Project on visual and aesthetic resources were assessed by identifying areas from which Project components may be observed and determining if various "viewpoints" would be affected.

The viewshed analysis indicated that the mine site will not be visible from the North Germansen FSR or the Nation River, nor will it be visible from 5 km west of the Project and 10 km north, east or south of the Project. Although it may be visible north of the Nation River, the river is more than 10 km away. It will not be visible from any known occupied cabins or from the top of Mount Milligan proper. The only park, tourism use area or forest recreation site that will have a view of the mine site is the provincial North Philip Lake forest recreation site. The mine site may also be visible from the Philip North FSR for a stretch of less than 5 km. This is considered a minor effect on visual aesthetics because the view area is small and residents and tourists would be aware that the road leads to the mine site.

In the EIS, the Proponent describes the three mechanisms by which direct and indirect effects on the visual landscape within and immediately adjacent to the mine site may occur for each project phase and component.

Direct alteration of the landscape

Changes in the landscape and vegetation will be greatest during construction when soil is stripped and vegetation removed for the mine pits and associated facilities. The Proponent identifies that construction of the power line may directly alter the landscape and cause a change to visual and aesthetic resources; however, the existing access road corridor and load-out facility would only further affect visual or aesthetic resources in a limited capacity. The landscape will continue to be changed during operations, mining and closure until facilities are decommissioned and reclamation is undertaken.

Increased light emissions

During all phases of the proposed Project, indirect effects on the viewshed (from vehicles, equipment, and buildings) will be associated with increased light from the mine site, access road and concentrate load-out facility. Increased light emissions during all phases of the Project activities are likely to have indirect effects on visual and aesthetic resources.

Increased air emissions

Emissions generated by the proposed Project would be primarily associated with dust generation from vehicles and equipment. Minor emissions are also associated with the incinerator operations as well as the periodic use of explosives at the mine site.

5.3.6.3 Mitigation

The Proponent has concluded that through the commitments and implementation of various mitigation measures which are further described in Appendix C (Amalgamated Table of Proponents Commitments, Mitigation and Best Management Practices) that the effects of the Project on visual and aesthetic resources will be *Not Significant.'* The Proponent states this rating will be achieved by managing and controlling emissions during all stages of the Project, restricting project vehicles to posted speed limits or, as appropriate, for road conditions to reduce dust and to increase safety, and monitoring dust levels during construction and operations and mitigating as required.

After decommissioning, there would be no additional effects on transportation or access, other than a reduction in traffic. Minor negative effects on visual and aesthetic resources would be expected during decommissioning of the power line because of increased disturbance to the landscape. Following decommissioning of the power line, adverse effects would be reversed and expected to return to pre-project conditions as the right of way would be reclaimed and reforested. At closure the TIA will be reclaimed and areas within the mine site returned to landforms similar to those that existed pre-mining.

5.3.6.4 Residual Effects and Discussion

Following a review of the available information, no significant residual visual and aesthetic effects were identified for the Project. Change in landscape associated with all phases of the mine site and power line were rated by the Proponent as *Not Significant (Minor),* as were the effects of increased light, emissions/dust from increased traffic and equipment during construction, operations and decommissioning activities

The BC EAO has concluded that the effects to visual and aesthetic resources associated with the proposed Project will be limited in extent, and largely reversible through site reclamation. Consequently, the provincial EA report expressed satisfaction that no significant residual adverse effects were associated with visual and aesthetic resources. This conclusion was based on:

- proposed project design commitments and other mitigation measures that have been agreed to by the Proponent,
- further requirements and obligations that will be imposed by permitting agencies; and,
- ongoing monitoring of operations and enforcement of commitments that will occur following the issuance of the required permit(s).

The federal RAs and FAs participated in the BC EAO Environmental Assessment review process and provided input related to their respective mandates to support that process.

5.3.6.5 Conclusions

In reaching a conclusion on the significance of the potential environmental effects on visual and aesthetic resources, the RAs have taken into account:

- The EIS, which includes a description of potential project effects on visual and aesthetic resources, and the Proponent's evaluation of the significance of residual effects;
- Mitigation measures described within this section; and,
- Mitigation measures that the RAs are satisfied will be implemented by the Proponent as described in Appendix C (Amalgamated Table of Proponents Commitments, Mitigation and Best Management Practices).

Provided that the Proponent successfully implements the required mitigation measures, the RAs are satisfied that the Project is not likely to cause significant adverse effects to visual and aesthetic resources.

The Proponent will conduct environmental (compliance) monitoring as per their commitments to the BC EAO, identified in Appendix C of this CSR, as well as those required under permits, licences and Authorizations. Pursuant to the *CEAA*, the Proponent is responsible for conducting Follow-Up Programs to determine the accuracy of the EA conclusion and the effectiveness of the mitigation measures. The RAs determined that under the *CEAA,* a Follow-Up Program relating to visual and aesthetic resources is unnecessary.

5.3.7 Noise

The Proponent discusses the background and anticipated impacts of noise on humans and wildlife behaviour in Section 4.4 and Section 5.4 of the EIS.

5.3.7.1 Background

Prior to the noise impact assessment the Proponent conducted a baseline noise appraisal and found that the average 24-hour equivalent sound level (L_{eq}) was as low as 21.7 dBA. This is typical for wilderness where there are few anthropogenic sources and where dense forest and hills act as effective noise absorbers and barriers.

Ambient noise was recognized as an issue, and selected as a VEC, because noise is defined as any unwanted sound, and the Project will significantly change the noise levels in the Project area. Noise generated by equipment, operations and processes associated with the construction, operations, and decommissioning of the proposed Project is an important consideration because of its intrinsic importance to health and well being to humans and wildlife.

For the purposes of the noise assessment, the LSA consists of an ellipsoid of about 1.5 km in distance from the proposed Project's permanent noise sources (i.e. the mill plant or the concentrate load-out facility). The plant site, construction phase living quarters, the mining pits, and part of local road infrastructure are all inside the LSA. A separate LSA was defined for the proposed concentrate load-out facility. The RSA identified in the EIS overlaps the proposed Project footprint by 8 km in each direction from potential noise sources associated with the proposed project. The boundary-determining factor for the RSA is that a distance of about 8 km is needed to attenuate high level blasting noise to the background levels in the surrounding environment.

5.3.7.2 Potential Project Effects

Noise will be produced by equipment and mining activities during construction, operation, and reclamation phases of the proposed Project (refer to Table 5.3.7-1). Maximum noise levels are

expected to occur during construction at locations where blasting (110 dBA $_{Lmax}$ @ 100m), will be necessary and over the duration of construction activities like ground clearance, excavation, and processing plant construction which are expected to be relatively short-term in nature. Temporal boundaries during operation will be equal to the time of project operation with boundaries limited to the mine site, the plant area, and hauling routes. No distinction is made between day time and night time periods because construction and operational activities are planned 24-hours a day. The Project activity and resulting noise levels will vary for the duration of the Project.

Each phase of the proposed Project will have both generic and phase-specific noise sources. During the early site preparation and construction phases, different types of construction equipment will be used. This equipment will include machines and devices varying in physical size, horsepower rating, and mode of operation which can vary widely in the noise they produce. Noise is expected to be generated by site clearing for the mine facilities (including the proposed powerline), stripping of overburden, blasting, construction traffic, and construction of mine infrastructure.

During mine operations, noise generating activities will be carried out with an initial equipment fleet comprising blast hole drills, electric cable shovels, front end loaders, trucks, and will be supplemented with back-up equipment of graders, track and rubber-tired dozers. Operation of drills, shovels, loaders and trucks over a small area of the pit will involve the generation of noise, often above 90 dBA. Electric cable shovels, like those to be used at Mount Milligan, generate less noise than diesel powered equipment. The area affected by operational noise will include the pit space, rock and overburden waste dumps, haulage roads, and the concentrate load-out facility. Support equipment generating noise will include dozers, water truck(s), graders, a rock breaker, and a small loader to maintain the surfaces of the roads, dumps, and operating benches.

Table 5.3-1 Typical Mining Noise Levels

Noise Source	Operating Condition	Typical Measured Noise Level
Haul Truck	Empty Passby	87 dBA Lmax @ 7 m
Haul Truck	Laden/Uphill	98 dBA Lmax @ 7 m
Highway Truck	Laden Passby	88 dBA Lmax @ 7 m
Wheel Loader	Loading	85 dBA Lmax @ 7 m
Primary Crusher	Crushing	104 dBA Lmax @ 4 m
Rock Breaker	Breaking	100 dBA Lmax @ 7 m
Blast Hole Drill	Maximum	100 dBA Lmax @ 7 m
Secondary Screen	Full Load	98 dBA Lmax @ 1 m
Hydraulic Excavator	Scraping	90 dBA Lmax @ 7 m
Reversing Alarm	Reversing Truck	92 dBA Lmax @ 4 m
Production Blast	Rock Fragmenting	110 dBA Lmax @ 100 m

Each phase of the proposed Project will have both generic and phase-specific noise sources. During the early site preparation and construction phases, different types of construction equipment will be used. This equipment will include machines and devices varying in physical size, horsepower rating, and mode of operation which can vary widely in the noise they produce. Noise is expected to be generated by site clearing for the mine facilities (including the proposed powerline), stripping of overburden, blasting, construction traffic, and construction of mine infrastructure.

During mine operations, noise generating activities will be carried out with an initial equipment fleet comprising blast hole drills, electric cable shovels, front end loaders, trucks, and will be supplemented with back-up equipment of graders, track and rubber-tired dozers. Operation of drills, shovels, loaders and trucks over a small area of the pit will involve the generation of noise, often above 90 dBA. Electric cable shovels, like those to be used at Mount Milligan, generate less noise than diesel powered equipment. The area affected by operational noise will include the pit space, rock and overburden waste dumps, haulage roads, and the concentrate load-out facility. Support equipment generating noise will include dozers, water truck(s), graders, a rock breaker, and a small loader to maintain the surfaces of the roads, dumps, and operating benches.

Noise sources during the closure and decommissioning phase will be similar to the construction phase impacts. However, noise effects will be lower because high-level noise sources such as drills and blasting will be absent. No noise effects are expected for the decommissioning phase.

5.3.7.3 Mitigation

The Proponent has concluded that through the commitments and implementation of various mitigation measures (which are outlined in detail in Appendix C) that changes to the ambient noise will be *Not Significant (Minor)*, defined as *'Effects of low magnitude, any duration, occur at all frequency, and effects can be distinguished at the level of individual organism or sub population'*. For example, the Proponent proposes to mitigate impacts by performing regular inspections and maintenance of construction vehicles and material handling vehicles and equipment (to ensure that they have quality mufflers installed); replacing worn parts and using lubricants to ensure that noise-output specifications continue to be met; and providing air inlet and exhaust silencers for combustion engines and other units. The proponent will develop a Noise Monitoring Program for the construction phase as well as within the camp dormitory to verify the effectiveness of the noise mitigation measures described in the application, and to comply with established noise limits (i.e., Equivalent Sound Level and Sound Pressure Levels)

5.3.7.4 Residual Effects and Discussion

The Proponent indicates that after mitigation has been applied, residual effects are expected, as Project development will cause direct changes in the ambient noise levels near the mine, along the access road and power line corridors and at the concentrate load-out facility. However, residual effects were rated as *Not Significant (Minor)* by the Proponent given their local extent, low magnitude and reversibility.

The BC EAO concluded the proposed Project will cause residual effects to background noise levels in the Project area. However, these effects are assessed as *Not Significant* given their low magnitude, local extent, and reversibility. Consequently the BC EAO was satisfied that there will be no significant adverse effects associated with noise based on the following factors:

- proposed project design commitments and other mitigation measures that have been agreed to by the proponent,
- further requirements and obligations that will be imposed by permitting agencies; and,
- ongoing monitoring of operations and enforcement of commitments that will occur following the issuance of the required permit(s).

The federal RAs and FAs participated in the BC EAO Environmental Assessment review process and provided input related to their respective mandates to inform that process.

5.3.7.5 Conclusions

In reaching a conclusion on the significance of the potential environmental effects to noise, the RAs have taken into account:

- The EIS, which includes a description of potential project effects on noise, and the Proponent's evaluation of the significance of residual effects;
- Mitigation measures described within this section; and,
- Mitigation measures that the RAs are satisfied will be implemented by the Proponent as described in Appendix C (Amalgamated Table of Proponents Commitments, Mitigation and Best Management Practices).

Provided that the Proponent successfully implements the required mitigation measures and the Noise Management Plan, the RAs are satisfied that the Project is not likely to cause significant adverse effects to noise.

The Proponent will conduct environmental (compliance) monitoring as per their commitments to the BC EAO, identified in Appendix C of this CSR, as well as those required under permits, licences and Authorizations. Pursuant to the *CEAA*, the Proponent is responsible for conducting Follow-Up Programs to determine the accuracy of the EA conclusion and the effectiveness of the mitigation measures. The RAs determined that under the *CEAA* a Follow-Up Programs relating to noise is unnecessary

5.4 Other Components

5.4.1 Accidents or Malfunctions

The risk of potential accidents and malfunctions occurring, to the detriment of the environment, is discussed in greater detail in Section 6.2.2 of the Proponent's EIS, and in supplementary information which was submitted to the RAs.

5.4.1.1 Background

Accidents and malfunctions that may occur during construction, operation, closure and post-closure at the mine have the capacity to affect the environment. The primary mechanism for accidents and malfunctions is spills or accidental releases of chemicals, reagents, petroleum products, or process materials (e.g., ore, tailings, and concentrate) onto the land or water. Pursuant to *CEAA*, the Proponent's assessment includes consideration of the potential accidents, malfunctions and unplanned events that could occur during any phase of the Project, the likelihood and circumstances under which these events could occur, and the environmental effects that may result from such events, assuming contingency plans are not fully effective. The Proponent has committed to incorporate this component into the overall Emergency Preparedness Plan for the Project.

5.4.1.2 Potential Project Effects and Mitigation

The Proponent has identified a number of measures, summarized in Table 5.4-1 and described in other sections of this CSR, that are designed to reduce or eliminate the likelihood of an accident or malfunction occurring. The mitigation measures and commitments outlined by the Proponent are expected to reduce the potential environmental effects of accidents and malfunctions as further described in Appendix C (Amalgamated Table of Proponents Commitments, Mitigation and Best Management Practices).

5.4.1.3 Conclusions

In reaching a conclusion on the significance of the adverse environmental effects from accidents or malfunctions associated with the Project, the RAs have taken into account:

- The EIS, which includes a description of how accidents and malfunctions may adversely effect the environment, and the Proponent's evaluation of the significance of residual effects;
- Mitigation measures described within this section; and,
- Mitigation measures that the RAs are satisfied will be implemented by the Proponent as described in Appendix C (Amalgamated Table of Proponents Commitments, Mitigation and Best Management Practices).

Provided that the Proponent successfully implements the required mitigation measures, and applicable EMPs, the RAs are satisfied that accidents and malfunctions are unlikely and that the Project is not likely to cause significant adverse environmental effects.

The Proponent will conduct environmental (compliance) monitoring as per their commitments to the BC EAO, identified in Appendix C of this CSR, as well as those required under permits, licences and Authorizations. Pursuant to the *CEAA*, the Proponent is responsible for conducting Follow-Up Programs to determine the accuracy of the EA conclusion and the effectiveness of the mitigation measures. The RAs determined that under the *CEAA* a Follow-Up Programs relating to accidents and malfunctions is unnecessary.

Table 5.4-1 Measures to Address Potential Accidents and Malfunctions

Mechanism	Mitigation	Contingency
Failure of secondary burner causing incinerator emissions	Monitor to confirm performance.	None required
Spills during the refuelling, servicing of construction equipments or accidents	Procedures will be developed and used to regulate field refuelling and servicing activities. Employment of a site-based environmental monitor during construction to monitor contractor performance.	Spill Response
Pipeline failure	Pipeline will be buried heat traced or have erosion protection on the dam fence. Flow meter and alarm to warn of failure	Replace line
Power line damage or loss of power to the mine with continuation of seepage pumping systems	Emergency gensets to provide orderly shutdown of mill and continuation of seepage pumping systems	Gensets. Repair power lines
Soils and overburden placed in the wrong locations.	Apply and check block model to identify materials. Monitor deposition.	Remove and replace inappropriately placed material
Failure of leachate retention system/inappropriate dumping	Ensure compact till under landfill, cover frequently, implement waste management plan.	Remove and replace inappropriately placed material.
Tailings line failure	Ensure lines on inside edge of dam crest. Flow monitoring and alarm systems to warn of failures and planned tailings line inspections.	Excavate spilled tailings and place in TIA.
Pipeline failure	Maintain collection ditches, TIA supernatant reclaim pumps and pipes.	Remove ditch blockage. Repair pit water pipelines and pumps.

Mechanism	Mitigation	Contingency
Pipeline or pump failure of recycle system (TIA shell runoff and seepage)	High level alarms on pumps. Monitor pipelines and maintain pumps.	Excavate soils and place in TIA
Failure of STP	Monitor and maintain STP	None required.
Failure of bag house or excessive TIA beach or road dust	Monitor and maintain bag houses. Apply water to TIA beach. Ensure good gravel base on road and apply magnesium chloride as required.	None required.
Failure of noise suppression equipment on trucks and of noise berms	Maintain vehicles and gensets. Inspect barriers.	Construct additional noise barriers (rock) around sources.
Accidents or malfunctions, that may impact the safe transport of explosives and operation of the explosives factory and magazine facilities	Siting of the explosives factory and magazine facilities upslope of the TIA to prevent any spills from the TIA impacting the facility; Standard Operating Procedures will be developed as required as part of the Explosives Management Plan.	As described in the Emergency Response and Spill Contingency Plan

5.4.2 Effects of the Environment on the Project

The Proponent provides background information on environmental factors deemed to have possible consequences on the Project in Section 5.17 of the Proponent's EIS, and in supplementary information which was submitted to the RAs.

5.4.2.1 Background

The assessment of the effects of the environment on the Project included identifying the environmental factors deemed to have possible consequences on the Project, the likelihood and severity of their occurrence and mitigation measures planned to minimize their impact. The environment in which the Project is located may have minor effects (e.g., inconveniences) to more profound effects (e.g., cause the mine to cease operations for some period).

5.4.2.2 Potential Project Effects

The Proponent examined four factors which have the greatest potential to affect the Project:

- forest fires;
- geohazards (i.e., avalanches, slides, flooding);
- seismic activity; and
- global climate change.

Forest Fires

Forest fire risk increases with warmer, drier summers. Further, Mountain Pine Beetle infestations of lodgepole pine increases fire risks due to the abundance of dry fuel, unless standing dead trees are harvested before they fall. Risk of fire due to dry pine stands is unlikely to decrease as recent climate trends to warmer winters have limited winter mortality of Pine Beetle populations. The Proponent will limit the risk from forest fires by maintaining a tree-less buffer zone at the edge of the Project. The mine site will provide vehicles and manpower to assist in fighting a forest fire, if required. As well, a water reservoir and distribution system for firefighting will be available at the mine site. In the event of a large fire, pumps at the MCWSP could be used as a water source. The Proponent has

stated that Terrane staff will watch for fires during lightning storms and will report any fires caused by a lightning strike and that the company will abide by Forest Protection Fire Hazard ratings and closures, particularly during construction.

Geohazards

Landslides, earthquakes, avalanches, and floods were considered by the Proponent as potential geohazards for the Project. The mine site itself is located on gentle, subdued slopes. Slope gradients are generally less than 30% within the Project footprint, however, steeper slopes are present where streams have incised thick glacial deposits, forming river scarps. Air photo interpretation and site reconnaissance of King Richard and Meadows Creeks indicate that the erosional river scarp slopes have a low terrain instability risk. The avalanche potential for the site is rated as low because the factors that produce avalanches are not present on the site. The Proponent will minimize flood potential through careful consideration of bridge crossings and stream culverts.

Seismicity

A probabilistic seismic hazard calculation for the mine site indicated that for a return period of 475 years (i.e., 10% probability of exceedance in 50 years), the seismic hazard is low. To prevent potential adverse effects, TIA and mine site structures will be constructed using appropriate seismic design parameters.

Global Climate Change

The potential effects on the Project over the mine life and post closure period of global climate change were assessed. The temporal scope of the assessment is a 15 year mine life plus 30 months of construction and about 22 years post closure for the open pit to fill and start overflowing through the TIA to Meadows Creek. Because of the imprecise nature of climate change models and the long projections required, the scenarios discussed in the EIS were generalized by the Proponent.

Several potential global climate change effects were considered as having potential to affect the Project and, based on risk, were taken into account in designing project facilities. These included: increased precipitation in the Project region during summer and winter potentially leading to larger snow packs and higher runoff, increased incidences and intensities of storms and increased temperature extremes (i.e., both minimums and maximums as well as warmer average temperatures). These effects were rated as having low risk on the Project.

5.4.2.3 Residual Effects and Discussion

The Proponent determined that the cumulative impacts of climate change and the operation of the proposed Mount Milligan Gold-Copper Mine are not likely to exacerbate impacts already caused by the Pine Beetle and salvage logging. There is a low risk from potential effects of climate change which may subsequently be associated with an increased frequency of extreme events including rain storms, change of snowfall volume, or thunderstorms and lightning strikes and consequent wild fires. The Proponent assures that the drainage plans regarding the ponds and water collection systems associated with the mine site have been designed to accommodate extreme events and that progressive re-vegetation/re-forestation management efforts are likely to offset the effects of deforestation on climate change.

5.4.2.4 Conclusions

In reaching a conclusion on the significance of adverse effects of the environment on the Project, the RAs have taken into account:

- The EIS, which includes a description of environmental phenomenon (including forest fires, geohazards, seismic activity and global climate change) that may adversely effect the Project, and the Proponent's evaluation of the significance of residual effects;
- Mitigation measures described within this section; and,
- Mitigation measures that the RAs are satisfied will be implemented by the Proponent as described in Appendix C (Amalgamated Table of Proponents Commitments, Mitigation and Best Management Practices).

Provided that the Proponent successfully implements the required mitigation measures and applicable EMPs, the RAs are satisfied that adverse environmental effects to the Project are not likely to cause significant adverse environmental effects.

The Proponent will conduct environmental (compliance) monitoring as per their commitments to the BC EAO, identified in Appendix C of this CSR, as well as those required under permits, licences and Authorizations. Pursuant to the *CEAA*, the Proponent is responsible for conducting Follow-Up Programs to determine the accuracy of the EA conclusion and the effectiveness of the mitigation measures. The RAs determined that under the *CEAA* a Follow-Up Programs relating to the effects of the environment on the Project is unnecessary.

5.5 Cumulative Environmental Effects

5.5.1 Background

Section 16(1) of CEAA requires that a comprehensive study include consideration of "any that are likely to result from the Project in combination with other projects or activities that have been or will be carried out". CEE are changes to the biophysical environment or socio-economic setting (if as a result of a change in the biophysical environment caused by the project) caused by an activity in association with past, present and future human activities.

In accordance with the CEA Agency Cumulative Effects Practitioner's Guide, a cumulative effects assessment (CEA) is done to ensure the incremental effects resulting from the combined influences of various projects or human activities are considered in the environmental assessment of the Mount Milligan Gold-Copper mine Project. These combined effects may be significant even though the effects of each project or activity, when individually assessed, are considered insignificant. CEA includes effects that are likely to result from the Project in combination with other projects or activities that have been or will likely be present in a reasonable temporal or spatial scale.

The Proponent's CEA considers potential incremental effects resulting from the combined influences of the proposed Mount Milligan Gold-Copper Mine and other past, present or planned human activities or projects (as described in Table 5.5-2). The CEA for each biological, physical and human VEC included a determination of:

- whether or not a project activity will have any effect on a VEC resulting from the Project or activity associated with the Project;
- whether or not an effect has occurred, determination of whether the cumulative effect acted cumulatively with the effects of other human activities, (past, present or planned); and,
- whether or not the effect of the Project, in combination with other effects, may cause a significant change now or in the future after mitigation.

In order to conduct the CEA the Proponent also identified temporal and spatial boundaries, as well as the level of certainty and any limitations in the CEA. The VECs identified in the environmental

CEA, which were selected for evaluation as required under the ToR for the EIS are summarized in Table 5.5-1 below.

5.5.2 Scope

Temporal Boundaries

The Proponent's CEA encompasses all phases of the Project including construction, operations, closure/decommissioning and post-closure. A development schedule for the proposed Mount Milligan Gold-Copper Mine is outlined in Table 2.7-1, Section 2.7. The Proponent has indicated that the temporal boundary for the purposes of the CEA typically ends when pre-Project conditions become re-established (i.e., effects are considered mitigated and/or effects on VECs are Not Significant).

Spatial Boundaries

The spatial boundaries for the proposed Mount Milligan Gold-Copper Mine are defined in Section 4.4. Spatial boundaries for the purposes of the EA are classified as the Local Study Area (LSA) and Regional Study Area (RSA) and may vary based on the geographic extent of the VEC under consideration. For the CEA, the spatial boundaries were selected to ensure that the areas assessed for potential cumulative effects were appropriate. Two separate study areas were developed for the natural (biophysical) environment and the social and-economic environment.

Table 5.5-1 Summary of VECs Addressed in the Proponent's CEA

Biophysical and Cultural Subject Areas	Valued Ecosystem Components
Fisheries and Aquatic Resources	Rainbow trout
Wildlife	Dragonflies Western Toad Raptors including northern goshawk Furbearers (fisher and wolverine) Grizzly Bear
Vegetation and Plant Communities	Plants used traditionally by First Nations Biodiversity and plant community structure and composition Rare plant species Plant communities at risk
Terrain, Soils, and Geology	Physiography and topography Soil quality
Air Quality and Climate	Climate change Air quality
Noise	Noise
Water Resources	Surface water quality Surface water quantity Sediment quality Groundwater quality Groundwater flow

Biophysical and Cultural Subject Areas	Valued Ecosystem Components
Archaeology and Heritage Resources	Archaeological/Heritage resources
Traditional Knowledge and Traditional Land Use	Current uses of land and resources for traditional purposes
Non-Traditional Land Use	Transportation and access* Availability of renewable resource use

***** The VEC for Non-Traditional Land Use (i.e., Transportation and Access) will only include water course crossings, as per the Scope of the federal Environmental Assessment for the Project.

The Biophysical CEA Study Area was derived from the RSA for Non-traditional Land Use which is based on the Land and Resource Management Plans (LRMPs) for the Fort St. James and Mackenzie areas, and these overlap the local study area for the Project.

There are no communities located near the proposed mine site, therefore the Proponent used a regional approach for the socio-economic assessment. The regional Socio-Economic CEA Study Area selected for this assessment coincides with the Socio-Economic Regional Study Area (SRSA) used to assess Project effects and consists of those communities that will be directly or indirectly affected by mine construction or operation.

5.5.3 Other Projects and Human Activities Considered in the CEA

For the CEA, the selection of other projects and human activities other than the proposed Mount Milligan Gold-Copper Mine were initially identified by reviewing available information on historical (closed) projects/activities, existing (active) projects, general land use activities and planned projects occurring within the CEA study areas.

Historical projects/human activities within the Biophysical CEA study area are primarily associated with forestry (logging activities and construction/use of forest service roads). The Pinchi Lake Mercury Mine, about 23 km northwest of the concentrate load-out facility was closed in 1975. There are no other historical large scale industrial projects or activities within the Biophysical CEA study area. There are no existing large industrial projects within the Biophysical CEA Study Area.

5.5.4 General Land Use

A detailed description of the known land use activities within the Biophysical CEA Study Area is described in Table 5.5-2 below.

Table 5.5-2 General Land Use Activities in Biophysical CEA Study Area as Identified by the Proponent

Project/Activity	Description
Transportation and Access	The North Germansen FSR is used all year round by residents and tourists. There is active logging in the area, so the road is maintained by Canfor Corp. The last 3 km of the western route, which was opened in 2005 by Pope & Talbot Inc., is referred to by the Proponent as the Rainbow FSR: it connects the Heidi Lake junction and the North Philip FSR with North Germansen FSR west of the site. Traffic in the study area will increase by no more than 20 percent because of the Project. Current estimates of traffic volumes along the Germansen Road (North Road) are that there are 500 – 700 vehicles per day (fewer vehicles use the road during the break up (120) and during the freeze up (220) periods). About 27-35 (average 31) Project associated vehicles will use the road on a daily basis. This amount of traffic represents an increase of between 4% (31/700) and 6% (31/500); in the break up period the percentages change to 25% and during the freeze up period the percentages change to 14%. The proposed mine will cut off the current access route to Heidi Lake. Terrane is committed to maintaining access via an alternative route. The section of Tachie Highway, between Fort St. James and the load-out facility, is also used by various residents and companies.
Mining Activities	There are no major mines currently operating. Other than the Project, there are no proposed mines. Serengeti Resources Inc. (Serengeti Resources Inc., 2007), High Ridge Resources and Yankee Hat Minerals Ltd (Ministry of Energy, Mines and Petroleum Resources 2007) are conducting exploration activities in the Biophysical CEA Study Area. Serengeti Resources Inc. is currently exploring three separate properties: 1. Kwanika - 28 km^2 property, road accessible, 85 km north of Mount Milligan. Previous drilling outlined extensive copper mineralized zone with some gold and molybdenum. Recent airborne surveys completed. Tchentlo - 61 km2 property 45 km west of Mount Milligan. Large, overburden covered property with potential porphyry copper-gold deposits identified in multiple areas. 2. Choo - 18 km^2 property 25 km west of the Mount Milligan copper-gold deposit. Previous work conducted at shallow depths. Untested potential at depth and in sections of the area. 3. High Ridge Resources Inc. has an advanced exploration copper-gold porphyry Project about 36 km southeast of the Mount Milligan deposit. Yankee Hat Minerals Ltd. has completed a major drilling and trenching program to characterize the Fran porphyry-related (gold-copper) property (BC Ministry of Energy, Mines and Petroleum Resources 2007b). The property is about 30 km southwest of the Mount Milligan Gold-Copper Mine. Kemess South Mine, an existing gold/copper mine located approximately 270 km (linear distance) away from the Project area was not included in the Biophysical CEA study area as the Proponent determined that there was no interaction between Kemess South mine site biophysical effects and Project biophysical effects.
Fishing	Tourists and residents fish within the RSA and LSA. The proposed Project is in Zone A of the Omineca-Peace Region 7 provincial management jurisdiction. There are provincial fishing regulations for Heidi Lake.
Guide Outfitting	There are currently four licenced guide outfitters.
Resident Hunting and Trapping	Resident hunters hunt deer, elk, and other game for meat. Residents can hunt during the open season; however, they are limited by the availability of game for harvest. There are 15 registered traplines that overlap the study area.
First Nations' Traditional Land Use	Hunting, trapping, fishing and the collection of traditional plants are important activities for First Nations.
Forest Management	Communities in the Biophysical CEA Study Area depend heavily on the use of natural resources. Mackenzie and Fort St. James are heavily dependent on timber resources. The Biophysical CEA Study Area overlaps the Mackenzie and Prince George Timber Supply Areas (TSAs). Various companies are licenced to operate in the area.

Project/Activity	Description
Recreation/Tourism*	Recreation activities include camping, boating, fishing and hunting, cross country skiing, snowmobiling, ice boating, canoeing, sailing and hiking. There has been reference to a proposed Eco-Lodge to be located somewhere near Mudzenchoot Provincial Park; however, details were not available regarding proposed location, timing or scope at the time of environmental assessment preparation.
Agriculture*	Scattered agricultural land use is primarily limited to near the load-out facility (i.e., more than 50 km south/southwest of the mine site).
Residential/Cabins*	There are two cabins seasonally occupied by First Nations within 20 km of the mine site. One is at the confluence of Rainbow Creek with the Nation River, the other is about 20 km east of the mine site. There are no houses located along the North Germansen FSR after the Whiskey Jack Restaurant and residence. There are some residences located along the Tachie Highway between the load-out facility and the turnoff to the North Germansen FSR.
Commercial/Industrial*	There are several commercial/industrial companies along the Tachie Highway between the load-out facility and the turnoff to the North Germansen FSR.

*Activities associated with traffic, agriculture, residential/cabins, recreation/tourism (including guide outfitting) and commercial/industrial developments are not within the Scope of Assessment for this Project.

Mining activities as specified in Table 5.5-2 are not included in the consideration of cumulative effects as they are not considered reasonably foreseeable developments. Only those mining projects that have entered environmental assessment or regulatory approval processes or are in operation are considered in this CEA. Effective CEA must be based on sufficient information about the potential effects of a proposed project which is typically only available during the environmental assessment or regulatory processes for a project.

5.5.5 Cumulative Effects Assessment Significance Rating

The Proponent's approach to considering the significance of cumulative effects was to determine which additional effects can be sustained by a VEC before undergoing changes in condition that cannot be reversed with mitigation. In the EIS this process is described as follows:

1. Evaluation of the significance of residual effects; and,
2. Comparison of the results against thresholds or land use objectives and trends.

Significance rating criteria were developed to rate potential incremental effects. Ratings were established based on experience with similar projects, particularly BC mining projects and through engagement with the TWG during the provincial EA process.

The Proponent considered that potential for a significant cumulative effect exists when the effects on a VEC being assessed met one of the following criteria:

- Are of a medium magnitude at a sub-regional spatial extent and are permanent in duration;
- Are of a medium magnitude at a regional spatial extent and are long term or permanent in duration;
- Are of a high magnitude at a local spatial extent and are long term or permanent in duration;
- Are of a high magnitude at a sub-regional spatial extent and are medium term, long term or permanent in duration; and,
- Are of a high magnitude at a regional extent for any duration.

The Proponent's initial triage for consideration of significance was based on magnitude, spatial extent and duration, and whether the effects on VECs were rated as potentially significant. An evaluation of the frequency, reversibility, ecological context, direction and certainty of effects was used to more fully assess the significance of the effect.

5.5.6 Biophysical CEA Study Area

The Biophysical CEA study area includes the regional and local study areas described for the various VECs. The study area was derived from the RSA for Non-traditional Land Use which is based on the Land and Resource Management Plans (LRMPs) for the Fort St. James and Mackenzie areas which overlap the LSA for the Project. The southern boundary included the McLeod Tsilcoh Forest Service Road and Carp Lake Provincial Park. This area was used to ensure relevant land use activities were addressed and provided a fixed area for the inclusion of foreseeable projects. Access, recreation and tourism land use activities occurring within eight LRMP subzones that overlapped the Project LSA were also reviewed, though notably access roads (with the exception of access crossings), recreation and tourism are not considered within the scope of the federal assessment and are only mentioned herein for information purposes.

Cumulative effects assessments were carried out for biophysical components where residual Project effects have the potential to contribute measurably to regional cumulative effects. The Proponent has summarized the reasonably foreseeable projects/activities within the proposed Biophysical CEA Study Area in Table 5.5-3 below.

Biophysical and Cultural Cumulative Effects

In the following sections, VEC specific residual effects of the Project are assessed with respect to other projects and activities. For each VEC specific residual effect, the potential spatial and temporal overlap with other projects and activities in the area were assessed. The residual effects (for VECs) which did not overlap spatially or temporally with other projects or activities were not carried forward into the CEA.

The Proponent determined that residual effects that were rated as *Not Significant (Negligible)* in the effects assessment would not be carried forward to the CEA unless identified as a concern/issue during consultation with stakeholders, regulators or First Nations. Residual effects rated as *Not Significant (Moderate)* were carried forward into the CEA. The rationale for those residual effects rated as *Not Significant (Minor)* was reviewed in detail, taking into consideration the following:

- predicated mitigation success
- spatial and temporal overlap with potential future/foreseeable human activity
- comments from stakeholders, regulators or First Nations

Table 5.5-3 Reasonably Foreseeable Projects in Biophysical CEA Study Area

Project/Activity	Start Date	Duration	Area
Mackenzie Green Energy Centre approved by the BC Environmental Assessment Office.	Unknown because of sale of Pope & Talbot facility. Reasonable to assume that project will proceed before 2016 because of commitment made by BC Bioenergy Strategy	~ 2 years construction 30 years operation	Located in Mackenzie. Primary linkage appears to be transportation routes referenced in EA, which include "resource roads" between Fort St. James and Mackenzie. Mackenzie Green Energy Centre has committed to providing 5% of funding for proposed upgraded road

Project/Activity	Start Date	Duration	Area
Proposed road upgrade between Mackenzie and Fort St. James	Unknown. Waiting for federal approval and funding. Reasonable to assume that project will proceed because of linkages between BC Bioenergy Strategy, Mackenzie Green Energy Centre and local economies.	~ 1 year construction On-going operation with routine maintenance	Preferred route generally follows, west to east, Rainbow FSR - North Philip FSR – Finlay Philip FSR linking Fort St. James and Mackenzie
Logging/management of Pine Beetle damaged forests	Reasonable to assume logging near Mount Milligan Gold-Copper Mine will have commenced within 10 years. Cutblock planning is heavily influenced by the Mountain Pine Beetle infestation affecting most of the pine dominated stands that are prevalent in the RSA	Next 10 years – most of the forests in area will have been logged to some extent.	Available information indicates that entire Biophysical CEA Study Area will be affected by Pine Beetle and logged to some extent. Implementation of management strategies and silviculture practices should reduce effects.

Table 5.5-4 VECs Considered by the Proponent in the CEA

VEC	Residual Effect
Fisheries and Aquatic Resources	
Rainbow trout	Loss of aquatic habitat
	Change in stream flow
Vegetation and Plant Communities	
Plant Communities at Risk	Loss of slender sedge-common hook moss community
Wildlife	
Dragonflies	Change in habitat availability
Western Toad	Change in habitat availability
Raptors including northern goshawk	Change in habitat availability
Furbearers (fisher and wolverine)	Change in habitat availability
Grizzly Bear	Change in habitat availability
Terrain, Soils and Geology	
Physiography and Topography	Alteration of landscape from baseline condition
Soil Quality	Change in quantity of reclamation suitability of soils
Air Quality and Climate	
Climate Change	Change in climate (with respect to forest clearing in the Project Area)
Air Quality	Change in air quality
Other	
Non-traditional Land Use	Increase in traffic*
Renewable Resource Use	Loss of available timber and non-timber resources
Traditional Land Use	Change in traditional land use

*Access road crossings are outside the scope of assessment.

5.5.6.1 Terrain, Soils and Geology

The Proponent assessed how the Project may interact with the following components of Terrain, Soils and Geology:

- Alteration of landscape from baseline condition; and
- Reclamation suitability of soils.

The Proponent determined that the residual effects associated with the above components were considered *Not Significant (Minor to Moderate).* As summarized in Table 5.5-5 below, the Proponent considered that mining activities and forest activities, including and logging management of Pine Beetle damaged forests, may interact with VEC specific residual effects of the Project and were therefore analysed. The residual effects from these activities are summarized in Table 5.5-6. The Proponent has indicated that effects of the Project in conjunction with the effects of exploration, forest activities and management of the Pine Beetle damaged forests are negligible to minor. There are no future foreseeable mining projects proposed in the study area and residual effects associated with mining activities are not considered in the determination of incremental effects section.

Table 5.5-5 Proponent's Assessment of Linkages between other Human Activities and Reasonably Foreseeable Projects with Terrain, Soils and Geology

Terrain, Soils and Geology Residual Effect	**Representative Future Land Use**											**Reasonably Foreseeable Projects**		
	Transportation and Access	Mining Activities	Fishing	Guide Outfitting	Resident Hunting and Trapping	First Nation's Traditional Land Use	Forest Management	Recreation/Tourism	Agriculture	Residential/Cabins	Commercial/Industrial	Mackenzie Green Energy Centre	Proposed Upgraded Road between Fort St. James and Mackenzie	Logging/Management of Pine Beetle Damaged Forests
Physiography and Topography														
Alteration of landscape from baseline condition	NI	o	NI	NI	NI	NI	o	NI	NI	NI	NI	NI	NI	o
Soil Quality														
Soil reclamation suitability	NI	o	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI

Legend: Linkage definitions: o interaction; - key interaction; + benefit; NI no interaction.

The effects on terrain, soils and geology carried forward for inclusion in the determination of incremental effects on the environment includes: logging/management of Pine Beetle infected/damaged forests (alteration of landscape from baseline condition). The Proponent's analysis indicated that the Project contribution to the Cumulative Environmental Effect on terrain, soils and geology is *Not Significant (Minor)*.

Table 5.5-6 Proponent's Assessment of Spatial and Temporal Overlap between Mount Milligan Gold-Copper Mine and other Projects Human Actions on Terrain, Soils and Geology

	Human Activity	Residual Effect	Extent	Duration	Rationale	Mount Milligan Contribution/overlap
Representative Future Land Use	**Mining Activities**					
	Exploration	Alteration of landscape from baseline conditions Change in Reclamation suitability of soils	Mining exploration activities range in distance from the Project (10 km to 60 km).	Expected to occur periodically during project life	Exploration activities identified as concern by First Nations.	Effects associated with exploration are rated negligible to minor and will be fully mitigated. There is no overlap with residual effects for terrain and soils identified for Mount Milligan Gold-Copper Mine.
	Forest Activities					
	Logging	Alteration of landscape from baseline conditions	Expected to occur sporadically within study area. Annual allowable cuts are set for the timber supply areas by Ministry of Forestry.	Expected to occur periodically during project life.	Removal of timber and non-timber resources alter the landscape form baseline conditions.	Although primarily second growth, the project removes the available timber resources from within the project study area. The implementation of standard mitigation measures during routine forest management practices will reduce potential residual effects. The contribution of Mount Milligan Gold-Copper Mine to the alteration of landscape from baseline conditions when compared to routine forest management practices is considered negligible because of the known success of standard best management practices.
Reasonably Foreseeable Projects	**Logging/Management of Pine Beetle Damaged Forests**					
	Logging and appearance of remaining dead/ damaged trees	Alteration of landscape from baseline conditions	Include in years the expected duration of the effect	Include rational for including this activity	Removal of timber and non-timber resources alter the landscape from baseline conditions. Pine beetle damaged trees will also alter the landscape	The contribution of Mount Milligan Gold-Copper Mine to the alteration of landscape from baseline conditions in relation to management of the pine beetle damaged forests is considered negligible because of the limited spatial extent of the project study area and the commitment by Terrane to ensure the site is appropriately revegetated at closure.

5.5.6.2 Climate and Air Quality

The Proponent assessed how the Project may cause changes to air quality and climate. The Proponent concluded that residual effects of the Project on climate and air quality were considered *Not Significant (Minor)* and therefore were carried forward into the CEA (see also Table 5.5-4).

Tables 5.5-2 and 5.5-3 outline the representative land uses and foreseeable projects that could interact with the potential effects caused by the Project. As summarized in Table 5.5-7 the Proponent determined that transportation and access, recreation/tourism, the proposed upgraded road between Fort St. James and Mackenzie, and the logging/management of Pine Beetle damaged forests may interact with Project effects on the climate and air quality components. The cumulative effects on climate change from other projects and human actions in combination with the Project are provided in Table 5.5-8.

The assessment of spatial and temporal overlap between Mount Milligan Gold-Copper Mine and other projects and human interactions on climate change indicate that effects are *Not Significant (Minor)*. Therefore, the CEA considered those activities that were determined to have potential affects on climate change which include logging management of Pine Beetle damaged forests.

The cumulative effects on air quality from other projects and human actions in combination with the Project are provided below in Table 5.5-9.

Table 5.5-7 Proponent's Assessment of Linkages between other Human Activities and Reasonably Foreseeable Projects with Climate and Air Quality

Climate and Air Quality Residual Effect	**Representative Future Land Use**											**Reasonably Foreseeable Projects**		
	Transportation and Access	Mining Activities	Fishing	Guide Outfitting	Resident Hunting and Trapping	First Nation's Traditional Land Use	Forest Management	Recreation/Tourism	Agriculture	Residential/Cabins	Commercial/Industrial	Mackenzie Green Energy Centre	Proposed Upgraded Road between Fort St. James and Mackenzie	Logging/Management of Pine Beetle Damaged Forests
Change in climate	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	o
Change in air quality	o	NI	NI	NI	NI	NI	NI	o	NI	NI	NI	NI	o	o

Legend: o interaction; - key interaction; + benefit; NI no interaction.

Table 5.5-8 Proponent's Assessment of Spatial and Temporal Overlap between Mount Milligan Gold-Copper Mine and other Projects and Human Actions on Climate Change

	Human Activity	Residual Effect	Extent	Duration	Rationale	Overlap with Mount Milligan
	Logging/Management of Pine Beetle Damaged Forests					
Reasonably Foreseeable Projects	Logging/ Management of dead/ damaged trees	Change in climate	The spatial extent of the residual effect will be all of the King Richard Creek watershed, the area of the Project access road and the power line wherever lodgepole pine are killed by Mountain Pine Beetle	The duration for management logging is forecast to be up to 10 years. However, the small residual effect from the Project will last a few years past the mine life of 15 years until vegetation re-establishes.	Logging will remove mostly dead trees which will not absorb carbon dioxide but some live trees as well; the Project may lengthen the time period when the carbon dioxide sink is effective over the area the Project.	The Project construction and operation is likely to overlap with the management of Pine Beetle damaged forests in the CEA study area. The spatial overlap will be the Project site which has been logged recently. Although reforestation may be delayed at mine closure, the mine will occupy only a very small fraction of the total clear cut pine area within the CEA study area and thus the contribution of the Project on residual effects on climate have been rated as *Not Significant (Minor)*

The assessment of spatial and temporal overlap between Mount Milligan Gold-Copper Mine and other projects and human interactions on air quality indicate that effects range from *Not Significant (Negligible)* to *Not Significant (Minor)*. Therefore, the CEA considered the activities determined to have potential affects on air quality which include transportation and access and recreation/tourism. The effects of the Project in combination with the effects of logging/management of Pine Beetle infected/damaged forests was considered when assessing the cumulative effects on climate change. The analysis indicated that the Project contribution to the cumulative environmental effect on climate change is *Not Significant (Minor)* during construction and operations and *Not Significant (Negligible)* during closure.

Table 5.5-9 Proponent's Assessment of Spatial and Temporal Overlap between Mount Milligan Gold-Copper Mine and other Projects Human Actions on Air Quality

	Human Activity	Residual Effect	Extent	Duration	Rationale	Mount Milligan Contribution/ overlap
	Transportation and Access					
Representative Future Land Use	Vehicle exhaust emissions and dust	Change in air quality. The Project will cause a minor increase in exhaust gases and dust. Exhaust gases from mine related vehicular traffic which is mine related will add to any exhaust gases from other sources within	Mine site and access road to Fort St. James	The mine contribution will be the mine life (including closure). Post closure there will be no Project effects on air quality.	Mine-related traffic will be incremental to other traffic on access roads and will be a new source of exhaust	The only overlap will be the public highway and FSR portion of the access to the mine site.

Human Activity		Residual Effect	Extent	Duration	Rationale	Mount Milligan Contribution/ overlap
		the CEA study area which, include the access road and mine site; the power line will have little to no traffic for the greater part of the time it is in use.			and dust at the mine site itself.	
	Recreation/Tourism					
	Vehicle exhaust emissions and dust	Change in air quality- details same as Transportation and Access above	Extent will be the same as previous	Duration will be the same as previous	Recreation/ tourism involving vehicles will be the principal form of this activity in the CEA study area	There will be no overlap at the mine site but tourist traffic may add to the traffic on the access road. Tourist traffic will be discouraged along the power line right of way. The contribution of tourism traffic to air quality in the CEA Study Area is considered negligible.
Reasonably Foreseeable Projects	**Proposed Upgraded Road between Fort St. James and Mackenzie**					
	Vehicle exhaust emissions and dust	Change in air quality. Effects will be the same as previous	Mine site and access road to Fort St. James. There is also the potential for Project traffic to use the upgraded road to Mackenzie	The temporal overlap with the Project is currently unknown	It is presumed that upgrading the road will increase the amount of traffic along the access route. Traffic associated with tourism, logging and resident commuting is predicted.	Due to permitting requirements, construction of the road upgrade would probably not overlap with construction of the mine site. During operations of the mine site, there is the potential for overlap between emissions from Project traffic and emissions from traffic/ equipment constructing the road upgrade. The contribution of the Project on residual effects on air quality in combination with upgrading the road has been rated as *Not Significant (Negligible)* because of the limited amount of traffic associated with the Project.

	Human Activity	Residual Effect	Extent	Duration	Rationale	Mount Milligan Contribution/ overlap
	Logging/Management of Pine Beetle Damaged Forests					
Reasonably Foreseeable Projects	Logging/ Management of dead/ damaged trees Vehicle exhaust emissions and dust	Change in air quality associated with dust and emissions generated during logging activities.	The spatial extent of the Project related residual effects of on air quality are limited to a 1.5 km area around the mine site and along the access road. Pine Beetle damaged forest is predicted to spatially overlap with the Project in the next 10 years	The duration for management logging is forecast to be up to 10 years. Residual effects on air quality from Mount Milligan Gold-Copper Mine will cease post closure.	Logging activities and associated traffic will generate emissions within the CEA study. These emissions will be mitigated to the extent possible.	The *Not Significant (Minor)* residual effects on air quality identified during the Project construction and operation will overlap with the management of Pine Beetle damaged forests in the CEA study area. The contribution of the on residual effects on air quality has been rated as *Not Significant (Negligible)* because of the limited emission sources and the small study area of the Project.

5.5.6.3 Fisheries and Aquatic Resources

The Proponent assessed how the Project may interact with the following components of Fish and Fish Habitat and Aquatic Resources:

- Loss of aquatic habitat;
- Increase in sedimentation;
- Change in stream flow;
- Change in water quality;
- Change in Rainbow Creek thermal regime; and,
- Mercury and methylation in the MCWSP.

The Proponent determined that the residual effects associated with the above components were considered *Not Significant (Negligible to Minor)* after successful implementation of the FHMCP. The assessment carried forward those activities assessed to have potential affects on fisheries and aquatic resources, which include loss of aquatic habitat and change in stream flow.

Tables 5.5-2 and 5.5-3 outline the representative land uses and foreseeable projects that could interact with the potential effects caused by the Project. Table 5.5-0 below summarizes which of the foreseeable projects and representative land uses (human actions) may have an interaction with loss of aquatic habitat and change in stream flow. Fishing activities associated with fishing, guide outfitting, and exploration camps (mining activities) may interact with VECs carried over into the CEA. Concerns were expressed at stakeholder consultations that the increase in the number of people associated with the mine in the area, could result in increased pressures on fish stocks in lakes and

fish-bearing streams in the area. However, no employees or contractors will be allowed to fish while working on the Project. In addition, upon implementation of mitigation measures, the effect on fish populations in lakes and streams near the mine is expected to be negligible. A listing of the cumulative effects from other projects and human actions in combination with the Project on rainbow trout is provided in Table 5.5-11.

Table 5.5-10 Proponent's Assessment of Linkages between other Human Activities and Reasonably Foreseeable Projects with Fish and Fish Habitat and Aquatic Resources

Fish and Fish Habitat and Aquatic Resources Residual Effect	**Representative Future Land Use**											**Reasonably Foreseeable Projects**		
	Transportation and Access	Mining Activities	Fishing	Guide Outfitting	Resident Hunting and Trapping	First Nation's Traditional Land Use	Forest Management	Recreation/Tourism	Agriculture	Residential/Cabins	Commercial/Industrial	Mackenzie Green Energy Centre	Proposed Upgraded Road between Fort St. James and Mackenzie	Logging/Management of Pine Beetle Damaged Forests
Rainbow trout	NI	o	-	-	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Loss of aquatic habitat	NI	o	-	-	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Change in stream flow	NI	o	-	-	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI

Legend: o interaction; - key interaction; + benefit; NI no interaction.

Table 5.5-11 Proponent's Assessment of Spatial and Temporal Overlap between Mount Milligan Gold-Copper Mine and other Projects and Human Actions on Rainbow Trout

Human Activity		**Residual Effect**	**Extent**	**Duration**	**Rationale**	**Mount Milligan Contribution/ overlap**
Representative Future Land Use	Mining Activities					
	Exploration	Increase in fishing pressure and associated increase in fish harvesting because of the presence of the exploration workforces	Accessible surface water bodies along the transportation corridors to respective sites.	It is not possible to estimate temporal overlap between exploration activities and the Project. Worst case assumes that they occur concurrently during the life of the mine.	Potential fishing by exploration workforce.	None. No employees working for the Mount Milligan Gold-Copper Mine or contractors will be allowed to fish while working on the Project.

The effect of the Project in combination with the effects of mining activities (exploration) was considered when assessing cumulative effects on Fish and Fish Habitat and aquatic resources. The analysis indicated that the Project's contribution to the CEE on Rainbow trout is not likely to occur.

5.5.6.4 Vegetation and Plant Communities

The Proponent assessed how the Project may interact with the following vegetation and plant community components: plants used traditionally by First Nations, biodiversity and plant community structure and composition, rare plant species and plant communities at risk. Residual effects associated with vegetation and plant communities were considered *Not Significant (Minor)*; other than for the loss of slender sedge-common hook moss community (a plant community at risk) that was assessed as *Not Significant (Moderate)*.

Based on the Proponent's analysis, rare plant species and plant communities at risk were carried forward as vegetation and plant community components for the CEA. Table 5.5-12 below summarizes which of the projects and activities may have an interaction with the vegetation and plant community components (plant communities at risk).

A description of the cumulative effects from other projects and activities that interact with the Project on Plant Communities at Risk is provided in the 5.5-13. The cumulative effect of logging to remove Pine Beetle killed trees in conjunction with the Project will be a delay in the re-growth of vegetation in the mine area beyond the time regeneration will have commenced in other logged areas.

Following the review of the available information no linkages were identified between the Project and other projects and activities for the loss of vegetation and plant communities, specifically the slender sedge-common hook moss community. The analysis indicated that the Project contribution to the CEE on vegetation and plant communities is *Not Significant (Negligible)*.

Table 5.5-12 Proponent's Assessment of Linkages Between Other Projects and Activities and Planned Projects with Plant Communities at Risk

	Representative Future Land Use											**Reasonably Foreseeable Projects**		
Vegetation and Plant Communities Residual Effect	Transportation and Access	Mining Activities	Fishing	Guide Outfitting	Resident Hunting and Trapping	First Nation's Traditional Land Use	Forest Management	Recreation/Tourism	Agriculture	Residential/Cabins	Commercial/Industrial	Mackenzie Green Energy Centre	Proposed Upgraded Road between Fort St. James and Mackenzie	[illegible] Pine Beetle Damaged
Loss of Plant Communities at Risk														
Loss of slender sedge-common hook moss community	NI	NI	NI	NI	NI	NI	o	NI	NI	NI	NI	NI	NI	o

Legend: o interaction; - key interaction; + benefit; NI no interaction.

Table 5.5-13 Proponent's Assessment of Spatial and Temporal Overlap between Mount Milligan Gold-Copper Mine and other Projects and Human Actions on Plant Communities at Risk

	Human Activity	Residual Effect	Extent	Duration	Rationale	Mount Milligan Contribution/ overlap
Representative Future Land Use	**Forest Management**					
	Logging	Loss of slender sedge-common hook moss community	Any communities at risk within the CEA study area where logging takes place may be affected.	On going, no timeframe other than for pine harvest (discussed below)	Logging changes forest community structure	The contribution of the Project on residual effects associated with routine forest management to the slender sedge-common hook moss community is assessed as *Not Significant (Negligible)*.
Reasonably Foreseeable Projects	**Logging/Management of Pine Beetle Damaged Forests**					
	Logging/ Management of dead/ damaged trees	Loss of slender sedge-common hook moss community	The spatial extent is essentially coincident with the area affected by Mountain Pine Beetle	Salvage logging should be completed within about 10 years and harvested areas re-vegetated	Changes in forest community structure because of logging affect the slender sedge-common hook moss community	The contribution of the Project on residual effects to the slender sedge-common hook moss community is assessed as *Not Significant (Negligible)*.

5.5.6.5 Wildlife

The Proponent assessed how the Project may cause change to the following wildlife components: dragonflies, western toads, raptors (including the goshawk), songbirds, waterfowl, furbearers (fisher and wolverine), beaver, moose, Northern Caribou and grizzly bear. The Proponent concluded that all residual effects of the Project on wildlife were considered *Not Significant (Minor)*.

Tables 5.5-2 and 5.5-3 outline the representative land uses and foreseeable projects that could interact with the potential effects caused by the Project. Based on analysis, dragonflies/western toads, goshawk/fisher and grizzly bear were carried forward as wildlife components for the CEA. As summarized in Table 5.5-14 below, the Proponent determined that transportation and access roads, mining activities, guide outfitting, forest management, the proposed upgrade to road between Fort St. James and Mackenzie and proposed logging management of the Pine Beetle damaged forest may interact with Project effects on wildlife species carried over into the CEA (dragon flies/western toad, goshawk/fisher, grizzly bear).

Tables 5.5-15, 5.5-16 and 5.5-17 provide a summary of the cumulative effects from other projects and representative land use (human actions) in combination with the Project on dragonflies/ western toads, goshawk/fisher and grizzly bear, respectively. The CEA considered the activities determined to have potential affects on wildlife (i.e., changing habitat availability and/or loss of habitat).

The assessment of spatial and temporal overlap between Mount Milligan Gold-Copper Mine and other projects and human actions on wildlife indicates that effects are *Not Significant (Negligible)* except for effects on the Western toad and the grizzly bear which were considered *Significant (Minor)*. However the contribution of the Project on residual effects associated with traffic to the Western toad is assessed as *Not Significant (Negligible)* because of the known success of standard best management practices and the small footprint of the facility. As such, only the effects to the

grizzly bear were carried forward for inclusion in the determination of incremental effects on the environment. Specifically, the effects of logging/management of Pine Beetle infected/damaged forests, which could cause a change in habitat availability for the grizzly bear were included in the determination of incremental effects on the environment.

The effects on grizzly bears directly associated with displacement are expected to be minor. Mortalities could occur due to conflict with vehicles; however, the overall effect of incidental mortality on grizzly bear populations is expected to be minor. The contribution of Mount Milligan Gold-Copper Mine on residual effects associated with traffic to grizzly bear is assessed as *Not Significant (Negligible)*.

The Proponent's analysis of CEE concluded that there would be no significant adverse cumulative impacts to wildlife. As such, no additional monitoring programs outside those identified in the Environmental Monitoring and Follow-Up Program were proposed. It is expected that potential cumulative effects from reasonable foreseeable projects will be monitored with the proposed monitoring programs proposed as they proceed.

Table 5.5-14 Proponent's Assessment of Linkages between other Human Activities and Reasonably Foreseeable Projects with Wildlife

Wildlife Residual Effect	**Representative Future Land Use**											**Reasonably Foreseeable Projects**		
	Transportation and Access	Mining Activities	Fishing	Guide Outfitting	Resident Hunting and Trapping	First Nation's Traditional Land Use	Forest Management	Recreation/Tourism	Agriculture	Residential/Cabins	Commercial/Industrial	Mackenzie Green Energy Centre	Proposed Upgraded Road between Fort St. James and Mackenzie	Logging/Management of Pine Beetle Damaged Forests
Dragonflies and Western Toad	o	NI	NI	NI	NI	NI	o	NI	NI	NI	NI	NI	o	o
Goshawk and Fisher	o	NI	NI	NI	o	NI	o	NI	NI	NI	NI	NI	o	o
Grizzly Bear	o	o	NI	o	NI	NI	o	NI	NI	NI	NI	NI	o	o

Legend: o interaction; - key interaction; + benefit; NI no interaction.

Table 5.5-15 Proponent's Assessment of Spatial and Temporal Overlap between Mount Milligan Gold-Copper Mine and other Projects and Human Actions on Dragonflies and Western Toads

Human Activity		Residual Effect	Extent	Duration	Rationale	Mount Milligan Contribution/ overlap
Representative Future Land Use	**Transportation and Access**					
	Traffic	Change in habitat availability for Western toad	Spatially limited to the Project study area and along the transportation corridor.	Construction and operations, and closure. Minor overlap post-closure.	Change in habitat can affect various life stages and migration patterns	The contribution of the Project on residual effects associated with traffic to the Western toad is assessed as *Not Significant (Negligible)*.
	Forest Management					
	Logging and traffic	Change in habitat availability for Western toad and dragonflies	Expected to occur sporadically within study area.	Expected to occur periodically during Project life.	The landscape is altered form baseline conditions which affects habitat availability.	The contribution of the Project to logging and the change in habitat availability for western toad and dragonflies when compared to routine forest management practices is considered *Not Significant (Negligible)*.
Reasonably Foreseeable Projects	**Proposed Upgraded Road between Fort St. James and Mackenzie**					
	Construction of road upgrade	Change in habitat availability for Western toad	Mine site and access road to Fort St. James (and the load out facility).	The temporal overlap with the Mount Milligan Gold-Copper Mine is unknown at this time.	Mine-related traffic will be added to other current and future traffic on access road.	The contribution of the Project on traffic along the access road (during construction of an upgraded access road) on western toad and dragonflies would be *Not Significant (Negligible)* as the access road already exists.
	Increased traffic	Change in habitat availability for Western toad	Mine site and access road to Fort St. James (and the load out facility).	The temporal overlap with the Project is unknown at this time.	Mine-related traffic will be added to other current and future traffic on access road.	The contribution of the Project on traffic along the access road (if upgraded) on western toads and dragonflies would be *Not Significant (Negligible)* as the current increase in traffic is rated as *Not Significant (Minor)*.
	Logging/Management of Pine Beetle Damaged Forests					
	Logging/ Management of dead/ damaged trees	Change in habitat availability for Western toad and dragonflies	The spatial extent is essentially coincident with the area affected by Mountain Pine Beetle	Salvage logging should be completed within about 10 years and harvested areas revegetated	It is estimated that a significant portion of the forests in CEA study area will be damaged or dead over the next 10 years by Pine Beetle.	The contribution of the Project on residual effects associated with logging and/or management of Pine Beetle damaged forests on Western toad and dragonflies is considered *Not Significant (Negligible)* because of the large area affected by the Pine Beetle.

Table 5.5-16 Proponent's Assessment of Spatial and Temporal Overlap between Mount Milligan Gold-Copper Mine and other Projects and Human Actions on Goshawk and Fisher

Human Activity		Residual Effect	Extent	Duration	Rationale	Mount Milligan Contribution/ overlap
Representative Future Land Use	**Transportation and Access**					
	Traffic	Change in habitat availability for fisher and goshawk	Spatially limited to the Project study area and along the access corridor.	Construction and operations, and closure. Minor overlap post-closure.	Fisher will relocate when habitat availability is altered. Goshawk may experience increased conflicts with traffic.	The contribution of the Project on residual effects associated with traffic to fisher and goshawk is assessed as *Not Significant (Negligible)*.
	Resident Hunting and Trapping					
	Trapping	Change in habitat availability for fisher	Spatially limited to the Project study area and area used for trapping	Construction and operations, and closure.	Fisher will relocate when habitat availability is altered.	The contribution of the Project on residual effects associated with trapping to fisher is assessed as *Not Significant (Negligible)*.
	Forest Management					
	Logging and traffic	Change in habitat availability for fisher and goshawk	Expected to occur sporadically within study area.	Expected to occur periodically during the Project life.	The landscape is altered form baseline conditions which affects habitat availability.	The contribution of the Project to logging and the change in habitat availability for goshawk and fisher when compared to forest management practices is considered *Not Significant (Negligible)*.
Reasonably Foreseeable Projects	**Proposed Upgraded Road between Fort St. James and Mackenzie**					
	Construction of road upgrade	Change in habitat availability for fisher and goshawk	Spatially limited to transportation corridor.	Construction and operations, and closure.	Fisher will relocate when habitat availability is altered. Goshawk may experience increased conflicts with traffic.	The contribution of the Project on residual effects associated with traffic to fisher and goshawk is assessed as *Not Significant (Negligible)*.
	Logging/Management of Pine Beetle Damaged Forests					
	Logging/ Management of dead/ damaged trees	Change in habitat availability for fisher and goshawk	The spatial extent is essentially coincident with the area affected by Mountain Pine Beetle	Salvage logging should be completed within about 10 years and harvested areas revegetated	It is estimated that a significant portion of the forests in CEA study area will be damaged or dead over the next 10 years.	The contribution of the Project on residual effects from logging and management of Pine Beetle damaged forests on fisher and goshawk is considered *Not Significant (Negligible)* because of the large area damaged

Table 5.5-17 Proponent's Assessment of Spatial and Temporal Overlap between Mount Milligan Gold-Copper Mine and other Projects and Human Actions on Grizzly Bear

	Human Activity	Residual Effect	Extent	Duration	Rationale	Mount Milligan Contribution/ overlap
Representative Future Land Use	**Transportation and Access**					
	Traffic	Change in habitat availability for grizzly bear	Spatially limited to the Project study area and along the transportation corridor.	Construction and operations, and closure.	Grizzly bear will avoid the access road most of the time.	The contribution of the Project on residual effects associated with traffic to grizzly bear is assessed as *Not Significant (Negligible)*.
	Forest Management					
	Logging and traffic	Change in habitat availability for grizzly bear	Expected to occur sporadically within study area.	Expected to occur periodically during the Project life.	The landscape is altered form baseline conditions which affects habitat availability.	The contribution of the Project to logging and the change in habitat availability to grizzly bear when compared to routine forest management practices is considered *Not Significant (Negligible)*.
Reasonably Foreseeable Projects	Proposed Upgraded Road between Fort St. James and Mackenzie					
	Construction of road upgrade	Change in habitat availability for grizzly bear	The temporal overlap with the Project is unknown at this time.	Mine-related traffic will be added to other current and future traffic on access road.	Grizzly bear will avoid the access road most of the time.	The contribution of the Project on residual effects associated with construction of the road upgrade to grizzly bear is assessed as *Not Significant (Negligible)*.
	Increased traffic	Change in habitat availability for grizzly bear	The temporal overlap with the Project is unknown at this time.	Mine-related traffic will be added to other current and future traffic on access road.	Grizzly bear will avoid the access road most of the time.	The contribution of the Project on residual effects associated with traffic to grizzly bear is assessed as *Not Significant (Negligible)*.
	Logging/Management of Pine Beetle Damaged Forests					
	Logging/ Management of dead/ damaged trees	Change in habitat availability for grizzly bear	The spatial extent is essentially coincident with the area affected by Mountain Pine Beetle	Salvage logging should be completed within about 10 years and harvested areas revegetated	It is estimated that a significant portion of the forests in CEA study area will be damaged or dead over the next 10 years	The contribution of the Project on residual effects associated with logging and/or management of Pine Beetle damaged forests on habitat availability for grizzly bears is considered *Not Significant (Minor)*.

5.5.6.6 Non-traditional Land Use

The Proponent assessed how the Project may cause changes to non-traditional land use components (ecologically representative areas, transportation and access, renewable resource use and tourism and other recreational land uses). The Proponent concluded that residual effects of the Project on non-traditional land use were considered *Not Significant (Negligible to Moderate).*

Tables 5.5-2 and 5.5-3 outline the representative land uses and foreseeable projects that could interact with the potential effects caused by the Project. As summarized in Table 5.5-18 below, the Proponent determined that transportation and access roads, First Nation's traditional land use, forest management, recreation/tourism, the Mackenzie Green Energy Centre, the proposed upgrade to road between Fort St. James and Mackenzie and proposed logging management of the Pine Beetle damaged forest may interact with Project effects on non traditional land.

Table 5.5-19 provides a summary of the cumulative effects from other projects and representative land use (human actions) in combination with the Mount Milligan Gold-Copper Mine project on transportation and access and renewable resource use.

The assessment of spatial and temporal overlap between Mount Milligan Gold-Copper Mine and other projects and human actions on non-traditional land use indicate that effects are *Not Significant (Negligible)* except for effects on transportation and access which are *Not Significant (Minor)*.

The effects of the Project in combination with increases in traffic and loss of available timber and non-timber resources (logging/management of Pine Beetle infected/damaged forests) was considered when assessing the cumulative effects on non-traditional land use. The analysis indicated that the Project contribution to the Cumulative Environmental Effect on non-traditional land use is *Not Significant (Minor)*.

Table 5.5-18 Proponent's Assessment of Linkages between other Human Activities and Reasonably Foreseeable Projects with Non-Traditional Land Use

	Representative Future Land Use											**Reasonably Foreseeable Projects**		
Non-Traditional Land Use Residual Effect	Transportation and Access	Mining Activities	Fishing	Guide Outfitting	Resident Hunting and Trapping	First Nation's Traditional Land Use	Forest Management	Recreation/Tourism	Agriculture	Residential/Cabins	Commercial/Industrial	Mackenzie Green Energy Centre	Proposed Upgraded Road between Fort St. James and Mackenzie	Logging/Management of Pine Beetle Damaged Forests
Transportation and Access														
Increase in traffic	o	NI	NI	NI	NI	NI	o	o	NI	NI	NI	o	o	o
Renewable Resource Use														
Loss of available timber and non-timber resources	NI	NI	NI	NI	NI	o	o	o	NI	NI	NI	o	NI	o

Legend: o interaction; - key interaction; + benefit; NI no interaction.

Table 5.5-19 Assessment of Spatial and Temporal Overlap between Mount Milligan Gold-Copper Mine and other Projects Human Actions on Non-traditional Land Use

	Human Activity	Residual Effect	Extent	Duration	Rationale	Mount Milligan Contribution/ overlap
Representative Future Land Use	**Transportation and Access**					
	Traffic	Increased traffic along access road	Mine site and access road to Fort St. James (and the load out facility).	The mine contribution will be the mine life (including closure). Post closure there will be no effects of the Project on traffic	Mine-related traffic will be added to other current and future traffic on access road.	The contribution of the Project on residual effects on traffic in combination with existing and future traffic is assessed as *Not Significant (Minor)* as mine traffic will represent an increase of no more than 20 percent because of the Project.
	First Nation's Traditional Land Use					
	Traditional collection of plants for food and medicinal purposes	Loss of available timber and non-timber resources	The spatial boundary is limited to the mine site study area as well as areas of the power line corridor that require clearing.	The mine site will be unavailable for traditional land use activities during the life or the mine.	The use of the Project area for the collection of berries has been raised by First Nations	The contribution of the Project on residual effects on traditional land use in combination with existing and land uses is assessed as *Not Significant (Negligible)* because of the close proximity of similar traditional land use areas.
	Forest Management					
	Logging	Loss of available timber and non-timber resources and increased traffic	Expected to occur sporadicall y within study area. Annual allowable cuts are set for the timber supply areas by Ministry of Forestry.	Expected to occur periodically during Project life.	The landscape is altered from baseline conditions which affect areas used for other non-traditional land use activities.	The contribution of the Project to the loss of available timber resources and the alteration of the landscape s when compared to routine forest management practices is considered *Not Significant (Negligible)* because of the known success of standard best management practices and the relatively small study area of the facility.
	Recreation / Tourism					
	Tourism/ recreational traffic and recreational land use	Increased traffic and a decrease in visual aesthetics	Mine site and access road to Fort St. James (and the load out facility).	For traffic the mine contribution will be the mine life (including closure).	Recreation and tourism are important land uses in the area.	The contribution of the Project to traffic along the access road is rated as *Not Significant (Negligible)* and should not conflict with tourism/ recreational use with the implementation of mitigation measures.

	Human Activity	Residual Effect	Extent	Duration	Rationale	Mount Milligan Contribution/ overlap
Reasonably Foreseeable Projects	**Mackenzie Green Energy Centre**					
	Traffic and logging	Increased logging traffic and increased logging in area	Spatial extent of logging activity associated with Mackenzie Green Energy Centre is unknown.	The temporal overlap with the Project is unknown at this time.	Traffic from the (upgraded road) and logging to provide fuel for the facility are the primary effects.	Mackenzie Green Energy Centre does not physically overlap with the Project. Traffic and logging to provide fuel for the facility are the only residual effects that overlap with the Project.
	Proposed Upgraded Road between Fort St. James and Mackenzie					
	Road upgrade	Increased traffic along access road	Mine site and access road to Fort St. James (and the load out facility).	The temporal overlap with the Project is unknown at this time.	Mine-related traffic will be added to other current and future traffic on access road.	From a non-traditional land use perspective, the contribution of the Project on traffic along the access road (if upgraded) would be *Not Significant (Negligible)* as the increase in traffic is rated as *Not Significant (Minor)*.
	Logging/Management of Pine Beetle Damaged Forests					
	Logging of dead/ damaged trees because of Pine Beetle	Increased traffic and loss of available timber and non-timber resources	The spatial extent is essentially coincident with the area affected by Mountain Pine Beetle	Salvage logging should be completed within about 10 years and harvested areas revegetated	It is estimated that a significant portion of the forests in CEA study area will be damaged or dead over the next 10 years.	The contribution of the Project on residual effects associated with logging and/or management of Pine Beetle damaged forests is considered *Not Significant (Negligible)* because of the large area affected

5.5.6.7 Current Use of Lands and Resources for Traditional Purposes

The Proponent assessed how the Project may cause changes to the current use of lands and resources for traditional purposes by Aboriginal persons. The Proponent concluded that residual effects associated with the Project were *Not Significant (Minor).*

The Project is located within:

- The treaty boundary as derived from the McLeod Lake Indian Band Adhesion and Settlement Agreement (Adhesion Agreement) (Crown Publication Inc., 1999).
- The area that is the subject of a lawsuit between the Province and a number of Treaty 8 First Nations as to whether or not it is a part of Treaty 8.
- The claimed traditional territory of the Nak'azdli First Nation.

As such, potential linkages between the Project and traditional land use are related to the traditional use of land by the McLeod Lake Indian Band, Nak'azdli First Nation, West Moberly First Nations and Halfway River First Nation. Any other activity or project on land that is used for traditional

activities by the McLeod Lake Indian Band, Nak'azdli First Nation, West Moberly First Nations or Halfway River First Nation also has the potential to interact with the Project.

Residual environmental effects associated with terrain, soils and geology, vegetation and plant communities and water resources include the loss of available traditional land use areas and potential chemical and physical changes in soil quality and water quality. The residual effects to terrain, soils and geology are largely unavoidable in the development of the mineral resource. However, the Proponent has that any effects due to potential chemical and physical changes in soil quality and water quality will be considered in the Environmental Compliance Monitoring and Follow-Up Programs.

Potential residual effects on plants used traditionally by First Nations were assessed as *Not Significant (Minor)* in the effects assessment in Section 5.7, Vegetation and Plant Communities. The Proponent has determined that development of the Project will cause alterations to the occurrence patterns of plants traditionally used by First Nations primarily during construction. Mitigation measures identified in Volume 3, Project Description and the Environmental Management Systems (Volume 6), are expected to minimize the extent of these alterations. Reduction of environmental effects are likely to be addressed primarily as part of reclamation, and specifically by the commitment to re-plant with native vegetation species with a specific emphasis on plants traditionally used by First Nations.

The RAs have considered the potential current land uses and the applicable surrounding land uses as described in Table 5.5-2 and residual effects associated with changes to current use of lands and resources for traditional purposes. There is the potential that non-traditional land use residual effects, specifically forest management may cause changes in traditional land use associated with the Project. The Proponent has informed the RAs that the impacts of logging due to the Pine Beetle infestation are likely to interact with those effects due to the Project. The RAs acknowledge that there is likely to be a negligible increase in environmental effects due to the Project relative to the effects associated with logging management activities. The RAs have also considered that it is likely that the logging management activity would be conducted regardless of the Project proceeding.

In their determination and assessment of cumulative effects, the RAs have relied on the guidance document provided by the CEA Agency. The RAs conclude that significant adverse cumulative effects related to the Project and associated with changes to current use of lands and resources for traditional purposes are not likely to occur.

5.6 Mine Closure

The Proponent discusses Decommissioning and Closure Activities Section 3.9 of the EIS.

Mine Pits

At the end of operations, the MBX/66 open pit will be about 1800 m long and 1200 m wide and about 375 m deep from the top of the high wall to its deepest cut elevation. The Southern Star pit will be about 1400 m long and 200 m wide and about 300 m deep from the top of the high wall to its deepest cut elevation. The crest elevation (i.e., top of high wall) of the MBX/66 will be connected to the MBX pit via a sill.

At closure, about 330 million tonnes of tailings will reside in the TIA of which 295 million tonnes will be low sulphur containing scavenger tailings and 35 million tonnes will be higher sulphur containing cleaner tailings. Cleaner tailings will be placed into the open pit during the last eight months of operation and a layer of non-acid generating scavenger tailings placed over the entire the cleaner tailings and PAG and oxide/weathered waste rock. This will create a saturated low sulphur

non-acid generating tailings cover of about 2 m deep. At closure, the tailings pond supernatant will be drained to the open pit via an overflow channel.

A wetland will be established above the cleaner tailings cell and, where accessible, will be planted with native wetland plants. A bog wetland will be established over much of central/western portion. These wetlands will create reducing conditions in the bottom sediments over the cleaner tailings and PAG waste rock thereby preventing oxygen transfer to the potentially acid generating materials. The saturated scavenger tailings, wetlands and water cover will prevent acid production and minimize metal leaching. The wetlands will also polish surface runoff over the scavenger tailings surface, and after the pit lake fills, will polish the pit lake overflow. About 23 ha of submergent wetland, 40 ha of emergent wetland and 299 ha of bog wetland will be created to form a wetland complex of approximately 362 ha.

Overall mine site

Topsoil and overburden will be stockpiled for the duration of the Project and used as reclamation material upon closure. Mulched surface organics are expected to add organic matter to the salvaged topsoil/ subsoil mixture to improve its reclamation quality, and the addition of fertilizers to reclaimed sites may be employed to improve the nutrient content of the soil to support revegetation. The entire mine site will be re-contoured, an approximate a depth of 0.3 m of topsoil (generally a greater depth than pre-Project conditions) will be placed and re-planting will be undertaken.

The final design of the landscape will generally include:

- 167 ha lake with a maximum depth of 292 m and volume of 170 M m3 within the mined out pits
- 40 ha of exposed rock faces and 20 ha of revegetated flat berms on the high wall on the west side of the former MBX and Southern Star pits
- 362 ha of wetlands, bog and pool on the west end of the reclaimed tailings area
- 310 ha relatively flat plateau on the reclaimed scavenger tailings
- 157 ha of upland hills, rock slopes and benches on reclaimed tailings dams and West Separator Berm
- 44 ha restored Meadows Creek catchment in the reclaimed MCWSP including a constructed wetland/fen and riparian zone

Revegetation of the mine area will consist of native vegetation species. The Proponent has committed to establishing a native vegetation nursery on site in Year 10 of operations that will include vegetation species of importance to First Nations for use in reclamation. The overall goal of the reclamation plan is to restore areas to as close to their pre-development wildlife capability as possible and to optimize biological productivity and biodiversity in new landforms created by the Mount Milligan Gold-Copper mine project through the re-establishment of the landscape features that target key habitat suitability for target VECs such as northern goshawk, fisher, moose, grizzly bear, songbirds, raptors, western toad, waterfowl and insects.

Road and transmission corridors and the processing plant (mill) site, laydown site and construction sites will be restored to pre-disturbance conditions, as feasible, using combinations of natural succession, site preparation and planting of native vegetation species. Restoration of road corridors will also consider recreational public access post-closure. Power transmission line poles adjacent tot creeks, lakes and wetlands may be retained and augmented with platforms or cross-beams to provide potential habitat for raptors. In the open restoration areas of the processing plant site, laydown site and construction sites, special habitat characteristics may be incorporated in to restoration, including

placement of coarse woody debris and retention of transmission power poles to provide raptor nest sites.

Meadows Creek Water Supply Pond

The Meadows Creek Water Supply Pond will be decommissioned upon closure (i.e., drained). Meadows Creek will be re-established and the water supply pond basin will be re-contoured and re-vegetated.

6.0 STAKEHOLDER, PUBLIC AND ABORIGIONAL ENGAGEMENT

6.1 Proponent's Stakeholder and Public Participation Program

The Proponent's public engagement program provided numerous opportunities for public involvement in the review of the Project and the environmental assessment. These opportunities included several open house forums and comment periods that were designed to educate the general public on the Project, exchange information with Project representatives, express any environmental or social concerns and provide input into the EA process. A summary of detailed information on the Proponent's public engagement process can be found in Section 1.9 and Appendices A-I in Volume 1 of the EIS (Terrane Metals Corporation, 2008a).

The Proponent held two rounds of public open houses. In the first round, five open house forums were held in March 2007 at various locations in local communities including McLeod Lake, Fort St. James, Mackenzie, and Prince George. A second round of public open houses was held in July 2007. Notices of the open houses were communicated through advertisements in local papers, flyer postings, as well as in a news release given to local media. Key issues raised during these open houses included:

- fish habitat and reclamation;
- loss of livelihood (hunting) for children;
- tailings pond seepage and timing for seepage;
- local hiring;
- acid rock generation and adequate funds for remediation;
- water quality, quantity and sources of water;
- training and employment opportunities;
- length of commute for workers during operations;
- volume of traffic and safety of highways and roads;
- opportunities for Mackenzie as a result of the Project;
- access to Heidi Lake;
- effects on the land, plants, water, fish, and animals;
- desire to have the Project and business opportunities; and
- contaminants related to the food chain.

The Proponent also maintained a Project website that was updated regularly with information about the proposed Project. A three-dimensional computer simulated video of the proposed

Project that illustrates what the mine site will look like throughout the life of the proposed Project was shown at the second round of open houses and made available on the website.

The Proponent also consulted with, and gave presentations to, local government officials, regional community representatives and economic development organizations on a number of occasions. A Community Sustainability Committee was established by the Proponent in May 2008 with representatives invited from First Nations and local governments as well as local colleges in Fort St. James and Mackenzie.

6.2 Provincial Stakeholder and Public Participation Program

The BC EAO conducted a process of stakeholder engagement and public participation pursuant to the requirements of the BC *Environmental Assessment Act,* including the Section 11 Order that was issued in respect of the Project. During the pre-application phase, the BC EAO held a 30-day public comment period between January 12, 2008 and February 11, 2008 on the Project draft terms of reference. Given previous open houses and consultations held by Proponent, no additional open houses were held for the Terms of Reference review; however, copies of the draft terms of reference were placed in local libraries. The Terms of Reference were also posted to the BC EAO website. Only three written public comments were received and they expressed general support for the proposed Project.

The BC EAO made the Proponent's EIS available on its website on September 4, 2008 and a 45-day public comment period on the EIS was held between October 2 and November 16, 2008. Public open houses were held in Fort St. James, Prince George, Mackenzie and McLeod Lake between November 3 and 6, 2008. Approximately 70 to 100 people attended each of the first three open houses and approximately 30 people attended the McLeod Lake meeting. Sixty-three written comments were received with the majority expressing general support for the Project; a summary of public comments and Proponent responses was posted to the BC EAO Project website.

6.3 Federal Stakeholder and Public Participation

In accordance with Sections 21(1), 21.2, and 22 of the *CEAA (1992, ch37.)*, public consultation for comprehensive studies is required. The RAs ensured that public concerns with respect to the proposed scope of the EA and other issues were considered. Comments received on the proposed Project Scope were incorporated into a report and recommendation to the Minister of the Environment regarding scoping and whether the Project should continue to be assessed by means of a comprehensive study. Between October and December 2008, the GOC invited comment and input from the general public on the proposed Comprehensive Study Scoping Document. The notice was posted on the CEAR Internet Site as well as in local newspapers. Comments were collected, summarized and then incorporated into the final version of the document.

Public consultation on the EIS was also carried out and comments received during this consultation process are summarized in Appendix A. On May 27, 2009, the federal government posted a notice for public consultation on the EIS for the Project. The notice was posted on the CEAR Internet Site and the comment period was held between the dates of May 27, 2009 and June 23, 2009. Similar notices were also posted in local newspapers and libraries. During this time, 107 letters were received by DFO and the CEA Agency, through mail, email, and facsimile. The letters received came from individuals representing community governments, local businesses and residents of British Columbia. Of the 107 letters received, 105 were in support of the mine. Support was expressed for anticipated positive economic benefits, as well as for the thorough nature of the EA process. Many of the communications were form letters, containing consistent statements such as:

- '…this project will be able to diversify northern and regional economies'
- 'The new mine site footprint has been reduced by 29% from the initial 1993 permit application.'
- 'Terrane has utilized science and technology to put fourth a truly sustainable and environmentally sound mine project…'
- 'Terrane … proposes a state of the art facility which employs the latest technologies to protect the environment.'

- 'Responsible economic development of this kind is critical to our community and out region.'
- 'The additional employment opportunities for aboriginal and non aboriginal residents will provide a sustainable platform for the economic base for Ft St James'

Two respondents voiced concern over the EA process undertaken to date. Mining Watch Canada expressed concern over not being directly notified about the EIS comment period when it was posted on the CEAR and advertised in local news papers. Mining Watch furthered voiced concerns with the EIS's assessment of alternatives, effects on sensitive species, and the CEA, which it felt were inadequate. Concerns regarding the Project were also received from the Nak'azdli First Nation. These comments are noted in Section 6.4 of this report.

6.4 Aboriginal Engagement

The proposed Mount Milligan Gold-Copper Mine is situated within the claimed traditional territory of the McLeod Lake Indian Band as an adherent to Treaty No. 8 and within the asserted traditional territory of the Nak'azdli First Nation. It is also in the area that is the subject of litigation among certain First Nations that are signatories to Treaty 8, Canada and the Province (in which litigation the parties take differing positions as to the western boundary of Treaty 8).

Aboriginal Consultation in the Harmonized Provincial/Federal EA

The McLeod Lake Indian Band, West Moberly First Nations, Halfway River First Nation and Nak'azdli First Nation were invited to participate in the harmonized EA review process as members of the BC EA Technical Working Group (TWG). The McLeod Lake Indian Band, West Moberly First Nations, and Halfway River First Nation participated to varying degrees. The Nak'azdli First Nations declined the BC EAO invitation.

All four First Nations were informed of the harmonized EA review progress and were provided with all information that was sent to the TWG. The BC EAO offered to consult with all four First Nations in a manner the BC EAO considered was consistent with "deep consultation", in relation to the Haida spectrum of consultation, by actively seeking meetings and offering approaches to address any procedural or technical issues raised by First Nations. The BC EAO also shared information and views/positions on matters relating to Treaty rights, asserted Aboriginal rights and the potential for impacts on those rights from the proposed Project.

At a public open house for the Mount Milligan Gold-Copper Mine EIS review, representatives of the Tsay Keh Dene Band questioned why they were not being consulted by the BC EAO and the federal government in relation to the proposed Project. At a subsequent information meeting, further concerns were expressed by the Tsay Keh Dene Band about the potential for impacts to downstream water quality in the Nation River and wildlife habitat. The BC EAO and GOC confirmed that these types of potential impacts were being addressed in considerable detail by the TWG. The southern boundary of Tsay Keh Dene Band asserted traditional territory is greater than 50 km downstream from the proposed Mount Milligan Gold-Copper Mine and thus it was determined that the potential for impacts on Tsay Keh Dene Band asserted rights is extremely low. The BC EAO confirmed its view that consultation with the Tsay Keh Dene Band was not necessary and that the concerns raised by Tsay Keh Dene Band were being raised by others; hence, their concerns were already being satisfactorily addressed by the TWG.

A detailed record of Aboriginal consultation during the harmonized EA process is found in part C of the BC EAO Assessment Report (BC EAO, 2009). Specifically, the BC EAO Assessment Report provides a review and assessment of the following:

- The First Nations setting;
- Key Project-related issues and concerns identified by First Nations that are parties or adherents to Treaty No. 8 (Treaty 8);
- Key project-related issues and concerns identified by First Nations that have asserted Aboriginal rights that may be affected by the;
- The specific identification of asserted Aboriginal rights, or Treaty rights, that may be impacted by the proposed Project, BC EAO's conclusions as to the degree to which the proposed Project might impact those rights, and BC EAO's assessment as to where on the Haida spectrum the proper consultative procedure should be located;
- The process of consultation engaged in by the Proponent under the direction of BC EAO, and by BC EAO on behalf of the Province, both preceding and during the EA review of the Project, as well as the accommodation measures that have been utilized or that are contemplated; and,
- Having regard to the overall consultation and accommodation process, BC EAO's conclusion as to the reasonableness of the process in the circumstances and BC EAO's conclusion as to whether the Crown duties have been discharged.

In addition, the Proponent engaged Aboriginal groups during the development of its application and has summarized its undertakings in its Mount Milligan First Nations Consultation Report (Terrane Metals Corporation, 2009b).

Aboriginal Engagement During the Federal Comprehensive Study Review

Subsequent to the Province issuing an EA Certificate (#M09-01) on March 18, 2009 the GOC has continued to engage with Aboriginal groups. In addition to the four First Nations noted in Section 5.3.1, the GOC corresponded with the Tsay Keh Dene Band, Takla Lake First Nation, and Métis BC Nation on matters related to the federal EA review process, including the track decision and public comment period and participant funding.

The Nak'azdli First Nation has provided the GOC with the following submissions with regards to its interests in the Project:

- Nak'azdli First Nation Aboriginal Interest and Use Study (AIUS) on the Proposed Mount Milligan Gold and Copper Mine at Shus Nadloh (Volume II, June 2008);
- Review of the Mount Milligan Project Supplemental Information (July 7, 2009, Centre for Science in Public Participation);
- Updated Response to Terrane Metal Corporation's Mount Milligan Mine Environmental Assessment Report (Sections 2.5.2 and 5.10 (Socio-Economic Impacts) (July 3, 2009, GMG Consulting Services);
- Review of the Fisheries and Aquatic Resources of Terrane Metals Environmental Assessment documents (received July 12, 2009, Ecologistics Resource Management Inc.); and,
- Letter from Nak'azdli Band Council dated July 7, 2009 (*Chief Fred Sam to DFO*) re: Shus Nadloh (Mount Milligan Gold-Copper Mine CEA Registry No. 08-03-39778).

The RAs have considered the information provided by the First Nations in making a determination of significance of effects in relation to areas of federal interest within the federal scope of Project. Discussions between the RAs and First Nations will continue during the subsequent regulatory phases of the Project (i.e., MMER), as well as for authorizations, permitting and licensing.

7.0 ENVIRONMENTAL MONITORING AND ENVIRONMENTAL ASSESSMENT FOLLOW-UP PROGRAMS

7.1 Background

The CEA Agency's *Operational Policy Statement Follow-Up Programs* differentiates between environmental compliance monitoring and an EA Follow-Up Program under the *CEAA* as follows:

- Environmental compliance monitoring verifies whether required mitigation measures were implemented; and,
- A Follow-Up Program determines the accuracy of the conclusions of the environmental assessment and the effectiveness of the mitigation measures.

During the BC EA review of the proposed Mount Milligan Gold-Copper Mine, the Proponent committed to undertaking environmental compliance monitoring and Follow-Up Programs as described in Section 6.4 of the EIS (Terrane Metals Corporation, 2008a).

Under the federal EA process, and under paragraph 16(2)(c) of the *CEAA*, the RAs must consider the need for, and the requirements of, a Follow-Up Program in respect of the Project. The RAs have determined that the scale and long life cycle of the proposed Mount Milligan Gold-Copper Mine necessitates the establishment of a Follow-Up Program pursuant to the *CEAA*.

The purpose of this Follow-Up Program is to:

- Verify the accuracy of the EA predictions; and,
- Determine the effectiveness of any measures taken to mitigate the adverse environmental effects of the Project.

Where appropriate, the results of the Follow-Up Program may also support:

- The implementation of adaptive management measures used to address previously unanticipated adverse environmental effects; and,
- Environmental management systems used to manage the environmental effects of projects.

The specific EA predictions, and the mitigation measures that will be taken to eliminate, reduce or control of the adverse environmental effects of the Project, are described in Section 5 of this CSR.

The Follow-Up Program components described below for the construction, operations and closure phases are outlined at a high level of detail. The design of specific Follow-Up Program elements (location, frequency and reporting) may need to be modified based on future permits, licences, authorizations and/or approvals, and are subject to adaptation based on changes in environmental conditions and observations of the Project's effect(s) on the environment.

7.2 Roles and Responsibilities

The RAs roles in the Follow-Up Program, as articulated in the *CEAA Operational Policy Statement,* include the following elements:

1. **Design of, or delegation of the design of, the Follow-Up Program.**
   The RAs will largely rely on the Province's lead to determine the final design for all elements of the Follow-Up and Monitoring Program(s). Exceptions to this delegation are the Follow-Up Program elements related to areas addressed under federal regulatory instruments.
2. **Setting conditions in authorizations, permits, contracts, leases or other binding documents (regulatory instruments) where appropriate related follow-up measures, environmental thresholds, or reporting and compliance monitoring schedules.**
   For components of the Project subject to authorization under the *Fisheries Act*, related follow-up elements will be specified, where appropriate, as terms and conditions. There are no components of the Follow-Up Program related to the proposed explosives factory and magazine facilities, and therefore an *Explosives Act* licence would not contain terms and conditions related to follow-up.
3. **Ensuring the implementation of the Follow-Up Program.**
   The RAs are satisfied that the commitments related to follow-up monitoring subject to the BC EAO EA Certificate, monitoring for the *MMER*, and the *Fisheries Act* authorizations, will be sufficient to ensure the implementation of the EA Follow-Up Program under *CEAA*.
4. **Monitoring of the status of the Project and the design and implementation of the associated Follow-Up Program.**
   During the implementation of the Follow-Up Program, the Proponent will annually submit Project activity reports including the results of the Follow-Up Program. The RAs, with assistance from other federal authorities and in consultation with provincial agencies, will review the Project activity reports to confirm the status of the Project and verify implementation of the Follow-Up Program.
5. **Fulfillment of Follow-Up Program related Registry requirements.**
   RAs will post Follow-Up Program notices and results on the Agency's internet site.

The Proponent's roles and responsibilities include implementing the Follow-Up Program described in this section, including conducting the required monitoring and analyzing the results, and, undertaking any adaptive management measures, where required, based on the results of monitoring. Further details regarding the Proponent's reporting responsibilities are described in section 7.4, below.

7.3 Follow-Up Program Outline

7.3.1 Construction Phase

The elements of the construction phase Follow-Up Program, expected to occur from 2009 to 2011, are summarized in Table 7.3-1. The frequency and specific locations at which the Follow-Up Program will be implemented will be determined at a later date in consultation with applicable federal and provincial departments and agencies.

Table 7.3-1 Proposed Construction Phase Follow-Up Program

Topic	Purpose	Monitoring/Sampling Locations
Fish	Construction monitoring will be a requirement of any Authorization issued under subsection 35(2) of the *Fisheries Act.*	
Wildlife	Monitoring to confirm presence/ absence of species in comparison to baseline conditions. Wildlife movement corridors have not been observed within the LSA. Monitoring the Project Boundary should confirm the presence or absence of any wildlife corridors in the LSA.	Local Study Area (LSA)
Site water quality	Surface water sampling and analysis to confirm predictions of surface (source) water quality. More specifically, to confirm predictions that there will be no export of metals, TSS and other parameters (as listed in s. 6.4 of the EIS) to surface waters from the site.	Pit water
		Tailing Impoundment Area (TIA) seepage ponds (TIA shell runoff)
		TIA basin water
		Sewage Treatment Plant (STP) effluent
Meadows Creek Water Supply Pond (MCWSP)	Sampling and analysis to confirm no release of contaminated water from the MCWSP, in particular, to confirm predictions that there will be no exceedances of British Columbia Approved Water Quality Guidelines (BC Ministry of Environment) or the Environmental Quality Guidelines (Canadian Council of Ministers of the Environment) for TSS or turbidity in Rainbow Creek.	Inflow to MCWSP
		As there should be no outflow from MCWSP, the emergency spillway will be monitored for any evidence of release.
Hydrogeology	Monitoring of groundwater wells to confirm the seepage quantity as well as sampling and analysis of groundwater quality as a result of any seepage.	Groundwater wells located predominantly down gradient of the TIA.
Hydrology	Flow measurements to confirm the predictions made in the EA regarding flow volumes in Meadows Creek, Rainbow Creek and Alpine Creek and related predictions of effects to fish, fish habitat and aquatic resources.	Hydrology stations on Rainbow Creek (three sites), Alpine Creek (one site) and Meadows Creek (one site)
Receiving Water Quality	Sampling and analysis to verify predictions that British Columbia Approved Water Quality Guidelines (BC Ministry of Environment) or the Environmental Quality Guidelines (Canadian Council of Ministers of the Environment) or site-specific water quality objectives will be met for downstream water quality.	Rainbow Creek (thee sites), Alpine Creek (one site) and Meadows Creek (two sites).
Climate and Air Quality	To verify predictions that any air quality changes resulting from site emissions will meet the applicable provincial standards for ambient air quality related to total particulate matter (dust) (e.g., standards under the *Environmental Management Act*)	Downslope of the TSF.

7.3.2 Operations Phase

The elements of the operations phase Follow-Up Program are summarized in Table 7-2. The expected duration of the operation phase is fifteen (15) years, commencing in 2012. The frequency and specific locations at which the program will be implemented will be determined at a later date in consultation with applicable federal and provincial departments and agencies.

Table 7.3-2 Proposed Operations Phase Follow-Up Program

Topic	Purpose	Locations
Fisheries Values	Environmental effects monitoring as required under the *MMER* of the *Fisheries Act* to detect environmental effects and determine the magnitude and geographical extent of the effects. Data will be collected to be measure growth, reproduction, and age distribution of fish, in comparison with baseline data. Fish surveys will determine whether the mine is affecting fish through statistical analysis between fish population measurements taken in an exposure area and a reference area. Fish tissue samples will be collected from a minimum of eight individuals of the same species.	Rainbow Creek, Meadows Creek and other suitable sites as necessary to ensure that an adequate sample size is obtained.
	Sampling of fish to determine if Rainbow trout in Alpine Lake are residents, seasonally present, or present on an opportunistic basis only and/or are subject to winter kill.	Alpine Lake
	Sampling and analysis of fish tissue for mercury and arsenic concentrations to assess if they increase beyond two standard deviations of the background mean tissue levels during operations or post-closure.	Rainbow trout in the Rainbow Creek watershed.
	Sampling and analysis of selenium in whole body tissues concentrations to assess if they increase beyond two standard deviations of the background mean tissue levels during operations or post-closure.	Rainbow trout and slimy sculpin in the Rainbow Creek watershed.
Wildlife Monitoring	Any occurrence of SAR will be recorded together with the location and the date of the observation. Observations will be reported to the mine Environmental Superintendent who will make a decision as to the appropriate follow-up actions, if any, in consultation with the mine manager.	Project Boundary (footprint).
Site Surface Water Quality Monitoring	Although no surface water discharges from the mine site are predicted during operations, sampling and analysis will confirm predictions of on-site water quality for use in groundwater assessments and closure planning.	Pit water, TIA supernatant, sewage treatment plant effluent, Meadows Creek seepage collection system sump and Esker Lakes.

Topic	Purpose	Locations
Groundwater Quality and Quantity Monitoring	Monitoring of groundwater levels and flow, and sampling and analysis for groundwater quality, to detect changes in shallow groundwater on the site due to mine operations, particularly of TIA basin seepage quantity and quality.	There is a current network of potential long term monitoring wells located around the TIA. Additional monitoring wells are planned for the mine site, to be available for groundwater monitoring during mine development and operations.
		Seep surveys will be conducted along the Meadows Creek escarpment, with the location and flow of seeps will to be determined.
	Seepage Collection Site/ Recycle Pond sites: • North dam near the north sediment pond • Northeast dam near Esker Lakes • Northeast dam near the junction of the northeast and southeast dams • South dam near the western end of the water supply pond	
Stream and Lake Water Quality Sampling	Sampling and analysis of surfaces waters assess if the mine has any effect on the regional water quality. These data will support the prediction that there will be no surface discharges from the mine during operations, that any changes in downstream water quality would be slow. Monitoring results would be compared to water quality guidelines or objectives (as determined in consultation with MOE).	Rainbow Creek at three sites, Alpine Creek at one site, Meadows Creek upstream of the water supply pond, the water supply pond overflow at the mouth of Meadows Creek, and upstream and downstream in the Nation River at two sites. If fish are determined to use Alpine Lake on a resident or seasonal basis, water quality will be monitored in Alpine Lake.
	Sampling and analysis of sediments to determine whether metals are accumulating in the lake from mine influence.	Alpine Lake. Should metals accumulation be detected, sediment sampling will be increased to include Alpine Creek at the Alpine Lake outlet and at its confluence with Rainbow Creek.
Surface Water Hydrology	Monitoring to confirm the predictions made in the effects assessment regarding rates of flow (flow volumes) of surface waters.	Rainbow Creek, Alpine Creek and Meadows Creek.

7.3.3 Closure and Post-Closure Phase

The elements of the post-closure phase Follow-Up Program are described in Table 7.3-3. The duration of post-closure monitoring will be determined by federal and provincial authorities based on the results of operational follow-up monitoring and performance. Generally, this phase commences at the cessation of mining activity, and concludes when it is verified that on-site water quality has stabilized and monitoring indicates that there are no material future adverse effects on local receiving waters. The frequency and specific locations at which the program will be implemented will be determined at a later date, in consultation with applicable federal and provincial departments and agencies.

Table 7-3 Proposed Post-closure Phase Follow-Up Program

Topic	Purpose	Locations
Program elements led by Provincial Ministries		
Fish	Monitoring fish tissue levels to confirm EA predictions regarding protection of aquatic species.	Rainbow Creek (three sites) and Meadows Creek (one site).
Benthos and Periphyton	Monitoring to detect changes in the presence and abundance of benthos and periphyton species, which will be utilized as indicators of stream health.	Rainbow Creek (thee sites), Alpine Creek (one site) and Meadows Creek (two sites).
Wildlife	Monitoring to confirm EA predictions regarding the presence and abundance of wildlife species.	Transects on reclaimed TIA and WSB.
Vegetation	Monitoring to confirm EA predictions regarding the presence and abundance of vegetation species, and their metal content.	10 test plots on TIA surface
		3 test plots on WSB
		5 test plots on pit high wall
Site Water Quality	Sampling and analysis to confirm predictions of surface (source) water quality, specifically to confirm predictions of receiving water quality post-closure for TIA and pit lake.	Pit lake (3 depths)
		Tailings pond seepage
		Tailings pond shell runoff
		WSB seepage and runoff
Hydrogeology	Monitoring of groundwater wells to confirm the seepage quantity, as well as sampling and analysis of groundwater quality, as a result of any seepage.	Groundwater wells
		TIA seepage ponds
		Seep surveys (Meadows Creek)
		Esker Lakes
Hydrology	Flow measurements to confirm the predictions made in the EA regarding flow volumes in Meadows Creek, Rainbow Creek and Alpine Creek.	Hydrology stations on Rainbow Creek (three sites), Alpine Creek (one site) and Meadows Creek (one site).
Receiving Water Quality	Sampling and analysis to verify predictions that British Columbia Approved Water Quality Guidelines (BC Ministry of Environment) or the Environmental Quality Guidelines (Canadian Council of Ministers of the Environment) or site-specific water quality objectives will be met for downstream water quality.	Rainbow Creek (thee sites), Alpine Creek (one site) and Meadows Creek (two sites).

7.4 Reporting of the Follow-Up Program.

The Follow-Up Program will be conducted by the Proponent in consultation with federal and provincial agencies, First Nations and stakeholders.

Reporting will be undertaken in the form and at the frequency required under the federal *MMER* and the BCl *Mines Act* and *Environmental Management Act* permits. Annual summary reports will be prepared by the Proponent and will provide details on any trends that can be identified through the monitoring and follow-up programs, specifically, any trends in the predicted effects of the Project as assessed in the EA. In addition, the summary reports will provide a determination of how and what mitigation measures were implemented, the effectiveness (success) of the mitigation measures or other measures designed to reduce adverse effects of the Project on the environment. The reports will also identify any adaptive management opportunities that have been, or are to be, adopted.

The Proponent will provide relevant reports to respective federal and provincial agencies, First Nations, stakeholders and the public. All reports will be provided to, and discussed at, the Community Sustainability Committee. The Proponent will post annual summary reports on their website for public access.

As indicated in Section 7.2 above, RAs will post Follow-Up Program notices and results on the CEA Agency's internet site.

8.0 CONCLUSIONS

The federal EA review of the proposed Mount Milligan Gold-Copper Mine project was completed on the basis of the information provided by the Proponent in their EIS and subsequent supplemental information (as referenced), information provided during the BC EAO lead harmonized EA review, the advice of provincial regulatory agencies and provincial experts, expert advice provided by FAs, and comments provided by First Nations, stakeholders and the public.

Since the approved 1993 BC Mine Development Certificate and during the Proponent's consultation regarding the subject application, provincial and federal regulatory agency, First Nations, stakeholder, and public input has been incorporated by the Proponent into their mine plan. As a result, the current proposed Mount Milligan Gold-Copper Mine footprint has been significantly reduced. The current mine plan will encompasses an approximate area of 1,821 hectares spread over 5 kilometres whereas the 1993 mine plan covered an approximate area of 2,559 hectares spread over 10 kilometres. The plan also uses Meadows Creek to establish the water supply pond needed for mine process water (as well as water recycling), which avoids otherwise significant impacts to Rainbow Creek and its fisheries and aquatic resources. The Proponent has designed the mine for closure using a life-of-asset approach to examine all phases of the mine life and has committed to establishing and Environmental Management System (EMS) consistent with ISO 14001 environmental standards.

In reaching a conclusion on the significance of adverse environmental effects associated with the construction, operation and closure of the proposed Mount Milligan Gold-Copper Mine, the RAs have considered:

- The EIS, which includes a description of potential Project effects on biological, physical and human components, and the Proponent's evaluation of the significance of residual effects;
- Comments on the proposed Project made by federal and provincial government agencies, local governments, First Nations, stakeholders and the public, as well as the Proponent's responses to these comments;
- The proposed Fish Habitat Mitigation and Compensation Plan (FHMCP) proposed by the Proponent that will be required for a subsection 35(2) Authorization under the *Fisheries Act* (if determined appropriate by DFO following the EA);
- Mitigation measures that the RAs are satisfied will be implemented by the Proponent as described throughout this document and in Appendix C (Amalgamated Table of Proponents Commitments, Mitigation and Best Management Practices); and
- Commitments made by the Proponent to carry out environmental monitoring and Follow-Up Programs for the construction, operations, closure and post-closure of the proposed Mount Milligan Gold-Copper Mine.

Based on this information, as RAs pursuant to the *CEAA,* Fisheries and Oceans Canada (DFO) and Natural Resources Canada (NRCan) have determined that the proposed Mount Milligan Gold-Copper Mine is not likely to cause significant adverse environmental effects.

9.0 REFERENCES

1. AMEC, 2008a. Memo to DFO Re: Mount Milligan compensation options update and Rainbow Creek flow reduction.
2. AMEC, 2008b. Memo to Andrew Thrift (Terrane Metals Corporation) Re: Instream flow threshold calculations for Rainbow Creek. *Available on request from CEA Registry*
3. AMEC, 2008c. Memo to Andrew Thrift (Terrane Metals Corporation) Re: Mount Milligan compensation options update and Rainbow Creek flow reduction. *Available on request from CEA Registry*
4. AMEC, 2009a. Memo to Andrew Thrift (Terrane Metals Corporation) Re: Rational for Alpine Lake not being a HADD of fish habitat. *Available on request from CEA Registry*
5. AMEC, 2009b. Memo to Andrew Thrift (Terrane Metals Corporation) Re: Rational for stream crossings associated with the transmission line and access road not being HADDs of fish habitat for the Mount Milligan Project. *Available on request from CEA Registry*
6. AMEC, 2009c. Mount Milligan Copper-Gold Project Fish Habitat Mitigation and Compensation Plan (Version 2.0), submitted for Terrane Metals Corporation.
7. British Columbia Environmental Assessment Office, 2009. Mount Milligan Copper-Gold Project Assessment Report.
8. Canadian Council of Ministers of the Environment, 2002. Canadian Environmental Quality Guidelines.
9. Cumulative Effects Assessment Working Group (Hegmann, G., C. Cocklin, R. Creasey, S. Dupuis, A. Kennedy, L. Kingsley, W. Ross, H. Spaling and D. Stalker) and AXYS Environmental Consulting Ltd, 1999. Cumulative Effects Assessment Practitioners Guide. Prepared for the Canadian Environmental Assessment Agency. Available from: http://www.ceaa.gc.ca/default.asp?lang=En&n=43952694-1 accessed July 31, 2007.
10. Environment Canada, 2007. National Inventory Report 1990-2005: Greenhouse Gas Sources and Sinks in Canada.
11. Federal Environmental Assessment Review Office, 1994. A Reference Guide for the *Canadian Environmental Assessment Act*: Determining Whether a Project is Likely to Cause a Significant Adverse Environmental Affect.
12. Fisheries and Oceans Canada and Natural Resources Canada, 2008. Comprehensive Study Scoping Document for the Proposed Mount Milligan Gold-Copper Mine. Ref: 08-03-39778. *Available from the CEAA Registry,*
13. Knight Piésold, 2007. Mount Milligan Project: Mine Waste Alternatives Study. Report submitted to Terrane Metals Corporation. 26pp. + 3 app.
14. Liber, K., L. Weber and C. Levesque, 2005. Sublethal toxicity of two wastewater treatment polymers to lake trout fry (*Salvelinus namaycush*). Chemosphere 61(8):1123-1133
15. Ministry of Forestry, 1998. Fish-stream identification guidebook, Second Edition. Forestry Practices Code of British Columbia. http://www.for.gov.bc.ca/tasb/legsregs/fpc/FPCGUIDE/FISH/FishStream.pdf
16. Ministry of Forestry, 2002. Fish-stream crossing guidebook. Forestry Practices Code of British Columbia. http://www.for.gov.bc.ca/tasb/LEGSREGS/FPC/FPCGUIDE/FishStreamCrossing/FSCGdBk.pdf

17. Senmin (Pty) Ltd. Sasolburg Site, 2004. Material Safety Data Sheet – Potassium Amyl Xanthate (PAX) FP 220. 10pp.
18. Tennant, D.L. 1976. Instream flow regimens for fish, wildlife, recreation, and related environmental resources. Pages 359-373 *In* J.F. Osborn and C.H. Allman, eds. Proceedings of the symposium and specialty conference on instream flow needs. Volume 11. American Fisheries Society, Bethesda.
19. Terrane Metals Corporation, 2008a. Mount Milligan Copper-Gold Project Environmental Assessment (EIS). *Referred to herein as the Environmental Impact Statement (EIS).*
20. Terrane Metals Corporation, 2008b. Letter from Terrane to the BC Environmental Assessment Office Re: Amendments to EIS.
21. Terrane Metals Corporation, 2009a. Letter from Terrane to Fisheries and Oceans Canada and Natural Resources Canada. Re: Mount Milligan Project- Assessment of Underground Mining Method Alternatives. *Available on request from CEA Registry.*
22. Terrane Metals Corporation, 2009b. Mount Milligan First Nations Consultation Report.
23. Tessman, S.A. 1980. Environmental Assessment, Technical Appendix E in Environmental Use Sector Reconnaissance Elements of the western Dakotas Region of South Dakota study. Water Resources Research Institute, South Dakota State University.

Appendix A

Summary of Public Comments submitted with regards to the proposed Mount. Milligan Gold-Copper Mine Environmental Impact Statement

Summary of Public Comments submitted with regards to the proposed Mount. Milligan Gold-Copper Mine Environmental Impact Statement

Respondent Number	Public Comments on the Proposed Mount Milligan Gold-Copper Mine Environmental Impact Statement, which were submitted from May 27, 2009 to June 23, 2009 (Concern/Support)
	Concern
1	• Concerned that Mining Watch Canada was not directly notified of the comment period when it was posted on the CEA Registry • Using the Nak'azdli First Nation as an option for tailings management was dismissed without adequate explanation • Alternative tailings management options were not explored in the alternatives assessment • Environmental effects and mitigation measures were only considered for Rainbow trout when two other sensitive aquatic species (bull trout and Arctic grayling) are present within the study area. • The potential of the project to promote further development of the area through the extension of electricity supply and road improvements is not considered in the CEA. • The cumulative effects of increased access for hunting and fishing via improved roads and the electricity corridor on already diminished populations of sensitive fish and wildlife species is not adequately evaluated or mitigation measures proposed. • Cumulative effects on First Nations should be considered in light of historic developments that have created long standing struggles to preserve their cultural identity, physical territories and natural resources
	Support
2	• The adjustments made to the development plan and design details are consistent with their commitment to minimize adverse environmental impacts • Project will provide economic diversification and benefits to Northern BC
3	• Project would be a huge economic boost for Mackenzie • Proponent has assured the hotel staff that the development of the mine would be conducted in an environmentally responsible manner.
4	• Proponent has demonstrated commitment to the sustainability of our regional economy • The Proponent's submission to the *CEAA* process is thorough, comprehensive, and provides the requisite information in order to complete and assessment of the environmental effects of the project.
5	• Proponent has shown tremendous desire to provide our community with a desperately needed boost to our economy. • The EA document has been reviewed by multiple federal experts and as such the government is responsible for assuring that the proponent minimizes environmental impacts. As such the respondent feels that the mine will be environmentally sustainable once the federal experts approve the EIS

Respondent Number	Public Comments on the Proposed Mount Milligan Gold-Copper Mine Environmental Impact Statement, which were submitted from May 27, 2009 to June 23, 2009 (Concern/Support)
	Support
6	• Impressed with the Proponents inclusion of First Nations in the project planning • Impressed with Proponents efforts to reduce mine impacts • Impressed by Proponents willingness to use up-to-date technologies in Project design. • Impressed with social and economic benefits from the Project
7	• The new mine site has been reduced by 29% from the initial 1993 permit application • Proponent has used science ad technology to put fourth a sustainable and environmentally sound project • Proponent has eliminated water discharge until well into closure period • They have an integrated waste rock and tailings management system that allows closure without water treatment • The project will be able to diversify northern and regional economies.
8	• Substantial economic benefits to the region • Project footprint reduced 29% since 1993 application • Comprehensive environmental assessment, including an innovative sustainability assessment above-and-beyond regulatory requirements • No surface water discharge until well into closure period • Integrated waste rock and tailings management that allows closure without treatment
9	• The project will provide much needed economic stimulus and long term benefits for all communities in the region
10	• Mining is seen as a bright light in out future and a vital industry for our economic diversification • Likes the reduced mine footprint, protection of streams, integrated waste rock and tailings management plan
11	• Diversification to Mackenzie such as mining would greatly help the situation in Mackenzie
12	• Comprehensive environmental assessment, including an innovative sustainability assessment above-and-beyond regulatory requirements • It would be an asset to the community to have another source of industry for our town especially with the downturn in our lumber industry
13	• The Project is a low risk venture and there are enough measures in place to keep the environment safe
14	• The environmental application put fourth by the Proponent has exceeded industry standards • The project in environmentally sound and is of great economic importance

Respondent Number	Public Comments on the Proposed Mount Milligan Gold-Copper Mine Environmental Impact Statement, which were submitted from May 27, 2009 to June 23, 2009 (Concern/Support)
	Support
15-31	• The new mine site has been reduced by 29% from the initial 1993 permit application • Proponent has used science ad technology to put fourth a sustainable and environmentally sound project • Proponent has eliminated water discharge until well into closure period • They have an integrated waste rock and tailings management system that allows closure without water treatment • The project will be able to diversify northern and regional economies.
32	• The positive economic effects of the project come at a welcome time to the Bulkley-Nechako Regional District • The project has been greatly improved by the thorough work that the Proponent has done, and the rigorous review that will be conducted • The Proponent has developed effective mitigation strategies to ensure risks are minimized
33	• The much reduced footprint at 29% combined with no surface water discharge unit well into closure, extensive water recycling applications and protection of streams demonstrates a commitment to the reduced footprint.
34	• The much reduced footprint at 29% combined with no surface water discharge unit well into closure, extensive water recycling applications and protection of streams demonstrates a commitment to the reduced footprint.
35-105	• The Proponent proposes a state-of-the-art facility which employs the latest technologies to protect the environment • Responsible economic development is crucial to our community and region
106-107	• The project is environmentally sound and of great economical importance to the region

Appendix B

Environmental Management Plans and Associated Management Plans

Environmental Management Plans and Associated Management Plans

The Environmental Management Plans (EMPs) are presented in the EIS at the conceptual level because the Project has not yet been given approval, has not yet obtained the permits needed to operate, and has not yet completed detailed engineering. These processes may impose changes on the Project which might affect details about how the proposed management plans function at the operational level. The Environmental Management Plans are discussed in Volume 6 of the EIS, unless otherwise specified. The EMPs that will be implemented for all applicable phases of the Project are listed below:

- Occupational Health and Safety Management Plan
- Air Quality Management Plan
- Archaeology and Cultural Heritage Resources Management Plan
- Emergency Preparedness Plan
- Explosives Management Plan
- Fisheries Management Plan
- Hazardous Materials Management Plan
- Landscape, Soils and Vegetation Management Plan
- Noise Management Plan
- Non-Hazardous Solid Waste and Domestic Waste Water Management Plan
- Petroleum Management Plan
- Recruitment, Training and Employment Plan
- Sustainability Management Plan
- Transportation and Access Management Plan
- Water Management Plan
- Wildlife Management Plan
- Ore and Waste Rock Management Plan (Volume 3 and Section 6.3.17)
- Waste Rock Segregation and Management Plans (Volume 3 and Section 5.2
- Tailings Management Plan (Section 3.5)
- Construction Environmental Management Plan (Section 3.8)

Other Referenced Plans:

- Mine Closure Plan
- Accident and Spill Management Plan

Appendix C

Amalgamated Table of Proponents Commitments, Mitigation Measures and Best Management Practices

Amalgamated Table of Proponents Commitments, Mitigation Measures and Best Management Practice

Note: Measures below pertain to areas of federal jurisdiction and interest. These mitigation measures and Best Management Practices are excerpts from the BC EAO Table of Proponent Commitments, the BC EAO Assessment Report and the draft CSR Table of Proponents Commitments which was provided to the RAs by the Proponent.

Sustainability Area/ Component	Commitments, Mitigation Measures and Best Management Practices
Governance	
Policies	• Develop and implement corporate policies (Policies) that will be made available on the Terrane website for reference during all phases of the Mount Milligan Gold-Copper Mine project including but not limited to, Environmental Policy, Sustainability Policy and First Nations Policy • Conduct annual reviews of the Project's compliance with the policies, and Environment Management Plans. • Ensure that responsible site management, employees and contractors are familiar with, and their actions at all times comply with relevant Acts, regulations, permits, licences, authorizations and approvals.
Consultation	• Establish a consultation and review process that provides for periodic reporting and comment on sustainability indicators and an on-going stakeholder forum process for discussing current and future initiatives. The primary mechanism for stakeholder and First Nation involvement will be a Community Sustainability Committee. • Publish an annual sustainability report for First Nations and local communities on Terrane's progress in implementing environmental stewardship, economic contributions and social development. An initial report will be prepared during construction and the first full report will be prepared following the first year of operations.
Goals and Objectives	• Establish measurable sustainability goals and objectives in consultation with First Nations, local communities and regulatory agency representatives. • Include metrics (e.g., environmental monitoring) on the attainment of goals and objectives in the annual sustainability report.
Sustainability Management Plan	• Develop a Sustainability Management Plan (SMP) that includes guidelines on community participation, means to address issues, complaints, criticisms, commendations or constructive advice and ways to build and support community organizations. The SMP will address First Nation and Non-First Nation communities and will be developed in consultation with local communities.
Contractors	• Require that Terrane's contractors comply with Terrane's policies to the greatest extent possible with particular reference to policies related to environmental responsibility.

Sustainability Area/ Component	Commitments, Mitigation Measures and Best Management Practices
Environmental Stewardship	
Environmental Management	• Establish an Environmental Management System consistent with the ISO 14001 standard. The system will include Environmental Management Plans (EMPs), and where required, Standard Operating Procedures (SOPs) to implement the EMPs. • Environmental staff on site during construction will monitor for listed VECs and habitat features requiring protection. • Maintain a proactive working relationship with DFO and Ministry of Environment (MOE) - Environmental Stewardship Division in the development of Environmental Management Plans (EMPs). DFO and the MOE will be provide an opportunity to comment on all EMPs relevant to their mandates.
ARD Prevention and ML Control	• Implement the waste rock segregation and management plans described in Volume 3 and Volume 5 of the Proponents EIS. • Ensure that potentially acid generating waste rock and tailings (cleaner tailings), and oxide and weathered waste rock placed in the TIA or open pit will be stored underwater. • Test borrow material for (off-site) road construction for acid-base accounting ABA and metal content prior to use. • In the unlikely event of an early shutdown of the mine, potentially acid generating (PAG) material in the PAG separator dyke will be kept fully saturated, by pushing the PAG material into the cleaner tailings cell, or other means acceptable to the Ministry of Energy, Mines and Petroleum Resources. • Overburden near the oxide/weathered rock boundary will be visually inspected for the presence of clasts that might be mineralized. If a high density of clasts are found then the overburden will be handled as oxide/weathered rock and stored in the TIA. • Where there is a disagreement between the neutralization potential measured from i) Leco – CO2 and ii) ICP-Ca assays in verification testing of material classification in the block model, the PAG result shall be taken as correct unless a non-acid generating result is obtained using the modified Sobek method for ABA by an external lab. • Establish pit wall wash stations when the ultimate pit wall is exposed. • Develop field-scale test pads containing representative materials early during mine operations to collect further geochemical data.
Monitoring	• Monitor the performance of environmental systems according to the plans described in Section 6.4, and as modified in permits and licences, and develop triggers for implementing any required contingency plans. • Hire an Independent Environmental Monitor for the construction phase of the Project. Ensure they have the authority to stop work if unacceptable environmental effects are occurring. In areas that may be problematic, such as meandering or braided streams, ensure input by qualified engineer and fisheries biologists on design or as further specified by the Authorization under S. 35(2) of the *Fisheries Act.*

Sustainability Area/ Component	Commitments, Mitigation Measures and Best Management Practices
Closure	• Further develop in consultation with regulatory agencies, First Nations and local communities the closure plan including progressive reclamation as described in Section 3.9. At the end of mine operations, implement the approved closure plan. • Ensure the general mine camp facilities are closed and remediated after mine construction.
Water Management	• Construct and operate mine facilities such that any surface drainage from operating components flows into the TIA. • Implement best environmental management practices during construction, including erosion control. • Finalize and implement a construction water management plan that minimizes the potential for the release of contact water to the environment. If required by MOE (and in consultation with DFO), install a flocculent addition system for construction of the Meadows Creek Water Supply Pond as a contingency to remove suspended solids in the water. • Operate systems, implement staged TIA dam construction and monitor water management to ensure that there is no discharge of surface contact water from the mine site to receiving streams during operations. • Install additional groundwater wells to enhance the ability to monitor seepage and implement the monitoring program outlined in Section 6.5. • Operate seepage recovery and pump back systems to collect TIA dam shell and seepage and return it to the TIA. • Monitor any seepage through deep sand and gravel aquifers and implement contingency collection systems if required including constructing a seepage collection ditch and sump adjacent to Meadows Creek. • Install sediment holding ponds, where appropriate. • Divert non-contact clean water around the site, where possible, or divert turbid water to sediment holding ponds. • Sequence construction to prevent the discharge of contact water and erosion or sedimentation. • Ensure domestic waste is treated in an enclosed system and effluent discharged into TIA and solid waste from the RBC sewage treatment system is disposed of by a licenced contractor. • Discharge treated sewage into a till-lined holding lagoon down slope from the construction camp. • Ensure (TIA) design adheres to 2007 CDA Dam Safety Guidelines and the dam failure consequence classification. • Update the water quality models after the first year of operations and every three years thereafter, and more frequently as required based on changes in observed water quality, and collect monitoring data during operations to confirm predictions. • As a component of ongoing water quality monitoring during operations, conduct monitoring at site WQ6 (Alpine Creek) to ensure that the remaining aquatic life in Alpine Lake and Creek are protected. Assess monitoring results by comparing to water quality guidelines (WQGs) or water quality objectives (WQOs) (as determined in consultation with MOE), and/or the actual presence of aquatic life, and/or results of any other environmental effects monitoring.

Sustainability Area/ Component	Commitments, Mitigation Measures and Best Management Practices
Water Management Continued	• If fish are determined to use Alpine Lake on a resident or seasonal basis, monitor water quality in Alpine Lake to ensure that the remaining aquatic life in Alpine Lake and Creek are protected. Assess monitoring results by comparing to WQGs or WQOs (as determined in consultation with MOE), and/or the actual presence of aquatic life, and/or results of any other environmental effects monitoring.
Protection of Fisheries Values	• Implement a "no fishing" policy for all employees and contractors while on company business or commuting to and from the mine. • Implement the wildlife management plan in Volume 6 of the Proponent's EIS to minimize any direct or indirect adverse effects on wildlife. • Ensure protection of the fisheries resources in Rainbow Creek and the Nation River and of the wildlife by implementing the water and waste management plans. • Finalize and implement the proposed Fish Habitat Mitigation and Compensation Plan described in Section 6.4 and as approved by DFO in consultation with MOE and First Nations, during the first year of construction. • Construct in the dry season as best as possible. • Use coffer dams and diversion ditches for isolation of instream works. • For the Meadows Creek Water Supply Pond (MCWSP) remove organic soils and vegetation prior to inundation of water to reduce the potential for mercury methylation (methyl mercury formation) and ensure progressive breaching at closure. • At closure drain MSWSP and fish habitat components will be reconstructed and restored. • At closure, silt laden water from the MCWSP will be pumped to the TIA to avoid discharge to lower Meadows Creek • Recycle water to the maximum extent practical to minimize water withdrawal from MCWSP. • Collect runoff during construction in down slope sediment holding pond in the MCWSP and return water to the TIA. • Complete fish salvages for any to instream works prior to commencement of construction. • Conduct work within the Reduced Risk Timing Windows for the Protection of Fish and Wildlife in Region 7 – Omineca to the maximum extent possible. • Follow recommendations in the Guidelines for the Use of Explosives in or near Canadian Fisheries Waters (DFO 1998) (e.g., ensure the blasting buffer of 150m is adhered to). • Stream crossings (structure selection based on the decision matrix) to adhere to Fish-Stream Crossing Guidebook (Ministry of Forests 2002), or as authorized in consultation with DFO. • Beaver activity will be considered in the design of crossing structures. Crossings will be monitored and blockages related to beaver activity removed during operations. • Maximize use of existing ROW's or cut-lines. • Align ROW to minimize the number of crossings and cross streams perpendicular to flow, as best as possible

Sustainability Area/ Component	Commitments, Mitigation Measures and Best Management Practices
Protection of Fisheries Values Continued	• Minimize removal of riparian vegetation and minimize disturbance of riparian vegetation at power line stream crossings. • Monitor tissue mercury and arsenic concentrations on a schedule to be agreed with BC MOE. If tissue mercury and arsenic levels in Rainbow trout increase beyond two standard deviations of the background mean tissue levels during operations or post-closure, a literature review will be conducted to review the state of the science with respect to safe consumption levels. Based on findings, the need for additional site specific studies will be determined. • Monitor the selenium in whole body tissues of Rainbow trout and Slimy sculpin in the Rainbow Creek watershed on a schedule to be agreed with MOE. If tissue selenium levels in either species increase beyond two standard deviations of the background mean tissue levels during operations or post-closure, a literature review will be conducted to review the state of the science with respect to whole body tissue threshold levels that are protective of these species. Based on findings, the need for additional site specific studies, which may include reproductive and/or stock assessments, will be determined. The application of any trigger levels would consider the then current understanding of the potential effect of water and sediment concentrations and the current applicable government guidelines for the metals in media including fish tissue. • Revegetate disturbed riparian areas with native vegetation. • Avoid bank side construction by locating poles as upland as possible, and avoid construction on meander bends due to potential for erosion or future fisheries impacts. • Any crossing that cannot be constructed according to DFO's OPS will be assess individually for its potential risk to fish and fish habitat and will include any additional mitigation measures prescribed by the Independent Environmental Monitor that may be necessary to ensure that no HADD of fish habitat occurs. • Complete additional sampling to determine if Rainbow trout in Alpine Lake are residents, seasonally present, or present on an opportunistic basis only and are subject to winter kill. If fish are determined to be using Alpine Lake on a resident or seasonal basis, monitor fish in Alpine Lake as a component of environmental effects monitoring. • Minimize the number of temporary stream crossings necessary to construct and maintain the transmission line by maximizing the use of existing forestry roads and by constructing new spur roads to either side of the crossings of larger, fish-bearing streams such as the Pack and Parsnip rivers and Lignite, Robinson, and Philip creeks. • All temporary stream crossings at fish-bearing streams along the proposed transmission line will be constructed with clear-span bridges with abutments above the high water mark, as per DFO Pacific Region's "Clear Span Bridges" Operational Statement. Closed-bottom culverts will be installed on all non-fish-bearing stream crossings. • As part of re-establishment of the Meadows Creek channel, remediate Project impacts that may have occurred to fish spawning habitat downstream of the Meadows Creek Water Supply Pond to the confluence with Rainbow Creek.
Protection of Wildlife Values	• Implement a "no hunting" policy for all employees and contractors while on company business or commuting to and from the mine. • Implement the wildlife management plan in Volume 6 to minimize any direct or indirect adverse effects on wildlife.

Sustainability Area/ Component	Commitments, Mitigation Measures and Best Management Practices
Protection of Wildlife Values Continued	• Minimize areas of disturbance. • Install raptor-deterrents on power lines at major river crossings. • Schedule the clearing of vegetation outside of bird breeding windows where possible. When this is not possible, conduct pre-clearing nest and bird surveys using appropriate protocols. • Implement recommended buffers as per MOE Best Management Practices and as outlined in the Wildlife Management Plan. • Conduct pre-construction surveys for wolverine dens. • Include site specific mitigation for northern caribou in the Wildlife Management Plan. • Create temporary habitat near the affected area. • Avoid known wildlife travel corridors. • Install wildlife deterrents/exclusion fencing at the mine site. • Complete amphibian salvages at impacted areas prior to construction. • Give wildlife the right-of-way on access roads. • Ensure maximum truck speeds and other road traffic control measures/enforced speed limits as outlined in the Transportation and Access management Plan.
Vegetation and Soils	• Adhere to recommended streamside buffer widths, where appropriate. • Do not use herbicides or pesticides in any part of the mine Project. • Salvage vegetation, particularly rare plants and soils wherever possible. • Reclaim of disturbed areas as they are no longer needed for mining related activities, including revegetation with plants used traditionally by First Nations. • Add fertilizers to reclaimed sites, where appropriate. • Establish a native plant nursery in year 10 of operations to provide native plant feedstock including, in consultation with First Nations, plants of traditional value for reclamation. • Use overburden from the pits as construction material. • Topsoil salvage and incorporation of mulched surface organics with salvaged topsoil incorporation of finer textured material into stockpiled soil prior to re-distribution. • Separate salvage and stockpiling of soils rated with poor reclamation suitability (load-out facility only). • Avoidance of activity on soils during wet conditions and minimize repeated passes over soil areas. • Utilize discing or ripping soils to alleviate compaction. • Continue discussions with MOE regarding the plant community's data set, and collect further information prior to construction as necessary. • Continue discussions with MOE regarding sediment sampling during permitting and undertake additional sampling as necessary to add to the baseline database. • Minimize disturbance of riparian vegetation at power line stream crossings. • Follow DFO Pacific Region's "Maintenance of Riparian Vegetation in Existing Rights of Way" Operational Statement and principles and practices in British Columbia Hydro's Approved Works Practices for Managing Riparian Vegetation when maintaining the transmission line right-of-way.

Sustainability Area/ Component	Commitments, Mitigation Measures and Best Management Practices
Hazardous Materials	• Store hazardous materials in double-walled tanks and fully contained facilities with concrete floors and footings in the mill and maintenance buildings that are located upslope of the TIA water containment area. • Implement stringent containment and management practices at hazardous materials storage facilities. • Implement all recommended best management practices for proper material handling and storage.
Noise	• Develop a Noise Monitoring Program for the construction phase as well as within the camp dormitory to verify the effectiveness of the noise mitigation measures described in the application. • Schedule noisy construction activity during normal working hours. • Ensure regular machinery inspection and maintenance. Machinery will be inspected for quality mufflers, worn parts will be replaced and lubricants will be applied to ensure that the manufacturer's noise-output specifications are met. • Comply with established noise limits. • Implement a Noise Mitigation Strategy. • Consider noise barriers, baffles or enclosures for particularly noisy equipment such as crushers, grinders, compressors, pumps and gearboxes. • Concentrate hauling hours limited to those proposed in EA application.
Air emissions and Air Quality	• Monitor and implement dust suppression measures including watering, grading and adding coarse road bed material for mine and access roads. Water TIA tailings beaches to control dusting as needed. • Maintain bag-houses and fog sprays to control dust from the lime silo, concentrate load-out facility and crusher. • Use dust suppression measures including dust collection systems for bulk materials handling. • Utilize covers or control devices for crushing and milling to avoid the generation of dust such as enclosed low speed conveyor belts, dust containment at conveyor transfer points (curtains and rubber seals), and stockpiling concentrate within an enclosed storage building. • Implement mulching and place brush and tree materials in the topsoil stockpiles so that burning of brush or non-merchantable trees is minimized during clearing of the mine site. • Cover trucks carrying concentrate to the load-out facility near Fort St James. • Implement energy use minimization programs including purchasing energy efficient equipment and following manufacturer maintenance practices. • Use modern construction/mining equipment that meets the latest applicable Canadian emission standards. • Standard Operating Procedures (SOPs) will be developed prior to mine operations will include measures to minimize engine idling. Maintenance requirements for haul roads will be assessed further as part of detailed design. • Ensure proper and timely equipment maintenance. • Use vapour recovery units at fuel and chemical storage tanks. • Conserve energy by reducing unnecessary lighting, heating, and air conditioning and ensuring proper building and facility insulation. • Use grid electricity for plant and some mining equipment operations.

Sustainability Area/ Component	Commitments, Mitigation Measures and Best Management Practices
Air emissions and Air Quality Continued	• Operate and maintain the domestic waste incinerator according to manufacturer's recommendations to minimize emissions. • If the quantity of oily rags or used absorbent pads is 25% greater than the amount outlined in the Table 3.6-5 of the EA Application, they will be removed from site by a licenced hauler and not incinerated. • The hazardous and domestic wastes management plans will be reviewed and expanded so that only acceptable materials as identified in the EA Application will be incinerated. • Batteries, solvents, paints and treated wood will not be incinerated. • At minimum use low-sulphur diesel and use ultra-low sulphur diesel when it is readily available.
Adaptive Management	• Implement an adaptive management approach by developing sound management plans with the best information available prior to Project engineering and construction, monitor their implementation and adapt the plans as required.
Risk Management	• Continue to implement a risk management approach for the design, construction, operation and closure of the Mount Milligan Gold-Copper Mine project.
Social Development	
Health and Safety	• Monitor noise levels within the construction camp dormitory in order to verify the effectiveness of the noise mitigation measures as described in the EA Application.
Traditional Knowledge and Traditional Land Use	• Continue to seek and use Traditional Knowledge (TK) throughout the life of the Project. • Incorporate TK into the environmental assessment review and permitting process.
Cultural Heritage Resources	• Protect existing and any new cultural heritage resources sites: ▪ monitor Site J-3/GgRs-5 during power line construction to ensure avoidance ▪ review all Project plans/drawings on an on-going basis to ensure that areas affected by the Project undergo study as necessary ▪ mark all Project plans/drawings to identify all areas of archaeological and cultural sensitivity that require protection or monitoring ▪ implement protective measures throughout the Project area to avoid and mitigate effects on identified archaeological resources and culturally sensitive areas ▪ develop and implement a chance find procedure for construction, operation, and closure of the mine to ensure that appropriate protocol and notification procedures are followed when any unidentified archaeological or cultural heritage resources/remains encountered during development activities. This will include the immediate stoppage of work and the Archaeology Branch and relevant First Nations being informed.
Non-Traditional Land Use	• Re-establish access to Heidi Lake for fishing.

Appendix D

Fish Habitat Mitigation and Compensation Plan

Fish Habitat Mitigation and Compensation Plan

Terrane Metals
Fish Habitat Mitigation and Compensation Plan Summary
10 August 2009

MEMO

To	Andrew Thrift, Terrane Metals		
From	Brad Horne		
Tel	-	**AMEC File No.**	VE51916
Fax	-	**cc**	
Date	10 August 2009		
Subject	Summary of the Mt Milligan project Fish Habitat Mitigation and Compensation Plan		

As requested, the following summarizes the Fish Habitat Mitigation and Compensation Plan prepared by AMEC for the Mount Milligan Gold-Copper Mine project.

Construction and operation of the Mount Milligan project will result in the harmful alteration, disruption, or destruction (HADD) of fish habitat in the Rainbow Creek watershed. Mitigation measures have been incorporated into the Project to minimize these losses. These measures include relocation of the TSF to the King Richard Creek watershed, relocation and minimizing the size of the WSP, and re-establishment of habitat, flows, and fish access in Meadows Creek post-closure. However, residual impacts to fish habitat are unavoidable due to the location of the orebody and construction of required mine infrastructure over top of existing stream habitat and from the reduction of flows in some streams due to mine site water management.

In total, 126,584 m^2 of fish habitat will be affected by the Project. This habitat is restricted to three Rainbow Creek tributaries: Meadows Creek, a 4th order tributary of Rainbow Creek; King Richard Creek, a 3rd order tributary of Meadows Creek, and Alpine Creek, a 3rd order tributary of Rainbow Creek. Most (76%) of the affected habitat occurs in King Richard Creek where the existing habitat is comprised largely of fens created by beaver dams. These fens provide low quality habitat for Rainbow trout.

Higher quality habitat for Rainbow trout is present in Meadows Creek. This habitat will be unavailable for fish production during mining due to the construction and operation of the WSP and diversion ditch and because of the anticipated reduction in stream flow. Habitat and stream flow in Meadows Creek will be restored at the conclusion of mining.

Two options to compensate for the affected habitat were described in a conceptual Fish Habitat Compensation Plan submitted with the EA Application: stocking and creating an access channel to Heather Lake, a barren lake in the Limestone Creek sub-watershed, and creating groundwater-fed spawning/rearing channels in the upper Rainbow Creek watershed. Field work conducted in 2008 assessed the feasibility of these two options and identified other options available in the Rainbow Creek watershed. All of these options, plus the original seven options proposed in the 1991 mine application, were screened against regulatory, technical and economic feasibility, stability and permanence, and biological relevancy criteria.

From this analysis, four options within the Rainbow Creek watershed were proposed as compensation for the Mount Milligan Gold-Copper Mine project. These options include creation of overwintering ponds in upper reaches of Rainbow Creek, habitat complexing with large woody debris and boulder clusters in middle reaches of Rainbow Creek, creation of off-channel rearing / overwintering pools in middle reaches of Rainbow Creek, and creation of spawning/rearing channels in lower reaches of Rainbow Creek. All four options are intended to alleviate habitat bottlenecks for Rainbow trout in different parts of the Rainbow Creek watershed. Compensation options were targeted to increase production of Rainbow trout, the fish species most directly affected by the Project. Spawning/rearing channels in lower Rainbow Creek also have the potential to benefit red-listed Arctic grayling and blue-listed bull trout populations in the Nation River. Taken together, and assuming they are successful, these options would provide compensation for the HADD caused by the mine development.

Restoration of nine abandoned culverts in the Nation River watershed has been identified as a contingency option should any of the four “on-site” compensation options prove to be unstable, technically unfeasible, or not functioning as intended. This option is lower on the DFO hierarchy because it does not directly benefit the affected fish population but is consistent with provincial fisheries management objectives.

Terrane will continue to work with DFO, BC Ministry of Environment fisheries staff, and local First Nations to develop a compensation plan that achieves DFO’s “no-net-loss” policy while being consistent with traditional use and regional fisheries management objectives.