6. Assessment Methodology

6.1 INTRODUCTION

Environmental assessment (EA) in British Columbia (BC) and Canada provides an integrated process for identifying and evaluating the potential adverse environmental, social, economic, heritage, and health effects that may result from the components and activities of a Project. This chapter of the Application/EIS describes the effects assessment methodology that was used to identify and assess these potential effects for the Brucejack Gold Mine Project (the Project). The methodology described in this chapter is consistent with the requirements of the Application Information Requirements (AIR; BC EAO 2014) and the Environmental Impact Statement Guidelines (the Guidelines; CEA Agency 2013a) for the Project.

An EA generally has the following objectives:

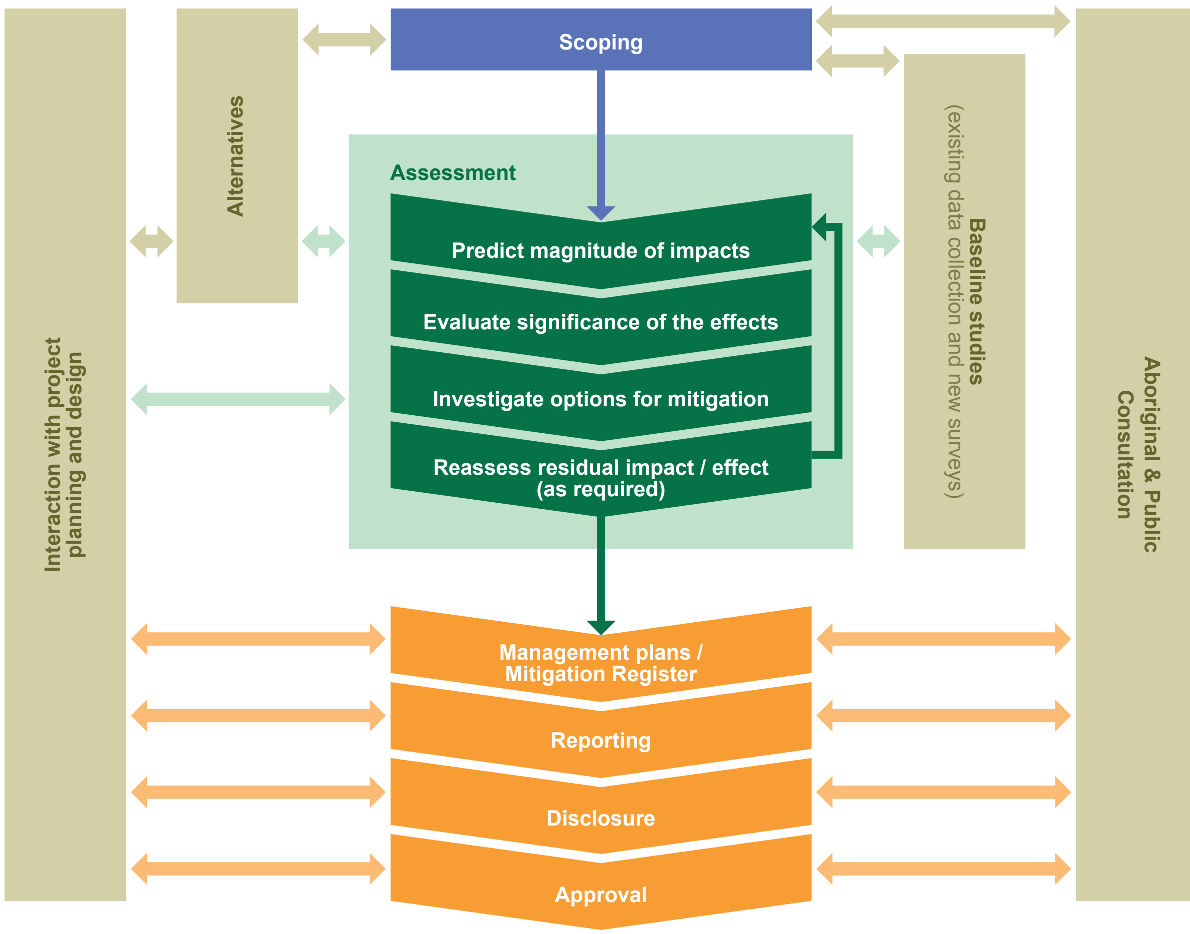
- to identify potential interactions among Project components and the surrounding biophysical and socio-economic environments;
- to identify any potential effects on valued components (VCs) resulting from the Project;
- to propose mitigation measures to avoid, mitigate, or compensate for potential effects;
- to identify any residual effects that cannot be mitigated;
- to determine the significance of these residual effects and their likelihood of occurrence;
- to assess potential cumulative effects that could result from interaction between the Project and other projects and human activities;
- to identify mitigation measures for potential cumulative effects and identify cumulative residual effects that cannot be mitigated; and
- to determine both the significance of these cumulative residual cumulative effects and their likelihood of occurrence.

Figure 6.1-1 provides an overview of the EA process that was followed to develop this Application/EIS. The EA process was iterative: analysis of baseline studies, stakeholder feedback (inclusive of Aboriginal groups), and re-evaluation of Project design (including evaluation of alternatives and improved mitigation measures) all contributed to the refinement of EA scoping, as well as the avoidance of effects and design of mitigation measures to reduce the scale of residual effects. The following guidance documents were used in the development of this methodology:

- *An Ecological Framework for Environmental Impact Assessment in Canada* (Beanlands and Duinker 1983);
- Application Information Requirements (BC EAO 2014);
- Environmental Impact Statement Guidelines (CEA Agency 2013a); and
- BC EAO *Guideline for the Selection of Valued Components and the Assessment of Potential Effects* (BC EAO 2013a).

Figure 6.1-1

Overview of the Environmental Assessment Process



The content included in this chapter is intended to:

- identify the objectives of the effects assessment process;
- provide a general description of how baseline information was integrated into the Application/EIS (both through the collection of new baseline data, and a review of existing information);
- describe the scoping process used to identify and categorize intermediate components and receptor VCs;
- identify the approach used to select assessment boundaries;
- present the method used to predict and assess effects;
- provide an overview of the types of mitigation measures to reduce the potential for significant adverse effects;
- identify the criteria and process used to determine the significance of residual effects on receptor VCs; and
- describe the methodology used to assess cumulative effects.

The detailed methods used in the assessments for each selected component are provided in the relevant chapters for each intermediate component and receptor VC within this Application/EIS. Information gleaned from public consultation and Traditional Knowledge/Traditional Use (TK/TU) information is integrated into multiple areas of the overall assessment methodology. Chapter 24, Assessment of Potential Commercial and Non-commercial Land Use Effects and Chapter 25, Assessment of Potential Effects to Current Use of Lands and Resources for Traditional Purposes, of the Application/EIS outlines how this information has been incorporated.

6.2 REGULATORY FRAMEWORK

The regulatory framework for EA in BC includes two broad types of requirements:

- the requirements that apply to the Project (e.g., to meet a particular emission limit); and
- the requirements that apply to the EA process (e.g., scope of Project and the assessment, consultation, and associated permitting processes).

The assessment process for a standard EA under federal and provincial law for the Project is defined in detail in Chapter 2. Each assessment chapter includes a separate description of the regulatory framework and regulatory requirements for each assessment topic. This includes laws, regulations, decrees, treaties and other instruments or declarations of relevance. In addition, the assessment chapters discuss other plans and guidelines of relevance to the Project including jurisdictional policies (e.g., land use management plans).

6.3 BASELINE CHARACTERIZATION

6.3.1 Regional Overview

Each assessment chapter provides a regional overview of the relevant environmental, social, economic, heritage, and health conditions surrounding the Project. The regional data was used to determine the framework for the assessment and to characterize Project effects. The regional overview also describes processes relevant to the environmental, social, economic, heritage and health regional settings, and considers current conditions, trends and variability over time. Information described in each assessment chapter includes:

- available scientific studies, supplemented by Aboriginal traditional knowledge and community knowledge (see Chapter 24 and 25); and
- references to supporting documents, maps, and engineering and technical reports, which are included in the appendices to the Application/EIS.

6.3.2 Historical Activities

Each assessment chapter provides a brief description of historical and current activities influencing the Project footprint. These activities include construction of the exploration access road, forestry activities in the Wildfire Creek area near the Bell-Irving River, historical mining projects in the Granduc area, use of the Granduc Access Road, and construction of the Long Lake Hydroelectric Project transmission line. Other projects and activities that are currently in the regulatory process (e.g., construction activities have not commenced), or that are planned or proposed but are not yet committed or certain (i.e., they are less advanced than the Brucejack Gold Mine Project in the planning cycle) may be considered in the assessment of cumulative effects, although not as part of the baseline.

6.3.3 Site-specific Baseline Studies

Each assessment chapter describes baseline studies undertaken to support each of the effects assessments, including a description of the information sources that were reviewed to obtain existing data, data collection and analytical methodologies, and a summary of results. Detailed baseline study results are provided in an appendix to the Application/EIS for each assessment topic. A summary table of the Project-specific field baseline data collection programs undertaken for each assessment subject area is provided below (see Table 6.3-1).

Table 6.3-1. Summary of Field-based Baseline Studies for the Brucejack Gold Mine Project

Assessment Themes	Field Baseline Studies	Years of Available Data
Atmospheric Environment	Meteorology and Climate	2011 to 2012
	Air Quality	2012
	Noise	2012
Terrestrial Environment	Geochemistry	2011 to 2013
	Terrain and Soil	2008[1] , 2012
	Terrestrial Ecology	2008[1] , 2012
	Rare Plants and Rare Plant Habitat	2012 to 2013
	Wetlands	2012
	Grizzly Bear	2008[1], 2009[1], 2011 to 2013
	Black Bear	2012[2]
	Moose	2009[1], 2010[1], 2011, 2012[2]
	Mountain Goats	2008[1], 2009[1], 2010-2013
	Marten (furbearers)	2012
	Fisher	2012
	Wolverine	2012-2013
	Marmots	2008[1], 2009[1], 2012
	Raptors	2008[1], 2009[1], 2010, 2012
	Waterbirds	2008[1], 2009[1], 2012

(continued)

Table 6.3-1. Summary of Field-based Baseline Studies for the Brucejack Gold Mine Project (completed)

Assessment Themes	Field Baseline Studies	Years of Available Data
Freshwater Environment	Hydrology (Surface Water Quantity)	1987[3], 1988[3], 2007[1], 2008[1], 2009-2012
	Hydrogeology (Groundwater Quality and Quantity)	2010 to 2013
	Limnology and Bathymetry	2009 to 2013
	Surface Water Quality	1987-2001[3], 2007-2008[1], 2009-2013
	Sediment Quality	2009-2013
	Aquatic Resources (Primary Producers, Zooplankton, Benthic Macro-invertebrates)	2008-2013
	Fish and Fish Habitat	1989[3], 2008-2009[1], 2010-2013
Human Environment	Heritage (Archaeology)	2010 to 2013
	Socio-Economic, including Aboriginal groups (government, population demographics, economic base and labour, education, community services and infrastructure)	2012-2013
	Land Use	2009 to 2012
	Visual Quality	2012

[1] Study originally complete for Seabridge Gold's KSM Project, which provided data within the relevant Brucejack Gold Mine Project study area.
[2] Habitat suitability mapping
[3] Studies originally completed by Newhawk Gold Mines Ld. for the Sulphurets Projects.

Detailed baseline information improves the ability of the EA to predict how the proposed Project would affect local environmental, social, economic, heritage, and health current conditions, and how these components may respond to changes. Baseline studies also help to identify issues, concerns, and sensitivities in relation to the surrounding environment of the Project. Thus, baseline studies for the Project were conducted to:

- identify the key environmental, social, economic, health, and heritage conditions that may be affected by the Project components and activities;
- describe and where possible quantify characteristics of the existing conditions (nature, condition, quality, extent, etc.), both now and in the future in absence of the Project;
- provide data to aid the prediction and modelling of effects;
- inform judgments about the sensitivity, vulnerability, and/or importance of resources/ receptors; and
- characterize pre-disturbance conditions for the purpose of future monitoring and reclamation activities.

6.3.3.1 Data Sources

The existing conditions in the baseline monitoring study areas, as they pertain to the selected components, are discussed in each assessment chapter. This information includes:

- information from scientific studies, supplemented by Aboriginal traditional knowledge and community knowledge where available;

- references to supporting documents, including annual baseline data reports, engineering, and technical reports which are included in the appendices to the Application/EIS;
- desktop research such as FishWizard, other mine assessment reports, regional studies, etc.; and
- methodology guidance documents and/or operating statements specifying how baseline data should be collected (e.g., Water and Air Baseline Monitoring Guidance Document for Mine Proponents and Operators; BC MOE 2012).

6.3.3.2 Methods

Baseline studies were conducted using a tiered approach beginning with a desk-based review of information available from government sources, engineering and technical reports, scientific studies, and peer-reviewed articles. The description of the baseline provides a high-level overview of methods used to collect baseline information, including a description of standards and methodologies used, and data collection and analytical methodologies, and any limitations encountered and assumptions made.

As existing available baseline data were limited, comprehensive baseline field programs began in 2009, and were conducted throughout 2010, 2011, 2012, and 2013 to support the Project. Table 6.3-1 provides a high-level summary of the field-based studies that were conducted for various subject areas. The Proponent has a data sharing agreement with Seabridge Gold Inc. for their proposed KSM Project, a nearby mining project. As such, baseline data collected for the KSM Project by Seabridge Gold Inc. were used to aid characterization of the Brucejack Gold Mine Project baseline due to the close proximity of the two projects and overlapping study areas (as noted in Table 6.3-1).

Although the baseline studies were commenced prior to formal Aboriginal consultation, the studies considered information that was available from previous projects in the area, such as the KSM Project.

6.3.3.3 Characterization of Baseline Condition

Characterization of the baseline condition was undertaken to describe and where possible quantify characteristics of the existing conditions (nature, condition, quality, extent, etc.). As noted, the baseline considers current conditions, as well as those changing conditions (i.e., trends) apparent in the baseline (e.g., depletion of wildlife populations). Each assessment chapter includes summaries of baseline data results with references to relevant Appendices, as applicable.

6.4 ESTABLISHING THE SCOPE OF THE EFFECTS ASSESSMENT

Issues scoping is fundamental to focusing the Application/EIS on those issues where there is the greatest potential to cause significant adverse effects and to focus the assessment on those aspects of the biophysical and human environment that are of greatest importance to society. This, in turn, further improves the effectiveness and efficiency of the assessment, in part by facilitating the selection of appropriate study methods and focusing analysis on key Project-environment interactions (Beanlands and Duinker 1983). The preliminary scope of the effects assessment was determined as part of the BC EAO and the Agency processes, including release of the draft AIR and the EIS Guidelines for comment by regulators, Aboriginal communities, and the public.

Each assessment chapter of this Application/EIS includes a description of the issues scoping process used to identify potential effects of the Project that are likely to affect specific environmental, social, economic, heritage, and health components. The chapters also describe the scoping process used to select assessment boundaries and to understand the potential interaction or cause-effect pathways between Project activities and environmental, social, economic, health, and heritage components.

The methodology outlined here is adapted from the BC EAO's (2013a) document *Guideline for the Selection of Valued Components and Assessment of Potential Effects*.

The scope of the effects assessment for each chapter was undertaken following four key steps:

- *Step 1:* undertaking a scoping process to select components, sub-components[1] and indicators[2] based on a consideration of the Project's potential to interact with a component;
- *Step 2:* consideration of feedback on the results of the scoping process from technical experts and the EA Working Group;
- *Step 3:* defining assessment boundaries for each subject area, and/or sub-component; and
- *Step 4:* identification of key potential effects on subject areas and/or sub-components.

These steps are described in detail below.

6.4.1 Selecting Candidate Components

Each assessment chapter of this Application/EIS describes the issues scoping process used to identify subject areas, sub-components, and associated indicators within each of the environmental, social, economic, heritage, or health assessment themes that have the potential to be adversely affected by Project components and/or physical activities.

Components are scoped in consultation with key stakeholders, including Aboriginal communities and the EA Working Group. Consideration of certain components may also be a legislated requirement, or known to be a concern because of previous project experience.

The following criteria and information was considered during the component scoping process:

- baseline studies;
- Project footprint data;
- technical studies and engineering documents;
- impact matrix table (see Table 6.4-1);
- legislative requirements (e.g., AIR and EIS Guidelines, *Fisheries Act* 1985);
- established operational procedures and best practices;
- the Nisga'a Final Agreement (NFA; NLG, Province of BC, and Government of Canada 1998);
- policy guidance;
- Cassiar-Iskut-Stikine Land Resource Management Plan (BC ILMB 2000);
- Nass South Sustainable Resource Management Plan (BC MFLNRO 2012);
- issues raised to date by potentially affected Aboriginal groups (as summarized in the Section 11 Consultation Reports; Rescan 2013a, 2013b);
- resilience of a component to change;
- potential interaction with another project/activity to create a cumulative effect(s);

[1] In some cases, it is useful and appropriate to lump components into a broadly defined subject area (e.g., wildlife) and use sub-components (e.g., species or guilds) to "split the components to define the subject area more narrowly."
[2] Indicators are metrics used to measure and report on the condition and trend of an intermediate component or receptor VC and are distinct from sub-components. Indicators have the following attributes: relevant, practical, measurable, responsive, accurate and predictable.

- a review of available information (including past, proposed, and current mining EA projects);
- feedback from the EA Working Group, including Aboriginal groups;
- feedback from key stakeholders, including tenure holders, community and interest groups; and
- professional judgement.

When selecting candidate components, the following questions were considered:

- Is the component present in the local or regional area?
- Does the project have the potential to interact with or adversely affect the component?
- Does a legally binding government requirement exist to protect the component?
- Does the component reflect a legislative or regulatory requirement or government management priority?
- Does the component pertain to Aboriginal interests, including claimed or proven Aboriginal rights (including title) and Treaty rights?
- Is there a potential for significant adverse cumulative effects? What known stressors are already occurring on the land base?
- Is the component itself, or the potential adverse effect, of particular concern to the public, Aboriginal groups, or government?
- Is the component particularly sensitive or vulnerable to disturbance?

To further refine the assessment, the following questions were considered when selecting sub-components, and defining indicators to measure effects:

- Could the potential effects of the project on the component be measured and monitored? Is the candidate component better represented/evaluated by using a different indicator?
- Could the potential effect on an intermediate component or receptor VC be effectively considered within the assessment of another?
- Is the information about the intermediate component or receptor VC needed to support the assessment of potential effects on another?

6.4.1.1 Scoping Potential Interactions between the Project and Candidate Components

During the development of the AIR, a scoping exercise was conducted with technical experts on April 10, 2013 to explore potential Project interactions with candidate components, and to identify the key potential adverse effects associated with that interaction. Professional judgement, combined with knowledge of the Project and experience from previous mining projects in the area (e.g., KSM Project), was used to identify these effects and assess the potential for interaction.

The scoping document was circulated for review and approval by the EA Working Group and feedback from that process has been integrated into the Application/EIS.

The primary output from the scoping workshops was the production of an impact scoping matrix, consisting of a list of candidate components that could be affected by Project components and/or physical activities (presented in Table 6.4-1). Interactions between the Project and a candidate component were assessed based on the following assumptions:

1. candidate components were present in the local or regional Project area; and
2. the Project has the potential to interact with and measurably affect the component.

Table 6.4-1. Likelihood of the Brucejack Gold Mine Project Interacting and Affecting Environmental, Social, Economic, Heritage and Health Candidate Components

	Biophysical																					Economic	Social			Heritage				Human Health				Land Use	
Project Components and Physical Activities by Phase	Air Quality	Climate	Noise	Groundwater Quality	Groundwater Quantity	Surface Water Hydrology	Surface Water Quality	Aquatic Resources	Fish	Fish Habitat	Terrain	Terrestrial Ecology	Soils	Wetlands	Ungulates	Furbearers	Grizzly bear	Bats	Raptors	Migratory birds	Amphibians	Labor Market	Education, Skills, and Training	Community Infrastructure, Housing, and Services	Family and Worker Well-being	Navigation	Protected Archaeological Resources	Protected Historical Resources	Protected Paleontological Resources	Drinking Water	Air Quality	Noise	Country Foods	Commercial Land Use	Non-commercial Land Use
Construction Phase																																			
Activities at existing adit																																			
Air transport of personnel and goods																																			
Avalanche control																																			
Chemical and hazardous material storage, management and handling																																			
Construction of back-up diesel power plant																																			
Construction of Bowser Aerodrome																																			
Construction of detonator storage area																																			
Construction of electrical tie-in to BC Hydro grid																																			
Construction of electrical substation at mine site																																			
Construction of equipment laydown areas																																			
Construction of helicopter pad																																			
Construction of incinerators																																			
Construction of Knipple Transfer Area																																			
Construction of local site roads																																			
Construction of Mill Building (electrical induction furnace, backfill paste plant, warehouse, mill/ concentrator)																																			
Construction of mine portal and ventilation shafts																																			
Construction of Brucejack Operations Camp																																			
Construction of ore conveyer																																			
Construction of tailings pipeline																																			
Construction and decommissioning of Tide Staging Area construction camp																																			
Construction of truck shop																																			
Construction and use of sewage treatment plant and discharge																																			
Construction and use of surface water diversions																																			
Construction of water treatment plant																																			
Development of underground portal and facilities																																			
Employment and Labour																																			
Equipment maintenance/machinery and vehicle refuelling/fuel storage and handling																																			
Explosives storage and handling																																			
Grading of the mine site area																																			
Helicopter use																																			
Installation and use of Project lighting																																			
Installation of surface and underground crushers																																			
Installation of transmission line and associated towers																																			
Machinery and vehicle emissions																																			
Potable water treatment and use																																			
Pre-production ore stockpile construction																																			
Procurement of goods and services																																			
Quarry construction																																			

(continued)

Table 6.4-1. Likelihood of the Brucejack Gold Mine Project Interacting and Affecting Environmental, Social, Economic, Heritage and Health Candidate Components (continued)

	Biophysical																					Economic	Social			Heritage				Human Health				Land Use	
Project Components and Physical Activities by Phase	Air Quality	Climate	Noise	Groundwater Quality	Groundwater Quantity	Surface Water Hydrology	Surface Water Quality	Aquatic Resources	Fish	Fish Habitat	Terrain	Terrestrial Ecology	Soils	Wetlands	Ungulates	Furbearers	Grizzly bear	Bats	Raptors	Migratory birds	Amphibians	Labor Market	Education, Skills, and Training	Community Infrastructure, Housing, and Services	Family and Worker Well-being	Navigation	Protected Archaeological Resources	Protected Historical Resources	Protected Paleontological Resources	Drinking Water	Air Quality	Noise	Country Foods	Commercial Land Use	Non-commercial Land Use
Construction Phase (cont'd)																																			
Solid waste management																																			
Transportation of workers and materials																																			
Underground water management																																			
Upgrade and use of exploration access road																																			
Use of Granduc access road																																			
Operations Phase																																			
Air transport of personnel and goods and use of aerodrome																																			
Avalanche control																																			
Backfill paste plant																																			
Back-up diesel power plant																																			
Bowser Aerodrome																																			
Brucejack Access Road use and maintenance																																			
Brucejack Operations Camp																																			
Chemical and hazardous material storage, management, and handling																																			
Concentrate storage and handling																																			
Contact water management																																			
Detonator storage																																			
Discharge from Brucejack Lake																																			
Electrical induction furnace																																			
Electrical substation																																			
Employment and Labour																																			
Equipment laydown areas																																			
Equipment maintenance/machine and vehicle refueling/fuel storage and handling																																			
Explosives storage and handling																																			
Helicopter pad(s)																																			
Helicopter use																																			
Knipple Transfer Area																																			
Machine and vehicle emissions																																			
Mill building/concentrators																																			
Non-contact water management																																			
Ore conveyer																																			
Potable water treatment and use																																			
Pre-production ore storage																																			
Procurement of goods and services																																			
Project lighting																																			
Quarry operation																																			
Sewage treatment and discharge																																			
Solid waste management/incinerators																																			
Subaqueous tailings disposal																																			

(continued)

Table 6.4-1. Likelihood of the Brucejack Gold Mine Project Interacting and Affecting Environmental, Social, Economic, Heritage and Health Candidate Components (continued)

	Biophysical																					Economic	Social			Heritage				Human Health				Land Use	
Project Components and Physical Activities by Phase	Air Quality	Climate	Noise	Groundwater Quality	Groundwater Quantity	Surface Water Hydrology	Surface Water Quality	Aquatic Resources	Fish	Fish Habitat	Terrain	Terrestrial Ecology	Soils	Wetlands	Ungulates	Furbearers	Grizzly bear	Bats	Raptors	Migratory birds	Amphibians	Labor Market	Education, Skills, and Training	Community Infrastructure, Housing, and Services	Family and Worker Well-being	Navigation	Protected Archaeological Resources	Protected Historical Resources	Protected Paleontological Resources	Drinking Water	Air Quality	Noise	Country Foods	Commercial Land Use	Non-commercial Land Use
Operations Phase (cont'd)																																			
Subaqueous waste rock disposal																																			
Surface crushers																																			
Tailings pipeline																																			
Truck shop																																			
Transmission line operation and maintenance																																			
Underground backfill tailing storage																																			
Underground backfill waste rock storage																																			
Underground crushers																																			
Underground: drilling, blasting, excavation																																			
Underground explosives storage																																			
Underground mine ventilation																																			
Underground water management																																			
Use of mine site haul roads																																			
Use of portals																																			
Ventilation shafts																																			
Warehouse																																			
Waste rock transfer pad																																			
Water treatment plant																																			
Closure Phase																																			
Air transport of personnel and goods																																			
Avalanche control																																			
Chemical and hazardous material storage, management, and handling																																			
Closure of mine portals																																			
Closure of quarry																																			
Closure of subaqueous tailing and waste rock storage (Brucejack Lake)																																			
Decommissioning of Bowser Aerodrome																																			
Decommissioning of back-up diesel power plant																																			
Decommissioning of Brucejack Access Road																																			
Decommissioning of camps																																			
Decommissioning of diversion channels																																			
Decommissioning of equipment laydown																																			
Decommissioning of fuel storage tanks																																			
Decommissioning of helicopter pad(s)																																			
Decommissioning of incinerators																																			
Decommissioning of local site roads																																			
Decommissioning of Mill Building																																			
Decommissioning of ore conveyer																																			
Decommissioning of Project lighting																																			
Decommissioning of sewage treatment plant and discharge																																			

(continued)

Table 6.4-1. Likelihood of the Brucejack Gold Mine Project Interacting and Affecting Environmental, Social, Economic, Heritage and Health Candidate Components (completed)

	Biophysical																					Economic	Social			Heritage				Human Health				Land Use	
Project Components and Physical Activities by Phase	Air Quality	Climate	Noise	Groundwater Quality	Groundwater Quantity	Surface Water Hydrology	Surface Water Quality	Aquatic Resources	Fish	Fish Habitat	Terrain	Terrestrial Ecology	Soils	Wetlands	Ungulates	Furbearers	Grizzly bear	Bats	Raptors	Migratory birds	Amphibians	Labor Market	Education, Skills, and Training	Community Infrastructure, Housing, and Services	Family and Worker Well-being	Navigation	Protected Archaeological Resources	Protected Historical Resources	Protected Paleontological Resources	Drinking Water	Air Quality	Noise	Country Foods	Commercial Land Use	Non-commercial Land Use
Closure Phase (cont'd)																																			
Decommissioning of surface crushers	Grey	Grey	Grey				Grey	Grey			Grey	Grey	Grey																	Grey	Grey	Grey	Grey		
Decommissioning of surface explosives storage	Grey	Grey	Grey				Grey	Grey			Grey	Grey	Grey	Grey																Grey	Grey	Grey	Grey		
Decommissioning of tailings pipeline	Grey	Grey	Grey			Grey	Grey	Grey			Grey	Grey	Grey																	Grey	Grey	Grey	Grey		
Decommissioning of transmission line and ancillary structures	Grey	Grey	Grey			Grey	Grey	Grey			Black	Black	Black	Grey												Grey				Grey	Grey	Grey	Grey		
Decommissioning of underground crushers	Grey	Grey	Grey																												Grey	Grey	Grey		
Decommissioning of waste rock transfer pad	Grey	Grey	Grey	Grey	Grey	Grey	Black	Grey																						Black	Grey	Grey	Black		
Decommissioning of water treatment plant	Grey	Grey	Grey	Grey	Grey	Black	Grey	Black						Grey																Grey	Grey	Grey	Grey		
Employment and Labour																						Black	Black	Grey	Black										
Helicopter use	Grey	Grey	Grey												Black	Black	Black	Black	Black	Black	Black										Grey	Grey	Grey	Grey	Grey
Machine and vehicle emissions	Grey	Grey	Grey			Grey									Black	Black	Black	Black	Black	Black	Black										Grey	Grey	Grey		
Procurement of goods and services																						Black	Black	Grey	Black										
Removal or treatment of contaminated soils	Grey	Grey	Grey	Grey	Grey		Grey	Grey			Grey	Grey	Grey	Grey																Grey	Grey	Grey	Grey		
Solid waste management	Grey	Grey	Grey	Grey	Grey									Grey	Black	Black	Black	Black	Black	Black	Black										Grey	Grey	Grey		
Transportation of workers and materials (mine site and access roads)	Grey	Grey	Grey			Grey					Grey	Grey	Grey	Grey	Black	Black	Black	Black	Black	Black	Black										Grey	Grey	Grey	Black	Black
Post-Closure Phase																																			
Discharge from Brucejack Lake				Grey	Grey	Black	Black	Black	Grey			Grey		Grey																Black			Black		
Employment and Labour																						Black	Grey	Grey	Grey										
Environmental monitoring				Grey	Grey	Black		Grey				Black																							
Procurement of goods and services																						Black	Grey	Grey	Grey										
Subaqueous tailing and waste rock storage				Grey	Grey	Black	Black	Black																		Grey				Black			Black		
Underground mine				Black	Black		Grey	Grey																						Grey			Grey		

Black = likely interaction between project components/physical activities and an environmental, social, economic, heritage, or health candidate component

Grey = possible interaction between project components/physical activities and an environmental, social, economic, heritage, or health candidate component

White = unlikely interaction between project components/physical activities and an environmental, social, economic, heritage, or health candidate component

The potential for interaction was assigned a colour code as follows: not expected (white), possible (grey), and likely (black). Interactions coded as not expected (white) are considered to have no potential for adverse effects on a component and are scoped out of further assessment in the relevant predictive study and assessment chapter.

Results of the impact matrix screening process demonstrate that the majority of candidate components are predicted to have either: an unlikely interaction (white), a possible interaction (grey), or a likely interaction (black) with some component of the Project.

Two components were screened out as candidates for assessment because no interaction between the component and the Project was identified:

- protected historical resources; and
- protected paleontological resources.

Following this scoping process, sediment quality and visual quality were scoped out as sub-components, rather to be dealt with as effect pathways to Aquatics Resources and Land Use.

Candidate components identified as possibly affected by the Project are:

- fish;
- fish habitat;
- wetlands;
- non-traditional land use;
- traditional land use; and
- navigation.

A secondary outcome of the scoping workshops was the further refinement and identification of sub-components (e.g., hoary marmot) of a subject area (e.g., wildlife) and potential indicators (e.g., percent habitat loss) to use as metrics when assessing potential effects on a component.

A third outcome of the scoping workshops was the identification of a number of ‘intermediate’ and ‘receptor’ components (see Table 6.4-4 below). Intermediate components are specific attributes of the biophysical environment that if affected (i.e., if there is a positive or negative change in the baseline condition), act as a pathway to pass on those changes to receptor components (thereby also having the potential to affect or change the baseline condition of a receptor component). Where a receptor component is perceived as important by the public, scientists, government agencies, Aboriginal groups, or other stakeholders, these are referred to as receptor valued components (receptor VCs).

In accordance with the *Guideline for the Selection of Valued Components and Assessment of Potential Effects* (BC EAO 2013a), the assessment is encouraged to focus on effects on receptor VCs. This achieves two objectives: the first which is to emphasize the importance of the ultimate receptor VC, and the second to increase efficiency and reduce redundancy in the EA process.

Intermediate components will be contained in a section of the Application/EIS called Predictive Studies (see Part B)[3]. Results from the predictive studies for each intermediate component will be incorporated into the effects assessment for relevant receptor VCs (e.g., changes in air quality and noise and any applicable ambient objectives will be used to support the effects assessment for human health and wildlife receptor VCs). The determination of significance of residual effects will be conducted only on receptor VCs.

Pathways between intermediate components and receptor VCs will be described, and information illustrating these linkages will be included in each relevant predictive study chapter. As an overarching guide, Figure 6.4-1 shows the linkages between intermediate and receptor VCs. Note that receptor VCs are qualified and referred to simply as VCs in certain subject area assessment chapters that have numerous receptors and sub-components, to present the assessment outcomes in an accessible manner and avoid confusion with intermediate components that are subjected to predictive studies.

6.4.1.2 Consultation Feedback on Valued Components

As part of the EA processes under the BC *Environmental Assessment Act* (2002a) and *Canadian Environmental Assessment Act, 2012* (2012) the preliminary list of components in the draft AIR (dAIR) and draft EIS Guidelines was released for comment and feedback in May 2013. Comments on both documents were received over a period of 30 days from regulators, Aboriginal groups and the public/stakeholders. Each assessment chapter includes a discussion on how scoping feedback was incorporated into sub-component and/or indicator selection.

The scoping process also relied on feedback from Pretivm-led public consultation, the Skii km Lax Ha TK/TU report (Appendix 25-A, Skii km Lax Ha Traditional Knowledge and Traditional Use Report), considerations under the Nisga'a Final Agreement (NFA), and regulatory requirements.

6.4.1.3 Summary of Intermediate Components and/or Receptor Valued Components Included/Excluded in the Application for the Application/Environmental Impact Statement

Specific rationale for why each subject area and component or sub-component was selected or excluded is included in the relevant assessment chapter of this Application/EIS and will be summarized using the table formats below (Table 6.4-2; Table 6.4-3). Supporting text discussing the selection process and rationalizing the final list of intermediate components or receptor VCs will also be provided.

Table 6.4-2. <Subject Area> Intermediate Component(s)/Receptor Valued Components Included in the Application/EIS

Sub-Components	Identified by*				Rationale for Inclusion
	AG	G	P/S	IM	

**AG = Aboriginal Group; G = Guideline requirement; P/S = Public/Stakeholder; IM = Impact Matrix.*

The selected intermediate components and receptor VCs identified for the Project can be logically grouped into the following assessment themes: atmospheric environment, terrestrial environment, freshwater environment, and human environment. Components selected for inclusion in this EA are presented in Table 6.4-4.

[3] While the BC EAO guidance document suggests the results of studies for intermediate component to simply be appended to relevant receptor VC chapters, for transparency, readability, and ease of reference purposes, it is the proponent's preference to provide a devoted section in the Application that contains the results of all Predictive Studies for all intermediate components.

Figure 6.4-1

Linkages between Intermediate and Receptor Valued Components

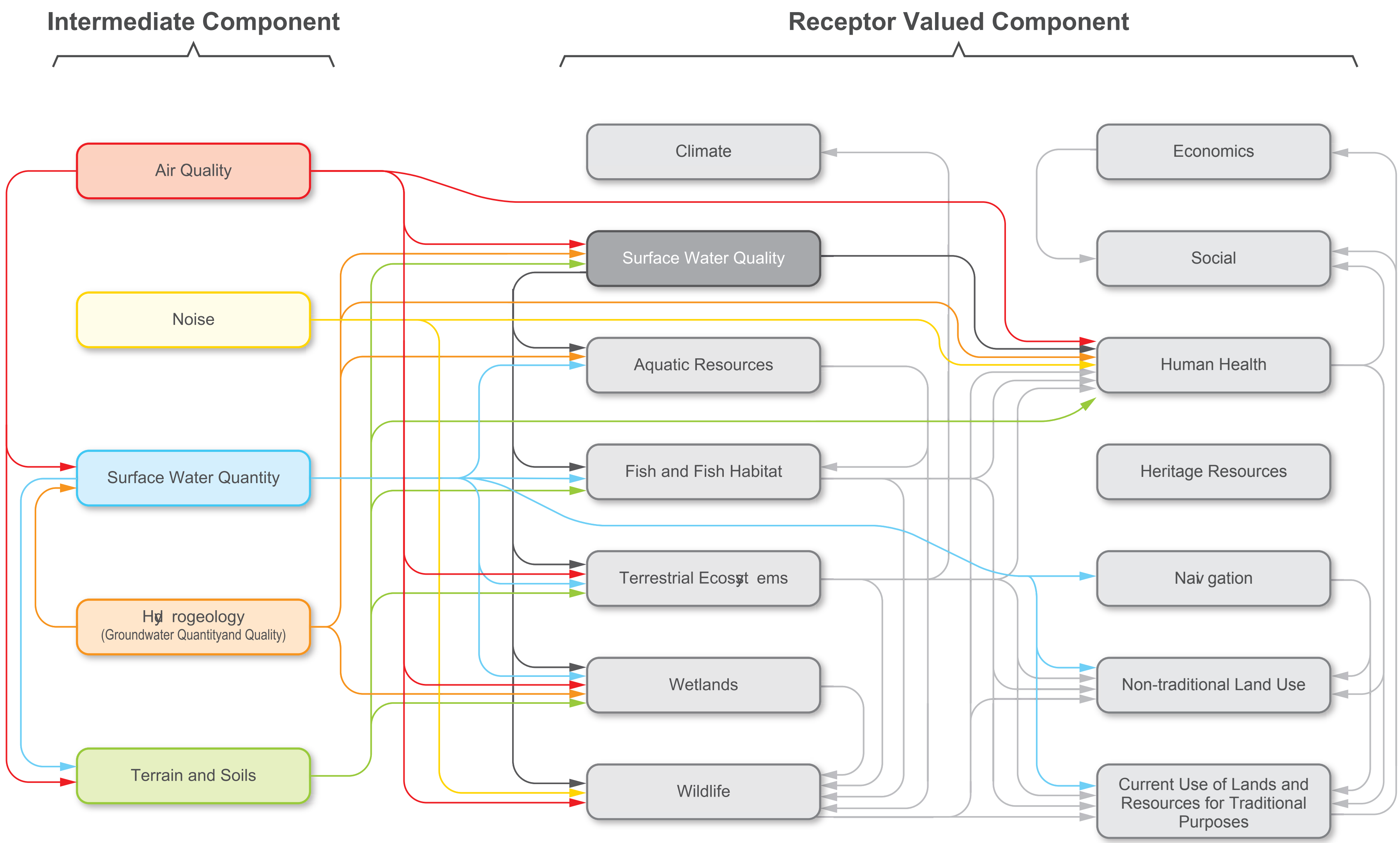


Table 6.4-3. <Subject Area> Intermediate Component(s)/Receptor Valued Components Excluded from the Application/EIS

Intermediate Component or Receptor VC	Identified by*				Rationale for Exclusion
	AG	G	P/S	IM	

AG = Aboriginal Group; G = Government; P/S = Public/Stakeholder; IM = Impact Matrix.

Table 6.4-4. Selected Intermediate Components and Receptor Valued Components for the Brucejack Gold Mine Project

Assessment Themes	Selected Components			Component Type	
	Subject Area	Sub-Components	Indicators	Intermediate Component	Receptor Valued Component
Atmospheric Environment	Air	Air Quality	• Concentrations of criteria air contaminants (NO_x, CO, Total Suspended Particulate (TSP), PM_{10}, $PM_{2.5}$, SO_x)	√	
	Climate	n/a	• Emissions of CO_2 and other greenhouse gases		√
	Noise	n/a	• Decibel levels and propagation of sound	√	
Freshwater Environment	Groundwater	Groundwater quality	• Concentrations of total and dissolved metals, nutrients, turbidity, total suspended solids, temperature	√	
		Groundwater quantity	• Flow volume and movement	√	
	Surface Water	Surface Water Quantity	• Flow volume and movement	√	
		Surface Water Quality	• Concentrations of total and dissolved metals, nutrients, turbidity, TSS, temperature		√
	Aquatic Resources	Primary and Secondary Producers	• Abundance and diversity of periphyton, phytoplankton, benthic invertebrates, and zooplankton; changes in sediment quality		√
	Fish and Fish Habitat	Fish habitat	• Habitat loss and alteration		√
		Dolly Varden Bull Trout coho salmon sockeye salmon Chinook salmon	• direct mortality • sensory disturbance • water quality degradation (metals, contaminants, TSS)		√
Terrestrial Environment	Terrain and Soil	Terrain stability	• subsidence rates • decreasing terrain stability (increased incidence of geohazards)	√	

(continued)

Table 6.4-4. Selected Intermediate Components and Receptor Valued Components for the Brucejack Gold Mine Project (continued)

Assessment Themes	Selected Components			Component Type	
	Subject Area	Sub-Components	Indicators	Intermediate Component	Receptor Valued Component
Terrestrial Environment (cont'd)	Terrain and Soil	Soil quality	• Increase in metal concentrations • Changes to pH • Changes to electrical conductivity • Changes in soil organic carbon	√	
		Soil quantity	• changes in soil association quantity and distribution	√	
	Terrestrial Ecology	Rare plant and lichens and rare plant and lichen habitat	• removal of plant or lichen species • alteration of plant or lichen habitat (as measured by e.g., dust deposition, introduction and spread of invasive species, changes in hydrology)		√
		Economic and culturally important plants			√
		Alpine ecosystems	• Changes in ecosystem function and extent		√
		Parkland ecosystems			√
		Riparian ecosystems			√
		Forested ecosystems			√
	Wetlands	Wetland function	• Degradation of wetland function		√
		Wetland extent	• Wetland area lost • Wetland area degraded		√
	Wildlife and Wildlife Habitat	Mountain goat	Changes in: • habitat (loss or alteration) • disruption of movements • sensory disturbance • direct mortality • indirect mortality • attractants • chemical hazards		√
		Moose			√
		Grizzly bear			√
		Bats (emphasis on little brown myotis and northern myotis)			√
		American marten			√
		Hoary marmot			√
		Migratory birds terrestrial (emphasis on species at risk incl. barn swallow) and waterfowl			√
		Raptors			√
		Western toad			√

(continued)

Table 6.4-4. Selected Intermediate Components and Receptor Valued Components for the Brucejack Gold Mine Project (continued)

Assessment Themes	Selected Components			Component Type	
	Subject Area	Sub-Components	Indicators	Intermediate Component	Receptor Valued Component
Human Environment	Economy	Income production and revenue	• changes in personal and commercial income • changes in tax revenues		√
		Labour market	• Skills and wage pressures on local labour force		√
		Economic activity	• Continuation of, or increased access to business opportunities and economic diversification		√
	Social	Education, skills and training	• Changes in access to education and training resources and opportunities • Changes in levels of education, knowledge, and skills		√
		Community infrastructure, services, and housing	• Pressure on community infrastructure (e.g., utilities, roads/rail, power) • Pressure on use of community services (e.g., policing, hospitals, social services, community center, recreation facilities) • Changes in demand for housing		√
		Family and worker well-being	• Pressure on workers and their families as a result of camp rotation schedules		√
	Heritage	Protected archaeological sites	• loss, alteration, and/or degradation of archaeological sites		√
	Human Health	Drinking water quality	• Concentrations of total and dissolved metals, nutrients, turbidity, TSS		√
		Air quality	• Concentrations of criteria air contaminants (NO_x, CO, TSP, PM_{10}, $PM_{2.5}$, SO_x)		√
		Noise	• sleep disturbance • sleep interference • complaints • interference with speech communication • high annoyance		√
		Country foods	• degradation of quality of country foods		√

(continued)

Table 6.4-4. Selected Intermediate Components and Receptor Valued Components for the Brucejack Gold Mine Project (completed)

Assessment Themes	Selected Components			Component Type	
	Subject Area	Sub-Components	Indicators	Intermediate Component	Receptor Valued Component
Human Environment (cont'd)	Navigation		• changes to safe navigation • changes to accessibility of navigable waters		√
	Non-traditional Land Use	Commercial land use	• changes in access to land and resource use areas • changes to the experience of the natural environment • changes to the distribution of wildlife resources		√
		Non-commercial land use	• changes in access to land and resource use areas • changes to the experience of the natural environment • changes to the distribution of wildlife resources		√
	Current Aboriginal Use	Fishing opportunities and practices	• change in access to lands and resources • change in sensory disturbances • change in the amount of resources • change in the quality of resources		√
		Hunting/trapping opportunities and practices	• change in access to lands and resources • change in sensory disturbances • change in the amount of resources • change in the quality of resources		√
		Plant gathering opportunities and practices	• change in access to lands and resources • change in sensory disturbances • change in the amount of resources • change in the quality of resources		√
		Habitations, trails, burials and other cultural landscapes	• change in access to lands and resources • change in the amount of resources		√

The following subject areas (air, noise, groundwater, surface water hydrology, and terrain and soil) are classified as intermediate components and will be discussed in Chapters 7 through 11 of this Application/EIS as “Predictive Studies”. Climate, surface water quality, aquatic resources, fish and fish habitat, terrestrial ecology, wetlands, wildlife and wildlife habitat, economy, social, human health, heritage, navigation, commercial and non-commercial land use, current use of lands and resources for traditional purposes, established aboriginal rights and interests, and Nisg̲a’a Nation treaty right, interests and information requirements are the subject areas that are classified as receptor VCs and are discussed in Chapters 12 through 27 of this Application/EIS.

6.4.2 Assessment Boundaries

Assessment boundaries define the maximum limit within which the effects assessment and supporting studies (i.e., predictive studies) are conducted. They encompass the areas within, and times during which, the Project is expected to interact with the intermediate components and receptor VCs, as well as the constraints that may be placed on the assessment of those interactions due to political, social, and economic realities (administrative boundaries), and limitations in predicting or measuring changes (technical boundaries). The definition of these assessment boundaries is an integral part of the assessment process of a subject area, and encompasses possible direct, indirect, and induced effects of the Project on that subject area, as well as the trends in natural processes that may be relevant.

Each assessment chapter of the Application/EIS provides and describes the spatial, temporal, administrative, and technical assessment boundaries (if applicable).

<u>Spatial Boundaries</u>

Spatial boundaries are determined based on the location and distribution of intermediate components and receptor VCs, and the spatial extent of Project effects. The spatial scale of an assessment may encompass the Project footprint, a local study area (LSA), and a regional study area (RSA). Beyond the spatial boundaries, the Project is expected to have negligible potential effects.

Spatial boundaries for each subject area are based on the following criteria:

- the scope of the EA (i.e., the biophysical or socio-economic extent of the Project activities and components, and associated effects);
- the location and distribution of intermediate components and receptor VCs;
- the extent to which traditional and contemporary land and resource use, inclusive of legislated boundaries such as the Nisg̲a’a Wildlife Area and protected areas, could potentially be affected by the Project; and
- feedback and input received during consultation activities.

To define and describe the spatial boundaries for each effects assessment, each assessment chapter of the Application/EIS includes the following information:

- criteria used to determine the extent of spatial boundaries for each VC;
- a description of the local and regional spatial extent of the assessment relative to each VC; and
- maps outlining the spatial extent of the local and regional study areas.

For the purpose of the Application/EIS, the following definitions are used to define the study areas:

- Project Footprint is defined as the area of land or water associated with the proposed sites for all physical structures and activities that comprise the Project (See Figure 6.4-2).
- Assessment Footprint is defined as an area that extends beyond the Project Footprint and provides a conservative area assumed to be functionally lost due to Project activities (Figure 6.4-2). The Assessment Footprint allows for an area of disturbance beyond the anticipated Project Footprint to allow for minor adjustments in the realized footprint disturbances between completion of the EA and ground disturbance during physical activities related to Project development. At the mine site, the boundary extends to the height of land or to the nearest sub-watershed boundary (e.g. East Lake) around Project infrastructure. In certain areas other physical features were also used to define the Assessment Footprint when they were considered to be the limit of the potential effects of the Project such as natural terrain features, buffers from infrastructure (minimum of 100 m) and geology.
- Local study area (LSA) is defined as the Project footprint and surrounding area within which there is a reasonable potential for immediate direct and indirect effects on a specific intermediate component or receptor VC due to an interaction with a Project component(s) or activities.
- Regional study area (RSA) is defined as the spatial area within which direct and indirect effects are anticipated to occur.

Temporal Boundaries

The potential effects of the Project will change over time, depending on the activities that occur during each phase of the Project. Temporal boundaries are the time periods considered in the assessment. Each assessment chapter of the Application/EIS presents the temporal boundaries for each intermediate component and receptor VC, as well as the rationale for boundary selection. Potential effects will be considered for each phase of the Project (where relevant), which are:

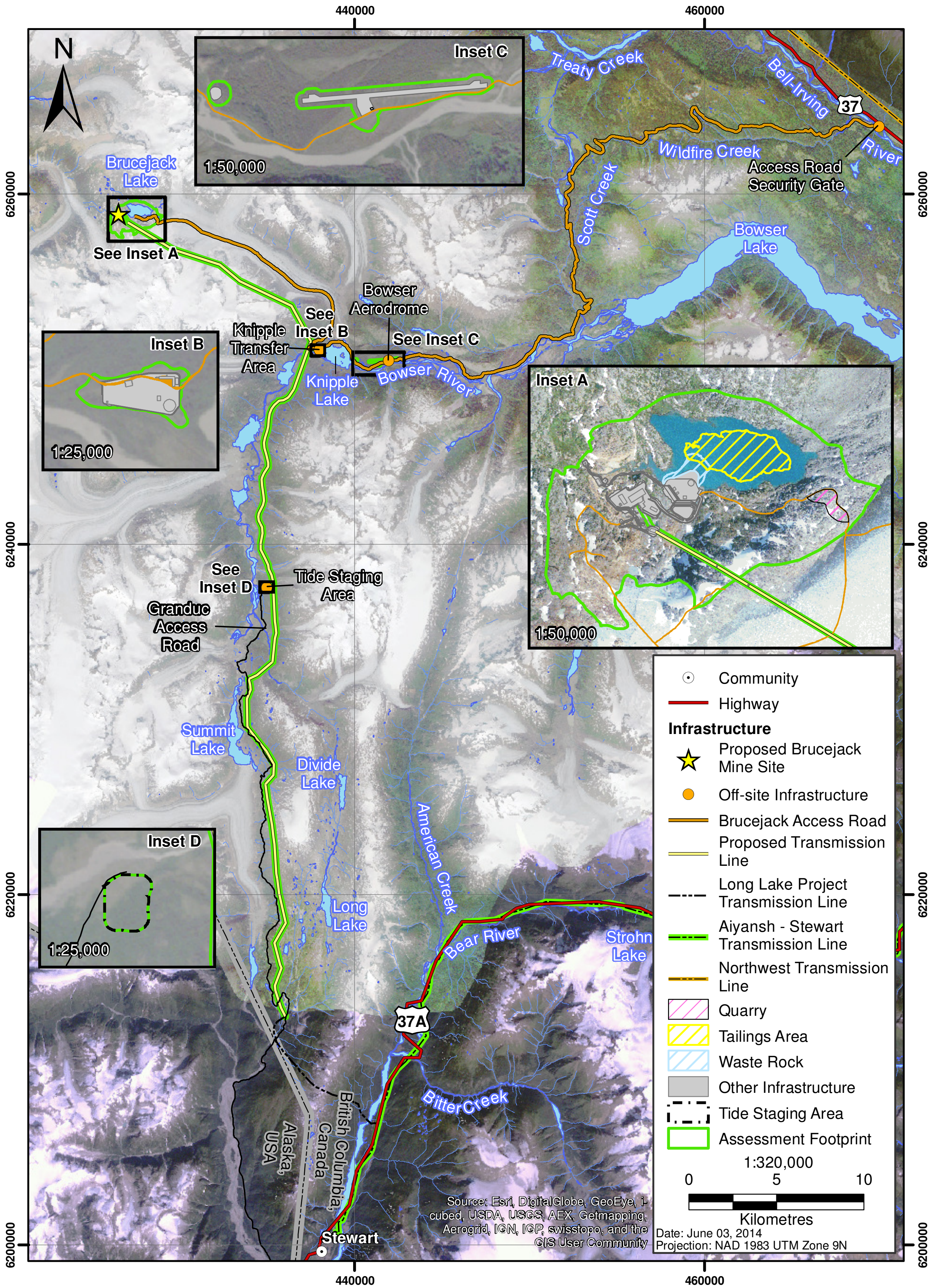
- Construction phase: 2 years;
- Operation phase: 22 years;
- Closure phase: 2 years; and
- Post-closure phase: minimum of 3 years.

The most recent feasibility study report from June 2014 (Appendix 5-A) describes an 18 year Operation phase, while an earlier feasibility study (Tetra Tech 2013a) had identified a 22 year Operation phase. For the purposes of this environmental assessment, an Operation phase of 22 years has been used as this is expected to provide, overall, a more conservative effects assessment associated with greater waste rock and tailings production and longer period of active disturbance prior to reclamation activities.

The temporal boundaries were then refined, where appropriate, in relation to planned activities over the lifetime of the Project, within which a reasonable expectation of interaction with an intermediate component or receptor VC can be predicted. These boundaries were adjusted as appropriate to reflect seasonal variations or life-cycle requirements of biological receptors, or forecasted trends in social, economic, health or heritage receptors. In some cases, effects were assessed or predictions modelled only for those phases of the Project where predicted effects would be expected to peak (e.g., the majority of air quality emissions occur only during the Construction and Operation phases).

Outside of these temporal boundaries, the Project is expected to have negligible potential effects.

Figure 6.4-2
Brucejack Gold Mine Project: Project Infrastructure and Assessment Footprint



Administrative Boundaries

Administrative boundaries arise when jurisdictional (i.e., political) issues, or time and money constraints impact the scientific process of identifying Project effects. These boundaries may include existing datasets collected on the basis of regional or provincial boundaries that are not the same as the spatial boundaries of the selected intermediate components or receptor VCs. Other examples of administrative boundaries include confidentiality associated with sensitive cultural sites or archaeological remains, or newly imposed policy requirements on the EA process itself (e.g., timelines).

Administrative boundaries may not apply to every intermediate component or receptor VC. However, where administrative boundaries may affect the identification and/or assessment of potential effects, the nature of the administrative boundaries and their effect on the assessment are included and described in the relevant assessment chapter.

Technical Boundaries

Technical boundaries limit the ability to sample the environment (e.g., a legal restriction prohibiting the sampling of Species at Risk), and, thereby limit the ability to predict or measure change. Sampling may be compromised when dealing with large geographical settings, or widely dispersed species. Elusive or sensitive species may only practically be sampled by proxy (i.e., the existence of suitable and/or potential habitat), rather than by actual measurement. Each assessment chapter documents technical boundaries, and how they affect the EA process and ability to identify Project effects.

Technical boundaries may not apply to every intermediate component or receptor VC. However, where technical boundaries may affect the identification and/or assessment of potential effects, the nature of the technical boundaries and their effect on the assessment are included in the relevant assessment chapter.

6.4.3 Identifying Potential Effects

An important step in the assessment process is to determine how the selected intermediate components and receptor VCs may be affected by the Project. An evaluation by Project phase (i.e., Construction, Operation, Closure and Reclamation, and Post-closure) is completed in each assessment chapter that addresses the following questions:

- What are the types of effects that result from the interaction of the Project's components and activities with intermediate components and receptor VCs?
- Over what assessment boundaries (spatial and temporal) are these effects anticipated to occur?

The description of these linkages will include, where relevant, direct, indirect, and induced effects. A direct effect is an effect that results from a direct interaction between the Project and an environmental, social, economic, heritage, or health component. Direct effects result from specific Project interactions with intermediate components and receptor VCs throughout the project footprint and LSA, including the Mine Site, use of the access road, and transmission line corridor. Indirect effects are the result of direct effects of the Project that lead to other effects (i.e., increase in the consumption of goods and services). Induced effects are the effects that result from other activities (which are not part of the Project) that happen as a consequence of the Project, such as an increase in household income leading to altered spending habits which result in changes to retail sales). Depending on the nature of the effect, potential effects may be felt at multiple spatial scales.

Cause-effect pathways or linkages between intermediate components and receptor VCs will also be identified and a figure showing the interaction will be provided. Only effects related to planned events are discussed here; effects related to unplanned events (e.g., spills, traffic accidents) are discussed in Chapter 31, Environmental Effects of Accidents and Malfunctions.

For Predictive Study intermediate components, this section will focus on identifying key potential effects using the approach discussed and shown in Section 6.5.1 below.

6.5 EFFECTS ASSESSMENT AND MITIGATION

Each assessment chapter provides a detailed discussion of the key potential effects arising from the Project components and activities, as well as discussion and evaluation of mitigation measures that will be taken to reduce the potential for significant adverse effects arising from the Project.

6.5.1 Identifying Key Effects

Each assessment chapter will identify and discuss the components and activities from the Project on selected components; this analysis will be based on the results of the baseline studies (i.e., the conditions of the existing environment), the issues or concerns raised during the EA pre-application phase and through consultation activities, scientific knowledge, and past experience on other mining projects (particularly in northwest BC).

The evaluation of the strength of interaction considers any embedded controls (i.e., physical or procedural controls that are already planned as part of the Project design, regardless of the results of the EA Process). An example of an embedded control is a standard acoustic enclosure that is designed to be installed around a piece of major equipment. This avoids the situation where an effect is assigned a magnitude based on a hypothetical version of the Project that considers none of the embedded controls.

To focus the assessment and reveal key interactions that have greater potential to result in significant adverse residual effects, or to be of particular concern to government, Aboriginal groups, or the public, an impact matrix approach is used, for some subject areas where such a visual graphic was considered to be useful, to identify and rank Project-Component interactions (see Table 6.5-1). To populate the impact matrix, the following questions or criteria were screened for each intermediate component or receptor VC:

- Based on the information available, is there potential for a serious adverse residual effect, even with available mitigation?
- Does the component pertain to Aboriginal interests, including claimed or proven rights and title, and Treaty rights?
- Does the component reflect a legislative or regulatory requirement or government management priority (e.g., species of conservation concern)?
- Is there potential for serious adverse cumulative effects?
- Is the component itself, or the potential effect, of particular concern to the public, Aboriginal groups, or the government?
- Is the component particularly sensitive or vulnerable to disturbance?

The interactions were then ranked as follows:

- Blank — no interaction anticipated.
- Green — negligible to minor adverse effect expected; implementation of best practices, standard mitigation and management measures; effects are well-understood and well-regulated, and may be managed under another government process; no monitoring required, no further consideration warranted. Effects ranked as such may be readily addressed through the implementation of proven effective mitigation measures or Best Management Practices (BMPs).

Effects identified as negligible to minor and the mitigation measures to address these effects will be very briefly discussed, but **will not be carried forward in the assessment**.

- Yellow – potential for moderate adverse effect requiring unique active management/monitoring/ mitigation; warrants further consideration and **will be carried forward in the assessment.**
- Red – key interaction resulting in potential significant major adverse effect or significant concern; warrants further consideration and **will be carried forward in the assessment.**

Supporting rationale for assigned rankings is provided in each assessment chapter.

For those interactions marked yellow or red in Table 6.5-1 (i.e., are being carried forward in the assessment), the effects assessment applies best practice methods to predict the nature and extent of effects that may result from the Project. For subject areas that did not utilize the above approach to determine key potential interactions, the justification for this decision is provided within the individual chapter text as well as a description of the methodology used to determine these key interactions.

Table 6.5-1. Example of Ranking Potential Effects on Intermediate Components or Receptor Valued Components

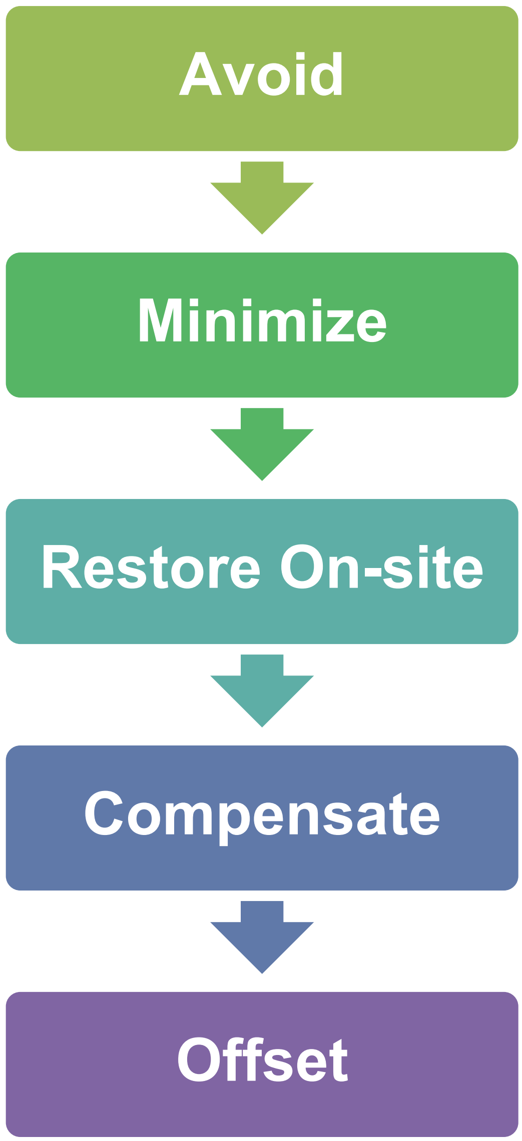
Project Components/ Physical Activities	**<Subject Area> and/or <Sub-Components>**						
	Effect 1	**Effect 2**	**Effect 3**	**Effect 4**	**Effect 5**	**Effect 6**	**Effect 7**
Construction							
Project component/Activity 1	● (green)	● (green)	○	● (green)	● (yellow)		
Project component/Activity 2	● (red)	○	● (yellow)	● (red)		● (yellow)	
Operation							
Project Component/Activity 5		● (red)	● (red)	● (red)	● (yellow)	● (yellow)	
Project Component/Activity 6		● (yellow)	● (yellow)	● (yellow)			
Closure							
Project Activity 7	● (green)	● (green)		● (green)			
Project Activity 8	● (yellow)		● (yellow)	● (yellow)		● (yellow)	
Post-Closure							

Notes:
○ = No interaction anticipated.
● (green) = Negligible to minor adverse effect expected; implementation of best practices, standard mitigation and management measures; no monitoring required, no further consideration warranted.
● (yellow) = Potential moderate adverse effect requiring unique active management/monitoring/mitigation; warrants further consideration.
● (red) = Key interaction resulting in potential significant major adverse effect or significant concern; warrants further consideration.

6.5.2 Implementing Mitigation Measures

Each assessment chapter of the Application/EIS discusses the availability and implementation of mitigation measures to avoid, minimize, control, restore on-site, compensate, or offset adverse effects to intermediate components or receptor VCs. A mitigation hierarchy is followed as described in the BC Ministry of Environment's *Guidelines for the Selection of Valued Components and Assessment of Potential Effects* (2013a) and is presented in Figure 6.5-1. Note that decisions regarding the need for and scope of mitigation, including compensation and offset, does not pre-suppose the outcome of the effects assessment.

ERM



Key approaches to applying the hierarchy to mitigate potential effects include:

- **Optimizing Alternatives**: Preventing or reducing adverse effects by changing an aspect of the Project (e.g., choosing a new access route).
- **Design Changes**: Preventing or reducing adverse effects by redesigning aspects of the Project (e.g., changing the routing of the transmission line), or changing the timing of an activity (e.g., minimizing or prohibiting road usage during key migration periods).
- **Best Achievable Control Technology (BACT):** Eliminating, minimizing, controlling, or reducing adverse effects through the use of technological applications (e.g., sludge water treatment plants).
- **Management Practices**: Eliminating, minimizing, controlling, or reducing adverse effects on intermediate components or receptor VCs through management practices (e.g., watering unpaved roads to control dust).
- **Restoration**: Restoration focuses on establishing appropriate composition, structure, pattern, and ecological processes necessary to make systems sustainable, resilient, and healthy under current and future conditions. Restoration is different from avoiding and minimizing residual effects because it can be implemented at a later date.
- **Compensation**: Offsetting remaining effects that cannot be prevented or reduced through remedial or compensatory actions, so that the net effect on the community or ecosystem is neutral or beneficial (e.g., enhancement of similar habitat in another area, enhancement of other social/economic/cultural benefits).

Proposed mitigation and monitoring activities for each assessment subject area is described in the applicable sections of the Application/EIS, and compiled into discrete subject area Environmental Management Plans (EMPs). Each EMP applies a systematic approach for integrating Project-specific mitigation and monitoring activities throughout the life cycle of the Project (i.e., into each Project phase).

The EMPs that will be required include:

- Air Quality Management Plan;
- Aquatics Effects Monitoring Plan;
- Avalanche Management Plan;
- Ecosystem Management Plan;
- Emergency Response Plan;
- Hazardous Materials Management Plan;
- Heritage Management Plan;
- Invasive Plants Management Plan;
- ML/ARD Management Plan;
- Noise Management Plan;
- Rare Plant Management Plan;
- Soil Management Plan;
- Spill Prevention and Response Plan;
- Tailings Management Plan;

- Transportation and Access Management Plan;
- Waste Management Plan;
- Waste Rock Management Plan;
- Water Management Plan;
- Wetlands Monitoring Plan; and
- Wildlife Management and Monitoring Plan.

If the proposed implementation controls and mitigation measure(s) are not sufficient to eliminate an effect, a residual effect is identified. Residual effects on receptor VCs will be carried through to a significance determination exercise (Section 6.6). Predicted changes to intermediate components will be characterized and pathways to receptor VCs will be discussed.

6.6 RESIDUAL EFFECTS

Predicted changes or residual effects are those adverse effects remaining after the implementation of all mitigation measures, and are therefore the potential consequences of the Project on the intermediate components or receptor VCs. Each assessment chapter of the Application/EIS describes direct, indirect and/or induced residual effects of the Project as applicable.

6.6.1 Residual Effects Remaining After Mitigation

For each residual effect that is identified, the Application/EIS makes use of standard ecological risk assessment frameworks that categorize the levels of detail and quality of the data required for the effects assessment. These frameworks generally include the following tiers of information requirements (CEA Agency 2013a):

- **Tier 1**: Qualitative (expert opinion, including traditional and local knowledge, literature review, and existing site information, if available);
- **Tier 2:** Semi-quantitative (measured site-specific data and existing site information); and
- **Tier 3**: Quantitative (recent field surveys and detailed quantitative methods, e.g., predictive modeling).

Following the BC EAO's *Guideline for the Selection of Valued Components and Assessment of Potential Effects* (BC EAO 2013a), residual effects will only be assessed qualitatively if a quantitative assessment is not possible. Where quantitative analyses are not possible, a rationale will be provided.

A detailed assessment was undertaken for each identified residual effect to support a determination of significance for the predicted effect. Residual effects were analyzed using best practice methods to predict the nature and extent of effects that could result from the Project. These methods are described in each assessment chapter. For each intermediate component or receptor VC, the assessment chapter includes any relevant references, analyses, and explanations that define:

- how scientific, engineering, community and Aboriginal knowledge were used in the assessment;
- which studies included the assistance of communities and individuals and who was involved (if the information can be made public);
- data collection methods and limitations;

- model assumptions and study methodologies, including statistical analysis or mathematical modeling;
- study and model outputs, calculations, supporting analyses, and an explanation of results; and
- reference literature or other information sources for any contributions, including traditional knowledge.

A summary of residual effects or predicted changes is provided for each assessment category using the format shown in Table 6.6-1.

Table 6.6-1. Summary of Residual Effects / Predicted Changes after Mitigation

Sub-component	Project Phase[1] (Timing of Effect)	Project Component / Physical Activity	Description of Cause-Effect	Description of Mitigation Measure(s)	Description of Residual Effect

[1] *Project phases are Construction, Operation, Closure, and Post-closure*

6.7 CHARACTERIZING RESIDUAL EFFECTS, LIKELIHOOD, SIGNIFICANCE, AND CONFIDENCE

After the residual effects have been analyzed, they need to be characterized using a standard set of criteria, which are used to support a determination of significance. An assessment of probability of the residual effect occurring is also made but is not considered when evaluating the significance of an effect. Confidence in the outcomes or conclusions of the effects assessment is also evaluated.

6.7.1 Characterizing Residual Effects

Residual effects to receptor VCs are described using the attributes defined below. Any modifications to these characterization criteria are discussed in the relevant Application/EIS chapter. Each assessment chapter describes individual ranking criteria pertaining to a particular effect, and where possible, assigns and rationalizes quantitative levels or values (e.g., threshold values).

- **Magnitude:** This refers to the expected magnitude or severity of the residual effect. The corresponding significance levels are defined as:
  - *Low*: differing from the average value for baseline conditions to a small degree, but within the range of natural variation and well below a guideline or threshold value;
  - *Moderate*: differing from the average value for baseline conditions and approaching the limits of natural variation, but below or equal to a guideline or threshold value; or
  - *High*: differing from baseline conditions and exceeding guideline or threshold values so that there will be a detectable change beyond the range of natural variation (i.e., change of state from baseline conditions).
- **Geographic Extent**: This refers to the spatial scale over which the residual effect is expected to occur, and includes:
  - *Local*: an effect is limited to the Project footprint;

    - *Landscape*: an effect extends beyond the Project footprint to a broader area;
    - *Regional*: an effect extends across the regional study area; or
    - *Beyond Regional*: an effect that extends possibly across or beyond the province of BC.

- The corresponding **geographic extent** definitions for social, economic, and health receptors are:
    - *Individual/Household*: an effect limited to individuals, families and/or households;
    - *Community*: an effect extending to the community level;
    - *Regional/Aboriginal peoples*: an effect extending across the broader regional community or economy, or an effect extending to one or more Aboriginal groups; or
    - *Beyond Regional*: an effect extending possibly across or beyond the province.
- **Duration:** This refers to the length of time the effect lasts; the duration of an effect can be:
    - *Short-term*: an effect that lasts approximately 1 to 5 years;
    - *Medium-term*: an effect that lasts between 6 to 25 years;
    - *Long-term*: an effect that lasts between 26 and 50 years; or
    - *Far Future*: an effect that lasts more than 50 years.
- **Frequency:** This refers to how often the effect occurs; the frequency of an effect is defined as:
    - *Once:* an effect that occurs once during any phase of the Project;
    - *Sporadic*: an effect that occurs at sporadic or intermittent intervals during any phase of the Project;
    - *Regular*: an effect that occurs regularly during any phase of the Project; or
    - *Continuous*: an effect that occurs constantly during any phase of the Project.
- **Reversibility:** This refers to the degree to which the effect is reversible and is classified as:
    - *Reversible Short-Term*: an effect that can be reversed relatively quickly;
    - *Reversible Long-Term*: an effect that can be reversed after many years; or
    - *Irreversible*: an effect cannot be reversed (i.e., is permanent).
- **Resiliency**: This refers to the capacity of an intermediate component or receptor VC to resist or recover from major changes in structure and function following disturbances, without undergoing a shift to a vastly different regime that is very difficult to reverse. The classes for resiliency are:
    - *Low*: the component is considered to be of low resiliency following disturbances;
    - *Moderate*: the component is considered to be moderately resilient following disturbances; or
    - *High*: the component is considered to be highly resilient following disturbances.
- **Ecological or Social Context:** This refers to the current condition of the intermediate component or receptor VC and its sensitivity. For example, an effect may have more of an impact in an area that is ecologically sensitive or a greenfield site, rather than a disturbed or brownfield location. The corresponding levels are defined as:
    - *Low*: the component is considered to have little to no unique attributes;
    - *Neutral*: the component is considered to have some unique attributes; and
    - *High*: the component is considered to be unique.

6.7.2 Likelihood of Residual Effects

Following recent guidance (September 9, 2013) from BC EAO (2013a), likelihood of residual effects is recommended to be assessed prior to the determination of significance. This differs to the approach recommended by CEAA (CEA Agency 1994), which evaluates probability following determination of significance. While this Application/EIS follows the most recent guidance from BC EAO, in order to maintain currency for both EAO and CEAA approaches, likelihood has not been considered in the determination of significance. Significance was assessed for all residual effects assuming that they *would* occur and does not assume a lower level of significance purely based on probability of occurrence; this approach provides an objective consideration of significance and is consistent with CEAA (1994).

The likelihood of a residual effect occurring is expressed as a probability, to determine the potential for the Project to cause a residual effect. Probability is determined according to the attributes identified below.

Probability: This refers to the likelihood that an adverse effect will occur in circumstances where it is not certain that the effect will materialize and is classified as:

- *Low*: an effect that is unlikely, but could occur;
- *Medium*: an effect that is likely, but may not occur; or
- *High*: an effect that is highly likely to occur.

Narrative descriptions and justifications for the likelihood (probability) assessment are provided along with the valuation of these attributes in each of the chapters within the Application/EIS.

6.7.3 Significance of Residual Effects

The CEA Agency's (1994) *Determining Whether a Project is Likely to Cause Significant Adverse Environmental Effects* was used as guidance in evaluating the significance of the adverse residual effects for the Project. The significance of residual effects of the Project is founded on a comparison of the current receptor VC if the Project does not proceed, with the predicted state of the receptor VC if the Project proceeds, after mitigation measures described in Section 6.5.2 are applied.

To assess the significance of a residual effect, the Application/EIS relies on detailed information including statistical analysis or mathematical modelling, including predictive model results from the predictive studies on intermediate components. Where data is lacking, professional judgment has been used to support the assessment.

When defining and evaluating the ultimate significance of a residual effect, each assessment chapter in the Application/EIS defines how significance is determined. Where available, thresholds were used (e.g., aquatic life receiving environment criteria, ambient air criteria, or land and resource management planning objectives) to assist with the determination of significance. Each assessment chapter defines thresholds of significance as well as the source literature for those thresholds.

The significance of effects will be ranked according to the two categories described below. Each assessment chapter clearly defines how the terms "significant" and "not significant" were considered in relation to each receptor VC, and provides a detailed rationale for the significance determination, following the general terms defined below.

- **Not significant**: Residual effects have low or moderate magnitude, local to regional geographic extent, short- or medium-term duration, could occur at any frequency, and are reversible in either the short or long-term. The effects on the receptor VC (e.g., at a species or local population level) are either indistinguishable from background conditions (i.e., occur within the range of natural variation as influenced by physical, chemical, and biological processes), or distinguishable at the individual level. Land and resource management plan objectives will likely be met, but some management objectives may be impaired. There is a medium to high level of confidence in the analyses. Follow up monitoring of these effects may be required if the magnitude is medium.

- **Significant**: Residual effects have high magnitude; have regional or beyond regional geographic extent; duration is long-term or far future; and occur at all frequencies. Residual effects on receptor VCs are consequential (i.e., structural and functional changes in populations, communities, and ecosystems are predicted) and are irreversible. The ability to meet land and resource management plan objectives is impaired. Confidence in the conclusions can be high, medium, or low.

6.7.4 Confidence in and Risk of Residual Effects

6.7.4.1 Characterizing Confidence

Confidence, which can also be understood as the degree of scientific certainty, is a measure of how well residual effects are understood. Confidence includes a consideration of the acceptability of the data inputs and analytical methods used to predict and assess Project effects. It depends on the certainty of the predicted outcome, and it allows the decision-maker to evaluate risk associated with the Project. Confidence levels are defined as:

- *Low* (less than 50% confidence): The cause-effect relationship(s) between the Project and its interaction with the environment is poorly understood and/or data for the Project area or scientific analyses are incomplete, leading to a high degree of uncertainty;
- *Medium* (50 to 80% confidence): The cause-effect relationship(s) between the Project and its interaction with the environment is not fully understood, and/or data for the Project area or scientific analyses are incomplete, leading to a moderate degree of uncertainty; or
- *High* (greater than 80% confidence): The cause-effect relationship(s) between the Project and its interaction with the environment is well understood, and/or data for the Project area or scientific analyses are complete, leading to a low degree of uncertainty.

6.7.4.2 Risk Assessment

The Application/EIS includes a risk assessment for those receptor VCs where residual effects are identified as significant, or for where there is a high level of uncertainty in the conclusions or outcomes of the assessment. For example, if the uncertainty associated with the characterization of a residual effect is of sufficient degree that the significance of the residual effect could change if the characterization is wrong, or if the consequence of an unintentional project-related event (e.g., mitigation failure) could result in a significant adverse effect, additional detailed consideration of possible outcomes in terms of likelihood and consequence may be warranted.

The need for more detailed risk analysis is determined in consultation with the EAO and the Agency. Circumstances that may trigger the need for more detailed risk analysis may include a low to moderate degree of confidence coupled with predicted severity of the effect (i.e., those effects falling into the orange or red risk category). The following issues were also taken into consideration:

- substantial gaps in data pertaining to the receptor VC;
- residual effects on a highly sensitive receptor VC (e.g., a rare species);
- reliance on unproven mitigation;
- absence of, or conflicting, scientific evidence regarding the potential outcomes of impacts and their behavior in the environment (e.g., toxicity thresholds);
- potential for significant adverse effect arising from a plausible unintentional project-related event; or
- potential for legal liability.

If more detailed risk analysis is deemed to be necessary given a consideration of the above factors, the risk assessment identifies and evaluates the range of likely, plausible, and possible outcomes in terms of potential significance and likelihood. A discussion on the need for and scope of follow-up monitoring to address uncertainty associated with residual effects is provided where necessary.

Residual effects and their characterization criteria, significance determination, likelihood, and confidence evaluations will be summarized for each assessment chapter using the format shown in Table 6.7-1.

6.7.4.3 Follow-up Program

Where a risk assessment identified a moderate to major risk of significant residual effects, follow-up programs are discussed as required. The purpose of follow-up programs is to describe any proposed strategies that are specifically targeted at addressing significant residual effects. Where applicable the chapters describe any proposed measures including monitoring of effects or evaluation of mitigation measures to adjust management strategies over the course of the project. Where required adaptive management strategies are discussed to apply in the event that original predictions of effects and mitigation effectiveness are not as expected.

6.8 SUMMARY OF RESIDUAL EFFECTS AND SIGNIFICANCE

The assessment of residual effects and their significance are summarized for each assessment category, using the format presented in Table 6.8-1.

A similar format is used to summarize predicted changes on intermediate components and a discussion identifying linkages with receptor VCs is provided.

6.9 CUMULATIVE EFFECTS ASSESSMENT

The potential for cumulative effects arises when the residual effects of a project affect (i.e., overlap and interact with) the same resource/receptor that is affected by the residual effects of other historic, existing or reasonably foreseeable future projects or activities. The cumulative effects assessment considers the potential environmental, economic, health, social, and heritage cumulative effects of the Project according to the requirements of the EAO and CEA Agency (as described in the AIR and EIS Guidelines).

The following documents are used to guide the cumulative effects assessment, where applicable:

- *BC EAO User Guide* (BC EAO 2010a) for a cumulative effect assessment;
- *Guidelines for the Selection of Valued Components and Assessment of Potential Effects* (BC EAO 2013a);
- Operational Policy Statement: Addressing Cumulative Environmental Effects under the Canadian Environmental Assessment Act, 2012 (CEA Agency 2013b);
- *Cumulative Effects Assessment Practitioners' Guide* (Hegmann et al. 1999);
- *A Reference Guide for the Canadian Environmental Assessment Act: Determining Whether a Project is Likely to Cause Significant Adverse Environmental Effects* (Federal Environmental Assessment Review Office 1994); and
- *A Reference Guide for the Canadian Environmental Assessment Act: Assessing Environmental Effects on Physical and Cultural Resources* (Federal Environmental Assessment Review Office 1994).

Table 6.7-1. Characterization of Residual Effects, Likelihood, Significance, and Confidence

Residual Effects	Evaluation Criteria									
	Magnitude *(minor, moderate, major)*	**Duration** *(short, medium, long, far future)*	**Frequency** *(once, sporadic, regular, continuous)*	**Geographic Extent** *(local, landscape, regional, beyond regional)*	**Reversibility** *(reversible short-term; reversible long-term; irreversible)*	**Resiliency** *(low, neutral, high)*	**Context** *(low, neutral, high)*	**Likelihood** *(low, medium, high)*	**Significance of Adverse Residual Effects** *(not significant; significant)*	**Confidence** *(low, medium, high)*

Table 6.8-1. Summary of Residual Effects, Mitigation, and Significance

Residual Effects	Project Phase(s)	Mitigation Measures	Significance

The cumulative effects assessment methodology for each selected intermediate component and receptor VC generally follows the steps laid out below (Figure 6.9-1):

- scoping;
- analysis;
- identification of mitigation measures;
- identification of residual cumulative effects;
- determination of significance;
- risk assessment; and
- follow-up.

6.9.1 Types of Cumulative Effects

Cumulative effects can manifest through a number of cause-effect pathways, including:

- **Physical-chemical transport**. A physical or chemical constituent is transported away from the action under review where it then interacts with another action (e.g., air emissions, waste water effluent, sediment).
- **Nibbling loss**. The gradual disturbance and loss of land and habitat (e.g., clearing of land for new roads into a forested area).
- **Spatial or temporal crowding**. Cumulative effects can occur when there are too many projects or activities within an area in too brief a period of time. A threshold may be exceeded and the environment may not be able to recover to pre-disturbance conditions. This can occur quickly or gradually over a long period of time before the effects become apparent. Spatial crowding results in an overlap of effects among actions (e.g., noise from a highway near multiple mines). Temporal crowding may occur if effects from different actions overlap or occur before a VC has had time to recover.
- **Growth-inducing potential**. Each new action can stimulate further actions to occur. The effects of these "spin-off" actions (e.g., increased vehicle access into a previously remote area lacking roads) may add to the cumulative effects already occurring in the vicinity of the proposed action, creating a "feedback" effect. Such actions may be considered "reasonably-foreseeable actions."

Interacting projects and activities may combine to create additive, synergistic or induced effects. An additive effect increases the effect in a linear way (e.g., two projects both remove foraging habitat for the same moose population). A synergistic effect may result in an effect greater than the sum of the two actions (e.g., two projects remove escape habitat for mountain goat, shifting their foraging activities to an area where they are susceptible to increased predation). An induced effect may result when an effect stimulates another effect (e.g., construction of road access can stimulate "tie-in" roads for forestry or other projects which may result in additional environmental effects).

6.9.2 Projects and Activities Considered

Past, present, and reasonably foreseeable future projects and activities that overlap spatially or temporally and have the potential to interact with the Project were considered in the cumulative effects assessment. Table 6.9-1 presents information on the past, present and reasonably foreseeable future projects with the potential to interact with the Project. The past, present and reasonably foreseeable future activities are presented separately in Table 6.9-2. These tables have been considered for each of the intermediate components and Receptor VC cumulative effects assessments. Figure 6.9-2 shows the spatial relationship between the Project and all past, present, and reasonably foreseeable future projects and activities. A description of the project or activity, the operational period, and residual effects according to available information and professional judgment is provided in the subsequent sections.

Figure 6.9-1

Steps to Cumulative Effects Assessment

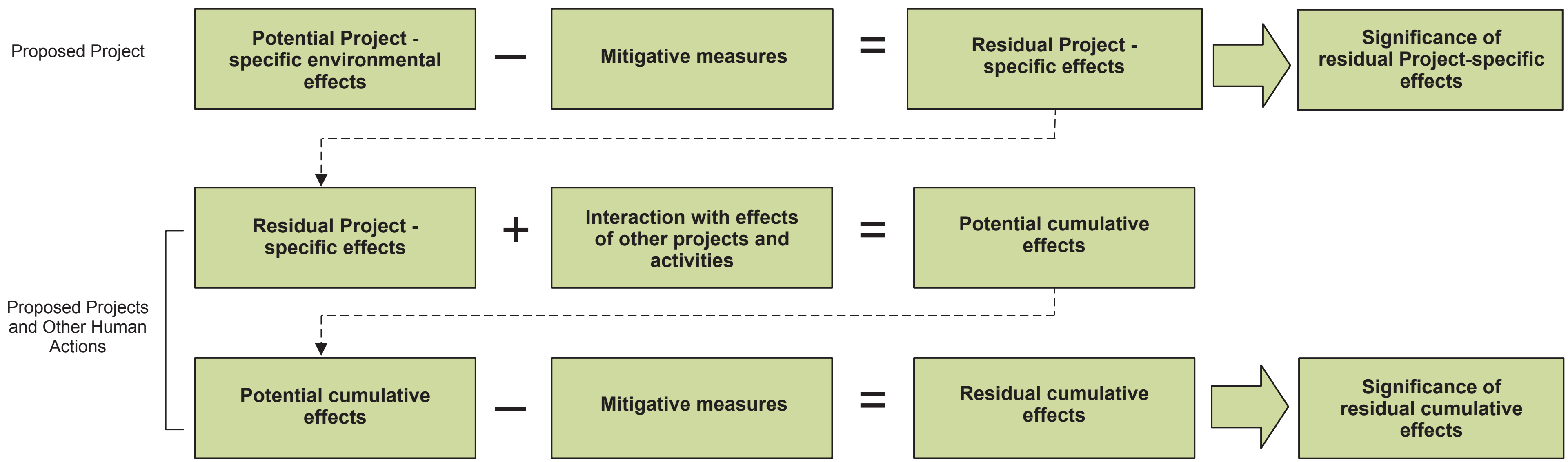


Table 6.9-1. Past, Present and Reasonably Foreseeable Future Projects with the Potential to Interact with the Brucejack Gold Mine Project

	Project Name	Development Type	Company / Organization	Location / Coordinates	Proximity to Project	Infrastructure	Operational Period	Current Regulatory Status
Past	Eskay Creek Mine	Underground mine	Barrick Gold Corporation	56° 39' N 130° 27' W	25 km	Underground works; waste rock and tailings storage in Albino Lake and Tom Mackay Lake; tailings pipeline and access road.	1995 to 2008	Post-closure restoration and monitoring
	Galore Creek Project - access road only	Access road	NovaGold	57° 5' N 131° 6' W	106 km	48-km access road	n/a	EA Certificate issued 2007
	Goldwedge Mine	Underground mine	Catear Resources Ltd.; ceased trading in 1990	56° 29' N 130° 12' W	2 km	Underground works; land and lake waste rock and tailings disposal.	1985 to 1989	Closed
	Granduc Mine	Underground mine	Newmont Mining Corporation Ltd. Esso Resources Canada	56° 12' N 130° 20' W	32 km	Underground works; tunnel; access road; 2,000-tpd mill; concentrator facility.	1971 to 1978 1980 to 1984	Closed; potential for redevelopment
	Johnny Mountain Mine	Underground mine	International Skyline Gold Corp.	56° 37' N 131° 04' W	56 km	Underground works; tailings impoundment; airstrip; road.	1988 to 1990 1993	Closed
	Kitsault Mine	Open pit mine	B.C. Molybdenum, a subsidiary of Kennco Exploration (Western) Ltd. from 1963 to 1972; Climax Molybdenum Company of British Columbia (CMC) and affiliates from 1973 to 1998	55° 25' N 129° 25' W	126 km	Open pit works; waste rock facilities; stockpiles; mill; concentrator; truck shop; haul roads.	1967 to 1972 1981 to 1982	Closed; reclamation completed in 2006; redevelopment being proposed by Avanti Mining Inc.
	Silbak Premier Mine	Open pit/ underground mine	Various companies from 1918 to1996; Westmin Resources Ltd. from 1998 to 1996	56° 03' N 130° 00' W	35 km	Open pit and underground workings; 2,000-tpd mill; buildings; cyanide plant; tailings pond.	1918 to 1953 1953 to 1996 1989 to 1996	Care and Maintenance since 1996; potential redevelopment may be proposed by Ascot Resources Ltd.
	Snip Mine	Mine	Cominco Ltd.; Homestake Canada Inc. (beginning in 1996); and acquired by Barrick Gold Corp. in 2001	56° 40' N 131° 06' W	56 km	Underground works; mill; tailings impoundment; ancillary facilities.	1991 to 1999	Closed and reclaimed in 1999

(continued)

Table 6.9-1. Past, Present and Reasonably Foreseeable Future Projects with the Potential to Interact with the Brucejack Gold Mine Project (continued)

	Project Name	Development Type	Company / Organization	Location / Coordinates	Proximity to Project	Infrastructure	Operational Period	Current Regulatory Status
Past (cont'd)	Snowfield Exploration Project	Exploration	Pretium Resources Inc.	56°28' N 130°11'W	7 km	Exploration access roads.	1980s to 2010	Exploration completed, no future activities proposed
	Sulphurets Advanced Exploration Project	Exploration; bulk sample	Newhawk Gold Mines Ltd.	56° 30' N 130° 12' W	0 km	Underground works; waste rock pad.	1986 to 1990	Care and maintenance since 1996; reclaimed in 1999
	Swamp Point Aggregate Mine	Open pit mine	Ascot Resources Ltd.	55° 28' N 130° 02' W	112 km	Sand and gravel pit; ship loading facility; lay down areas; haul roads.	Construction and operation between 2006 and 2008, closed in 2011	EA Certificate issued 2006; closed in 2011
Present	Brucejack Exploration and Bulk Sample Program	Exploration; bulk sample	Pretium Resources Inc.	56° 28' N 130° 11' W	0 km	Reactivation of Newhawk Gold Mines Inc. exploration access road and underground works.	2011-present	Exploration ongoing; Bulk Sample Program Completed
	Forrest Kerr Hydroelectric Power Facility	Hydro	AltaGas Renewable Energy Inc.	56°44' N 130°39' W	41 km	~37.3-km long transmission line, plant site, 8-km access road.	From mid-2014 for 60 years	Construction in progress
	Long Lake Hydroelectric Power Facility	Hydro	Regional Power/ Premier Power Corp	56° 6' N 129° 59' W	42 km	20-m high rock fill dam; 10-km 138-kV transmission line.	From mid-2013 for 80 years	Commenced operation in December 2013
	McLymont Creek Hydroelectric Power Facility	Hydro	AltaGas Renewable Energy Inc.	56° 41' N 130° 47' W	45 km	Access roads; powerhouse; 10-km transmission line.	From end of 2015 for 40 years	EA Certificate issued 2012; Construction in progress
	Northwest Transmission Line	Transmission Line	BC Hydro	Along Highway 37 from Terrace to Bob Quinn Lake	36 km	344-km 287-kV transmission line.	From mid-2014 for 50+ years	EA Certificate issued 2011; Construction in progress
	Red Chris Mine	Open pit mine	Imperial Metals Corp.	57° 42' N 129° 47' W	139 km	Open pit; process plant; waste rock dump; tailings pile; effluent treatment; 23-km access road; 30,000-tpd mill.	28-year mine life / 2014 to 2042	EA Certificate extended in 2010; Construction in progress

(continued)

Table 6.9-1. Past, Present and Reasonably Foreseeable Future Projects with the Potential to Interact with the Brucejack Gold Mine Project (continued)

	Project Name	Development Type	Company / Organization	Location / Coordinates	Proximity to Project	Infrastructure	Operational Period	Current Regulatory Status
Future	Arctos Anthracite Coal Project	Open pit mine	Fortune Coal Ltd.	between 57° 06' N and 57° 23' N; and 128°37' W and 129° 15' W	116 km	Four open pit areas; tailings storage facility; 150 km of new railway.	20-year mine life/ 2017 to 2037	Pre-application stage
	Bear River Gravel Project	Mine	Glacier Aggregates Inc.	55° 56' N 129° 38' W	63 km	Gravel extraction from the Bear River, expanded existing infrastructure; shipping.	20-year mine life / 2020 to 2045	No longer a requirement to complete an EA
	Bronson Slope Project	Open pit mine	Skyline Gold Corp.	56°39' N 131°05' W	60 km	Open pit mine, concentrator plant, tailings storage locations, access road, transmission line; waste storage; and plant site.	20-year mine life / 2019 to 2039	Withdrawn
	Coastal GasLink Pipeline Project	Pipeline	Coastal GasLink Pipeline Ltd.	Groundbirch to Kitimat 54° 1' N 128° 41' W	288 km	650-km long, 48-inch diameter natural gas pipeline; metering facilities, compressor stations, and possibly a natural gas liquid injection facility.	From 2018 for 30+ years	Pre-application stage
	Galore Creek Project	Open pit mine	Galore Creek Mining Corporation (NovaGold and Teck Resources)	57° 13' N 131° 26' W	106 km	Five open pits, waste rock facilities, process plant, 13-km conveyor tunnel, a 71-km slurry pipeline, and an 87-km access road.	18-year mine life / 2018 to 2036	Certified in 2007, re-drafting Project Description
	Granduc Copper-Mine	Underground mine	Castle Resources Inc.	56° 14' N 130° 20' W	32 km	New mill and Tailings Management Facility (TMF), upgrades to the existing 54-km haul road, a power transmission line, and ancillary facilities.	15-year mine life / 2016 to 2031	Not yet in Pre-application stage
	KSM Project	Open pit and Underground mine	Seabridge Gold Inc.	56° 33' N 130° 7' W	4 km	Open pit and underground works; ore processing facilities; TMF; water treatment plant and water storage; rock storage facilities; access roads; 23-km tunnel; transmission lines; hydro plants; permanent accommodations; and other ancillary facilities.	52.5-year mine life / 2020 to 2073	EA review stage

(continued)

Table 6.9-1. Past, Present and Reasonably Foreseeable Future Projects with the Potential to Interact with the Brucejack Gold Mine Project (continued)

	Project Name	Development Type	Company / Organization	Location / Coordinates	Proximity to Project	Infrastructure	Operational Period	Current Regulatory Status
Future (cont'd)	Kinskuch Hydroelectric Project	Hydro	Syntaris Power	55° 42' N 129° 19' W	102 km	40-km 138-kV transmission line.	50+ years	Pre-application stage
	Kitsault Mine	Open pit mine	Avanti Kitsault Mining Inc.	55º 25' N 129º 25' W	124 km	Kitsault Pit, a conveyor material handling system, ore stockpile, process plant and camp accommodations, and a TMF.	16-year mine life / 2016 to 2032	EA Certificate issued 2013
	Kutcho Project	Underground and open pit mine	Capstone Mining Corp.	58° 12' N 128° 22' W	223 km	Mostly underground works and some open pit works; underground backfill of tailings and waste.	12-year mine life / 2017 to 2029	Pre-application stage
	LNG Canada Export Terminal Project	LNG	LNG Canada Development Inc.	54° 1' N 128° 41' W	287 km	Natural gas liquefaction facility and marine terminal; supporting infrastructure and facilities.	25+ years / 2020 to 2045+	Pre-application stage
	Northern Gateway Pipeline Project	Pipeline	Enbridge Inc.	54° 1' N 128° 41' W	288 km	Two 1,172-km pipelines, a marine terminal, and associated facilities.	30+ years / 2017 to 2047	EA review stage (joint review panel)
	Prince Rupert Gas Transmission Project	Pipeline	Prince Rupert Gas Transmission Ltd.	54° 12' N 130° 17' W	252 km	750-km sweet natural gas pipeline; metering facilities; compressor stations; access roads; bridges.	40+ years / 2018 to 2058	Pre-application stage
	Prince Rupert LNG Project	LNG	Prince Rupert LNG Ltd.	54° 12' N 130° 18' W	251 km	Liquefied natural gas plant; port; shipping infrastructure.	30-60 years / 2021 to 2051	Pre-application stage
	Schaft Creek Project	Open pit mine	Copper Fox Metals Inc.	130° 58'N 57° W	111 km	Open pit, tailings/PAG waste rock storage facility, camp, and mill.	15-year mine life /2017 to 2032	Pre-application stage
	Spectra Energy Gas Pipeline Project	Pipeline	Spectra Energy Corp.	55° 43' N 126° 16' W	50 km	851 to 872-km pipeline(s); two metering stations; and up to five compressor stations.	2018 - undetermined	Pre-application stage
	Storie Moly Project	Open pit mine	Columbia Yukon Explorations	59°14' 30" N 129°51' 24" W	309 km	Use of existing infrastructure from the former Cassiar Mining camp; new open pit; waste rock and tailings storage facilities.	20-year mine life /2019 to 2039	Pre-application stage
	Treaty Creek Hydroelectric Project	Hydro	Northern Hydro Ltd.	Unknown	25 km	Intake, weir, penstock, powerhouse and tail race, transmission line, access road and laydown area(s).	2015 - undetermined	Unknown

(continued)

Table 6.9-1. Past, Present and Reasonably Foreseeable Future Projects with the Potential to Interact with the Brucejack Gold Mine Project (completed)

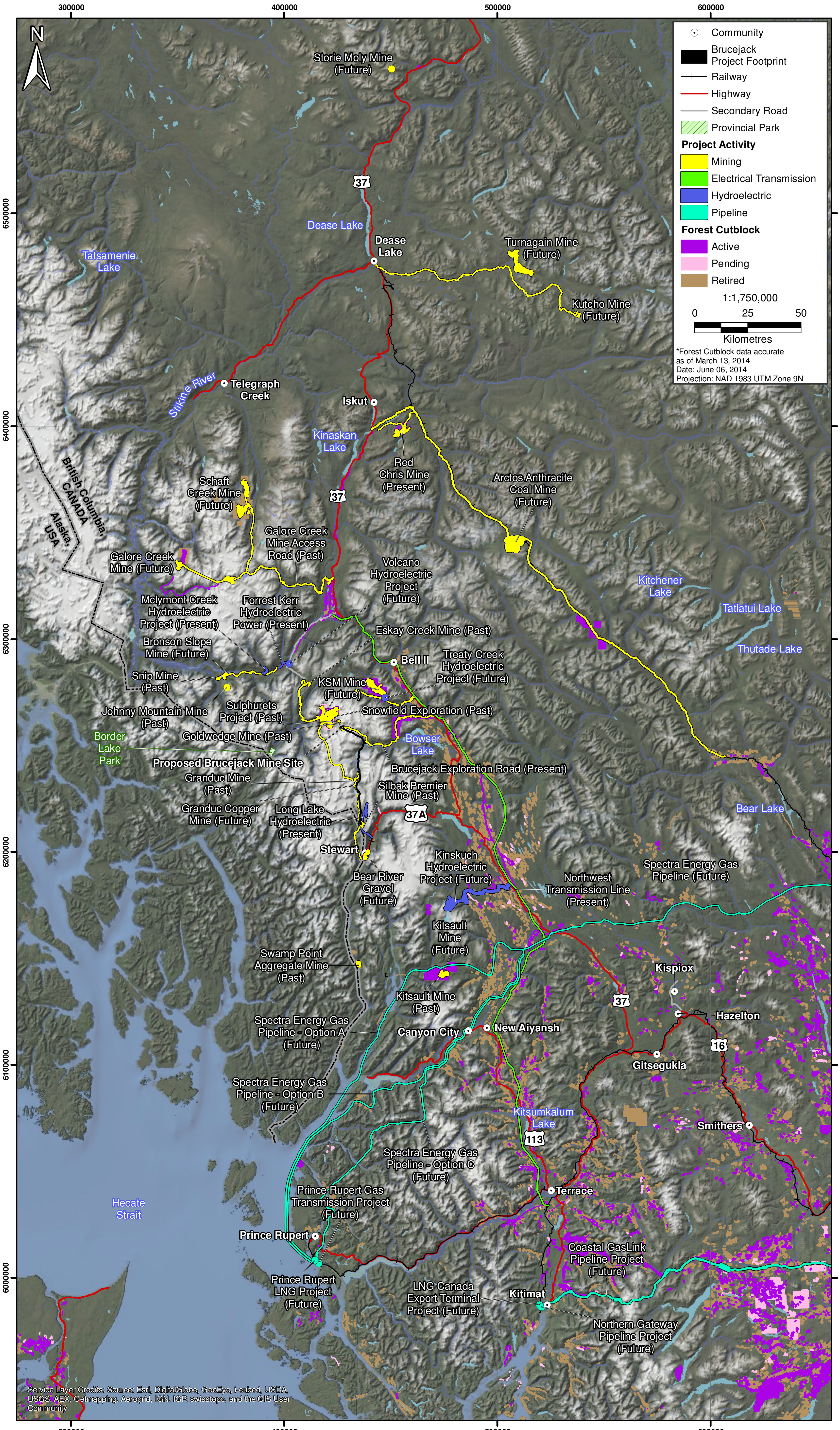
	Project Name	Development Type	Company / Organization	Location / Coordinates	Proximity to Project	Infrastructure	Operational Period	Current Regulatory Status
Future *(cont'd)*	Turnagain Project	Open pit mine	Hard Creek Nickel Corp.	58°30' N 128°45' W	235 km	Open pit; waste dumps; 23-km transmission line; process plant; mine service buildings; truck shop; explosives manufacturing facility; tailings and waste rock storage areas.	28-year mine life / 2017 to 2045	Not yet in Pre-application stage
	Volcano Creek Hydroelectric Project	Hydro	AltaGas Ltd.	56° 43' N 130° 35' W	38 km	2.35-km penstock, powerhouse, weir and water intake facilities, 1.2-km 287-kV transmission line interconnection, and short spur roads.	60+ years / 2015 - 2075	Feasibility Study in progress; EA not required

Table 6.9-2. Past, Present and Reasonably Foreseeable Future Activities with the Potential to Interact with the Brucejack Gold Mine Project

Activity Type	Land Users	Description
Parks and Protected Areas	Recreationists	There are four BC Parks facilities within 50 km of the Brucejack Mine Site, namely Bear Glacier, Border Lake, Lava Forks and Ningunsaw Provincial Parks. The continued conservation and recreational use of these parks is expected to remain unaffected by the proposed Project.
Guide outfitting	Three registered guide outfitting licences	In the past and currently, guide outfitting occurs mostly between late spring and early fall. This activity is expected to continue. Species targeted include black bear, grizzly bear, caribou, deer, moose, mountain sheep, mountain goat, and wolf.
Aboriginal harvest	Skii km Lax Ha, Nisg̲a'a Nation and Tahltan Nation	The traditional land use activities in the region include fishing, hunting, trapping and plant gathering, as carried out by Aboriginal groups in the greater area of the Project and collectively referred to as Aboriginal Harvest.
Hunting	BC residents	Four in-use Wildlife Management units (WMU) exist in the vicinity of the Project. Harvest levels and the number of hunters have fluctuated from year to year. These fluctuations are expected to continue.
Trapping	Six trapping licences	Three of the six traplines overlap the infrastructure of the proposed Project. One is leased and currently in use, another is inactive, and the third is owned by a member of the Ski km Lax Ha. Species harvested on the leased trapline include marten, squirrel, beaver, lynx, weasel, mink, otter, and wolverine. Trapping activities occur twice per year, once in the spring and once in the fall. This activity is expected to continue into the future.
Commercial recreation (including fishing)	Eight commercial recreation licences	Two of the eight licences overlap the proposed Project infrastructure. These licences include heliskiing, lodging, eco-tourism and fishing camps, guided freshwater recreation, guided backcountry expeditions, river rafting, a trapline cabin, angling, and other multiple use licenses. Activities occur during the winter and summer months and are expected to continue.
Forestry	Seven forest licences	The proposed Project overlaps the Cassier and Nass TSAs. There has been historical forest harvesting activities in the vicinity of the proposed Project, but there has been no recent logging activity in the Bob Quinn area. Two of the three licences overlap the proposed Project infrastructure. There is expected to be future forestry activity as a result of declining access costs.
Mineral exploration	Sixty-four entities holding mineral claims	Mineral exploration has occurred in the past and present and is expected to continue in the foreseeable future.
Agricultural Land Reserves	None	There are no known agricultural activities or Agricultural Land Reserves located near the proposed Project.
Oil and Gas	None	There are no known oil and gas tenures located near the proposed Project.
Transportation	Industrial, land users and general public	Transportation activities have occurred in the past and present and are expected to continue into the future. Transportation infrastructure in the vicinity of the proposed Project includes highways 37 and 37A, forest service roads, airstrips, and transmission lines.

Figure 6.9-2

Past, Present and Reasonably Foreseeable Projects with Potential to Interact with the Brucejack Gold Mine Project



Projects and activities considered in the cumulative effects assessment are identified as:

- past (closed) projects and activities within the cumulative effects assessment study areas;
- present (active and inactive) projects and activities within the cumulative effects assessment study areas; and
- reasonably foreseeable future projects (not hypothetical) and activities that are likely to occur within the cumulative effects assessment study areas.

Screening criteria were applied to determine whether projects and activities should be included or excluded from the cumulative effects assessment, including some or all of the following considerations:

- a project/activity is within an RSA;
- a project/activity is within zone of influence of Project effects;
- a project/activity is currently under some type of regulatory review;
- a project/activity is within or effects overlap with socio-economic influenced areas;
- specific nature of effect (i.e., present or potential impact on VC of local or regional concern);
- a project/activity has an effect on migratory species; and
- a high degree of confidence exists that the other project or activity would not interact with the residual effects of the Project.

For those projects and activities identified in Table 6.9-1 and Table 6.9-2, information provided in Sections 6.9.2.1 to 6.9.2.4 includes the following, where available:

- location, physical size (e.g., footprint, volume of process throughput, hydroelectric capacity), and spatial distribution of components;
- components (e.g., main plant, access roads, accommodation) and supporting infrastructure (e.g., waste treatment, powerlines);
- expected life or period of activity (including start date) and phasing involved (e.g., exploration, construction, standard operations, later plans for upgraded or expanded operations, decommissioning and abandonment);
- variations in seasonal operation (e.g., winter closures);
- number of permanent and temporary employees;
- frequency of use for intermittent activities;
- transportation routes and mode of transport (e.g., roads, railways, and traffic volume);
- process used (e.g., open pit mining);
- water use (withdrawals; groundwater wells);
- regulatory authorizations received (e.g., existing permits/licenses/approvals); and
- description and staging of EA process (if applicable).

6.9.2.1 Past Projects

Past industrial projects within the Brucejack Gold Mine Project cumulative effects assessment study areas are confined to mining and exploration activities. Mining projects within the CEA study areas that have been active since 1918 (the past temporal boundary) but are now closed are listed in Table 6.9-1. The project locations are shown in Figure 6.9-2 and summarized below.

Eskay Creek Mine

The historic Eskay Creek Mine was an underground gold-silver mine located approximately 80 km north of Stewart, BC. The closed mine is approximately 25 km from the Project site. Operation of the mine began in 1995 and required the construction of the Eskay Creek Mine Road. The mine was closed in the first quarter of 2008 (Murphy and Napier 1996). During decommissioning, restoration activities included removing buildings and infrastructure and re-vegetating some of the Project area. Restoration is continuing. The mine site will continue to be monitored (Rescan 2010).

Project Facts:

- **Production** – Approximately 750 tpd of ore was mined. (McGurk, Laundry, and MacGillvray 2005).
- **Project Lifespan** – The project was active for 13 years.
- **Footprint** – 27 ha of land was cleared at the mine site between 1998 and 2004, 9 ha of which were reclaimed by 2004 (Barrick Gold Corp. 2004).
- **Access** – Access to the mine site was via the Iskut Road (30 km) and the Eskay Creek Mine Road (30 km; Murphy and Napier 1996). These roads were built between 1991 and 1994 from Highway 37 along the Iskut River to Volcano Creek and up to the mine site.
- **Traffic Volume** – Between three and five loads (6 to 10 trips) per day along Highway 37 (Rescan 2006).
- **Tailings Storage** – Waste rock and tailings are stored under water. Between 1995 and 2001, they were discharged in Albino Lake. Beginning September 2001, tailings was discharged through a pipeline to Tom Mackay Lake (McGurk, Laundry, and MacGillvray 2005).
- **Water (inputs/outputs)** – As of 2008, water continued to flow from the waste rock impoundment (Albino Lake), the tailings impoundment (Tom MacKay Lake), and the mine site into Ketchum Creek and into the Unuk River (McGurk, Laundry, and MacGillvray 2005).
- **Employment** – At full capacity, the mine directly employed 350 people (Mineral Resources Education Program of BC 2009).

Galore Creek Project – Access Road Only

The Galore Creek Project is a proposed copper-gold-silver open-pit mine located approximately 106 km northwest of the proposed Brucejack Gold Mine Project (Rescan 2006), which received an EA Certificate in 2007. Approximately 48 km of the access road from Highway 37 to the Galore Creek mill site was constructed in 2007, before the Project was halted in late 2007 (Delaney 2010). A revised prefeasibility study has been undertaken which includes revision of the mine footprint and alteration to the mine capacity. These proposed elements are considered as a Reasonably Foreseeable Action in Section 6.9.2.3. This section considers only the access road as a Past Project or Activity.

Project Facts:

- **Production** – Production is discussed in Section 6.9.2.3.
- **Project Lifespan** – Access road construction was completed along 48 km and is expected to be in place for 18 years, after a 4-year mine construction period (NovaGold 2012). The future proposal includes development of the remainder of the 87-km access road (Rescan 2006).
- **Footprint** – The construction activities to date include a 48-km access road (Delaney 2010).
- **Access** – The access road was built from Highway 37, along More and Sphaler creeks to the Porcupine River, and up to Scotsimpson Creek.

- **Traffic Volume -** This information is not available.
- **Water (inputs/outputs) -** Data are not available for the access road.
- **Employment -** This information is not available.

Goldwedge Mine

The historic Goldwedge Mine was owned by Catear Resources Ltd., and is located approximately 70 km northwest of Stewart, BC and 2 km northwest of Brucejack Lake on Catear Creek, a tributary of Brucejack Lake (E.R. Kruchkowski Consulting Ltd. 1989).

Project Facts:

- **Production** – This information is not available.
- **Project Lifespan** – This information is not available.
- **Footprint** – This information is not available.
- **Access** – Access to the mine site was by helicopter from Stewart or the Tide Lake Airstrip near Granduc Mine (E.R. Kruchkowski Consulting Ltd. 1989).
- **Traffic Volume** – This information is not available.
- **Tailings and Waste Rock** – Waste disposal at the Goldwedge project included on-land and lake disposal of an un-quantified volume of waste rock and approximately 4,000 t of tailings from a small underground mine (Price 2005).
- **Employment** – This information is not available.

Granduc Mine

Granduc Mine was a copper mine located approximately 32 km south of the Project. Much of the current town of Stewart was built to support the development of the Granduc Mine (Silver Standard Resources Inc. 2010). Construction of the Granduc Mine began with tunnel driving in 1964 and was completed in 1970. The mine operated until 1978, was re-opened in 1980, and operated again until its closure in 1984. Since the construction of the Granduc Mine began in the 1960s there have been several other mining projects in the area, many of which use the Granduc access road and staging area to support their activities. Section 6.7.2.3 discusses potential for redevelopment of the Granduc Mine by its current owner, Castle Resources Ltd.

Project Facts:

- **Production -** The project was built with a mill capacity of 2,000 tpd (McGuigan and Harrison 2010). A total of 15.2 Mt of ore was produced over the life of the mine (BC MEMPR 1988).
- **Project Lifespan** – eight years (1970 to 1978) and four years (1980 to 1984).
- **Footprint** – The mine included underground workings, a mill site near Summit Lake and an 18.4 km tunnel connecting them (StewartBC.com 2004). Concentrator facilities were located at Tide Lake in the Bowser River Valley, and an all-weather road was constructed from Tide Lake to Stewart (Reinhard 2008).
- **Access**– The mine site was accessed by helicopter, or by the 35 km long Granduc Access Road.
- **Traffic Volume** – The Granduc Mine hauled approximately 24 loads per day of concentrate to the Stewart Bulk Terminals until its closure in 1984 (StewartBC.com 2004).
- **Tailings Storage** – Tailings were not contained (P. Wojdak, pers. comm).

- **Water (inputs/outputs)** – Tailings were washed down Bowser River Valley into Bowser Lake (Heffernan 2005; P. Wojdak, pers. comm.). Groundwater for the power plant, industrial water runoff, shower drainage, floor waste in the process areas, etc., were also collected and discharged to the Leduc River, which drains into Alaska.
- **Employment** – The mine employed 750 people (StewartBC.com 2004).

Johnny Mountain Mine

Johnny Mountain Mine is a closed underground mine located in the Iskut River watershed approximately 56 km northwest of the Eskay Creek Mine Road, in the Bronson Slope area south of Snip Mine. The Johnny Mountain mine began operation in 1988 and closed in 1990 (BC MEMPR 2008). Skyline Gold re-opened the mine for a limited two-month production run in 1993 (Skyline Gold Corp. 1993). The property still offers exploration potential (Skyline Gold Corp. 2006b).

Project Facts:

- **Production –** 175,000 t were mined between 1988 and 1990, and 21,850 t were mined in 1993 (Skyline Gold Corp. 2006b).
- **Project Lifespan** – two years.
- **Footprint –** The mine footprint is adjacent to, but independent of, Snip Mine. When weather prevented use of the Johnny Mountain airstrip, the Bronson airstrip was shared with the Snip Mine (P. Wojdak, pers. comm.).
- **Access –** The mine was a fly-in/fly-out operation with its own airstrip. A road connected the mine site to the Bronson airstrip at Snip Mine, as an alternative access route (P. Wojdak, pers. comm.).
- **Traffic Volume –** The mine relied mostly on air transportation.
- **Tailings Storage –** The tailings impoundment is located on Johnny Mountain (P. Wojdak, pers. comm.).
- **Water (inputs/outputs)** – not available.
- **Employment –** The mine employed approximately 155 people (BC MEMPR 1989).

Kitsault Mine

Kitsault Mine is a closed mine located in the Nass Area approximately 126 km south of the proposed Brucejack Gold Mine Project. Between January 1968 and April 1972, approximately 9.3 Mt of ore were produced with about 10.4 million kg of molybdenum recovered. In 1981 and 1982, about 4 Mt of ore were produced yielding approximately 3.1 million kg of molybdenum (Avanti Mining Inc. 2009). Reclamation of the mine was completed in 2006. The proposed redevelopment of the Kitsault property by Avanti Kitsault Mine Ltd. is discussed in Section 6.9.2.3.

Project Facts:

- **Production –** Between January 1968 and April 1970, approximately 9.3 Mt of ore were produced with about 22.9 million pounds of molybdenum recovered. Over 4 Mt of ore were milled during 1981 and 1982.
- **Project Lifespan –** Four years of mining (1967 to 1972), and two additional years of milling (1981 and 1982).
- **Footprint –** The disturbed area is approximately 175 ha. It included an open pit, two waste rock management facilities (Patsy and Clary), two low grade ore stockpiles, overburden

stockpiles, the mill and concentrator buildings, truck shop, service and haul roads, and settling pond at the base of the open pit (AMEC 2010).

- **Access -** The mine was accessed by road north of Terrace to Nass Camp via Highway 113 and the Nass Camp Forest Service Road to Cranberry Junction.
- **Traffic Volume** – not available.
- **Tailings Storage -** Tailings were piped to Alice Arm for submarine disposal (AMEC 2010).
- **Water (inputs/outputs)** – The mine discharged into Lime Creek at the head of Alice Arm.
- **Employment -** In December 1969, the mine employed 210 people (BC DMPR 1970).

<u>Silbak Premier Mine</u>

Silbak Premier Mine is located approximately 35 km south of the proposed Brucejack Gold Mine Project. The mine operated continuously under various owners from 1918 to 1953. During that time about 4.7 Mt of ore were produced. From 1953 to 1996 the mine operated intermittently producing another 26,000 t of ore (StewartBC.com 2011). Westmin Resources Ltd. operated the mine from 1989 to 1996 and production was 550 tonnes per day in 1995 (BC MEMPR 2013). The project was placed in long term care and maintenance in April 1996 due to poor grades in the developed zones and dwindling reserves. In 2009 the property was optioned by Ascot Resources Ltd. from Boliden Ltd. Ascot Resources Ltd. released a technical report and resource estimate for the property in March 2013 which indicates that future redevelopment of this project is possible (P&E Mining Consultants Inc. 2011).

Project Facts:

- **Production -** From 1918 to 1953 4,700,000 t of ore were produced and from 1954 to 1996 another 26,000 t were produced (StewartBC.com 2011). Historical production included 2 million ounces of gold and 4.28 million ounces of silver (P&E Mining Consultants Inc. 2011).
- **Project Lifespan** – The mine operated continuously from 1918 to 1953 and intermittently from 1954 to 1996 (StewartBC.com 2011).
- **Footprint -** Open pit mine, underground mine workings, 2,000 tpd CIP (carbon-in-pulp) mill, surface buildings, a cyanide plant, and a tailings pond (StewartBC.com 2011).
- **Access -** The project is reached from Stewart by the Granduc road.
- **Traffic Volume** – Not available.
- **Tailings Storage -** The tailings pond dam is located at 56° 03’ 40” N and 130° 01’ 55” W and an elevation of 310 masl.
- **Water (inputs/outputs)** – Not available.
- **Employment** – Employment varied throughout the life of the mine.

<u>Snip Mine</u>

The historic Snip Mine is a closed underground mine located in the Iskut River watershed approximately 61 km northwest of the Eskay Creek Mine. The Snip Mine operated between January 1991 and June 1999, first by Cominco Ltd. and then, beginning in 1996, by Homestake Canada Inc. The mine was closed and reclaimed in 1999 (Sibbick and MacGillivray 2006). Like the Johnny Mountain mine, it is located in the Bronson Slope area and the property still offers exploration potential (Skyline Gold Corp. 2006b).

Project Facts:

- **Production –** From 1991 to 1999 the mine produced 32,093 tonnes of gold, 12,182 tonnes of silver and 249,276 kg of copper from 1.2 Mt of ore (BC MEMPR 2007).
- **Project Lifespan** – Eight years.
- **Footprint –** The mine consisted of an underground mining operation, mill, tailings impoundment, and ancillary facilities.
- **Access –** The mine was a fly-in/fly-out operation accessible by helicopter (Sibbick and MacGillivray 2006). The site could also be accessed by boat (Price 2003), or hovercraft along the Iskut and Stikine rivers.
- **Traffic Volume –** The mine relied mostly on air (P. Wojdak, pers. comm.).
- **Tailings Storage –** The tailings impoundment was constructed in the saddle of a narrow valley forming the headwaters to both Monsoon and Sky creeks. Dams were constructed at each end to form a tailings impoundment approximately 150 m wide and 800 m long. Discharge from the impoundment was directed toward Sky Creek (Sibbick and MacGillivray 2006).
- **Water (inputs/outputs) –** The mine site is drained by the Bronson, Monsoon, and Sky creek drainages. Both Bronson and Monsoon creeks flow directly into the Iskut River, whereas Sky Creek flows into the Craig River and then to the Iskut River (Sibbick and MacGillivray 2006).
- **Employment** – On average, 122 people were employed by the mine (BC MEMPR 1993).

<u>Snowfield Exploration Project</u>

The Snowfield Exploration Project involved drilling and exploration activities on the Snowfield property which is located 65 km north of the town of Stewart and approximately 7 km north of the Brucejack Gold Mine Project (Pretium Resources Inc. 2013). Exploration was undertaken by Silver Standard Resources and Newhawk Gold Mines Ltd. between the mid-1980s and 2010 on the property which was sold to Pretium Resources Inc. in 2010. Findings produced in the 2011 technical report indicate that the property contains a near-surface, low grade, bulk tonnage, and porphyry-style gold deposit with associated silver, copper, molybdenum and rhenium (P&E Mining Consultants Inc. 2011). Pretivm and Seabridge Gold Inc. have signed a Mutual Confidentiality and Cooperation Agreement provides for, amongst other things, the completion of an engineering study examining the economics of combining Pretivm's Snowfield project and Seabridge Gold's KSM project into one operation (Pretium Resources Inc. 2013). At this stage no formal indications have been made by either party that the resource will be developed.

Project Facts:

- **Production –** The operation never went into production (Pretium Resources Inc. 2013).
- **Project Lifespan** – Exploration was undertaken from the mid-1980s until 2010 (Pretium Resources Inc. 2013).
- **Footprint** – The exploration project consisted of drilling operations only.
- **Access** – The property lies immediately east of the KSM project and was accessed by helicopter in the past. Future road access could potentially be from the proposed access road from the KSM project site to Highway 37 (P&E Mining Consultants Inc. 2011).
- **Traffic Volume** – not available.
- **Tailings Storage** – No tailings were produced, as operation never went into production (P&E Mining Consultants Inc. 2011).

- **Water (inputs/outputs)** – Information relating to water inputs and outputs is not available.
- **Employment** – The operation never went into production.

Sulphurets Advanced Exploration Project

The historic Sulphurets Project was an advanced underground exploration project located near Brucejack Lake. Newhawk Gold Mines Ltd. excavated underground workings between 1986 and 1990 as part of an advanced exploration and bulk sampling program. Construction of the underground workings generated approximately 124,000 t of waste rock. The waste rock was placed as a shallow pad along the southern boundary of Brucejack Creek and used as the foundation for the camp and other facilities (Price 2005). The operation never went into production, and in 1996 the Sulphurets property was placed in care and maintenance. Development plans for the project were indefinitely suspended and Newhawk Gold Mines Ltd. decided to fully reclaim the property in 1999 (Price 2005). Underground workings developed as part of the Sulphurets Project will be used to support development and mining activities for the Brucejack Gold Mine Project.

Project Facts:

- **Production –** The operation never went into production (Price 2005).
- **Project Lifespan** – The operation never went into production (Price 2005).
- **Footprint** – Sulphurets was an underground exploration project, with a waste rock pad adjacent to Brucejack Creek (Price 2005).
- **Access** – Overland access was from Highway 37, along a logging road to the barge landing on Bowser Lake, by boat up the length of the lake (NE to SW end), then by dirt road up the Bowser River to the toe of the Knipple Glacier and up the mountain to access the glacier, 7 km on an ice road up the Knipple Glacier and finally 1 km on a mine road along the southern edge of Brucejack Lake to the Sulphurets Camp (Price 2005).
- **Traffic Volume** – not available.
- **Tailings Storage** – No tailings were produced, as operation never went into production (Price 2005).
- **Water (inputs/outputs)** – Underground workings and waste rock pad were adjacent to Brucejack Creek, and mine water and potentially acid rock drainage-generating waste rock were deposited into Brucejack Lake. Brucejack Creek flows from Brucejack Lake, under the Sulphurets Glacier, eventually emerging in Sulphurets Creek, which flows to the Unuk River (Price 2005).
- **Employment** – The operation never went into production.

Swamp Point Aggregate Mine

The historic Swamp Point Aggregate Mine was an aggregate (sand and gravel) pit and ship-loading facility located on the Portland Canal (BC EAO 2010b). The project location was approximately 112 km southeast of the Brucejack Gold Mine Project. The lifespan of the project was estimated at approximately 18 years, with a maximum production capacity of about 3.3 Mt of aggregate per year (BC MOE 2006).

Ascot Resources Ltd. received an EA Certificate for the Swamp Point project in 2006 and began site development in October of that year, with plans to export sand and gravel to west coast North American markets by ships and barges (Ascot Resources Ltd. 2010). The first shipment of aggregates began in April 2007, while construction of both onshore and deep water infrastructure continued (Ascot Resources Ltd. 2009, 2010).

In July, 2008, Ascot Resources Ltd. suspended construction of its ship loading facility at Swamp Point in reaction to the economic downturn (Ascot Resources Ltd. 2010). In June 2011 the camp at the mine site was closed and most of the associated equipment was removed (Ascot Resources Ltd. 2010).

Project Facts:

- **Production –** 3.3 Mt of aggregate/year (BC MOE 2006).
- **Project Lifespan –** 18 years, but never went into full production (BC MOE 2006).
- **Footprint –** The project included lay-down areas, haul roads, mining and processing equipment, and a ship loading facility (Ascot Resources Ltd. 2010).
- **Access –** Site access was by air or water. There was no road access to the site (Ascot Resources Ltd. 2010).
- **Traffic Volume –** There was no vehicle traffic. Vessel traffic was Panamax class (70,000 dwt) freighters (Ascot Resources Ltd. 2010).
- **Tailings Storage** – Not applicable.
- **Water (inputs/outputs)** – Water was diverted from Steep Creek to Reservoir Lake and withdrawn from Reservoir Lake (BC MOE 2006).
- **Employment** – The project was expected to create 20 to 50 direct, non-seasonal jobs (BC MOE 2006).

6.9.2.2 Present Projects

With the suspension of construction for the Galore Creek Mine project in late 2007, and closure of the Eskay Creek Mine in March 2008, there are currently no operating mine projects close to the Project (BC Stats 2010). However, the Red Chris Mine is currently under construction, exploration for the Brucejack Gold Mine Project is ongoing, and closure and reclamation activities for Eskay Creek Mine are ongoing. There are also a number of hydroelectric developments in the region. The NTL, McLymont Creek, and Forrest Kerr Hydroelectric Power projects are engaged in construction activities, while the Long Lake Hydroelectric Power project commenced operation in December 2013. These existing projects are summarized in Table 6.9-1 and are shown in Figure 6.9-2.

<u>Brucejack Exploration and Bulk Sample Program</u>

The exploration phase of the Brucejack Gold Mine Project commenced in 2011 and included a drilling program, reactivation of an access road constructed by Newhawk Gold Mines Ltd., construction of an exploration access road from Highway 37 to the reactivated access road constructed by Newhawk Gold Mines Ltd. and a bulk sample program. The bulk sample program included development and dewatering of underground workings initially established by Newhawk Gold Mines Ltd., and subaqueous deposition of waste rock in Brucejack Lake. In addition, historical mineral exploration activities associated with the Sulphurets Project (Section 6.9.2.1) took place within the project area.

- **Production and Project Lifespan** – The Project is in the pre-application stage and has not entered production. The proposed Project is the subject of this Application/EIS.
- **Activity Timeline** – Exploration activities began in 2011 and are ongoing.
- **Footprint** – Brucejack is an underground exploration project. Above-ground infrastructure includes accommodations buildings, a kitchen building, an office building, explosives storage, a sewage treatment plant, and a water treatment plant.

- **Access** – During 2012, an exploration access road was built from Highway 37 to the west end of Bowser Lake. The road connects to the road originally constructed by Newhawk Gold Mines Ltd. to access the Sulphurets Project.
- **Traffic Volume** – The volume of traffic using Highway 37 and the exploration access road during the last few years that exploration and bulk sampling have been underway has varied considerably, due to changing transport requirements for activities that have differed over time. However, this figure has never exceeded five trips per day.
- **Tailings Storage** – No tailings will be produced during the exploration phase of the Project. PAG rock from underground was deposited into Brucejack Lake.
- **Water (inputs/outputs)** – Treated water from underground dewatering is discharged to Brucejack Creek, and effluent from the sewage treatment plant is discharged to Camp Creek and Brucejack Creek.
- **Employment** – Employment records for the exploration phase of the Project show a monthly average of 128 personnel present on site and at the Wildfire and Scott Creek camps during 2012. The figures for 2013 show a monthly average of 101 personnel present on the site during that time.

<u>Forrest Kerr Hydroelectric Power Facility</u>

The Forrest Kerr Hydroelectric Power Project is a run-of-river hydroelectric power facility located on the Iskut River near the confluence of Forrest Kerr Creek, approximately 50 km west of Bob Quinn Lake junction (Glassman 2003), and about 41 km northwest of the Project.

The project received an EA Certificate in 2003 and successfully applied to amend the certificate in 2009/2010 to increase generation capacity to 195 MW (Cambria Gordon 2009). The project includes provisions for interconnection with the McLymont Creek (about 70 MW) and the Volcano Creek (about 16 MW) hydropower projects. The Volcano Creek and McLymont Creek projects are discussed in below.

As of April 2013, site development activities were underway (JOC News Service 2010). Construction began in spring 2011 and the project is expected to come into service mid-2014 (NDIT 2012). It will provide enough electricity for about 70,000 homes in BC, and will deliver electricity to the previously announced NTL (JOC News Service 2010; Simpson 2010).

Project Facts:

- **Production** – The facility will supply 195 MW run-of-river hydroelectric power, with a transmission line capacity of 287 kV (Cambria Gordon 2009; AltaGas Renewable Energy Inc. 2010; Simpson 2010).
- **Project Lifespan** – Construction will last 48 months, and the project life will be 60 years, considering the 60-year electricity purchase agreement between AltaGas Income Trust and BC Hydro (JOC News Service 2010; Simpson 2010; NDIT 2012).
- **Footprint** – At the generation site area, approximately 29 ha of land will be cleared for a plant site, an underground powerhouse, and tailrace (AltaGas Renewable Energy Inc. 2010). The approximately 37.3 km long transmission line will run from the plant site, along the new 8 km access road and the Eskay Creek Mine Road to Highway 37 at Bob Quinn. It will have a right-of-way clearing width of 68 m (Glassman 2003).
- **Access** – Access to the project is from Highway 37 and the Eskay Creek Mine Road. A new 8 km gravel road was constructed in 2005 (Cambria Gordon 2009). The airstrip at Bob Quinn Lake will also be used to transport personnel and materials.

- **Traffic Volume** – It is assumed that there will be limited traffic along Highway 37 and the Eskay Creek Mine Road during operation. The primary traffic will comprise employees heading to and from the Forrest Kerr camp. These trips are expected to amount to approximately one trip per day.
- **Tailings Storage** – The project will not require tailings storage.
- **Water (inputs/outputs)** – Water will be diverted from the Iskut River through a 3.1 km tunnel resulting in approximately 252 m^3/s diversion flow, and returned to the Iskut River at the tailrace (Glassman 2003; AltaGas Renewable Energy Inc. 2010).
- **Employment** – A construction workforce of about 400 will be required, and operation will provide permanent employment for six to ten people (Cambria Gordon 2009; NDIT 2012).

<u>Long Lake Hydroelectric Power Facility</u>

The Long Lake Hydroelectric Power Facility is located on Cascade Creek, approximately 17 km north of Stewart, BC (CEA Agency 2012b) and approximately 42 km south of the Brucejack Gold Mine Project. Features of the facility include the re-development of a 20 m high rockfill dam located at the head of Long Lake, and a new 10 km long 138 kV transmission line. In 2010, the project was awarded a contract with BC Hydro, construction began in July 2010, and the project commenced operation in December 2013.

Project Facts:

- **Production –** 31 MW hydroelectric project (CEA Agency 2012b).
- **Project Lifespan** – The project will span 80 years (CEA Agency 2012b).
- **Footprint** – The project includes a 20 m high rockfill dam, a 7.2 km long penstock, and a 10-km long 138-kV transmission line (NDIT 2012).
- **Access** – On-site project facilities will use existing service roads (NDIT 2012).
- **Traffic Volume** – Although traffic increased during the construction period, during operation employee traffic is assumed to amount to approximately one trip per day.
- **Tailings Storage** – The project will not require tailings storage.
- **Water (inputs/outputs)** – The storage dam has created a reservoir inundating an area of approximately 278 ha (CEA Agency 2012b), but will improve the water quality of the Cascade Creek and Salmon River by providing more flows and diluting effluents from past mining operations (Regional Power 2011).
- **Employment** – The project employed up to 160 people during construction (NDIT 2012). It is assumed the project would create one or two full time jobs during operation.

<u>McLymont Creek Hydroelectric Power Facility</u>

The McLymont Creek Hydroelectric Project is located approximately 100 km northwest of Stewart and 140 km southwest of Iskut (Government of BC 2012). The project is approximately 9.5 km from the Forrest Kerr Hydroelectric Power Project, and 45 km northwest of the Project.

BC Hydro awarded AltaGas Renewable Energy Inc. an Electricity Purchasing Agreement (EPA) in November 2011, and the project received an EA Certificate in May 2012 (BC EAO 2012a). The project is expected to be operational in November 2015 after a three-year construction period (Government of BC 2012).

Project Facts:

- **Production –** 70 MW of run-of-river hydroelectric energy (Government of BC 2012).

- **Project Lifespan** – The project will span 40 years (Government of BC 2012).
- **Footprint -** The project includes a new 9.5 km access road, a 6.2 km access road, a powerhouse, a 10 km transmission line, and an intake and other components located on McLymont Creek (Government of BC 2012).
- **Access** – The project site will be accessed via the Eskay Creek Mine Road, via the Forrest Kerr road and along a new 9.5 km access road (BC EAO 2012a).
- **Traffic Volume** – It is assumed that traffic along Highway 37 and Eskay Creek Mine Road during operation will be generated by employees who are likely to be using the Forrest Kerr camp. It is expected to amount to approximately one trip per day (BC EAO 2012a).
- **Tailings Storage** – The project will not require tailings storage.
- **Water (inputs/outputs)** – The proposed project would alter the flow regime in the lower 4.5 km of McLymont Creek over the long term (BC EAO 2012a).
- **Employment -** The project will provide 100 to 120 full-time and part-time jobs during construction and up to four full-time employment positions once operational (Government of BC 2012).

Northwest Transmission Line

The NTL will be an approximately 344-km electricity transmission line (BC Hydro 2012). The 287-kV capacity line will generally follow the Highway 37 corridor, running from the Skeena Substation at Terrace and connecting with a new substation near Bob Quinn Lake; the line will pass within approximately 36 km of the Brucejack Gold Mine Project (BC Hydro 2012).

BC Hydro received an EA Certificate in February, 2011 and construction began January 2012. The project is expected to be operational in Spring 2014 (BC Hydro 2012).

Project Facts:

- **Production** – The project comprises a new 344-km 287 kV transmission line between the Skeena Substation at Terrace and Bob Quinn Lake (BC Hydro 2012).
- **Project Lifespan** –The line is expected to be in use for 50 or more years (Rescan 2010).
- **Footprint** – Vegetation will be cleared from the transmission line right-of-way (ROW) to a total width of approximately 38 m (19 m each side). Dangerous trees that could fall on the electrical wires outside this ROW will also be selectively cut (Rescan 2010).
- **Access-** Access to the northern segment of the transmission line will be via Highway 37 and the Eskay Creek Mine Road. Helicopters may be used in areas where terrain access is hazardous or exceptionally difficult. New permanent, semi-permanent, or temporary roads and the expansion or improvement of existing Forest Service roads and trails may be required along some sections of the route (Rescan 2010).
- **Traffic Volume-** Traffic is expected to increase during the construction period (Rescan 2010). During operations, a limited amount of seasonal traffic on an annual basis to assess danger trees and do periodic vegetation clearing is expected.
- **Tailings Storage** – The project will not require tailings storage.
- **Water (inputs/outputs)** – No water use, but the transmission line will cross many watersheds and rivers (Rescan 2010).
- **Employment -** Project construction would create an estimated 860 full-time equivalent (FTE) jobs during the construction phase (Rescan 2010).

Red Chris Mine

Red Chris Mine is an approved open-pit mine project that will produce copper and gold. The project is located on the Todagin Plateau between Ealue and Kluea lakes, approximately 18 km southeast of the village of Iskut and approximately 139 km north of the Brucejack Gold Mine Project (BC EAO 2005). The project received an EA Certificate in 2005, which was extended in 2010. Federal approval of the project under the CEAA (1992) was challenged by a third party, and the Supreme Court of Canada allowed development to proceed in 2010 (RCDC 2010).

Construction of an exploration access road was completed in 2008 to reduce the reliance on helicopter support, and allow deep drilling exploration to be initiated. Construction of the mine was based on the anticipated northward extension of the existing electrical transmission line from Meziadin Junction to Iskut. Construction on the NTL began in January 2012, and Red Chris Mine construction began shortly after, in May 2012 (BC Hydro 2012; Gillstrom, Anand, and Robertson 2012).

Project Facts:

- **Production** – The project's mill production rate will be 30,000 tpd (Gillstrom, Anand, and Robertson 2012).
- **Project Lifespan** – The project life will span 28 years (Gillstrom, Anand, and Robertson 2012).
- **Footprint** – The mine will comprise two open pits that will eventually merge into a single pit, a processing plant, waste rock dump, low grade ore stockpiles, tailings impoundment, runoff collection system and mine effluent treatment plant, a new 23-km access road and a parallel power line from Highway 37 to the mine site (BC EAO 2005).
- **Access** – The mine site will be accessed by a new 23-km access road that would leave Highway 37 on the south side of Coyote Creek (BC EAO 2005).
- **Traffic Volume** – Concentrate would be transported by truck to the Stewart Bulk Terminals via a new access road and Highway 37, using approximately 28 one-way trips per day (BC EAO 2005). Traffic carrying cargo other than concentrate is estimated at 11 one-way trips per day.
- **Tailings Storage** – Black Lake is proposed to be used as a tailings pond for the project. This lake is at the headwaters of Trail Creek where there is the potential for loss of fish habitat (BC EAO 2005).
- **Water (inputs/outputs)** – Water output from the mine may drain into Coyote Creek, Quarry Creek, and Kluea Lake via Trail Creek. The project plans to withdrawal fresh water from the groundwater aquifer, and possibly the Klappan River if there is insufficient groundwater available (BC EAO 2005).
- **Employment -** The project will generate approximately 250 direct full-time jobs (BC EAO 2005).

6.9.2.3 Reasonably Foreseeable Future Projects

Reasonably foreseeable future projects are those within the cumulative effects assessment that have entered or completed the BC EA process, or are anticipated to enter the BC EA process during the review of the Project. Table 6.9-1 summarizes the projects that meet these criteria, and their locations are shown on Figure 6.9-2.

There is uncertainty around the prediction of project effects from projects that are in the pre-application stage of the BC EAO process and have not yet completed the EA process. Potential effects and influences that can be predicted are based on publically available information and professional judgment. Assumptions are made considering typical projects of similar size and type where information is missing or lacking. Documentation and justification of these assumptions are included in the description of the project.

Arctos Anthracite Coal Project

The Arctos Anthracite Coal Project (formerly Mount Klappan Coal Project) is a proposed open pit mine, and is located approximately 116 km northeast of the Brucejack Gold Mine Project. The project entered the EA process in 2004 when it submitted a Project Description to the BC EAO, describing an anticipated production of up to 1.5 Mt of coal per year (BC EAO 2010b). Plans included facilities to crush and wash coal at the mine site, load coal onto trucks, and haul product to the Port of Stewart along a proposed new access route connecting to Highway 37 (BC EAO 2010b). In 2008, work was temporarily deferred as Fortune Minerals Inc. was seeking a joint venture partnership to develop the project (BC EAO 2010b).

Since 2004, Fortune Minerals completed technical reports assessing production rate and transportation alternatives including trucking to Stewart Bulk Terminals and shipment by rail to Ridley Terminal in Prince Rupert (Marsten 2005; Fortune Minerals Ltd. 2009). In 2010, Fortune Minerals announced the development of a railway transportation option for hauling product from the mine site along 150 km of new railway connecting to the current terminus of track at Minaret, and to the Ridley Coal Terminal in Prince Rupert (Drötboom 2010). Updates to the project's technical study were completed to include this option, along with an increase in project capacity to 3 Mt per year (Marston Canada Ltd. 2011).

For the purposes of the cumulative effects assessment, it is assumed that the project will have a two year construction phase beginning in 2015.

Project Facts:

- **Production –** The project will produce 3 Mt of coal (Marsten 2005, 2007; Fortune Minerals Ltd. 2010).
- **Project Lifespan** – The project will span at least 20 years (Marsten 2005, 2007; Fortune Minerals Ltd. 2010).
- **Footprint** – The project comprises an open pit mine at four resource areas, including the Lost-Fox deposit area; a wash plant, and mine and off-site infrastructure (Rescan 2004).
- **Access** – The property can be accessed by a road along a BC Rail right-of-way, and the Ealue Lake Road off Highway 37 (Fortune Coal Ltd. 2006).
- **Traffic Volume** – Coal will be transported by rail along 150 km of new railway connecting to the current terminus of track at Minaret, and then to the Ridley Coal Terminal in Prince Rupert (Marston Canada Ltd. 2011). It is assumed that other mine cargo will also be transported via rail.
- **Tailings Storage** – The project will include a tailings storage facility (Rescan 2004).
- **Water (inputs/outputs)** – the headwaters of the Stikine, Nass, and Skeena River systems are in the general vicinity of Arctos Anthracite. Proposed development will occur primarily in the upper drainage of the Little Klappan River, which flows into the Stikine River (Rescan 2004; Marsten 2005).
- **Employment -** Projections estimate that over 200 workers will be needed for construction, and over 400 full-time jobs will be created for 20 years of operation. This totals in excess of 8,500 person years of direct employment (Rescan 2004).

Bear River Gravel Project

The Bear River Gravel project is located in Stewart, BC, at the mouth of the Bear River, approximately 63 km south of the Brucejack Gold Mine Project. While reducing the risk of flooding on the Bear River, Glacier Aggregates Inc. plans to extract, process, and ship the gravel resource (Cambria Gordon 2006).

The most recent project description available on the BC EAO website (Cambria Gordon 2006) discusses plans to extract 2 Mt per year of gravel from the lower Bear River in the first year of operation, with the potential to extract up to 3.8 Mt per year within the first five years. Two years of initial construction is anticipated before the project becomes operational. Construction activities will continue through the first few years of operations, until the project reaches its full production capacity. During operation, the project plans to ship material from the deep sea Port of Stewart to Pacific Rim markets (Cambria Gordon 2006).

The project began the harmonized provincial/federal EA process in 2005, and an updated project description was submitted in 2006. On July 6, 2012, the new CEAA, 2012 (2012) came into force, and as a result, there is no longer a requirement to complete an EA of this project under CEAA, 2012 (CEA Agency 2012a). While there is no information on anticipated construction start dates, for the purpose of this assessment it is assumed that construction will begin in 2018.

Project Facts:

- **Production** – up to 3.8 Mt per year within five years (Cambria Gordon 2006).
- **Project Lifespan** – The project will span 25 years (Cambria Gordon 2006).
- **Footprint –** The Project encompasses an area of approximately 175 ha including sections of the Bear River, Portland Canal, and District of Stewart industrial land base. The project plans to use and expand on existing infrastructure (Cambria Gordon 2006).
- **Access** – Access is by paved highway connecting the project to northern BC routes. The deep sea Port of Stewart also supports year-round marine transportation (Cambria Gordon 2006).
- **Traffic Volume** – Two ships per month will accommodate initial gravel extraction rates with four ships per month accommodating the projected increased rates. The facility will accommodate ships up to 70,000 dwt (Cambria Gordon 2006).
- **Tailings Storage** – The project will not require tailings storage.
- **Water (inputs/outputs)** – The project is located at the confluence of the Bear River and the Portland Canal. Process water may be extracted from the Bear River or a well upstream of the intertidal zone (Cambria Gordon 2006).
- **Employment –** The project will generate approximately 100 person-years of employment during construction and approximately 40 permanent positions during operation (Cambria Gordon 2006).

<u>Bronson Slope Project</u>

The Bronson Slope gold deposit is located approximately 30 km west of the Eskay Creek Mine Road (Skyline Gold Corp. 2006a), and approximately 60 km northwest of the Brucejack Gold Mine Project. The proposed Bronson Slope Project was advanced in the EA and *Mines Act* (1996) approval processes in the mid-1990s, but was deferred in 1996 (Skyline Gold Corp. 2006a).

In 2008, Skyline Gold Corporation submitted its Bronson Slope Project Description to the BC EAO and the CEA Agency (Skyline Gold Corp. 2008), however the Application/EIS appears as withdrawn on the BC EAO's e-Pic website and the Major Project Management Office (MPMO) website (MPMO 2010; BC EAO 2013b).

The Preliminary Assessment completed in 2009 assumes that power for the project will be supplied from the NTL or possibly by a direct connection to the BC Hydro grid near the proposed Forrest Kerr Hydroelectric Power station. Other alternative electricity generation and supply options are also being evaluated and a more comprehensive pre-feasibility study is expected in the near future (Leighton Asia Ltd. 2009).

For the purposes of the Brucejack Gold Mine Project cumulative effects assessment, it is assumed that the project will have a two-year construction period with operations based on a mill feed rate of 15,000 tpd. Given that the Project is still early in the planning process and a Project Description is under development, it is also assumed that this construction period will not begin until 2019.

Project Facts:

- **Production -** 15,000 tpd gold-copper-silver-molybdenum mine proposal in British Columbia (Leighton Asia Ltd. 2009).
- **Project Lifespan** – 20-year mine life (Leighton Asia Ltd. 2009).
- **Footprint -** The proposal includes an open pit mine, concentrator plant, tailings storage locations, access road, and a transmission line that connects to the BC Hydro grid. Mine site infrastructure would include a waste storage facility and plant site (Leighton Asia Ltd. 2009).
- **Access** – The project is currently accessed by the airstrip located adjacent to the confluence of Bronson Creek and the Iskut River (Leighton Asia Ltd. 2009).

  Currently, mine access roads, the Iskut Road (30 km) and the Eskay Creek Mine Road (30 km), run from Bob Quinn on Highway 37 to the Eskay Creek Mine, and a connecting development access road (5 km) has been constructed to the Forest Kerr Hydroelectric Power site. The Bronson Slope project is approximately 30 km east of the Forrest Kerr road along the Iskut River, and conceptual designs for a permanent access road to the mine site were developed by a consortium of exploration companies, the Province of BC, and the government of Canada in the early 1990s. The existing network of basic roads around the property will also require upgrading (Leighton Asia Ltd. 2009).
- **Traffic Volume** – It is assumed that concentrate traffic from Bronson Slope will be travelling to Stewart along the Eskay Creek Mine Road, Highway 37 and 37A and that other cargo will travel along Highway 37, south to Highway 16. Volumes are estimated at three concentrate haul trips per day and six cargo trips per day.
- **Tailings Storage -** Two tailings facilities are proposed for the 51.7 Mm^3 of tailings expected to be produced during the life of mine: Cell A with an area of 1 km^2, would be located southwest of the Snip tailings pond, and Cell B would be a small 130 m by 275 m depression (called Boundary Lake) located north of the main valley (Leighton Asia Ltd. 2009).
- **Water (inputs/outputs)** – Surplus water derived from tailings and runoff would be discharged into Bronson Creek. Sky Creek is located downstream of the tailings impoundments.
- **Employment -** Approximately 241 employees would be needed during operation.

<u>Coastal GasLink Pipeline Project</u>

Coastal GasLink Pipeline Ltd., a subsidiary of TransCanada PipeLine Ltd. (TransCanada), is proposing a 650-km long, 48-inch natural gas pipeline from the Groundbirch area to the Kitimat area. The pipeline passes within 288 km of the Brucejack Gold Mine Project. The project will have the initial capacity of 1.7 billion cubic feet per day (bcf/d) with the potential for expansion up to approximately 5 bcf/d. The project includes the pipeline in addition to metering facilities, one to five compressor stations, temporary construction facilities, and may involve the construction and operation of a natural gas liquid injection facility or a hydrocarbon dew point control facility (or both). The pipeline right-of-way will be approximately 40 to 45 m wide in most areas (TransCanada 2012).

TransCanada has initiated an Application/EIS process for the project which is currently under review by the BC EAO. Construction of the project is intended to commence in mid-2015 and commissioning of the project in 2018 (TransCanada 2012).

Project Facts:

- **Production -** Initial capacity of 1.7 bcf/d with potential expansion to approximately 5 bcf/d (TransCanada 2012).
- **Project Lifespan -** The projected lifespan of the project is 30+ years (TransCanada 2012).
- **Footprint -** A 650-km, 48-inch diameter natural gas (LNG) pipeline, metering facilities, one to five compressor stations, temporary construction facilities, a potential natural gas liquid injection facility, a potential hydrocarbon dew point control facility and access roads (TransCanada 2012).
- **Access -** The project can be accessed via existing and constructed access roads (TransCanada 2012).
- **Traffic Volume** – There is no available traffic volume information.
- **Tailings Storage** – The project will not require tailings storage.
- **Water (inputs/outputs) -** Water requirements at the compressor stations during operations are limited, and water is generally only required for general cleanup, landscaping and potable uses. Water will be transported by truck. In addition, withdrawal and return of water for hydrostatic testing of the pipeline will take place (TransCanada 2012).
- **Employment -** The project will provide approximately 2,500 to 3,000 person years of employment during construction along with approximately 15 to 20 permanent positions during the operations and maintenance phase (TransCanada 2012).

<u>Galore Creek Project</u>

The Galore Creek Project is a proposed copper-gold-silver open-pit mine located approximately 106 km northwest of the proposed Brucejack Gold Mine Project (Rescan 2006). The project received an EA Certificate in 2007 and construction on an access road from Highway 37 to the Galore Creek mill site began in mid-2007. Approximately 48 km of the road was completed when the project was halted later in 2007 (Delaney 2010). The project is jointly owned by NovaGold and Teck Resources, and in 2011 NovaGold announced its intention to sell its interest in the Galore Creek partnership (NovaGold 2012).

In 2011, studies on reducing the construction and production costs were completed. The most recent prefeasibility study has redesigned the project, decreasing the footprint in the Galore Creek Valley and increasing the footprint in the More Valley, as well as increasing the scale to a nominal 95,000 tpd capacity (NovaGold 2012).

The most recent feasibility study has mining and waste rock facilities in the Galore Creek Valley, and plant and tailings facilities in the adjacent West More Valley. A 13.6 km tunnel would be used for conveying ore and moving equipment between the two facilities. From the proposed mill site in the West More Valley, a 71 km pipeline would transfer concentrate to a filter plant and concentrate truck-loading facility located near Highway 37. From the filter plant, the concentrate would be transported by truck to the Port of Stewart (NovaGold 2012).

Considering the extent of the project changes, it is assumed for the purposes of the CEA that the Galore Creek Mine Project would not begin construction until 2018.

Project Facts:

- **Production** – Project plans are to process up to 95,000 tpd (NovaGold 2012).
- **Project Lifespan** – The project will span 18 years, after a four-year construction period (NovaGold 2012).
- **Footprint** – The project includes five open pits, waste rock facilities, process plant, 13 km conveyor tunnel, a 71-km slurry pipeline, and an 87-km access road (NovaGold 2012).
- **Access** – Access to the mine site from Stewart is via Highway 37A and 37. An access road was built from Highway 37, along More and Sphaler creeks to the Porcupine River, and up to Scotsimpson Creek. The proposal includes development of the remainder of the 87 km access road (Rescan 2006).
- **Traffic Volume –** The number of concentrate truck loads from the mine is estimated at 34 trips per day. In addition, it is estimated that approximately 36 trips per day will be required for other mine supplies.
- **Tailings Storage –** About 510 Mt of tailings will be stored in West More Valley (NovaGold 2012).
- **Water (inputs/outputs) -** The Galore Creek Valley drains into the Stikine River through the Scud River, and into Alaskan waterways. The concentrate de-watering plant will discharge treated water to the Iskut River (Rescan 2006). Discharge water from the tailings impoundment will be into West More Creek (NovaGold 2012).
- **Employment –** The project will create approximately 553 long-term jobs and will employ approximately 900 to 1,000 people during construction (Rescan 2006).

<u>Granduc Copper Mine</u>

The proposed reopened Granduc Copper Mine is located 40 km northwest of Stewart in northwestern BC and previously produced between 1971 and 1984 (see Section 7.3.2, Historical Activities). Castle Resources Inc. acquired the Granduc property from Bell Copper in July 2010, and began exploration drilling with the aim of redeveloping the mine (Marketwire 2010a; Scales 2012).

In 2011, Castle Resources had the 17 km tunnel rehabilitated, and plans to rehabilitate specific levels of the old underground mine to establish underground drill stations for exploration. In February 2013, Castle Resources completed a Preliminary Economic Assessment that evaluates mining methods, tailings impoundment, and a suitable milling process (Dickson 2012). The mine will use sub-level caving techniques and borehole open stoping (BHOS) method (Dickson 2012; Scales 2012). Infrastructure will include a new mill, TMF, upgrades to the existing haul road, a transmission line to the Long Lake Hydroelectric Project, and several ancillary facilities (Tetra Tech 2013b).

Castle Resources is currently working on environmental studies and permitting and the proposed mine is planned to begin operations phase in 2016, if approved.

Project Facts:

- **Production** – The project will have a peak mill production rate of 8,500 tpd (Dickson 2012).
- **Project Lifespan** – The life of mine will be 15 years.
- **Footprint** – The proposed project includes a new mill and TMF, upgrades to the existing 54 km haul road, a power transmission line, and ancillary facilities (Dickson 2012).
- **Access** – Currently, access to the property is by helicopter from Stewart, BC, or a marshalling point on the access road (McGuigan and Harrison 2010). There is a 50 km access road to Stewart that is currently closed during the winter season. The road will be upgraded and maintained as the main access route for the project.

- **Traffic Volume** – This information is unknown.
- **Tailings Storage** – A tailings storage facility will be located 4 km north of the Salmon Glacier within the Summit Basin. Tailings will be deposited in two cross-valley impoundments, one non-potentially acid-generating and one potentially acid-generating. The tailings storage facility is designed to store 36.9 Mt of tailings (Tetra Tech 2013b).
- **Water (inputs/outputs)** – The mine dewatering effluent is expected to be highly diluted and will not require additional treatment. It will be pumped and allowed to free flow by gravity out of the Leduc drainage tunnel. Freshwater supply to the mine is assumed to be drawn from groundwater sources. Sewage generated at the camp complex and plant complex will be collected and treated by a sewage treatment plant (Tetra Tech 2013b).
- **Employment -** The Granduc Copper Mine and mill will create 250 to 300 jobs (Scales 2012).

KSM Project

The proposed KSM Project is a copper, gold and silver deposit located approximately 65 km north-northwest of Stewart, BC and 4 km northeast of the Brucejack Gold Mine Project. The project will use open pit mining and block cave underground mining methods and as of May 14, 2012 has reported reserves of 38.2 million ounces of gold, 9.9 billion pounds of copper, 191 million ounces of silver, and 213 million pounds of molybdenum (Rescan 2012; Tetra Tech-Wardrop 2012). The mine will operate at 130,000 tpd over the first 25 years of the 52.5 year mine life and 90,000 tpd for the remainder (Rescan 2012).

The project officially entered the environmental assessment process in April 2008 with the submission of a project description to the BC EAO. In February, 2013 Seabridge Gold Inc. announced completion of the filing process of its provincial Application for an Environmental Assessment certificate and its federal Environmental Impact Statement (Rescan 2012).

Project Facts:

- **Production** – The project will have a production rate of 130,000 tpd over the first 25 years, and 90,000 tpd over the last 30 years (Tetra Tech-Wardrop 2012).
- **Project Lifespan** – The mine will be constructed in five years and operate for 52.5 years, beginning in 2019 (Rescan 2012; Tetra Tech-Wardrop 2012).
- **Footprint** – The proposed project includes: three large open pit mine and two underground block caves; ore processing facilities; a TMF; a water treatment plant and water storage facility; rock storage facilities; two twinned diversion tunnels, access and mine roads; a 23-km twinned tunnel for transporting ore by conveyance, electrical power transmission, diesel fuel by pipeline, personnel and supplies and water management activities; a 28.5-km, 287 kV transmission line extension from the Northwest Transmission Line; two energy recovery plants and two mini-hydro plants; permanent accommodations; and other ancillary facilities (Tetra Tech-Wardrop 2012).
- **Access -** There will be two primary access roads to the mine and plant site: the existing Eskay Creek Mine Road, which will be upgraded and extended to become the Coulter Creek Access Road, and the Treaty Creek Access Road, which will be constructed between Highway 37 and the proposed Processing and Tailings Management Area. In addition a temporary glacier access route will be used over the Frank Mackie glacier from the end of the Granduc Access road to the KSM mine site (Tetra Tech-Wardrop 2012).
- **Traffic Volume -** Approximately 82 one-way trips per day along Treaty Creek Access road and 3 trips per day along Coulter Creek Access Road. Of those trips, 36 trips per day will utilize Highway 37A and 49 trips per day will utilize Highway 37 and Highway 16 (Tetra Tech-Wardrop 2012).

- **Tailings Storage -** A TMF will be constructed in three cells: two for flotation tailings and a lined cell for carbon in leach (CIL) tailings. In total the TMF will have a capacity of 2.3 Bt (Rescan 2012).
- **Water (inputs/outputs)** – Two diversion tunnel routes will be required to route glacial melt water and non-contact valley runoff from the Mitchell and McTagg valleys around the mine area. Hydroelectricity will be generated from two hydroelectric plants installed along these diversion routes: Mitchell Diversion Hydro and McTagg Diversion Hydro. All contact water from the mine areas will be directed to a water storage facility (WSF) and treated with a high density sludge lime water treatment plant (WTP). Energy recovery infrastructure will be used at the water treatment plant and the tailings storage facility. Four temporary water treatment facilities will be used during pre-production stages (Rescan 2012).
- **Employment -** Annual on-site employment for 1,100 during construction and 930 people per year during operation (Rescan 2012).

<u>Kinskuch Hydroelectric Project</u>

The Kinskuch Hydroelectric Project is a proposed 80 MW hydroelectric project along the Kinskuch River and Lake, located 50 km east of Stewart and 102 km southeast of the Project. The project would generate approximately 270 GWh of energy per year and includes a penstock, powerhouse, 40 km long 138 kV transmission line, a potential substation upgrade, and ancillary facilities (Pottinger Gaherty Environmental Consultants Ltd. 2008).

Construction of the project was planned for 2012, with commissioning in 2015 but the project is behind schedule and still in the regulatory process.

Project Facts:

- **Production** – 80 MW of hydroelectric power, generating approximately 270 GWh of energy per year (Pottinger Gaherty Environmental Consultants Ltd. 2008).
- **Project Lifespan** – The lifespan of the Project is not currently published, although it is assumed to be in excess of 50 years for the purposes of this assessment.
- **Footprint** – A penstock, powerhouse, 40 km long 138 kV transmission line, a potential substation upgrade, and ancillary facilities (Pottinger Gaherty Environmental Consultants Ltd. 2008).
- **Access -** The project area will be accessed via existing mainline logging roads. A new construction road is required between the powerhouse and intake. Alternatively, helicopters may be used to transport equipment in the project area (Pottinger Gaherty Environmental Consultants Ltd. 2008).
- **Traffic Volume** – This information is not available.
- **Tailings Storage** – The project will not require tailings storage.
- **Water (inputs/outputs) -** A submerged intake would collect water from the northeast end of Kinskuch Lake and water would travel through a penstock to the powerhouse and be discharged to Kinskuch River (Pottinger Gaherty Environmental Consultants Ltd. 2008).
- **Employment -** The project will provide approximately 400 person-years of local employment during the planning, assessment and design phases. During construction the project will employ approximately 120 persons for about three years. The project will create approximately six permanent jobs during operations.

Kitsault Mine

Re-opening of the Kitsault molybdenum mine, located approximately 124 km south of the Project, has been proposed by Avanti Kitsault Mining Inc. (Avanti Mining Inc. 2009). Avanti submitted an Application for an Environmental Assessment Certificate on April 30, 2012, for which the BC EAO issued on March 18, 2013 (BC EAO 2012b). As of June 2013, the project was still under federal review by the CEA Agency, in accordance with the joint review panel agreement (Avanti Mining Inc. 2012).

The project will be an open pit operation that will utilize the existing access roads and power line. Molybdenum concentrates will be trucked to the Port of Vancouver (AMEC 2010).

For the purposes of this assessment it is assumed that Avanti will begin the 25-month construction phase in 2014, with commissioning of the project in 2016.

Project Facts:

- **Production** – The projected production rate for the project is 40,000 to 50,000 tpd (Avanti Mining Inc. 2012).
- **Project Lifespan** – 15- to 16-year mine life (Avanti Mining Inc. 2012).
- **Footprint** – The new project infrastructure will include the Kitsault Pit, a conveyor material handling system, ore stockpile, process plant and camp accommodations, and a TMF with an overall surface disturbance estimated at 664 ha (Avanti Mining Inc. 2012).
- **Access –** The new Kitsault Mine can be accessed via water, float plane, or by a 100 km northbound paved road from Terrace to Nass Camp, and then a farther 95 km via an upgraded gravel road to site (Wardrop 2009). Existing roads to the project do not require significant upgrades (AMEC 2010).
- **Traffic Volume –** During construction, there will be an average of 48 one-way trips per day. During operation, approximately 80 tpd of molybdenum concentrate will be produced and transported from the mine site to the Port of Vancouver generating a maximum of 54 one-way trips per day (Avanti Mining Inc. 2012). It is assumed that the majority of this traffic will be along the Nass Forest Service Road, Highway 37, and Highway 37A.
- **Tailings Storage -** The TMF will encompass Patsy Lake and require two embankments for impoundment (AMEC 2010).
- **Water (inputs/outputs) –** Patsy Creek flows will be dammed by the TMF embankment and diverted. Discharge and seepage from the project may affect downstream water quality at Lime Creek and Patsy Creek (AMEC 2010).
- **Employment -** The proposed Project will employ up to 700 people during construction and approximately 300 during operations (Avanti Mining Inc. 2012).

Kutcho Project

The Kutcho Project is a part underground, part open-pit copper-zinc-gold-silver project with three mineral deposits. The project is located approximately 120 km east of the community of Dease Lake and approximately 223 km northeast of the Brucejack Gold Mine Project.

In 2005, the EA process was initiated with the submission of a project description to the BC EAO. This project description was based on a design concept for a larger facility that used only open-pit mining (JDS Energy & Mining Inc. 2010).

In February 2011, Kutcho Copper Corp. released a prefeasibility study describing the project as using mostly underground mining methods with a production rate of 2,500 tpd (JDS Energy & Mining Inc. 2010). The project will produce separate copper and zinc concentrates, with by-product gold and silver reporting to the copper concentrate. The concentrates will be transported to the Port of Stewart (Capstone Mining Corp. 2011).

Kutcho Copper Corp. plans to proceed towards submission of an EA Certificate Application and the process is currently in the pre-application stage. Construction is anticipated to begin in 2015.

Project Facts:

- **Production** – The project is expected to have a production rate of 2,500 tpd, mining 912,500 t of ore annually (JDS Energy & Mining Inc. 2010; Capstone Mining Corp. 2011).
- **Project Lifespan** – 12-year mine life (JDS Energy & Mining Inc. 2010; Capstone Mining Corp. 2011).
- **Footprint** – The proposed project is located within an area outlined by Andrea, Sumac, and Playboy creeks. The project is expected to have a small environmental footprint as a result of minimal open pit mining (4% of the total production), as well as utilization of tailings and waste for underground backfill and an encapsulated paste fill arrangement for any tailings and waste that are stored on surface (Capstone Mining Corp. 2011).
- **Access -** Access to the property is by air to the gravel airstrip located at the junction of Kutcho and Andrea creeks. There is an existing 131 km access road leading to the mine site from Dease Lake, which is also used to access the site. This road will be upgraded as part of project construction (JDS Energy & Mining Inc. 2010).
- **Traffic Volume -** Transportation of concentrate will be by truck from the mine site along Highway 37 to the Port of Stewart. Estimates of traffic volumes peak at 15 trips per day (Capstone Mining Corp. 2011).
- **Tailings Storage -** Approximately 40% of the tailings will be used for hydraulic fill. Tailings not required for backfill will be filtered, but not cemented, to produce “dry tailings” for storage in the TMF and the mined starter pit. Tailings will be managed by dry stacking them within a lined enclosure contained within a non-PAG waste rock berm (JDS Energy & Mining Inc. 2010).
- **Water (inputs/outputs)** – Water sources for the project have not been defined but possible options include runoff collection, wells, and dewatering from underground and drawing from creeks (JDS Energy & Mining Inc. 2010). If required during mine operation, dry stack surface water runoff will be treated to meet discharge standards and water quality criteria before being released in Andrea Creek. Andrea Creek flows into Kutcho Creek, which flows into the Turnagain River and then to the Liard River (JDS Energy & Mining Inc. 2010).
- **Employment -** The underground mine personnel requirement peaks at 125 personnel during full production, with 69 on site at one time (JDS Energy & Mining Inc. 2010).

<u>Liquefied Natural Gas Canada Export Terminal Project</u>

LNG Canada Development Inc. has proposed a natural gas liquefaction facility and marine terminal for the export of liquefied natural gas (LNG). The project will be located in Kitimat, BC, approximately 287 km from the proposed Brucejack Gold Mine Project, and will require approximately 104 million m^3/day of natural gas of which approximately 96 million m^3/day will be processed into 24 million tonnes per annum of LNG and the remainder used for fuel. A marine terminal will be constructed to accommodate two LNG carriers each with a capacity between 130,000 m^3 and 265,000 m^3 and a materials offloading area. In addition, the proposed project will include supporting infrastructure and facilities including power supply and handling, water supply and handling, and waste collection and treatment as well as temporary infrastructure and facilities (Stantec Consulting Ltd. 2013). The project would rely on a pipeline currently proposed by Coastal GasLink Pipeline Ltd. to deliver gas to the Kitimat area.

The proponent anticipates that the project will be constructed in two or three phases with completion of the first phase in 2019/2020 and subsequent phase(s) will be developed as market demand requires. The project entered the provincial and federal environmental permitting processes in 2013 (Stantec Consulting Ltd. 2013).

Project Facts:

- **Production –** The facility will produce 24 million tonnes per annum of LNG (Stantec Consulting Ltd. 2013).
- **Project Lifespan –** The project is expected to operate for a minimum of 25 years (Stantec Consulting Ltd. 2013).
- **Footprint –** The project footprint will be approximately 300 to 350 ha. It will include a natural gas receiving and LNG production facility which will include storage tanks, connecting piping, an NGL rail car staging area, and loading facility, a marine terminal and offloading area, supporting infrastructure and facilities including power supply and handling, water supply and handling, waste collection and treatment, supporting maintenance and laydown area and roads, and temporary infrastructure and facilities outside of the facility site, including laydown areas and a construction camp (Stantec Consulting Ltd. 2013).
- **Access –** The project is accessible from Vancouver by air, Prince George, Prince Rupert and Terrace by various major provincial highways, and by marine access. The main marine access route for carriers to the terminal will start near the Triple Island Pilotage Station and continue south through Principe Sound, angle east and northeast into Douglas Channel to the Kitimat Arm (Stantec Consulting Ltd. 2013).
- **Traffic Volume –** At full build-out the project expects 170 to 350 LNG carrier visits per year depending on the size of the carriers (Stantec Consulting Ltd. 2013).
- **Tailings Storage** – The project will not require tailings storage.
- **Water (inputs/outputs) –** The project will withdraw up to 70,000 m^3/day of water from the Kitimat River for cooling the LNG processes. Expected liquid wastes include sewage, wastewater from cooling and dehydration processes, and site gathered storm water. Wastewater discharge locations are expected to include the Kitimat River (for clean storm water discharge) and the Kitimat Arm marine waters and allowable ballast water discharges (Stantec Consulting Ltd. 2013).
- **Employment –** The full build-out construction is expected to generate up to 20,000 person-years of employment. Approximately 200 to 400 people will be permanently employed during operations (Stantec Consulting Ltd. 2013).

<u>Northern Gateway Pipeline Project</u>

The proposed Northern Gateway Pipeline Project, owned by Enbridge Inc., consists of two 1,172 km pipelines, a marine terminal, and associated facilities. The oil export pipeline spans from Bruderheim, Alberta to Kitimat, BC and is capable of transporting 525,000 barrels per day (Northern Gateway Pipeline LP 2010). The pipeline passes within approximately 288 km of the Project and would be located within a 25-m wide permanent right-of-way. The Kitimat Terminal is on the west side of Kitimat Arm and will include oil and condensate tanks, pump facilities, two tanker berths, one utility berth, and other ancillary facilities (Northern Gateway Pipeline LP 2010).

A Joint Review Panel is currently reviewing the project's Environmental Assessment and released draft project conditions on April 12, 2013. If approved, project construction will begin in 2014, with the project in-service in 2017, although it is indicated that this timing is dependent upon the timing of regulatory decisions, commercial sanctions, detailed engineering, and construction progress (National Energy Board 2013).

Project Facts:

- **Production -** The pipelines will have capacities of 525,000 barrels of petroleum per day and 193,000 barrels of condensate per day (Northern Gateway Pipeline LP 2010).
- **Project Lifespan -** The project will have an operating life of over 30 years (Northern Gateway Pipeline LP 2010).
- **Footprint -** Two 1,177-km long, buried pipelines (oil and condensate), ten pump stations and other ancillary facilities. Also a marine terminal will include: oil and condensate tanks, pump facilities, other associated facilities, two tanker berths and one utility berth (Northern Gateway Pipeline LP 2010).
- **Access -** The Kitimat Terminal is accessible from the existing road network and will not require any major road construction. Some lengths of the pipeline and temporary construction areas will require access roads to be built (Northern Gateway Pipeline LP 2010).
- **Traffic Volume -** Marine traffic will consist of 190 to 250 oil and condensate tankers per year (Northern Gateway Pipeline LP 2010).
- **Tailings Storage** – The project will not require tailings storage.
- **Water (inputs/outputs) -** All surface water from the marine terminal site will be collected in a remote impoundment reservoir and any contaminated water will be treated in an oil-water separator before discharge into the Pacific Ocean. Potable water will be trucked to site and any potable wastewater and sewage will be trucked offsite to another location for disposal (Northern Gateway Pipeline LP 2010).
- **Employment -** About 62,700 person years of construction employment and about 1,150 long-term jobs throughout Canada (Northern Gateway Pipeline LP 2010).

<u>Prince Rupert Gas Transmission Project</u>

Prince Rupert Gas Transmission Ltd., a subsidiary of TransCanada PipeLines Ltd. is proposing a 750 km, 48-inch diameter, sweet natural gas pipeline from the Hudson's Hope area to the proposed Pacific NorthWest LNG export facility near Prince Rupert, at Lelu Island. The project passes within 252 km of the proposed Brucejack Gold Mine Project. The project would have an initial capacity of approximately 2 bcf/d with the potential for expansion up to approximately 3.6 bcf/d. Additional infrastructure includes metering facilities, and two to six compressor stations, new access roads, bridges, stockpile sites, borrow sites, contractor yard and construction camps. A 2 km wide conceptual corridor and two marine routing alternatives are being considered for the project. The right-of-way will likely be 40 to 45 m wide for the majority of the pipeline. It is possible that more than 2 ha of foreshore will be disturbed by the pipeline shore crossings and the methods that will be used for the pipe to cross the land/sea interface have not been determined (TransCanada 2013).

Prince Rupert Gas Transmission Ltd. plans to submit an application for EAC to the BC EAO and EIS to the CEA Agency in early 2014. Construction activities will commence in early 2015 with commissioning of the pipeline in late 2018 (TransCanada 2013).

Project Facts:

- **Production -** Initial capacity of 2 bcf/d with the potential for expansion up to 3.6 bcf/d (TransCanada 2013).
- **Project Lifespan –** The project is expected to operate for at least 40 years (TransCanada 2013).
- **Footprint -** A 750-km, 48-inch diameter natural gas (LNG) pipeline, metering facilities, two to six compressor stations, temporary construction facilities, and new access roads (TransCanada 2013).
- **Access –** New access roads will be built where necessary (TransCanada 2013).
- **Traffic Volume** – This information is not available.
- **Tailings Storage** – The project will not require tailings storage.
- **Water (inputs/outputs) -** Water requirements at the compressor stations during operations are limited, and water is generally only required for general cleanup, landscaping and potable uses. In addition, withdrawal and return of water for hydrostatic testing of the pipeline will take place (TransCanada 2013).
- **Employment -** Approximately 4,400 to 5,500 person years of work will be generated during the construction phase and 30 to 40 permanent field positions will be created during the operations and maintenance phase (TransCanada 2013).

<u>Prince Rupert LNG Project</u>

The proposed Prince Rupert LNG Project, owned by Prince Rupert LNG Ltd., a subsidiary of BC International Ltd., is approximately 17 km from Prince Rupert and 251 km south from the Brucejack Gold Mine Project. It is a liquefied natural gas (LNG) facility on Ridley Island at the Port of Prince Rupert, BC. The project includes a natural gas liquefaction plant and associated port and infrastructure facilities to export gas to international markets. The LNG facility will be developed in two phases, reaching a nominal capacity of 21 million tonnes per annum (mtpa) when fully developed (AECOM 2013).

Prince Rupert LNG Ltd. plans to submit an EIS to the CEA Agency in Q2 2014. A 60-month construction stage for Phase 1 would commence in Q2 2016, with Phase 1 completion in 2021. Phase 2 would commence in accordance to market demand (AECOM 2013).

Project Facts:

- **Production -** The facility would produce 21 mtpa LNG at the end of Phase 2, when fully developed (AECOM 2013).
- **Project Lifespan -** The operational life of the facility is 30 years but can be extended up to 60 years (AECOM 2013).
- **Footprint –** The project covers approximately 125 ha of land and includes a deep-water port, marine loading facilities, materials offloading facility, fuel and chemical storage and handling, natural gas liquefaction plant, ancillary facilities (AECOM 2013).
- **Access –** LNG carriers will access the project via Hectate Strait. No new roads are required for the project, although some existing roads may require upgrading (AECOM 2013).
- **Traffic Volume -** During Phase 1 there will be an estimated 189 vessel calls per year and an additional 95 vessel calls per year during Phase 2 (AECOM 2013).
- **Tailings Storage** – The project will not require tailings storage.

- **Water (inputs/outputs) -** Water will be sourced from the municipal water supply. Total water consumption by the facility during normal use is estimated to be 108 m^3/day. Sanitary sewage treatment plants will be installed to treat sanitary waste from the construction camp. Process water discharges will be collected and reused, where possible, and then sent to a sedimentation pond for treatment and monitoring (AECOM 2013).
- **Employment -** Phases 1 and 2 will create 9,000 and 3,500 person years of employment, respectively. The project is expected to employ 250 people directly during operations in addition to contract workers and indirect employment (AECOM 2013).

<u>Schaft Creek Project</u>

The Schaft Creek Project is a proposed mine located 80 km southwest of Telegraph Creek, and 111 km northwest of the Brucejack Gold Mine Project. The mineral claims of interest are situated near upper Schaft Creek, a tributary of Mess Creek, which flows into the Stikine River downstream of the community of Telegraph Creek.

The project is currently in the pre-application stage of the BC EA process that was launched in 2006. The closest major power source is located at Meziadin Junction. Consideration of on-site power generation may have serious implications on the financial viability of the project. It is assumed that power will be supplied by the provincial electrical grid through a transmission line from Highway 37 near Bob Quinn, along the selected access route.

Copper Fox plans to submit an Application for an EA Certificate for the project, and concurrent permit applications for road building, and the environmental assessment process is in the pre-application stage. For the purposes of the Brucejack Gold Mine Project CEA, it is assumed that the three-year construction phase will overlap with the Project construction and operation phases.

Project Facts:

- **Production -** The project is expected to mine 150,000 tpd of ore, producing approximately 494,200 dry tonnes of concentrates per year (Copper Fox Metals 2010; BC EAO 2011).
- **Project Lifespan** – 15-year mine life (Copper Fox Metals 2010).
- **Footprint -** will include an open pit, tailings/PAG waste rock storage facility, camp, and mill (Copper Fox Metals Inc. 2006).
- **Access -** The mine site is currently accessible by helicopter from Bob Quinn. Road access to the site is proposed via the Mess Creek Access Route. The route extends north from More Creek along the upper Mess Creek, entering the mine site and Schaft Creek drainage near Snipe Lake (Bender and McCandish 2008).
- **Traffic Volume -** The project will involve trucking of concentrate from the minesite to the deep sea Port of Stewart via Highway 37 and 37A (Bender and McCandish 2008). An estimated 54 concentrate trips per day will be required[4], and an additional 57 trips per day carrying other mine supplies.
- **Tailings Storage -** The tailings storage facility will be situated in the Skeeter Lake Valley north of the open pit. The tailings storage facility will store 812 Mt of tailings (Copper Fox Metals Inc. 2006; Bender and McCandish 2008).

[4] This report is using the most current information available, which may not be consistent with the project descriptions filed with the EAO.

- **Water (inputs/outputs) -** It is anticipated that excess water from the tailings area will be discharged via Schaft Creek into the Mess Creek drainage, a major tributary of the Stikine River (Copper Fox Metals Inc. 2006).
- **Employment** – The project is estimated to generate approximately 2,100 jobs during the construction phase and approximately 700 permanent jobs during mine operations (Copper Fox Metals 2010).

Spectra Energy Gas Pipeline Project

Spectra Energy Corp. has proposed a LNG pipeline system (the Spectra Energy Gas Pipeline) from the Cypress area in northeast BC to Prince Rupert area on the west coast. The pipeline would consist of either one or two adjacent pipelines approximately 851 to 872 km in length and having a diameter of 36 to 48 inches. The primary pipeline route is proposed from Cypress area to Cranberry Junction, with three potential routes west of Cranberry Junction to the terminus on Ridley Island, near Prince Rupert. The exact location of the pipelines and their proximity to the Project could not be determined, although they are not expected to pass within 50 km of the Project. The three western routes under consideration include a land route, through the north Coast Mountains and two routes with marine segments. The majority of the pipeline will be buried along its entire length. The project will include two new metering and up to five new compressor stations that would be located along the pipeline system (Spectra Energy Corp. 2012).

Spectra Energy plans to submit an EA application in the first quarter of 2014 and start construction in the second quarter 2015. The pipeline would be in-service in the fourth quarter of 2018 (Spectra Energy Corp. 2012).

Project Facts:

- **Production -** The system will transport approximately 2.4 billion cubic feet of natural gas on a daily basis (Spectra Energy Corp. 2012).
- **Project Lifespan -** Construction is planned for 2015 with the pipeline in-service in 2018. Spectra Energy stated, "with a prudent and timely maintenance program, the proposed pipeline would have an indeterminate life" (Spectra Energy Corp. 2012).
- **Footprint -** A pipeline from Cypress, BC to Prince Rupert, BC with either a 45 m or 55 m right-of-way, two metering stations, up to five compressor stations, access roads, lay-down areas and various temporary construction workspaces and other ancillary facilities (Spectra Energy Corp. 2012).
- **Access -** Access will be by temporary and permanent access roads (Spectra Energy Corp. 2012).
- **Traffic Volume** – Not available.
- **Tailings Storage** – The project will not require tailings storage.
- **Water (inputs/outputs) -** Water will be required during construction for horizontal directional drilling, hydrostatic pressure testing of the pipeline, fire suppression and for dust control. Domestic water and sewage disposal will be required for temporary construction camps and for operation of compressor stations. Water source options will be outlined in the EA (Spectra Energy Corp. 2012).
- **Employment -** 3,000 to 3,600 person years during construction and approximately 50 to 60 permanent jobs for the life of the project (Spectra Energy Corp. 2012).

Storie Moly Project

The Storie molybdenum deposit is located approximately 6 km southwest of Cassiar and 100 km north of Dease Lake (Yukon Explorations Inc. 2006), and approximately 309 km north of the Brucejack Gold Mine Project. A report by Purcell and Wheeler (2008) estimates a project milling capacity of 20,000 tpd. It is expected that concentrates would be transported by truck from the mine site to the bulk terminal facility in Stewart, about 300 km away (CHF Investor Relations 2009).

Although, Columbia Yukon submitted a Draft Project Description to provincial and federal EA regulators on June 3, 2010 (Marketwire 2010b), public information on the project is limited. Plans for both a pre-feasibility study and Environmental Assessment study are underway (CHF Investor Relations 2009).

For the purposes of the CEA, it is assumed that the project would take approximately 15 months to construct with construction beginning sometime in 2019.

Project Facts:

- **Production -** The project is assumed to have a mill feed rate of 20,000 tpd (Purcell and Wheeler 2008).
- **Project Lifespan** – The project lifespan will be 20 years (Purcell and Wheeler 2008).
- **Footprint** – Possible use of existing infrastructure from the former Cassiar Mining camp, plus a new open pit and waste rock and tailings storage facilities.
- **Access** – Current access to the site is via Highway 37, the access road to the old Cassiar community, and then a 5-km dirt road (Yukon Explorations Inc. 2006).
- **Traffic Volume - I**t is estimated that nine trips per day will be needed to transport both concentrate and other cargo during operation.
- **Tailings Storage** – This information is not available.
- **Water (inputs/outputs)** – This information is not available.
- **Employment** – This information is not available.

Treaty Creek Hydroelectric Project

The Treaty Creek Hydroelectric Project is still in the early planning stages and is considered in the Brucejack Gold Mine Project CEA because of its close proximity to the Project. As currently proposed, it is located approximately 25 km north east of the Brucejack Gold Mine Project. Northern Hydro Limited has proposed three inter-connected run-of-river hydroelectric projects on Treaty Creek, Todedada Creek and an un-named creek with a combined installed capacity of 24.3 MW (BC MFLNRO 2012).

Northern Hydro Limited was granted an investigative use permit for Treaty Creek for determining the distribution limits of fish, measuring water quality and water quantity parameters, and deriving its expected output capacity. The investigative use permit application states that the proposed project will have a plant capacity of 13.5 MW and is anticipated to operate an average annual power output of 5,666 V. It would consist of an intake, weir, penstock, powerhouse and tail race, transmission line, access road and laydown area(s). Northern Hydro Limited plans to commission the project in 2015 (BC MFLNRO 2012).

Project Facts:

- **Production** – 13.5 MW of run-of-river generated hydroelectric energy with an average annual power output of 5,666 V and project design flow of 32 m^3/s (BC MFLNRO 2012).

- **Project Lifespan** – This information is not available.
- **Footprint** – The proposed project includes water intake and weir structures, a penstock, a powerhouse and a tail race, a transmission line, an access road and laydown area(s) (BC MFLNRO 2012).
- **Access –** The project will require construction of access roads; however, detailed design of the access roads is not available (BC MFLNRO 2012).
- **Traffic Volume** – This information is not available.
- **Tailings Storage** – The project will not require tailings storage.
- **Water (inputs/outputs) –** Water from Treaty Creek, a tributary of Bell-Irving River, will be diverted through a penstock (BC MFLNRO 2012).
- **Employment –** This information is not available.

<u>Turnagain Project</u>

The Turnagain Project is a proposed nickel and cobalt open pit mine located approximately 70 km east of Dease Lake (Wardrop 2010), and 235 km northeast of the proposed Brucejack Gold Mine Project. Although this project does not appear to have entered the environmental assessment process, technical reports by Wardrop (2010) and AMC Mining Consultants Ltd. (2011) provide details on the proposed project.

Originally the project included open pits at three mineralized zones, but the Hatzl zone underlies the Turnagain River, which is fish-bearing and considered a wildlife corridor. As such, underlying mineralized material has more recently been excluded as potentially mineable (AMC Mining Consultants Ltd. 2011). The original plans also included a refinery, which has since been removed from the scope of the project (AMC Mining Consultants Ltd. 2011).

Current plans involve mining at the two remaining zones. These zones will begin as two separate open pits, and merge into one over the 28-year mine life. The mine will feed the crusher at an average rate of 43,400 tpd during the first five years, and increase to an average of 84,600 tpd thereafter (AMC Mining Consultants Ltd. 2011). Shipments of concentrate would likely be transported by truck via Highway 37 to Prince Rupert, and delivered to Fairview Terminal for loading onto an ocean vessel (Wardrop 2010).

The project is reviewable under both the BC EAA (2002b) and CEAA (1992), and the proposed TMF location would require listing in Schedule 2 of the Metal Mine Effluent Regulations (MMER; SOR/2002-222) of the *Fisheries Act* (1985; AMC Mining Consultants Ltd. 2011). Construction of the NTL and Red Chris Mine have increased certainty of power supply for the project (Wardrop 2010), and it is assumed for the purposes of the cumulative effects assessment that the project will begin the pre-application phase in 2013 with construction beginning in 2015 and operation in 2017.

Project Facts:

- **Production –** The mine will produce a maximum mill feed rate of 87,000 tpd (AMC Mining Consultants Ltd. 2011).
- **Project Lifespan –** The project lifespan will be 28 years. (AMC Mining Consultants Ltd. 2011).
- **Footprint –** The ore body will be mined in two pit areas merging into one, with waste dumps located southwest of the pits, and a 23-km transmission line. A process plant, mine service buildings, a truck shop, explosives manufacturing facility, maintenance, and accommodation facilities and tailings and waste rock storage areas will also be required (Wardrop 2010).

- **Access** – Current access to the property is by paved road to Dease Lake then by aircraft to the mine site. A historic dirt road along the Turnagain River Valley provides seasonal access (Wardrop 2010).
- **Traffic Volume** – It is assumed that approximately 46 trips per day will be needed to transport nickel metal and cobalt hydroxide, as well as other cargo during operation (Wardrop 2010).
- **Tailings Storage -** The tailings storage facility would ultimately be designed to store 757 Mt of tailings over the mine life. The proposed location for this facility is Flat Creek Valley (Wardrop 2010).
- **Water (inputs/outputs) -** Freshwater inputs for the project will be collected from alluvial groundwater wells just north of the plant site in the vicinity of the Turnagain River. Water will be diverted around the tailings storage facility and released downstream of the tailings storage facility directly to Flat Creek. The project plans to discharge water directly to the Turnagain River if discharge water quality criteria are being met (Wardrop 2010).
- **Employment** – The mine workforce will be between 61 and 240 staff, depending on the year and quantity of material mined (AMC Mining Consultants Ltd. 2011).

Volcano Creek Hydroelectric Project

The Volcano Creek Hydroelectric Project is owned by AltaGas Ltd. and located approximately 38 km east of the Brucejack Gold Mine Project on a south bank tributary (Volcano Creek) that parallels the existing Eskay Creek Mine Road. It is a proposed run-of-river project with a targeted output of 16 MW which will provide power to BC Hydro through the Forrest Kerr 287 kV transmission system to the BC Hydro Northwest Transmission Line substation at Bob Quinn (AltaGas Ltd. 2013).

AltaGas Ltd. plans to commission the project in 2015 and states that the facility will generate enough power for approximately 4,000 homes (AltaGas Ltd. 2013).

Project Facts:

- **Production** – The proposed project will produce 16 MW of run-of-river hydroelectric energy (AltaGas Ltd. 2013).
- **Project Lifespan** – Commissioning is planned for 2015; however, the project lifespan is not indicated. Alta Gas has signed a 60-year contract with BC Hydro.
- **Footprint** – The proposed project includes a 2.35-km penstock, powerhouse, weir and water intake facilities, 1.2-km 287-kV transmission line interconnection, and short spur roads (AltaGas Ltd. 2013).
- **Access -** The project will be accessed from the Eskay Creek Mine Road via short spur roads (AltaGas Ltd. 2013).
- **Traffic Volume** – This information is not available.
- **Tailings Storage** – The project will not require tailings storage.
- **Water (inputs/outputs) -** Water from Volcano Creek will be diverted via a 2.35-km penstock. The lower 475 m of Volcano Creek is accessible by fish and the remainder is characterized as non-fish bearing (AltaGas Ltd. 2013).
- **Employment -** This information is not available.

6.9.2.4 Non-traditional Land Use Activities

Non-traditional land use activities that may interact cumulatively with the Brucejack Gold Mine Project were identified through their inclusion in the Cassiar Iskut-Stikine Land and Resource Management Plan

(CIS LRMP; BC ILMB 2000), the Nass South Sustainable Resource Management Plan (BC MFLNRO 2012), BC Statistics for the Regional District of Kitimat-Stikine, and Traditional Knowledge studies. The non-traditional land use activities in the region include recreational hunting, trapping, guide outfitting, eco-tourism and fishing, heli-skiing, guided mountaineering, timber harvesting, and different types of freshwater recreation (Chapter 24; Appendix 21-A).

The selection of land use activities for inclusion in the assessment of cumulative effects on non-traditional land use focused on activities known to occur within the land use LSA and RSA (see Figure 6.9-3 below). The land use LSA and RSA represent areas expected to be directly or indirectly affected by the development of the proposed Project. Non-traditional land use activities selected for the Brucejack Gold Mine Project CEA are summarized in Table 6.9-3. Each of the activities in Table 6.9-3 has occurred in the past and is anticipated to occur in the future. In order to capture potential interactions between the Project and land use activities where little information exists, it is anticipated that some activities will increase in the future.

Table 6.9-3. Summary of Non-traditional Land Use Activities in Brucejack Gold Mine Project Regional Area

Types of Land Use	Land Use Description
Parks and Protected Areas	Bear Glacier, Border Lake, Lava Forks and Ningunsaw Provincial Parks.
Guide Outfitting	Three registered guide outfitting licences are relevant to the CEA.
Hunting	There are four Wildlife Management units (WMU) that are relevant to the CEA. Moose is the most hunted species among resident hunters.
Trapping	There are six trapping licences relevant to the CEA. Of the three that overlap proposed Project infrastructure, one is leased, one is inactive, and the remaining licence is held by a member of Ski km Lax Ha.
Commercial Recreation	There are eight commercial recreation licences relevant to the assessment of cumulative effects, including for heli-skiing, river rafting, fishing, lodging, guided mountaineering, guided freshwater recreation, multiple use, backcountry expeditions, and a trapper cabin.
Forestry	The Project falls within the Cassiar Timber Supply Area (TSA) and Nass TSA. There are seven forest licences relevant to the assessment of cumulative effects.
Mineral Exploration	There are 64 entities holding mineral claims in areas relevant to the assessment of cumulative effects.
Transportation and Utilities	Highways and Roads: Highways 37 and 37A are paved and located east of the proposed Project. A small number of forest service roads are located near Highway 37. The Granduc Access Road is located near the proposed south option transmission line. Airports/airstrips: There are airstrips at Tide Lake Flats, Stewart, and Bob Quinn. Electrical Transmission Lines: Once built, the Northwest Transmission Line will extend along Highway 37. The Long Lake Hydro transmission line is located proximally to the Project and commenced operation in December 2013. The existing Aiyansh-Stewart Transmission Line runs from Stewart, north past Meziadin Lake, and ends in New Aiyansh. Telecommunications Sites: None.

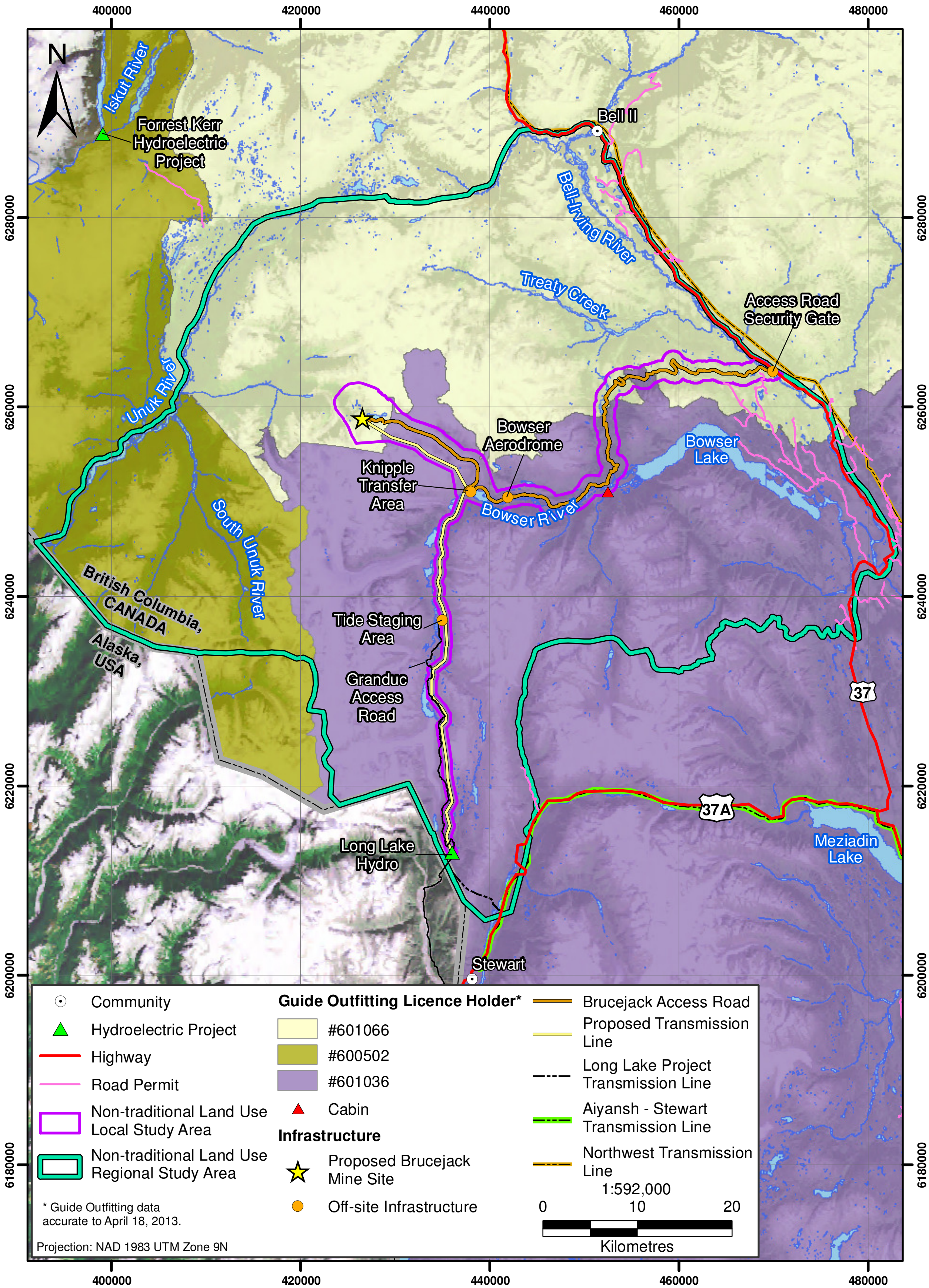
Parks and Protected Areas

No provincial parks or protected areas are located near proposed Project infrastructure. Border Lake Provincial Park is located approximately 180 km south of Telegraph Creek in the Unuk River Valley, along the Alaskan border, and approximately 30 km southwest of the Brucejack Gold Mine Project (Figure 6.9-3). The park covers an area of just over 800 ha and protects wetland environment surrounded by three small lakes in the Unuk River Valley. The Unuk River flows through the park (BC Parks 2013).

Figure 6.9-3

Guide Outfitting, Transportation and Utilities in the Brucejack Gold Mine Project Regional Study Area

ERM



- **Activity Timeline** – The activity timeline is ongoing.
- **Areas Used** – The park is approximately 800 ha (BC Parks 2013) and is located approximately 30 km southwest of the Brucejack Gold Mine Project. There is no record of the number of visitors to this park.
- **Access** – There is no vehicle access to the park. It may be accessed by raft via the Unuk River or by foot by backpackers and hunters (BC Parks 2013).
- **Traffic Volume** – There is no vehicle, air or watercraft access to the park (BC Parks 2013).
- **Water (inputs/outputs)** – This information is not available.
- **Employment** – This information is not available.

Guide Outfitting

The CIS LRMP area is considered to have some of the best big-game hunting in North America because of its diverse and abundant wildlife species and extensive backcountry areas (BC ILMB 2000). There are three guide outfitting licences relevant to the assessment of cumulative effects (Figure 6.9-3; Appendix 21-A). Species targeted include black bear, grizzly bear, caribou, deer, moose, mountain sheep, mountain goat, and wolf (Appendix 21-A). Increasing resident access to the hunting area by development of mining and logging roads and increased helicopter traffic may negatively affect some of the licence holders.

- **Activity Timeline** – Guide outfitting happens mostly between late spring and early fall.
- **Areas Used** – Areas identified as important by license holders include Willow Creek, Tumeka Lake, Telegraph Creek, Bowser Lake, and Bowser River near Todd Creek (Appendix 21-A).
- **Access** – Hunting guide tenures are accessed by vehicle, wheel or float plane, foot, ATV, or jet boat (Appendix 21-A).
- **Traffic Volume** – This information is not available.
- **Water (inputs/outputs)** – This information is not applicable.
- **Employment** – Northwest Ranching and Outfitting employs two seasonal workers. Milligan Outfitting employs one guide outfitter and two full-time employees (Appendix 21-A).

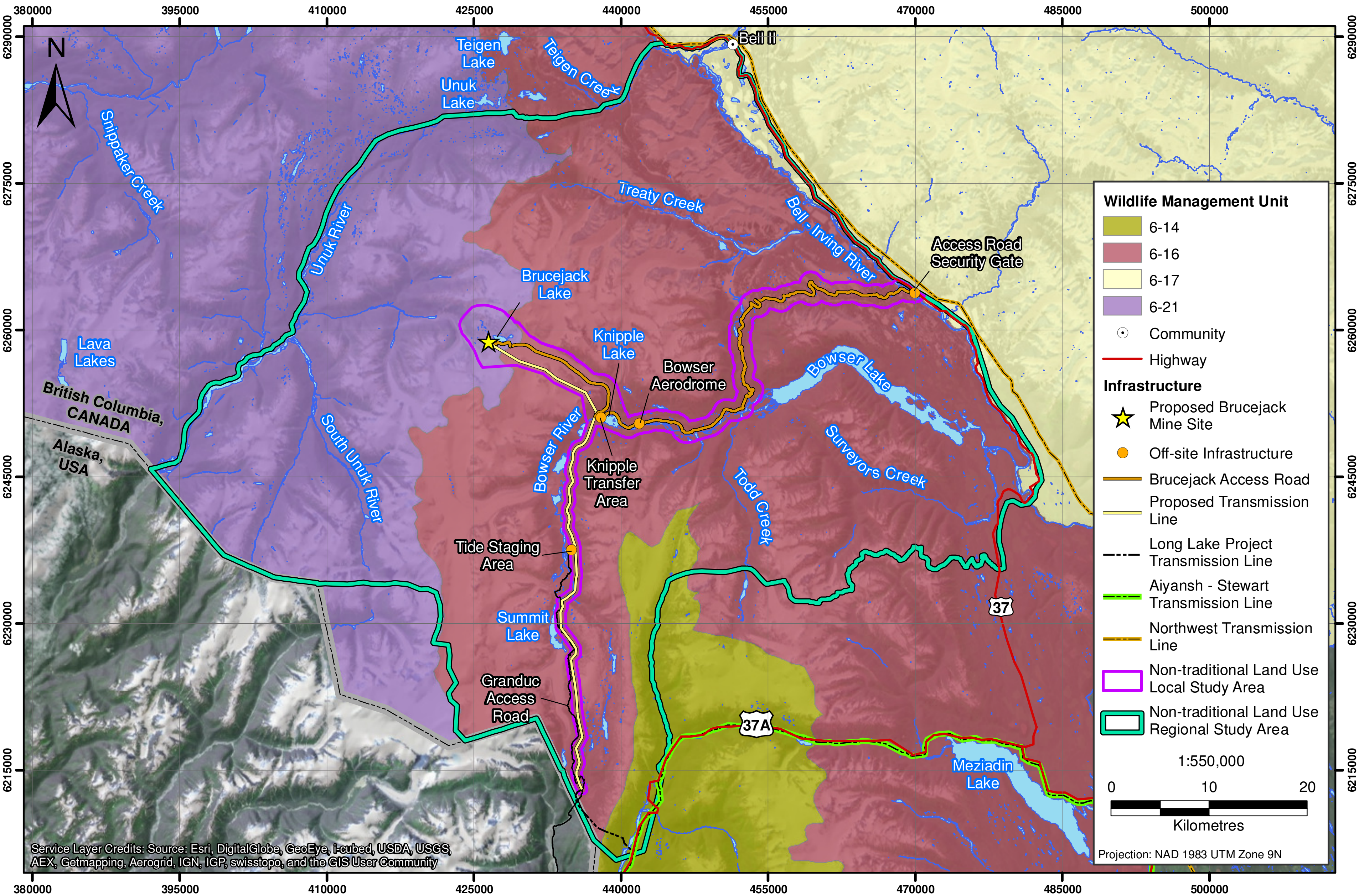
Hunting

Resident hunters are either citizens or permanent residents of Canada who meet the requirements to be considered a resident of BC (BC MFLNRO 2011). The vast majority of land uses in the vicinity of the Project are located within WMU (Wildlife Management Unit) 6-16, with the area immediately around the mine site spilling over into WMU 6-21. The land use study areas include small portions of WMU 6-17 and WMU 6-14 (Figure 6.9-4). In all WMUs, harvest levels have fluctuated from year to year, as have the number of hunters; in other words, there is no consistent increase or decrease in the harvest or harvester of any species.

- **Activity Timeline** – Hunting happens mostly between late spring and early fall.
- **Areas Used** – All areas in the vicinity of the proposed Project are used (Figure 6.9-4).
- **Access** – Hunting access in the area may be by vehicle, boat, aircraft, foot, horse, ATV, or snowmobile.
- **Traffic Volume** – This information is not available.
- **Water (inputs/outputs)** – This information is not applicable.
- **Employment** – This information is not applicable.

Figure 6.9-4

Wildlife Management Units in the Brucejack Gold Mine Project Regional Study Area



Trapping

There are six trapline licences that are relevant to the assessment of cumulative effects, and three trapline licences that overlap proposed Project infrastructure (Figure 6.9-5). Of the three traplines that overlap the infrastructure of the proposed Project, one is leased and currently in use, another is inactive, and the third is owned by a member of the Ski km Lax Ha and is considered within Chapter 25, Assessment of Potential Effects to Current Use of Lands and Resources for Traditional Purposes. Species harvested on the leased trapline include marten, squirrel, beaver, lynx, weasel, mink, otter, and wolverine (Appendix 21-A).

- **Activity Timeline** –Trapping occurs twice per year: once in the spring and once in the fall.
- **Areas Used** – Three trapping tenures overlap proposed Project infrastructure including the proposed mine, process plant, exploration road, transmission line corridor, Bowser Lake, or other Project infrastructure (Appendix 21-A).
- **Access** – One trapline owner noted that his tenure was accessed by foot and in the future will likely be accessed by the Brucejack exploration road (Appendix 21-A).
- **Traffic Volume** – This information is not available.
- **Water (inputs/outputs)** – This information is not applicable.
- **Employment** – Trapping is for domestic and economic purposes, typically providing intermittent employment for one or two people per trapline.

Commercial Recreation

Northwestern BC provides a number of recreational opportunities, with revenues from tourism in the region increasing between 2005 and 2008 (BC Stats 2010). There are two active commercial recreation licences that overlap proposed Project infrastructure, and an additional six are proximal to the Project (See Figure 6.9-6). Each of the eight licences is relevant to the assessment of cumulative effects. As identified in Appendix 21-A, *Non-Traditional Land Use Baseline Report,* commercial recreation licences within the vicinity of the proposed Project include heli-skiing, lodging, eco-tourism and fishing camps, guided freshwater recreation, guided backcountry expeditions, river rafting, a trapline cabin, angling, and other multiple use licences (Appendix 21-A).

- **Activity Timeline** –Heli-skiing, backcountry expeditions, and snowmobiling occur in the winter, while eco-tourism fishing camping and guided freshwater recreation are summer activities. Baseline research indicated that a number of commercial tenure owners' reported plans to maintain or expand their businesses and recreational and tourism activities in the area.
- **Areas Used** – Areas used by licence holders include the exploration road, Iskut River, Unuk River, Bell-Irving River, Bowser Lake, Bell 2 Lodge, and other general areas in the vicinity of the proposed Project (Figure 6.9-6).
- **Access** – Commercial recreation opportunities are accessed by Highway 37; with helicopters; and via other transportation infrastructure based in Smithers, Terrace, and Alaska.
- **Traffic Volume** – Traffic volume includes some vehicle and helicopter traffic.
- **Water (inputs/outputs)** – Rafting tours take place along the Iskut and Unuk rivers, and fishing and canoeing takes place along the Bell-Irving River and Nass River.
- **Employment** – Spey Lodge is located west of Highway 37 along the Bell-Irving River and employs five staff on a seasonal basis. Bear Mountaineering and Skeena Valley Expeditions are commercial recreation businesses that employ guides on a seasonal basis and operate both in the vicinity of the Project and elsewhere in the province. Other employment information was not available.

Figure 6.9-5
Trapline Areas in the Brucejack Gold Mine Project Regional Study Area

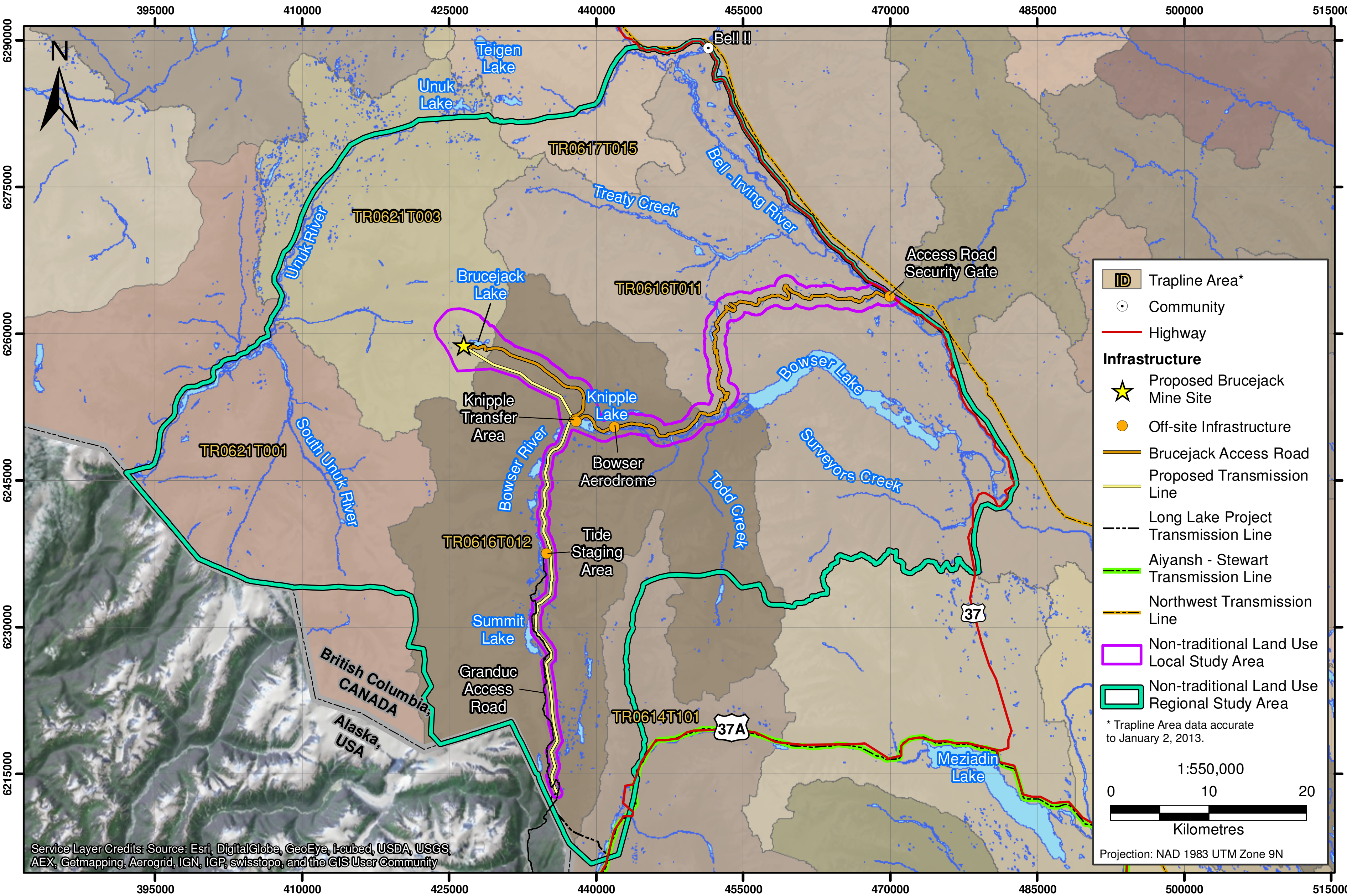
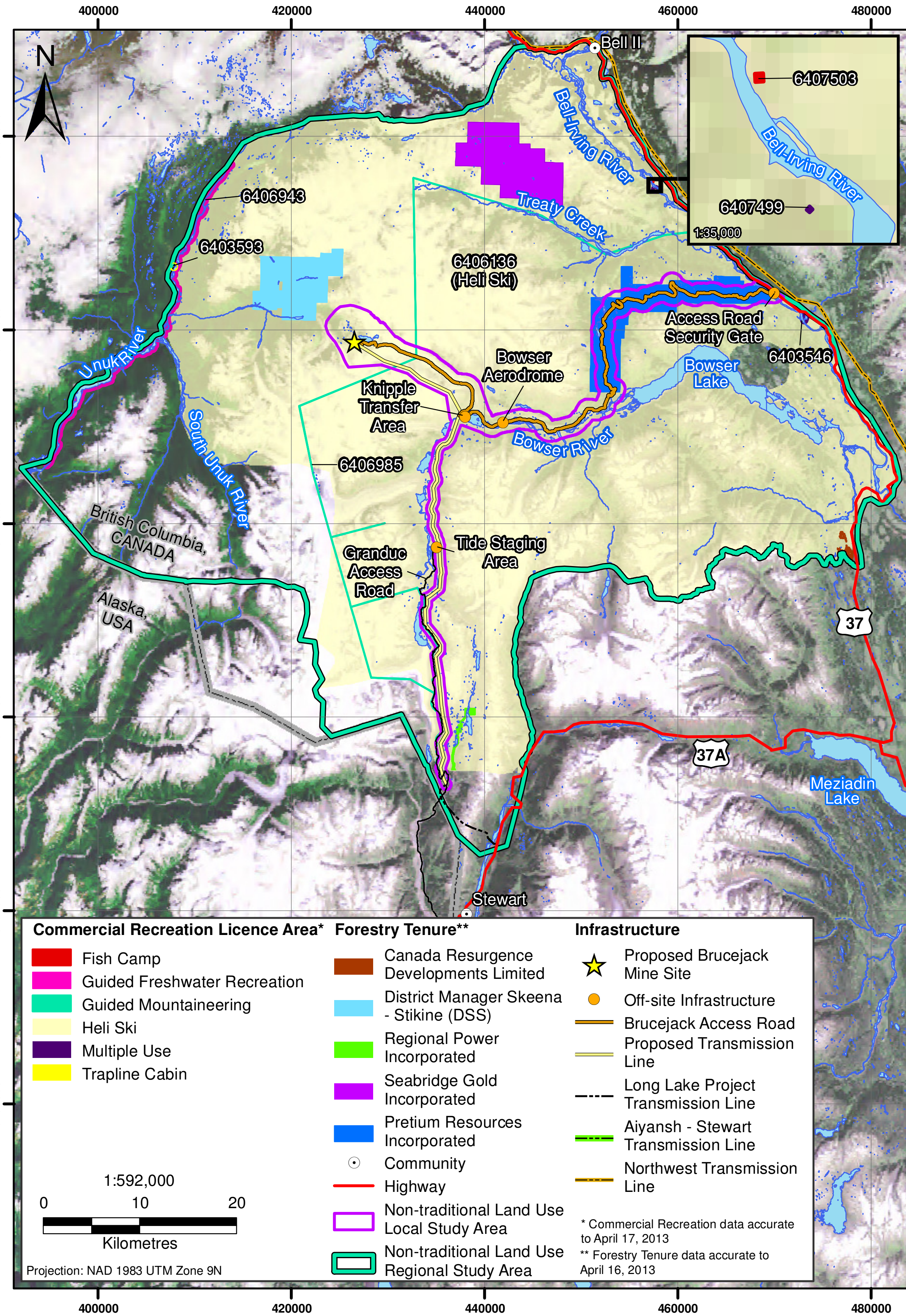


Figure 6.9-6

Commercial Recreation and Forestry Licences in the Brucejack Gold Mine Project Regional Study Area



Forestry

The proposed Project overlaps two forest districts (Skeena Stikine and Kalum), as well as the Cassiar and Nass TSA. Forest harvesting activities in the area have not been notable. Figure 6.9-6 shows the location of active cutblocks in the Regional Area, whereas Figure 6.9-2 shows the cutblocks more broadly across northern BC.

Highway 37 traverses the central and eastern portions of the Cassiar TSA, which is located north of the Project. The BC Ministry of Forests, Lands and Natural Resources Operations has indicated that limited economic opportunities exist in the TSA because of the climate and small scattered population, as well as lack of transportation networks and electricity (BC MOF 1999). The annual allowable cuts in the region have fallen over the past decade in general (BC Stats 2010) and there has been no recent logging activity in the Bob Quinn area.

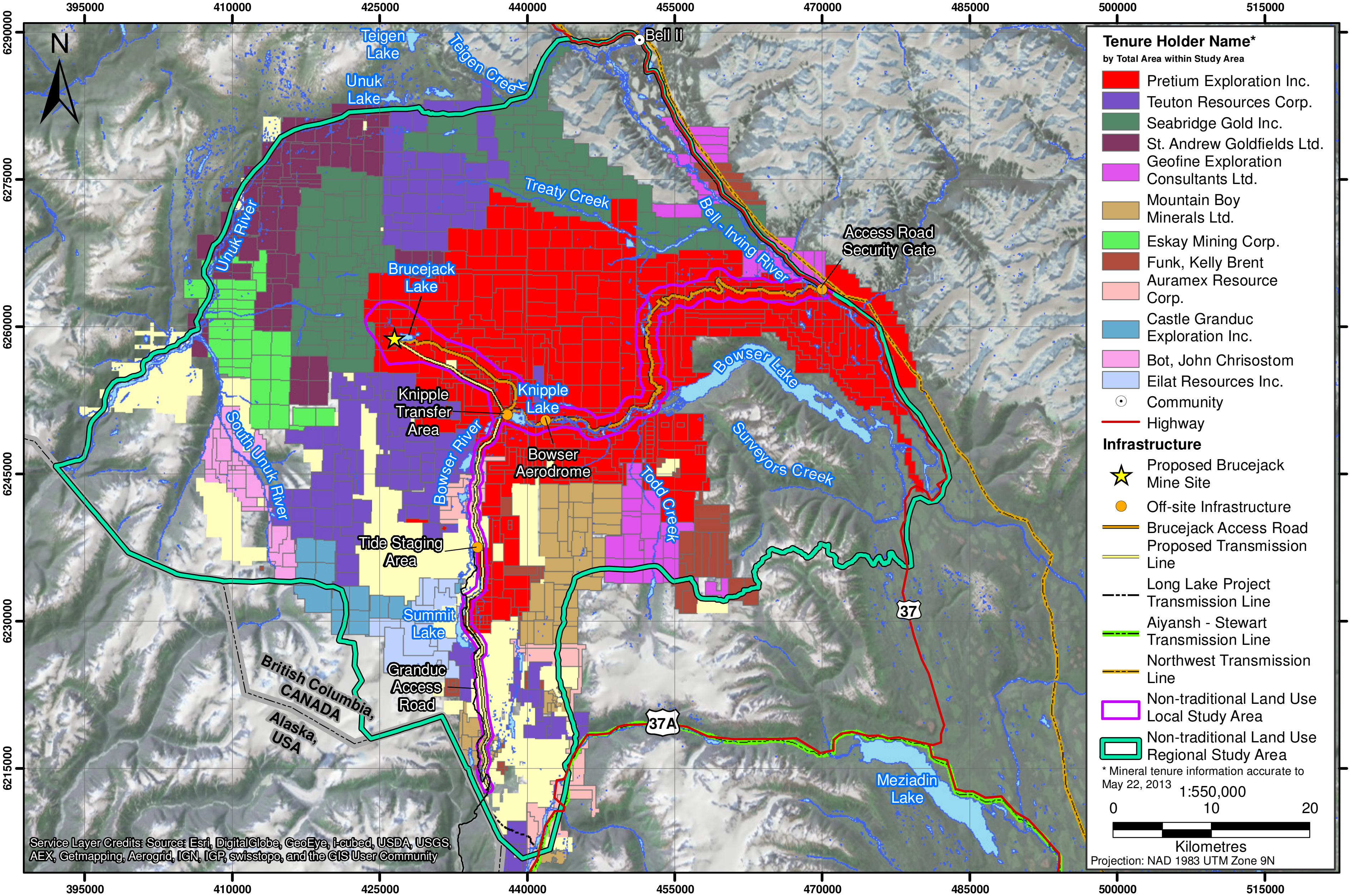
As of January 2013, three forest licences overlapped proposed Project infrastructure, and seven additional forest licences were in the general vicinity of the proposed Project (Appendix 21-A; Figure 6.9-6). The former include: 1) Pretivm's forestry licence that overlaps portions of Bowser Valley Road within the LSA (L48433); 2) a licence associated with the proposed KSM Project, but currently held by the District Manager of the Skeena-Stikine that overlaps the land use LSA, west of the proposed Project (L48499); and 3) a forestry licence near the south option transmission line held by Regional Power Incorporated (L48364).

- **Activity Timeline** – There is presently no major forestry activity in the vicinity of the Project, although it has occurred in the region in the past and is expected to occur again in the future.
- **Areas Used** – Areas used for forestry include Bob Quinn and Meziadin to Bell II.
- **Access** – Access costs are a limiting factor to forest harvesting activities. However, there are plans for future timber harvesting in the region. Access costs could decline and the timber harvesting land base could expand as a result of roads developed for new mines (BC ILMB 2000).
- **Traffic Volume** – Forestry has historically caused higher volumes of traffic in northwestern BC. Forestry traffic peaked in the 1990s, when between 10,000 and 16,000 loads were shipped each year along Highway 37 and 37A to various sites, travelling from the Brown Bear Forestry Service Road, north of Meziadin Junction, into Stewart. Past logging traffic along Highway 37 and 37A, travelling between the Yukon border and Smithers, may have accounted for up to 30 to 40 truckloads per year (Rescan 2009).
- **Water (inputs/outputs)** – Forestry activities have the potential to affect surface water quantity (Rescan 2006).
- **Employment** – Employment in the forestry sector has slowed. Northwestern BC was previously home to nine sawmills, two operating pulp mills, and remanufacturing plants. There are currently only two sawmills and one pulp mill, and the remanufacturing plants are closing (Rescan 2009).

Mineral Claim Holders

A mineral claim is a claim for a metal ore or natural substance found in the place or position in which it was originally formed, thereby requiring extraction via mining (BC MEMPR 2011). Sixty-four people or businesses have mineral claims relevant to the assessment of cumulative Project effects (as shown in Figure 6.9-7 and discussed in Appendix 21-A). Foreseeable future mining projects considered in the Brucejack CEA are summarized in Section 6.9.2.3.

Figure 6.9-7
Mineral Claims in the Brucejack Gold Mine Project Regional Study Area



Placer Claims

Placer claims apply to metal or natural substances which can be mined but are found in loose earth, rock, gravel, and sand (BC MEMPR 2011). As of February 2013, there were 71 placer claims belonging to five people or businesses that are relevant to the assessment of cumulative Project effects (Figure 6.9-8 and Appendix 21-A). Within the LSA, there are placer claims belonging to Pretium Resources Inc. and Seabridge Gold Inc. Foreseeable future mining projects considered in the Brucejack CEA are summarized in Section 6.9.2.3.

Water Licences

There are two water licences belonging to Pretivm and Boliden Ltd. which are located in the proposed Project. There are an additional three water licences in the general vicinity of the proposed Project: two belong to Long Lake Hydro Inc. and one belongs to River West Enterprises Ltd. (Appendix 21-A). All five water licences considered are current and used for work camps, general power, and land improvement. They are located along Brucejack Lake and Cascade River. Further details about projects operating these water licences can be found in Sections 6.8.2.2 (Long Lake Hydro) and 6.8.2.1 (Silbak Premier Mine).

Agricultural Land Reserves

There are no known agricultural activities or Agricultural Land Reserves located near the proposed Project.

Oil and Gas

There are no known oil and gas tenures located near the proposed Project.

Transportation

Roads

Road access to the mine site will be via the existing 79 km exploration road (the Brucejack Access Road) from Highway 37. The road consists of approximately 33 km of reactivated road originally constructed in the late 1980s by Newhawk Gold Mines Ltd. and 35 km of new road constructed by Pretivm. The road was constructed to support exploration activities at the Brucejack property. Approximately 12 km of the road is along Knipple Glacier (Figure 6.9-9). For the Project, the road will be used to mobilize equipment and supplies to the mine site and to truck concentrate from the mine site to Highway 37 and to the port at Stewart. The road will require upgrades to support mine traffic during operations.

Along the transmission line corridor, an unpaved service road runs between Long Lake and the Long Lake Hydro Project Generation Station. This road originally made up part of the Granduc Road, which serviced the Premier Mine and, later, the Granduc Mine. This road is accessed by multiple users, for example by Regional Power for the Long Lake Project (Regional Power 2011).

Highway 37 (the Stewart-Cassiar Highway) runs in a north-south direction to the east of the proposed Project. The highway runs for 724 km through northwestern BC, and is one of only two overland routes to Alaska. It connects a number of small, rural settlements in northwestern BC. The highway is almost entirely paved or sealed and has a speed limit of 80 to 90 km/hour. Conditions are suitable for a range of personal, recreational, and industrial vehicles, although motorists are cautioned that logging and other large trucks use the road 24 hours a day (BC MOTI 2011).

A small number of forestry roads are proximal to the proposed Project and can potentially be accessed via Highway 37 (Figure 6.9-9). One inactive forestry road intersects the exploration road at Wildfire Camp, and the forestry roads are located some distance from Project infrastructure. It is likely that these roads are used by local First Nations and/or commercial fishing tenure holders to access fishing locations and trapline cabins.

Figure 6.9-8
Placer Claims in the Brucejack Gold Mine Project Regional Study Area

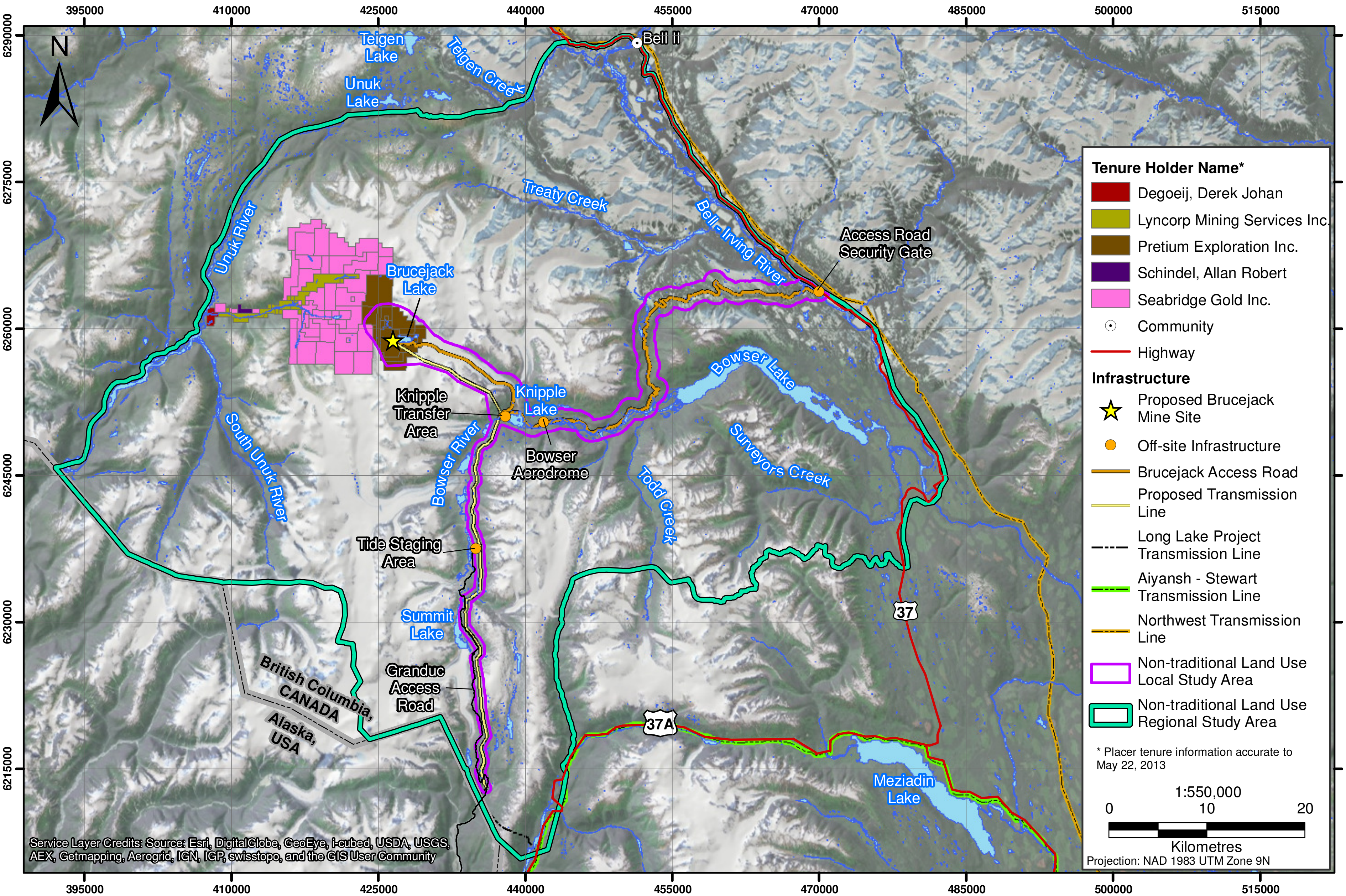
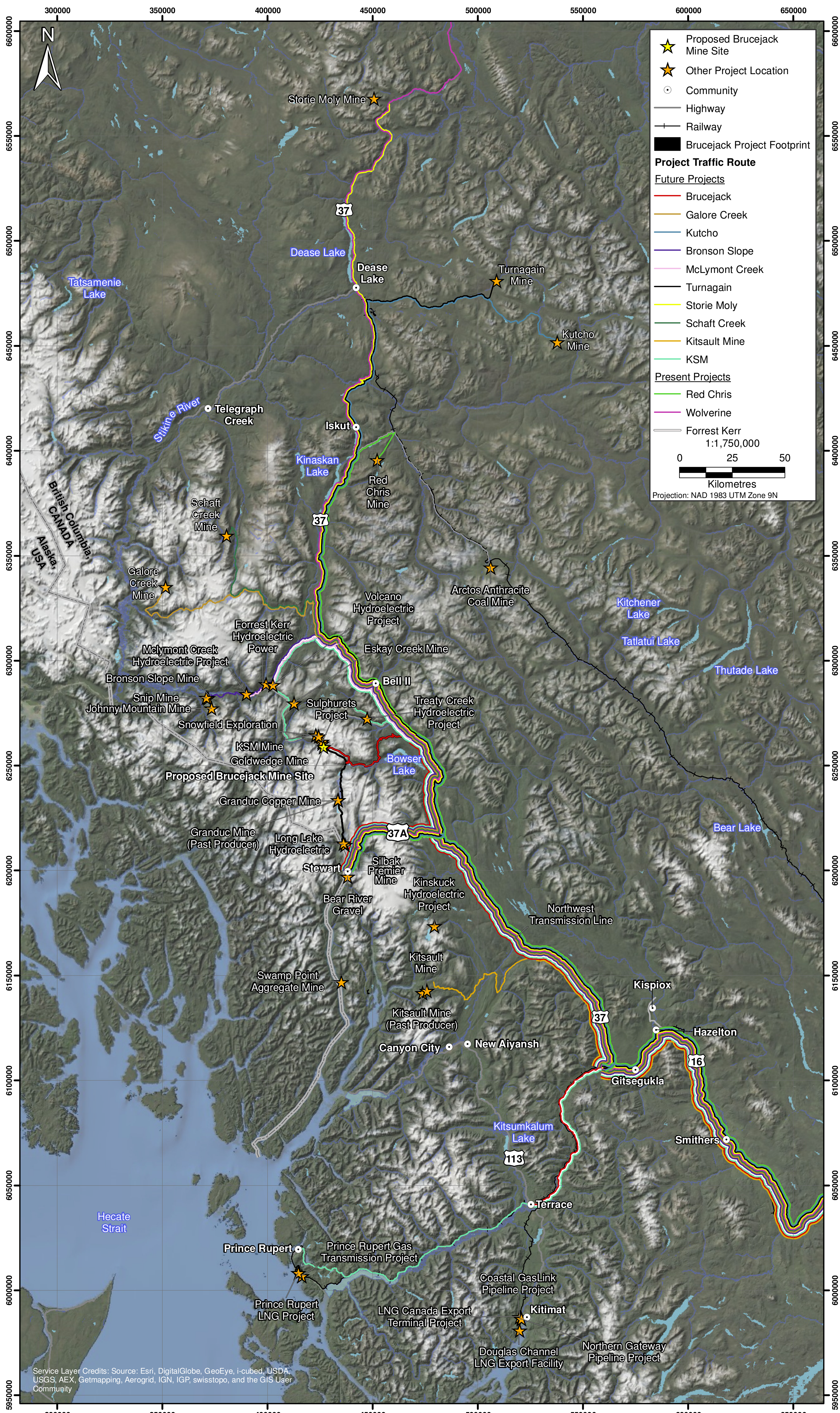


Figure 6.9-9
Present and Future Project Traffic Routes



With a number of proposed projects in the region (including the Brucejack Gold Mine Project), there is an expected overall increase in the volume of development-related traffic. The Brucejack Gold Mine Project may share overlapping transportation routes along Highway 37 and 37A to the Port of Stewart, as well as along Highway 16. Projects that will potentially share these routes include Forrest Kerr Hydroelectric, Red Chris Mine, Wolverine Mine, Bronson Slope Mine, KSM Project, Galore Creek Mine, Kitsault Mine, Kutcho Mine, McLymont Creek Hydroelectric, Schaft Creek Mine, Storie Moly Mine, and Turnagain Mine. The location of each project and the overlapping transportation routes are illustrated in Figure 6.9-9.

Airstrips

Apart from the airports at Stewart and Bob Quinn, which are relatively distant from the proposed Project, one small landing strip or runway was identified along the transmission line corridor (Figure 6.9-9), in an area known as the Tide Lake Flats. It was originally constructed as a 1,000-foot airstrip that was used to ferry freight from Stewart to the Granduc Mine, prior to the completion of the Granduc Road (McLeod and McNeil 2004).

6.9.2.5 Traditional Land Use Activities (Aboriginal Harvest)

Traditional land use activities that may interact cumulatively with the Project were identified through their inclusion in the assessment of potential effects to traditional lands and resources (Chapter 25; Appendices 25-A, B, and C). The traditional land use activities in the region include fishing, hunting, trapping and plant gathering, as carried out by Aboriginal groups in the greater area of the Project and collectively referred to as Aboriginal Harvest. The Skii km Lax Ha, Nisga'a Nation and Tahltan Nation are the three Aboriginal groups identified to carry out such traditional land use.

The Skii km Lax Ha are considered by the provincial government as a wilp or "house" of the larger Gitxsan Nation, and as a distinct First Nation by the federal government. The Skii km Lax Ha have asserted their traditional territorial boundary from the northern side of Cranberry River in the south, to Ningunsaw Pass in the north, and with the Unuk River and Groundhog Range as the western and eastern boundaries respectively. Aboriginal harvest by the Skii km Lax Ha in the greater area affected by the Project comprises hunting, trapping, fishing and the collection of plants, berries and mushrooms.

The Nisga'a Treaty Nation have established rights to use the Nass Area according to the Nisga'a Final Agreement of 1999. The area of the Nass River to the south of the Project area comprises the bulk of such land, with the Nass Area extending to the upper reaches of the Bell-Irving River to the east of the mine site area. Although the utilization and trade in fish and aquatic species is particularly important to the Nisga'a, they also harvest a wide array of terrestrial wildlife species and plant resources.

The Tahltan Nation's territory stretches from the BC-Alaska border in the west to the Stikine Plateau in the east, and from the BC-Yukon border in the north to the Unuk River and Treaty Creek areas in the south. The eastern extremity of the Brucejack Access Road falls within this territory and the area around Bob Quinn has been identified by the Tahltan as the harvesting area closest to the Project. The Tahltan harvest wildlife, fish, plants and berries throughout their traditional territory.

6.9.3 Establishing the Scope of the Cumulative Effects Assessment

The methodology for identifying potential cumulative interactions between Project-related residual effects and other projects and/or human activities is described for each intermediate component and receptor VC in the respective chapters. An effect matrix approach was used to select candidate projects/activities. The effect matrix is provided in Table 6.9-4.

A summary of all Project-related residual effects (identified in Section 6.6 and Table 6.6-2) that will be considered and analyzed for the potential to interact cumulatively with selected projects and/or activities is included; this analysis is supported by Table 6.9-5 (blank table shown for illustrative purposes). For each intermediate component and receptor VC, the analysis narrows the scope of the cumulative effects assessment to focus only on those projects and activities where there is an anticipated cumulative interaction with the predicted changes and residual effects from the Brucejack Gold Mine Project. A description of the type of cumulative effect that is expected is also provided.

The design or implementation of future projects and activities may change due to their conceptual nature, leading to uncertainty in predicting the potential for cumulative effects.

6.9.3.1 Cumulative Effects Assessment Boundaries

The cumulative effects assessment considers the spatial and temporal extent of Project-related predicted changes and residual effects on receptor VCs, combined with the anticipated residual effects from other projects and activities, to assist with analyzing the potential for a cumulative effect to occur.

Spatial Boundaries

Local cumulative effects assessment study areas were defined for intermediate components and receptor VCs based on the different spatial scales over which cumulative effects may occur. The spatial boundaries used to assess potential cumulative effects are shown in each of the chapters in this Application/EIS. Final boundaries are the result of consultation with Aboriginal groups, government agencies, the public and stakeholders, and the BC EAO and CEA Agency.

Temporal

The expected timing and duration of Project-related residual effects was compared with the timing of the residual effects of other past, present, and future projects or activities to identify temporal overlap. This process included an assessment of whether past projects or activities affected the current baseline condition of each intermediate component and receptor VC. Figure 6.9-10 portrays the temporal category for each of the projects and/or activities that were considered in the assessment.

The following temporal phases were assessed in this Application/EIS:

- **Past:** The year 1918 is the historical temporal boundary, representing a time when organized mining activity first started to occur in the regional area. Effects of past activities are captured in baseline studies.
- **Present:** This category includes existing projects and activities which are operating or undergoing construction, or those that will be operating concurrently with the Project.
- **Foreseeable Future:** Future boundaries are VC-specific and are based on the predicted length of time it would take for the VC to recover to baseline conditions, if possible. The future boundaries are identified in each VC chapter.

6.9.4 Cumulative Effects and Mitigation

Based on the outcomes of Table 6.9-5, projects and activities with the potential to cause a cumulative effect with the Brucejack Gold Mine Project were identified and discussed for each affected receptor VC. Additional mitigation measures to minimize cumulative effects were identified and discussed where applicable.

Table 6.9-4. Potential Interaction of Projects and Activities with the Brucejack Gold Mine Project

Projects and Activities	Biophysical																		Economic		Land Use	Social			Heritage	Human Health			Traditional Lands and Resources
														Wildlife					Labour Market										
	Air Quality	Climate[1]	Noise	Groundwater Quality	Groundwater Quantity	Surface Water Hydrology (Channel Morphology)	Surface Water Quality	Aquatic Resources - Primary and Secondary Producers	Fish	Fish Habitat	Terrain and Soils	Terrestrial Ecology	Wetlands	Moose	Mountain Goat	Grizzly Bear	American Marten	Western Toad	Increased Competition for Labour and Wage	Decrease in Employment at Closure	Commercial Land Use	Education, Skills Development, and Training	Community Infrastructure, Services and Housing	Family and Worker Well-being	Protected Archaeological Resources	Drinking Water	Air Quality	Noise	Hunting/Trapping Opportunities and Practices
Historical																													
Eskay Creek Mine								▒	▒		▒			■	■	■	■	■			▒								
Galore Creek Project - Access Road Only											▒	▒		■	■	■					▒								
Goldwedge Mine				▒	▒		▒				▒	▒	▒	■	■	■	■	■			▒					▒			
Granduc Mine							▒	▒	▒		▒	▒	▒	■	■	■	■	■			▒					▒			
Johnny Mountain Mine														■	■	■	■				▒								
Kitsault Mine																■					▒								
Silbak Premier Mine							▒	▒			▒	▒	▒	■	■	■		■			▒					▒			
Snip Mine														■	■	■					▒								
Snowfield Exploration Project				▒	▒		▒	■			■	■		■	■	■	■	■			▒								
Sulphurets Advanced Exploration Project				■	■	■	■	■	▒		■	■	■	■	■	■		■			▒					■			
Swamp Point Aggregate Mine																■													
Present																													
Brucejack Exploration and Bulk Sample Program	▒			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■			■					■			■
Forrest Kerr Hydroelectric Power Facility														■	■	■					▒								
Long Lake Hydroelectric Power Facility											▒	▒	■	■	■	■	■	■			▒					▒			
McLymont Creek Hydroelectric Facility														■	■	■			▒		▒			▒					
Northwest Transmission Line									■	■	▒	▒	■	■	■	■	■	■			■			▒		▒			■
Red Chris Mine																			▒	▒	▒	■	■	■					▒
Reasonably Foreseeable Future																													
Arctos Anthracite Coal Project														■	■	■				▒	▒	■	■	■					▒
Bear River Gravel Project														■	■	■	■				▒	▒	▒	■					
Bronson Slope Project														■	■	■			▒	▒	▒			■					
Coastal GasLink Pipeline Project																■			▒				▒	▒					
Galore Creek Project														■	■	■			▒	▒	▒	▒	▒	■					
Granduc Copper Mine							▒	▒	▒	▒	▒		▒	■	■	■	■	■	▒		▒			■		▒			▒
KSM Project	■		■	▒	▒		■	■	■	■	■		■	■	■	■	■	■	■		■	■	■	■		▒	▒	▒	■
Kinskuck Hydroelectric Project														■	■	■			▒		▒	▒	▒	▒					
Kitsault Mine																■			■		▒	■	■	■					▒
Kutcho Project																			■			■	■	■					
LNG Canada Export Terminal Project																			▒				▒	▒					
Northern Gateway Pipeline Project																			▒				▒	▒					
Prince Rupert Gas Transmission Project																			▒				▒	▒					
Prince Rupert LNG Project																			▒										
Schaft Creek Project														■	■	■			▒	▒	▒	■	■	■					

(continued)

Table 6.9-4. Potential Interaction of Projects and Activities with the Brucejack Gold Mine Project (completed)

	Biophysical																		Economic		Land Use	Social			Heritage	Human Health			Traditional Lands and Resources
														Wildlife					Labour Market										
Projects and Activities	Air Quality	Climate[1]	Noise	Groundwater Quality	Groundwater Quantity	Surface Water Hydrology (Channel Morphology)	Surface Water Quality	Aquatic Resources - Primary and Secondary Producers	Fish	Fish Habitat	Terrain and Soils	Terrestrial Ecology	Wetlands	Moose	Mountain Goat	Grizzly Bear	American Marten	Western Toad	Increased Competition for Labour and Wage	Decrease in Employment at Closure	Commercial Land Use	Education, Skills Development, and Training	Community Infrastructure, Services and Housing	Family and Worker Well-being	Protected Archaeological Resources	Drinking Water	Air Quality	Noise	Hunting/Trapping Opportunities and Practices
Reasonably Foreseeable Future (cont'd)																													
Spectra Energy Gas Pipeline Project																			Grey		Grey		Grey	Grey					
Storie Moly Project																			Grey	Grey		Grey	Grey	Grey					
Treaty Creek Hydroelectric Project	Grey										Grey	Grey	Black	Black	Black	Black	Black	Black			Black					Grey			Grey
Turnagain Project																			Grey		Grey	Grey	Grey	Grey					
Volcano Hydroelectric Project														Black	Black	Black					Grey								
Land Use Activities - All Stages (past, present future)																													
Parks and Protected Areas	n/a			n/a	n/a									Black	Black	Black			n/a	n/a	n/a	n/a	n/a	n/a		n/a	n/a	n/a	
Guide Outfitting	n/a			n/a	n/a									Black	Black	Black			n/a	n/a	n/a	n/a	n/a	n/a		n/a	n/a	n/a	Grey
Aboriginal Harvest (fishing, hunting/trapping, plant gathering)	n/a			n/a	n/a				Black			Black		Black	Black	Black	Black		n/a	n/a	n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a
Hunting	n/a			n/a	n/a									Black	Black	Black	Black		n/a	n/a	n/a	n/a	n/a	n/a		n/a	n/a	n/a	Grey
Trapping	n/a			n/a	n/a												Black		n/a	n/a	n/a	n/a	n/a	n/a		n/a	n/a	n/a	Grey
Commercial Recreation (including fishing)	n/a			n/a	n/a				Black					Black	Black	Black			n/a	n/a	n/a	n/a	n/a	n/a		n/a	n/a	n/a	
Forestry	n/a			n/a	n/a	Black			Black	Black	Black	Black	Grey	Black	Black	Black	Black	Black	n/a	n/a	n/a	n/a	n/a	n/a		n/a	n/a	n/a	Grey
Agricultural Land Reserves[2]	n/a			n/a	n/a														n/a	n/a	n/a	n/a	n/a	n/a		n/a	n/a	n/a	
Oil and Gas[2]	n/a			n/a	n/a														n/a	n/a	n/a	n/a	n/a	n/a		n/a	n/a	n/a	
Transportation	n/a			n/a	n/a								Grey	Black	Black	Black		Black	n/a	n/a	n/a	n/a	n/a	n/a		n/a	n/a	n/a	Grey

Black = likely interaction between Brucejack Gold Mine Project and other project or activity.

Grey = possible interaction between Brucejack Gold Mine Project and other project or activity.

White = unlikely interaction between Brucejack Gold Mine Project and other project or activity.

[1] Climate is not anticipated to have any cumulative effect interactions with any past, current or future projects or activities.

[2] No known activities located near the proposed Project.

Figure 6.9-10
Temporal Overlap Between All Other Projects and Activities and the Brucejack Gold Mine Project

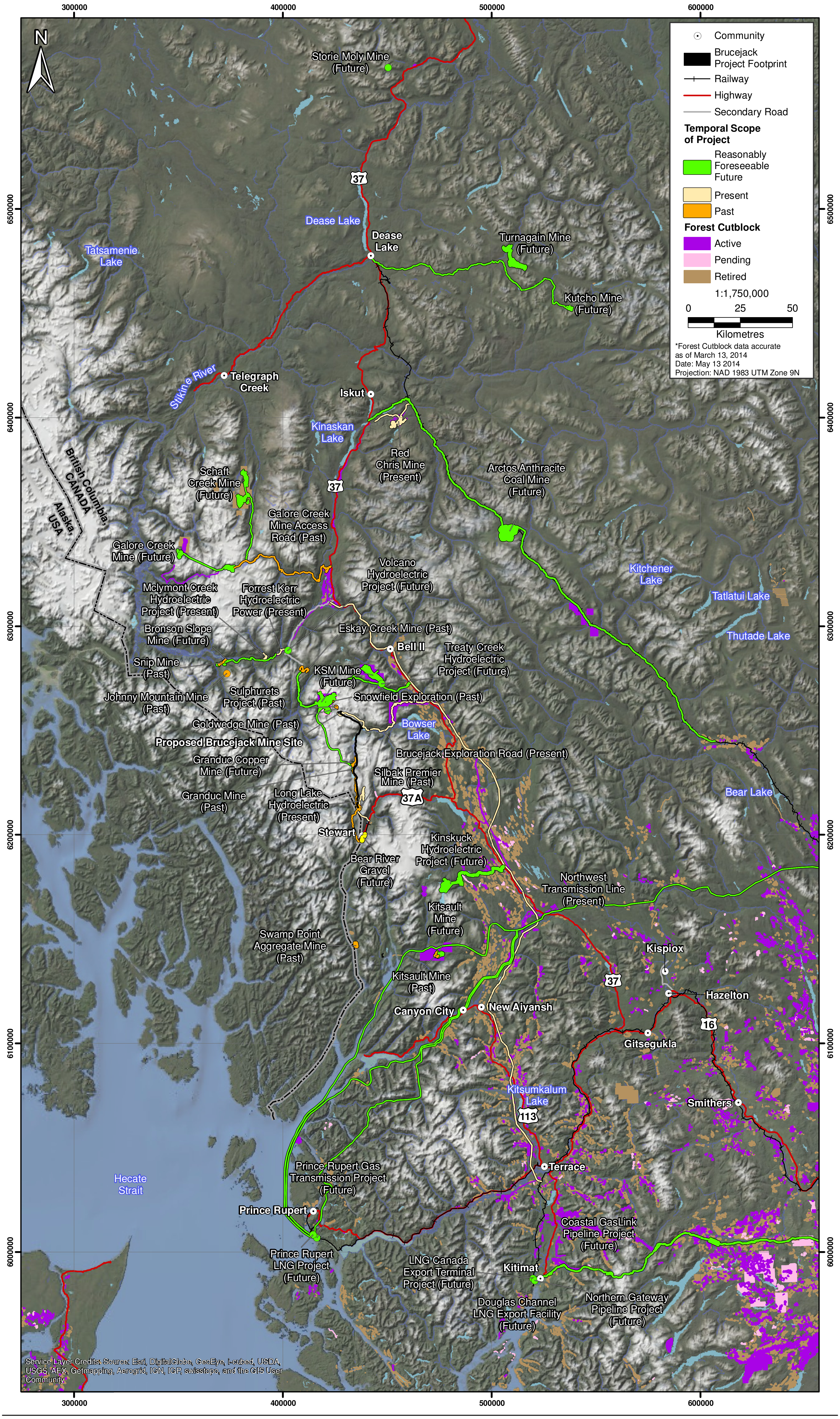


Table 6.9-5. Potential Cumulative Effects between the Brucejack Gold Mine Project and Other Projects and Activities

	Brucejack Gold Mine Project	Past Project or Activity (name)	Existing Project or Activity (name)	Reasonably Foreseeable Future Project or Activity (name)	Type of Potential Cumulative Effect (physical-chemical transport, nibbling loss, spatial crowding, temporal crowding, synergistic, additive, growth inducing)
Description of Residual Effect					

6.9.4.1 Potential Cumulative Effects

The cumulative effects assessment applies best practice methods to predict the nature and extent of cumulative effects that may result from the Project in combination with other projects and activities. These methods are described in the relevant assessment chapters.

The potential for key cumulative residual effects was explored through either qualitative or quantitative means. Published information on past, current, and future projects is limited mainly to previous and current mine reviews, and public information available on company websites. Greater reliance was therefore placed on professional judgment and traditional knowledge when assessing cumulative effects.

To define key cumulative effects and mitigation, the following questions were considered (BC EAO 2013a):

- Would the residual effect of the Project result in a measurable change in the cumulative effect? If not, a detailed cumulative effects assessment may not be warranted.
- Would the residual effect of the Project substantively change the characteristics of the cumulative effect (e.g., substantive increase in magnitude, extent, duration, or frequency)? If not, a detailed cumulative effects assessment may not be warranted.
- Is the receptor VC already significantly adversely affected by other projects and activities? If so, a detailed cumulative effects assessment may be warranted.
- Is the receptor VC so sensitive to additional disturbance that even a small incremental adverse effect may be sufficient to cause a significant adverse cumulative effect? If so, a detailed cumulative effects assessment may be warranted.

For each receptor VC with a predicted key cumulative effect, the cumulative effects assessment makes reference to any relevant literature, analyses, and explanations which identify:

- how scientific, engineering, community, and Aboriginal knowledge were used in the analysis;
- which studies included the assistance of communities and individuals, who was involved (if the information can be made public), and how contributors were selected;
- data collection methods and associated limitations;
- model assumptions and study methodologies;
- study and model outputs, calculations, supporting analyses, and an explanation of results; and
- reference literature or other information sources for any contributions, including traditional knowledge.

6.9.4.2 Implementing Mitigation Measures for Cumulative Effects

Mitigation measures for cumulative effects involves taking further action, where possible, to avoid or minimize cumulative effects on receptor VCs. Because cumulative effects typically result from the combined effects of multiple developments, responsibility for their prevention and management is shared among the various contributing developments. It is usually beyond the responsibility or capability of any one party to implement all of the measures needed to reduce or eliminate cumulative effects; therefore, collaborative efforts are needed. Implementation of additional mitigation measures for cumulative effects is confounded by the involvement of and lack of control over operators of other projects and activities. Proposed mitigation measures must take technical, environmental, and economical feasibility into consideration as well as the ability to influence the independent operators of other projects and activities. Key approaches to avoid, reduce, control, eliminate, offset, or compensate for potential cumulative effects are described in Section 6.5.2.

Proposed mitigation and monitoring activities for each key cumulative effect are described in the applicable sections of the Application/EIS, and compiled into discrete discipline-specific Environmental Management Plans (EMPs). Each EMP applies a systematic approach for integrating Project-specific mitigation and monitoring activities throughout the life cycle of the Project (i.e., into each Project phase). Adaptive management plans, compensation plans, and follow-up monitoring plans are also included in an EMP where required.

If the proposed implementation controls and mitigation measure(s) were deemed insufficient to eliminate a key cumulative effect for a receptor VC, the residual effect was identified and carried through to the significance determination exercise. Intermediate components were considered for their influence on receptor VCs, but no significance determination was made for intermediate components, in accordance with the methodology described in Section 6.7.

6.10 CUMULATIVE RESIDUAL EFFECTS

Cumulative residual effects are those adverse effects remaining after the implementation of all mitigation measures, and are therefore the expected consequences of the Project on the selected intermediate components and receptor VCs. Each assessment chapter of the Application/EIS describes direct, indirect, and/or induced residual effects of the Project.

6.10.1 Cumulative Residual Effects Remaining After Mitigation

If the proposed mitigation measure(s) were deemed insufficient to eliminate the Project's contribution to a key cumulative effect, a cumulative residual effect was identified and described and the specific projects and activities contributing to the cumulative residual effect(s) were discussed. The methodologies, underlying assumptions, and data limitations are provided in the accompanying text within each chapter. The Application/EIS also identifies any residual adverse cumulative effects after the application of additional mitigation measures, summarized in a table, as per Table 6.10-1.

Table 6.10-1. Summary of Cumulative Residual Effects

Valued Component	Timing of Cumulative Residual Effect	Description of Cause-Effect	Description of Additional Mitigation (if any)	Description of Cumulative Residual Effect

6.11 CHARACTERIZING CUMULATIVE RESIDUAL EFFECTS, LIKELIHOOD, SIGNIFICANCE, AND CONFIDENCE

Characterization, significance determination, and assessment of likelihood, probability and risk were assessed by comparing two scenarios:

1. Future case *without* the Project - A consideration of residual effects from all other past, existing, and future projects and activities *without* the Brucejack Gold Mine Project. This analysis was designed to answer the following question: given the status of current baseline conditions, how will VCs be affected by the residual effects from other reasonably foreseeable projects and activities in the absence of the Brucejack Gold Mine Project? The results of baseline data used in the Project-related effects assessment was used to facilitate this discussion.
2. Future case *with* the Project - A consideration of all residual effects from past, existing, and future projects and activities on a VC *with* the Brucejack Gold Mine Project. This scenario was designed to answer the question: when combined with other project and activities, does the Brucejack Gold Mine Project act as a trigger that pushes the intermediate component or receptor VC beyond significant thresholds?

The cumulative residual effects identified in the "Future case *with* the Project" scenario were subjected to the characterization process using the attributes defined in Section 6.6.2: direction, magnitude, duration, geographic extent, frequency, reversibility, resiliency, and ecological context. Any modifications to these characterization criteria are rationalized and discussed in the relevant Application/EIS chapter. Each assessment chapter describes individual ranking criteria pertaining to a particular effect and, where possible, assigns and rationalizes quantitative levels or values (e.g., threshold values). Areas where insufficient data were available to characterize a cumulative residual effect are identified, with the attribute rankings being described as uncertain in these instances.

6.11.1 Likelihood of Cumulative Residual Effects

As discussed in Section 6.6.3, likelihood of cumulative residual effects has been assessed in this Application/EIS prior to the significance assessment, following the most recent guidance (September 30, 2013) from the BC EAO (2013a). The likelihood of a cumulative residual effect occurring is expressed as a probability, to determine the potential for the Project to cause cumulative residual effects. Probability is determined according to the attributes identified in Section 6.6.3. Narrative descriptions and justifications are provided along with the valuation of these attributes within each of the chapters of the Application/EIS. Qualitative terms are defined as clearly as possible within each assessment chapter. Each assessment chapter also defines the source literature used to establish thresholds. Areas where insufficient data are available to provide an assessment are highlighted.

6.11.2 Significance of Cumulative Residual Effects

When defining and evaluating the significance of the Project's contribution to a cumulative residual effect, each assessment chapter in the Application/EIS defines how significance is determined. Where available, thresholds were used (e.g., aquatic life receiving environment criteria, ambient air criteria, or land and resource management planning objectives) to assist with the determination of significance. Each assessment chapter defines any thresholds used, as well as the source literature for those thresholds. Areas where data are insufficient to provide an assessment are highlighted, with the potential cumulative effects being described as uncertain in these instances.

The significance for cumulative residual effects is determined according to the categories described below. Each assessment chapter defines how the term "significance" was assessed in relation to each receptor VC, and provides a detailed rationale for the significance determination.

- **Not significant**: Residual effects have low or moderate magnitude, local to regional geographic extent, short- or medium-term duration, could occur at any frequency, and are reversible in either the short- or long-term. The effects on the receptor VC (e.g., at a species or local population level) are either indistinguishable from background conditions (i.e., occur within the range of natural variation as influenced by physical, chemical, and biological processes), or distinguishable at the individual level. Land and resource management plan objectives will likely be met, but some management objectives may be impaired. There is a medium to high level of confidence in the analyses. Follow-up monitoring of these effects may be required if the magnitude is medium.
- **Significant**: Residual effects have high magnitude, regional or beyond regional geographic extent, long-term or far future duration, and occur at all frequencies. Residual effects on receptor VCs are consequential (i.e., structural and functional changes in populations, communities, and ecosystems are predicted) and are irreversible. The ability to meet land and resource management plan objectives is impaired. Confidence in the conclusions can be high, medium, or low.

6.11.3 Confidence, Uncertainty, and Risk of Cumulative Residual Effects

6.11.3.1 Characterizing Confidence

Confidence, which can also be thought of as scientific uncertainty, is a measure of how well residual effects are understood, which includes a consideration of the acceptability of the data inputs and analytical methods used to predict and assess Project effects. It depends on the certainty of the predicted outcome, and it allows the decision-maker to evaluate risk associated with the Project. Confidence was assessed according to the attributes identified in Section 6.7.1.

Cumulative residual effects and their characterization criteria, significance determination, likelihood, and confidence evaluations will be summarized for each assessment chapter using the format shown in Table 6.11-1.

6.11.3.2 Risk Assessment

In instances where a cumulative residual effect was rated significant, with a low level of confidence and a high probability of occurring, a risk assessment approach was applied. Risk assessment follows the methodology outlined in Section 6.6.4.2: Risk Assessment.

6.11.3.3 Follow-up Program

Where a risk assessment identified a moderate to major risk of significant cumulative residual effects, follow-up programs are discussed as required. The purpose of follow-up programs is to describe any proposed strategies that are specifically targeted at addressing significant residual cumulative effects. Where applicable, the chapters describe any proposed measures including monitoring of effects or evaluation of mitigation measures to adjust management strategies over the course of the project. Where required, adaptive management strategies are discussed to apply in the event that original predictions of effects and mitigation effectiveness are not as expected.

6.11.4 Cumulative Residual Effects Summary

The significance of each cumulative residual effect is discussed and a summary table with the significance evaluation is included in each chapter of the Application/EIS. An example of the table is shown in Table 6.11-2.

Table 6.11-1. Significance Determination of Cumulative Residual Effects for <Subject Area> or <Sub-Component 1> – Future Case with the Project

	Evaluation Criteria									
Cumulative Residual Effects	**Magnitude** *(minor, moderate, major)*	**Duration** *(short, medium, long, far future)*	**Frequency** *(once, sporadic, regular, continuous)*	**Geographic Extent** *(local, landscape, regional, beyond regional)*	**Reversibility** *(reversible short-term; reversible long-term; irreversible)*	**Resiliency** *(low, neutral, high)*	**Context** *(low, neutral, high)*	**Likelihood** *(low, medium, high)*	**Significance of Adverse Residual Effects** *(not significant; significant)*	**Confidence** *(low, medium, high)*

Table 6.11-2. Summary of Project and Cumulative Residual Effects, Mitigation, and Significance

			Significance of Residual Effects	
Residual Effects	**Project Phase(s)**	**Mitigation Measures**	**Project**	**Cumulative**
Sub-component 1				
Residual Effect 1				
Residual Effect 2				
Sub-component 2				
Residual Effect 1				

6.12 CONCLUSION

The Application/EIS summarizes the key residual and cumulative residual effects and the Proponent's conclusion on the potential for significant adverse environmental effects resulting from the Project.

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