Section 6.10
Terrestrial Environment - Vegetation and Plant Communities

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6.10 Vegetation and Plant Communities

This section presents the effects assessment of the proposed Kitsault Mine Project (proposed Project) activities on vegetation and plant communities. This section includes the rationale for each of the selected Valued Components (VCs) and identifies their potential interactions with Project components and activities. Potential effects are identified and assessed, along with mitigation measures to minimise, eliminate, prevent and respond to potential adverse effects.

6.10.1 Valued Component Scoping and Rationale

The Application Information Requirements (AIR) included a preliminary list of components for consideration as vegetation and plant communities VCs for the proposed Project, including ecosystem composition, wetland ecosystems, old forests, species at risk, ecological communities at risk, and metal concentrations in plant tissues. More specifically, the AIR listed areas of potential impact to be assessed, which included:

- Ecosystem composition as defined by the Prince Rupert Forest Region (Banner et al. 1993) which includes trees, shrubs, herbs and bryophytes;
- Wetland ecosystems;
- Old growth forests as defined by the Resource Inventory committee (RIC) (1998) (note in this Environmental Assessment (EA) section the term old forests is used);
- Plant species at risk as defined by the British Columbia Conservation Data Centre (BC CDC), the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and the *Species at Risk Act (SARA)* (Government of Canada 2002);
- Ecological communities at risk as defined by the BC CDC;
- Cultural plant species of importance to the Nisga'a Nation (large cedars, pine mushroom habitat and cultural plants (including berry producing species));
- Cultural plant species of importance to Aboriginal groups (either directly as food or indirectly as food for important harvest wildlife species);
- Potential for invasive, noxious plants as defined in the *Weed Control Act* (Government of British Columbia (BC) 1996c) and *Forests and Range Practices Act* (Government of BC 2002b);
- Long-term direct and indirect potential impacts; and
- Loss of ecosystems or alteration of baseline ecosystems as potential VCs.

Metal concentrations in plant tissues are important, because plants are harvested for food (plants, berries, and wildlife) by the Nisga'a Nation and Aboriginal groups. This issue and its potential effects assessment is discussed in the Section 6.12 Environmental Health and Section 10.0 Human Health. Invasive species are considered an indicator of potential effects of proposed Projects activities and are discussed under ecosystem composition. During consultation, cultural plants were identified by the Nisga'a Nation and Aboriginal groups as a potential concern with regards to this proposed Project. This concern was included in the AIR and the VC scoping process to determine if selection is warranted.

Riparian ecosystems within the Project footprint were identified by Biogeoclimatic (BGC) unit for the Coastal Western Hemlock Wet Submaritime Montane Variant (CWHws2) and Mountain Hemlock Moist Maritime Leeward Variant (MHmm2). However, only 40 percent (%) of one polygon was mapped with a riparian ecosystem in the MHmm2 within the Waste Rock Management Facility (WRMF) and it was not associated with a watercourse. Although riparian ecosystems were a proposed VC, it was determined based upon the vegetation assessment that wetland ecosystems would be more appropriate and were therefore chosen as the primary VC.

Based on the above exclusion or inclusion rationale, six preliminary VCs (ecosystem composition, wetland ecosystems, old forests, species at risk, ecological communities at risk and cultural plants) were considered and validated through a VC and issue identification and scoping process. Three steps were conducted: project interaction matrix; issue scoping and identification; and VC selection rationale. This process considers the results of consultation with the Working Group including the Nisga'a Nation and Aboriginal groups, as well as scientific and regulatory concern and relevance to the proposed Project. The following subsections describe the results of each step, and provide a list and rationale of vegetation and plant communities VCs selected for the proposed Project.

6.10.1.1 Project Interaction Matrix

The development of an interaction matrix is a primary step in validating the potential effects of the proposed Project on the preliminary VCs identified above. Table 6.10.1-1 below presents an interaction matrix for the vegetation and plant communities' discipline. The type of interaction anticipated between Project components and preliminary VCs are presented through the following symbols:

- o to indicate that there is an interaction;
- - to indicate a key interaction; and
- + to indicate a benefit.

Table 6.10.1-1: Project Interaction Matrix for Vegetation and Plant Communities

Project Component / Activity	Preliminary Vegetation and Plant Communities VCs					
	Ecosystem Composition	Wetland Ecosystems	Old Forests	Species at Risk	Ecological Communities at Risk	Cultural Plants
Construction Phase						
Existing access road	o	NI	NI	NI	NI	o
Emissions and dust generation	-	-	-	o	o	o
Land clearing, excavating and grading	-	-	-	-	-	-
Mine infrastructure	-	-	NI	o	NI	o
Kitsault Pit development	-	o	o	o	NI	o
Borrow sources	-	NI	NI	o	NI	o

Project Component / Activity	Preliminary Vegetation and Plant Communities VCs					
	Ecosystem Composition	Wetland Ecosystems	Old Forests	Species at Risk	Ecological Communities at Risk	Cultural Plants
Expansion of exploration camp to create construction and permanent camps	-	o	o	o	o	-
WRMF development	-	-	-	-	NI	-
TMF development	-	-	-	-	NI	-
Operations Phase						
Existing access road	o					
Emissions and dust generation	-	-	-	o	o	o
Kitsault Pit	NI	NI	NI	NI	NI	NI
WRMF development	-	-	NI	-	NI	-
TMF development	-	-	NI	-	NI	-
Mine infrastructure	o	NI	NI	NI	NI	NI
Surface / ground water management	-	-	NI	-	NI	-
Decommissioning and Closure Phase						
Access road	-	-	NI	NI	NI	NI
Emissions and dust generation	-	-		o	NI	o
Re-vegetation	-	-	NI	NI	NI	NI
WRMF area reclamation	-	o	NI	NI	NI	NI
TMF area reclamation	-	-	NI	NI	NI	NI
Surface / ground water management	-	-	NI	NI	NI	NI
Post-Closure						
Kitsault Pit	NI	NI	NI	NI	NI	NI
TMF (monitoring of water quality and re-vegetation growth)	o	o	NI	o	NI	o
WRMF (monitoring of water quality and re-vegetation growth)	o	o	NI	o	NI	o
Mine infrastructure (monitoring of water quality, re-vegetation growth)	o	o	NI	o	NI	o

Interaction defintions: o - interaction; - - key interaction; + - benefit; NI - no interaction

Note: ML/ARD - metal leaching / acid rock drainage; TMF - Tailings Management Facility; WRMF - Waste Rock Management Facility; TMF area reclamation refers to the TMF north and south beach and northeast embankment

6.10.1.2 Issue Scoping and Identification

The interactions identified above for each Project component are further refined through issues scoping and identification. This approach is presented separately for each phase of the proposed Project and identifies the key issues and rationale for inclusion within the effects assessment. Three key issues associated with vegetation and plant communities were identified, including:

1. Dust deposition: dust from road traffic could affect photosynthesis, respiration, transpiration, and allow the penetration of phytotoxic gaseous pollutants in vegetation, eventually reducing plant growth and density. Predictions of fugitive dust dispersion from proposed Project related activities was assessed in Section 6.2 Atmospheric Environment.
2. Loss of baseline ecosystems: baseline ecosystems will be directly removed during the development of the proposed Project in the construction phase and replaced with mining infrastructure as well as the new landforms (i.e., Tailings Management Facility (TMF), tailings beaches, Northeast Embankment and WRMF).
3. Introduction and spread of invasive plant species: invasive plants are extremely aggressive and can out-compete native vegetation leading to dense, widespread areas of invasive plants and reduced ecosystem viability and diversity. Introduced invasive plants can invade the bare ground caused from the land clearing, excavating, and grading.

Emission deposition was not considered as a potential key issue in the vegetation and plant communities effects assessment because the primary crusher and Process Plant are enclosed facilities with emission control equipment (such as cartridge-based dust collectors, baghouses, and dynamic wet scrubbers) with a dust removal efficiency of >95% (Palczynski pers. comm.). Table 6.10.1-2 to Table 6.10.1-3 identifies key issues associated with each Project component by proposed Project phase and the potential interaction with preliminary VCs.

Potential key issues for vegetation and plant communities are most pronounced in the construction and operations phases of the proposed Project. Re-vegetation as outlined in the Reclamation and Closure Plan (Section 11.2.14 and Appendix 3.0-L) is planned to occur during the decommissioning and closure, and post-closure phases.

Table 6.10.1-2: Potential Issues by Project Component and Preliminary Valued Component – Construction Phase

Project Component / Activity	Relevant Key Issues	Preliminary Valued Component(s)	Rationale
Existing access road	Potential spread of invasive plants	Ecosystem composition	Regulatory requirement
Emissions and dust generation	Dust deposition	Ecosystem composition, wetlands, old forests, species at risk, ecological communities at risk cultural plants	Vegetation growth and viability due
Land clearing, excavating, and grading	Loss of baseline ecosystems; increase in invasive plants	Ecosystem composition, wetlands, old forests, species at risk, ecological communities at risk, cultural plants	Removal of overstorey and understorey vegetation; alteration of baseline ecosystems and physical topography
Mine infrastructure installations	Loss of baseline ecosystems; increase in invasive plants	Ecosystem composition, wetlands, old forests, species at risk, ecological communities at risk, cultural plants	Removal of overstorey and understorey vegetation; alteration of baseline ecosystems and physical topography
Kitsault Pit development	Loss of baseline ecosystems; increase in invasive plants	Ecosystem composition, wetlands, old forests, species at risk, cultural plants	Removal of overstorey and understorey vegetation; alteration of baseline ecosystems and physical topography
Process plant and ancillary facilities	Loss of baseline ecosystems; increase in invasive plants	Ecosystem composition, wetlands, old forests, species at risk, cultural plants	Removal of overstorey and understorey vegetation; alteration of baseline ecosystems and physical topography
Expansion of exploration camp	Loss of baseline ecosystems; increase in invasive plants	Ecosystem composition, wetlands, old forests, species at risk, ecological communities at risk, cultural plants	Removal of overstorey and understorey vegetation; alteration of baseline ecosystems and physical topography
WRMF development	Loss of baseline ecosystems; increase in invasive plants	Ecosystem composition, wetlands, old forests, species at risk, cultural plants	Loss of baseline ecosystems due to placement of waste rock in the WRMF
TMF development	Loss of baseline ecosystems; increase in invasive plants	Ecosystem composition, wetlands, old forests, species at risk, cultural plants	Loss of baseline ecosystems from the construction of northeast and south embankments in the TMF

Note: TMF - Tailings Management Facility; WRMF - Waste Rock Management Facility

Table 6.10.1-3: Relevant Key Issues by Project Component and Preliminary Valued Component – Operations Phase

Project Component	Relevant Key Issues	Preliminary Valued Component (s)	Rationale
Emissions and dust generation	Dust deposition	Ecosystem composition, wetlands, old forests, species at risk, ecological communities at risk, cultural plants	Vegetation growth and viability
WRMF development	Loss of baseline ecosystems	Ecosystems, wetlands, species at risk, cultural plants	Loss of baseline ecosystems due to placement of waste rock in the WRMF
TMF development	Loss of baseline ecosystems	Ecosystems, wetlands, species at risk, cultural plants	Loss of baseline ecosystems in the TMF
Surface / ground water management	Loss of baseline ecosystems	Ecosystems, wetlands, species at risk, cultural plants	Drawdown affecting wetlands and impoundment affecting ecosystems

Note: TMF - Tailings Management Facility; WRMF - Waste Rock Management Facility

6.10.1.3 Valued Component Selection Rationale

The VC and issues identification scoping process identified a number of key issues for each preliminary VC related to the vegetation and plant communities' discipline. The relevance of preliminary VCs was validated through the consideration of interactions with proposed Project activities, scientific literature, the Nisga'a Nation, Aboriginal groups, government regulations, land management plans and other stakeholders (Table 6.10.1-4).

Table 6.10.1-4: Vegetation and Plant Communities Valued Component Selection Rationale

Valued Component	Rationale							
	Interaction With Proposed Project Activities	**Scientific Literature and Professional Judgement**	**Nisga'a Lisims Government**	**Aboriginal Groups Included by BC EAO**	**Applicable Government Agencies**	**Land And Resource Management Plans**	**The Public and Other Stakeholders**	**Federal And Provincial Regulations and Guidelines**
Ecosystem Composition	Removal of vegetation during the construction and operation phase	VC assessed in recent EA process; baseline information reported by Rescan (2010a)	Yes; ecosystems contain cultural plants	Identified as a VC through BC EAO Working Group process	Provincial: BC EAO, BC MOA, BC MFLNRO; Federal: EC, Agency	North Coast LRMP Planning Table 2005	No	*Weed Control Act* (BC MOA), *Forests and Range Practices Act* (BC MFLNRO), *BCEAA*. Federal: EC, *CEA Act*, North Coast LRMP
Wetland Ecosystems	Removal of wetlands during the construction and operation phase	VC assessed in recent EA process; baseline information reported by Rescan (2010b)	Yes; wetland ecosystems provide cultural plants	Identified as a VC through BC EAO Working Group process	Provincial: BC EAO; Federal: EC, Agency	North Coast LRMP	No	Federal: EC Policy on Wetland Conservation
Old Forests	Removal of old forests during the construction phase	VC assessed in recent EA process; baseline information reported by Rescan (2009a)	Yes; old cedars (red and yellow) are culturally important species to the Nisga'a Nation	Identified as a VC through BC EAO Working Group process	Provincial: BC EAO; Federal: EC, Agency	North Coast LRMP	No	Provincial: Old Growth Management Area (BC MFLNRO)
Species at Risk	Removal of potential ecosystems supporting species at risk during the construction and operation phase	VC assessed in recent EA process; baseline information reported by Rescan (2009a)	No	Identified as a VC through BC EAO Working Group process	Provincial: BC EAO; Federal: EC, Agency		No	Federal: *SARA (*Schedule 1), COSEWIC, BC CDC, *Forests and Range Practices Act*

Valued Component	Rationale							
	Interaction With Proposed Project Activities	**Scientific Literature and Professional Judgement**	**Nisga'a Lisims Government**	**Aboriginal Groups Included by BC EAO**	**Applicable Government Agencies**	**Land And Resource Management Plans**	**The Public and Other Stakeholders**	**Federal And Provincial Regulations and Guidelines**
Ecological Communities at Risk	Removal of Ecosystems at Risk during the construction phase	VC assessed in recent EA process; baseline information reported by Rescan (2009a)	No	Identified as a VC through BC EAO Working Group process	Provincial: BC EAO; Federal: EC, Agency		No	BC CDC *Forests and Range Practices Act*
Cultural Plants	Removal of cultural species (e.g., berry-producing species), large cedar trees and pine mushroom habitat during the construction and operation phase	VC assessed in recent EA process; baseline information reported by Rescan (2009a)	Yes; old cedar forests, dry ecosystems for pine mushroom habitat and berry producing plants	Identified as a VC through BC EAO Working Group process	Provincial: BC EAO; Federal: EC, Agency	North Coast LRMP	Regional residents	NFA, North Coast Land Use Objectives Orders (BC ILMB 2008)

Note: Agency - Canadian Environmental Assessment Agency; BC - British Columbia; BC CDC - BC Conservation Data Centre; *BCEAA* - BC *Environmental Assessment Act;* BC EAO - BC Environmental Assessment Office; BC ILMB - BC Integrated Land Management Bureau; BC MFLNRO - BC Ministry of Forests, Lands and Natural Resources Operations; BC MOA - BC Ministry of Agriculture; *CEA Act - Canadian Environmental Assessment Act;* COSEWIC - Committee on the Status of Endangered Wildlife in Canada; EA - Environmental Assessment; EC - Environment Canada; LRMP - Land and Resource Management Plan; *SARA - Species at Risk Act;* VC - Valued Component

The following six VCs were selected for the vegetation and plant communities discipline based on the following rationale. Further validation is also presented in each VC discussion section.

- **Ecosystem composition**: refers to the baseline ecosystems which comprise the landscape. Loss of baseline ecosystems due to land clearing, excavating, grading, and the construction of new landforms associated with proposed Project development are the primary effects on vegetation resources. The information for this VC is presented in the Vegetation Baseline Report (Appendix 6.10-A) following closure and reclamation.
- **Wetland ecosystems**: refers to the baseline wetland ecosystems commonly found between terrestrial and aquatic habitats. Loss of baseline wetland ecosystems due to clearing associated with the proposed Project development as well as the development of the tailings pond would be the primary effect on wetland resources. The information for this VC was obtained from the baseline data (Appendix 6.10-A).
- **Old forests**: refers to the baseline old forest ecosystems which are defined by RIC (1998) as forests greater than 250 years old since a disturbance. Loss of baseline old forest ecosystems due to clearing associated with proposed Project development is the primary effect on old forests. The information for this VC was obtained from the baseline data. Old forests are important ecosystems for other disciplines (i.e., wildlife, biodiversity). In addition, old forests are regulated and conserved under the old growth management area policy (Government of BC 2011);
- **Species at risk**: refers to plant species at risk as defined by the provincial BC CDC, the federal *SARA* (Government of Canada 2002), COSEWIC (2011) the provincial *Forest and Range Practices Act* authorities. Loss of baseline ecosystems due to clearing associated with proposed Project development is the primary effect on potential habitat for species at risk. Species at risk are federally and provincially government regulated;
- **Ecological communities at risk**: refers to the baseline ecosystems which are listed as Ecological Communities at Risk by the BC CDC. Loss of ecological communities at risk due to clearing associated with proposed Project development is the primary effect. Ecological communities at risk are determined by the provincial government, but are not legislated by the provincial or federal government; and
- **Cultural plants**: refers to four components: cedar trees (redcedar and yellow-cedar); pine mushroom habitat; cultural plants (species used for medicine, dietary, spiritual / religious, and utensils) and edible berry-producing plants). The Nisga'a Nation issues and rights, values, interests, and uses were considered in choosing the four components listed above. The proposed Project will remove potential cultural plant habitat including the tree layer and understorey vegetation during the construction and operations phase. The potential effect of land clearing to accommodate the mine's infrastructure could result in a loss of cultural plants and large cedar trees.

Detailed vegetation baseline reports were conducted for the proposed Project in 2009 and 2010. This assessment considers baseline data from three baseline reports: the Vegetation Baseline Report (Appendix 6.10-A), "Kitsault Project Vegetation and Ecosystem Mapping Baseline Report" (Rescan 2010a); and "Kitsault Project 2009 Wetland Baseline Report" (Rescan 2010b). These sources are used for background information about all the VCs.

6.10.2 VC #1: Ecosystem Composition

6.10.2.1 Introduction

Three key issues were identified for the Ecosystem Composition VC: loss of baseline ecosystems; dust deposition; and potential introduction and spread of invasive plants. Removal of the overstorey and understorey vegetation would occur throughout the proposed Project footprint. This stage is expected to occur during the construction and operations (TMF and WRMF) phases. In addition, alteration of the baseline landforms may directly affect the final ecosystems. Vegetation clearing and additional traffic open up the opportunity for an influx of invasive plants. Also, heavy machinery traffic increases dust deposition. This interaction is expected to extend over the life span of the proposed Project.

6.10.2.1.1 Relevant Legislation and Legal Framework

The vegetation and plant community section is included under the requirements of the BC *Environmental Assessment Act (BCEAA)* (Government of BC 2002a). Assessment of vegetation is also considered with the BC *Mines Act* (Government of BC 1996b), which requires the development of an environmental management and reclamation plan to support the mitigation and closure of the proposed Project. The baseline report for this proposed Project meets the criteria of the *BCEAA* to support this assessment (Appendix 6.10-A). Invasive plant designation and legislation is addressed by the BC Ministry of Agriculture (BC MOA) *Weed Control Act* (Government of BC 1996c) and the BC Ministry of Forests, Lands and Natural Resource Operations (BC MFLNRO) *Forest and Range Practice Act*.

6.10.2.1.2 Spatial Boundaries

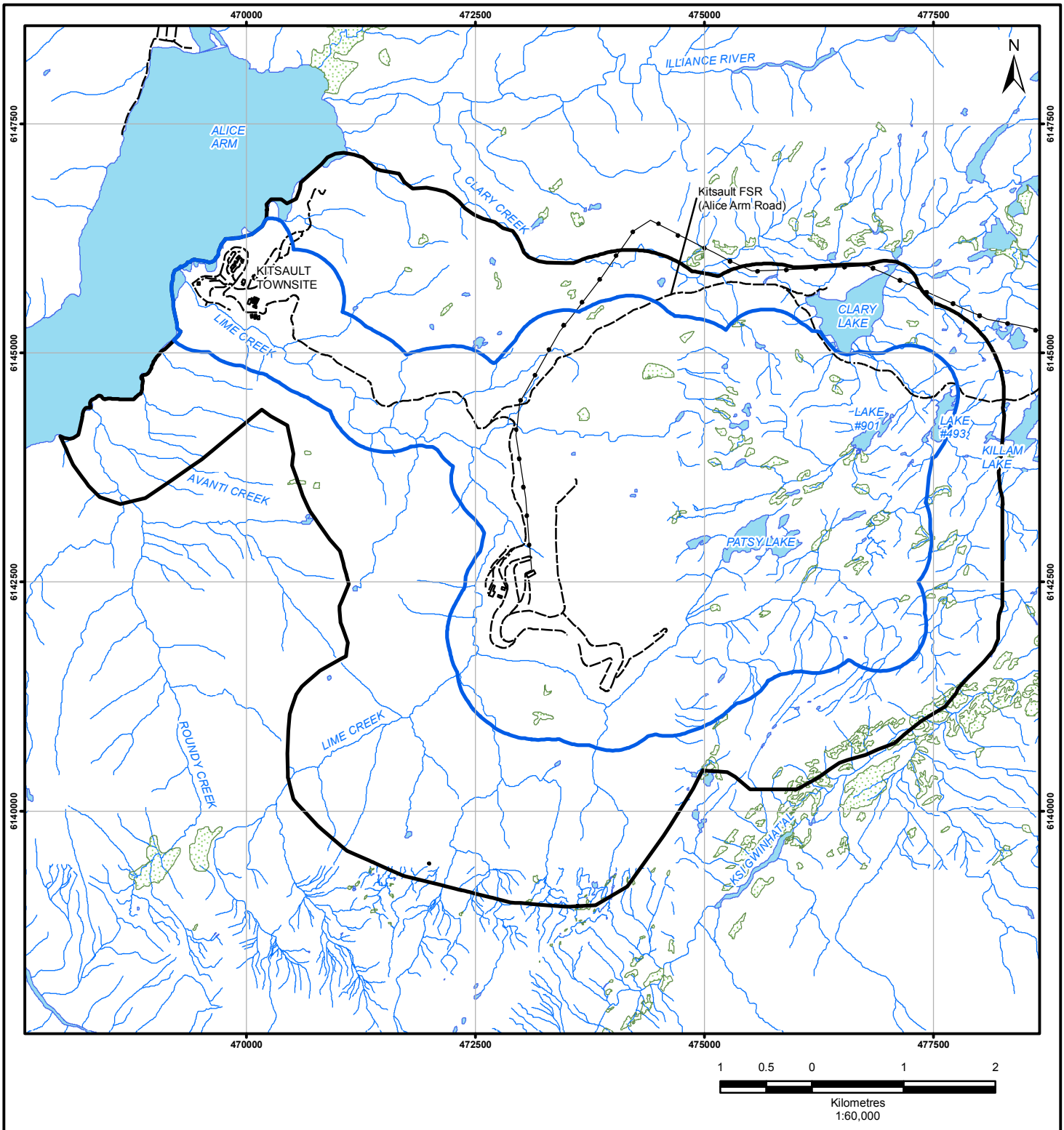
Spatial boundaries for the Ecosystem Composition VC are limited to the geographic areas evaluated based on reasonable expectation of direct proposed Project effects. For cumulative effects assessments (CEAs), the boundaries are selected by working outward from the zone of influence from effects specific to the proposed Project. If the zone of influence of the proposed Project overlaps with that of another project or human activity, the study area boundary for cumulative environmental effects (CEE) is expanded to encompass this additional zone.

For the terrestrial studies, including vegetation ecosystems, the following three general study area boundaries were established (see Figure 6.10.2-1):

- A Local Study Area (LSA) includes the proposed Project infrastructure, specifically the cyclone sand plant, primary crusher, Process Plant, seepage collection ponds, pump station, WRMF, TMF, Kitsault Pit, stockpiles, site road and haul road along

Lime Creek plus a buffer encompassing the zone of direct effects specific to the proposed Project. The proposed terrestrial LSA is consistent with the AIR and represents the direct effects of the proposed Project to the terrestrial environment as well as a 500 metre (m) buffer (to include any contiguous effects from activities causing disturbance to the terrestrial environment) surrounding Project components to provide a reasonable assessment area based on the planned activities in the proposed Project;

- A Regional Study Area (RSA) was established to include the proposed Project and surrounding region, encompassing the zone of influence for effects specific to the proposed Project. The terrestrial RSA was defined as an additional 500 m buffer surrounding the LSA. The lack of contributing projects in the vicinity was a factor in determining the width of the buffer. This buffer accounts for the direct and anticipated indirect effects which may occur as a result of Project Development; and
- A Cumulative Effects Study Area (CESA) includes past, present and reasonably foreseeable future human activities likely to result in residual effects or impacts on each VC; only those human activities that have residual effects which have a temporal and spatial overlap with the proposed Project's residual effects are considered. The spatial limits of the CESA are consistent with the RSA.



Legend

- Access Road
- Transmission Line
- Stream
- Waterbody
- Wetland
- Terrestrial Local Study Area
- Terrestrial Regional Study Area

Avanti Kitsault Mine Ltd.

Terrestrial Local and Regional Study Areas

DATE: November 2011	**Figure** 6.10.2-1
PROJECT: VE51988	06-50-010_Study_Area.pdf
ANALYST: MY / QA/QC: CT	
PROJECTION/DATUM: UTM Zone 09/NAD 83	

Y:\GIS\Projects\VE\VE51988_Kitsault\Mapping\06_vegetation\Baseline\06-50-010.mxd

6.10.2.1.3 Temporal Boundaries

Temporal boundary selection is based on a reasonable expectation of the time over which the proposed Project would have effects on biophysical and human environment receptors. Mine operation is projected to be 15 to 16 years following construction; decommissioning and closure, and post-closure phases would follow.

Preliminary temporal boundaries of the proposed Project, which are contingent on permitting, include four primary phases:

1. Construction Phase - estimated 25-month period. Includes:
   - Site clearing and preparation, earthworks such as excavating and grading site;
   - Facilities, such as the mine processing facilities, TMF South Embankment, and water management facilities;
   - Camp complex;
   - May include the Patsy Creek diversion (this may be scheduled during the operations phase depending on environmental and project feasibility considerations).
2. Operations Phase - estimated at approximately two months of commissioning, and 15 to 16 years of mining (last two years are milling low-grade ore).
3. Decommissioning and Closure Phase - estimated at 15 to 17 years. Includes a closure period during which the buildings and decommissioned infrastructure would be removed and the area reclaimed.
4. Post-Closure Phase - estimated at five years or more. This includes post-closure monitoring until on-site water quality has stabilised and indicates no material future adverse effects on local receiving waters; stabilisation of WRMF and TMF would also be considered in post-closure monitoring.

The temporal boundaries for the Ecosystem Composition VC are consistent with those timelines presented above. Also, the temporal boundaries for the Ecosystem Composition VC are expected to be primarily affected during the initial construction phase and site development. Continued localised effects are expected during the operations phase. No seasonal variability is expected for this VC.

6.10.2.2 Information Source and Methods

The assessment of potential effects for the Ecosystem Composition VC is based on site-specific baseline reporting conducted for the proposed Project. Detailed vegetation baseline reports were conducted for the proposed Project in 2009 and 2010. This assessment considers baseline data from three baseline reports: “Kitsault Project Vegetation and Ecosystem Mapping Baseline Report” (Rescan 2010a); “Kitsault Project 2009 Wetland Baseline Report” (Rescan 2010b), and AMEC’s Vegetation Baseline Report (Appendix 6.10-A). Provincial and regional information sources were reviewed and provided a background to support the Terrestrial Ecosystem Mapping (TEM) specific to the proposed Project completed during the baseline assessment. Information sources specific to the

proposed Project followed the provincial "Standard for Terrestrial Ecosystem Mapping" prepared by the RIC (1998). The ecosystems were derived from the BC Ministry of Forests (BC MOF) field guide, "A Field Guide to Site Identification and Interpretation for the Prince Rupert Forest Region, Part 1 and 2" (Banner et al. 1993). Aerial photography, contours, a forestry inventory database (Vegetation Resource Inventory (VRI)) (BC MOF 2007), and a Digital Elevation Model (DEM) were used to interpret the landscape within the RSA and LSA of the proposed Project.

To determine the potential effects of the proposed Project on the Ecosystem Composition VC, the proposed Project footprint was applied to the terrestrial ecosystem map produced for the baseline report. Spatial analysis through a Geographic Information System (GIS) protocol was employed.

6.10.2.3 Detailed Baseline for Ecosystem Composition

Following review of the baseline reports, the LSA boundary underwent a slight adjustment. Consequently, the area of the BGC units changed. The revised LSA covers three BGC units:

- CWHws2;
- MHmm2; and
- Mountain Hemlock Moist Maritime Parkland Subzone (MHmmp).

Table 6.10.2-1 summarises the baseline area within each BGC unit for the revised LSA. The MHmm2 covers the largest area (1553 hectares (ha)).

Table 6.10.2-1: Baseline Distribution of Biogeoclimatic Units

BGC Unit	Biogeoclimatic Unit	LSA	
		ha	%
CWHws2	Coastal Western Hemlock Wet Submaritime Montane Variant	331	17
MHmm2	Mountain Hemlock Moist Maritime Leeward Variant	1,553	78
MHmmp	Mountain Hemlock Moist Maritime Parkland Subzone	96	5
	Total Area	**1,980**	**100**

Note: ha - hectare; LSA - Local Study Area; % - percent

Figures presented in Section 1.4 of the baseline report (Appendix 6.10-A) depict the baseline distribution of the BGC units and ecosystems (site series, site associations), including water features.

6.10.2.4 Cultural Ecological or Community Knowledge

Desk-based research indicates the importance of a wide range of vegetation resources to the Nisga'a Nation and Aboriginal groups for cultural, economic, and medicinal purposes. As such, general information about their interests and values is presented in the Cultural

Plants VC (Section 6.10.9). Part C and D of the Application and Appendix 8.0-C (Road Used Effects Assessment) provides further information from publicly available sources. During future consultation with the Nisga'a Nation and the Aboriginal groups, additional understanding and site-specific information may be obtained about the value and interest of ecosystem composition in the LSA to the Nisga'a Nation and Aboriginal groups.

6.10.2.5 Past, Present or Future Projects / Activities

The proposed Project would be influenced by the past mining activities that have occurred within the footprint. Beginning in 1959, the site has seen various activities and stages of mining, from diamond drilling to the initial stages of molybdenum exploration starting in 1968. These activities have had an impact that directly relates to the Ecosystem Composition VC, because the natural setting and baseline conditions of the site were disturbed. The last operation phase of the mine began in 1981 lasting until reclamation of the site began from 1996 to 2006. Post reclamation vegetation monitoring is carried out annually as a requirement for amended Permit M-10. A summary of previous and on-going reclamation activities for the proposed Project site are provided in Section 3.1.2 (History of Reclamation).

6.10.2.6 Potential Effects of the Proposed Project and Proposed Mitigation

6.10.2.6.1 Identification and Analysis of Potential Project Effects

The assessment of effects on Ecosystem Composition VC include consideration of effects from Project components (direct effects), effects from other VCs (indirect effects), and combined effects (indirect combined with direct effects) as a result of the proposed Project during each Project phase (construction, operations, decommissioning and closure, and post closure).

6.10.2.6.1.1 Potential Direct Effects

Three potential direct effects on ecosystem composition were considered: loss of baseline ecosystems; dust deposition; and spread of invasive plants. Table 6.10.2-2 lists the potential direct effects of the proposed Project on ecosystem composition.

Table 6.10.2-2: Potential Direct Project Effects on Ecosystem Composition

Project Component / Activity	Project Phase	Potential Direct Effect	Likelihood Of Occurrence
Increase use of access roads	C, O	Conditions may promote the spread and establishment of invasive plant species which could reduce ecosystems integrity	Unlikely
Dust generation by proposed project activities including materials hauling, stockpiling, waste rock disposal, stripping, and overburden storage	C, O, D/C, PC	Increased road use and proposed project operations activities may promote dust deposition, which may affect rate of photosynthesis thus reducing ecosystems integrity	Unlikely
Land clearing, excavating, grading for mine facilities	C	Land disturbance affects loss of baseline ecosystems and spread of invasive plant species	Likely
WRMF development	C, O	Loss of baseline ecosystems	Likely
TMF development	C, O	Loss of baseline ecosystems	Likely
Surface and ground water management	O, D/C	Loss of baseline ecosystems	Likely

Project phase: C - construction; D/C - decommissioning and closure; O - operations; PC - post-closure
Note: TMF - Tailings Management Facility; WRMF - Waste Rock Management Facility

Loss of baseline ecosystems: Ecosystems refer to the site series, site associations and non-classified units within the BGC classification. Site series are the stable plant communities at a late successional stage with similar environmental properties (Banner et al. 1993). Site associations represent sites capable of producing the same near-climax vegetation, regardless of BGC unit (Banner et al. 1993). Non-classified units are non-forested units that have not been described by the BC MFLNRO.

Table 6.10.2-3 describes the Baseline Case, Project Case, change in baseline distribution, conceptual reclamation area, and the change in baseline following reclamation by BGC unit for each ecosystem. The last column represents the change in area for each ecosystem from baseline to closure following reclamation. The following discussion refers to the area and percentage of ecosystems by BGC unit in the LSA potentially lost due to the mine facilities (referred to as the Project Case) (Table 6.10.2-3 and Figure 6.10.2-2).

In the Project Case, the total area of upland ecosystems potentially lost would be 440 ha (35% of upland ecosystems), wetland ecosystems potentially lost would be 113 ha (24% of wetland ecosystems). Also the proposed Project would utilise 115 ha (5% of the LSA) of baseline disturbance. Included in the baseline disturbance is 44 ha (2% of the LSA) of rubbly mine spoils (25 ha) and reclaimed mine sites (19 ha).

In the CWHws2, site series 01, western hemlock (WH) – amabilis fir – bramble, and site series 05, WH – amabilis fir – queen's cup would have the highest effects (17 and 18%

respectively) for upland units. The total change to upland ecosystems in the Project Case would be 16% (29 ha). In total, the wetland ecosystems only show a minor loss of 1 ha or 3% of wetlands in the (Coastal Western Hemlock (CWH) ecosystem). Although the non-vegetated units show the highest level of effect (48%), it represents a loss of 3 ha. The loss of baseline ecosystems in the CWHws2 is mainly contributed to the expansion of the Kitsault Pit.

Several upland ecosystems in the MHmm2 potentially affected are: site series 01 mountain hemlock (MH) – amabilis fir – blueberry (224 ha or 40%); site series 06 MH - yellow-cedar - deer cabbage (70 ha or 65%); site series 03 amabilis fir - MH - oak fern (51 ha or 52%); herbaceous meadows (4 ha or 47%). The total change to upland ecosystems in the Project Case would be 42% (411 ha). The wetlands show a total loss of 26% (112 ha); the ecosystems most affected are the wetland fens (102 ha or 28%). The potential effects on non-vegetated, sparsely vegetated, and anthropogenic units is 36% (29 ha). The loss of baseline ecosystems in the MHmm2 is mainly attributed to the development of the TMF and the WRMF.

The MHmmp effects range from 0 to <1% for upland, wetland, and anthropogenic units. The proposed Project development would have a minor effect on the MHmmp.

Table 6.10.2-3: Direct Effects on Ecosystem Composition in the Local Study Area

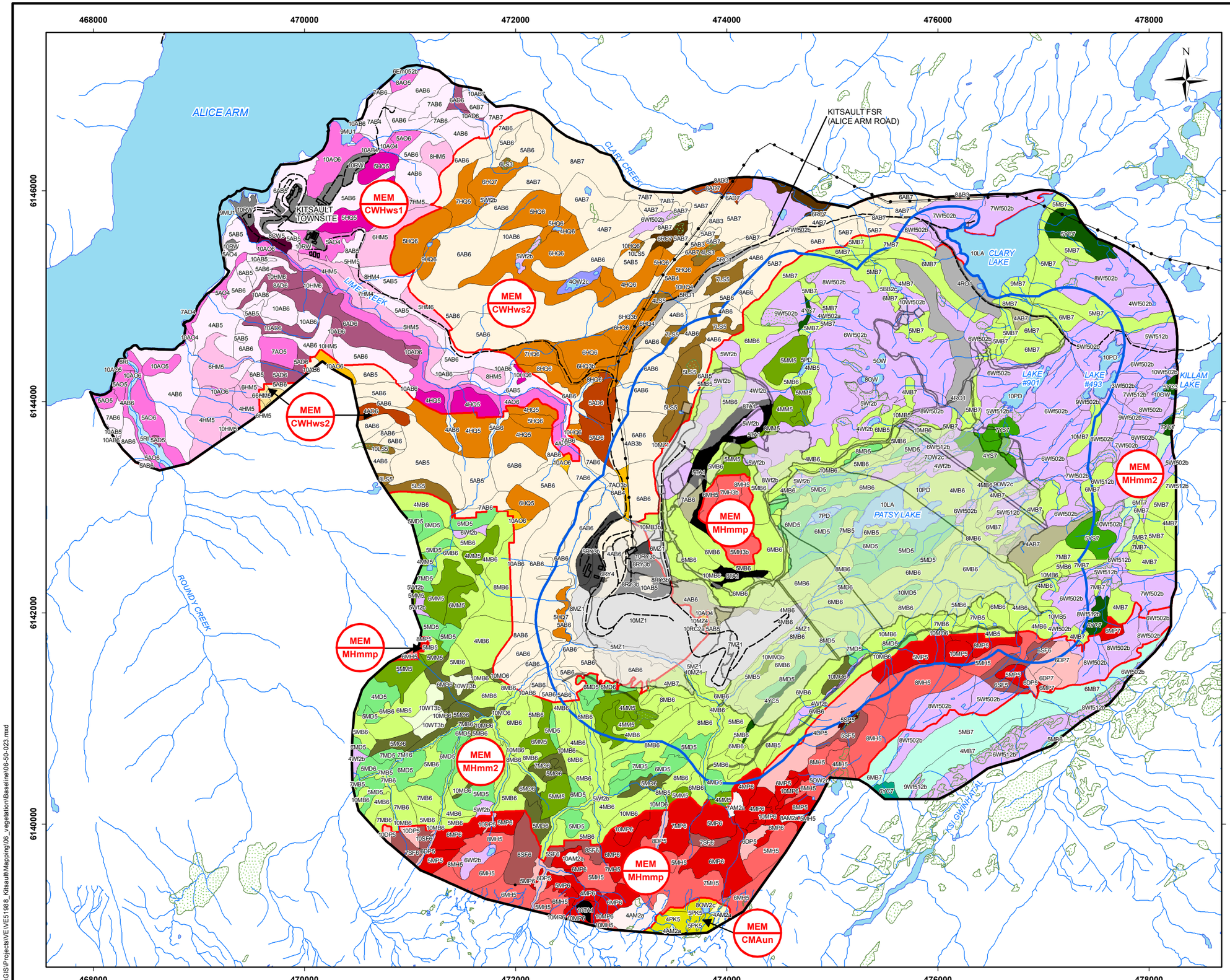
BGC Unit	Site Series Name	Site Series	Map Unit	Baseline Case	Project Case	Change in Baseline Distribution		Conceptual Reclamation Area	Change in Baseline Distribution following Reclamation	
				ha	ha	ha	%	ha	ha	%
CWHws2	WH - Amabilis fir - Bramble	01	AB	150	125	-25	-17	134	-16	-11
	WH - Lodgepole pine - Feathermoss	03	HM	6	6	<1	-1	6	0	0
	Amabilis fir - Western redcedar - Oak fern	04	AO	9	9	-1	-7	9	-1	-7
	WH - Amabilis fir - Queen's cup	05	HQ	15	13	-3	-18	13	-3	-18
	Amabilis fir - Western redcedar - Devil's club*	06	AD	3	3	0	0	3	<1	9
	Total Upland			***184***	***155***	***-29***	***-16***	***164***	***-20***	***-11***
	Lodgepole pine - Sphagnum	10	LS	20	20	<1	-2	20	<1	<1
	Western redcedar - Sitka spruce	11	RC	5	5	<1	-4	5	-<1	-4
	Shallow open water	00	OW	<1	<1	0	0	0	0	0
	Wetland fen	Wf		6	6	<1	-4	6	<1	1
	Narrow-leaved cotton-grass - Peat-moss	Wf50		13	13	<1	-3	13	0	0
	Total Wetland			***45***	***43***	***-1***	***-3***	***45***	***-<1***	***<1***
	River	00	RI	4	3	-1	-23	3	-1	-23
	Rock	00	RO	2	<1	-2	-97	<1	-2	-97
	Total Non-vegetated, Sparsely Vegetated and Anthropogenic			***6***	***3***	***-3***	***-48***	***3***	***-3***	***-48***
	Baseline Disturbance			*97*	*26*	*-71*	*-74*	*26*	*-70*	*-73*
	Project Disturbance			*0*	*104*	*104*	-	*93*	*93*	-
	Total			**331**	**331**	**0**	**0**	**331**	**0**	**0**
MHmm2	Herbaceous meadows*	00	AM	8	4	-4	-47	4	-4	-45
	Crowberry - Bog blueberry - Alpine azalea	00	CA	27	24	-4	-14	37	9	33
	Heather-Heath Parkland*	00	HH	2	2	0	0	2	0	0
	MH - Indian hellebore*	00	MH	2	1	-1	-32	1	-1	-31
	Wet seepage meadow*	00	WM	2	2	<1	-4	2	-<1	-4
	Willow thickets*	00	WT	1	<1	-1	-92	<1	-1	-92
	MH - Amabilis fir - Blueberry	01	MB	563	340	-224	-40	444	-119	-21
	MH - Amabilis fir - Mountain-heather	02	MM	97	67	-30	-31	127	30	31
	Amabilis fir - MH - Oak fern	03	MO	98	47	-51	-52	47	-51	-52

BGC Unit	Site Series Name	Site Series	Map Unit	Baseline Case	Project Case	Change in Baseline Distribution		Conceptual Reclamation Area	Change in Baseline Distribution following Reclamation	
				ha	ha	ha	%	ha	ha	%
	MH - Amabilis fir - Bramble	04	AB	40	24	-16	-40	24	-16	-39
	Amabilis fir - MH - Twistedstalk	05	MT	31	19	-11	-37	19	-11	-37
	MH - Yellow-cedar - Deer cabbage	06	MD	107	37	-70	-65	170	63	59
	Yellow-cedar - MH - Hellebore*	07	YH	<1	<1	0	0	<1	0	0
	Total Upland			***979***	***568***	***-411***	***-42***	***879***	***-100***	***-10***
	MH - Yellow-cedar - Sphagnum	08	YS	14	9	-5	-38	10	-4	-32
	Yellow-cedar - MH - Skunk cabbage	09	YC	30	21	-9	-31	22	-8	-27
	Shallow open water	00	OW	10	6	-4	-36	7	-4	-35
	Buckbean	BB		<1	<1	0	0	<1	0	0
	Wetland fen	Wf		103	48	-55	-54	78	-25	-24
	Narrow-leaved cotton-grass - Peat-moss	Wf50		223	200	-23	-10	202	-20	-9
	Sitka sedge - Peat-moss	Wf51		42	26	-16	-38	26	-16	-38
	Wetland marsh	Wm		2	2	<1	-1	2	0	0
	Yellow pond-lily	YL		<1	<1	0	0	<1	0	0
	Total Wetland			***425***	***313***	***-112***	***-26***	***347***	***-77***	***-18***
	Cliff	00	CL	5	3	-1	-28	4	-<1	-6
	Lake	00	LA	18	<1	-18	-100	<1	-18	-100
	Pond	00	PD	19	16	-3	-17	16	-3	-17
	River	00	RI	1	1	<1	-46	1	-<1	-<1
	Rock	00	RO	24	23	-1	-4	30	6	24
	Talus	00	TA	15	10	-5	-34	15	-<1	-2
	Total Non-Vegetated, Sparsely Vegetated and Anthropogenic			***82***	***52***	***-29***	***-36***	***65***	***-16***	***-20***
	Baseline Disturbance			*67*	*23*	*-44*	*-66*	*26*	*-41*	*-62*
	Project Disturbance			*0*	*597*	*597*	-	*235*	*235*	-
	Total			**1553**	**1553**	**0**	**0**	**1553**	**0**	**0**
MHmmp	Herbaceous meadows	00	AM	3	3	0	0	3	0	0
	Dry Closed Forest*	00	DF	1	1	0	0	1	0	0
	Dry Open Parkland Forest	00	DP	9	9	0	0	9	0	0

BGC Unit	Site Series Name	Site Series	Map Unit	Baseline Case	Project Case	Change in Baseline Distribution		Conceptual Reclamation Area	Change in Baseline Distribution following Reclamation	
				ha	ha	ha	%	ha	ha	%
	MH - Mountain-heather Parkland	00	MH	32	32	<1	<1	32	0	0
	Mesic Open Parkland	00	MP	33	33	<1	<1	33	-<1	-<1
	Moist (subhygric) Closed Forest	00	SF	4	4	0	0	4	0	0
	Moist (subhygric) Open Parkland Forest*	00	SP	1	1	0	0	1	<1	1
	Total Upland			***82***	***82***	***<1***	***<1***	***82***	***0***	***0***
	Wetland fen	Wf		10	10	0	0	10	0	0
	Narrow-leaved cotton-grass - Peat-moss	Wf50		1	1	0	0	1	0	0
	Total Wetland			***11***	***11***	***0***	***0***	***11***	***0***	***0***
	Rock	00	RO	3	3	0	0	3	0	0
	Total Non-Vegetated, Sparsely Vegetated and Anthropogenic			***3***	***3***	***0***	***0***	***3***	***<1***	***<1***
	Project Disturbance			*0*	*<1*	*<1*	*-*	*0*	*0*	*-*
	Total			**96**	**96**	**0**	**0**	**96**	**0**	**0**
Total Upland				*1245*	*805*	*-440*	*-35*	*1126*	*-120*	*-10*
Total Wetland				*480*	*367*	*-113*	*-24*	*403*	*-77*	*-16*
Total Non-vegetated, Sparsely Vegetated and Anthropogenic				*91*	*59*	*-32*	*-35*	*72*	*-19*	*-21*
Total Uncommon Ecosystems				*20*	*15*	*-6*	*-27*	*15*	*-5*	*-25*
Total Baseline Disturbance				*164*	*49*	*-115*	*-70*	*52*	*-112*	*-68*
Total Project Disturbance				*0*	*701*	*701*	*-*	*328*	*328*	*-*
Total				**1980**	**1980**	**0**	**0**	**1980**	**0**	**0**

Source: Biogeoclimatic Ecosystem Classification follows Banner et al. (1993) and MacKenzie and Moran (2004)

Note: * Indicates uncommon ecosystems (≤1 of LSA); BGC - Biogeoclimatic; ha - hectare; MH - Mountain Hemlock; WH - Western Hemlock; % - percent



Legend

- Access Road
- Transmission Line
- Stream
- Waterbody
- Wetland
- BGC Unit
- Mine Footprint
- Terrestrial Local Study Area
- Terrestrial Regional Study Area

Ecosystems

CWHws1
- 01 AB
- 03 HM
- 04 AO
- 05 HQ
- 06 AD
- 09 CW

CWHws2
- 01 AB
- 03 HM
- 04 AO
- 05 HQ
- 06 AD
- 10 LS
- 11 RC

MHmm1
- 01 MB
- 09 YC

MHmm2
- 00 WT
- 01 MB
- 02 MM
- 03 MO
- 04 AB
- 05 MT
- 06 MD
- 08 YS
- 09 YC

MHmmp
- 00 AM
- 00 DP
- 00 MH
- 00 MP
- 00 SF
- 00 SP

CMAun
- 00 AM
- 00 PK

Wetland Site Association
- Em05
- Wf, Wf50, Wf51
- OW, BB

Sparsely Vegetated and Anthropogenic
- 00 LA, 00 PD, 00 RI
- 00 MU
- 00 MZ
- 00 RO
- 00 RW
- 00 RY
- 00 TA

Example Ecosystem Legend: 01 AB
- 01 AB — Map Unit / Site Series

Example Map Label: 5AB6
- 5 — Structural Stage
- AB — Map Code
- 6 — Decile

Example Ecosection/BGC Label:
- MEM — Ecosection
- CWHws1 — BGC Unit

Scale:1:35,000

1 0.5 0 1 Kilometres

Reference

1. Base Data
Geobase 1:20,000 (TRIM)
Land and Resource Data Warehouse 1:20,000 (TRIM)
2: Kitsault Mine General Layout
Supplied by AMEC and Knight Piesold on March 2011

CLIENT:	Avanti Kitsault Mine Ltd.
PROJECT:	Kitsault Mine Project
	Distribution of Ecosystems Project Case
DATE: November 2011	ANALYST: MY
	Figure 6.10.2-2
JOB No: VE51988	QA/QC: CT
	PDF FILE: 06-50-023_ecosystem.pdf
GIS FILE: 06-50-023.mxd	
PROJECTION: UTM Zone 9	DATUM: NAD83

Y:\GIS\Projects\VE\VE51988_Kitsault\Mapping\06_vegetation\Baseline\06-50-023.mxd

Direct effects of the proposed Project to the ecosystem composition VC following reclamation in the Conceptual Reclamation Case vary depending on the BGC unit. In the CWHws2, there would be a decrease in mesic sites and non-vegetated units. Site series 02 shows a projected increase in the MHmm2, possibly due to the steeper slopes being created around the TMF and the WRMF. Again, mesic sites (site series 01 and 03), moist sites (site series 04 and 05) and non-vegetated units decreased in the MHmm2. The MHmmp remained unchanged.

Overall the change in baseline ecosystems following the conceptual reclamation plan is a potential loss of 328 ha. The potential total loss to upland ecosystems would be 120 ha (10%), wetland ecosystems represent a potential loss of 77 ha (16%), non-vegetated, sparsely vegetated and anthropogenic units would have a loss of 19 ha (21%) and the baseline disturbance represents a loss of 112 ha (68%). This loss of ecosystems is mainly attributed to the expansion of the open pit, TMF supernatant Pond, tailings ponds and the WRMF.

Nine uncommon ecosystems (CWHws2/06, MHmm2/00-AM, /00-HH, /00-MH, /00-WM, /00 WT, /07, MHmmp/00 SP) would be affected by the proposed Project with a change of 14 ha, for a total change of <1% of all uncommon ecosystems (Table 6.10.2-3) and Figure 6.10.2-2.

Road dust deposition: Road dust may affect photosynthesis, respiration, transpiration, and allow the penetration of phytotoxic gaseous pollutants in vegetation. The effect dust could have is determined by a number of variables, including:

- Concentration of dust particles in the ambient air and its associated deposition rates;
- Size distribution of dust particles;
- Dust chemistry - ranging from highly alkaline dusts to inert dusts and acidic dusts;
- Meteorological and local microclimate conditions and degree of penetration of dust into vegetation; and
- Characteristics of the vegetation and leaf surface can influence the rates of dust deposition on vegetation, such as surface roughness and wetness.

Potential effects from dust were assessed based on the potential for increase in windblown fugitive dust from increased road traffic during the life of the proposed Project. In this analysis, ecosystems were not considered equal in sensitivity to dust. Two factors were used to determine sensitivity: level of acidity of soils due to the neutralising effects of (calcium carbonate enriched) road dust on acidic soils; and relative amount of mosses and lichens, which are most sensitive to dust uptake. Highly acidic ecosystems (which in turn have a high percentage of mosses) including bogs (CWHws1/10, MHmm2/08) were rated high in sensitivity. Rich fens (Wf, Wf50, Wf51), also with a high moss content, and acidic pine-dominated uplands (CWHws2/03) were rated moderate in sensitivity. All other ecosystems were considered low in sensitivity. The area of potentially sensitive ecosystems was determined by assuming buffer zone along the various access roads. For the

assessment it was assumed that forested sites would have a 25 m zone of potential dust influence. Shrubby and parkland ecosystems were assumed to have a 50 m zone of influence and open areas (graminoid vegetation) were assumed to have a 100 m zone of influence (Bessie pers. comm.). Note these assumed zones of influence fall within the LSA as defined in the Spatial Boundaries Section 6.2.2.1 of the Atmospheric Environment - Air Quality and Climate section (Section 6.2) of this EA. Disturbed areas, recent burn, and open water were not assessed.

Using these assumptions it was assumed that road dust risks may occur over a maximum area of 84 ha in the LSA (Table 6.10.2-4). High sensitivity classes would have the greatest risk, with 2% and 8% of this class potentially affected in the CWHws2 and MHmm2 respectively.

Table 6.10.2-4: Potential Effects of Road Dust on Ecosystem Composition in the Local Study Area

BGC Unit	Dust Sensitivity Class	Total Project Area (ha)	Total Area within Dust Zone of Influence (ha)	% of Classes Affected
CWHws2	High	20	<1	2
	Moderate	25	1	5
	Low	154	1	0
MHmm2	High	9	1	8
	Moderate	274	50	18
	Low	591	31	5
Total Sensitive Class		**1072**	**84**	**8**

Note: BGC - Biogeoclimatic; ha - hectare; % - percent

The dustfall assessment undertaken in Section 6.2 Atmospheric Environment - Air Quality and Climate provides details of predicted dust deposition distances from representative road conditions that support the basic assumptions utilised for this assessment. For the proposed Project, rates of dustfall were conservatively estimated for maximum annual mean ambient total suspended particulate (TSP) concentration beyond the fence line. The results of this assessment predicted that the dustfall would be within BC monthly objectives (BC Ministry of Environment (BC MOE) 1979) within 5 m of the proposed Project haul roads.

Spread of invasive plant species: Invasive plants, (also commonly referred to as 'weeds') are both an ecological and an economic problem. They are extremely aggressive and can out-compete native vegetation leading to dense, widespread areas of invasive plants. As a result, the diversity of native plant communities is decreasing and ecosystems are being damaged. As native vegetation is reduced, so is the amount of forage available for wildlife. Many of these invasive plants are not considered a food source, are toxic, or cause mechanical problems to animals and humans. Invasive plants are capable of producing thousands of seeds per plant, which may lie dormant for many years. These species can pose a threat to the continued existence of many of our native species and the biodiversity of the environment (BC MFLNRO 2011).

In the Baseline Case, no invasive plant species were recorded during field surveys. Three species - bull thistle (*Cirsium vulgare)*, Japanese knotweed (*Fallopia japonica)*, and burdock species *Arctium spp.* - were documented as occurring in the RSA (BC MFLNRO (Invasive Alien Plant Program (IAPP)) 2010). The greatest threat for the introduction of invasive species is most likely to occur in the period following development activities when the native vegetation is removed and species, such as Canada thistle (*Cirsium arvense*), scentless chamomile (*Matricaria perforata*), oxeye daisy (*Leucanthemum vulgare),* and common tansy (*Tanacetum vulgare)* are known to invade. These species, except for Canada thistle, are present along the Squish Forest Service Road (FSR) and along the Nisga'a Highway (Hwy) (BC MOFR (IAPP) 2010) and have presented numerous challenges for resource managers. Once established, weeds may persist for long time periods and prevent native species from re-establishing.

The potential for direct effects of the proposed Project on ecosystem composition to become indirect effects on other disciplines is summarised in Table 6.10.2-5. The main indirect effects on other VCs are: wildlife, environmental health, and cultural resources for the Nisga'a Nation and Aboriginal groups. Wildlife habitat and environmental health are indirectly affected due to the direct loss of baseline ecosystems, which potentially reduces habitat for wildlife. A loss of baseline ecosystems could potentially indirectly affect the level of groundwater and hydrology levels by removing the overstorey and understorey. However, mitigation measures would minimise this potential indirect effect on groundwater and hydrology and thus, this potential effect is not carried forward into the groundwater or hydrology effects assessment.

Table 6.10.2-5: Potential Indirect Project Effects on Other Valued Components

Direct Project Effect (Adverse or Positive)	Project Phase	Potential Indirect Project Effect	Carry Forward (Yes / No)	Rationale
Loss of baseline ecosystems	C, O	May affect hydrogeology ; increase in ground water	No	Mitigation measures are in place for potential effects from an increase in available ground water
	C, O	May affect surface hydrology; increase in surface water levels	No	Mitigation measures are in place for potential effects from an increase in available surface water
	C, O	May affect terrestrial environment; erosion of slopes due to lack of the surface stabilisers	No	Mitigation measures are in place for potential effects from soil erosion
	C, O	May affect wildlife habitat; loss of wildlife habitat	Yes	Removal of baseline ecosystems, many of which are berry-producing shrubs may affect food availability for wildlife as well as cover and escape habitat

Direct Project Effect (Adverse or Positive)	Project Phase	Potential Indirect Project Effect	Carry Forward (Yes / No)	Rationale
	C, O	May affect environmental health; reduced overall condition for all biota	Yes	Removal of plant species may contribute to potential effects on environmental health
	C, O	May affect cultural resources for the Nisga'a Nation Land use	No	This effect is discussed under the Cultural Plants VC
	C, O	May affect cultural resources for Aboriginal Groups Land use	No	This effect is discussed under the Cultural Plants VC
Dust deposition	C, O, D/C, PC	Deposition may affect air quality; decrease in air quality	No	The effects of dust deposition cover a low area in relation to the LSA
Spread of invasive plant species	C, O	May affect wildlife habitat; loss of wildlife habitat	No	Removal of baseline ecosystems, may promote the spread of invasive plant species
	C, O	May affect environmental health; reduced overall condition for all biota	No	Mitigation measures are in place for potential effects from spread of invasive plants

Project phase: C - construction; D/C - decommissioning and closure; O - operations; PC - post-closure

The potential interaction between direct effects of the proposed Project on the Ecosystem Composition VC and potential residual effects on other discipline VCs are depicted in Table 6.10.2-6. One potential residual effect on another VC could potentially indirect effect Ecosystem Composition VC. The alteration of landscapes is a residual effect listed in the soil and terrain discipline (Section 6.9). The alteration of landscapes interacts with the direct effect of loss of baseline ecosystems, which in turn affects ecosystem composition.

Table 6.10.2-6: Summary of Potential Interaction Between Project Direct Effects on Other Valued Components and Ecosystem Composition

Direct Project Effect	Air Quality and Climate Change	Noise and Vibration	Hydrogeology	Groundwater Quality	Freshwater and Sediment Quality	Surface Hydrology	Freshwater Fisheries	Marine Water Quality	Marine Biota	Terrestrial Environment	Wildlife and Their Habitat	Environmental Health	Economic	Social	Heritage	Health	Nisga'a Nation Land Use	Aboriginal Groups Land Use
Loss of baseline ecosystems	NI	NI	o	NI	NI	o	NI	NI	NI	-	-	o	n/a	n/a	n/a	n/a	n/a	n/a

Interaction definitions: o - interaction; - key - interaction; + - benefit; NI - no interaction; n/a - not applicable

6.10.2.6.1.2 Potential Combined Effects

Table 6.10.2-7 assesses the potential combined effects of the proposed Project resulting from the interaction of potential direct and indirect effects of the proposed Project on the Ecosystem Composition VC. The potential combined Project effect likely to occur is a loss of ecosystem composition due to the direct Project footprint development, and potential ecosystem changes through landscape alteration.

Table 6.10.2-7: Potential Combined Project Effects on Ecosystem Composition

Potential Indirect Project Effect	Potential Combined Project Effect	Project Phase	Likelihood Of Occurrence
Alteration of landscapes	Loss of ecosystems due to proposed Project footprint	C, D/C	Likely
	Loss of ecosystems due to dust deposition and the potential spread of invasive species	C, D/C	Unlikely
	Change in ecosystem composition (site series)	C, D/C	Likely

Project phase: C - construction; D/C - decommissioning and closure; O - operations

6.10.2.6.1.3 Summary of Potential Effects

The overall potential effects on the Ecosystem Composition VC are the loss of baseline ecosystems due to construction of the mine facilities, dust deposition due to increased mine related activities, and the spread of invasive plants due to disturbance. Table 6.10.2-8 summarises these effects.

Table 6.10.2-8: Summary of Potential Project Effects to be Carried Forward Into the Assessment for Ecosystem Composition

Adverse Effects / Positive Effects	Project Phase	Direction
Loss of baseline ecosystems	C, O	Negative
Dust deposition	C, O, D/C, PC	Negative
Spread of invasive plant species	C, O, D/C, PC	Negative

Project phase: C - construction; D/C - decommissioning and closure; O - operations; PC - post closure

6.10.2.6.2 Mitigation Measures

Through proper mitigation techniques, the effects on the Ecosystem Composition VC within the proposed Project footprint can be minimised and managed to effectively reduce potential negative effects. Table 6.10.2-9 summarises the mitigation measures identified for the proposed Project by phase. Details regarding mitigation measures applicable to vegetation and plant communities are outlined in the Environmental Management Plans (EMP) (Section 11.2) and further discussed below.

Table 6.10.2-9: Potential Project Effect by Project Phase on Ecosystem Composition and Mitigation Measures

Project Effect	Project Phase	Mitigation / Enhancement Measure	Mitigation Success Rating
Dust deposition	C, O, D/C, PC	Dust suppression measures following the Dust Management Plan (Section 11.2.5)	Medium; prevention / reduction
Loss of baseline ecosystems	C	Minimise Project footprint;	Medium; reduce
	C	Salvage soil for reclamation following the Soil Management Plan (Section 11.2.16)	High; enhance
	D/C, PC	Re-vegetate according to the Reclamation and Closure Plan (Section 11.2. 14 and Appendix 3.0-L)	Medium; enhance
Spread of invasive plant species	C, O, D/C, PC	Prevent introduction of invasive species by following the Vegetation Management Plan (Section 11.2.8)	High to Medium; prevent / reduce and respond

Project phase: C - construction; D/C - decommissioning and closure; O - operations; PC - post-closure

6.10.2.6.2.1 Dust Suppression Measures

Watering would be used in high-traffic areas during dry conditions to help reduce the dust load and increase visibility along access roads and other dust generation sources (i.e., materials handling and stockpiling, TMF shoreline) as part of safe work practices. Road watering is a prevention measure to reduce road dust and is recommended in the Dust Management Plan (Section 11.2.5).

6.10.2.6.2.2 Project Footprint Minimisation

A clearly defined, compact proposed Project footprint would minimise overall effects on ecosystem composition. As an existing brownfield site, the use of previous disturbed areas would be maximised wherever possible to help maintain a compact Project footprint. Specific key measures incorporated into the proposed Project include, wherever feasible:

- Facility location planning: grouping facilities in centralised areas and development of a functional Project footprint, especially for the TMF;
- Use of existing forestry roads to reduce the site access footprint; and
- Use of existing disturbance areas as a foundation for expansion of new facilities.

At the mine site, administrative buildings, processing facilities and support buildings, infrastructure, and the TMF are grouped as closely as possible to minimise the aerial extent of disturbance. A number of options were assessed for the possible location of the TMF with footprint minimisation being a key factor in determining the final location of the site (see Section 3.13 Alternate Means of Carrying Out the Project).

6.10.2.6.2.3 Invasive Species Management Plan

In order to mitigate potential effects due to the introduction of invasive plant species, an Invasive Species Management Plan, located within the Vegetation Management Plan (refer to Section 11.2.8), would be implemented. Prevention, early detection and control measures would be undertaken, when required, on a site and species-specific basis. Preventative measures to minimise the introduction of invasive plants include limiting soil disturbance, re-vegetating disturbed sites, using certified weed free seed and ensuring equipment potentially exposed to invasive plants is cleaned. Early detection through monitoring can eradicate individual plants and ensure new infestations are removed proactively. Control measures would be restricted to those species considered to be problematic (noxious and invasive weed species). Noxious (as defined in the *Weed Control Act*) and / or invasive species, (as defined by BC MFLNRO *Forests and Range Practices Act)*, should be controlled using methods compatible with the survival of broad-leaved native plants. The preferred method of weed control is mechanical; hand pulling, mowing, tilling, and mulching prompt re-establishment of native plant cover species. Treating invasive plants with chemicals (herbicides) can be very effective and is a typical treatment method used for spot treatments (refer to the Vegetation Management Plan, Section 11.2.8). If such treatment is considered necessary, low amounts of herbicide would be used only on specific areas and would be applied by licensed pesticide applicators. Using a combination of prevention, early detection, and control measures is considered to have a medium to high rate of success in mitigating the introduction and spread of invasive species.

6.10.2.6.2.4 Salvage Soil for Reclamation

During the construction phase of the proposed Project, topsoil and organic horizons (peat soils) would be salvaged and stored for use during the closure and decommissioning phase. These soils would be stored separately for 15 years. Salvaging soils provides an adequate growth medium from the original site and limits plant mortality by retaining a dormant seed population. Details regarding soil salvage and management are provided in the Reclamation and Closure Plan (Section 11.2.14; Appendix 3.0-L) and the Soil Management Plan (Section 11.2.16). The mitigation success rating is high, because soil salvage is anticipated to prove beneficial in enhancing the likelihood of the overall site reclamation and closure.

6.10.2.6.2.5 Reclamation and Closure Plan

A Reclamation and Closure Plan (Section 3.10; Section 11.2.14; Appendix 3.0-L) is an important and standard step associated with closure and decommissioning activities of mining developments. Reclamation and closure plans should clearly outline all the mine features requiring reclamation, recommendations for site preparation, fertiliser application and re-vegetation intended for all the mine facilities.

The primary objective of the Reclamation and Closure Plan (Appendix 3.0-L) is to return, where practical, areas disturbed by mining operations to an acceptable land use and capability. The end land use capability objectives are based on pre-development site conditions. Similar to pre-development conditions, the post-closure landscape would be

capable of productively supporting land use of value to wildlife, wildlife habitat and the habitat of species at risk. Reclamation and closure activities would employ well known and proven closure approaches and technologies to facilitate the establishment of self-sustaining vegetation communities and foster the return to functional ecosystems. Adaptive management techniques can be implemented during the proposed Project lifespan to respond to reclamation requirements.

Based on results from the ongoing re-vegetation monitoring program, the mitigation success rating of re-vegetation to enhance ecosystems post-closure is considered medium (see Section 3.1.2 History of Reclamation).

6.10.2.7 Potential Residual Effects and Their Significance

6.10.2.7.1 Potential Residual Effects After Mitigation

A residual effect is an environmental effect that remains, or is predicted to remain, even after mitigation measures have been applied (Canadian Environmental Assessment Agency (Agency) 2011). The development of the proposed Project would have a potential residual effect on the Ecosystem Composition VC due to the loss of baseline ecosystems from the TMF Supernatant Pond (refer to Table 6.10.2-10) and the original brownfield area of the historic mine site. Two other potential effects, dust deposition and invasive plants, have been excluded based on mitigation and associated success of mitigation ratings. Mitigation measures identified in the Project Description (Section 3.0) and Environment Management System (EMS) (Section 11.1) would minimise the extent of these alterations.

Table 6.10.2-10: Summary of Potential Residual Effects for Ecosystem Composition

Project Phase	Residual Effect	Direction
C, O, D/C	Loss of baseline ecosystems from the TMF Supernatant Pond	Negative

Interaction definitions: C - construction; D/C - decommissioning and closure; O - operations
Note: TMF - Tailings Management Facility

The landscape would differ from the baseline condition with the addition of the WRMF, the TMF Supernatant Pond and the open pit lake; although it is expected the adjacent landscape is anticipated to function in a similar manner to pre-proposed project conditions (refer to the Physiography and Topography VC, Section 6.9.2). The complete restoration of the baseline conditions following Project closure is not possible. The Reclamation and Closure Plan (Appendix 3.0-L) incorporates measures to develop the irreversible alterations in landscape into new features, which are physically and functionally integrated in the post-closure landscape. There are four key new features which would be created in the Project Case:

- A new water feature, or lake, would be developed through quarrying and reclamation of the Kitsault Pit;

- In the location of Patsy Lake, the water body would be enlarged by the construction and reclamation of the TMF;
- The construction of the WRMF would be a positive relief feature on the landscape that would alter the current drainage course of Patsy Creek; and
- The northeast and south embankments would remain as a stabilising structure for the TMF pond.

The TMF Supernatant Pond would remain an open water body; therefore, there would be an estimated loss of 195.2 ha (11% of baseline vegetation in the LSA). The tailing beaches (areas remaining above water) would be covered with growth medium and re-vegetated to support upland and wetland landscapes. The WRMF would be re-sloped and covered with a growth medium to promote the establishment of new vegetation. Growth medium and topsoil would be applied to the downstream faces of the embankments then seeded to native species. For other facilities, the surficial material would be replaced once a facility has been decommissioned but a significant change to the baseline landscapes is not expected.

6.10.2.7.2 Significance of Potential Residual Effects

The significance of potential residual effects on the Ecosystem Composition VC is summarised in Table 6.10.2-11. Each potential residual effect was subjected to a nine rating criteria to determine significance; these criteria are described in Section 5.0. The ecological context of the loss of baseline ecosystems is rated medium as changes to baseline landscape and drainage directly influence the development of ecosystems and ecological niches through variability. The potential effect is considered to be local in spatial extent, reversible and negative in direction. The potential residual effect of the proposed Project on ecosystem composition is rated as not significant (minor).

Table 6.10.2-11: Residual Effects Assessment by Project Development Phase for Ecosystem Composition

Parameter	Stage Of Development / Rating			
Stage of Project Development	All			
Potential residual effect	Loss of ecosystems from baseline conditions			
Effect attribute				
Magnitude	Medium	Medium	Medium	Medium
Spatial extent	Local	Local	Local	Local
Duration	Long-term	Long-term	Long-term	Long-term
Frequency	Once	Once	Once	Once
Reversibility	Yes	Yes	Yes	Yes
Ecological context	Medium	Medium	Medium	Medium
Direction	Negative	Negative	Negative	Negative
Certainty	Medium	Medium	Medium	Medium
Residual effect significance	Not significant	Not significant	Not significant	Not significant

Parameter	Stage Of Development / Rating			
Stage of Project Development	All			
Potential residual effect	Loss of ecosystems from baseline conditions			
Effect attribute				
	(minor)	(minor)	(minor)	(minor)
Level of confidence	Medium	Medium	Medium	Medium
Probability of Occurrence	High	High	High	High

6.10.2.8 Potential Cumulative Effects

Cumulative effects are assessed with known projects (past, present, and future) occurring in the CESA. Table 6.10.2-12 provides a summary of Project related effects on ecosystem composition and the rationale for carrying forward into the CEA.

Table 6.10.2-12: Project Related Residual Effects - Rationale for Carrying Forward Into the Cumulative Effects Assessment

Project Component	Project Phase	Residual Effect	Rationale	Carried Forward in CEA
Mine site facilities	All	Loss of ecosystems from baseline conditions rated as not significant (minor)	The proposed Project footprint overlaps the historical Kitsault mine and potential residual effects on ecosystem composition are considered reversible.	No

The previous mining project at Kitsault started reclamation in 1996, which was last monitored in 2010. The proposed Project footprint overlaps previously disturbed areas and areas successfully reclaimed throughout the historic site, which will be maintained where possible. Following decommissioning and closure, the majority of the site will be re-vegetated and potential residual effects on ecosystem composition are considered reversible. Current and potentially foreseeable future projects, including the Northwest Transmission Line (NTL), do not occur within the terrestrial CESA boundary and would not overlap with potential residual effects on ecosystem composition associated with the proposed Project. Therefore there are no cumulative effects for the Ecosystem Composition VC.

6.10.2.9 Limitations

The conceptual reclamation plan was developed prior to the reclamation and closure section, therefore elements within the plan may change.

6.10.2.10 Conclusion

The proposed Project would directly affect 120 ha (10%) of upland ecosystems, 77 ha (16%) of wetland ecosystems, and 19 ha (21%) of non-vegetated, sparsely vegetated, and anthropogenic ecosystems. Overall, the proposed Project would utilise 112 ha (6% of the

Project footprint) of previously disturbed or reclaimed areas. The direct effects would be loss of baseline ecosystems, dust deposition and potential spread of invasive plant species. Mitigation measures would be in place to minimise these effects. The loss of ecosystems, particularly from the formation of the TMF Supernatant Pond, is a residual effect on ecosystem composition. The potential residual effect on ecosystem composition is rated as not significant (minor).

6.10.3 VC #2: Wetland Ecosystems

6.10.3.1 Introduction

One key issue was identified for the Wetland Ecosystems VC: the loss of baseline wetland ecosystems. Wetland ecosystem loss was quantitatively assessed by comparing the baseline and the conceptual reclamation area to determine how the proposed Project might affect the Wetland Ecosystem VC. Removal of the overstorey and understorey vegetation would occur throughout the proposed Project footprint. This stage is expected to occur during the construction and operations phases.

6.10.3.1.1 Relevant Legislation and Legal Framework

The vegetation and plant community section is included under the requirements of the *BCEAA*. Assessment of vegetation is also considered with the *Mines Act*, which requires the development of an environmental management and reclamation plan to support the mitigation and closure of the proposed Project. The baseline report for this proposed Project meets the criteria of the *BCEAA* to support this assessment. In addition, Environment Canada (EC) has a policy on wetland conservation (EC 2009), which identifies environmental information needs to be included in an EA, that may include a potential affect from a proposed Project on a wetland.

6.10.3.1.2 Spatial Boundaries

Spatial boundaries for the Wetland Ecosystems VC are limited to the geographic areas identified within the proposed Project footprint and were evaluated based on reasonable expectation of direct effect of the proposed Project. For CEAs, boundaries are selected by working outward from effects specific to the proposed Project. If the zone of influence of the proposed Project overlaps with that of another project or human activity, the study area boundary for CEE is expanded to encompass this additional zone.

For the terrestrial studies, including wetlands, the following three general study area boundaries are usually established:

- A LSA includes the proposed Project infrastructure, specifically the cyclone sand plant, primary crusher, Process Plant, seepage collection ponds, pump station, WRMF, TMF, Kitsault Pit, stockpiles, site road and haul road along Lime Creek plus a buffer encompassing the zone of direct effects specific to the proposed Project. The proposed terrestrial LSA is consistent with the AIR and represents the direct effects of the proposed Project to the terrestrial environment as well as a 500 m

buffer (to include any contiguous effects from activities causing disturbance to the terrestrial environment) surrounding Project components to provide a reasonable assessment area based on the planned activities in the proposed Project;

- A RSA was established to include the proposed Project and surrounding region encompassing the zone of influence for effects specific to the proposed Project. The terrestrial RSA was defined as an additional 500 m buffer surrounding the LSA. The lack of contributing projects in the vicinity was a factor in determining the width of the buffer. This buffer accounts for the anticipated indirect effects which may occur as a result of Project development; and
- A CESA includes past, present and reasonably foreseeable future human activities likely to result in residual effects or impacts on each VC; only those human activities that have residual effects which have a temporal and spatial overlap with the proposed Project's residual effects are considered. The spatial limits of the CESA are consistent with the RSA.

6.10.3.1.3 Temporal Boundaries

Temporal boundary selection is based on a reasonable expectation of the time over which the proposed Project would have effects on biophysical and human environment receptors. Mine operation is projected to be 15 to 16 years following construction; decommissioning and closure, and post-closure phases would follow.

Preliminary temporal boundaries of the proposed Project which are contingent on permitting include four primary phases:

1. Construction Phase – estimated 25-month period. Includes:
   - Site clearing and preparation, earthworks such as excavating and grading site;
   - Facilities, such as the mine processing facilities, TMF South embankment, and water management facilities;
   - Camp complex; and
   - May include the Pasty Creek diversion (this may be scheduled during the operations phase depending on environmental and project feasibility considerations).
2. Operations Phase – estimated at approximately two months of commissioning, and 15 to 16 years of mining (last two years are milling low-grade ore).
3. Decommissioning and Closure Phase – estimated at 15 to 17 years. Includes a closure period during which the buildings and decommissioned infrastructure would be removed and facilities reclaimed.
4. Post-Closure Phase – estimated at five years or more. This includes post-closure monitoring until on-site water quality has stabilised that indicates no material future adverse effects on local receiving waters. Stabilisation of WRMF and TMF would also be considered in post-closure monitoring.

The temporal boundaries for Wetland Ecosystems VC are consistent with those timelines presented above. Also, the temporal boundaries are expected to be primarily affected during the initial construction phase and site development. Continued localised effects are expected during the operations phase. No seasonal variability is expected for this VC.

6.10.3.2 Information Source and Methods

The assessment of effects for the Wetland Ecosystems VC is based on site-specific baseline reporting (Appendix 6.10-A; Rescan 2010a; Rescan 2010b) conducted for the proposed Project. Provincial and regional information sources were reviewed and provided a background to support the TEM specific to the proposed Project completed during the baseline assessment. Information sources specific to the proposed Project followed the provincial "Standard for Terrestrial Ecosystem Mapping" prepared by RIC (1998). The wetland ecosystems were derived from the BC MOF field guide, "A Field Guide to Site Identification and Interpretation for the Prince Rupert Forest Region, Part 1 and 2" (Banner et al. 1993) and "Wetlands of British Columbia" (MacKenzie and Moran 2004). Aerial photography, contours, a forestry inventory database (BC MOF 2007) and a DEM were used to interpret the landscape within the RSA and LSA of the proposed Project.

To determine the effect of the proposed Project on the Wetland Ecosystems VC, the proposed Project footprint was applied to the terrestrial ecosystem map produced for the baseline report. Spatial analysis through a GIS protocol was employed to determine the effect of the proposed Project.

6.10.3.3 Detailed Baseline for Wetland Ecosystems

Section 1.4 of the Vegetation Baseline Report (Appendix6.10-A) provides figures that depict the baseline distribution of wetlands (site series and site associations), including water features.

Wetlands occur in all three BGC units, although the MHmm2 had the highest area for wetlands (425 ha). In CWHws2, lodgepole pine - sphagnum (site series 10) was the dominant wetland with 20 ha. Narrow-leaved cotton-grass – Peat–moss fen was the dominant wetland (223 ha) in the MHmm2. A minor amount of wetland fens occurred in the MHmmp. In total wetlands cover 480 ha or 24% of the LSA.

6.10.3.4 Cultural Ecological or Community Knowledge

Specific information relating to cultural knowledge is presented in the Cultural Plants VC (Section 6.10.7).

6.10.3.5 Past, Present or Future Projects / Activities

The proposed Project would be influenced by the past mining activities that have occurred within the footprint. Beginning in 1959, the site has seen various activities and stages of mining, from diamond drilling to the initial stages of molybdenum exploration starting in 1968. These activities have had an impact that directly relates to the Wetland Ecosystems VC because the natural setting and baseline conditions of the site were disturbed. The last

operation phase of the mine began in 1981 lasting until reclamation of the site began from 1996 to 2006. Post reclamation monitoring occurred in 2010. A summary of previous and on-going reclamation activities for the proposed Project site are provided in Section 3.1.2 (History of Reclamation).

6.10.3.6 Potential Effects of the Proposed Project and Proposed Mitigation

6.10.3.6.1 Identification and Analysis of Potential Project Effects

The assessment of effects on Wetland Ecosystems VC include consideration of potential effects from Project components (direct effects), effects from other VCs (indirect effects) affected by the proposed Project, and combined effects (combination of direct and indirect effects) during each Project phase (construction, operations, decommissioning and closure, and post closure).

6.10.3.6.1.1 Potential Direct Effects

One potential direct effect was considered: loss of baseline wetland ecosystems. Table 6.10.3-1 lists the potential direct effects of the proposed Project on the Wetland Ecosystems VC.

Table 6.10.3-1: Potential Direct Project Effects on Wetland Ecosystems

Project Component	Project Phase	Potential Direct Project Effect	Likelihood of Occurrence
Land clearing, excavating and grading	C	Land disturbance affect loss of baseline wetland ecosystems	Likely
WRMF development	C, O, D/C	Loss of baseline wetland ecosystems	Likely
TMF development	C, O	Loss of baseline wetland ecosystems	Likely

Project phase: C - construction; D/C - decommissioning and closure; O - operations

Note: TMF - Tailings Management Facility; WRMF - Waste Rock Management Facility

Loss of baseline wetland ecosystems: The following table (Table 6.10.3-2) describes the Baseline Case, Project Case, change in baseline distribution, conceptual reclamation area, and the change in baseline following reclamation by BGC unit for each ecosystem. The last column represents the change in area for each ecosystem from baseline to closure following reclamation.

In the Project Case, the direct loss of wetland ecosystems is 113 ha (24%) in the LSA (See Table 6.10.3-2 and Figure 6.10.3-1). The proposed Project would have a minor effect on wetlands in the CWHws2 in the LSA. The wetland site series 11, western redcedar – Sitka spruce, showed a loss of <1 ha (4%) and wetland fens (Wf and Wf50) represent a loss of 1 ha (3%). The total loss to wetlands in the Project Case would be 3% (1 ha). The largest potential effect in the Project Case would occur in the MHmm2 to site series 09, yellow-cedar – MH – skunk cabbage (9 ha or 31%), site series 08, MH – yellow-cedar – sphagnum (5 ha, or 38%) and open water (4 ha or 36%). Wetland fens (Wf, Wf50, Wf51) cumulatively

would show a loss of 94 ha (25%) in the MHmm2 in the LSA. In the MHmm2 the total loss to wetlands in the Project Case would be 112 ha (26%). No wetlands would be affected in the MHmmp.

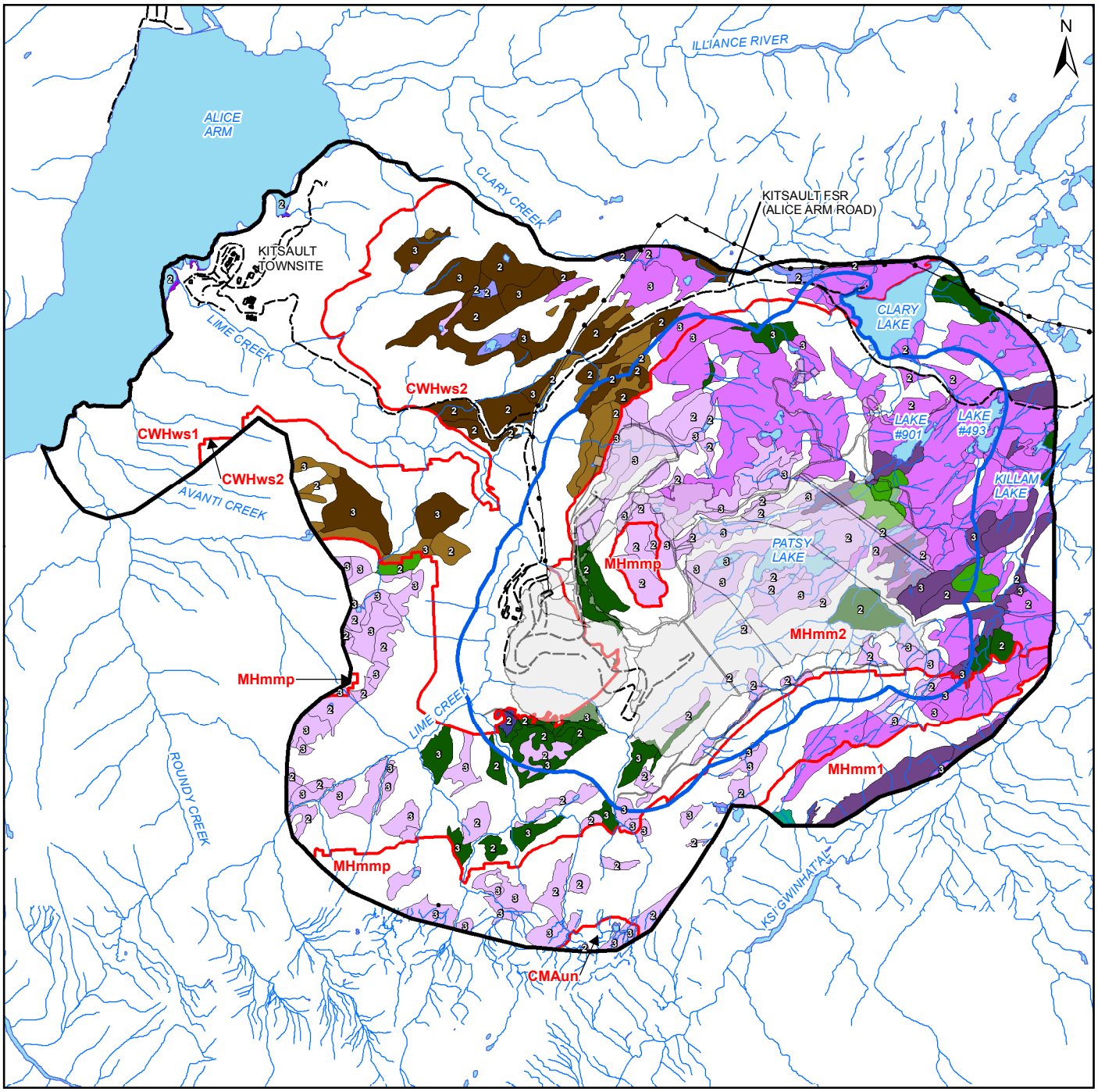
Potential direct effects to the Wetland Ecosystems VC following reclamation in the Conceptual Reclamation case are highest in the MHmm2. In the CWHws2 site series 11 would show a loss of 4% (<1 ha). Site series 08 and 09 in the MHmm2 would show a loss of 4 ha (32%) and 8 ha (27%) respectively; open water would show a loss of 4 ha (35%); wetland fens and site association Wf51 and Wf50 would show a loss of 25 ha (24%) and 36 ha (14%) respectively. The major loss of open water in the MHmm2 is due to the formation of the tailing beaches. Wetland fens were reduced due to the formation of the TMF north and south beach. Overall the potential effect from the Baseline Case following reclamation is a loss of 77 ha (16%) of wetlands in the LSA.

Table 6.10.3-2: Direct Effects on Wetland Ecosystems in the Local Study Area

BGC Unit	Site Series Name	Site Series	Map Unit	Baseline Case	Project Case	Change in Baseline Distribution		Conceptual Reclamation Area	Change in Baseline Distribution following Reclamation	
				ha	ha	ha	%	ha	ha	%
CWHws2	Lodgepole pine – Sphagnum	10	LS	20	20	<1	-2	20	<1	<1
	Western redcedar - Sitka spruce*	11	RC	5	5	<1	-4	5	<1	-4
	Shallow open water*	00	OW	<1	<1	0	0	0	0	0
	Wetland fen	Wf		6	6	<1	-4	6	<1	<1
	Narrow-leaved cotton-grass - Peat-moss	Wf50		13	13	<1	-3	13	0	0
	Total Wetlands			***45***	***43***	***-1***	***-3***	***45***	**<1**	**<1**
MHmm2	MH - Yellow-cedar - Sphagnum*	08	YS	14	9	-5	-38	10	-4	-32
	Yellow-cedar - MH - Skunk cabbage	09	YC	30	21	-9	-31	22	-8	-27
	Shallow open water*	00	OW	10	6	-4	-36	7	-4	-35
	Buckbean*	BB		<1	<1	0	0	<1	0	0
	Wetland fen	Wf		103	48	-55	-54	78	-25	-24
	Narrow-leaved cotton-grass - Peat-moss	Wf50		223	200	-23	-10	202	-20	-9
	Sitka sedge - Peat-moss	Wf51		42	26	-16	-38	26	-16	-38
	Wetland marsh*	Wm		2	2	<1	-1	2	0	0
	Yellow pond-lily*	YL		<1	<1	0	0	0	0	0
	Total Wetlands			***425***	***313***	***-112***	***-26***	***347***	***-77***	***-18***
MHmmp	Wetland fen	Wf		10	10	0	0	10	0	0
	Narrow-leaved cotton-grass - Peat-moss	Wf50		1	1	0	0	1	0	0
	Total Wetlands			***11***	***11***	***0***	***0***	***11***	***0***	***0***
Total Wetland				*480*	*367*	*-113*	*-24*	*403*	*-77*	*-16*
Total Non-wetlands				*1336*	*864*	*-472*	*-35*	*1197*	*-139*	*-10*
Total Uncommon Wetlands				*27*	*18*	*-9*	*-33*	*19*	*-8*	*-29*
Total Baseline Disturbance				*164*	*49*	*-115*	*-70*	*52*	*-112*	*-68*
Total Project Disturbance				*0*	*701*	*701*	*-*	*328*	*328*	*-*
Total				**1980**	**1980**	**0**	**0**	**1980**	**0**	**0**

Source: Biogeoclimatic Ecosystem Classification follows Banner et al. (1993) and MacKenzie and Moran (2004)

Note: * Indicates uncommon wetland ecosystems (≤1 of LSA); BGC - Biogeoclimatic; ha - hectare; MH - Mountain Hemlock; WH Western Hemlock; % - percent



Legend

- Access Road
- Transmission Line
- Stream
- Waterbody
- BGC Unit
- Mine Footprint
- Terrestrial Local Study Area
- Terrestrial Regional Study Area

1 0.5 0 1 2
Kilometres
1:60,000

Wetlands

Decile1

CWHws2
- 10 LS
- 11 RC

MHmm1
- 09 YC

MHmm2
- 08 YS
- 09 YC

Wetland Site Association
- Em05
- Wf
- Wf50
- Wf51
- OW
- BB

Decile 2

CWHws2
- 2 10 LS
- 2 11 RC

MHmm2
- 2 08 YS
- 2 09 YC

Wetland Site Association
- 2 Em05
- 2 Wf
- 2 Wf50
- 2 Wf51
- 2 Wm
- 2 OW

Decile 3

CWHws2
- 3 10 LS
- 3 11 RC

MHmm2
- 3 09 YC

Wetland Site Association
- 3 Wf
- 3 Wf50
- 3 Wf51

Example Ecosystem Legend:
10 LS
- Map Unit
- Site Series

Note: Refer to report for decile explanation.

Avanti Kitsault Mine Ltd.

Distribution of Wetlands – Project Case

DATE: November 2011	**Figure** 6.10.3-1
PROJECT: VE51988	06-50-014_EIA_wetland.pdf
ANALYST: MY / QA/QC: CT	
PROJECTION/DATUM: UTM Zone 09/NAD 83	amec

Y:\GIS\Projects\VE\VE51988_Kitsault\Mapping\06_vegetation\Baseline\06-50-014.mxd

Two wetlands in the CWHws2, five wetlands in the MHmm2 and one wetland ecosystem in the MHmmp (Table 6.10.3-2) are uncommon wetland ecosystems. These are western redcedar - Sitka spruce (site series 11) and shallow open water in the CWHws2; MH – yellow-cedar – sphagnum (site series 08), shallow open water, buckbean, wetland marsh and yellow pond-lily in the MHmm2; and narrow-leaved cotton-grass - peat-moss (site association Wf50) in the MHmmp. The total loss is 8 ha or 24% of the baseline uncommon wetlands.

6.10.3.6.1.2 Potential Indirect Effects

The potential for direct effects of the proposed Project on wetland ecosystems to become indirect effects on other disciplines is summarised in Table 6.10.3-3. The main indirect effects on other VCs are potential loss of wildlife habitat and environmental health.

Table 6.10.3-3: Potential Indirect Project Effects on Other Valued Components

Direct Project Effect (Adverse or Positive)	Project Phase	Potential Indirect Project Effect	Carry Forward (Yes / No)	Rationale
Loss of baseline wetland ecosystems	C, O	May affect hydrogeology; increase in groundwater	No	Mitigation measures are in place for potential effects from an increase in available ground water
	C, O	May affect surface hydrology; increase in surface water levels	No	Mitigation measures are in place for potential effects from an increase in available surface water
	C, O, D/C	May affect groundwater quality; decreased groundwater quality	No	Mitigation measures are in place for potential effects from reduced groundwater quality
	C, O	May affect terrestrial environment; erosion of slopes due to lack of the surface stabilisers	No	Mitigation measures are in place for potential effects from soil erosion
	C, O	May affect wildlife habitat; loss of wildlife habitat	Yes	Removal of wetland ecosystems may affect food availability for wildlife as well as cover and escape habitat
	C, O	May affect environmental health; reduced overall condition for all biota dependent on wetlands	Yes	Removal of plant species may contribute to potential effects on environmental health
	C,O	May affect heritage resources; decrease lands with archaeological potential	No	Mitigation measures are in place for potential effects from loss of wetland ecosystems

Direct Project Effect (Adverse or Positive)	Project Phase	Potential Indirect Project Effect	Carry Forward (Yes / No)	Rationale
	C, O	May affect cultural resources for the Nisga'a Nation Land use	No	This effect is discussed under the Cultural Plants VC
	C, O	May affect cultural resources for Aboriginal Groups Land use	No	This effect is discussed under the Cultural Plants VC

Project phase: C - construction; D/C - decommissioning and closure; O - operations; PC - post-closure
Note: VC - valued component

The potential interaction between direct effects of the proposed Project on the Wetland Ecosystems VC and potential residual effects on other discipline VCs are depicted in Table 6.10.3-4. Potential indirect effect on wetlands could occur from the potential residual effects of the Project on hydrology.

Drawdown of wetlands due to stream diversion would be an indirect effect from the interaction with the potential residual effects of hydrology. Wetland ecosystems in the LSA occur mainly in the MHmm2 and are dominated by wetland fens, although bogs, swamps, and minor amount of marshes occur. Marshes are shallowly flooded mineral wetlands with a fluctuating water table. A swamp is mineral wetland with a flowing or fluctuating semi permanent near-surface water table. Bogs develop in basins where peat accumulation has raised the wetland surface above groundwater flow. Fens develop in basins as well, but the water table is usually at or just below the peat surface. The groundwater level has a defining effect on these wetlands. Fundamental changes to the water regime could convert these wetland ecosystems to other communities (MacKenzie and Moran 2004). Two diversion channels would divert ground water away from the wetlands associated with the proposed Project facilities.

Table 6.10.3-4: Summary of Potential Interaction Between Project Direct Effects on Other Valued Components and Wetland Ecosystems

Direct Project Effect	Air Quality and Climate Change	Noise And Vibration	Hydrogeology	Groundwater Quality	Freshwater and Sediment Quality	Surface Hydrology	Freshwater Fisheries	Marine Water Quality	Marine Biota	Terrestrial Environment	Wildlife And Their Habitat	Environmental Health	Economic	Social	Heritage	Health	Nisga'a Nation Land Use	Aboriginal Groups Land Use
Loss of baseline wetland ecosystems	NI	NI	-	o	NI	-	NI	NI	NI	NI	-	o	n/a	n/a	n/a	n/a	n/a	n/a

Interaction definitions: o - interaction; - - key interaction; + - benefit; NI - no interaction; n/a - not applicable

6.10.3.6.1.3 Potential Combined Effects

Table 6.10.3-5 assesses the potential combined effects of the proposed Project resulting from the interaction of potential direct and indirect Project effects on the Wetland Ecosystems VC. The combined effect of the proposed Project likely to occur is a direct loss of wetland ecosystems due to a potential drawdown in the water table.

Table 6.10.3-5: Potential Combined Project Effects by Project Phase on Wetland Ecosystems

Potential Indirect Project Effect	Potential Combined Project Effect	Project Phase	Likelihood of Occurrence
Change in hydrology (drawdown of surface water)	Change in wetland ecosystems due to a potential drawdown in the water table	C, O, D/C	Likely
	Decrease in wetland ecosystems due to a potential drawdown in the water table from the Project footprint	C, O, D/C	Likely

Project phase: C - construction; D/C - decommissioning and closure; O - operations; PC - post-closure

6.10.3.6.1.4 Summary of Potential Effects

Table 6.10.3-6 presents a summary of the potential effects of the proposed Project to be carried forward in the assessment on the Wetland Ecosystems VC. Project development would directly remove 113 ha of wetlands, particularly from the development of the TMF. Wetland ecosystems would also be altered due to the south diversion channel and low grade (ore) stockpile (LGS) diversion channel.

Table 6.10.3-6: Summary of Potential Project Effects to be Carried Forward Into the Assessment for Wetland Ecosystems

Adverse Effects / Positive Effects	Project Phase	Direction
Loss of baseline wetlands	C, O	Negative

Project phase: C - construction; D/C - decommissioning and closure; O - operations

6.10.3.6.2 Mitigation Measures

Through proper mitigation techniques, the potential effects on wetland ecosystems within the proposed Project footprint can be minimised and managed to effectively reduce potential negative effects. Table 6.10.3-7 summarises the mitigation measures identified for the proposed Project by phase. These techniques include footprint minimisation; soil salvage; and site reclamation, which are discussed in detail in Section 6.10.2.6.2. Additional mitigation measures include:

- **Site Map of Wetlands**: Prior to construction, utilise Project TEM map to identify important environmental features, including wetlands, to be considered during final

footprint alignment and identification of construction laydown areas (see Appendix 6.10-A and the Wildlife Management Plan (Section 11.2.21)).

Table 6.10.3-7: Potential Project Effect by Project Phase on Wetland Ecosystems and Mitigation Measures

Project Effect	Project Phase	Mitigation / Enhancement Measure	Mitigation Success Rating
Loss of baseline wetlands	C	Minimise Project footprint – utilise a site map prepared from TEM to identify important features	Medium, Reduce
	C	Salvage soil for reclamation following the Soil Management Plan (see Section 11.2.16)	High, Prevent
	D/C, PC	Re-vegetate according to the Reclamation and Closure Plan (Appendix 3.0-L)	Medium, Enhance

Project phase: C - construction; D/C - decommissioning and closure; O - operations

Note: TEM - Terrestrial Ecosystem Mapping

Details regarding mitigation measures applicable to vegetation and plant communities are outlined in the EMPs (Section 11.2). Summary of mitigation techniques to minimise effects on wetlands include:

- **Minimise Project footprint:** As an existing brownfield site, the use of previous disturbed areas would be maximised wherever possible to help maintain a compact Project footprint (see Section 6.10.2 for additional discussion on Project footprint minimisation); and
- **Maintain soil salvage:** During construction, topsoil and surface organic horizons would be salvaged and stored for use during reclamation. Salvaging soils provides an adequate growth medium from the original site and limits plant mortality by retaining a dormant seed population (Section 11.2.16 Soil Management Plan; Appendix 3.0-L Reclamation and Closure Plan).

Mitigation measures to reduce the potential effects of Project design and construction, soil salvage, and the Reclamation and Closure Plan were discussed in the previous section (Section 6.10.2.6.2), and it is anticipated that these measures could be are applicable to the Wetland Ecosystems VC.

6.10.3.7 Potential Residual Effects and Their Significance

6.10.3.7.1 Potential Residual Effects after Mitigation

A residual effect is an environmental effect that remains, or is predicted to remain, even after mitigation measures have been applied (Agency 2011). As a result of the proposed Project, approximately 113 ha of baseline wetland ecosystems would be removed. The development of a compact Project footprint and the eventual reclamation of the site would reduce the overall effect of the proposed Project on Wetland Ecosystems VC. The conceptual reclamation plan includes consideration of wetland development and

enhancement, particularly around the TMF. The original distribution of baseline wetland ecosystems would not be re-established; however, some portions of these wetlands would be expected to re-establish with the application of a successful reclamation and re-vegetation program. Following mitigation, the proposed Project would have a residual effect on Wetland Ecosystems VC due to the loss of potentially 77 ha (16%) of wetlands. Table 6.10.3-8 lists the potential residual effects for the Wetland Ecosystems VC.

Table 6.10.3-8: Summary of Potential Residual Effects for Wetland Ecosystems

Project Phase	Residual Effect	Direction
C, O, D/C	Loss of baseline wetlands from the TMF Supernatant Pond	Negative

Project phase: C - construction; D/C - decommissioning and closure interaction; O - operations
Note: TMF - Tailings Management Facility

6.10.3.7.2 Significance of Potential Residual Effects

The significance rating of potential residual effects for the wetland ecosystems VC is summarised in Table 6.10.3-9. Each potential residual effect identified was subjected to a nine rating criteria to determine significance; these criteria are described in Section 5.0. The ecological context of the loss of wetland ecosystems is rated medium as changes to baseline landscape and drainage directly influence the development of wetland ecosystems and ecological niches through variability. The potential effect is considered local in spatial extent, non-reversible and negative in direction. Although 113 ha of wetlands would be removed by the proposed Project, wetland development is part of the conceptual reclamation plan and it is anticipated that the proposed Project reclamation vegetation program would assist in the possible restoration of some portions of the lost wetlands. Since wetlands occur commonly throughout the local and regional area, the overall direct loss of wetlands is not considered to affect the diversity and abundance of wetlands in the context of the local and regional area. Thus, potential residual effect of the proposed Project on wetland ecosystems is rated as not significant (minor).

Table 6.10.3-9: Residual Effects Assessment by Project Development Phase for Wetland Ecosystems

Parameter	Stage Of Development / Rating			
Stage of Project development	All			
Residual Effect	Loss of wetland ecosystems from baseline conditions			
Effect attribute	Construction	Operations	Closure	Post-Closure
Magnitude	Medium	Medium	Medium	Medium
Spatial extent	Local	Local	Local	Local
Duration	Chronic	Chronic	Chronic	Chronic
Frequency	Once	Once	Once	Once
Reversibility	No	No	No	No

Parameter	Stage Of Development / Rating			
Ecological context	Medium	Medium	Medium	Medium
Direction	Negative	Negative	Negative	Negative
Certainty	Medium	Medium	Medium	Medium
Residual effect significance	Not Significant (minor)	Not Significant (minor)	Not Significant (minor)	Not Significant (minor)
Level of confidence	Medium	Medium	Medium	Medium
Probability of occurrence	High	High	High	High

6.10.3.8 Potential Cumulative Effects

6.10.3.8.1 Identification and Analysis of Potential Project Cumulative Effects

Cumulative effects are assessed with known projects (past, present and future) occurring in the CEA. Table 6.10.3-10 provides a summary of Project related effects on wetland ecosystems and the rationale for carrying forward into the CEA.

Table 6.10.3-10: Project Related Residual Effects - Rationale for Carrying Forward Into the Cumulative Effects Assessment

Project Component	Project Phase	Residual Effect	Rationale	Carried Forward in CEA
Mine site facilities	All	Loss of wetland ecosystems from baseline conditions rated as not significant (minor)	Other than the historical Kitsault mine site, potential wetland ecosystem residual effects do not overlap with any other past, present of foreseeable future projects.	No

Note: CEA - Cumulative Effects Assessment

The previous mining project at Kitsault started reclamation in 1996, which was last monitored in 2010. The proposed Project footprint overlaps previously disturbed areas and areas successfully reclaimed throughout the historic site, which will be maintained where possible. Although potential residual effects to wetland ecosystems associated with the Project are considered non-reversible current and potentially foreseeable future projects, including the NTL, do not occur within the terrestrial CESA boundary. Therefore there are no cumulative effects for Wetland Ecosystems VC.

6.10.3.9 Limitations

The conceptual reclamation plan was developed prior to the reclamation and closure section; therefore, elements within the plan may change.

6.10.3.10 Conclusion

Potential direct effects of the proposed Project are expected to occur on the Wetland Ecosystem VC. As a result of the proposed Project, a decrease in baseline wetland ecosystems would occur, resulting in the direct effects of loss of wetland ecosystems. The development of a compact Project footprint and the eventual reclamation of the site would reduce the overall effect of the proposed Project on the Wetland Ecosystems VC. The original distribution of baseline wetland ecosystems would not be re-established; however, upon reclamation, a fully functional landscape would be developed to support the reclamation goals. Following implementation of mitigation measures, residual effects, in the form of new TMF Supernatant Pond, is expected to remain for the Wetland Ecosystem VC. The anticipated significance of potential residual effects on wetland ecosystems is rated as not significant (minor).

6.10.4 VC #3: Old Forests

6.10.4.1 Introduction

The key issue identified for the Old Forests VC (defined as structural stage 7, forests greater than 250 years old) is the removal of old growth stage forests. Removal of the overstorey and understorey ecosystems would occur in varying degrees throughout the proposed Project footprint. Vegetation clearing is expected to occur primarily during the construction phase, with additional clearing occurring during the operations phase of the proposed Project. Re-vegetation in the decommissioning stage would not be able to re-create these forests due to the time span required to develop an old forest.

6.10.4.1.1 Relevant Legislation and Legal Framework

The vegetation and plant community section is included under the requirements of the *BCEAA*. Assessment of vegetation and is also considered with the *Mines Act*, which requires the development of an environmental management and reclamation plan to support the mitigation and closure of the proposed Project. The baseline report for the proposed Project meets the criteria of the *BCEAA* to support this assessment. In addition, the BC MFLNRO identifies old growth management areas in BC; however the proposed Project does not fall within an old growth management area.

6.10.4.1.2 Spatial Boundaries

Spatial boundaries for the Old Forests VC are limited to the geographic areas evaluated based on reasonable expectation of direct effect of the proposed Project. For CEAs, boundaries are selected by working outward from the zone of influence from effects specific to the proposed Project. If the zone of influence of the proposed Project overlaps with that of another project or human activity, the study area boundary for CEE is expanded to encompass this additional zone.

For the terrestrial studies, including old growth-stage ecosystems, the following three general study area boundaries are usually established:

- A LSA includes the proposed Project infrastructure, specifically the cyclone sand plant, primary crusher, Process Plant, seepage collection ponds, pump station, WRMF, TMF, Kitsault Pit, stockpiles, site road and haul road along Lime Creek plus a buffer encompassing the zone of direct effects specific to the proposed Project. The proposed terrestrial LSA is consistent with the AIR and represents the direct effects of the proposed Project to the terrestrial environment as well as a 500 m buffer (to include any contiguous effects from activities causing disturbance to the terrestrial environment) surrounding Project components to provide a reasonable assessment area based on the planned activities in the proposed Project;
- A RSA was established to include the proposed Project and surrounding region encompassing the zone of influence for effects specific to the proposed Project. The terrestrial RSA was defined as an additional 500 m buffer surrounding the LSA. The lack of contribution projects in the vicinity was a factor in determining the width of the buffer. This buffer accounts for the anticipated indirect effects which may occur as a result of Project Development; and
- A CESA includes past, present, and reasonably foreseeable future human activities likely to result in residual effects or impacts on each VC; only those human activities that have residual effects which have a temporal and spatial overlap with the proposed Project's residual effects are considered. The spatial limits of the CESA are consistent with the RSA.

6.10.4.1.3 Temporal Boundaries

Temporal boundary selection is based on a reasonable expectation of the time over which the proposed Project would have effects on biophysical and human environment receptors. Mine operation is projected to be 15 to 16 years following construction; decommissioning and closure and post-closure phases would follow.

Preliminary temporal boundaries of the proposed Project which are contingent on permitting include four primary phases:

1. Construction Phase – estimated 25-month period. Includes:
   - Site clearing and preparation, earthworks such as excavating and grading site;
   - Facilities, such as the mine processing facilities, TMF South embankment, and water management facilities;
   - Camp complex; and
   - May include the Patsy Creek diversion.
2. Operations Phase – estimated at approximately two months of commissioning, and 15 to 16 years of mining (last two years are milling low-grade ore).
3. Decommissioning and Closure Phase – estimated at 15 to 17 years. Includes a closure period during which the buildings and decommissioned infrastructure would be removed and facilities reclaimed.

4. Post-Closure Phase – estimated at five years or more. This includes post-closure monitoring until on-site water quality has stabilised and indicates no material future adverse effects on local receiving waters; stabilisation of WRMF and TMF would also be considered in post-closure monitoring.

The temporal boundaries for the Old Forests VC are consistent with those timelines presented above. The temporal boundaries for the Old Forests VC are expected to be primarily affected during the initial construction phase and site development. Continued localised effects are expected during the operations phase. No seasonal variability is expected for this VC.

6.10.4.2 Information Source and Methods

The assessment of effects for the old growth distribution VC is based on site-specific baseline reporting conducted for the proposed Project (Rescan 2010a). Provincial and regional information sources were reviewed and provided a background to support the TEM specific to the proposed Project completed during the baseline assessment. Information sources specific to the proposed Project followed the provincial "Standard for Terrestrial Ecosystem Mapping" prepared by RIC (1998). Aerial photography and a forestry inventory database (BC MOF 2007) were used to interpret the old-growth stage ecosystems within the LSA and RSA of the proposed Project.

To determine the effect of the proposed Project on the Old Forests VC, the proposed Project footprint was applied to the terrestrial ecosystem map produced for the baseline report (Appendix 6.10-A; Rescan 2010a). Spatial analysis through a GIS protocol was employed to determine the potential effect of the proposed Project.

6.10.4.3 Detailed Baseline for Old Forests

Baseline analysis shows old forests present in all BGC units, except the Coastal Mountain-heather Alpine Zone Undifferentiated (CMAun) in the RSA; by definition, trees do not occur within the alpine. In the LSA, old forests only occur in the CWHws2, MHmm2 and MHmmp. A total of 306 ha (15%) of old forests occur in the LSA and 811 ha (16%) of the RSA.

6.10.4.4 Cultural Ecological or Community Knowledge

Desk-based research indicates the importance of a wide range of vegetation resources to the Nisga'a Nation and Aboriginal groups for cultural, economic, and medicinal purposes. As such, general information about their interests and values is presented in Cultural Plants VC (Section 6.10.9). Part C and D of the Application and Appendix 8.0-C (Road Use Effects Assessment) provides further information from publicly available sources. During future consultation with the Nisga'a Nation and the Aboriginal groups, additional understanding and site-specific information may be obtained about the value and interest of old forests in the LSA to the Nisga'a Nation and Aboriginal groups.

6.10.4.5 Past, Present or Future Projects / Activities

The proposed Project would be influenced by the past mining activities that have occurred within the footprint. Beginning in 1959, the site has seen various activities and stages of mining, from diamond drilling to the initial stages of molybdenum exploration starting in 1968. These activities have had an impact that directly relates to the Old Forests VC, because the natural setting and baseline conditions of the site were disturbed. The last operation phase of the mine began in 1981, lasting until reclamation of the site began in 1996 to 2006. Post reclamation monitoring occurred in 2010. A summary of previous and on-going reclamation activities for the proposed Project site are provided in Section 3.1.2 (History of Reclamation).

6.10.4.6 Potential Effects of the Proposed Project and Proposed Mitigation

6.10.4.6.1 Identification and Analysis of Potential Project Effects

The assessment of effects on Old Forests VC include consideration of effects from Project components (direct effects), effects from other VCs (indirect effects) affected by the proposed Project, and combined effects (direct combined with indirect effects) during each Project phase (construction, operations, decommissioning and closure, and post closure).

6.10.4.6.1.1 Potential Direct Effect

One potential direct effect was considered: loss of baseline old forests due to land clearing, excavating, and grading. Table 6.10.4-1 shows the potential direct effects of the proposed Project on old forests.

Table 6.10.4-1: Potential Direct Project Effects on Old Forests

Project Component	Project Phase	Potential Direct Project Effect	Likelihood Of Occurrence
Land clearing, excavating and grading	C	Land disturbance affects loss of baseline old forests	Likely
WRMF development	C	Land disturbance affects loss of baseline old forests	Likely
TMF development	C	Land disturbance affects loss of baseline old forests	Likely

Project phase: C - construction; D/C - decommissioning and closure; O - operations; PC - post-closure
Note: WRMF - Waste Rock Management Facility; TMF - Tailing Management Facility

Loss of baseline old forests: The highest area coverage for old forests occurred in the MHmm2. However, this may be attributable to the difference in mapping methods. In total, old growth covers 306 ha (15%) of the LSA. In the LSA, a potential loss of 2 ha (6%) of old forests in the CWHws2 is expected from the proposed Project, while in the MHmm2, an estimated loss of 44 ha (17%) of old forests is expected (Table 6.10.4-2 and

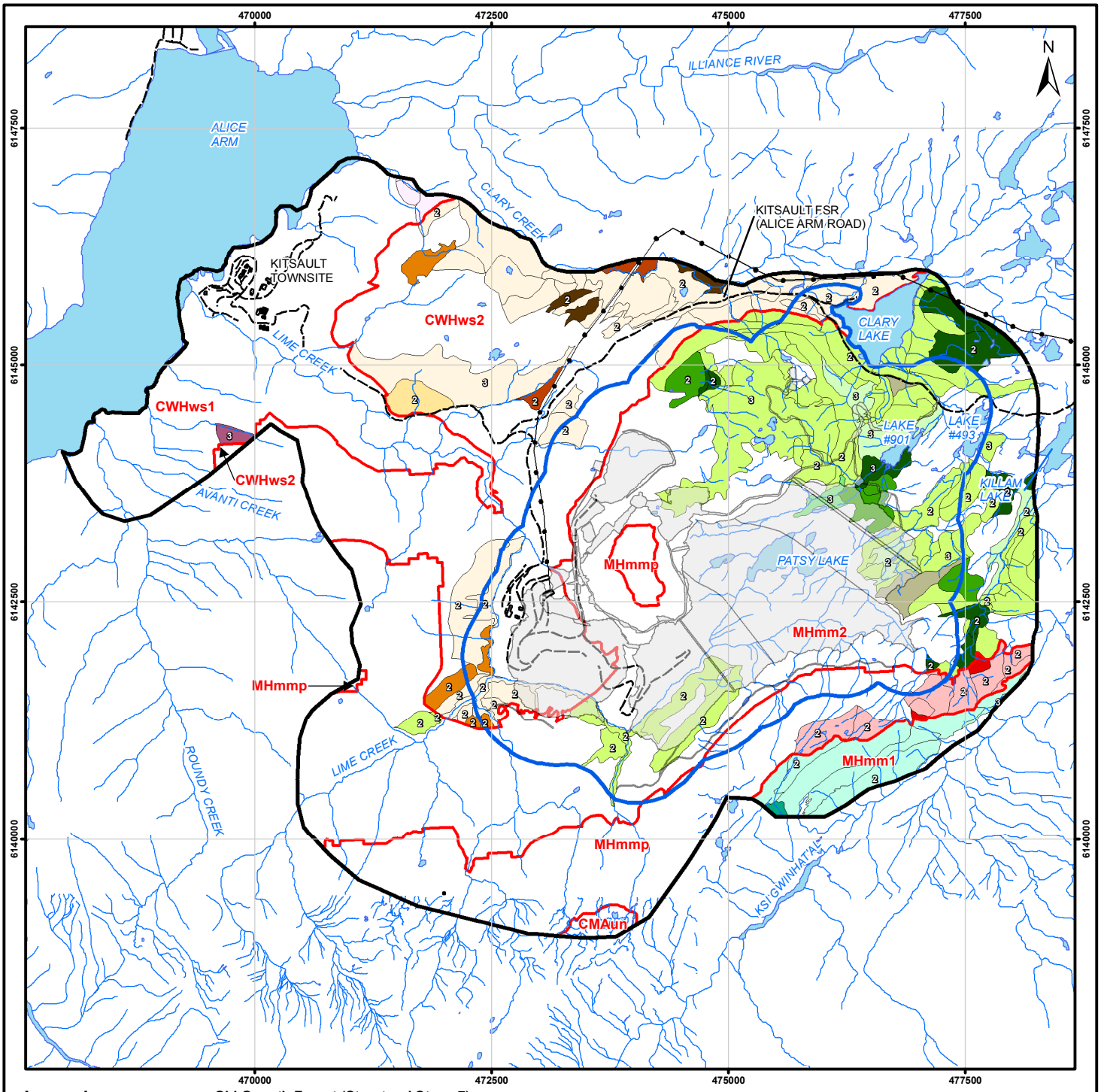
Figure 6.10.4.1). No old forests are affected in the MHmmp. In total, the proposed Project would directly remove 46 ha (15%) of old forests in the LSA which accounts for 6% of old forest available in the RSA.

A conceptual reclamation area has not been provided because forests in the proposed Project are classified as old forests at a structural age of greater than 250 years (which is equivalent to structural stage 7 in TEM (RIC 1998), therefore, reclamation is a long term plan and is not considered in the conceptual reclamation plan.

Table 6.10.4-2: Direct Effects on Old Forests in the Local Study Area

BGC Unit	Site Series Name	Site Series	Map Unit	Baseline Case	Project Case	Change in Baseline Distribution	
				ha	ha	ha	%
CWHws2	WH - Amabilis fir - Bramble	01	AB	30	28	-2	-8
	WH - Amabilis fir - Queens's cup	05	HQ	9	9	0	0
	Amabilis fir - WH - Devil's club	06	AD	<1	<1	0	0
	WH - Sitka spruce	11	RC	1	1	0	0
	Total Old Forests			***39***	***37***	***-2***	***-6***
MHmm2	MH - Amabilis fir - Blueberry	01	MB	178	150	-28	-16
	MH - Amabilis fir - Mountain-heather	02	MM	4	4	0	0
	Amabilis fir - MH - Oak fern	03	MO	13	12	-1	-6
	MH - Amabilis fir - Bramble	04	AB	21	19	-2	-10
	Amabilis fir - MH - Twistedstalk	05	MT	21	17	-4	-19
	MH - Yellow-cedar - Deer cabbage	06	MD	2	0	-1	-94
	MH - Yellow-cedar - Sphagnum	08	YS	14	9	-5	-38
	Yellow-cedar - MH - Skunk cabbage	09	YC	10	8	-1	-15
	Total Old Forests			***263***	***220***	***-44***	***-17***
MHmmp	Dry Open Parkland Forest	00	DP	2	2	0	0
	Moist (subhygric)Open Parkland Forest	00	SP	1	1	0	0
	Total Old Forests			***3***	***3***	***0***	***0***
Total Old Forests				*306*	*260*	*-46*	*-15*
Total Non-old Forests				*1511*	*972*	*-539*	*-36*
Total Baseline Disturbance				*164*	*49*	*-115*	*-70*
Total Project Disturbance				*0*	*701*	*701*	*-*
Total				**1980**	**1980**	**0**	**0**

Note: MH - Mountain Hemlock; WH - Western Hemlock



Legend

- Access Road
- Transmission Line
- Stream
- Waterbody
- Mine Footprint
- BGC Unit
- Terrestrial Regional Study Area
- Terrestrial Local Study Area

Old Growth Forest (Structural Stage 7)

Decile 1		Decile 2		Decile 3	
CWHws1		**CWHws2**		**CWHws1**	
	01 AB	2	01 AB	3	06 AD
CWHws2		2	03 HM	**CWHws2**	
	01 AB	2	05 HQ	3	01 AB
	05 HQ	2	06 AD	**MHmm1**	
	06 AD	2	11 RC	3	01 MB
	11 RC	**MHmm1**		**MHmm2**	
MHmm1		2	01 MB	3	01 MB
	01 MB	**MHmm2**		3	05 MT
	09 YC	2	01 MB	3	06 MD
MHmm2		2	05 MT	3	09 YC
	01 MB	2	08 YS		
	04 AB	2	09 YC		
	05 MT	**MHmmp**			
	08 YS	2	00 DP		
	09 YC				
MHmmp					
	00 DP				
	00 MP				

Example Ecosystem Legend:

01 AB
- Map Unit
- Site Series

Note: Refer to report for decile explanation.

1 0.5 0 1 2

Kilometres
1:60,000

Avanti Kitsault Mine Ltd.

Distribution of Old Forests – Project Case

DATE: November 2011	**Figure** 6.10.4-1
PROJECT: VE51988	06-50-015_EIA_old_growth.pdf
ANALYST: MY / QA/QC: CT	
PROJECTION/DATUM: UTM Zone 09/NAD 83	amec

Y:\GIS\Projects\VE\VE51988_Kitsault\Mapping\06_vegetation\Baseline\06-50-015.mxd

6.10.4.6.1.2 Potential Indirect Effects

The potential for direct effects of the proposed Project on old forests to become indirect effects on other disciplines is summarised in Table 6.10.4-3. The main indirect effects on other VCs are: loss of wildlife habitat; environmental health; and potential reduction and / or loss of Nisga'a Nation and Aboriginal groups' plant and heritage sites. Wildlife habitat and environmental health are potentially indirectly affected because the removal of old forests can reduce wildlife habitat availability and environmental health. A removal of old forests could also indirectly affect economic, social, heritage, Nisga'a Nation land use, and Aboriginal groups land use VCs.

Table 6.10.4-3: Potential Indirect Project Effects on Other Valued Components

Direct Project Effect (Adverse or Positive)	Project Phase	Potential Indirect Project Effect	Carry Forward (Yes / No)	Rationale
Loss of baseline old forests ecosystems	C, O	May affect hydrogeology ; increase in ground water	No	Mitigation measures are in place for potential effects from an increase in available ground water
	C, O	May affect surface hydrology; increase in surface water levels	No	Mitigation measures are in place for potential effects from an increase in available surface water
	C, O	May affect terrestrial environment; erosion of slopes due to lack of the surface stabilisers	No	Mitigation measures are in place for potential effects from soil erosion
	C, O	May affect wildlife habitat; loss of wildlife habitat	Yes	Removal of baseline ecosystems, affects cover and escape habitat
	C, O	May affect environmental health; reduced overall condition for all biota	Yes	Removal of old forest and plant species may contribute to potential effects on environmental health
	C, O	Reduced species diversity	No	Biodiversity issue
	C, O	May affect Nisga'a Nation and aboriginal groups economy	Yes	Potential forestry resources may be an issue in the Nass Wildlife Area
	C, O	May affect Nisga'a Nation and aboriginal groups social values for renewable resources	Yes	Potential forestry resources may be an issue in the Nass Wildlife Area
	C, O	May affect archaeological potential	Yes	Mitigation measures would include an assessment

Project phase: C - construction; D/C - decommissioning and closure; O - operations
Note: LSA - Local Study Area

The potential for an interaction between potential residual Project effects on other VCs and potential direct Project effects on old forests is summarised in Table 6.10.4-4. Generally, there are interactions between potential direct effects on old forest and wildlife habitat,

environmental health, economic, social, heritage, the Nisga'a Nation land use and Aboriginal groups land use VCs that have the potential for indirect effects on these other components (see Table 6.10.4.-3). However, there are no potential interactions with residual effects on other VCs that may lead to indirect effects on old forest.

Table 6.10.4-4: Summary of Potential Interaction Between Project Direct Effects on Other Valued Components and Old Forests

Direct Project Effect	Air Quality and Climate Change	Noise and Vibration	Hydrogeology	Groundwater Quality	Freshwater and Sediment Quality	Surface Hydrology	Freshwater Fisheries	Marines Water Quality	Marine Biota	Terrestrial Environment	Wildlife and Their Habitat	Environmental Health	Economic	Social	Heritage	Health	Nisga'a Nation Land Use	Aboriginal Groups Land Use
Loss of old forest baseline ecosystems	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	-	-	o	o	o	NI	o	o

Interaction definitions: o - interaction; - - key interaction; + - benefit; NI - no interaction

6.10.4.6.1.3 Potential Combined Effects

There are no potential combined effects from the interaction of potential indirect and direct effects on old forest.

6.10.4.6.1.4 Summary of Potential Effects

The overall potential effect of the proposed Project on the Old Forests VC is anticipated to be the loss of baseline old forest ecosystems due to land clearing. Table 6.10.4-5 summarises this potential effect.

Table 6.10.4-5: Summary of Potential Project Effects to be Carried Forward Into the Assessment for Old Forests

Adverse Effects / Positive Effects	Project Phase	Direction
Loss of old forest baseline ecosystems	C, O	Negative

Project phase: C - construction; D/C - decommissioning and closure; O - operations; PC post-closure

6.10.4.7 Mitigation Measures

Through proper mitigation techniques, the potential effects on old forests distribution within the proposed Project footprint can be minimised and managed to effectively reduce potential negative effects. Table 6.10.4-6 summarises the mitigation measures identified for the proposed Project by phase. These techniques include Project footprint minimisation, which is discussed in Section 6.10.2.6.2. Additional mitigation measures include:

- **Mapping of Old Forests**: Prior to construction, a field survey will be conducted using TEM mapping to verify the presence and location of old-growth stands. The TEM map would provide locations details of important environmental features, including old forest stands, that t would be considered during final footprint alignment and identification of construction laydown areas (see Appendix 6.10-A and the Wildlife Management Plan (Section 11.2.21)); and
- **Timber Salvage Plan**: Merchantable timber would be identified and removed from the site, while non-merchantable trees and other debris will be disposed of as per the *Forest and Range Practices Act* and in accordance with the *Wildlife Act* (Government of BC 1996d) (see Section 112.8 Vegetation Management Plan).

Table 6.10.4-6: Potential Project Effect by Project Phase on Old Forests and Mitigation Measures

Project Effect	Project Phase	Mitigation / Enhancement Measure	Mitigation Success Rating
Loss of baseline old forests	C	Project Footprint minimisation	Medium, Reduce
		A Site map showing old growth stage forests within the Project footprint area prepared from TEM mapping to direct a field survey to verify the presence of old growth stands	Medium, Prevent
		Timber Salvage Plan (Section 11.2.8 Vegetation Management Plan)	Medium, Reduce

Project phase: C - construction

Note: TEM - Terrestrial Ecosystem Mapping

Details regarding mitigation measures applicable to vegetation and plant communities are outlined in the EMPs (Section 11.2). In summary, mitigation techniques to minimise potential effects on cultural plants include:

- **Minimise Project footprint:** As an existing brownfield site, the use of previous disturbed areas would be maximised wherever possible to help maintain a compact Project footprint (see Section 6.10.2 for additional discussion on Project footprint minimisation);
- **Site map of old forest**: Prior to construction, a site map of important environmental features, including old forest stands, would be developed and considered during final footprint alignment and identification of construction laydown areas (see Section 11.2.8 Vegetation Management Plan and 11.2.21 Wildlife Management Plan); and
- **Reclamation following mine closure**: The primary objective of the Reclamation and Closure Plan (Appendix 3.0-L) is to return, where practical, areas disturbed by mining operations to acceptable land use and capability (see discussion in Section 6.10.2.7). In the CWHws2 variant and the MH zone, forests are classified as old forests when time since disturbance is greater than 250 years old. Therefore, reclaiming old forests is a long-term plan and consequently rated as low mitigation success.

6.10.4.8 Potential Residual Effects and Their Significance

6.10.4.8.1 Potential Residual Effects After Mitigation

A residual effect is an environmental effect that remains or is predicted to remain, even after mitigation measures have been applied (Agency 2011). The proposed Project would have a potential residual effect on the old forest VC due to the loss of approximately 46 ha of old forests from the WRMF, tailings ponds and northeast embankment (Table 6.10.4-7).

Table 6.10.4-7: Summary of Potential Residual Effects for Old Forests

Project Phase	Residual Effect	Direction
D/C	Loss of old forests from the WRMF, tailings ponds and northeast embankment	Negative

Project phase: D/C - decommissioning and closure interaction

Note: WRMF - Waste Rock Management Facility

6.10.4.8.2 Significance of Potential Residual Effects

The significance rating of the potential residual effect for the Old Forests VC is summarised in Table 6.10.4-8. Each residual effect identified is subjected to a nine rating criteria to determine significance; these criteria are described in Section 5.0. The ecological context of the alteration of baseline landscapes is rated medium as changes to baseline old forests directly influence the development of ecosystems and ecological niches through variability. The potential residual effect is considered local in spatial extent, reversible (after a few life cycles) and negative in direction, and the magnitude is rated medium (15% change). The residual effect of the proposed Project on Old Forests VC is rated as not significant (minor).

Table 6.10.4-8: Residual Effects Assessment by Project Development Phase for Old Forests

Parameter	Stage Of Development / Rating			
Stage of Project development	Construction and Operations			
Potential residual effect	Loss of old forests from baseline conditions			
Effect attribute				
Magnitude	Medium			
Spatial extent	Local			
Duration	Chronic			
Frequency	Once			
Reversibility	Yes			
Ecological context	Medium			
Direction	Negative			
Certainty	Low			
Residual effect significance	Not significant (minor)			
Level of confidence	Medium			
Probability of occurrence	High			

Note: n/a - not applicable

6.10.4.9 Potential Cumulative Effects

6.10.4.9.1 Identification and Analysis of Potential Project Cumulative Effects

Cumulative effects are assessed with known projects (past, present and future) occurring in the CEA. Table 6.10.4-9 provides a summary of Project-related effects on old forests and the rationale for carrying forward into the CEA.

Table 6.10.4-9: Project Related Residual Effects - Rationale for Carrying Forward Into the Cumulative Effects Assessment

Project Component	Project Phase	Residual Effect	Rationale	Carried Forward in CEA
Mine site facilities	C, O	Loss of old forests from baseline conditions rated as not significant (minor)	Other than the historical Kitsault mine site, potential residual effects to old forests do not overlap with any other past, present of foreseeable future projects.	No

Project phase: C - construction; D/C - decommissioning and closure; O - operations

Note: CEA - Cumulative Effects Assessment

The previous mining project at Kitsault started reclamation in 1996, which was last monitored in 2010. The proposed Project footprint overlaps previously disturbed areas and areas successfully reclaimed throughout the historic site, which will be maintained where possible. Potential residual effects to old forests associated with the Project are considered reversible. There are no cumulative effects for the Old Forests VC as current and potentially foreseeable future projects, including the NTL, do not occur within the terrestrial CESA boundary.

6.10.4.10 Limitations

Old forests may be under mapped in the LSA according to the VRI database.

6.10.4.11 Conclusion

Potential direct effects of the proposed Project are expected to occur on the Old Forests VC throughout the construction and operations phases of the proposed Project. The original distribution of old forests will not be re-established within the proposed Project time frame. The potential residual effect represents the loss of 46 ha of old forest ecosystems from the proposed Project footprint, and is rated as not significant (minor).

6.10.5 VC #4: Species at Risk

6.10.5.1 Introduction

One potential effect of the proposed Project was identified for the Species at Risk VC: the removal of baseline ecosystems that could potentially support species at risk. Removal of the understorey vegetation would occur throughout the proposed Project footprint. This

stage is expected to occur during the construction phase and continue into the operations phase.

6.10.5.1.1 Relevant Legislation and Legal Framework

The vegetation and plant community section is included under the requirements of the *BCEAA*. Assessment of vegetation is also considered with the *Mines Act*, which requires the development of an environmental management and reclamation plan to support the mitigation and closure of the proposed Project. The baseline report for this proposed Project meets the criteria of the *BCEAA* to support this assessment. Plant species at risk are listed federally under *SARA* as well as provincially under the *Forest and Range Practice Act*. The later lists endangered or threatened plants and plant communities. Presently only one species is provincially listed under the *Forest and Range Practices Act* tall bugbane (Actaea elata var. elata).

6.10.5.1.2 Spatial Boundaries

Spatial boundaries for the Species at Risk VC are limited to the geographic areas evaluated based on reasonable expectation of direct effect of the proposed Project. For CEAs, boundaries are selected by working outward from the zone of influence for effects specific to the proposed Project. If the zone of influence of the proposed Project overlaps with that of another project or human activity, the study area boundary for CEE is expanded to encompass this additional zone.

For the terrestrial studies, the following three general study area boundaries are usually established:

- A LSA includes the proposed Project infrastructure, specifically the cyclone sand plant, primary crusher, Process Plant, seepage collection ponds, pump station, WRMF, TMF, Kitsault Pit, stockpiles, site road and haul road along Lime Creek plus a buffer encompassing the zone of direct effects specific to the proposed Project. The proposed terrestrial LSA is consistent with the AIR and represents the direct effects of the proposed Project to the terrestrial environment as well as a 500 m buffer (to include any contiguous effects from activities causing disturbance to the terrestrial environment) surrounding Project components to provide a reasonable assessment area based on the planned activities in the proposed Project;
- A RSA was established to include the proposed Project and surrounding region, encompassing the zone of influence for effects specific to the proposed Project. The terrestrial RSA was defined as an additional 500 m buffer surrounding the LSA. The lack of contributing projects in the vicinity was a factor in determining the width of the buffer. This buffer accounts for the anticipated indirect effects which may occur as a result of Project Development; and
- A CESA includes past, present and reasonably foreseeable future human activities likely to result in residual effects or impacts on each VC; only those human activities that have residual effects, which have a temporal and spatial overlap with the

proposed Project's residual effects, are considered. The spatial limits of the CESA are consistent with the RSA.

6.10.5.1.3 Temporal Boundaries

Temporal boundary selection is based on a reasonable expectation of the time over which the proposed Project would have effects on biophysical and human environment receptors. Mine operation is projected to be 15 to 16 years following construction; decommissioning and closure, and post-closure phases would follow.

Preliminary temporal boundaries of the proposed Project which are contingent on permitting include four primary phases:

1. Construction Phase – estimated 25-month period. Includes:
   - Site clearing and preparation, earthworks such as excavating and grading site;
   - Facilities, such as the mine processing facilities, TMF South Embankment, and water management facilities;
   - Camp complex; and
   - May include the Patsy Creek diversion (this may be scheduled during the operations phase depending on environmental and project feasibility considerations).
2. Operations Phase – estimated at approximately two months of commissioning, and 15 to 16 years of mining (last two years are milling low-grade ore).
3. Decommissioning and Closure Phase – estimated at 15 to 17 years. Includes a closure period during which the buildings and decommissioned infrastructure would be removed and facilities reclaimed.
4. Post-Closure Phase – estimated at five years or more. This includes post-closure monitoring until on-site water quality has stabilised and indicates no material future adverse effects on local receiving waters; stabilisation of WRMF and TMF would also be considered in post-closure monitoring.

The temporal boundaries for Species at Risk VC are consistent with those timelines presented above. Also, the temporal boundaries are expected to be primarily affected during the initial construction phase and site development. Continued localised effects are expected during the operations phase. No seasonal variability is expected for this VC.

6.10.5.2 Information Source and Methods

The assessment of potential effects for the Species at Risk VC is based on site-specific baseline reporting conducted for this proposed Project. Species at risk are defined for the purposes of this report to include:

- Vascular and non-vascular species listed by the BC CDC, which are typically ranked as Red or Blue- listed (BC CDC 2010); and

- Vascular and non-vascular species listed as Special Concern, Threatened, or Endangered under *SARA* (Schedule 1) and COSEWIC.

Species at risk were not observed during field surveys in 2010. There are potentially 19 vascular plant species, of which four are Red- listed and 33 non-vascular plant species; nine of these are Red- listed and one Blue- listed fungus are at risk, as defined by the BC CDC (refer to the Vegetation Baseline Report (Appendix 6.10-A).

Potential habitat for species at risk was derived from the TEM completed during the baseline assessment. Information sources specific to the proposed Project followed the provincial "Standard for Terrestrial Ecosystem Mapping" prepared by RIC (1998). The wetland ecosystems were derived from the BC MOF field guide, "A Field Guide to Site Identification and Interpretation for the Prince Rupert Forest Region, Part 1 and 2" (Banner et al. 1993) and "Wetlands of British Columbia" (MacKenzie and Moran 2004). Aerial photography, contours, a forestry inventory database (BC MOF 2007), and a DEM were used to interpret the landscape within the RSA and LSA of the proposed Project.

6.10.5.3 Detailed Baseline for Species at Risk

No species at risk were documented during field surveys; therefore, ecosystem units (BGC and site series) were ranked to determine the ability to support potentially occurring species at risk. Of the 52 species at risk potentially occurring in the LSA, 41 were used in the assessment. Of the 11 species removed, five species are restricted to estuarine habitat and six species, all bryophytes, have insufficient habitat information. As a result, 41 species could be linked to specific ecosystems (Appendix 6.10-B).

The ecosystems units (Appendix 6.10-B) were ranked according to their ability to support listed plant species potentially occurring in the proposed Project area. Four categories of ecosystem potential to support plant species at risk (very low, low, medium, and high potential) were used (Table 6.10.5-1). An ecosystem with a ranking of high has the potential to support more than eight listed plants; an ecosystem ranked as medium has the potential to support four to seven listed plants; an ecosystem ranked low can potentially support two to three listed plants; and ecosystems ranked very low could potentially support none or one listed plant.

Table 6.10.5-1: Ecosystem Ranking for Potentially Occurring Species at Risk in the Local Study Area

Ecosystem Potential	Potential Number of Species at Risk
Very low	0-1
Low	2-3
Medium	4-7
High	8 +

Generally, the proposed Project is dominated by ecosystems with very low and low potential to contain plant species at risk, with the exception of the CWHws2, which has four

ecosystems ranked as high and five as medium. The four ecosystems ranked as high are: a bog forest; two wetlands; and rock (rock outcrops) (see Table 6.10.5-2 and Figure 6.10.5-1). The total area of ecosystems ranked as high for potentially occurring species at risk is 41 ha (2% of LSA) and only occur in the CWHws2.

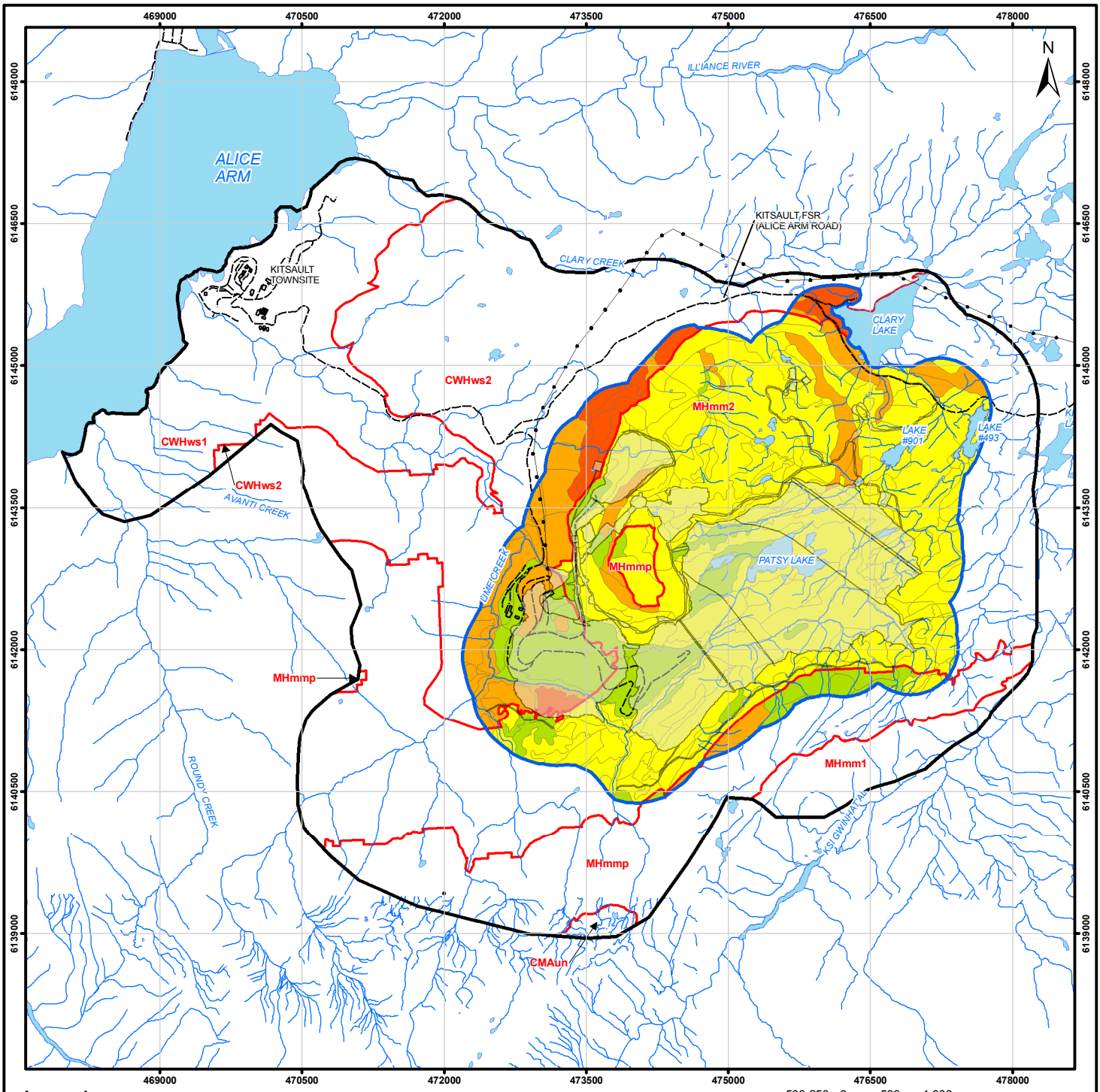
Table 6.10.5-2: Ecosystem Potential Rankings for Species at Risk in the Local Study Area

BGC Unit	Site Series Name	Site Series	Map Unit	Baseline Case (ha)	Rating	Ecosystem Potential Ranking
CWHws2	Lodgepole pine - Sphagnum	10	LS	20	8	high
	Wetland fen	00	Wf	6	15	high
	Narrow-leaved cotton-grass - Peat-moss	00	Wf50	13	15	high
	Rock	00	RO	2	17	high
	Total Area for Potential High Ranking			**41**		
CWHws2	WH - Amabilis fir - Bramble	01	AB	150	3	medium
	Amabilis fir - Western redcedar - Oak fern	04	AO	9	4	medium
	WH - Amabilis fir - Queen's cup	05	HQ	15	6	medium
	Amabilis fir - Western redcedar - Devil's club*	06	AD	3	4	medium
	Western redcedar - Sitka spruce - Skunk cabbage	11	RC	6	3	medium
	Total Area for Potential Medium Ranking			**177**		
CWHws2	WH - Lodgepole pine - Feathermoss	03	HM	6	1	low
	Western redcedar - Sitka spruce - Skunk cabbage	11	RC	5	low	
	Shallow open water	00	OW	0	3	low
	Total Area for Potential Low Ranking			**11**		
CWHws2	River	00	RI	4	0	very low
	Total Area for Potential Very Low Ranking			**4**		
MHmm2	Cliff	00	CL	5	5	medium
	Rock	00	RO	24	6	medium
	Total Area for Potential Medium Ranking			**29**		
MHmm2	Wet seepage meadow*	00	WM	2	3	low
	MH - Amabilis fir - Blueberry	01	MB	563	0	low
	MH - Yellow-cedar - Sphagnum	08	YS	14	2	low
	Wetland fen	00	Wf	103	3	low
	Narrow-leaved cotton-grass - Peat-moss	00	Wf50	223	3	low
	Sitka sedge - Peat-moss	00	Wf51	42	3	low

BGC Unit	Site Series Name	Site Series	Map Unit	Baseline Case (ha)	Rating	Ecosystem Potential Ranking
	Wetland marsh	00	Wm	2	3	low
	Talus	00	TA	15	2	low
	Total Area for Potential Low Ranking			**964**		
MHmm2	Herbaceous meadows*	00	AM	8	0	very low
	Crowberry - Bog blueberry - Alpine azalea	00	CA	27	0	very low
	Heather-Heath Parkland*	00	HH	2	0	very low
	MH - Indian hellebore*	00	MH	2	0	very low
	Willow thickets*	00	WT	1	1	very low
	MH - Amabilis fir - Mountain-heather	02	MM	97	0	very low
	Amabilis fir - MH - Oak fern	03	MO	98	0	very low
	MH - Amabilis fir - Bramble	04	AB	40	0	very low
	Amabilis fir - MH - Twistedstalk	05	MT	31	0	very low
	MH - Yellow-cedar - Deer cabbage	06	MD	107	0	very low
	Yellow-cedar - MH - Hellebore*	07	YH	<1	0	very low
	Yellow-cedar - MH - Skunk cabbage	09	YC	30	1	very low
	Shallow open water	00	OW	10	0	very low
	Buckbean	00	BB	<1	0	very low
	Yellow pond-lily	00	YL	<1	0	very low
	Lake	00	LA	18	0	very low
	Pond	00	PD	19	0	very low
	River	00	RI	1	0	very low
	Total Area for Potential Very Low Ranking			**491**		
MHmmp	Rock	00	RO	3	5	medium
	Total Area for Potential Medium Ranking			3		
MHmmp	Wetland fen	00	Wf	10	3	low
	Narrow-leaved cotton-grass - Peat-moss	00	Wf50	1	3	low
	Total Area for Potential Low Ranking			**11**		

BGC Unit	Site Series Name	Site Series	Map Unit	Baseline Case (ha)	Rating	Ecosystem Potential Ranking
MHmmp	Herbaceous meadows	00	AM	3	0	very low
	Dry Closed Forest*	00	DF	1	0	very low
	Dry Open Parkland Forest	00	DP	9	0	very low
	MH - Mountain-heather Parkland	00	MH	32	0	very low
	Mesic Open Parkland	00	MP	33	0	very low
	Moist (subhygric) Closed Forest	00	SF	4	0	very low
	Moist (subhygric) Open Parkland Forest*	00	SP	1	0	very low
	Total Area for Potential Very Low Ranking			**83**		

Note: BGC - biogeoclimatic; CWHws2 - Coastal Western Hemlock Wet Submaritime Montane Variant ; ha - hectare; MH - Mountain Hemlock; MHmmp - Mountain Hemlock Moist Maritime Parkland Subzone; MHmm2 - Mountain Hemlock Moist Maritime Leeward Variant; WH - Western Hemlock



Legend

- Access Road
- Transmission Line
- Stream
- Waterbody
- Mine Footprint
- BGC Unit
- Terrestrial Local Study Area

Ranked Species at Risk Ecosystem Classes

- High
- Medium
- Low
- Very Low
- Not Ranked

Note

High = ecosystem occurring and ranked high in any decile;
high ranked ecosystems override medium and low ranked ecosystems.
Medium = ecosystem occurring and ranked medium in any decile;
medium ranked ecosystems override low ranked ecosystems
Low = ecosystem occurring and ranked low in any decile
Not ranked = no ranked ecosystems (either high, medium or low) occur in this polygon

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Ecosystem Potential Rankings for Species at Risk in the LSA

DATE: November 2011	**Figure** 6.10.5-1
PROJECT: VE51988	06-50-013_ecosystem_species_risk_v2.pdf
ANALYST: MY / QA/QC: CT	
PROJECTION/DATUM: UTM Zone 09/NAD 83	amec

6.10.5.4 Cultural Ecological or Community Knowledge

No species at risk are listed as cultural plants.

6.10.5.5 Past, Present or Future Projects / Activities

The proposed Project would be influenced by past mining activities that have occurred within the footprint. Beginning in 1959, the site has seen various activities and stages of mining, from diamond drilling to the initial stages of molybdenum exploration starting in 1968. These activities have had an impact that directly relates to the Species at Risk VC, because the natural setting and baseline conditions of the site were disturbed. The last operation phase of the mine began in 1981, lasting until reclamation of the site began from 1996 to 2006. Post reclamation monitoring occurred in 2010. A summary of previous and on-going reclamation activities for the proposed Project site are provided in Section 3.1.2 (History of Reclamation).

6.10.5.6 Potential Effects of the Proposed Project and Proposed Mitigation

6.10.5.6.1 Identification and Analysis of Potential Project Effects

The assessment of effects on Species at Risk VC include consideration of effects from Project components (direct effects), effects from other VCs (indirect effects) affected by the proposed Project, and combined effects (direct and indirect effects combined) during each Project phase (construction, operations, decommissioning and closure, and post closure).

6.10.5.6.1.1 Potential Direct Effects

Loss of baseline potential ecosystems for species at risk was considered as a potential direct effect of the proposed Project on the Species at Risk VC. Table 6.10.5-3 lists the potential direct Project effects for the Project components. It also summarises the likelihood of the direct effects that may occur during each Project phase on the Species at Risk VC.

Table 6.10.5-3: Potential Direct Project Effects on Species at Risk

Project Component	Project Phase	Potential Direct Project Effect	Likelihood Of Occurrence
Land Clearing, excavating and grading	C	Land disturbance affects loss of baseline potential ecosystems for species at risk	Likely
WRMF development	C, O	Loss of baseline potential for species at risk ecosystems	Likely
Surface and ground water management	C, O, D/C	Loss of moist to very wet ecosystems and sparsely vegetated units, which have a higher potential for species at risk	Likely
TMF development	C, O	Loss of baseline potential for species at risk ecosystems	Likely

Project phase: C - construction; D/C - decommissioning and closure; O - operations; PC - post-closure

Note: TMF - Tailings Management Facility; WRMF - Waste Rock Management Facility

Loss of baseline potential ecosystems for species at risk: No provincially listed or federally listed plant species at risk were identified in the proposed Project study area during baseline studies. Thus, a total of 3 ha of ecosystems with high potential for plant species at risk would be affected by the proposed Project in the Project Case (Table 6.10.5-3). Potential effects to species at risk were assessed based on the combined area of high and medium ranked classes affected, since these make up the classes most likely to contain species at risk throughout the LSA. The effect in the Project Case would be a loss of 34 ha (13% of high and medium ranked classes in the LSA). Following reclamation in the Conceptual Reclamation Case, a loss of 16 ha (6%) from high and medium ranked classes would be expected. As shown in Table 6.10.5-4 the high and medium classes occur in the CWHws2 and the Mhmm2.

Table 6.10.5-4: Direct Effects to Ranked Ecosystems for Species at Risk

BGC Unit	Ecosystem Potential Ranking	Baseline Case	Project Case	Change in Baseline Distribution		Conceptual Reclamation Area	Change in Baseline Distribution Following Reclamation	
		ha	ha	ha	%	ha	ha	%
CWHws2	High	42	39	-3	-7	40	-2	-4
	Medium	183	154	-29	-16	163	-20	-11
	Low	6	6	-<1	-1	6	-<1	-<1
	Very Low	4	3	-1	-23	3	-1	-23
MHmm2	Medium	29	26	-2	-8	34	6	19
	Low	965	636	-328	-34	779	-186	-19
	Very Low	492	270	-222	-45	479	-13	-3
MHmmp	Medium	3	3	0	0	3	0	0
	Low	11	11	0	0	11	0	0
	Very Low	82	82	0	0	82	0	0
	Total Ranked Area	**1816**	**1231**	**-585**	**-32**	**1600**	**-216**	**-12**
	High + Medium	*256*	*222*	*-34*	*-13*	*240*	*-16*	*-6*

Note: BGC - Biogeoclimatic; CWHws2 - Coastal Western Hemlock Wet Submaritime Montane Variant; ha - hectare; MHmmp - Mountain Hemlock Moist Maritime Parkland Subzone; MHmm2 - Mountain Hemlock Moist Maritime Leeward Variant;% - percent

6.10.5.6.1.2 Potential Indirect Effects

The potential for direct effects of the proposed Project on species at risk to become indirect effects on other disciplines is summarised in Table 6.10.5-5. The main indirect effect on other VCs is environmental health. Environmental health is potentially indirectly affected because the direct loss of baseline ecosystems for species at risk can reduce the overall habitat condition for all biota.

Table 6.10.5-5: Potential Indirect Project Effects on Other Valued Components

Direct Project Effect (Adverse or Positive)	Project Phase	Potential Indirect Project Effect	Carry Forward (Yes / No)	Rationale
Loss of baseline potential ecosystems for species at risk	C, O	May affect environmental health; reduced overall condition for all biota	Yes	Removal of potential ecosystems for species at risk may contribute to potential effects on environmental health

Project phase: C - construction; O - operations

The potential for an interaction between direct effects of the proposed Project on Species at Risk VC and potential effects on other discipline VCs are depicted in Table 6.10.7-6. Generally the proposed Project effects had interactions with environmental health (see Table 6.10.7-5) and terrestrial (soils and terrain) VCs. The alteration of landscapes is a residual effect listed in the soils and terrain discipline (Section 6.9). Change in baseline landscapes may directly affect the final ecosystems, and thus the potential of ecosystems for species at risk.

Table 6.10.5-6: Summary of Potential Interaction Between Project Direct Effects on Other Valued Components and Species at Risk

Direct Project Effect	Air Quality and Climate Change	Noise and Vibration	Hydrogeology	Groundwater Quality	Freshwater and Sediment Quality	Surface Hydrology	Freshwater Fisheries	Marine Water Quality	Marine Biota	Terrestrial Environment	Wildlife and Their Habitat	Environmental Health	Economic	Social	Heritage	Health	Nisga'a Nation Land Use	Aboriginal Groups Land Use
Loss of baseline potential ecosystems for species at risk	NI	NI	NI	NI	NI	NI	NI	NI	NI	-	NI	o	NI	NI	Nil	Nil	NI	NI

Interaction definitions: o - interaction; - - key interaction; + - benefit; NI - no interaction

6.10.5.6.1.3 Potential Combined Effects

Table 6.10.5-7 assesses the potential combined effects of the proposed Project resulting from the interaction of potential direct and indirect Project effects on the Species at Risk VC. The combined effect of the proposed Project likely to occur is loss of baseline ecosystems, which represents potential habitat for species at risk.

Table 6.10.5-7: Potential Combined Project Effects by Project Phase on Species at Risk

Potential Indirect Project Effect	Potential Combined Project Effect	Project Phase	Likelihood Of Occurrence
Ecosystem alteration	loss of potential habitat for species at risk.	C	Likely
Alteration in landform diversity	Change in landscapes may reduce potential ecosystems for species at risk.	C	Likely

Project phase: C - construction

6.10.5.6.1.4 Summary of Potential Effects

The overall potential effect on the Species at Risk VC is the loss of baseline potential species at risk ecosystems due to excavating, grading, and water diversion (Table 6.10.5-8).

Table 6.10.5-8: Summary of Potential Project Effects to be Carried Forward Into the Assessment for Species at Risk

Adverse Effects / Positive Effects	Project Phase	Direction
Loss of baseline potential ecosystems for species at risk	C	Negative

Project phase: C - construction

6.10.5.6.2 Mitigation Measures

Through proper mitigation techniques, the potential effects on the Species at Risk VC within the proposed Project footprint can be minimised and managed to effectively reduce potential negative effects. Table 6.10.5.9 summarises the mitigation measures for the Species at Risk VC. These techniques include: minimising the Project footprint; prevention of invasive species; soil salvage; and site reclamation, which are discussed in Section 6.10.2.6.2. An additional mitigation measure includes:

- **Species at Risk Avoidance**: During construction, environmental monitors would be provided with an illustrated list of potentially occurring plant species at risk which may occur in the areas to be cleared. Where practical, plant species at risk identified by the environmental monitors would be salvaged, and re-established in suitable natural habitats unaffected by mine construction (see Section 11.2.8 Vegetation Management Plan).

Table 6.10.5-9 summarises the mitigation measures identified for the proposed Project by phase.

Table 6.10.5-9: Potential Project Effect by Project Phase on Species at Risk and Mitigation Measures

Project Effect	Project Phase	Mitigation / Enhancement Measure	Mitigation Success Rating
Loss of baseline potential habitat (ecosystems) for species at risk	C	Minimise Project footprint	Medium, Reduce
	C	Species at risk avoidance during construction clearing (Section 11.2.8 Vegetation Management Plan)	High, Prevent
	C, O	Invasive species management (Section 11.2.8 Vegetation Management Plan)	Medium, Prevent
	C	Salvage soil for reclamation (Section 11.2.16 Soils Management Plan)	High Enhance
	D/C, PC	Re-vegetate according to the Reclamation and Closure Plan (Appendix 3.0-L)	Medium, Enhance

Project phase: C - construction; D/C - decommissioning and closure; O - operations; PC - post-closure

Details regarding mitigation measures applicable to vegetation and plant communities are outlined in the EMPs (Section 11.2).

- **Minimise Project footprint:** As an existing brownfield site, the use of previous disturbed areas would be maximised wherever possible to help maintain a compact Project footprint (see Section 6.10.2 for additional discussion on Project footprint minimisation);
- **Invasive species management:** Prevention, early detection and control measures would be undertaken, when required, on a site and species-specific basis (see discussion in Section 6.10.2.7; Section 11.2.8 Vegetation Management Plan);
- **Maintain soil salvage:** During construction, topsoil and surface organic horizons would be salvaged and stored for use during reclamation. Salvaging soils provides an adequate growth medium from the original site and limits plant mortality by retaining a dormant seed population (Section 11.2.16 Soil Management Plan; Appendix 3.0-L Reclamation and Closure Plan); and
- **Reclamation following mine closure**: The primary objective of the Reclamation and Closure Plan (Appendix 3.0-L) is to return, where practical, areas disturbed by mining operations to acceptable land use and capability (see discussion in Section 6.10.2.7).

6.10.5.7 Potential Residual Effects and Their Significance

6.10.5.7.1 Potential Residual Effects After Mitigation

A residual effect is an environmental effect that remains, or is predicted to remain, even after mitigation measures have been applied (Agency 2011). The potential residual effects after mitigation were discussed in Section 6.10.2.7. The development of the proposed Project would have a residual effect on the Species at Risk VC due to the loss of baseline

ecosystems from the TMF Supernatant Pond, WRMF, and the construction of the northeast and south embankments, although only low and very low classes of ecosystems with the potential for species at risk occur in these areas. Although, no plant species at risk (provincially or federally) were identified in the proposed Project study area during baseline studies, approximately 34 ha (16%) ranked as high or medium potential for species at risk are expected to be affected. Mitigation and reclamation would reduce this potential effect, but a potential residual effect to ecosystems with the potential for species at risk would remain. The potential residual effects after mitigation were discussed in Section 6.10.2.7. Table 6.10.5-10 lists the potential residual effects for Species at Risk VC.

Table 6.10.5-10: Summary of Potential Residual Effects for Species at Risk

Project Phase	Residual Effect	Direction
C, O, D/C	Loss of potential ecosystems for species at risk	Negative

Project phase: C - construction; D/C - decommissioning and closure interaction; O - operations

6.10.5.7.2 Significance of Potential Residual Effects

The significance rating of the potential residual effect for the Species at Risk VC is summarised in Table 6.10.5-11. Each residual effect identified was subjected to a nine rating criteria to determine significance; these criteria are described in Section 5.0. The ecological context is rated high. The effect is considered local in spatial extent, reversible, and negative in direction. Confidence in the assessment is medium, since it is unlikely all rare plants have been observed and there remains a possibility for loss of unobserved rare plants during Project development. The potential residual effect of the proposed Project on species at risk is rated as not significant (minor) because the location of the high and medium classes for species at risk is not within a proposed Project facility.

Table 6.10.5-11: Residual Effects Assessment by Project Development Phase for Species at Risk

Parameter	Stage Of Development / Rating			
Stage of Project development	All			
Potential Residual effect	Loss of potential baseline ecosystems for species at risk			
Effect attribute				
Magnitude	Low			
Spatial extent	Local			
Duration	Chronic			
Frequency	Once			
Reversibility	Yes			
Ecological context	High			
Direction	Negative			

Parameter	Stage Of Development / Rating			
Stage of Project development	All			
Potential Residual effect	Loss of potential baseline ecosystems for species at risk			
Effect attribute				
Certainty	Medium			
Residual effect significance	Not significant (minor)			
Level of confidence	Medium			
Probability of occurrence	Low			

6.10.5.8 Potential Cumulative Effects

6.10.5.8.1 Identification and Analysis of Potential Project Cumulative Effects

Cumulative effects are assessed with known projects (past, present and future) occurring in the CEA. Table 6.10.5-12 provides a summary of Project related effects on ecosystems for species at risk and the rationale for carrying forward into the CEA.

Table 6.10.5-12: Project Related Residual Effects - Rationale for Carrying Forward Into the Cumulative Effects Assessment

Project Component	Project Phase	Residual Effect	Rationale	Carried Forward in CEA
Mine site facilities	C, O	Loss of potential baseline ecosystems for species at risk rated as not significant (minor)	Other than the historical Kitsault minesite, potential residual effects to ecosystems for species at risk do not overlap with any other past, present of foreseeable future projects.	No

Project phase: C - construction; O - operations

The previous mining project at Kitsault started reclamation in 1996, which was last monitored in 2010. The proposed Project footprint overlaps previously disturbed areas and areas successfully reclaimed throughout the historic site, which will be maintained where possible. Potential residual effects to ecosystems for species at risk associated with the Project are considered reversible. There are no cumulative effects for ecosystems for Species at Risk VC as current and potentially foreseeable future projects, including the NTL, do not occur within the terrestrial CESA boundary.

6.10.5.9 Limitations

The conceptual reclamation plan was developed prior to the reclamation and closure section; therefore, elements within the plan may change.

6.10.5.10 Conclusion

Species at risk were not observed during field surveys in 2009 or 2010. Potential ecosystems for species at risk was derived from TEM and ranked for their potential to support species at risk. The CWHws2 was the only BGC unit with ecosystems ranked with high potential for species at risk. Following reclamation, there was a total loss of 16 ha (6%) of ecosystem with a high and medium ranked potential for species at risk. The potential direct effect is loss of baseline potential ecosystems that support species at risk due to land clearing, excavating, and grading. The loss of ecosystems with the potential to support species at risk, particularly from the formation of the TMF Supernatant Pond and development of the proposed Project facilities, is a potential residual effect. The residual effect on Species at Risk VC is rated as not significant (minor).

6.10.6 VC #5: Ecological Communities at Risk

6.10.6.1 Introduction

Two key issues were identified for the Ecological Communities at Risk VC: removal of baseline ecosystems and potential spread of invasive plant species. Removal of the overstorey and understorey vegetation would occur throughout the proposed Project footprint. This stage is expected to occur during the construction and operations (TMF and WRMF) phases. Vegetation clearing and additional traffic open up the opportunity for an influx of invasive plants. This interaction is expected to extend over the life span of the proposed Project.

6.10.6.1.1 Relevant Legislation and Legal Framework

The vegetation and plant community section is included under the requirements of the *BCEAA*. Assessment of vegetation is also considered with the *Mines Act*, which requires the development of an environmental management and reclamation plan to support the mitigation and closure of the proposed Project. The baseline report for this proposed Project meets the criteria of the *BCEAA* to support this assessment. The BC CDC recognises ecological communities at risk; however, no legislation supports this policy.

6.10.6.1.2 Spatial Boundaries

Spatial boundaries for the Ecological Communities at Risk VC are limited to the geographic areas evaluated, based on reasonable expectation of direct effects of the proposed Project. For CEAs, the boundaries are selected by working outward from the zone of influence from effects specific to the proposed Project. If the zone of influence of the proposed Project overlaps with that of another project or human activity, the study area boundary for CEE is expanded to encompass this additional zone.

For the terrestrial studies, including vegetation ecosystems, the following three general study area boundaries are usually established:

- A LSA includes the proposed Project infrastructure, specifically the cyclone sand plant, primary crusher, Process Plant, seepage collection ponds, pump station,

WRMF, TMF, Kitsault Pit, stockpiles, site road and haul road along Lime Creek plus a buffer encompassing the zone of direct effects specific to the proposed Project. The proposed terrestrial LSA is consistent with the draft AIR and represents the direct effects of the proposed Project to the terrestrial environment as well as a 500 m buffer (to include any contiguous effects from activities causing disturbance to the terrestrial environment) surrounding Project components to provide a reasonable assessment area based on the planned activities in the proposed Project;

- A RSA was established to include the proposed Project and surrounding region encompassing the zone of influence for effects specific to the proposed Project. The terrestrial RSA was defined as an additional 500 m buffer surrounding the LSA. The lack of contributing projects in the vicinity was a factor in determining the width of the buffer. This buffer accounts for the direct and anticipated indirect effects which may occur as a result of Project Development; and
- A CESA includes past, present and reasonably foreseeable future human activities likely to result in residual effects or impacts on each VC; only those human activities that have residual effects which have a temporal and spatial overlap with the proposed Project's residual effects are considered. The spatial limits of the CESA are consistent with the RSA.

6.10.6.1.3 Temporal Boundaries

Temporal boundary selection is based on a reasonable expectation of the time over which the proposed Project would have effects on biophysical and human environment receptors. Mine operation is projected to be 15 to 16 years following construction; decommissioning and closure, and post-closure phases would follow.

Preliminary temporal boundaries of the proposed Project which are contingent on permitting include four primary phases:

1. Construction Phase – estimated 25-month period. Includes:
   - Site clearing and preparation, earthworks such as excavating and grading site;
   - Facilities, such as the mine processing facilities, TMF South Embankment, and water management facilities;
   - Camp complex; and
   - May include the Patsy Creek diversion (this may be scheduled during the operations phase depending on environmental and project feasibility considerations).
2. Operations Phase – estimated at approximately two months of commissioning, and 15 to 16 years of mining (last two years are milling low-grade ore).
3. Decommissioning and Closure Phase – estimated at 15 to 17 years. Includes a closure period during which the buildings and decommissioned infrastructure would be removed and facilities reclaimed.
4. Post-closure Phase – estimated at five years or more. This includes post-closure monitoring until on-site water quality has stabilised and indicates no material future

adverse effects on local receiving waters; stabilisation of WRMF and TMF would also be considered in post-closure monitoring.

The temporal boundaries for the Ecological Communities at Risk VC are consistent with those timelines presented above. Also, the temporal boundaries for the Ecological Communities at Risk VC are expected to be primarily affected during the initial construction phase and site development. Continued localised effects are expected during the operations phase. No seasonal variability is expected for this VC.

6.10.6.2 Information Source and Methods

Ecological communities at risk are defined for the purposes of this report to include ecological communities listed by the BC CDC, which are typically ranked as Red or Blue-listed (BC CDC 2010) on the basis of the provincial Conservation Status Rank (SRANK) assigned by the BC CDC.

The assessment of effects for the Ecological Communities at Risk VC is based on site-specific baseline reporting conducted for this proposed Project. Detailed vegetation baseline reports were conducted for the proposed Project in 2009 and 2010. This assessment considers baseline data from three baseline reports: "Kitsault Project Vegetation and Ecosystem Mapping Baseline Report" (Rescan 2010a); "Kitsault Project 2009 Wetland Baseline Report" (Rescan 2010b), and AMEC's Vegetation Baseline Report (Appendix 6.10-A). Provincial and regional information sources were reviewed and provided a background to support the TEM specific to the proposed Project completed during the baseline assessment. Information sources specific to the proposed Project followed the provincial "Standard for Terrestrial Ecosystem Mapping" prepared by RIC (1998). The ecosystems were derived from the BC MOF field guide, "A Field Guide to Site Identification and Interpretation for the Prince Rupert Forest Region, Part 1 and 2" (Banner et al. 1993). Aerial photography, contours, a forestry inventory database (BC MOF 2007), and a DEM were used to interpret the landscape within the RSA and LSA of the proposed Project.

To determine the potential effect of the proposed Project on the Ecological Communities at Risk VC, the proposed Project footprint was applied to the terrestrial ecosystem map produced for the Vegetation Baseline Report (Appendix 6.10-A). Spatial analysis through a GIS protocol was employed to determine the effect of the proposed Project.

6.10.6.3 Detailed Baseline for Ecological Communities at Risk

The Vegetation Baseline Report (Appendix 6.10-A) summarises the detailed methods for the terrestrial field survey and TEM and depict the baseline distribution of ecological communities at risk (site series and site associations).

Within the LSA, two ecological communities at risk occur within the CWHws2. Site series, 03 (WH – lodgepole pine – Feathermoss) and site series 04 (amabilis fir – western redcedar – oak fern) are both provincially blue listed. These ecological communities at risk cover 15 ha (5% of the CWHws2) or <1% of the LSA.

6.10.6.4 Cultural Ecological or Community Knowledge

Desk-based research indicates the importance of a wide range of vegetation resources to the Nisga'a Nation and Aboriginal groups for cultural, economic, and medicinal purposes. As such, general information about their interests and values is presented in Cultural Plants VC (Section 6.10.9). Parts C and D of the Application provide further information from publicly available sources. During future consultation with the Nisga'a Nation and the Aboriginal groups, additional understanding and site-specific information may be obtained about the value and interest of ecological communities at risk in the LSA to the Nisga'a Nation and Aboriginal groups.

6.10.6.5 Past, Present, or Future Projects / Activities

The proposed Project would be influenced by the past mining activities that have occurred within the footprint. Beginning in 1959, the site has seen various activities and stages of mining, from diamond drilling to the initial stages of molybdenum exploration starting in 1968. These activities have had an impact that directly relates to the Ecological Communities at Risk VC, because the natural setting and baseline conditions of the site were disturbed. The last operation phase of the mine began in 1981 and lasted until 1996. Reclamation started in 1996 and ran until 2006, with post reclamation monitoring occurring in 2010. A summary of previous and on-going reclamation activities for the proposed Project site are provided in Section 3.1.2 (History of Reclamation).

6.10.6.6 Potential Effects of the Proposed Project and Proposed Mitigation

6.10.6.6.1 Identification and Analysis of Potential Project Effects

The assessment of potential effects on the Ecological Communities at Risk VC includes consideration of effects from Project components (direct effects) and effects from other VCs (indirect effects), and combined effects (indirect combined with direct effects) as a result of the proposed Project during each Project phase (construction, operations, decommissioning and closure, and post-closure).

6.10.6.6.1.1 Potential Direct Effects

Two potential direct effects on ecological communities at risk were considered: loss of baseline ecological communities at risk ecosystems; and the introduction and spread of invasive plant species. Table 6.10.6-1 summarises the likelihood of potential direct effects that may occur during each Project phase on ecological communities at risk.

Table 6.10.6-1: Potential Direct Project Effects on Ecological Communities at Risk

Project Component	Project Phase	Potential Direct Project Effect	Likelihood Of Occurrence
Access and mine access roads	O	Conditions may promote the spread of invasive plant species which could reduce ecological communities at risk	Unlikely
Land Clearing, excavating, grading for mine facilities	C	Land disturbance affects loss of baseline ecological community at risk ecosystems and spread of invasive plant species	Likely

Project phase: C - construction; O - operations

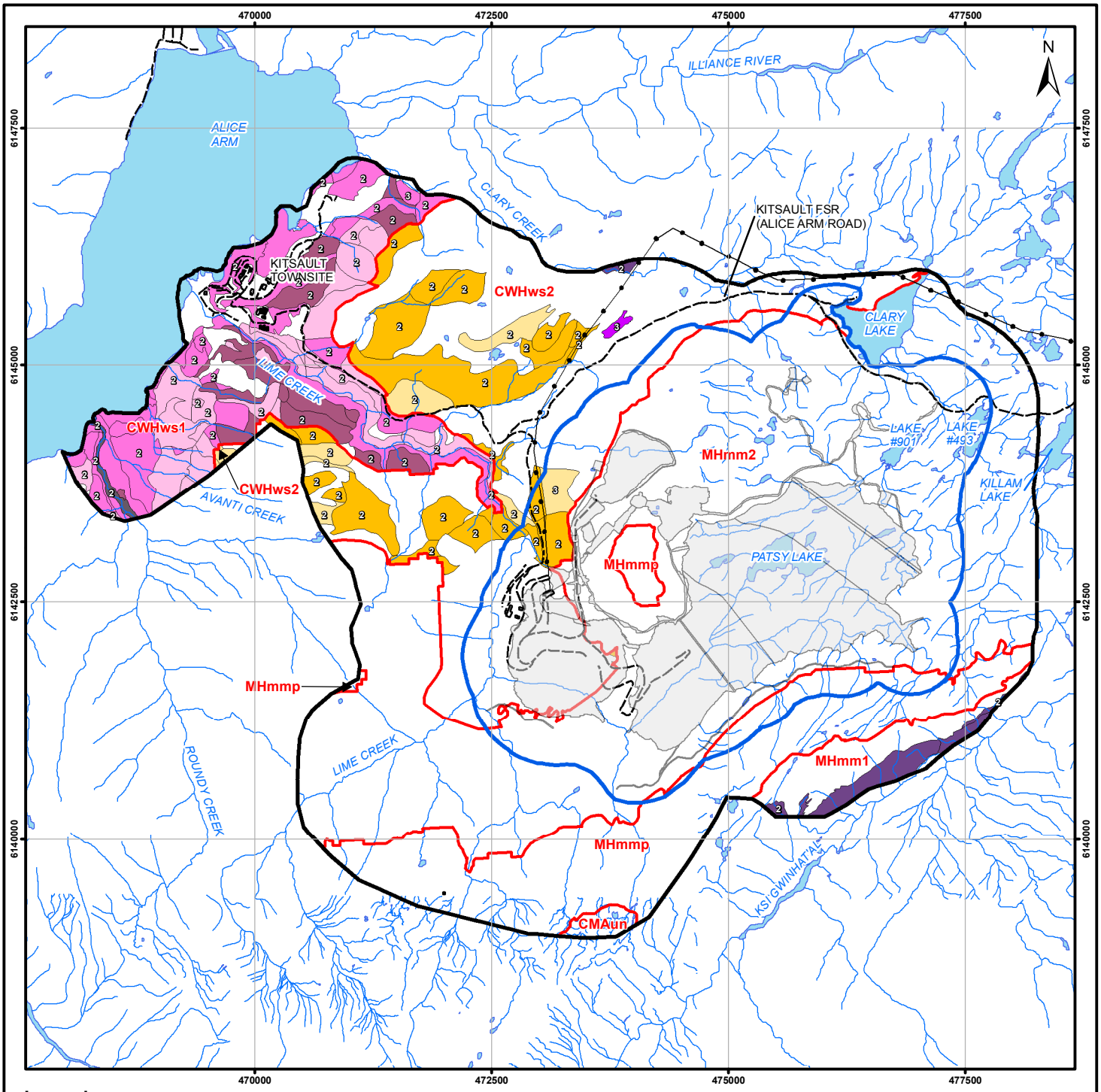
Loss of baseline ecological communities at risk: Within the LSA, two ecological communities at risk occur within the CWHws2. Site series, 03 (WH – lodgepole pine – Feathermoss) and site series 04 (amabilis fir – western redcedar – oak fern) are both provincially Blue- listed and cover approximately 15 ha or <1% of the LSA. Proposed Project development would potentially remove 1 ha of site series 04 (7% of the CWHws2) and <1 ha of site series 03 (1%of the CWHws2) (See Table 6.10.6-2 and Figure 6.10.6-1). This loss is mainly attributed to the construction of mine site roads, conveyor belt system and the expansion of the Kitsault Pit. Potential direct effects to Ecological Communities at Risk VC following reclamation show no change from the Project Case; a loss of 1 ha (4% of ecological communities at risk in the CWHws2) would remain.

Table 6.10.6-2: Direct Effects on Ecological Communities at Risk in the Local Study Area

BGC Unit	Site Series Name	Site Series	Map Unit	Baseline Case	Project Case	Change in Baseline Distribution		Conceptual Reclamation Area	Change in Baseline Distribution following Reclamation	
				ha	ha	ha	%	ha	ha	%
CWHws2	WH - Lodgepole pine - Feathermoss	03	HM	6	6	0.03	-1	6	0.02	-<1
	Amabilis fir - Western redcedar - Oak fern	04	AO	9	9	0.65	-7	9	0.63	-7
Total Ecological Communities at Risk				*15*	*15*	*0.68*		*15*	*0.65*	*-4*
Total Non-Ecological Communities at Risk				*1801*	*1217*	*-585*	*-32*	*1586*	*-215*	*-12*
Total Baseline Disturbance				*164*	*49*	*-115*	*-70*	*52*	*-112*	*-68*
Total Project Disturbance				*0*	*701*	*701*	*-*	*328*	*328*	*-*
Total				**1980**	**1980**	**0**	**0**	**1980**	**0**	**0**

Source: Biogeoclimatic Ecosystem Classification follows Banner et al. (1993) and MacKenzie and Moran (2004)

Note: BGC - Biogeoclimatic; CWHwc2 - Coastal Western Hemlock Wet Submaritime Montane Variant; ha - hectare; % - percent



Legend

- Terrestrial Regional Study Area
- Terrestrial Local Study Area
- BGC Unit
- Access Road
- Stream
- Waterbody
- Transmission Line
- Mine Footprint

Rare Ecological Communities

Decile 1	Decile 2	Decile 3
CWHws1	**CWHws1**	**CWHws1**
03 HM	03 HM	04 AO
04 AO	04 AO	**CWHws2**
06 AD	06 AD	03 HM
CWHws2	08 CD	Wb13
03 HM	**CWHws2**	
04 AO	03 HM	
MHmm1	04 AO	
Wf51	Wf51	
	MHmm1	
	Wf51	

Example Ecosystem Legend:

03 HM
- Map Unit
- Site Series

Note: Refer to report for decile explanation.

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Distribution of Ecological Communities at Risk – Project Case

DATE: November 2011	Figure 6.10.6-1
PROJECT: VE51988	06-50-016_EIA_rare_eco_comm.pdf
ANALYST: MY / QA/QC: CT	
PROJECTION/DATUM: UTM Zone 09/NAD 83	amec

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Spread of invasive plants: Presently, invasive plants within the proposed Project footprint are not anticipated to affect ecological communities at risk. During baseline studies, no invasive plant species were recorded during field surveys. Three species - bull thistle (*Cirsium vulgare)*, Japanese knotweed (*Fallopia japonica)*, and burdock species *Arctium spp.* - were documented as occurring in the RSA (BC MFLNRO (IAPP) 2010).

6.10.6.6.1.2 Potential Indirect Effects

The potential for direct effects of the proposed Project on ecological communities at risk to become indirect effects on other disciplines is summarised in Table 6.10.6-3. The main indirect effects on other VCs are potential loss of wildlife habitat and environmental health. Wildlife habitat and environmental health could be indirectly affected because changes to baseline ecosystems can reduce wildlife habitat or change the overall condition for all biota.

Table 6.10.6-3: Potential Indirect Project Effects on Other Valued Components

Direct Project Effect (Adverse or Positive)	Project Phase	Potential Indirect Project Effect	Carry Forward (Yes / No)	Rationale
Loss of baseline ecological community at risk ecosystems	C	May affect terrestrial environment; erosion of slopes due to lack of the surface stabilisers	No	Mitigation measures are in place for potential effects from soil erosion
	C	May affect wildlife habitat; loss of wildlife habitat	Yes	Removal of ecological community at risk ecosystems may affect food availability for wildlife as well as cover and escape habitat
	C	May affect environmental health; reduced overall condition for all biota	Yes	Removal of ecological community at risk ecosystems may contribute to potential effects on environmental health
Spread of invasive plant species may change ecological community at risk ecosystems	C	May affect wildlife habitat; loss of wildlife habitat	Yes	Invasive species establishment, may affect food availability for wildlife
	C	May affect environmental health; reduced overall condition for all biota	Yes	Invasive species establishment may contribute to potential effects on environmental health

Project phase: C - construction

The potential for an interaction between direct effects of the proposed Project on Ecological Communities at Risk VC and potential effects on other discipline VCs are depicted in Table 6.10.6-4. Generally, there may be interactions between potential direct effects on ecological communities and terrestrial (soils and terrain), wildlife habitat, and environmental health VCs. Most of these interactions potentially lead to indirect effects on other VCs (see Table 6.10.6-4). One potential interaction between residual effects on terrain, surficial geology, and soil may lead to indirect effects on ecological communities at risk. The alteration of landscapes is considered a potential residual effect for the Physiography and Topography VC (Section 6.9). Change in baseline landscapes may directly affect the final ecosystems, which in turn potentially affects the establishment and persistence of ecological communities at risk.

Table 6.10.6-4: Summary of Potential Interaction Between Project Direct Effects on Other Valued Components and Ecological Communities at Risk

Direct Project Effect	Air Quality and Climate Change	Noise and Vibration	Hydrogeology	Groundwater Quality	Freshwater and Sediment Quality	Surface Hydrology	Freshwater Fisheries	Marines Water Quality	Marine Biota	Terrestrial Environment	Wildlife And Their Habitat	Environmental Health	Economic	Social	Heritage	Health	Nisga'a Nation Land Use	Aboriginal Groups Land Use
Loss of baseline ecological community at risk ecosystems	NI	NI	NI	NI	NI	NI	NI	NI	NI	o	o	o	n/a	n/a	n/a	n/a	n/a	n/a
Spread of invasive plant species	NI	NI	NI	NI	NI	NI	NI	NI	NI	o	o	o	n/a	n/a	n/a	n/a	n/a	n/a

Interaction definitions: o - interaction; - - key interaction; + - benefit; NI - no interaction; n/a - not applicable

6.10.6.6.1.3 Potential Combined Effects

Table 6.10.6-5 assesses the potential combined effects of the proposed Project resulting from the interaction of direct and indirect effects of the proposed Project on the Ecological Communities at Risk VC. The alteration of landscapes may cause a change in ecosystem composition and vegetation diversity, potentially leading to indirect effects on ecological communities at risk.

Table 6.10.6-5: Potential Combined Project Effects by Project Phase on Ecological Communities at Risk

Potential Indirect Project Effect	Potential Combined Project Effect	Project Phase	Likelihood Of Occurrence
Change in baseline landscape	Loss of ecological communities at risk and consequently a change in ecosystem composition due to Project footprint	C, O D/C	Unlikely
	Loss of ecological communities at risk will reduce ecosystem diversity	C, O D/C	Unlikely

Project phase: C - construction; D/C - decommissioning and closure; O - operations

6.10.6.6.1.4 Summary of Potential Effects

The overall potential effects on the Ecological Communities at Risk VC are the loss of baseline ecological community at risk ecosystems due to land clearing, excavating, and grading for mine facilities and the spread of invasive plant species. Following reclamation, the change in baseline ecosystems would represent a loss of 1 ha (4% of ecological communities at risk in theCWHws2). Table 6.10.8-6 summarises these effects.

Table 6.10.6-6: Summary of Potential Project Effects to be Carried Forward Into the Assessment for Ecological Communities at Risk

Adverse Effects / Positive Effects	Project Phase	Direction
Loss of baseline ecological communities at risk	C, O, D/C	Negative
Introduction and spread of invasive plants	C, O, D/C	Negative

Project phase: C - construction; D/C - decommissioning and closure; O - operations

6.10.6.6.2 Mitigation Measures

Through proper mitigation techniques, the potential effects on the Ecological Communities at Risk VC within the proposed Project footprint can be minimised and managed to effectively reduce potential negative effects. Section 6.10.2.6.2 lists the mitigation measures for the proposed Project. Mitigation measures summarised in Table 6.10.6-7 are specific to Ecological Communities at Risk VC. In summary, mitigation techniques to minimise effects on ecological communities at risk include: minimising the Project footprint;

soil salvage; site reclamation; and prevention of invasive species. An additional mitigation measure includes:

- **Review TEM map of ecological communities at risk:** Prior to construction, the status of data presented on the TEM map of important environmental features including ecological communities at risk would be confirmed during final footprint alignment and identification of construction laydown areas (see Appendix 6.10-A; and the Section 11.2.21 Wildlife Management Plan).

Table 6.10.6-7: Potential Project Effect by Project Phase on Ecological Communities at Risk and Mitigation Measures

Project Effect	Project Phase	Mitigation / Enhancement Measure	Mitigation Success Rating
Loss of ecological community at risk baseline ecosystems	C	Minimise Project footprint	Medium, Reduce
	C	Salvage soil for reclamation (Section 11.2.16 Soil Management Plan)	High, Enhance
	C	Map (based on TEM) of ecological communities at risk within the Project footprint area (Appendix 6.10-A)	High Prevent
	D/C, PC	Re-vegetate according to Reclamation and Closure Plan (Section 11.2.14; Appendix 3.0-L)	Medium, Enhance
Spread of invasive plant species	C, O, D/C, PC	Prevent introduction of invasive plant species by following the Invasive Species Management Plan (Section 11.2.14; Appendix 3.0-L)	High to Medium, Prevent / Reduce and Respond

Project phase: C - construction; D/C - decommissioning and closure; O - operations; PC -post-closure

Details regarding mitigation measures applicable to vegetation and plant communities are outlined in the EMPs (Section 11.2).

6.10.6.7 Potential Residual Effects and Their Significance

6.10.6.7.1 Potential Residual Effects After Mitigation

A residual effect is an environmental effect that remains, or is predicted to remain, even after mitigation measures have been applied (Agency 2011). The development of the proposed Project would directly remove 1 ha of ecological communities at risk due to the development of mine facilities (open pit, conveyor belt) and mine site access roads. Mitigation would reduce this potential effect, but a potential residual effect to ecological communities at risk would remain (Table 6.10.6-8).

Table 6.10.6-8: Summary of Potential Residual Effects for Ecological Communities at Risk

Project Phase	Residual Effect	Direction
C, O, D/C	Loss of ecological community at risk baseline ecosystems from development of the proposed Project, particularly the mine infrastructure and the Kitsault mine area	Negative

Project phase: C - construction; D/C - decommissioning and closure interaction; O - operations

6.10.6.7.2 Significance of Potential Residual Effects

The significance rating of potential residual effects for Ecological Communities at Risk VC is summarised in Table 6.10.6-9. Each residual effect identified was subjected to a nine rating criteria to determine significance; these criteria are described in Section 5.0. The ecological context of the loss of ecological communities at risk is rated high as ecological communities at risk are typically rare and easily susceptible to disturbance. The effect is considered local in spatial extent, reversible, and negative in direction, and is rated with a low level of magnitude because of the predicted 4% change in ecological communities at risk in the LSA. The potential residual effect of the proposed Project on ecological communities at risk is rated as not significant (minor).

Table 6.10.6-9: Residual Effects Assessment by Project Development Phase for Ecological Communities at Risk

Parameter	
Stage of Project development	All
Potential Residual effect	Loss of ecological communities at risk
Effect attribute	
Magnitude[1]	Low
Spatial extent	Local
Duration	Long-term
Frequency	Once
Reversibility	Yes
Ecological context	High
Direction	Negative
Certainty	High
Residual effect significance	Not significant (minor)
Level of confidence	Medium
Probability of occurrence	High

6.10.6.8 Potential Cumulative Effects

6.10.6.8.1 Identification and Analysis of Potential Project Cumulative Effects

Cumulative effects are assessed with known projects (past, present and future) occurring in the CEA. Table 6.10.6-10 provides a summary of Project-related effects on ecological communities at risk and the rationale for carrying forward into the CEA.

Table 6.10.6-10: Project Related Residual Effects - Rationale for Carrying Forward Into the Cumulative Effects Assessment

Project Component	Project Phase	Residual Effect	Rationale	Carried Forward in CEA
Mine site facilities	C, O	Loss of ecological communities at risk rated as not significant (minor)	Other than the historical Kitsault mine site, potential residual effects to ecological communities at risk do not overlap with any other past, present of foreseeable future projects.	No

Project phase: C - construction; O - operations

Note: CEA - cumulative effects assessment

The previous mining project at Kitsault started reclamation in 1996, which was last monitored in 2010. The proposed Project footprint overlaps previously disturbed areas and areas successfully reclaimed throughout the historic site, which will be maintained where possible. Potential residual effects to ecological communities at risk associated with the Project are considered reversible. There are no cumulative effects for the Ecological Communities at Risk VC as current and potentially foreseeable future projects, including the NTL, do not occur within the terrestrial CESA boundary.

6.10.6.9 Limitations

The conceptual reclamation plan was developed prior to the reclamation and closure section; therefore elements within the plan may change.

6.10.6.10 Conclusion

Within the LSA, two ecological communities at risk occur within the CWHws2. Site series, 03 (WH – lodgepole pine – Feathermoss) and site series 04 (amabilis fir – western redcedar – oak fern) are both provincially blue listed and cover approximately 15 ha or <1% of the LSA. Proposed Project development is mainly from the construction of mine site access roads, conveyor belt system and expansion of the Kitsault Pit. Mitigation measures, including a map of identified ecological communities at risk, and implementing invasive species management, but a potential residual effect to ecological communities at risk would remain. The mining facilities had only a minor affect on these ecosystems and the final loss of ecological communities at risk following reclamation was 4% (1 ha). The direct effect is loss of baseline ecological communities at risk, due to land clearing, excavating and grading. This VC will have a minor interaction with other VCs. The residual effect

represents the loss of ecological communities at risk baseline ecosystems from the proposed Project facilities. However, the residual effect on Ecological Communities at Risk VC is rated as not significant (minor).

6.10.7 VC #6: Cultural Plants

6.10.7.1 Introduction

Cultural plants include those plant species or groups identified by the Nisga'a Nation and Aboriginal groups as having social, economic or traditional use importance. Four cultural plant groups or species were identified through consultation and scoping: cedar trees (western red cedar and yellow-cedar), pine mushrooms, cultural plants. The key issue identified for the Cultural Plants VC is the loss of baseline ecosystems that support cultural plants. Loss of baseline ecosystems would occur throughout the proposed Project footprint as a direct consequence of vegetation clearing and surface disturbance. The interaction is expected to extend over the life span of the proposed Project but the majority of the alterations would occur during the construction and operations phases.

6.10.7.1.1 Relevant Legislation and Legal Framework

The proposed Project is within the Nass Area and the Nass Wildlife Area (NWA) as defined by the Nisga'a Final Agreement (NFA) (BC Ministry of Aboriginal Relations and Reconciliation (BC MARR) 2000). The mine site falls outside of Nisga'a Lands owned by the Nisga'a Nation under the terms of the NFA. Nisga'a Lands are approximately 25 kilometres (km) to the east of the Kitsault mine site; however, the Alice Arm Road overlaps with approximately 10 km of Nisga'a Lands (i.e., after the Nass Bridge parallel to the Nass River on the west side).

North Coast Land Use Objectives Orders (BC Integrated Land Management Bureau (BC ILMB) 2008) define "monumental cedar" as monumental western redcedar and monumental yellow-cedar that will meet the Nisga'a Nation and Aboriginal groups' cultural needs. Because of different cultural needs and the past and present availability of cedar, the Nisga'a Nation and Aboriginal groups have different definitions for "monumental cedar". In general terms, monumental cedars are large old cedar trees with limited defects allowing for their use as totems, house logs, or canoes (BC ILMB 2008).

6.10.7.1.2 Spatial Boundaries

Spatial boundaries for the Cultural Plants VC are limited to the geographic areas evaluated based on reasonable expectation of direct project effect. For CEAs, boundaries are selected by working outward from the zone of influence for effects specific to the proposed Project. If the zone of influence of the proposed Project overlaps with that of another project or human activity, the study area boundary for CEE is expanded to encompass this additional zone.

For the terrestrial studies, including vegetation and plant communities, the following three general study area boundaries are usually established:

- A LSA includes the proposed Project infrastructure, specifically the cyclone sand plant, primary crusher, Process Plant, seepage collection ponds, pump station, WRMF, TMF, Kitsault Pit, stockpiles, site road and haul road along Lime Creek plus a buffer encompassing the zone of direct effects specific to the proposed Project. The proposed terrestrial LSA is consistent with the AIR and represents the direct effects of the proposed Project to the terrestrial environment as well as a 500 m buffer (to include any contiguous effects from activities causing disturbance to the terrestrial environment) surrounding Project components to provide a reasonable assessment area based on the planned activities in the proposed Project;
- A RSA established to include the proposed Project and surrounding region encompassing the zone of influence for effects specific to the proposed Project. The terrestrial RSA was defined as an additional 500 m buffer surrounding the LSA. The lack of contributing projects in the vicinity was a factor in determining the width of the buffer. This buffer accounts for the anticipated indirect effects which may occur as a result of Project Development; and
- A CESA includes past, present and reasonably foreseeable future human activities likely to result in residual effects or impacts on each VC; only those human activities that have residual effects which have a temporal and spatial overlap with the proposed Project's residual effects are considered. The spatial limits of the CESA are consistent with the RSA.

6.10.7.1.3 Temporal Boundaries

Temporal boundary selection is based on a reasonable expectation of the time over which the proposed Project would have effects on biophysical and human environment receptors. Mine operation is projected to be 15 to 16 years following construction; decommissioning and closure, and post-closure phases would follow.

Preliminary temporal boundaries of the proposed Project which are contingent on permitting include four primary phases:

1. Construction Phase – estimated 25-month period. Includes:
   - Site clearing and preparation, earthworks such as excavating and grading site;
   - Facilities, such as the mine processing facilities, TMF South Embankment, and water management facilities;
   - Camp complex; and
   - May include the Patsy Creek diversion (this may be scheduled during the operations phase depending on environmental and project feasibility considerations).
2. Operations Phase – estimated at approximately two months of commissioning, and 15 to 16 years of mining (last two years are milling low-grade ore).
3. Decommissioning and Closure Phase – estimated at 15 to 17 years. Includes a closure period during which the buildings and decommissioned infrastructure would be removed and facilities reclaimed.

4. Post-closure Phase – estimated at five years or more. This includes post-closure monitoring until on-site water quality has stabilised and indicates no material future adverse effects on local receiving waters; stabilisation of WRMF and TMF would also be considered in post-closure monitoring.

The temporal boundaries for the Cultural Plants VC are consistent with those timelines presented above. The temporal boundaries for the Cultural Plants VC are expected to be primarily affected during the initial construction phase and site development. Continued localised effects are expected during the operations phase. No seasonal variability is expected for this VC.

6.10.7.2 Information Source and Methods

The assessment of potential effects for the Cultural Plants VC is based on site-specific baseline reporting conducted for the proposed Project. Detailed vegetation baseline reports were conducted for the proposed Project in 2009 (Rescan 2010a; Rescan 2010b) and 2010 (Appendix 6.10-A). Provincial and regional information sources were reviewed and provided a background to support the TEM specific to the proposed Project during the baseline assessment. Information sources specific to the proposed Project followed the provincial TEM guidelines outlined in "Standards for Terrestrial Ecosystem Mapping in BC" (RIC1998). Recently acquired aerial photography was used to interpret the landscape within the RSA and LSA of the proposed Project.

To determine the effect of the proposed Project on the Cultural Plants VC, the proposed Project footprint was superimposed on the terrain map produced for the baseline report. Spatial analysis using GIS protocol was employed to determine the effect of the proposed Project. Specifically, large cedar trees, potential pine mushroom habitat, and cultural plants were considered as part of the effects assessment.

6.10.7.3 Detailed Baseline for Cultural Plants

Three groups within the Cultural Plants VC were identified as potentially affected by the proposed Project: large cedar trees; pine mushroom habitat; and cultural plant species. Cultural plants include species used for medicine, dietary, spiritual / religious, utensils, dyes and edible berry-producing plants. Pine mushrooms have been evaluated separately from food plants due to their economic importance in the region. Baseline condition of the Cultural Plants VC is characterised and represented by a wide distribution of ecosystem units throughout the proposed Project area.

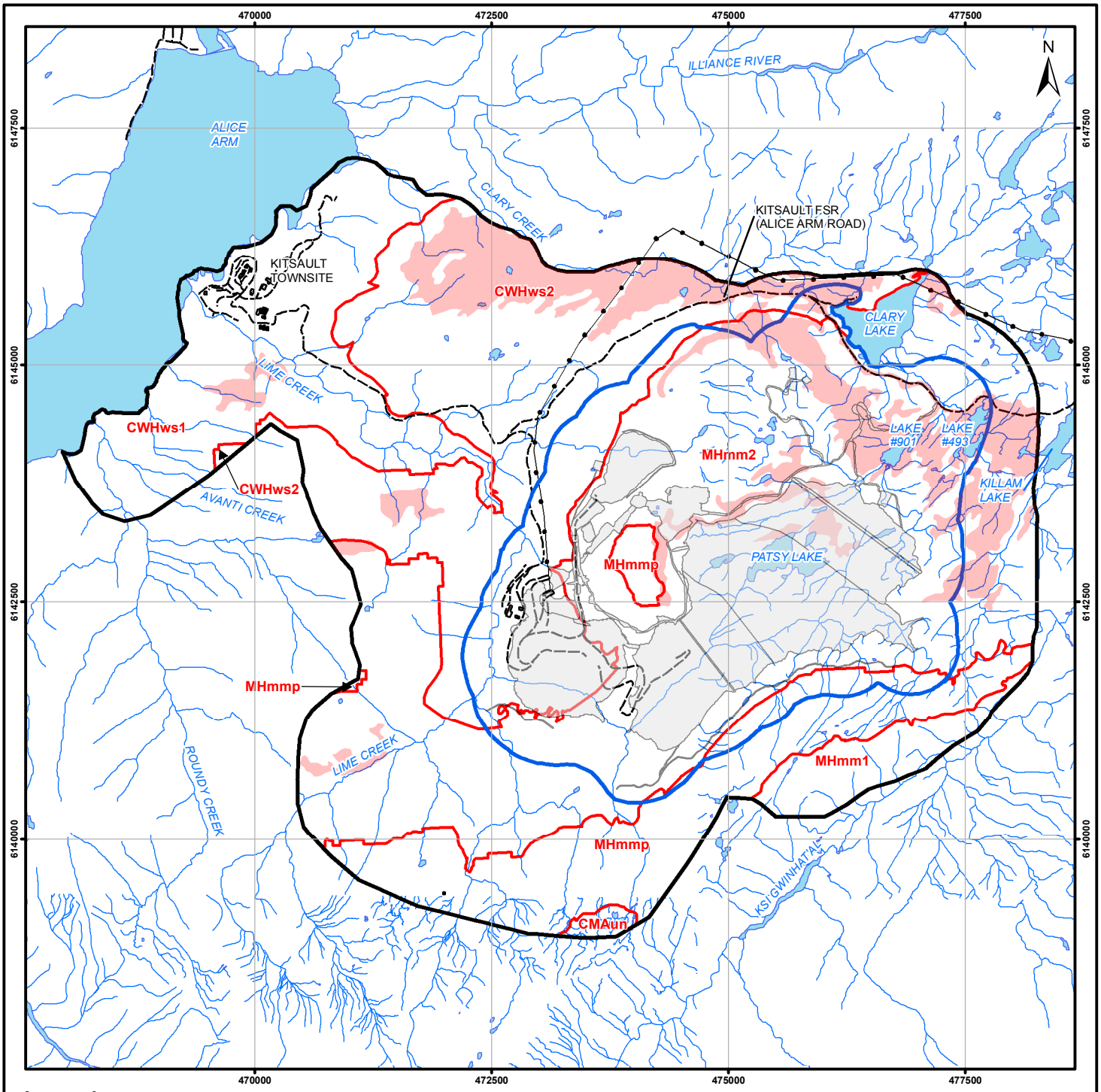
6.10.7.3.1 Large Cedar Model

Western redcedar (*Thuja plicata*) and yellow-cedar (*Chamaecyparis nootkatensis*) are considered to be important forest resources to the Nisga'a Nation. Redcedar was used to build dugout canoes, house posts and planks, totem poles, as well as storage and cooking boxes (Turner 1979). The Nisga'a Nation and Aboriginal groups in the coastal region have used and continue to utilise red and yellow-cedar for traditional and cultural purposes (BC MOF 2005). A total of 235 ha (12%) of potential large cedar trees occurs in the LSA,

predominantly in the MHmm2 variant. The specifics of the model are described in Appendix 6.10-B. Figures 6.10.7-1 shows the results of the model.

6.10.7.3.2 Pine Mushroom Model

The CWHws1 has been documented to support pine mushroom habitat (Trowbridge and Macadam 1998; BC MOF 1999; Northwest Institute for Bioregional Research 1999; Berch and Wiensczyk 2001, Kranabetter et al. 2000). In the proposed Project, the CWHws1 occurs in the RSA and the CWHws2 occurs in the LSA. The elevational range documented for pine mushroom habitat is between 140 m to 625 m (BC MOF 1999). Due to the combination of soil, site, elevation, and vegetation features, the BGC unit and site series most likely to produce pine mushrooms in the proposed Project area is the CWHws2, site series 03 (WH – lodgepole pine – feathermoss). The potential pine mushroom habitat model reflects these criteria. The specifics of the model are described in Appendix 6.10-B. Figure 6.10.7-2 shows the results of the model.



Legend

- Access Road
- Transmission Line
- Stream
- Waterbody
- Mine Footprint
- Terrestrial Regional Study Area
- Terrestrial Local Study Area
- BGC Unit
- Large Cedar

1 0.5 0 1 2

Kilometres
1:60,000

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Baseline Large Cedar Model

DATE: November 2011	Figure 6.10.7-1
PROJECT: VE51988	06-50-018_conifer_model_6b.pdf
ANALYST: MY / QA/QC: CT	
PROJECTION/DATUM: UTM Zone 09/NAD 83	

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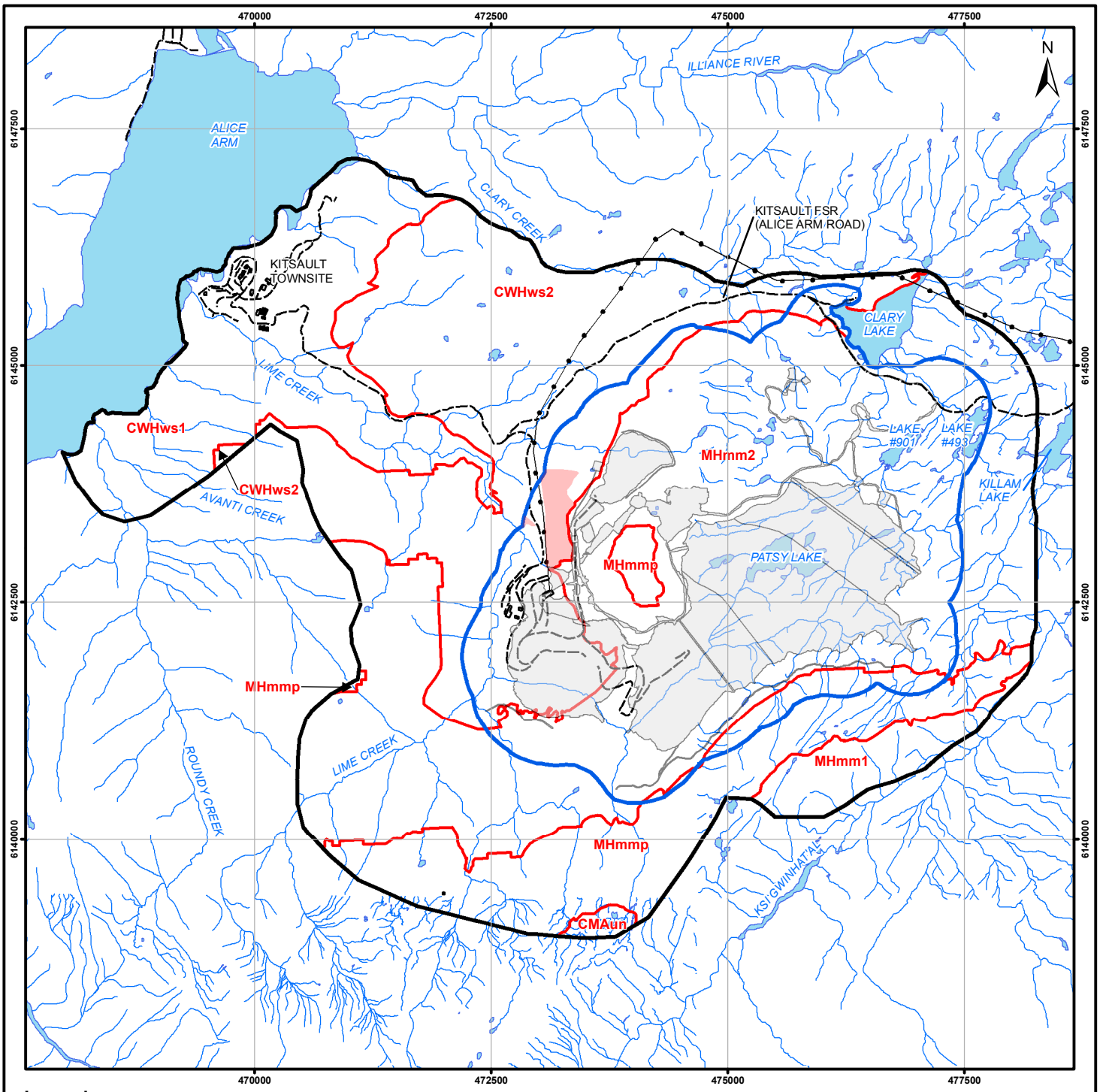

Legend

- Access Road
- Transmission Line
- Stream
- Waterbody
- Mine Footprint
- BGC Unit
- Pine Mushroom Potential
- Terrestrial Regional Study Area
- Terrestrial Local Study Area

1 0.5 0 1 2

Kilometres
1:60,000

Note
The HM unit is a minor component of each polygon i.e. approx. 30 – 40%

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Baseline Potential Pine Mushroom Habitat Model

DATE: November 2011	Figure 6.10.7-2
PROJECT: VE51988	06-50-017_pine_mushroom.pdf
ANALYST: MY / QA/QC: CT	
PROJECTION/DATUM: UTM Zone 09/NAD 83	amec

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6.10.7.3.3 Cultural Plant Potential

Cultural plants include plants species used for medicine, dietary, spiritual / religious, utensils, dyes (Appendix 6.10-B), and edible berry-producing plants. Berry-producing plants are addressed separately in Section 6.10.7.3.4.

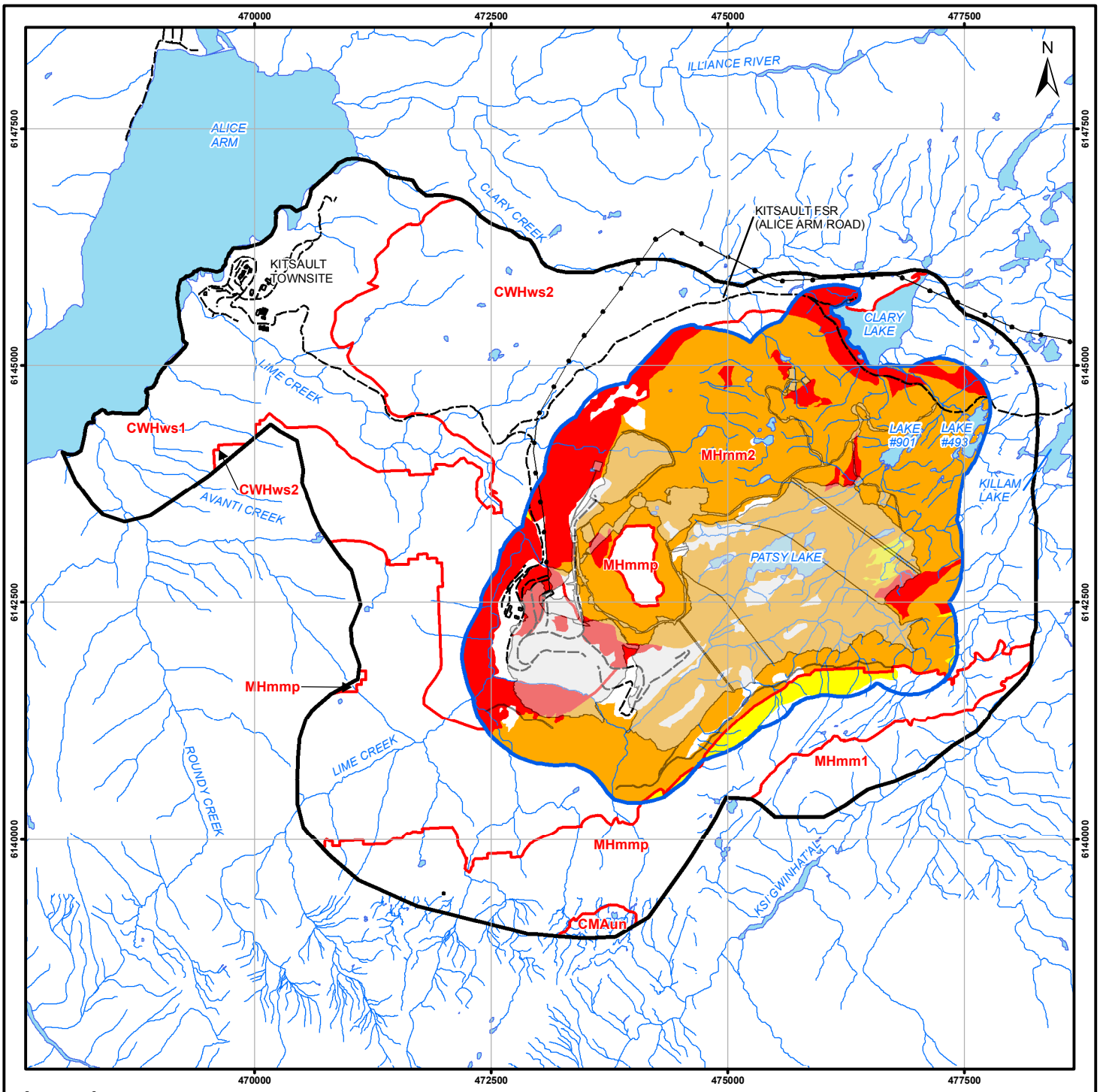
Vegetation data collected for the LSA were used to rank the BGC units and their site series for their potential to contain known species of cultural use plants (Appendix 6.10-B). The method used to rank the ecosystem unit (i.e., CWHws2/01 – AB) combined measures of mean richness, total richness, and unique and uncommon species of potential cultural use in order to determine an overall ranking. Similarly ranked ecosystem units were combined into cultural plant potential classes (high, medium and low) and mapped to determine their relative distribution within the LSA for the baseline case (Table 6.10.7-1).

Table 6.10.7-1: Baseline Cultural Plant Species Habitat Rankings in the Local Study Area

Cultural Plant Species Rank	BGC Unit, Site Series and Map Code	Area (ha)	Percent of LSA
High	CWHws2/01 - AB and MHmm2/04 - AB	190	10
Medium	MHmm2/01 - MB, /02 - MM, /03 - MO and /00 - Wf50;	981	50
Low	CWHws2/05 - HQ; MHmm2/00 - CA, /00 -WM, /00 - Wf51 and MHmmp/00 - MP	119	6

Note: BGC - Biogeoclimatic; CWHws2 - Coastal Western Hemlock Wet Submaritime Montane Variant; ha - hectare; LSA - Local Study Area; MHmmp - Mountain Hemlock Moist Maritime Parkland Subzone; MHmm2 - Mountain Hemlock Moist Maritime Leeward Variant

Approximately 10% of the LSA has a high cultural plant species potential. The ecosystem units with the high cultural plant potential are the WH – amabalis fir – bramble (/01 - AB) in the CWHws2 and the MH – amabalis fir – bramble (/04 - AB) in the MHmm2. The majority of the LSA has a moderate cultural plant potential (50%) and 6% has low potential (Figure 6.10.7-3). Unranked ecosystems total 690 ha or 35% of the LSA. This method rates all species as equal in importance, and the ecosystem unit with the most cultural plant species is rated the highest.



Legend

- Access Road
- Transmission Line
- Stream
- Waterbody
- Mine Footprint
- BGC Unit
- Terrestrial Regional Study Area
- Terrestrial Local Study Area

Ranked Cultural Plant Classes

- High
- Medium
- Low
- Not Ranked

1 0.5 0 1 2

Kilometres
1:60,000

Note
High = ecosystem occurring and ranked high in any decile;
high ranked ecosystems override medium and low ranked ecosystems.
Medium = ecosystem occurring and ranked medium in any decile;
medium ranked ecosystems override low ranked ecosystems
Low = ecosystem occurring and ranked low in any decile
Not ranked = no ranked ecosystems (either high, medium or low) occur in this polygon

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Distribution of Ranked Cultural Plant Species BEC Units - Baseline Case

DATE: November 2011	Figure 6.10.7-3
PROJECT: VE51988	06-50-019_cultural_food.pdf
ANALYST: MY / QA/QC: CT	
PROJECTION/DATUM: UTM Zone 09/NAD 83	amec

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6.10.7.3.4 Availability of Edible Berry-Producing Plant Species

Vegetation data collected for the LSA were used to rank the ecosystem units for their potential to produce edible berry species. The method used to rank the ecosystem units, described in Appendix 6.10-B, is based on the relative cover of edible berry producing species. Sixteen species were assessed as edible berry species.

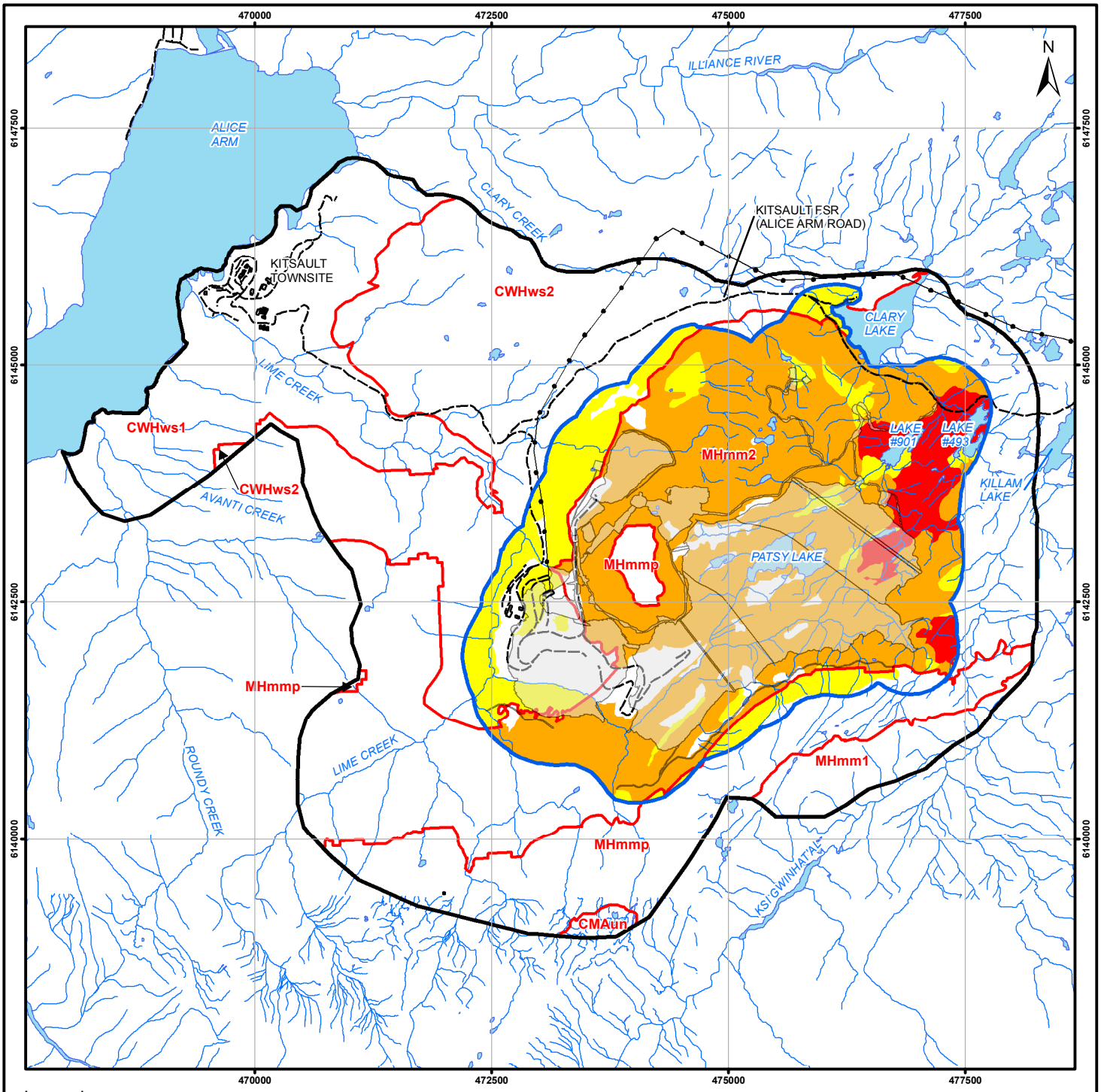
The majority of the ecosystem units had a low to medium overall potential berry rank (See Table 6.10.7-2 and Figure 6.10.7-4). Crowberry and Alaska blueberry composed most of the berry production in the LSA.

Crowberry – Bog blueberry – Alpine azalea (MHmm2/00 - CA) is ranked with a high potential to produce edible berry plant species. The majority of the proposed Project area has a moderate potential (35% of the LSA) to contain edible berry producing plant species. Approximately 1% of the LSA has a high potential and 24% of the LSA has low potential to contain edible berry-producing plant species.

Table 6.10.7-2: Baseline Berry Producing Plant Species Habitat Rankings in the Local Study Area

Berry Species Rank	BGC Unit, Site Series and Map Code	Area (ha)	% of LSA
High	MHmm2/00 - CA	27	1
Moderate	MHmm2/01 - MB, /02 - MM, and /04 - AB	700	35
Low	CWHws2/01 - AB and /05 - HQ; MHmm2/00 - WM, /03 - MO, /00 - Wf50 and /00 - Wf51; MHmmp/00 - MP	563	24

Note: BGC - Biogeoclimatic; CWHws2 - Coastal Western Hemlock Wet Submaritime Montane Variant; ha - hectare; LSA - Local Study Area; MHmmp - Mountain Hemlock Moist Maritime Parkland Subzone; MHmm2 - Mountain Hemlock Moist Maritime Leeward Variant



Legend

- Access Road
- Transmission Line
- Stream
- Waterbody
- Kitsault Mine Footprint
- BGC Unit
- Terrestrial Regional Study Area
- Terrestrial Local Study Area

Ranked Berry Cover Class

- High Potential
- Medium Potential
- Low Potential
- Not Ranked

Note

High = ecosystem occurring and ranked high in any decile;
high ranked ecosystems override medium and low ranked ecosystems.
Medium = ecosystem occurring and ranked medium in any decile;
medium ranked ecosystems override low ranked ecosystems
Low = ecosystem occurring and ranked low in any decile
Not ranked = no ranked ecosystems (either high, medium or low) occur in this polygon

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Kilometres
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Distribution of Ranked Berry Cover Classes - Baseline Case

DATE: November 2011	Figure 6.10.7-4
PROJECT: VE51988	06-50-021_berry_pot.pdf
ANALYST: MY / QA/QC: CT	
PROJECTION/DATUM: UTM Zone 09/NAD 83	amec

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6.10.7.4 Cultural Ecological or Community Knowledge

6.10.7.4.1 Nisga'a Nation

The Nisga'a Nation values land and forest resources, including timber and non-timber forest products and agriculture, which are important for cultural and economic reasons. As such, the Nisga'a Nation has interests in maintaining healthy and diverse forests and land, including clean water and wildlife and fish habitat.

6.10.7.4.2 Timber Products

The Nisga'a Nation Corporation, Lisims Forest Resources, manages the marketing and sale of Nisga'a Nation forest resources and is working to expand and diversify the market for Nisga'a Nation forest resources, including hemlock, balsam fir (*Abies amabilis*), cedar, spruce (*Picea spp*.), deciduous trees, and non-timber forest products (NTFP) such as pine mushrooms, on behalf of the Nisga'a Nation. In addition to domestic clients, Lisims Forest Resources sells Nisga'a Nation wood to China, Japan, and Korea, and is actively seeking partners to develop value-added wood products for domestic and international customers. "In Lax-galts'ap (a Nisga'a Village), two new businesses, a log home building program and a redcedar shake mill, are both value-added ventures" (Nisga'a Lisims Government (NLG) 2009).

NLG Lands and Resources Directorate is developing plans for compliance, enforcement, and a "post-forestry" transition period. NLG also houses a Forest Resources Department (NLG 2011). The forest industry has been in decline due to high energy costs resulting in limited Nisga'a Nation forestry activity. Despite the decline, Nisga'a Nation logging has continued due to strong cedar markets and saw log exports.

6.10.7.4.3 Non-Timber Forest Products

Nisga'a Nation pine mushroom harvest has been an important economic contributor since the 1980s (NLG 2005). Before the NFA, pine mushroom harvest was unregulated and unsustainable as Nisga'a harvesters competed with transient pickers and timber interests in the Nass Valley (Collier and Hobby 2010). Since the signing of the NFA, the Department of Forest Resources manages and regulates harvest of botanical forest products, including pine mushrooms and 10 other mushroom species and fiddleheads, within Nisga'a Lands. NLG requires all Nisga'a Nation and non-Nisga'a Nation harvesters and buyers to apply for a permit for an area-based harvest.

6.10.7.4.4 Culturally Important Plant Species

The Nisga'a Nation people have and continue to harvest a variety of plants, berries, mushrooms, and trees for nutritional, medicinal, construction, economic, and ceremonial purposes. Appendix 6.10-B provides a list of culturally important plant species, which was derived from reference material (Cybulski 1992; Turner 1979; Turner 1995; Scott pers. comm.). While each of the species have a specific function and significance within Nisga'a

Nation social and cultural systems, western redcedar and yellow-cedar as well as pine mushrooms have been noted as especially important in relation to the proposed Project.

6.10.7.4.5 Aboriginal Groups

There are five potentially affected Aboriginal groups along the Kitsault transportation route, including Kitselas First Nation, Kitsumkalum First Nation, Metlakatla First Nation, Gitxsan Chiefs, and Gitanyow Hereditary Chiefs. These Aboriginal groups have interests in maintaining and preserving vegetation resources within their asserted territory for purposes of consumption, ceremony, medicine, and construction. Plant harvesting has been and continues to be a culturally important activity for these Aboriginal groups. Some of the Aboriginal groups, in particular the Gitxsan Chiefs, have a history of brush management to encourage growth of berry-producing vegetation. Aboriginal groups harvest a wide range of vegetation along the Kitsault transportation route throughout the summer and fall months. Of particular, cultural and economic importance to many of the Aboriginal groups are cedar and pine mushrooms. Additional detail on Aboriginal plant harvest practices, purposes, and desired species is provided in Part D of the Application for Metlakatla First Nation and Appendix 8.0-C (Road Use Effects Assessment) for Kitselas First Nation, Kitsumkalum First Nation, Gitxsan Chiefs, and Gitanyow Hereditary Chiefs. Ongoing consultation with Aboriginal groups may provide additional understanding of the value and interests in particular vegetation species as related to the proposed Project.

6.10.7.5 Past, Present or Future Projects / Activities

The proposed Project would be influenced by the past mining activities that have occurred within the footprint. Beginning in 1959, the site has seen various activities and stages of mining, from diamond drilling to the initial stages of molybdenum exploration starting 1968. These activities have had an impact that directly relates to the vegetation and plant community discipline because the natural setting and baseline conditions of the site were disturbed. The last operation phase of the mine began in 1981 lasting until reclamation of the site began from 1996 to 2006. A summary of previous and on-going reclamation activities for the proposed Project site are provided in Section 3.1.2 (History of Reclamation).

6.10.7.6 Potential Effects of the Proposed Project and Proposed Mitigation

6.10.7.6.1 Identification and Analysis of Potential Project Effects

The assessment of potential effects on Cultural Plants VC include consideration of effects from Project components (direct effects), effects from other VCs (indirect effects) affected by the proposed Project, and combined effects (direct and indirect combined) during each Project phase (construction, operations, decommissioning and closure, and post-closure).

6.10.7.6.1.1 Potential Direct Effects

One potential direct effect was considered: loss of cultural plants and / or habitat that support cultural plants. Table 6.10.7-3 shows the potential direct effects of the proposed Project on cultural plants. Potential direct effects on large cedars (Table 6.10.7-4), pine

mushroom habitat (Table 6.10.7-5), capability to support cultural plants (Table 6.10.7-6), and capability to support berry producing species (Table 6.10.7-7) are summarised below.

Table 6.10.7-3: Potential Direct Project Effects on Cultural Plants

Project Component	Project Phase	Potential Direct Project Effect	Likelihood Of Occurrence
Land Clearing, excavating, grading for mine facilities	C	Land disturbance affects and the potential loss of cultural plants and habitat to support cultural plants	Likely
WRMF development	C, O	Loss of cultural plants and habitat to support cultural plants	Likely
TMF development	C, O	Loss of cultural plants and habitat to support cultural plants	Likely

Project phase: C - construction; O - operations.
Note: TMF - Tailings Management Facility; WRMF - Waste Rock Management Facility

Large Cedars: A total of 235 ha (12%) of potential large cedar trees occurs in the LSA, predominantly in the MHmm2 variant. The proposed Project would potentially remove 35 ha or 2% of large cedars available in the LSA (Table 6.10.7-4).

Table 6.10.7-4: Direct Affects to Large Cedar Potential Areas in the Local Study Area

Model 6b	Total	Baseline Case		Project Case		Change in Baseline Distribution	
	ha	ha	%	ha	%	ha	%
CWHws2	331	1	<1	1	<1	0	0
MHmm2	1553	234	15	199	13	35	15
MHmmp	96	0	0	0	0	0	0
LSA total	**1980**	**235**	**12**	**200**	**10**	**35**	**2**

Note: CWHws2 - Coastal Western Hemlock Wet Submaritime Montane Variant; ha - hectare; LSA - Local Study Area; MHmmp - Mountain Hemlock Moist Maritime Parkland Subzone; MHmm2 - Mountain Hemlock Moist Maritime Leeward Variant; % - percent

Potential Pine Mushroom Habitat: Pine mushroom habitat only occurs in the CWHws2 variant and occupies 2% of the CWHws2 variant. The potential effects to pine mushroom habitat by Project clearing in the Project Case is <1 ha, approximately a loss of 1% of available pine mushroom habitat in the LSA (Table 6.10.7-5). No changes were noted following the conceptual reclamation plan.

Table 6.10.7-5: Direct Affects to Potential Pine Mushroom Habitat in the Local Study Area

BGC Unit - CWHws2 Site Series 03	Baseline Case	Project Case	Change in Baseline Distribution		Conceptual Reclamation Area	Change in Baseline Distribution following Reclamation	
	ha	ha	ha	%	ha	ha	%
WH - Lodgepole pine - Feathermoss	6	6	<1	-1	6	-<1	-<1
Total of LSA	**1980**	**1980**	**0**	**0**	**1980**	**0**	**0**

Note: BGC - Biogeoclimatic; CWHws2 - Coastal Western Hemlock Wet Submaritime Montane Variant; ha - hectare; LSA - Local Study Area; % - percent

Capability to Support Cultural Plant Species: A total of 369 ha (31%) of medium and high ranked classes for cultural plants capability would be potentially affected in the Project Case (Table 6.10.7-6). Potential effects were assessed based on the combined area of high and medium ranked classes affected, since these make up the classes that maintain the greatest diversity of cultural plants in the LSA. The total amount of these combined classes would decrease 31% in the Project Case.

Following reclamation in the Conceptual Reclamation Case, there is a potential net loss of 193 ha of high and medium ranked cultural plant species potential areas representing a 16% loss.

Table 6.10.7-6: Direct Effects to Ranked Areas of Cultural Plant Species Capability in the Local Study Area

Cultural Plants Potential Rank	Baseline Case	Project Case	Change In Baseline Distribution		Conceptual Reclamation Area	Change In Baseline Distribution Following Reclamation	
	ha	ha	ha	%	ha	ha	%
High	190	149	-41	-22	158	-32	-17
Medium	982	654	-327	-33	821	-161	-16
Low	120	97	-23	-19	110	-10	-8
Total Ranked Area	1292	900	-392	-30	1089	-203	-16
High + Medium	**1172**	**803**	**-369**	**-31**	**979**	**-193**	**-16**

Note: ha - hectare; % - percent

Capability to Support Berry Producing Species: The proposed Project would potentially affect 274 ha (38%) of medium and high ranked habitat with the potential to produce berries in the Project Case (Table 6.10.7-7). Potential effects were assessed based on the

combined area of high and medium ranked classes affected, since these ecosystems produce the most berries (the ecosystem units with >10% cover of berry producing species); therefore, are the most likely to be utilised by people harvesting berry species. Overall, these combined classes decrease by 38% in the Project Case.

Following Project reclamation in the Conceptual Reclamation Case, there is a potential net loss of 96 ha of high and medium-ranked berry-producing potential areas for an overall 13% loss.

Table 6.10.7-7: Direct Effects to Ranked Areas of Berry Producing Species Capability in the Local Study Area

Edible Berries Potential Rank	Baseline Case	Project Case	Change In Baseline Distribution		Conceptual Reclamation Area	Change In Baseline Distribution Following Reclamation	
	ha	ha	ha	%	ha	ha	%
High	27	24	-4	-14	37	9	33
Medium	700	431	-270	-39	596	-105	-15
Low	564	446	-118	-21	457	-107	-19
Total Ranked Area	1292	900	-391	-30	1089	-202	-16
High + Medium	**728**	**454**	**-274**	**-38**	**632**	**-96**	**-13**

Note: ha - hectare; % - percent

6.10.7.6.1.2 Potential Indirect Effects

The potential for direct effects of the proposed Project on cultural plants to become indirect effects on other disciplines is summarised in Table 6.10.7-8. Potential indirect effects may occur on other VCs including cultural and heritage resources. The Nisga'a Nation and Aboriginal groups and heritage resources are potentially indirectly affected because the removal of cultural plants or habitat supporting cultural plants may affect the availability for use by the Nisga'a Nation and Aboriginal groups.

Table 6.10.7-8: Potential Indirect Project Effects on Other Valued Components

Direct Project Effect (Adverse or Positive)	Project Phase	Potential Indirect Project Effect	Carry Forward (Yes / No)	Rationale
Loss of cultural plants and/or habitat for cultural plants	C, O	Loss of habitat for cultural plant species, may affect cultural resources	Yes	Removal of cultural plants, many of which are berry-producing shrubs, may affect food availability for cultural groups, as well as use of cultural plants
	C, O	Loss of habitat for cultural plant species, may affect economic components	No	Removal of baseline ecosystems would not affect the harvesting of pine mushrooms (refer to Table 6.7.7-4)
	C, O	Loss of habitat for cultural plant species, may affect heritage resources	Yes	Removal of large cedars

Project phase: C - construction; O - operations

The potential interaction between direct effects of the proposed Project on the Cultural Plants VC and potential residual effects on other discipline VCs are depicted in Table 6.10.7-9.

The alteration of landscapes is a potential residual effect listed in the soils and terrain discipline (Section 6.9). Change in baseline landscapes may directly affect the final ecosystems, and thus the potential of ecosystems to support cultural plants.

Table 6.10.7-9: Summary of Potential Interaction Between Project Direct Effects on Other Valued Components and Cultural Plants

Direct Project Effect	Air Quality and Climate Change	Noise And Vibration	Hydrogeology	Groundwater Quality	Freshwater and Sediment Quality	Surface Hydrology	Freshwater Fisheries	Marine Water Quality	Marine Biota	Terrestrial Environment	Wildlife and Their Habitat	Environmental Health	Economic	Social	Heritage	Health	Nisga'a Nation Land Use	Aboriginal Groups Land Use
Loss of habitat for cultural plants	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	o	NI	-	-

Interaction definitions: - o interaction; - - key interaction; + - benefit; NI no interaction

6.10.7.6.1.3 Potential Combined Effects

Table 6.10.7-10 assesses the potential combined effects of the proposed Project resulting from the interaction of potential direct and indirect Project effects on the Cultural Plants VC. The potential combined Project effect likely to occur is loss of cultural plants and habitat for cultural plants due to the proposed Project footprint and ecosystem changes through landscape alteration.

Table 6.10.7-10: Potential Combined Project Effects by Project Phase on Cultural Plants

Potential Indirect Project Effect	Potential Combined Project Effect	Project Phase	Likelihood Of Occurrence
Alteration of landscape	Loss of cultural plants and loss of potential high and medium-ranked habitat classes for cultural plants due to proposed Project footprint and landscape alteration	C, O, D/C	Likely

Project phase: C - construction; D/C - decommissioning and closure; O - operations

6.10.7.6.1.4 Summary of Potential Effects

The potential overall effect on the Cultural Plants VC is the change in availability of cultural plants. Table 6.10.7-11 summarises these effects.

Table 6.10.7-11: Summary of Potential Project Effects to be Carried Forward Into the Assessment for Cultural Plants

Adverse Effects / Positive Effects	Project Phase	Direction
Loss of cultural plants and habitat for cultural plants	C, O	Negative

Project phase: C - construction; O - operations

6.10.7.6.2 Mitigation Measures

Through proper mitigation techniques, the effects on Cultural Plants VC within the proposed Project footprint can be minimised and managed to effectively reduce potential negative effects. Table 6.10.7-12 summarises the mitigation measure identified for the proposed Project by phase. These techniques include: footprint minimisation; timber salvage plan; soil salvage; and site reclamation, which are discussed in Section 6.10.2.6.2.

Table 6.10.7-12: Potential Project Effect by Project Phase on Cultural Plants and Mitigation Measures

Project Effect	Project Phase	Mitigation / Enhancement Measure	Mitigation Success Rating
Loss of cultural plants and habitat for cultural plants	C	Minimise Project footprint	Medium, Reduce
	C	Timber Salvage Plan (Section 11.2.8 Vegetation Management Plan)	High, Reduce
	C, O	Salvage soil for reclamation (Section 11.2.16 Soil Management Plan; Appendix 3.0-L Reclamation and Closure Plan)	High, Prevent
	D/C, PC	Re-vegetate according to the Reclamation and Closure Plan (Appendix 3.0-L).	Medium, Enhance

Project phase: C - construction; O – operations; D/C - decommissioning and closure; PC – post closure

Details regarding mitigation measures applicable to vegetation and plant communities are outlined in the Environmental Management Plans (Section 11.2).

6.10.7.7 Potential Residual Effects and Their Significance

6.10.7.7.1 Potential Residual Effects After Mitigation

A residual effect is an environmental effect that remains or is predicted to remain, even after mitigation measures have been applied (Agency 2011). The proposed Project would have a potential residual effect on cultural plants, specifically from the loss of 35 ha of potential large cedar trees, 369 ha of potential high and medium ranked cultural plant habitat, and 274 ha of potential high and medium ranked berry producing habitat. Potential effects to potential pine mushroom habitat is limited (approximately <1% would be lost) and with mitigation measures, not considered a residual effect. Following mitigation, the mine features are described in Section 6.10.2.7. The TMF Supernatant Pond is a residual effect, therefore the loss of cultural plants from the TMF Supernatant Pond is considered residual. Table 6.10.7-13 summarises the potential residual effects for the Cultural Plants VC.

Table 6.10.7-13: Summary of Potential Residual Effects for Cultural Plants

Project Phase	Potential Residual Effect	Direction
C, O	Loss of habitat for berry producing and cultural plant species from development of the proposed the TMF Supernatant Pond	Negative
C, O	Loss of large cedar trees from development of the TMF Supernatant Pond	Negative

Project phase: C - construction; O - operations

Note: TMF - Tailings Management Facility

6.10.7.7.2 Significance of Potential Residual Effects

The significance ratings of potential residual effects for the Cultural Plants VC are summarised in Table 6.10.7-14. Each residual effect identified was subjected to a nine rating criteria to determine significance; these criteria are described in Section 5.0. The ecological context of the loss of cultural plants and habitat is rated medium because changes to cultural plant habitat could affect surrounding wildlife use and community components in the local geographic scale. The potential effect is considered local in spatial extent, reversible over the long-term, negative in direction, and is rated with a medium level of magnitude because of the anticipated amount of change to potential cedar trees, cultural plant habitat, and berry-producing plant habitat available in the LSA. The potential residual effect of the proposed Project on cultural plants is rated as not significant (minor).

Table 6.10.7-14: Residual Effects Assessment by Project Development Phase for Cultural Plants Valued Component

Parameter	Stage of Development / Rating			
Stage of Project development	All			
Residual effect	Loss of cultural plants and habitat for cultural plants			
Effect attribute				
Magnitude	Medium			
Spatial extent	Local			
Duration	Long -term			
Frequency	Once			
Reversibility	Yes			
Ecological context	Medium			
Direction	Negative			
Certainty	Medium			
Residual effect significance	Not Significant (minor)			
Level of confidence	Medium			
Probability of occurrence	High			

6.10.7.8 Potential Cumulative Effects

6.10.7.8.1 Identification and Analysis of Potential Project Cumulative Effects

Cumulative effects are assessed with known projects (past, present and future) occurring in the CEA. Table 6.10.7-15 provides a summary of Project related effects on cultural plants and habitat for cultural plants and the rationale for carrying forward into the CEA.

Table 6.10.7-15: Project Related Residual Effects - Rationale for Carrying Forward Into the Cumulative Effects Assessment

Project Component	Project Phase	Residual Effect	Rationale	Carried Forward in CEA
Mine site facilities	C, O	Loss of cultural plants and habitat for cultural plants rated as not significant (minor)	Other than the historical Kitsault mine site, potential residual effects to cultural plants and habitat for cultural plants do not overlap with any other past, present of foreseeable future projects.	No

Project phase: C - construction; O - operations

The previous mining project at Kitsault started reclamation in 1996, which was last monitored in 2010. The proposed Project footprint overlaps previously disturbed areas and areas successfully reclaimed throughout the historic site, which will be maintained where possible. Potential residual effects to cultural plants and habitat for cultural plants associated with the Project are considered reversible. There are no cumulative effects for cultural plants and habitat for Cultural Plants VC as current and potentially foreseeable future projects, including the NTL, do not occur within the terrestrial CESA boundary.

6.10.7.9 Limitations

The conceptual reclamation plan was developed prior to the reclamation and closure section; therefore, elements within the plan may change.

6.10.7.10 Conclusion

Cultural plants include those plant species or groups identified by the Nisga'a Nation and Aboriginal groups as having social, economic, or traditional use importance. Four cultural plant groups or species were identified through consultation and scoping: cedar trees (western redcedar and yellow-cedar), pine mushrooms, cultural plants (plant species used for medicine, dietary, spiritual / religious, utensils, dyes), and edible berry-producing plants. The proposed Project would have a potential residual effect on cultural plants, specifically from the loss of 35 ha of potential large cedar trees, 369 ha of potential high and medium ranked cultural plant habitat and 274 ha of potential high and medium ranked berry producing habitat. Potential effects to pine mushroom habitat is limited (approximately <1% would be lost) and with mitigation measures, not considered a residual effect. Considering the planned cedar tree salvage and the relatively small proportion of available cultural plant habitat to be removed compared to the regional and local land-base, the potential residual effect of the proposed Project on cultural plants is rated as not significant (minor).