# Section 10 • Vegetation & Wildlife

## 10.1 Vegetation

### 10.1.1 Introduction

This section introduces the process for assessing potential effects of the Brule Mine Project on vegetation, describes the existing baseline vegetation conditions, summarizes the results of the Project-specific effects assessment for vegetation, and presents the approach for monitoring and mitigation related to vegetation issues. This information is detailed under the following subsections:

- Approach and Methods;
- Baseline Conditions;
- Mitigation Measures;
- Project Effects Assessment;
- Residual Project Effects: Summary and Characterization;
- Cumulative Effects Assessment;
- Residual Cumulative Effects: Summary and Characterization; and
- Monitoring.

### 10.1.2 Approach & Methods

#### *10.1.2.1 Key Issues*

The key issue for vegetation with respect to the Brule Mine Project is loss or alteration of plants or plant communities through direct (vegetation clearing) or indirect (edge-related) effects.

#### *10.1.2.2 Focal Features Selection*

Selection of the vegetation focal features to be considered in the impact assessment for the Brule Mine considered the following criteria: conservation status, rarity in the Project area and/or region, sensitivity to the effects of the proposed Project, socio-economic importance, and regional importance. The selected vegetation focal features are: ecological communities[1] of

[1] Equivalent to 'natural plant community' (CDC 2005).

conservation concern[2], old forest, and wetlands. A detailed consideration of traditional use plants (e.g., berry-producing shrubs) is presented in Section 14.3.

#### *10.1.2.3 Project Components Assessed*

All project components described for the Brule Mine Project (Section 3) were evaluated with respect to the key issues for vegetation and the selected focal features, to determine which project components were relevant for the vegetation project effects assessment. Five of the six primary Project components were selected: Brule Mine, Mine Power Supply, Falling Creek Connector Haul Route, Falling Creek Flats Loadout, and Loadout Power Supply. The Falling Creek Flats Loadout and its associated power supply line have been combined for the purpose of the vegetation assessment and mapping. The rationale for the selection process is presented in Table 10.1.2-1.

**Table 10.1.2-1: Project Components Assessed & Rationale for Selection: Vegetation**

| Project Component | To be assessed? | Relevant Key Issue | Relevant Focal Feature | Rationale |
|---|---|---|---|---|
| Brule Mine | Yes | Loss or alteration of vegetation | All | Land clearing may affect adjacent vegetation through microclimate changes (e.g., increased light, altered moisture regime) and wind damage. Also, may be potential for invasive and/or noxious plant encroachment on exposed soils, and dust accumulation on vegetation. |
| Mine Power Supply | Yes | Loss or alteration of vegetation | All | Land clearing/vegetation management may affect adjacent vegetation through microclimate changes (e.g., increased light, altered moisture regime) and wind damage. Also, may be potential for invasive and/or noxious plant encroachment on exposed soils. |

[2] As per the B.C. Conservation Data Centre (CDC 2005).

| Project Component | To be assessed? | Relevant Key Issue | Relevant Focal Feature | Rationale |
|---|---|---|---|---|
| Falling Creek Connector Haul Route | Yes | Loss or alteration of vegetation | All | Land clearing may affect adjacent vegetation through microclimate changes (e.g., increased light, altered moisture regime) and wind damage. Also, may be potential for invasive and/or noxious plant encroachment on exposed soils, and dust accumulation on vegetation. |
| Falling Creek Flats Loadout and Powerline | Yes | Loss or alteration of vegetation | All | Land clearing/vegetation management may affect adjacent vegetation through microclimate changes (e.g., increased light, altered moisture regime) and wind damage. Also, may be potential for invasive and/or noxious plant encroachment on exposed soils, and dust accumulation on vegetation. |
| Bullmoose Haul Route and Loadout | No | NA | NA | Existing vegetation disturbance unlikely to be exacerbated by Project-related activities. |

#### *10.1.2.4 Temporal Boundaries*

To assess potential Project effects, three assessment phases were used:

*Baseline* – Represents vegetation conditions prior to any Project-specific developments. The baseline conditions for vegetation incorporate the effects of existing human-caused disturbances, including the Dillon Mine footprint (assuming no reclamation) and its associated linear features.

*Phases 1 and 2 through Decommissioning/Reclamation* – Represents conditions during construction activities (i.e., 2006/2007), operations (2006 to 2017), and decommissioning/reclamation activities (starting in 2017 after operations cease). While recognizing that development, and then decommissioning/reclamation will be progressive over this combined assessment phase, a “maximum build-out” scenario is used to represent the “worst case” (i.e., most conservative) assessment of the effects on vegetation, with the assumption that the primary potential effects on vegetation (direct loss from clearing) will be similar for each phase, and that the results of reclamation (i.e., reestablishment of viable plant communities) will not be apparent until the years following decommissioning.

*Post-closure* – Represents conditions forecast into the future following closure (i.e., decommissioning) of the mine. This time frame includes all mitigation recommendations and all components of the Conceptual Reclamation Plan (Section 4.12).

### *10.1.2.5 Spatial Boundaries*

#### 10.1.2.5.1 Local Study Areas

Four “project component” Local Study Areas (LSAs) have been defined. Each project component LSA is delineated by the footprint or right-of-way of the project component to be assessed (Table 10.1.2-1) plus a 1 km buffer. The areas of the project component LSAs are: Brule Mine – 2,219 ha; Mine Power Supply – 4,897 ha; Falling Creek Connector Haul Route – 10,296 ha; and Falling Creek Flats Loadout and Powerline – 838 ha.

The project component LSAs are not mutually exclusive (Figure 10.1.2-1)—when all four are considered together as a single ‘project,’ LSA the total area is 16,520 ha rather than 18,250 ha, which is the total when the four component LSAs are considered separately. In general, the project LSA is used in the description of baseline availability of focal features (Section 10.1.3), and as the reporting area in the assessment of Project-specific effects (Section 10.1.5). The separate project component LSAs are used to highlight issues (e.g., concentrations of certain focal features, potential permanent loss of a focal feature), as appropriate.

#### 10.1.2.5.2 Regional Study Area

A Regional Study Area (RSA) was used to describe the availability and distribution of the focal features in each of the project component LSAs in a regional context, and to set the general boundaries for the review of existing knowledge. The RSA is a 1,010 $km^2$ area that extends, approximately, from the south side of the Pine River to the northern boundary of the Rocky Creek watershed, west to Falling Creek and east to the Sukunka River (Figure 10.1.2-1). The boundaries of this area and the rationale for its delineation are described in more detail in Section 10.2.2.5 where it is used to provide regional context for wildlife habitat availability and as the study area for the evaluation of cumulative effects for wildlife.

### *10.1.2.6 Project Effects Assessment*

The general approach for the Project effects assessment is described in Section 6. Specifically, for vegetation these steps were:

- Identify the key issues and potential Project effects for each focal feature, in consideration of proposed management plans, design modifications, and mitigation measures intended to reduce potentially adverse effects.

- Identify and characterize Residual Project Effects[3] based on the assumption that technically and economically feasible mitigation measures have been implemented and are effective as described—these mitigation measures are to be considered before proceeding to the next step.
- Determine if Residual Project Effects might contribute incrementally to regional cumulative effects[4] and must, therefore, be considered in the cumulative effects assessment (Section 10.1.2.7).

The study area boundaries for the vegetation Project effects assessment are described in Section 10.1.2.5. This assessment considers two periods of Project development: (1) Phases 1 and 2 through Decommissioning/Reclamation, and (2) Post-closure, as described in Section 10.1.2.4.

The character of each Residual Project Effect is evaluated using five criteria: magnitude, geographic extent, duration, frequency, and reversibility. These criteria were assessed in the context of the nature of potential effects, the mitigation strategies that are available for reducing or eliminating such effects, and the nature and anticipated severity of residual effects after mitigation. The classification schemes for each criterion are described in Table 10.1.2-2. Additionally, a confidence level was applied to each Residual Project Effect characterization (i.e., low, medium, high, Table 10.1.2-2). This confidence rating considered the accuracy and application of analytical tools, an understanding of the effectiveness of mitigation measures, and an understanding of known responses of plant communities to potential Project effects.

If it is determined that one or more Residual Project Effects might contribute incrementally to regional cumulative effects, then a cumulative effects assessment is required (Section 10.1.2.7). This determination is based on the aforementioned criteria, and on an evaluation of the Residual Project Effect (e.g., loss of an area of old forest) in a regional context (e.g., availability of old forest in the RSA).

The results of the Project effects assessment for the vegetation focal features are presented in Section 10.1.5, and a summary of the Residual Project Effects is provided in Section 10.1.6.

[3] Residual Project Effects are Project effects not considered to be fully addressed by the proposed mitigation measures (e.g., vegetation removal for facilities placement).

[4] The significance of Residual Project Effects was determined based on an understanding of localized effects in a regional context, as the arbitrary nature of local study areas typically overestimates adverse effects on a resource. Therefore, the relative contribution of Residual Project Effects to regional cumulative effects was evaluated.

**Table 10.1.2-2: Criteria for Residual Project Effects & Residual Cumulative Effects Characterization & Assessment of Residual Cumulative Effects Significance: Vegetation**

| Criterion | Description |
|---|---|
| Magnitude | **Low**: effect occurs that might not be detectable, but is within the range of natural variability and does not compromise ecological values |
| | **Medium**: clearly an effect but unlikely to pose a serious risk to the focal feature or represent a management challenge from an ecological standpoint |
| | **High**: effect is likely to post a serious risk to the focal feature and represents a management challenge from an ecological standpoint |
| Geographic Extent | **Site specific**: effect on focal feature confined to a single small area within the LSA |
| | **Local**: effect on focal feature within LSA |
| | **Regional**: effect on focal feature within a regional study area |
| Duration (1) | **Short term**: effect on focal features is limited to <1 year |
| | **Medium term**: effect on focal feature occurs between 1 to 4 years |
| | **Long term**: effect on focal feature lasts >4 years, but does not extend more than 10 years after decommissioning and final reclamation |
| | **Far future**: effect on focal feature extends >10 years after decommissioning and abandonment |
| Frequency (2) | **Low**: Frequency within range of annual variability and does not pose a serious risk to the focal feature or its economic or social/cultural values |
| | **Medium**: Frequency exceeds range of annual variability but is unlikely to pose a serious risk to the focal feature or its economic or social/cultural values |
| | **High**: Frequency exceeds range of annual variability and is likely to pose a serious risk to the focal feature or its economic or social/cultural values |
| Reversibility | **Reversible:** conditions will likely return to baseline conditions |
| | **Irreversible:** conditions will not likely return to baseline conditions |
| Significance (3) | **Significant**: effects with magnitude and duration combinations of:<br>• Medium magnitude and far future duration, or<br>• High magnitude, local or regional geographic extent, ,and any duration, or<br>• High magnitude, site-specific geographic extent, and far future duration |
| | **Not Significant:** effects of all other magnitude and duration combinations |
| Level of Confidence | **Low**: do not have confidence in prediction, could vary considerably |
| | **Medium**: confidence in prediction, moderate variability |
| | **High**: confidence in prediction, low variability |

**Notes: 1.** For short-term duration effects that occur more than once. **2.** Reclamation goals are a stabilized surface and a native plant community. It is assumed that successional processes will move post-mine vegetation communities towards the original vegetation type, ideally within a 10-year period following decommissioning and final reclamation. **3.** To determine the significance of Residual Cumulative Effects, magnitude and duration are the primary determinants of the significance rating, with geographic extent used to qualify certain ratings.

### *10.1.2.7 Cumulative Effects Assessment*

The general approach for the cumulative effects assessment is described in Section 6. Specifically, for vegetation these steps are:

- determine conditions for the focal features within the RSA in the absence of the Project (i.e., conditions at Baseline and into the foreseeable future[5]), and characterize and evaluate the significance of any Residual Cumulative Effects.
- determine the incremental effects of the Project to cumulative effects ("Project contribution") on the focal features within the RSA for the development phases under consideration.
- determine conditions for the focal features within the RSA and for the development phases under consideration, in the context of both the Project and all other projects and activities[6], and characterize and evaluate the significance of any Residual Cumulative Effects and the Project's contribution to those Residual Cumulative Effects.

A description of the analyses required to determine 'conditions' for the vegetation focal features on a regional scale, with and without the Project, is presented in Section 10.1.2.9. The RSA boundaries for the vegetation cumulative effects assessment are described in Section 10.1.2.5, and, again, three time periods are considered: Baseline, Phases 1 and 2 through Decommissioning/Reclamation, and Post-Closure (Section 10.1.2.4).

The nature of the Project contribution and each Residual Cumulative Effect (i.e., without and with Project) are evaluated using the same five criteria as used for the Residual Project Effects (Table 10.1.2-2). Again, these criteria are assessed in the context of mitigation strategies that are available for reducing or eliminating such effects.

As described in Section 6.0, the determination of significance of Residual Cumulative Effects is usually related to recognized thresholds for a region. For vegetation such thresholds are generally little understood, although for old forest there are targets for regional representation that are applicable (BCMOF 1999, see also Section 10.1.3.2). In general, however, this determination is qualitative rather than quantitative.

Results of the cumulative effects assessment are presented in Section 10.2.7, and a summary of the Residual Cumulative Effects is provided in Section 10.2.8.

[5] Although no spatial data was available for potential future developments in the RSA, the cumulative effects assessment considers this potential influence in a general sense with respect to this Project.
[6] See footnote above.

### *10.1.2.8 Information Sources*

#### 10.1.2.8.1 Literature Review

A summary of the existing vegetation and plant inventory information for the Project area was compiled from a review of the literature. The main information sources were unpublished government and consultant reports, and the data collected in support of the Dillon Mine Project *Mines Act* Permit Application (WCC 2004). In addition, the B.C. Species and Ecosystems Explorer[7] and the Terrestrial Information Mapping Service[8] were accessed for regionally specific information on rare plants and ecological (plant) communities, and a review of the *Species at Risk Act* (SARA) and Committee on the Status of Endangered Wildlife in Canada (COSEWIC) listings was conducted.

#### 10.1.2.8.2 Ecosystem Mapping

The regional study area is within Block 4 of Canadian Forest Products Ltd.'s (Canfor's) Tree Forest Licence (TFL) 48. In 1996, Canfor began mapping the TFL using the 1:20,000 Terrestrial Ecosystem Mapping (TEM) protocol (RIC 1998). Mapping for some parts of the TFL was completed using TEM (e.g., Geowest 1999); however, to expedite the process, Canfor switched to 1:20,000 Predictive Ecosystem Mapping (PEM) (RIC 1999) to complete the project (Rosen et al 2001). Thus, the ecosystem mapping available for the regional study area is a combination of both TEM and PEM data with one exception—a small part (12.3 ha) of the area around the Falling Creek Flats Loadout and Powerline was outside Canfor's mapped area. In order to ensure a complete ecosystem mapping base for the project LSA, polygons were delineated for this area using air photo interpretation with reference to Delong et al (1990) and MacKinnon et al (1990). Subzone lines were matched to the existing ecosystem mapping.

#### 10.1.2.8.3 Field Surveys

A total of 212 ecosystem sample plots were surveyed using the Ground Inspection Form (GIF) protocol (RIC 1998) in 2004 and 2005. Although the focus of this work was the ground-truthing of the wildlife habitat ratings (see Section 10.3.2.6), the GIF data were used to refine the PEM/TEM product in some locations. A summary of this field program is provided in Appendix E-1.

A wetlands assessment was conducted in June 2005; however, the focus of the assessment was wildlife values rather than vegetation values and further reference to this assessment is found in Section 10.3.3.

[7] http://srmapps.gov.bc.ca/apps/eswp/, accessed July 2005.
[8] http://maps.gov.bc.ca/imf406/imf.jsp?site=rrid_tib_ti, accessed July 2005.

A reconnaissance-level survey for traditional use and rare plants was conducted in September 2004. The methods and results of this survey are summarized in Appendix E-1.

#### *10.1.2.9 Analytical Techniques*

The analysis of potential project and cumulative effects on the vegetation is simply an area-based comparison between Baseline and Phases 1 and 2 through Decommissioning/Reclamation, and a qualitative assessment of Post-closure conditions, conducted for each focal feature. The requirements for these analyses are:

- ecosystem mapping (see Section 10.1.2.8.2);
- detailed Project component footprints, including all related elements (e.g., pit boundaries, new or upgraded road sections, powerline rights-of-way);
- regional spatial database of existing disturbances (“disturbance coverage”); and
- Conceptual Reclamation Plan (Section 4.12).

Integral to this analysis are disturbance buffers. Disturbance buffers define the zone over which potentially adverse edge effects resulting from human disturbances (e.g., clearing for development features, road traffic) have occurred, or may occur (in the case of Project-related activities) with respect to vegetation. These edge effects include, but are not limited to, increased sunlight, windthrow, altered moisture regime, dust accumulation, and spread of invasive plants (e.g., Farmer 1993; Stathers et al 1994; Burton 2002; Redding et al 2003). Depending on site-specific conditions, plant community type, and disturbance type, some or all of these edge effects may be occurring, and a potential concern. For the purposes of this assessment, any focal feature that falls within these disturbance buffers[9] is considered fully affected by the associated disturbance and is, therefore, not included in the area summaries. It is important to note that this is a conservative approach—in reality the degree of edge effect will vary within the disturbance buffer, with the greatest adverse effects closest to the disturbance, and the least effects at the outer boundary of the disturbance buffer. This approach is used to determine the availability of focal features and ecosystem units at baseline, with the disturbance buffers applied to existing disturbances, and for Phases 1 and 2 through Decommissioning/Reclamation and the Post-closure phase, with disturbance buffers applied as appropriate. In general, a 50 m buffer was applied to high use features (e.g., maintained roads, active railways, active mine sites), and features where vegetation management activities were presumed to be ongoing and intensive (e.g., powerlines and pipelines). The only exception was for the Falling Creek Flats Loadout where the buffer around the footprint corresponded to the predicted area of dust deposition for the ‘two coal stockpile with mitigation’ scenario (see Section 11). This buffer was used for Phases 1 and 2 through Decommissioning/Reclamation.

[9] The area of impact will also include the actual footprint as well as the buffer zone, if applicable (e.g., in the case of the Brule Mine project component).

Area calculations are complicated by the presence of "complex"[10] PEM/TEM polygons, that is, polygons described by up to three different ecosystem components. These complex polygons were addressed in two ways, depending on the type of summary. First, in order to generate accurate summaries of the area of each ecosystem unit within the study area of interest, it was necessary to "decompose" complex polygons. For instance, a 10 ha polygon comprised of 50% ESSFmv2/01 and 50% ESSFmv2/03 would be summarized as 5 ha of each ecosystem unit. Second, in the identification of focal features (e.g., old forest) if at least one of the components in a complex polygon met the focal feature criteria (e.g., structural stage 7) then the entire polygon was assigned to that focal feature. This is a conservative approach that recognizes that the PEM/TEM mapping approach does not allow one to be spatially explicit about where the component ecosystem units are located within a given polygon—it has been assumed that the ecosystem components within a complex PEM/TEM polygon are distributed evenly.

#### *10.1.2.10 Influence of Consultation on the Assessment*

The vegetation assessment approach was presented at a regulatory meeting in February 2005, an aboriginal and First Nations workshop in February 2005, and a public open house in February 2005 (all took place in Chetwynd). The approach was based on effects assessments for similar projects in the region. First Nations requested consideration of the effects of dust on food plants (e.g., berry shrubs) (Section 14), and are interested in seeing the use of native plant species optimized in reclamation efforts (refer to Section 4.12 for listings of candidate vegetation species for use in reclamation). The B.C. Ministry of Agriculture and Lands requested preparation of a plan for the prevention and control of noxious weeds and invasive plants (refer to Section 4.12 for planning information).

### 10.1.3 Baseline Conditions

The proposed Project is located within the Hart Foothills (HAF) Ecosection of the Sub-Boreal Interior (SBI) Ecoprovince, an area of low, rounded mountains and wide valleys on the east side of the Rocky Mountains. The regional study area falls within an Enhanced Resource Development Zone[11] and is mostly within the Highhat Landscape Unit, as defined in support of the Dawson Creek Land and Resource Management Plan (LRMP) process. As noted in Section 10.1.2.6, the regional study area is within TFL 48—a discussion of forest industry activities in this area is presented in Section 13.

In addition to Canfor's PEM/TEM product (see Section 10.1.2.6), there have been several vegetation mapping projects conducted in and around the regional study area beginning in the 1970s with the 1:50,000 biophysical mapping completed as part of the Northeast Coal Study (Harcombe 1978). In the early 1980s, Pedology Consultants (1982) developed a 1:20,000

[10] Or "compound" polygons (as per RIC 1998).

[11] This zone is managed for the development of resources such as timber, minerals and oil and gas, while minimizing impacts on other resource values (B.C. Government 1999).

biophysical map for the Burnt River property. Most recently, TEM mapping was done as part of the Willow Creek Coal Project (PVC 2002) in the north-western corner of the regional study area. In conjunction with these projects, there have been, in addition to the compilation of comprehensive plant species lists (Ceska 1979; Pedology Consultants 1982; Westworh 1998; PVC 2002), limited surveys for rare plants (i.e., Westworth 1998; this study [see Appendix E-1]).

There are six biogeoclimatic variants found in one or more of the project component LSAs (Figure 10.1.2-1, Table 10.1.3-1).

**Table 10.1.3-1: Area Summary of Biogeoclimatic Variants within the Local & Regional Study Areas**

| Area | Area of BWBSmw1 (ha)* | Area of BWBSwk1 (ha)* | Area of SBSwk2 (ha)* | Area of ESSFmv2 (ha)* | Area of ESSFwc3 (ha)* | Area of ESSFwk2 (ha)* |
|---|---|---|---|---|---|---|
| Brule Mine LSA | 15.4 | - | 352.3 | 1056.7 | - | - |
| Mine Power Supply LSA | 2658.8 | 38.0 | 372.3 | 774.9 | - | - |
| Falling Creek Connector Haul Route LSA | 22.9 | - | 3154.8 | 2971.8 | 1105.3 | 1757.8 |
| Falling Creek Flats Loadout & Powerline LSA | 238.4 | - | 353.1 | - | - | - |
| Project LSA | 2912.7 | 38.0 | 3906.1 | 4127.0 | 1105.3 | 1757.8 |
| RSA | 18815.1 | 62.9 | 32111.4 | 25809.8 | 3827.9 | 10525.3 |

**Note: *** That is unaffected by existing disturbance (see Section 10.1.2.9).

The Peace Boreal White and Black Spruce moist warm (BWBSmw1) variant occurs on rolling topography in the valley lowlands along major drainages with elevations ranging from 750 to 1,050 m (DeLong et al 1990). Trembling aspen (*Populus tremuloides*) leading stands dominate forests in this variant with lodgepole pine (*Pinus contorta*) present as a seral species on drier and poorer sites, and balsam poplar *(Populus balsamifera* ssp. *balsamifera*) common on low-lying, wetter sites (Delong et al 1990). Black spruce (*Picea mariana*) stands, often with a minor component of tamarack (*Larix laricina*), are common on organic soils (DeLong et al 1990). This variant is found within all project component LSAs, and is the third most common variant in the RSA (Table 10.1.3-1).

The Murray Boreal White and Black Spruce wet cool (BWBSwk1) variant is found in the foothills and mid to lower slopes of the Rocky Mountains, at elevations ranging from 1,050 to 1,200 m in the Project area (DeLong et al 1990). Mature spruce forests are dominated by white spruce (*Picea glauca*) with minor amounts of black spruce present on wetter and poorer sites (DeLong et al 1990). Pure black spruce stands can occur on very wet sites on organic soils (DeLong et al 1990). Lodgepole pine is the dominant seral species and pine forests with a minor spruce component are widespread in this variant (DeLong et al 1990). Trembling aspen is common as a seral species at lower elevations (Delong et al 1990). This variant is found only in the Mine Power Supply LSA, and is very rare within the RSA (Table 10.1.3-1); however, in a broader context this variant is not uncommon, occurring more to the northeast of the RSA, and on the east side of the Sukunka River.

The Finlay-Peace Wet Cool Sub-Boreal Spruce-Subalpine Fir (SBSwk2) variant occurs below 1,100 m in the foothills and valley bottoms of the region (MacKinnon et al 1990). Climax forests characterized by canopies of hybrid white spruce (*Picea engelmannii* x *glauca*) and subalpine fir (*Abies lasiocarpa*), with lodgepole pine present as a seral species on mesic and drier sites, and as a topoedaphic climax species on very dry sites (MacKinnon et al, 1990). Black spruce is present on moist to wet sites in this variant (MacKinnon et al, 1990). This variant is found within all project component LSAs, and is the most common variant in the RSA (Table 10.1.3-1).

The Bullmoose Moist Very Cold Engelmann Spruce-Subalpine Fir (ESSFmv2) variant is the driest and coldest of the lower elevation ESSF variants, reflecting its northern position and its lee position with respect to the Rocky Mountains (DeLong et al, 1994). Elevations generally range from 1,000 to 1,400 m, above the SBSwk2 and BWBSwk1 (DeLong et al 1994). The fire return interval is more frequent relative to other variants of the ESSF, which has resulted in a larger portion of the landscape being dominated by seral lodgepole pine stands (DeLong et al 1994). A mix of lodgepole pine and black spruce also occurs on poor sites at the lower elevational extent of this variant (DeLong et al 1994). This variant is found within all project component LSAs except the Falling Creek Flats Loadout and Powerline, and is the second most common variant in the RSA (Table 10.1.3-1).

The Caribou Wet Cold Engelmann Spruce-Subalpine Fir (ESSFwc3) variant occurs above the ESSFwk2, and is colder with a more persistent snowpack (Delong et al, 1994). Elevations range from 1,300 to 1,500 m (Delong et al, 1994). Forests in this variant tend to be widely spaced and clumpy and are generally dominated by subalpine fir and/or Engelmann spruce (Delong et al, 1994). The ESSFwc3 is further differentiated from the ESSFwk2 by having more devil's club (*Oplopanax horridus*) and less Indian hellebore (*Veratrum viride*) and Sitka valerian (*Valeriana sitchensis*) on mesic and wetter sites (Delong et al, 1994). This variant is found only within the Falling Creek Connector Road LSA, and is not very common with the RSA (Table 10.1.3-1); however, in a broader context this variant is not uncommon, occurring more predominantly west of the Rocky Mountain divide (Delong et al, 1994).

The Misinchinka Wet Cool Engelmann Spruce-Subalpine Fir (ESSFwk2) variant is wetter and warmer than the ESSFmv variants, but has very high snow accumulations, often more than three meters in depth (DeLong et al, 1994). Elevations generally range from 950 to 1,300 m, above the SBSwk2 (DeLong et al, 1994). The ESSFwk2 differs from the adjoining ESSFmv2 variant by having more oak fern (*Gymnocarpium dryopteris*) and foamflower (*Tiarella* spp.) on mesic and wetter sites (Delong et al, 1994). Due to infrequent wildfires, climax forests are dominated by Engelmann spruce and subalpine fir rather than lodgepole pine (Delong et al, 1994). Well-established swales of Sitka alder (*Alnus crispa* ssp. *sinuata*) are common, especially on north-facing slopes (Delong et al, 1994). This variant is also found only within the Falling Creek Connector Road LSA, and is the fourth most common variant in the RSA (Table 10.1.3-1).

Fifty-seven vegetated ecosystem units[12] were mapped in one or more of the project component LSAs (Appendix E-2). Descriptions of these ecosystem units are available in the expanded legend for the PEM (Appendix A, Rosen et al, 2001). By far the most common are the mesic site series (01) units: White Spruce–Trembling aspen–Step moss (AM) in the BWBSmw1; Hybrid spruce–Oak fern (SO) in the SBSwk2; Subalpine fir–Rhododendron–Feathermoss (FR) in the ESSFmv2; Subalpine fir–Rhododendron–Oak fern (FR) in the ESSFwc3; and Subalpine fir–Oak fern–Knight's plume (FO) in the ESSFwk2 (Appendix E-2).

The following summarizes the most common ecosystem units and structural stages in each project component LSA. The structural stages definitions, as per RIC (1998), are: 1 = non-vegetated/sparse vegetation, 0 to 20 years for normal forest succession, up to 100 years for non-vegetated ecosystems such as bedrock; 2 = herb layer, < 20 years for normal forest succession, may be permanent for some ecosystems (e.g., wetlands); 3 = shrub <10 m tall, 20 to 40 years for normal forest succession; 4 = pole-sapling, >10 m tall, <40 years; 5 = young forest, 40 to 80 years; 6 = mature forest, 80 to 140 years for the BWBS and SBS, 80 to 250 years for the ESSF; 7 = old forest, >140 years for the BWBS and SBS, >250 years for the ESSF.

The Brule Mine LSA is primarily within the ESSFmv2 and SBSwk2. The most common ecosystem units in this LSA are: Hybrid spruce–Oak fern (SBSwk2/01 [SO]); Subalpine fir–Rhododendron–Feathermoss (ESSFmv2/01 [FR]); and Subalpine fir–Lingonberry (ESSFmv2/02 [FL]) (Appendix E-2). More than two-thirds of this LSA is mapped as structural stages 5 and 6.

The Mine Power Supply LSA is within the BWBSmw1, BWBSwk1, SBSwk2, and ESSFmv2. The most common ecosystem units in this LSA are: White Spruce–Trembling aspen–Step moss (BWBSmw1/01 [AM]); Hybrid spruce–Oak fern (SBSwk2/01 [SO]); and Subalpine fir–Rhododendron–Feathermoss (ESSFmv2/01 [FR]) (Appendix E-2). Two-thirds of this LSA is mapped as structural stages 5 and 6.

The Falling Creek Connector Haul Route LSA is the most diverse project component LSA with area in five variants, but dominated by the ESSFmv2 and SBSwk2. The most common ecosystem units in this LSA are: Hybrid spruce–Oakfern (SBSwk2/01 [SO]); Subalpine fir–Rhododendron–Feathermoss (ESSFmv2/01 [FR]); Subalpine fir–Lingonberry (ESSFmv2/02 [FL]); Subalpine fir–Rhododendron–Oak fern (ESSFwc3/01 [FR]); and Subalpine fir–Oak fern–Knight's plume (ESSFwk2/01 [FO]) (Appendix E-2). More than two-thirds of this LSA is mapped as structural stages 5 and 6.

[12] In addition, 11 non-vegetated, sparsely vegetated, or anthropogenic units were mapped in one or more of the project component LSAs.

The Falling Creek Flats Loadout and Powerline LSA is within the BWBSmw1 and SBSwk2. By far the most common ecosystem unit in this LSA is Hybrid spruce–Horsetail (SBSwk2/06 [SH]) (Appendix E-2). More than half of this LSA is mapped as structural stages 6 and 3.

The following sections describe the baseline conditions for the three vegetation focal features (i.e., ecological communities of conservation concern, old forest, and wetlands) in the Project area, summarizing for each: selection rationale, and local and regional distribution and abundance. In addition, overviews of the potential conservation concerns in the Project area; the potential invasive and noxious plant species in the region; and baseline forest capability in the Brule Mine and Falling Creek Flats Loadout areas are presented.

#### *10.1.3.1 Ecological Communities of Conservation Concern*

Ecological communities of conservation concern were identified as a focal feature due to the limited distribution and extent of these ecological types, sensitivity to disturbance, conservation status, and the important contribution they make to landscape, community, and species biodiversity.

Ten ecological communities of conservation concern are known to occur in the biogeoclimatic variants represented within the project LSA (CDC 2005, Appendix E-3). Five of these, all blue-listed, have been mapped in the LSA: White Spruce–Currant–Bluebells (BWBSmw1/06 [SC]); White Spruce–Currant–Oak fern (BWBSmw1/05 [SO]); White Spruce–Huckleberry–Step moss (BWBSwk1/01 [SM]); Lodgepole pine–Black huckleberry–Reindeer lichen (SBSwk2/02 [LH]); and Subalpine fir–Alder–Horsetail (ESSFmv2/06 [FH]) (Appendix E-2). These ecological communities of conservation concern have then been rated with respect to conservation status based on the age (structural stage[13]) of the stand. The relative conservation status classes for CDC-listed ecological communities are based on the intrinsic vulnerability of old forest structural stages (CDC 2004a) and have been defined as follows:

- Extremely High – very old stands (structural stage 7);
- High – old stands (structural stage 6);
- Moderate – moderate age stands (structural stage 5); and
- Low – young stands (structural stages 1 to 4).

Ecological communities of conservation concern are found throughout the LSA (Figures 10.1.3-1 to 10.1.3-4)[14], and their distribution by project component LSAs is presented as part of Appendix E-2. The most common ecological community of conservation concern in the LSA is White Spruce–Currant–Oak fern (BWBSmw1/05 [SO]), and the most common in the RSA is

[13] See definitions in Section 10.1.3.

[14] Note for figure presentation where an ecological community of conservation concern is one component of a complex polygon the entire polygon is ‘flagged’ as an ecological community of conservation concern.

Lodgepole pine–Black huckleberry–Reindeer lichen (SBSwk2/02 [LH]), followed closely by White Spruce–Currant–Oak fern (BWBSmw1/05 [SO]). A summary of the ecological communities of conservation concern in the LSA and RSA, according to their relative conservation status, is presented in Table 10.1.3-2.

White Spruce–Currant–Bluebells (BWBSmw1/06 [SC]) and White Spruce–Currant–Oak fern (BWBSmw1/05 [SO]) have the greatest proportion of extremely high relative conservation status area, but their areas for future recruitment to this class (i.e., stands of moderate to low relative conservation value [younger stands]) are relatively low (Table 10.1.3-2). Subalpine fir–Alder–Horsetail (ESSFmv2/06 [FH]) has very little high or extremely high relative conservation status area, but the future recruitment area to these higher value classes is relatively large (Table 10.1.3-2). Lodgepole pine–Black huckleberry–Reindeer lichen (SBSwk2/02 [LH]) has a good distribution across the relative conservation status classes, except for the extremely high class (Table 10.1.3-2). Finally, White Spruce–Huckleberry–Step moss (BWBSwk1/01 [SM]) is a relatively insignificant component of the LSA and RSA, although as a mesic type it is likely relatively common in a broader context.

**Table 10.1.3-2: Baseline Area Summary of Ecological Communities of Conservation Concern within the Local & Regional Study Areas**

| Ecological Community of Conservation Concern | Ecosystem Unit Code | Relative Conservation Status | | | |
|---|---|---|---|---|---|
| | | Extremely High (ha) | High (ha) | Moderate (ha) | Low (ha) |
| White Spruce–Currant–Bluebells (BWBSmw1/06) | SC | LSA: 113.3<br>RSA: 683.4 | LSA: 18.9<br>RSA: 391.6 | LSA: 12.6<br>RSA: 242.7 | LSA: 22.2<br>RSA: 95.1 |
| White Spruce–Currant–Oak fern (BWBSmw1/05) | SO | LSA: 150.5<br>RSA: 1052.6 | LSA: 46.1<br>RSA: 745.2 | LSA: 11.7<br>RSA: 327.0 | LSA: 47.6<br>RSA: 176.6 |
| White Spruce–Huckleberry–Step moss (BWBSwk1/01) | SM | LSA: 2.7<br>RSA: 10.2 | LSA: 26.1<br>RSA: 32.2 | LSA: nil<br>RSA: 2.7 | LSA: 7.8<br>RSA: 8.3 |
| Lodgepole pine–Black Huckleberry–Reindeer lichen (SBSwk2/02) | LH | LSA: 0.3<br>RSA: 0.5 | LSA: 63.0<br>RSA: 626.6 | LSA: 53.2<br>RSA: 788.8 | LSA: 27.9<br>RSA: 1037.0 |
| Subalpine fir–Alder–Horsetail (ESSFmv2/06) | FH | LSA: nil<br>RSA: 68.3 | LSA: 8.6<br>RSA: 27.7 | LSA: 9.1<br>RSA: 22.4 | LSA: 145.8<br>RSA: 329.9 |

### *10.1.3.2 Old Forest*

Old forests are included as a focal feature because of the importance of these communities for biodiversity conservation, as wildlife habitat, and the extended time periods required for development of old forest structural and species composition attributes.

Old forest is identified within each biogeoclimatic variant using the old forest criteria in the Forest Practices Code of B.C. Biodiversity Guidebook (BCMOF 1995), that is, in the SBS and BWBS zones old forest is >140 years, and in the ESSF old forest is >250 years. For this assessment, these age classes are represented by structural stage 7 as per PEM/TEM standards (RIC 1998; RIC 1999).

There are 1400.1 ha of old forest within the LSA (Figures 10.1.3-1 to 10.1.3-4[15], Table 10.1.3-3). The distribution of this old forest area among the project component LSAs is presented later in this report (Section 10.1.5.2). The vast majority of the old forest is within the Mine Power Supply LSA (79.2%) (Figure 10.1.3-2, Table 10.1.5-2). Old forest is present in all of the biogeoclimatic variants represented within the LSA, but the majority is within the BWBSmw1 (Table 10.1.3-3). There are 9173.7 ha of old forest in the RSA, most of which is within the BWBSmw1 (60.7%), followed by the ESSFwk2 (14.0%) (Table 10.1.3-3).

It is important to note that the estimates of old forest availability used to describe baseline conditions and to assess Project effects are based on a static PEM/TEM product, and do not necessarily reflect current conditions—recent (and future planned) forest harvesting spatial information was unavailable for this assessment. Consequently, unmapped harvesting may have reduced old forest availability below that represented by the ecosystem mapping presented here.

**Table 10.1.3-3: Baseline Area Summary of Old Forest & Wetlands within the Local & Regional Study Areas**

| Biogeoclimatic Variant | Old Forest AREA (ha) | Wetlands Area (ha) |
|---|---|---|
| BWBSmw1 | LSA: 1154.6<br>RSA: 5569.4 | LSA: 30.6<br>RSA: 686.0 |
| BWBSwk1 | LSA: 3.1<br>RSA: 11.4 | LSA: nil<br>RSA: nil |
| SBSwk2 | LSA: 32.1<br>RSA: 1004.9 | LSA: 96.1<br>RSA: 300.6 |
| ESSFmv2 | LSA: 37.7<br>RSA: 1017.5 | LSA: 39.2<br>RSA: 121.4 |
| ESSFwc3 | LSA: 82.5<br>RSA: 282.8 | LSA: 13.2<br>RSA: 54.0 |
| ESSFwcp3 | Non-forested | LSA: nil<br>RSA: 0.2 |
| ESSFwk2 | LSA: 90.1<br>RSA: 1287.5 | LSA: 11.2<br>RSA: 66.4 |
| **Total** | **LSA: 1400.1**<br>**RSA: 9173.7** | **LSA: 190.3**<br>**RSA: 1228.6** |

[15] Note for figure presentation where an old forest ecosystem unit is one component of a complex polygon the entire polygon is “flagged” as old forest.

#### *10.1.3.3 Wetlands*

Wetlands have been included as a focal feature because they are sensitive to project disturbance, have high potential for rare plant occurrence, and contribute to species, community, and landscape level biodiversity. Wetlands are defined as areas where soils are water-saturated for a sufficient length of time such that excess water and resulting low soil oxygen levels are principal determinants of vegetation and soil development. Wetlands have a relative abundance of hydrophytes and/or soils featuring "hydric" characteristics (Mackenzie and Moran 2004).

For this project, wetlands were primarily identified and delineated using the 1:20,000 TRIM database—that is, mapped polygons identified as "marsh" or "swamp" were flagged, in addition, any PEM/TEM polygons identified as "OW" (open water) were also flagged. It is important to note that this approach does not identify all wetlands on the landscape; in particular, forested wetlands or very small wetlands would be under-represented (also see Section 10.1.3.4).

There are 190.3 ha of wetlands within the LSA (Figures 10.1.3-1 to 10.1.3-4, Table 10.1.3-3). The distribution of these wetlands among the project component LSAs is presented later in this report (Section 10.1.5.3). The majority of this wetland area is within the Falling Creek Connector Haul Route LSA (147.4 ha, or 77.5%), and the Mine Power Supply LSA (40.8 ha, or 21.4%) (Figures 10.1.3-2 and 10.1.3-3, respectively, also Table 10.1.5-3). Wetlands are present in all of the biogeoclimatic variants represented within the LSA, except for the BWBSwk1 (Table 10.1.3-3). There are 1,228.6 ha of wetlands in the RSA, most of which is within the BWBSmw1 (55.8%), followed by the SBSwk2 (24.5%) (Table 10.1.3-3).

#### *10.1.3.4 Conservation Concerns*

There is only one plant species currently listed under SARA that may occur in the regional study area: Haller's apple moss (*Bartramia halleriana*). This moss is listed under Schedule 1 (Threatened) of SARA. To date, it has been found in crevices and ledges of forested cliffs and on exposed stabilized talus slopes as far north as the upper Fraser River and Jasper National Park (Environment Canada 2004).

At least 57 red- and blue-listed vascular plant species are potentially present in the project LSA (Appendix E-4).

There are at present no CDC plant occurrence records for the regional study area (CDC 2004b). However, Westworth (1998) conducted rare plant surveys in the Burnt River LU in August 1997, and recorded four confirmed and two tentative rare species, all of which were found in variants that are also found in the project LSA. The four confirmed rare species were: *Galium trifidum* ssp. *trifidum* (small bedstraw) recorded in the SBSwk2 in a small wetland near Mink Creek[16,17];

[16] Note that the CDC (2005) does not indicate that this blue-listed species is found in any of the biogeoclimatic variants present in the project LSA (including the SBSwk2); thus, it is not listed in Appendix E-5.

*Euphrasia arctica* var. *disjuncta* (eyebright) recorded in the ESSFwk2 along an open subalpine ridgeline; *Carex xerantica* (white-scaled sedge) recorded in the ESSFwk2 in a dry subalpine meadow at the head of a shallow draw[18]; and *Ranunculus eschscholtzii* var. *suksdorfii* (mountain or subalpine buttercup) recorded in the ESSFwk2 in moist depressions and a meadow adjacent to a subalpine lake (Westworth 1998). Note that the *Ranunculus* and *Euphrasia* species are now yellow-listed (Klinkenberg 2004). The two tentative rare species were from the genera *Minuartia* and *Draba*. Although no details of methodology are provided, PVC (2002) reports that no rare plants were identified at the Willow Creek project site. Reconnaissance-level fieldwork conducted for the Dillon Mine in 2004 also did not locate any rare plants (Appendix E-1).

As noted previously, ten ecological communities of conservation concern may occur in the region (Appendix E-3)—five of these, all blue-listed, were mapped within the project LSA (Section 10.1.3.1)[19].

A number of rare wetland plant communities have recently been added to the CDC Red and Blue Lists[20]. These wetland communities have been classified using a relatively new B.C. wetland classification system (MacKenzie and Moran 2004) that has not yet been integrated into the PEM/TEM mapping protocols. Therefore, it is possible that some of the wetland communities within the project LSA conform to one or another of the newly listed rare wetland communities. Specifically, the WS (Willow-sedge) unit mapped in the SBSwk2 may contain the blue-listed Sitka willow-Sitka sedge ecological community of conservation concern (Appendix E-3).

### *10.1.3.5 Invasive Plants & Noxious Weeds*

Invasive plant species are typically non-native, often originating in Europe or Asia, and have spread to such an extent, either locally or regionally, that they may replace or overwhelm natural vegetation assemblages and can have significant economic implications with respect to agriculture and rangeland (Klinkenberg 2004). Many plant species, both in terrestrial and aquatic ecosystems, are considered invasive in B.C. (e.g., Meidinger et al, 2004). Noxious weeds are designated under the B.C. *Weed Control Act*, at the provincial and Regional District level, and are a subset of the known non-native, invasive plants occurring in the province.

The *Weed Control Act* imposes a duty on all land-occupiers to control designated noxious plants. Under the Act, species classified as noxious within all regions of the province are: annual sowthistle *(Sonchus oleraceus)*, Canada thistle (*Cirsium arvense*), crupina *(Crupina vulgaris)*,

[17] This species' habitat/range is wet shorelines, swamps, bogs, fens, ditches, and meadows from lowland to subalpine zones (Douglas et al 2002).
[18] This species' habitat/range is dry slopes and open forests in steppe and montane zones (Douglas et al 2002). Note that the
[19] PVC (2002) mapped a blue-listed ecological community (ESSFmv2/03, Subalpine fir–Black spruce–Labrador tea) in the Willow Creek project area; however, this community is now yellow-listed (CDC 2005).
[20] http://srmwww.gov.bc.ca/atrisk/changes.htm#NPC (accessed July 2005).

Dalmatian toadflax (*Linaria genistifolia* ssp. *dalmatica*), diffuse knapweed (*Centaurea diffusa*), dodder *(Cuscuta* spp.*)*, gorse *(Ulex europaeus)*, houndstongue *(Cynoglossum officinale)*, jointed goatgrass *(Aegilops cylindrica)*, leafy spurge *(Euphorbia esula)*, perennial sowthistle *(Sonchus arvensis)*, purple nutsedge *(Cyperus rotundus)*, rush skeletonweed *(Chondrilla juncea)*, scentless chamomile *(Matricaria maritima)*, spotted knapweed (*Centaurea maculosa*), tansy ragwort *(Senecio jacobaea)*, velvetleaf *(Abutilon theophrasti)*, wild oats *(Avena fatua)*, yellow nutsedge *(Cyperus esculentus)*, yellow starthistle *(Centaurea solstitialis)*, and yellow toadflax *(Linaria vulgaris)* (Cranston et al, 2002).

In addition, within the Peace Regional District, the Act classifies the following species as noxious: burdock (*Arctium* spp.), cleavers (*Galium aparine*), green foxtail (*Setaria viridis*), kochia (*Kochia scoparia*), night-flowering catchfly (*Silene noctiflora*), oxeye daisy (*Chrysanthemum leucanthemum*), quackgrass (*Agropyron repens*), Russian thistle (*Salsola kali*), tartary buckwheat (*Fagopyrum tataricum*), white cockle (*Lychnis alba*), and wild mustard (*Sinapsis arvensis*) (Cranston et al, 2002). Oxeye daisy is of particular concern in the Pine Pass-Chetwynd area (J. Forbes, BCMAL, pers. comm., September 2005).

Other non-native species that may be present within the Project area include: red clover (*Trifolium pratense*), dandelions (*Taraxacum* sp.), smooth brome grass (*Bromus inermis*), downy brome grass (*Bromus tectorum*), timothy (*Phleum pratense*), yellow sweet-clover (*Melilotus officinalis)*, white sweet-clover (*Melilotus alba*), and Russian knapweed (*Centaurea repens*) (White et al, 1993; Haber 1996).

Fire can play a role in the distribution and abundance of invasive plants. The fire-return interval is more frequent in the ESSFmv2 relative to other variants of the ESSF (DeLong et al, 1994), thus a substantial portion of the regional landscape in and around the Project area is dominated by seral lodgepole pine stands. Non-native grasses can out-compete native species in open pine stands, and species such as downy brome grass are known to affect fire regimes (Harrod and Reichard 2001). Moreover, some invasive plants, such as spotted knapweed and leafy spurge, are fire tolerant and may spread in post-burn situations (Harrod and Reichard 2001).

Industrial activities like forestry and mining increase the potential for invasive plant problems. For example, invasive plant seeds may be distributed by unclean machinery. Seed mixes used for replanting or reclamation efforts have been known to introduce invasive plants, although this is much less likely when high grade seed is used (as is planned for the Brule Mine). A plan for the prevention and management of noxious and invasive plant species in the Project area is presented in Section 4.12 as part of the Conceptual Reclamation Plan.

### 10.1.4 Mitigation Measures

Reclamation is the main strategy to mitigate the effects of the Project on vegetation focal features. The Reclamation Plan is presented in detail in Section 4.12.

Other mitigation strategies to reduce the effects of the proposed Project on vegetation include:

- avoidance of ecological communities of conservation concern when practical;
- interception of sedimentation sources which may impact wetlands and riparian areas (see Sections 4.3 and 4.4);
- inspection of off-site equipment to ensure that it is brought on to the Project site clean and free from soil and vegetative material that may be a source for the weed and non-native plant species introductions (see Section 4.12);
- use of mechanical vegetation control measures, rather than herbicide applications, where practical and appropriate (e.g., wetlands and riparian areas);
- avoidance of weed species in seed mixes used for reclamation by specifying the use of high grade (purity) seed only (see Section 4.12 for additional discussion of noxious weeds);
- reduction of windthrow risk along cutting boundaries (e.g., “feathering”); and
- dust control measures (see Section 4.10).

Further, the use of pre-existing road corridors, efforts to parallel existing pipeline and powerline rights-of-way, the minimization of waste rock dump footprints through mine design, and avoidance of riparian zones, contributes to the reduction of overall Project effects on vegetation.

### 10.1.5 Project Effects Assessment

Potential effects on vegetation from the proposed Project are related to loss or alteration of plants or plant communities through direct (vegetation clearing) or indirect (edge-related) means. The predicted Residual Project Effects[21] are described below for the three focal features (ecological communities of conservation concern, old forest, and wetlands).

#### *10.1.5.1 Ecological Communities of Conservation Concern*

The proportion of the area of ecological communities of conservation concern in the LSA affected during Phases 1 and 2 through Decommissioning/Reclamation is relatively minor (4.9%, Table 10.1.5-1), and the total area involved is small (37.5 ha).  Of this area, 16.1 ha is within the Brule Mine buffered facility footprint (Figure 10.1.3-1), and 2.6 ha is within the Falling Creek Flats Loadout buffered facility footprint (Figure 10.1.3-4), and, therefore, subject to direct effects (clearing) from the Project (Figures 10.3.1-4 and 4.2.10-1).

The largest area affected within a specific community in the LSA is 15.5 ha for the Subalpine fir–Alder–Horsetail (ESSFmv2/06 [FH]) unit, the majority of which (10.7 ha) will be cleared for the

[21] As noted previously, Residual Project Effects are Project effects not considered to be fully addressed by the proposed mitigation measures (Section 10.2.2.6).

Brule Mine development. Almost all of this area is in the low relative conservation value class (Table 10.1.5-1). The largest effect on the BWBSmw1 communities is within the Falling Creek Flats Loadout & Powerline LSA (30.3% [2.3 ha] of White Spruce–Currant–Oak fern affected; 41.0% [11.7 ha] of White Spruce–Currant–Bluebells affected). However, these effects are primarily indirect, related to the disturbance buffer around the coal stockpiles, as the cleared area is only 2.6 ha (all of which is White Spruce–Currant–Bluebells of extremely high relative conservation value). The largest effect on the ESSF community (Subalpine fir–Alder–Horsetail) is within the Brule Mine LSA (49.8% [10.7 ha] affected), and the largest effect on the SBS community (Lodgepole pine–Black Huckleberry–Reindeer lichen) is also within the Brule Mine LSA (29.3% [5.4 ha] affected). These effects are all direct, due to clearing in the mine footprint.

Some permanent loss of ecological communities of conservation concern is predicted into the Post-closure phase. First, communities that have been cleared for Project activities (e.g., within the mine footprint) are not expected to return fully to their pre-disturbance condition. Successful reclamation would require the maintenance of the original abiotic site characteristics (e.g., soil moisture, nutrient regime), and retention of all constituent vegetative parts (e.g., seed banks, underground propagules), which is unlikely to be achieved through reclamation efforts, particularly where units of concern are at the wetter end of the moisture spectrum (e.g., White Spruce–Currant–Bluebells, Subalpine fir–Alder–Horsetail)—post-mine reclamation tends to move affected areas toward drier site conditions (Section 4.12). Second, due to pit walls that remain post-closure (Figure 4.12.1-1), there will be a permanent loss of 2.7 ha of Lodgepole pine–Black Huckleberry–Reindeer lichen, and 6.3 ha loss of Subalpine fir–Alder–Horsetail.

In contrast, where the effect of Phases 1 and 2 through Decommissioning/Reclamation is within Project-related disturbance buffers (see Section 10.1.2.9) recovery is likely in the Post-closure phase. Ecological communities of conservation concern within these buffers will persist, assuming no substantial disruption of moisture regime, although vegetation composition may be altered due to edge effects. The extent and duration of this alteration is unknown.

#### *10.1.5.2 Old Forest*

The proportion of old forest area in the LSA affected during Phases 1 and 2 through Decommissioning/Reclamation is relatively minor (3.5%, Table 10.1.5-2), and the total area involved is small (48.9 ha). Of this area, 2.2 ha is within the Brule Mine buffered facility footprint (Figure 10.1.3-1), although <1.0 ha will actually be cleared for mine development (Figures 10.1.3-1 and 4.2.10-1); and 2.6 ha is within the Falling Creek Flats Loadout buffered facility footprint, all of which will be cleared during construction (Figure 10.1.3-4). There may also

**Table 10.1.5-1: Project-related Changes in Ecological Communities of Conservation Concern Area (ha) in the Local Study Area. Results for Extremely High & High Relative Conservation Value Classes are highlighted**

| Ecological community of conservation concern | Relative conservation value | Baseline availability (ha) | C/O/D Phase* Availability (ha) | C/O/D Phase* Change since Baseline (ha) | C/O/D Phase* Change since Baseline (%) | Post-closure Conditions |
|---|---|---|---|---|---|---|
| White Spruce–Currant–Bluebells (BWBSmw1/06 [SC]) | Extremely high | 113.3 | 101.6 | -11.7 | -10.3 | Partial recovery: reclamation unlikely to replicate all characteristics of original ecosystem unit, but edge effects associated with disturbance buffers on project components will lessen over time |
| | High | 18.9 | 18.9 | 0.0 | 0.0 | Unchanged from baseline – no Project effect |
| | Moderate | 12.6 | 12.6 | 0.0 | 0.0 | |
| | Low | 22.2 | 22.2 | 0.0 | 0.0 | |
| | *All classes* | *167.0* | *155.3* | *-11.7* | *-7.0* | Partial recovery: reclamation unlikely to replicate all characteristics of original ecosystem unit, but edge effects associated with disturbance buffers on project components will lessen over time |
| White Spruce–Currant–Oak fern (BWBSmw1/05 [SO]) | Extremely high | 150.5 | 146.9 | -3.6 | -2.4 | Full recovery possible: edge effects associated with disturbance buffers on project components will lessen over time |
| | High | 46.1 | 45.7 | -0.4 | -0.9 | |
| | Moderate | 11.7 | 11.6 | -0.1 | -0.9 | |
| | Low | 47.6 | 47.1 | -0.5 | -1.0 | |
| | *All classes* | *255.9* | *251.3* | *-4.6* | *-1.8* | |
| White Spruce–Huckleberry–Step moss (BWBSwk1/01 [SM]) | Extremely high | 2.7 | 2.7 | 0.0 | 0.0 | Unchanged from baseline – no Project effect |
| | High | 26.1 | 26.1 | 0.0 | 0.0 | |
| | Low | 7.8 | 7.8 | 0.0 | 0.0 | |
| | *All classes* | *36.6* | *36.6* | *0.0* | *0.0* | |
| Lodgepole pine–Black Huckleberry–Reindeer lichen (SBSwk2/02 [LH]) | Extremely high | 0.3 | 0.3 | 0.0 | 0.0 | Unchanged from baseline – no Project effect |
| | High | 63.0 | 62.5 | -0.5 | -0.8 | Partial recovery: small area (2.7 ha) of permanent loss in mine footprint, elsewhere reclamation unlikely to replicate all characteristics of original ecosystem unit, but edge effects associated with disturbance buffers on project components will lessen over time |
| | Moderate | 53.2 | 48.0 | -5.2 | -9.8 | |
| | Low | 27.9 | 27.9 | 0.0 | 0.0 | Unchanged from baseline – no Project effect |
| | *All classes* | *144.4* | *138.7* | *-5.7* | *-3.9* | Partial recovery: small area of permanent loss in mine footprint, elsewhere reclamation unlikely to replicate all characteristics of original ecosystem unit, but edge effects associated with disturbance buffers on project components will lessen over time |

| Ecological community of conservation concern | Relative conservation value | Baseline availability (ha) | C/O/D Phase* | | | Post-closure Conditions |
|---|---|---|---|---|---|---|
| | | | Availability (ha) | Change since Baseline (ha) | Change since Baseline (%) | |
| Subalpine fir–Alder–Horsetail (ESSFmv2/06 [FH]) | High | 8.6 | 7.9 | -0.7 | -8.1 | Partial recovery: reclamation unlikely to replicate all characteristics of original ecosystem unit, but edge effects associated with disturbance buffers on project components will lessen over time |
| | Moderate | 9.1 | 9.1 | 0.0 | 0.0 | Unchanged from baseline – no Project effect |
| | Low | 145.8 | 131.0 | -14.8 | -10.2 | Partial recovery: small area (6.3 ha) of permanent loss in mine footprint, elsewhere reclamation unlikely to replicate all characteristics of original ecosystem unit, but edge effects associated with disturbance buffers on project components will lessen over time |
| | *All classes* | *163.5* | *148.0* | *-15.5* | *-9.5* | |
| All ecological communities of conservation concern | Extremely high | 266.8 | 251.5 | -15.3 | -5.7 | Partial recovery: small area (9 ha) of permanent loss in mine footprint, elsewhere reclamation unlikely to replicate all characteristics of original ecosystem unit, but edge effects associated with disturbance buffers on project components will lessen over time |
| | High | 162.7 | 161.1 | -1.6 | -1.0 | |
| | Moderate | 86.6 | 81.3 | -5.3 | -6.1 | |
| | Low | 251.3 | 236.0 | -15.3 | -6.1 | |
| | *All classes* | *767.4* | *729.9* | *-37.5* | *-4.9* | |

**Notes:** * Phases 1 and 2 through Decommissioning/Reclamation.

be some minor clearing of old forest along the powerline right-of-way and new road segments (Figures 10.1.3-2 and 10.1.3-3), but in general the majority of the old forest in the LSA will only be subject to indirect effects within Project-related disturbance buffers.

The largest effect on old forest is within the Falling Creek Flats Loadout & Powerline LSA (39.2% [21.3 ha] affected) (Table 10.1.5-3). This effect is almost entirely related to the disturbance buffer around the coal stockpiles (see Section 10.1.2.9), as the actual cleared area is small (2.6 ha, see above).

In cleared areas, reclamation efforts will be directed at re-establishing forested stands, therefore, at Post-closure it is predicted that baseline conditions will recover in the far future (>140 years for old forest in the BWBS and SBS, and >250 years for forest in the ESSF). In addition, some degree of natural regeneration will take place. Whether old forest structural characteristics are also re-established within these reclaimed stands is unknown. In areas that are within disturbance buffers, it is even more likely that old forest types will return to baseline conditions. Old forest structural characteristics (e.g., multi-level canopy, presence of wildlife trees) should persist in these stands, unless windthrow is severe, although vegetation composition may be altered due to edge effects. The extent and duration of this alteration is unknown. A very small area (<1.0 ha) of old forest will be permanently lost within the mine footprint as a result of the post-closure retention of the Blind Pit walls (Figure 4.12.1-1).

As described in Section 10.1.3.2, it is important to note that the approach used to estimate old forest area likely overestimates the total area present.

**Table 10.1.5-2: Project-related Changes in Old Forest Area (ha) in the Local Study Area**

| Local Study Area | Area (ha) at Baseline | Area (ha) at C/O/D phase* | Change since Baseline (ha) | Change since Baseline (%) | Post-closure Condition |
|---|---|---|---|---|---|
| Brule Mine | 50.5 | 46.9 | -3.6 | -7.1 | Partial recovery: small area (< 1 ha) cleared in mine footprint will be permanently lost (remnant pit wall); ; edge effects within disturbance buffers will lessen over time |
| Mine Power Supply | 1,108.8 | 1,096.1 | -12.7 | -1.1 | Recovery likely: majority of affected area is within disturbance buffer, edge effects will lessen over time |
| Falling Creek Connector Haul Route | 209.1 | 194.4 | -14.7 | -7.0 | Recovery likely: majority of affected area is within disturbance buffer, edge effects will lessen over time |
| Falling Creek Flats Loadout & Powerline | 54.3 | 33.0 | -21.3 | -39.2 | Recovery likely: only small area cleared (2.6 ha) and eventual attainment of old forest structural stage assumed with reclamation efforts; edge effects within disturbance buffers will lessen over time |
| Project | 1,400.1 | 1,351.2 | -48.9 | -3.5 | Partial recovery: reclamation plus lessening of edge effects within disturbance buffers over time; very small area permanently lost |

**Note:** * Phases 1 and 2 through Decommissioning/Reclamation

### *10.1.5.3 Wetlands*

The proportion of the wetlands area in the LSA affected during Phases 1 and 2 through Decommissioning/Reclamation is relatively minor (2.7%, Table 10.1.5-3), and the total area involved is very small (5.1 ha). Very little of this area will be affected directly by the Project. Specifically, within the Brule Mine footprint, <1.0 ha of wetland will be directly removed and not reclaimed (Figures 10.1.3-1, 4.2.10-1 and 4.12.1-1), and no wetlands will be affected by the clearing proposed for the Falling Creek Flats Loadout (Figure 10.1.3-4). There may be some minor disruption to wetlands along the powerline right-of-way and new road segments (Figures 10.1.3-2 and 10.1.3-3), but in general the majority of the affected wetlands are only subject to indirect effects within Project-related disturbance buffers. There will be some recovery of affected wetlands in the Post-closure phase. As noted above, the majority of the affected wetlands area is within disturbance buffers, and not directly affected by the Project. Wetlands within these buffers will persist, assuming no substantial disruption of drainage patterns, although vegetation composition may be altered due to edge effects. The extent and duration of this alteration is unknown. As described previously, only a small wetland area (<.0 ha) will be permanently lost (i.e., cleared and not reclaimed) as a result of the Project.

As described in Section 10.1.3.3, it is important to note that the approach used to estimate wetland area likely underestimates the total area present.

**Table 10.1.5-3: Project-related Changes in Wetlands Area (ha) in the Local Study Area**

| Local Study Area | Area (ha) at Baseline | Area (ha) at C/O/D phase[1] | Change since Baseline (ha) | Change since Baseline (%) | Post-closure Condition |
|---|---|---|---|---|---|
| Brule Mine | 10.8 | 8.8 | -2.0 | -18.5 | Partial recovery: small area (< 1 ha) will not be reclaimed, but assuming no permanent alteration of moisture regime, edge effects within disturbance buffers will lessen over time (e.g., adjacent to Sediment Pond 1) |
| Mine Power Supply | 40.8 | 37.6 | -3.2 | -7.8 | Recovery likely: assuming no permanent alteration of moisture regime, edge effects within disturbance buffers will lessen over time |
| Falling Creek Connector Haul Route | 147.4 | 146.6 | -0.8 | -0.7 | Recovery likely: assuming no permanent alteration of moisture regime, edge effects within disturbance buffers will lessen over time |
| Falling Creek Flats Loadout & Powerline | 4.0[2] | 2.5 | -1.5 | -37.5 | Recovery likely: assuming no permanent alteration of moisture regime, edge effects within disturbance buffers will lessen over time |
| Project | 191.7[2] | 186.6 | -5.1 | -2.7 | Partial recovery: small permanent loss associated with mine site, recovery likely elsewhere |

**Note: 1.** Phases 1 and 2 through Decommissioning/Reclamation. **2.** Includes 1.4 ha of wetland just outside the LSA boundary that is within the disturbance buffer used for the coal stockpiles (see Section 10.1.2.9).

## 10.1.6 Residual Project Effects: Summary & Characterization

Based on the Project Effects Assessment described in Section 10.1.5, Residual Project Effects are further characterized and collated below for the three focal features. These Residual Project Effects are summarized in Table 10.1.6-1, and those that have the potential to contribute incrementally to cumulative effects in the RSA are subsequently identified for cumulative effects assessment.

In general, Residual Project Effects for the vegetation focal features are low in magnitude, local in geographic extent, continuous, and most are considered to be reversible, at least to some extent. The only exception is some ecological communities of conservation concern for which the effect is considered medium magnitude. Confidence ratings are medium for ecological communities of conservation concern, low to medium for old forest, and low for wetlands. These ratings are based on quality of spatial information, and level of understanding of the long-term recovery of each focal feature.

### *10.1.6.1 Ecological Communities of Conservation Concern*

The Residual Project Effect on ecological communities of conservation concern is considered to be of low to medium magnitude and far future in duration (Table 10.1.6-1), depending on the ecological community. Specifically, the effects on the Subalpine fir–Alder–Horsetail (ESSFmv2/06 [FH]), and White Spruce–Currant–Bluebells (BWBSmw1/06 [SC]) units are considered medium magnitude. Given the potentially permanent nature of the effect in some cases (i.e., not a full return to pre-disturbance community-specific conditions), this Residual Project Effect may contribute incrementally to Regional Cumulative Effects. A cumulative effects assessment is subsequently required (see Section 10.2.7).

### *10.1.6.2 Old Forest*

The Residual Project Effect on old forest is considered to be of low magnitude and far future in duration (Table 10.1.6-1). While old forest is moderately available in the RSA (10.2% of the total vegetated area), and only a small area is directly affected (cleared) by the Project (Section 10.1.5.2) and is likely to recover following reclamation, there will be a very small area (<1.0 ha) of old forest that is permanently lost due to post-closure retention of a pit wall, thus, this Residual Project Effect may contribute incrementally to Regional Cumulative Effects. A cumulative effects assessment is subsequently required (see Section 10.2.7).

### *10.1.6.3 Wetlands*

The Residual Project Effect on wetlands is considered to be of low magnitude and far future in duration (Table 10.1.6-1). However, given the relative scarcity of wetlands in the RSA (1.4% of the total vegetated area), and the permanent loss of a small wetland (<1.0 ha) due to Project

**Table 10.1.6-1: Residual Project Effects Matrix for Vegetation Focal Features. Residual Project Effects that might Contribute Incrementally to Cumulative Effects area highlighted.**

| Focal feature | Project phase[1] | Potential Project effect | Planned mitigation | Residual Project Effects (RPE) characterization[2] | | | | | RPE might contribute incrementally to cumulative effects? | RPE significance | Level of confidence in assessment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Magnitude | Geographic extent | Duration | Frequency | Reversibility | | | |
| Ecological communities of conservation concern | C/O/D | Loss | Progressive reclamation | Low-Medium | Local | Far future | Continuous | Irreversible | Yes | See Section 10.1.2.7 | Medium |
| | | Alteration | Dust control, invasive plant management | Low-Medium | Local | Long term | Continuous | Reversible? | No | Not significant | Medium |
| | P | Loss | -- | Low-Medium | Local | Far future | Continuous | Irreversible | Yes | See Section 10.1.2.7 | Medium |
| | | Alteration | Cessation of Project-related disturbances | Low-Medium | Site-specific | Long term | Continuous | Reversible? | No | Not significant | Medium |
| Old forest | C/O/D | Loss | Progressive reclamation | Low | Local | Far future | Continuous | Irreversible | Yes | See Section 10.1.2.7 | Low-Medium |
| | | Alteration | Dust control, invasive plant management | Low | Local | Long term | Continuous | Reversible? | No | Not significant | Low-Medium |
| | P | Loss | -- | Low | Local | Far future | Continuous | Irreversible | No | Not significant | Low-Medium |
| | | Alteration | Cessation of Project-related disturbances | Low | Site-specific | Long term | Continuous | Reversible? | No | Not significant | Low-Medium |
| Wetlands | C/O/D | Loss | None planned | Low | Local | Far future | Continuous | Irreversible | Yes | See Section 10.1.2.7 | Low |
| | | Alteration | Dust control, invasive plant management | Low | Local | Long term | Continuous | Reversible? | No | Not significant | Low |
| | P | Loss | -- | Low | Local | Far future | Continuous | Irreversible | Yes | See Section 10.1.2.7 | Low |
| | | Alteration | Cessation of Project-related disturbances | Low | Site-specific | Long term | Continuous | Reversible? | No | Not significant | Low |

**Notes: 1.** B=Baseline, C=Phase 1 (Construction), O=Phase 2 (Operations), D=Decommissioning/Reclamation, P=Post-Closure. **2.** Based on the assumption that mitigation measures are effective as planned. Refer to Table 10.1.2-2 for the classification schemes for these criteria. **3.** The significance of a Residual Project Effects is determined in the context of the potential to contribute incrementally to cumulative effects. Where a Residual Project Effects may contribute incrementally to cumulative effects, the determination of significance is advanced to the Residual Cumulative Effects assessment stage (see Section 10.1.8).

related effects (Section 10.1.5.3), this Residual Project Effect may contribute incrementally to Regional Cumulative Effects. A cumulative effects assessment is subsequently required (see Section 10.2.7).

### 10.1.7 Cumulative Effects Assessment

Residual Project Effects that might contribute incrementally to Regional Cumulative Effects were identified for ecological communities of conservation concern and wetlands (Section 10.1.6). The cumulative effects assessment for these focal features is a simple area comparison between Baseline and Phases 1 and 2 through Decommissioning/Reclamation, with a qualitative assessment of Post-closure conditions applied to the RSA (see Section 10.1.2.9).

In general, Project-related effects on ecological communities of conservation concern, old forest, and wetlands in the RSA are virtually non-existent at the regional scale (<1.0%, Table 10.1.7-1). The exception is the Subalpine fir–Alder–Horsetail (ESSFmv2/06 [FH]) unit for which Project effects result in a small (3.5%) decrease in unaffected area in the RSA during Phases 1 and 2 through Decommissioning/Reclamation (Table 10.1.7-1).

As discussed previously, where focal features are directly affected by the Project (i.e., cleared), there will be variation in the level of recovery during the Post-closure phase. For example, reclamation efforts are unlikely to replicate all characteristics of the original ecological communities of conservation concern, but given enough time old forest can be expected to re-establish (Table 10.1.7-1). However, for all focal features there will be a lessening of edge effects within the Project-related disturbance buffers during the Post-closure phase (Table 10.1.7-1).

**Table 10.1.7-1: Project-related Changes in Ecological Communities of Conservation Concern & Wetlands Area (ha) in the Regional Study Area**

| Unit | Area (ha) at Baseline | Area (ha) at C/O/D phase* | Change since Baseline (ha) | Change since Baseline (%) | Post-closure Condition |
|---|---|---|---|---|---|
| White Spruce–Currant–Bluebells (BWBSmw1/06 [SC]) | 1,412.8 | 1,401.1 | -11.7 | -0.8 | Partial recovery: reclamation unlikely to replicate all characteristics of original ecosystem unit, but edge effects associated with Project-related disturbance buffers will lessen over time |
| White Spruce–Currant–Oak fern (BWBSmw1/05 [SO]) | 2,301.4 | 2,296.8 | -4.6 | -0.2 | Partial recovery: reclamation unlikely to replicate all characteristics of original ecosystem unit, but edge effects associated with Project-related disturbance buffers will lessen over time |
| White Spruce–Huckleberry–Step moss (BWBSwk1/01 [SM]) | 53.4 | 53.4 | 0.0 | 0.0 | No Project effect |

| Unit | Area (ha) at Baseline | Area (ha) at C/O/D phase* | Change since Baseline (ha) | Change since Baseline (%) | Post-closure Condition |
|---|---|---|---|---|---|
| Lodgepole pine–Black Huckleberry–Reindeer lichen (SBSwk2/02 [LH]) | 2,452.9 | 2,447.2 | -5.7 | -0.2 | Partial recovery: small area of permanent loss in mine site, elsewhere reclamation unlikely to replicate all characteristics of original ecosystem unit, but edge effects associated with Project-related disturbance buffers will lessen over time |
| Subalpine fir–Alder–Horsetail (ESSFmv2/06 [FH]) | 448.3 | 432.8 | -15.5 | -3.5 | Partial recovery: small area of permanent loss in mine site, elsewhere reclamation unlikely to replicate all characteristics of original ecosystem unit, but edge effects associated with Project-related disturbance buffers will lessen over time |
| Old forest | 9,173.7 | 9,124.8 | -48.9 | -0.5 | Partial recovery: very small permanent loss associated with mine site, recovery likely elsewhere through reclamation and lessening of edge effects |
| Wetlands | 1,228.6 | 1,223.5 | -5.1 | -0.4 | Partial recovery: very small permanent loss associated with mine site, recovery likely elsewhere (i.e., within Project-related disturbance buffers) |

**Note:** ***** Phases 1 and 2 through Decommissioning/Reclamation.

### 10.1.8 Residual Cumulative Effects: Summary & Characterization

Based on the Cumulative Effects Assessment described in Section 10.1.7, Residual Cumulative Effects are further characterized for vegetation community loss or alteration in a regional context. Tables 10.1.8-1 to 10.1.8-3 summarize these effects for all three focal features, and any Residual Cumulative Effects are identified and assessed for their significance, and the Project's contribution to Residual Cumulative Effects is evaluated.

The significance of existing Residual Cumulative Effects on the ecological communities of conservation concern is considered to be medium, even in the absence of the incremental effects of future projects[22] (Table 10.1.8-1). There has undoubtedly been some loss of ecological communities of conservation concern due to logging and land clearing in the region. In fact, the CDC's rationale for the identification of forested units, such as White Spruce–Currant–Bluebells (BWBSmw1/06 [SC]) and White Spruce–Currant–Oak fern (BWBSmw1/05 [SO]), as ecological communities of conservation concern includes consideration of losses of undisturbed areas due to forest harvesting.

The significance of existing Residual Cumulative Effects on old forest is also considered to be medium, again, even in the absence of the incremental effects of future projects (Table 10.1.8-2). There has been loss of old forest due to logging and land clearing in the

[22] As discussed in Section 10.1.2.9, no projects were identified for the foreseeable future in this cumulative effects assessment. However, forestry-related activities, as well as those of other industries (e.g., oil and gas) are expected to occur.

**Table 10.1.8-1: Summary of Residual Cumulative Effects: Ecological Communities of Conservation Concern**

| EvaluationScenario[1] | Potential Cumulative Effect | Planned Mitigation | Residual Cumulative Effects (RCE) characterization[2] | | | | | RCE Significance | Project contribution to RCE | Level of Confidence |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Magnitude | Geographic Extent | Duration | Frequency | Reversibility | | | |
| RCE without the Project (B through foreseeable future) | Vegetation community loss | Forest regulations | Medium | Regional | Far future | Continuous | Reversible? | Significant | - | Medium |
| Project Contribution (C, O, D) | | Progressive reclamation, dust control, invasive plant management | Low | Regional | Far future | Continuous | Reversible? | - | Not significant | Medium |
| Project Contribution (P) | | Cessation of disturbance activities | Low | Regional | Far future | Continuous | Reversible? | - | Not significant | Medium |
| RCE with the Project (C, O, D, P) | | Forest regulations | Medium | Regional | Far future | Continuous | Reversible? | Significant | - | Medium |

**Notes: 1.** B=Baseline, C=Phase 1 (Construction), O=Phase 2 (Operations), D=Decommissioning/Reclamation, P=Post-Closure. **2.** Based on the assumption that mitigation measures are effective as planned. Refer to Table 10.1.2-2 for the classification schemes for these criteria.

**Table 10.1.8-2: Summary of Residual Cumulative Effects: Old Forest**

| EvaluationScenario[1] | Potential Cumulative Effect | Planned Mitigation | Residual Cumulative Effects (RCE) characterization[2] | | | | | RCE Significance | Project contribution to RCE | Level of Confidence |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Magnitude | Geographic Extent | Duration | Frequency | Reversibility | | | |
| RCE without the Project (B through foreseeable future) | Vegetation community loss | Forest regulations | Medium | Regional | Far future | Continuous | Reversible? | Significant | - | Medium |
| Project Contribution (C, O, D) | | Progressive reclamation, dust control, invasive plant management | Low | Regional | Far future | Continuous | Reversible? | - | Not significant | Low-Medium |
| Project Contribution (P) | | Cessation of disturbance activities | Low | Regional | Far future | Continuous | Reversible? | - | Not significant | Low-Medium |
| RCE with the Project (C, O, D, P) | | Forest regulations | Medium | Regional | Far future | Continuous | Reversible? | Significant | - | Medium |

**Note:** See Table 10.1.8-1.

**Table 10.1.8-3: Summary of Residual Cumulative Effects: Wetlands**

| EvaluationScenario[1] | Potential Cumulative Effect | Planned Mitigation | Residual Cumulative Effects (RCE) characterization[2] | | | | | RCE Significance | Project contribution to RCE | Level of Confidence |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Magnitude | Geographic Extent | Duration | Frequency | Reversibility | | | |
| RCE without the Project (B through foreseeable future) | Vegetation community loss | Forest regulations | Low | Regional | Far future | Continuous | Reversible? | Not significant | - | Medium |
| Project Contribution (C, O, D) | | Progressive reclamation, dust control, invasive plant management | Low | Regional | Far future | Continuous | Reversible? | - | Not significant | Low |
| Project Contribution (P) | | Cessation of disturbance activities | Low | Regional | Far future | Continuous | Reversible? | - | Not significant | Low |
| RCE with the Project (C, O, D, P) | | Forest regulations | Low | Regional | Far future | Continuous | Reversible? | Not significant | - | Medium |

**Note:** See Table 10.1.8-1.

region—some of which may be permanent. The level of old forest harvest in the region is controlled by forest practices standards, and Landscape Unit targets for old forest representation within specific BEC variants (MOF 1999).

The significance of existing Residual Cumulative Effects on wetlands is considered to be low (Table 10.1.8-3). There has likely been some direct loss of wetlands in the region due to agricultural land conversion; however, the most common potential effects on wetlands in the Project area have been and will continue to come from forest harvesting, and to varying extents the degree of that effect is controlled by forest practices standards.

Project-related changes in the area of unaffected wetlands, old forest, and ecological communities of conservation concern in the RSA are predicted to be small to nil during Phases 1 and 2 through Decommissioning/Reclamation (Table 10.1.7-1). There will be at least partial recovery of all affected focal features with decommissioning and reclamation of the mine site, closure and reclamation of the loadout, and deactivation of new Connector Route segments under WCC control (see Section 4.12). Therefore, the incremental contribution of the Project to existing Residual Cumulative Effects in the RSA is considered not significant for any of the three focal features (Tables 10.2.8-1 to 10.1.8-3).

### 10.1.9 Monitoring

No specific monitoring programs are proposed for vegetation in this section; however, several vegetation monitoring programs are described in the Conceptual Reclamation Plan (Section 4.12). In brief, the plan states that 1) reclamation success will be monitored using parameters such as productivity (e.g., growth), community composition, and sustainability parameters (e.g., species presence, stand density); 2) noxious weed assessments will be conducted on all disturbed mine areas; and 3) foliar tissue sampling will be used to evaluate wildlife forage quality following reclamation (see Section 4.12 for details).

## 10.2 Forest Capability

### 10.2.1 Introduction

The following section provides an assessment of residual effects of the Brule Mine Project on forest capability. The section describes the assessment approach and methods; baseline forest capability conditions; potential effects, and mitigation measures, and presents an assessment of predicted residual Project and residual cumulative effects on forest capability. In this discussion, the term “capability” is used to refer to a site’s potential to support forest stands, regardless of current conditions, and corresponds to forestry concepts of “site” or “potential” productivity. This assessment thus addresses any potential fundamental effects to the productive forest land base, as opposed to transient effects to actual fibre production on the assessed sites.

### 10.2.2 Approach & Methods

#### *10.2.2.1 Key Issues*

The key issue for forest capability with respect to the Brule Mine Project is the potential for reduction in forest capability as a result of Project development.

#### *10.2.2.2 Project Components Assessed*

The primary Project components assessed for potential effects on forest capability are the Brule Mine site, Falling Creek Flats Loadout, and the Falling Creek Connector Haul Route. The mine and loadout power supply lines were also considered, however powerline development is not expected to affect forest capability, as soils disturbance would be minimal.

#### *10.2.2.3 Temporal Boundaries*

To assess potential Project effects on forest capability, five assessment phases were considered:

*Baseline (B)* – Represents vegetation conditions prior to any Project-specific developments. The baseline conditions for vegetation incorporate the effects of existing human-caused disturbances, including the Dillon Mine footprint (assuming no reclamation) and its associated linear features.

*Construction/Preliminary Operations (Phase 1) (C)* – Represents conditions during construction and preliminary (low production) operations activities. These are the activities that occur until haulage begins to the Falling Creek Flats Loadout, expected in 2007.

*Full Operations (Phase 2) (O)* – Represents conditions during full production operations, when product coal is being hauled to the Falling Creek Flats Loadout – expected to be from 2007 to closure in 2017.

*Decommissioning/Reclamation (D)* – Represents conditions during the final decommissioning and reclamation period, expected to take place for a two to three year period beginning in 2017.

*Post-Closure (P)* – Represents conditions forecast into the future following completion of decommissioning and reclamation. This time frame includes post-implementation of the Conceptual Reclamation Plan (Section 4.12).

The potential for effects on forest capability will begin during construction and continue through decommissioning / reclamation. Construction, Operations, and Decommissioning / Reclamation were therefore combined in the summary effects tables.

### *10.2.2.4 Spatial Boundaries*

#### 10.2.2.4.1 Local Study Areas

Three "project component" Local Study Areas (LSAs) were defined for the forest capability assessment. Each project component LSA is delineated by the predicted footprint of soil disturbance. The areas of the project component LSAs are: Brule Mine – 743.6 ha; Falling Creek Connector Haul Route – 39.5 ha on new road segments and 9 ha on existing segments; and Falling Creek Flats Loadout – 29.5 ha. The actual mine facility footprint area is approximately 576 ha (635.4 ha of facility areas at the Brule Mine at full build-out, minus 59.7 ha for the Dillon Mine, which is an already permitted and existing site disturbance), however the buffered facility footprint was used as the LSA for the mine to allow for some equipment activity outside the perimeters of individual mine facilities. This is a conservative estimation, as it expected that only a portion of the buffered areas - which are 50 to 100 m plus around the exterior perimeter – The general approach for the cumulative would be affected. Powerline rights-of-way (ROW), which are 15 m wide, were examined for existing forest capability within the ROWs. However there are no defined LSAs and no effects assessments were completed for the powerlines, as site and soil disturbance is expected to be very minor.

#### 10.2.2.4.2 Regional Study Area

A Regional Study Area (RSA) was used to describe effects on forest capability in a regional context. The RSA for forest capability is the same as is used for the vegetation assessment (refer to Section 10.1) and the wildlife assessment (refer to Section 10.3). It is a 1,010 $km^2$ area that extends, approximately, from the south side of the Pine River to the northern boundary of the Rocky Creek watershed, west to Falling Creek and east to the Sukunka River (Figure 10.1.2-1).

### *10.2.2.5 Project Effects Assessment*

The general approach for the Project effects assessment is described in Section 6. For forest capability, these steps were:

- Identify potential Project effects on forest capability, in consideration of proposed management plans, design modifications, and mitigation measures intended to reduce potentially adverse effects.
- Identify and characterize Residual Project Effects[23] based on the assumption that technically and economically feasible mitigation measures have been implemented and are effective as described—these mitigation measures are to be considered before proceeding to the next step.

[23] Residual Project Effects are Project effects not considered to be fully addressed by the proposed mitigation measures.

- Determine if Residual Project Effects might contribute incrementally to regional cumulative effects[24] and must, therefore, be considered in the cumulative effects assessment (Section 10.1.2.7).

Five effects criteria were considered in evaluating each Residual Project Effect: magnitude, geographic extent, duration, frequency, and reversibility. These criteria were assessed in the context of the nature of potential effects, the mitigation strategies that are available for reducing or eliminating such effects, and the nature and anticipated severity of residual effects after mitigation. The classification schemes for each criterion are described in Table 10.2.2-1. Additionally, a confidence level was applied to each Residual Project Effect characterization. This confidence rating considered the accuracy and application of analytical tools and an understanding of the effectiveness of mitigation measures.

If it is determined that one or more Residual Project Effects might contribute incrementally to regional cumulative effects then a cumulative effects assessment is required (Section 10.2.2.6). This determination is based on the aforementioned criteria, and on an evaluation of the Residual Project Effect (i.e., reduction in forest capability) in a regional context.

**Table 10.2.2-1: Brule Mine Project – Forest Capability Residual Project Effects Ratings Criteria**

| Criterion | Description |
|---|---|
| Magnitude | **Low**: no or negligible measurable effects<br>**Medium**: measurable effects, but negligible adverse effects, or adverse effects adequately offset through mitigation<br>**High**: measurable, non-offset adverse effects |
| Geographic Extent | **Site-specific**: effects confined to the Local Study Area (LSA) |
| | **Regional**: effects occur beyond the LSA |
| Duration | **Short term**: effects limited to <1 year |
| | **Medium term**: effects occur >1 year, but not beyond the life of the project |
| | **Long term**: effects last up to 10 years beyond the life of the project |
| | **Far future**: effects extend >10 years beyond the life of the project |
| Frequency | **Once**: occurs once |
| | **Continuous**: occurs on a regular basis and regular intervals |
| | **Sporadic**: occurs rarely and at regular intervals |
| Reversibility | R = Reversible |
| | I = Irreversible |
| Significance (1) | **Significant**: effects with magnitude, extent and duration combinations of:<br>• high magnitude, more than site-specific in geographic extent, or<br>• high magnitude, site-specific geographic extent, and far future duration |
| | **Not Significant:** effects of all other magnitude and duration combinations |
| Level of Confidence | **Low**: do not have confidence in prediction, could vary considerably |
| | **Medium**: confidence in prediction, moderate variability |
| | **High**: confidence in prediction, low variability |

**Notes: 1.** To determine the significance of residual project or cumulative effects, magnitude and duration are the primary determinants of the significance rating, with geographic extent used to qualify certain ratings.

[24] The significance of Residual Project Effects was determined based on an understanding of localized effects in a regional context, as the arbitrary nature of local study areas typically overestimates adverse effects on a resource. Therefore, the relative contribution of Residual Project Effects to regional cumulative effects was evaluated.

### *10.2.2.6 Cumulative Effects Assessment*

The general approach for the cumulative effects assessment is described in Section 6 of the Application. Specifically, for forest capability these steps are:

- Determine conditions for forest capability within the RSA in the absence of the Project (i.e., conditions at Baseline and into the foreseeable future[25]), and characterize and evaluate the significance of any Residual Cumulative Effects.
- Determine the incremental effects of the Project to cumulative effects ("Project contribution") on forest capability for the development phases under consideration.
- Determine conditions for the forest capability within the RSA and for the development phases under consideration, in the context of both the Project and all other projects and activities[26], and characterize and evaluate the significance of any Residual Cumulative Effects and the Project's contribution to those Residual Cumulative Effects.

The RSA boundaries for the forest capability cumulative effects assessment are the same as those described for the vegetation cumulative effects assessment in Section 10.1.2.5. As with the assessment of Residual Project Effects, five effects criteria were considered in evaluating each Residual Cumulative Effect: magnitude, geographic extent, duration, frequency, and reversibility. Ratings for several of these criteria differ from those presented for residual Project effects. The classification schemes for the cumulative effects ratings criteria are presented in Table 10.2.2-2. Again, these criteria are assessed in the context of mitigation strategies that are available for reducing or eliminating such effects.

**Table 10.2.2-2: Brule Mine Project – Forest Capability Residual Cumulative Effects Ratings Criteria**

| Criterion | Description |
|---|---|
| Magnitude | **Low**: no or negligible effects |
| | **Medium**: measurable effects, but project effects <1% of the RSA, less than 50% of existing/approved disturbance, and maintains total disturbance at <5% of the RSA. |
| | **High**: measurable effects, project effects ≥1% of the RSA, ≥50% of existing/approved disturbance, or causes total disturbance of ≥5% of the RSA. |
| Geographic Extent | **Site-specific**: effects confined to the Local Study Area (LSA) |
| | **Regional**: effects occur beyond the LSA |
| Duration | **Short term**: effects limited to <1 year |
| | **Medium term**: effects occur >1 year, but not beyond the life of the project |
| | **Long term**: effects last up to 10 years beyond the life of the project |
| | **Far future**: effects extend >10 years beyond the life of the project |
| Frequency | **Once**: occurs once |
| | **Continuous**: occurs on a regular basis and regular intervals |

[25] Although no spatial data was available for potential future developments in the RSA, the cumulative effects assessment considers this potential influence in a general sense with respect to this Project
[26] See footnote above

| Criterion | Description |
|---|---|
| | **Sporadic**: occurs rarely and at regular intervals |
| Reversibility | Reversible |
| | Partially Reversible |
| | Irreversible |
| Significance (1) | **Significant**: effects with magnitude, extent and duration combinations of:<br>• medium magnitude and far future duration, or<br>• high magnitude, more than site-specific in geographic extent, or<br>• high magnitude, site-specific geographic extent, and far future duration |
| | **Not Significant:** effects of all other magnitude and duration combinations |
| Level of Confidence | **Low**: do not have confidence in prediction, could vary considerably |
| | **Medium**: confidence in prediction, moderate variability |
| | **High**: confidence in prediction, low variability |

**Notes: 1.** To determine the significance of residual project or cumulative effects, magnitude and duration are the primary determinants of the significance rating, with geographic extent used to qualify certain ratings.

#### *10.2.2.7 Analytical Techniques*

For all assessed project components, pre-development forest capability was determined using Site Index – Biogeoclimatic Ecosystem Classification (SIBEC) correlations (Ministry of Forests, 2005), based on Predictive or Terrestrial Ecosystem Mapping (PEM or TEM). SIBEC correlates capability (site index, or height of largest diameter (at breast-height) site tree on a 0.01 ha plot, age 50) with ecological classification units (site series), and is the currently accepted method in British Columbia for estimating site productivity without on-site measurements. Site index categories used in assessment are based on estimates for lodgepole pine (*Pinus contorta*) and hybrid white spruce (*Picea glauca* x *engelmannii*), and were defined as follows:

- Low – site index <15 m;
- Moderate – site index 15 to 20 m; and
- High – site index >20 m.

Sites with moderate-high forest capability are having the potential to be suitable for commercial forestry operations, while those in the low category are generally non-commercial.

#### *10.2.2.8 Effects of Consultation on the Assessment*

No specific concerns regarding potential Project effects on forest capability were raised during the Brule Mine Pre-Application period.

## 10.2.3 Brule Mine Site

### *10.2.3.1 Baseline Conditions*

Forest capability prior to mining disturbance within the Brule Mine footprint is summarized in Table 10.2.3-1, below. This information indicates that 71 percent of the area has moderate-high baseline forest capability, 25% of the area has low baseline forest capability, and the remaining 4% is non-forested sites (including exposed soil, organic bogs, and anthropogenic environments).

**Table 10.2.3-1: Pre-Mining Ecosystem Units & Forest Capability for the Brule Mine Site**

| Biogeoclimatic Subzone | Site Series | Map Code | Name | Site index Category | Area (ha) |
|---|---|---|---|---|---|
| ESSFmv2 | 01 | FR | Bl – Rhododendron – feathermoss | moderate | 285.6 |
| | 02 | FL | Bl – Lingonberry | low | 122.1 |
| | 03 | BT | BlSb – Labrador Tea | low | 69.6 |
| | 04 | FO | Bl – Oakfern – Knight's Plume | moderate | 58.3 |
| | 05 | FD | Bl – Devil's Club – Rhododendron | moderate | 10.3 |
| | 06 | FH | Bl – Alder – Horsetail | moderate | 28.9 |
| | 00 | ES | Exposed soil | non-forested | 19.4 |
| | 00 | RW | Rural | non-forested | 3.6 |
| SBSwk2 | 01 | SO | Swx – Oakfern | high | 77.3 |
| | 02 | LH | Pl – Huckleberry – Cladina | moderate | 5.5 |
| | 03 | SC | Sxw – Huckleberry – Highbush cranberry | moderate | 13.5 |
| | 04 | BF | SbPl – Feathermoss | moderate | 24.8 |
| | 05 | SD | Sxw – Devil's Club | high | 10.2 |
| | 06 | SH | Sxw – Horsetail | high | 10.1 |
| | 00 | SS | Sedge – Sphagnum | non-forested | 4.4 |
| | | | | **Total Area** | **743.6** |
| | | | Summary of Forest Capability Areas | | |
| | | | | High Capability | 97.6 |
| | | | | Moderate Capability | 426.9 |
| | | | | Low Capability | 191.7 |
| | | | | Non-Forested | 27.4 |

### *10.2.3.2 Assessment of Potential Project Effects, Mitigation Measures, & Residual Effects*

The following section presents information on effects on forest capability and mitigation of these effects for the Brule Mine site (information for the Falling Creek Flats loadout facility is provided in Section 10.2.2). The Local Study Area used for the purpose of evaluating residual project effects on forest capability is the buffered facility footprint.

The potential effect of mining operations on forest capability is alteration of this capability through disturbance. This effect will be mitigated through subsequent reclamation, but is not expected to be fully addressed or offset. Reclamation measures, including those to mitigate effects on forest capability, are presented in Section 4.12. Post-closure forest capability predicted to result from these measures (using methods identical to those employed in the baseline assessment) are summarized in Table 10.2.3-2.

**Table 10.2.3-2: Post-Mining Ecosystem Units & Forest Capability for the Brule Mine Site**

| Biogeoclimatic Subzone | Site Series | Map Code | Name | Site index Category | Area (ha) |
|---|---|---|---|---|---|
| ESSFmv2 | 01 | FR | Bl – Rhododendron – feathermoss | moderate | 331.5 |
| | 02 | FL | Bl – Lingonberry | low | 170.7 |
| | 03 | BT | BlSb – Labrador Tea | low | 18.9 |
| | 04 | FO | Bl – Oakfern – Knight's Plume | moderate | 14.5 |
| | 05 | FD | Bl – Devil's Club – Rhododendron | moderate | 3.7 |
| | 06 | FH | Bl – Alder – Horsetail | moderate | 4.4 |
| | 00 | ES | Exposed soil | non-forested | 5.7 |
| | 00 | PD | Pond | non-forested | 4.5 |
| | 00 | RO | Rock Outcrop | non-forested | 83.2 |
| | 00 | ZR | Road | non-forested | 4.1 |
| SBSwk2 | 01 | SO | Swx – Oakfern | high | 42.1 |
| | 02 | LH | Pl – Huckleberry – Cladina | moderate | 2.7 |
| | 03 | SC | Sxw – Huckleberry – Highbush cranberry | moderate | 27.4 |
| | 04 | BF | SbPl – Feathermoss | moderate | 10.6 |
| | 05 | SD | Sxw – Devil's Club | high | 5.4 |
| | 06 | SH | Sxw – Horsetail | high | 9.8 |
| | 00 | SS | Sedge – Sphagnum | non-forested | 4.4 |
| | | | | **Total Area** | **743.6** |
| | | | Summary of Forest Capability Areas | | |
| | | | | High Capability | 57.3 |
| | | | | Moderate Capability | 394.8 |
| | | | | Low Capability | 189.6 |
| | | | | Non-Forested | 101.9 |

Baseline forest capability is summarized in Table 10.2.1.1. Residual project effects determined from a comparison of pre- and post-disturbance forest capability are summarized in Table 10.2.3-3, below, with definitions for terms provided in Table 10.2.2-1.

**Table 10.2.3-3: Summary of Residual Project Effects: Forest Capability for the Brule Mine Site**

| Project Phase[1] | Potential Project Effect | Planned Mitigation | Residual Project Effects (RPE) Characterization[2] | | | | | RPE might Contribute Incrementally to Cumulative effects? | RPE Significance[3] | Level of Confidence in Assessment |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Magnitude | Geographic Extent | Duration | Frequency | Reversibility | | | |
| C/O/D | Alteration to Forest Capability | Reclamation (see Section 4.12) | Medium | Site-specific | Long term | Once | Mostly Reversible | Yes | See RCE | Medium |
| P | Alteration to Forest Capability | n/a | High | Site-specific | Far future | Once | Irreversible | Yes | See RCE | Medium |

**Notes: 1.** C=Construction, O=Operations, D=Decommissioning/Reclamation, P=Post-Closure. **2.** Based on the assumption that mitigation measures are effective as planned. Refer to Residual Effects Rating Criteria (Table 10.2.1.2-3) for definitions. **3.** The significance of RPEs are determined in the context of the potential to contribute incrementally to cumulative effects. Where a RPE may contribute incrementally to cumulative effects, the determination of significance is advanced to the Residual Cumulative Effects (RCE) assessment stage. n/a = Not Applicable.

The effects of development of the Brule mine site on forest capability are summarized as follows:

- Construction/Operations/Decommissioning Phases – effects are confined to the mine site (site-specific), long term in duration (lasting for the duration of mine life or until areas are reclaimed), and are partially reversible, through reclamation. Effects occur once for each area affected, although effects will accumulate over time on the mine site. Development of the mine, at the time of maximum disturbance, will result in removal of all forest capability from 575.7 ha (635.4 ha of soils disturbance at the Brule mine at full build-out, minus 59.7 ha on the Dillon mine, which is an already permitted and existing disturbance). The magnitude of this disturbance is rated as medium, as these effects are measurable, but will be addressed through mitigation. Effects on forest capability have the potential to contribute incrementally to cumulative effects. Confidence in this assessment is medium, as the prediction of post-closure forest capability is based on an understanding of post-closure terrain and soil conditions and on the implications of these conditions for development of post-closure ecosystems, but there will be variation in actual performance on reclaimed sites.
- Post-Closure Phase – effects are confined to the mine site (site-specific), far-future in duration (lasting past the life of the project). The residual effects remaining subsequent to reclamation are considered to be irreversible. Effects occur once for each area affected. Changes post-closure in comparison to the pre-disturbance setting are summarized in Table 10.2.3-4, below. This information indicates that mine development will result in the loss of area in all forested classes, and an increase in non-forested classes (primarily unreclaimed pit walls). The largest decrease, both absolutely and relatively, will occur in the "High" forest capability class, although some area in all classes is predicted to be replaced through reclamation. The magnitude of this effect is rated as high, as these effects are measurable and are the predicted post-mitigation effects (will not be offset through mitigation). These effects have the potential to contribute incrementally to cumulative effects. Confidence in this assessment is medium, as the prediction of post-closure forest capability is based on an understanding of post-closure terrain and soil conditions and on the implications of these conditions for development of post-closure ecosystems, but there will be variation in actual performance on reclaimed sites.

**Table 10.2.3-4: Summary of Forest Capability Changes at the Brule Mine Site, Post-Closure**

| Forest Capability Class | Area (ha) | | Post-Closure Change from Pre-Disturbance | |
|---|---|---|---|---|
| | Pre-Disturbance | Post-Closure | Hectares | Percent |
| High | 97.6 | 57.3 | -40.3 | -41 |
| Moderate | 426.9 | 394.8 | -32.1 | -8 |
| Low | 191.7 | 189.6 | -2.1 | -1 |
| Non-Forested | 27.4 | 101.9 | 74.5 | 272 |
| **Total** | **743.6** | **743.6** | | |

Development at the Brule Mine Site is predicted to affect forest capability on the site, initially through elimination of area capable of supporting forest stands during mine construction, operations and decommissioning, and ultimately through alterations to forest capability on the reclaimed site resulting from alterations to soil and surficial-material conditions. These effects are rated as having medium-high magnitudes in the Local Study Area, as they are measurable, and, in the case of the permanent or post-closure effects, are not entirely offset through mitigation. Significance of these effects is considered in the cumulative effects assessment (Section 10.2.7).

## 10.2.4 Falling Creek Flats Loadout

### *10.2.4.1 Baseline Conditions*

Forest capability prior to mining disturbance within the Loadout Facility footprint is summarized in Table 10.2.4-1, below. This information indicates that 96% of the area has moderate-high forest capability, with the remaining 4% comprised of non-forested units (wetlands).

**Table 10.2.4-1: Pre-Mining Ecosystem Units & Forest Productivity for the Brule Mine Loadout Facility**

| Biogeoclimatic Subzone | Site Series | Map Code | Name | Site Index Category | Area (ha) |
|---|---|---|---|---|---|
| SBSwk2 | 01 | SO | Sxw – Oak fern | high | 3.8 |
| | 05 | SD | Sxw – Devils' Club | high | 1.2 |
| | 06 | SH | Sxw – Horsetail | high | 19.0 |
| | 07 | - | Sb – Labrador tea - sphagnum | non-forested | 0.1 |
| | 32 | - | Non-forested fen/marsh | non-forested | 0.3 |
| BWBSmw1 | 00 | WW | Fuzzy-spiked wildrye – Coyote willow | non-forested | 0.8 |
| | 06 | SC | Sw – Currant – Bluebells | moderate | 4.3 |
| | | | | **Total Area** | **29.5** |
| | | | **Summary of Forest Capability Areas** | | |
| | | | | High Capability | 24.0 |
| | | | | Moderate Capability | 4.3 |
| | | | | Low Capability | 0.0 |
| | | | | Non-Forested | 1.2 |

### *10.2.4.2 Assessment of Potential Project Effects, Mitigation Measures, & Residual Effects*

The following section presents information on effects on forest capability and mitigation of these effects for the Falling Creek Flats loadout facility. The Local Study Area used for the purpose of evaluating residual project effects on forest capability is the facility soil disturbance footprint, with a total area of 29.5 ha.

The effect of the loadout facility on forest capability is the removal of forest capability on 29.5 ha of disturbance within the facility footprint for the period of construction and operation. This effect is a temporary one, as reclamation of the facility following mine closure will return forest capability to pre-disturbance conditions (see the Reclamation Plan, Section 4.12, for more detail on mitigation measures for the loadout facility). Thus, residual project effects are present only in the construction, operation, and decommissioning phases. These effects are summarized in Table 10.2.4-2, below, with definitions for terms provided in Table 10.2.2-1.

The residual effects of development of the Falling Creek Flats loadout facility on forest capability are summarized as follows. Effects are confined to the facility site (site-specific), long term in duration (not lasting more than 10 years past the life of the project), and reversible, through reclamation. Effects occur once as areas are cleared and occupied, and persist until reclamation. Development of the facility, at the time of maximum disturbance, will result in removal of all forest capability from 29.5 ha. The magnitude of this disturbance is rated as medium, as these effects are measurable, but will be addressed through mitigation. Effects on forest capability have the potential to contribute incrementally to cumulative effects. Confidence in this assessment is medium, as the prediction of post-closure forest capability is based on an understanding of post-closure terrain and soil conditions and on the implications of these conditions for development of post-closure ecosystems, but there will be variation in actual performance on reclaimed sites.

Development at the Falling Creek Flats Loadout facility is predicted to affect forest capability on the site during the construction, operation and decommissioning phases, through elimination of area capable of supporting forest stands. This effect is rated as having a medium magnitude in the Local Study Area, as it is measurable, but it will be fully reversed through reclamation.

## 10.2.5 Falling Creek Connector Haul Route

### *10.2.5.1 Baseline Conditions*

Forest capability prior to disturbance along the Haul Route is summarized in Tables 10.2.5-1 and 10.2.5-2, below. The first of these tables summarizes baseline forest capability conditions along new segments of the Haul Route (segments 2, 4, 7 and 9 – for more detail on route location and construction, see Section 3.4.2 and Table 3.4.2-2), with areas representing the total planned running width of these segments. The second table summarizes conditions along existing segments of road where mine transport activities require widening of the existing running surface (segments 3, 5, 6, 8, and 10) – areas reported in these tables are the incremental increases in running width.

**Table 10.2.5-1: Summary of Residual Project Effects: Forest Capability at the Falling Creek Flats Loadout**

| Project Phase[1] | Potential Project Effect | Planned Mitigation | Residual Project Effects (RPE) Characterization[2] | | | | | RPE might Contribute Incrementally to Cumulative effects? | RPE Significance[3] | Level of Confidence in Assessment |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Magnitude | Geographic Extent | Duration | Frequency | Reversibility | | | |
| C/O/D | Removal of Forest Capability | Reclamation (see Section 4.12) | Medium | Site-specific | Long term | Once | Reversible | Yes | See RCE | Medium |

**Notes: 1.** C=Construction, O=Operations, D=Decommissioning/Reclamation, P=Post-Closure. **2.** Based on the assumption that mitigation measures are effective as planned. Refer to Residual Effects Rating Criteria (Table 10.2.2.2-2) for definitions. **3.** The significance of RPEs are determined in the context of the potential to contribute incrementally to cumulative effects. Where a RPE may contribute incrementally to cumulative effects, the determination of significance is advanced to the Residual Cumulative Effects (RCE) assessment stage. n/a = Not Applicable.

**Table 10.2.5-2: Pre-Mining Ecosystem Units & Forest Capability for the Falling Creek Connector Haul Route – New Segments**

| Biogeoclimatic Subzone | Site Series | Map Code | Name | Site index Category | Area (ha) |
|---|---|---|---|---|---|
| | | | **Segment 2** | | |
| ESSFmv2 | 02 | FL | Bl – Lingonberry | low | 2.05 |
| | 06 | FH | Bl – Alder – Horsetail | moderate | 0.02 |
| SBSwk2 | 01 | SO | Swx – Oakfern | high | 0.20 |
| | 03 | SC | Sxw – Huckleberry – Highbush cranberry | moderate | 0.29 |
| | | | | | |
| | | | | **Total Area** | **2.56** |
| | | | Summary of Forest Capability Areas | | |
| | | | | High Capability | 0.20 |
| | | | | Moderate Capability | 0.31 |
| | | | | Low Capability | 2.05 |
| | | | | Non-Forested | 0.00 |
| | | | **Segment 4** | | |
| ESSFmv2 | 01 | FR | Bl – Rhododendron – feathermoss | moderate | 7.19 |
| | 02 | FL | Bl – Lingonberry | low | 4.66 |
| | 04 | FO | Bl – Oakfern – Knight's Plume | moderate | 1.77 |
| | 05 | FD | Bl – Devil's Club – Rhododendron | moderate | 0.07 |
| | 06 | FH | Bl – Alder – Horsetail | moderate | 0.76 |
| SBSwk2 | 03 | SC | Sxw – Huckleberry – Highbush cranberry | moderate | 0.28 |
| | 05 | SD | Sxw – Devil's Club | high | 0.03 |
| | | | | **Total Area** | **14.76** |
| | | | Summary of Forest Capability Areas | | |
| | | | | High Capability | 0.03 |
| | | | | Moderate Capability | 10.07 |
| | | | | Low Capability | 4.66 |
| | | | | Non-Forested | 0.00 |
| | | | **Segment 7** | | |
| Biogeoclimatic Subzone | Site Series | Map Code | Name | Site index Category | Area (ha) |
| ESSFwk2 | 01 | FO | Bl – Oakfern – Knight's plume | moderate | 6.73 |
| | 02 | FS | Bl – Oakfern – Sarsparilla | low | 0.08 |
| | 03 | FB | Bl – Oakfern – Bluebells | low | 0.01 |
| | 04 | FD | Bl – Devil's Club – Rhododendron | moderate | 0.06 |
| | 35 | - | Lichen – Bryophytes | non-forested | 0.09 |
| ESSFwc3 | 01 | FR | Bl – Rhododendron – Oakfern | moderate | 1.93 |
| | 03 | FG | Bl – Globeflower – Horsetail | moderate | 0.19 |
| | | | | **Total Area** | **9.09** |
| | | | Summary of Forest Capability Areas | | |
| | | | | High Capability | 0.00 |
| | | | | Moderate Capability | 8.91 |
| | | | | Low Capability | 0.09 |
| | | | | Non-Forested | 0.09 |

| Biogeoclimatic Subzone | Site Series | Map Code | Name | Site index Category | Area (ha) |
|---|---|---|---|---|---|
| | | | **Segment 9** | | |
| Biogeoclimatic Subzone | Site Series | Map Code | Name | Site index Category | Area (ha) |
| ESSFwk2 | 01 | FO | Bl – Oakfern – Knight's plume | moderate | 5.51 |
| | 02 | FS | Bl – Oakfern – Sarsparilla | low | 0.17 |
| | 03 | FB | Bl – Oakfern – Bluebells | low | 0.11 |
| | 04 | FD | Bl – Devil's Club – Rhododendron | moderate | 0.18 |
| | 05 | FR | Bl – Rhododendron – Oakfern | moderate | 0.91 |
| ESSFwc3 | 01 | FR | Bl – Rhododendron – Oakfern | moderate | 3.72 |
| | 02 | FQ | B – Rhododendron – Queen's cup | low | 0.07 |
| | 03 | FG | Bl – Globeflower – Horsetail | moderate | 1.35 |
| | 31 | - | Sb – Labrador tea – Sphagnum | non-forested | 0.06 |
| | | | | **Total Area** | **12.08** |
| | | | **Summary of Forest Capability Areas** | | |
| | | | | High Capability | 0.00 |
| | | | | Moderate Capability | 11.67 |
| | | | | Low Capability | 0.35 |
| | | | | Non-Forested | 0.06 |
| **Summary** | | | | | |
| **Site Index Category** | **Area (ha)** | | | | |
| High | 0.23 | | | | |
| Moderate | 30.96 | | | | |
| Low | 7.15 | | | | |
| Non-Forested | 0.15 | | | | |
| Total Area | 38.49 | | | | |

**Table 10.2.5-3: Pre-Mining Ecosystem Units & Forest Capability for the Falling Creek Connector Haul Route – Existing Segments**

| Biogeoclimatic Subzone | Site Series | Map Code | Name | Site index Category | Area (ha) |
|---|---|---|---|---|---|
| | | | **Segment 3** | | |
| SBSwk2 | 02 | LH | Pl – Huckleberry – Cladina | moderate | 0.02 |
| | 03 | SC | Sxw – Huckleberry – Highbush cranberry | moderate | 0.27 |
| | 05 | SD | Sxw – Devil's Club | high | 0.14 |
| | 00 | SS | Sedge – Sphagnum | non-forested | 0.02 |
| | 00 | BH | Sb – Horsetail | non-forested | 0.01 |
| | | | | | |
| | | | | **Total Area** | **0.46** |
| | | | Summary of Forest Capability Areas | | |
| | | | | High Capability | 0.14 |
| | | | | Moderate Capability | 0.29 |

| Biogeoclimatic Subzone | Site Series | Map Code | Name | Site index Category | Area (ha) |
|---|---|---|---|---|---|
| | | | **Segment 5** | | |
| Biogeoclimatic Subzone | Site Series | Map Code | Name | Site index Category | Area (ha) |
| ESSFmv2 | 01 | FR | Bl – Rhododendron – Feathermoss | moderate | 0.27 |
| | 02 | FL | Bl – Lingonberry | low | 0.14 |
| | 04 | FO | Bl – Oakfern – Knight's plume | moderate | 0.04 |
| | 06 | FH | Bl – Alder – Horsetail | moderate | 0.01 |
| | | | | **Total Area** | **0.46** |
| | | | Summary of Forest Capability Areas | | |
| | | | | High Capability | 0.00 |
| | | | | Moderate Capability | 0.32 |
| | | | | Low Capability | 0.14 |
| | | | | Non-Forested | 0.00 |
| | | | **Segment 6** | | |
| Biogeoclimatic Subzone | Site Series | Map Code | Name | Site index Category | Area (ha) |
| ESSFmv2 | 01 | FR | Bl – Rhododendron – feathermoss | moderate | 0.08 |
| | 01 | FO | Bl – Oak fern – Knight's plume | moderate | 0.01 |
| | 02 | FS | Bl – Oak fern – Sarsaparilla | low | 0.01 |
| | 34 | - | Salix – Sedge | non-forested | 0.02 |
| ESSFwk2 | 35 | - | Lichen – Bryophytes | non-forested | 0.06 |
| | | | | | |
| | | | | **Total Area** | **0.18** |
| | | | Summary of Forest Capability Areas | | |
| | | | | High Capability | 0.00 |
| | | | | Moderate Capability | 0.09 |
| | | | | Low Capability | 0.01 |
| | | | | Non-Forested | 0.08 |
| | | | **Segment 8** | | |
| Biogeoclimatic Subzone | Site Series | Map Code | Name | Site index Category | Area (ha) |
| | 01 | FO | Bl – Oakfern – Knight's plume | moderate | 1.01 |
| | 03 | FB | Bl – Oakfern – Bluebells | low | 0.02 |
| ESSFwk2 | 04 | FD | Bl – Devil's Club – Rhododendron | moderate | 0.04 |
| | 01 | FR | Bl – Rhododendron – Oakfern | moderate | 0.83 |
| ESSFwc3 | 03 | FG | Bl – Globeflower – Horsetail | moderate | 0.03 |
| | | | | **Total Area** | **1.93** |
| | | | Summary of Forest Capability Areas | | |
| | | | | High Capability | 0.00 |
| | | | | Moderate Capability | 1.91 |
| | | | | Low Capability | 0.02 |
| | | | | Non-Forested | 0.00 |
| | | | **Segment 10** | | |
| Biogeoclimatic Subzone | Site Series | Map Code | Name | Site index Category | Area (ha) |
| ESSFwk2 | 01 | FO | Bl – Oakfern – Knight's plume | moderate | 0.18 |
| | 02 | FS | Bl – Oakfern – Sarsparilla | low | 0.01 |
| | 03 | FB | Bl – Oakfern – Bluebells | low | 0.14 |
| | 05 | FR | Bl – Rhododendron – Oakfern | moderate | 0.04 |
| | 06 | FH | Bl – Horsetail – Sphagnum | low | 0.01 |
| SBSwk2 | 01 | SO | Sxw – Oakfern | high | 3.07 |
| | 02 | LH | Pl – Huckleberry – Cladina | moderate | 0.22 |
| | 03 | SC | Sxw – Huckleberry – Highbush cranberry | moderate | 0.56 |
| | 04 | BF | SbPl – Feathermoss | moderate | 0.48 |
| | 05 | SD | Sxw – Devil's Club | high | 0.69 |
| | 06 | SH | Sxw – Horsetail | high | 0.13 |
| | 07 | - | Sb – Labrador tea – Sphagnum | non-forested | 0.10 |
| | 00 | RI | River | non-forested | 0.01 |
| | 34 | WS | Shrubby organic meadow | non-forested | 0.02 |
| | | | | **Total Area** | **5.66** |
| | | | Summary of Forest Capability Areas | | |
| | | | | High Capability | 3.89 |

| Biogeoclimatic Subzone | Site Series | Map Code | Name | Site index Category | Area (ha) |
|---|---|---|---|---|---|
| | | | | Moderate Capability | 1.48 |
| | | | | Low Capability | 0.16 |
| | | | | Non-Forested | 0.13 |
| **Summary** | | | | | |
| **Site Index Category** | **Area (ha)** | | | | |
| High | 4.03 | | | | |
| Moderate | 4.09 | | | | |
| Low | 0.33 | | | | |
| Non-Forested | 0.24 | | | | |
| Total Area | 8.69 | | | | |

#### 10.2.5.1.1 Assessment of Potential Project Effects, Mitigation Measures, & Residual Effects

The following section presents information on effects on forest capability and mitigation of these effects for the Falling Creek Connector Haul Route.

The effects of Haul Route construction or alteration are different by category, as follows:

- **New Segments** – road construction will result in soils disturbance on approximately 38.5 ha. Within this area, forest capability will be removed for the duration of hauling operations. This effect is a temporary one, as de-activation and reclamation of these segments following mine closure will return forest capability to pre-disturbance conditions (see the Reclamation Plan, Section 4.12, for more detail on mitigation measures for these road segments). Thus, residual project effects are present only in the construction, operation, and decommissioning phases.
- **Existing Segments** – road construction will result in soils disturbance on approximately 8.7 ha, incremental and additional to existing road disturbance on this route. Within this area, forest capability will be removed for the duration of road use, which is expected to persist beyond the life of the Brule Mine Project. No mitigation of this loss is planned, and residual project effects are identical for all development phases.

Effects of Haul Route Development of forest capability are summarized in Table 10.2.5-3, below, with definitions for terms provided in Table 10.2.2-1.

**Table 10.2.5-4: Summary of Residual Project Effects: Forest Capability**

| Project Phase[1] | Potential Project Effect | Planned Mitigation | Residual Project Effects (RPE) Characterization[2] | | | | | RPE might Contribute Incrementally to Cumulative effects? | RPE Significance[3] | Level of Confidence in Assessment |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Magnitude | Geographic Extent | Duration | Frequency | Reversibility | | | |
| C/O/D | Removal of Forest Capability – New Road Segments | Reclamation (see Section 4.12) | Medium | Site-specific | Long term | Once | Reversible | Yes | See RCE | Medium |
| C/O/D/P | Removal of Forest Capability – Existing Road Segments | n/a | Low | Site-specific | Far future | Once | Reversible | Yes | See RCE | Medium |

**Notes: 1.** C=Construction, O=Operations, D=Decommissioning/Reclamation, P=Post-Closure. **2.** Based on the assumption that mitigation measures are effective as planned. Refer to Residual Effects Rating Criteria (Table 10.2.3.2-2) for definitions. **3.** The significance of RPEs are determined in the context of the potential to contribute incrementally to cumulative effects. Where a RPE may contribute incrementally to cumulative effects, the determination of significance is advanced to the Residual Cumulative Effects (RCE) assessment stage. n/a = Not Applicable.

The residual effects of development of the Falling Creek Flats Loadout facility on forest capability are summarized as follows:

- **New Segments** – effects are confined to the Haul Route (site-specific), long term in duration (not lasting more than 10 years past the life of the project), and reversible, through de-activation and reclamation. Effects occur once as areas are cleared and constructed, and persist until reclamation. Construction of these new road segments will result in removal of all forest capability from 38.5 ha. The magnitude of this disturbance is rated as medium, as these effects are measurable, but will be addressed through mitigation. Effects on forest capability have the potential to contribute incrementally to cumulative effects. Confidence in this assessment is medium, as the prediction of post-closure forest capability is based on an understanding of post-closure terrain and soil conditions and on the implications of these conditions for development of post-closure ecosystems, but there will be variation in actual performance on reclaimed sites.
- **Existing Segments** – effects are confined to the Haul Route (site-specific), and far- future in duration. These effects are reversible through road de-activation and reclamation, although such mitigation is not planned as part of decommissioning of the Brule Mine Project. Effects occur once as areas are cleared and constructed, and persist until reclamation, beyond the life of the Brule Mine Project. Construction of these new road segments will result in removal of all forest capability from 8.7 ha. The magnitude of this disturbance is rated as low, as these effects are negligible. Effects on forest capability have the potential to contribute incrementally to cumulative effects. Confidence in this assessment is medium, as the prediction of post-closure forest capability is based on an understanding of post-closure terrain and soil conditions and on the implications of these conditions for development of post-closure ecosystems, but there will be variation in actual performance on reclaimed sites.

Development of the Falling Creek Haul Route is predicted to affect forest capability on new road segments during the construction, operation and decommissioning phases, and on existing road segments in all project phases, through elimination of area capable of supporting forest stands. These effects are rated as having low-medium magnitudes in the Local Study Area, as they are either measurable, but fully offset through subsequent reclamation (new segments), or are negligible, in terms of area disturbed (existing segments). In the RCE / RSA context, the effects of development of the Falling Creek Haul Route on forest productivity are assessed as not making a significant impact to cumulative effects in the region, due to the small area affected relative to the RSA, and due to the fact that effects do not cause a shift in the forest capability resource into unacceptable conditions.

## 10.2.6 Powerlines

### *10.2.6.1 Baseline Conditions*

Baseline forest capability units along the powerline right-of-way are summarized in Table 10.2.6-1, below. Areas are summarized by presence only, not by area, as construction of the powerline will have no adverse effect on units present in the post-closure setting, and thus quantification of area affected is not required for this assessment. Total length of the powerline associated with the mine site is 20.7 km, with a right-of-way width of 15 m, for a total areal coverage of 31.1 ha. This area includes the Sukunka River crossing, spans of gullies, and portions of the line that would cross over areas that have already been cleared. Therefore, the total cleared area will be somewhat less than this total area. The total length associated with the loadout is 1.5 km, with a 15-m width, for a total areal coverage of 2.3 ha. This area includes the Pine River crossing, therefore the total cleared area would be somewhat less than 2 ha. Construction and operation of the powerline will result in initial clearing and maintenance brushing of vegetation within the right-of-way. These activities will be transient, temporarily impacting forest structure and maintaining it in shrub stages. However, as soil disturbance is minimal, there are no anticipated effects to forest capability, either during operation or post-closure.

**Table 10.2.6-1: Powerline Baseline Forest Capability Conditions**

| Biogeoclimatic Subzone | Site Series | Map Code | Name | Site index Category |
|---|---|---|---|---|
| **Pre-Mining Ecosystem Units and Forest Capability for the Brule Mine 25 kV Powerline** | | | | |
| ESSFmv2 | 01 | FR | Bl - Rhododendron - Feathermoss | moderate |
| | 03 | BT | BlSb - Labrador tea | low |
| | 00 | RP | Road surface | non-forested |
| | 33 | SE | Water sedge - Peat moss | non-forested |
| BWBSmw1 | 01 | AM | SwAt - Step moss | moderate |
| | 03 | SW | Sw - Wildrye - Peavine | moderate |
| | 05 | SO | $At - Black twinberry | moderate |
| | 06 | SC | Sw - Currant - Bluebells | moderate |
| | 07 | SH | Sw - Currant - Horsetail | moderate |
| | 00 | CF | Cultivated field | non-forested |
| | 00 | RI | River | non-forested |
| | 00 | WH | Willow - Horsetail - Sedge riparian wetland | non-forested |
| SBSwk2 | 01 | SO | Sxw - Oakfern | high |
| | 03 | SC | Sxw - Huckleberry - Highbush cranberry | moderate |
| | 04 | BF | SbPl - Feathermoss | moderate |
| | 06 | SH | Sxw - Horsetail | High |

| Biogeoclimatic Subzone | Site Series | Map Code | Name | Site index Category |
|---|---|---|---|---|
| **Pre-Mining Ecosystem Units and Forest Capability for the Falling Creek Flats Loadout Powerline** | | | | |
| SBSwk2 | 06 | SH | Sxw - Horsetail | high |
| | 32 | - | Non-forested fen/marsh | non-forested |
| BWBSmw1 | 01 | AM | SwAt - Step moss | moderate |
| | 07 | SH | Sw - Currant - Horsetail | moderate |
| | 00 | RP | Road surface | non-forested |
| | 00 | RI | River | non-forested |

As there are no anticipated effects of powerline construction and operation on forest capability, no further residual or cumulative effects assessment has been conducted for this Project component and indicator.

## 10.2.7 Assessment of Cumulative Effects

The following section provides information on the contribution of the Project to cumulative effects on forest capability in the Regional Study Area (RSA). The terrestrial RSA encompasses 100,570 ha – for a description and illustration of this area, and for more information on disturbances assessed within the RSA, see Section 10.3.2.5.2.

Table 10.2.7-1 presents information on disturbances causing alterations to forest capability in the Existing/Approved (baseline through foreseeable future) case, and with the Brule Mine Project. The Existing/Approved case includes the Willow Creek and Dillon coal mines, and Canfor forest development plan roads. Information on resource roads associated with the oil and gas sector was sought for this assessment, but not located. Road disturbance area is estimated based on a total road length of 973 km, and an average estimated road width of 8 m. For the Residual Cumulative Effects (RCE) assessment, maximum disturbance is assumed for all sources other than the Brule mine site, as mitigation information is not available for these other disturbances. All disturbances are assessed as having no forest capability for the duration of the disturbance, with the exception of the Brule Mine Project in the post-closure scenario, which assumes effective mitigation through reclamation.

**Table 10.2.7-1: Existing Forest Capability Impacts by Source in the RSA Compared to Effects of the Brule Mine Project**

| Existing/Approved | | | | | | | | Brule Mine Project (Combined Areas) | |
|---|---|---|---|---|---|---|---|---|---|
| Mining | | | | Roads | | Total | | | |
| Willow Creek Coal | | Dillon | | | | | | | |
| Area (ha) | % of RSA | Area (ha) | % of RSA | Area (ha) | % of RSA | Area (ha) | % of RSA | Area (ha) | % of RSA |
| 550 | 0.5 | 59.7 | 0.1 | 778.4 | 0.8 | 1388.1 | 1.4 | 652.4 | 0.6 |

The forest capability cumulative effects assessment matrix for the Brule Mine Project is presented in Table 10.2.7-2, with corresponding criteria presented in Table 10.2.2-2. Note that these criteria are not the same as those used for the assessment of residual project effects. For the purpose of assessment of effects on forest capability in the cumulative or regional context, “significance” has been similarly defined based on magnitude and duration of effects, but magnitude has been defined as total areal disturbance relative to the Regional Study Area.

Significant cumulative effects are sometimes defined as cumulative effects that result in the shift of a resource or indicator from acceptable to unacceptable conditions. It is not possible to apply this biologically based concept of significance to forest capability, as there is no threshold, “minimum viable population,” or similar concept beyond which further adverse effects on forest capability will result in a precipitous and irreversible decline in the resource. Adverse effects are simply linearly cumulative, and the relative areal basis of this assessment is meant to reflect this fact. In the assessment of Residual Project Effects, the Brule mine development in the post-closure phase is rated as having a “high” magnitude of impact on forest capability within the context of the Local Study Area. However, simply carrying this rating through into the assessment of Residual Cumulative Effects is not valid, as in the context of the Regional Study Area, the magnitude of impact is not high. Thus, magnitude in this context is evaluated using criteria appropriate for an assessment of cumulative effects in the Regional Study Area. Some care has been taken in definition of these criteria – for instance, note that although the Brule Mine Project is rated as having only a medium-magnitude effect on forest capability (and thus a non-significant contribution to Residual Cumulative Effects), a proposed mine of the size of the existing Quintette site would be rated as having a high magnitude effect, and thus a significant contribution to Residual Cumulative Effects, in a similarly sized study area.

**Table 10.2.7-2: Summary of Residual Cumulative Effects (RCE) on Forest Capability: Brule Mine Project**

| Evaluation Scenario[1] | Potential Project Effect | Planned Mitigation | Magnitude | Geographic Extent | Duration | Frequency | Reversibility | RCE Significance | Project Contribution to RCE | Level of Confidence |
|---|---|---|---|---|---|---|---|---|---|---|
| RCE without the Project (B through foreseeable future) | Alteration to Forest Capability | n/a | Medium | Regional | Far future | n/a | Partially Reversible | Significant | | Moderate |
| Project Contribution (C, O, D) | | Reclamation (see Section 4.12) | Medium | Site-specific | Long term | n/a | Reversible | | Not significant | Moderate |
| Project Contribution (P) | | n/a | Low | Site-specific | Far future | n/a | Irreversible | | Not significant | Moderate |
| RCE with the Project (C, O, D) | | Reclamation (see Section 4.12) | Medium | Regional | Far future | n/a | Partially Reversible | Significant | | Moderate |
| RCE with the Project (P) | | n/a | Medium | Regional | Far future | n/a | Partially Reversible | Significant | -- | Moderate |

**Notes: 1.** B=Baseline, C=Construction, O=Operations, D=Decommissioning/Reclamation, P=Post-Closure. **2.** Based on the assumption that mitigation measures are effective as planned. Refer to Residual Effects Rating Criteria table for definitions. n/a = Not Applicable.

Current cumulative effects in the RSA (existing/approved or baseline through foreseeable future case) are rated as having a medium magnitude (as these effects in total occupy less than 5% of the RSA). These effects are far future in duration, as, in the absence of information to the contrary, the forestry road network is seen as a permanent disturbance (although individual roads may be de-activated and re-forested, the total area occupied by roads is unlikely to change substantially). Because of the semi-permanent nature of the road disturbance in the RSA, the effects on forest capability are rated as partially reversible, as although all disturbances can be regenerated, the area disturbed by roads likely will not be in the foreseeable future. Based on the assessment of magnitude, geographic extent, and duration, the current cumulative effects are rated as significant. As stated above, this finding is not meant to imply an unacceptable condition in the forest capability resource as a result of cumulative effects of industrial development in the RSA, but simply to reflect the fact that these effects have had a “significant” (measurable and long-term to far future) impact on the indicator.

The Brule Mine Project contribution to regional effects on forest capability during construction, operations and decommissioning is rated as medium in magnitude, based on area affected, and long-term in duration, as the loss of forest capability resulting from project development will be mitigated through reclamation within 10 years following the end of operations. As this assessment is based on elimination of all forest capability over the project disturbance footprint, these effects are rated as reversible, as forest capability will be restored through reclamation. Based on the magnitude, geographic extent and duration ratings, the project at the construction, operations and decommissioning phases is rated as having no significant contribution to Residual Cumulative Effects.

The Brule Mine Project contribution to regional effects on forest capability in the post-closure phase is rated as low in magnitude, based on area affected. This rating considers the post-mitigation setting, and thus assesses the predicted far-future alterations to forest capability resulting from changes in soil and surficial material conditions on the reclaimed mine site, as opposed to the construction/operations/decommissioning assessment of elimination of all forest capability within the disturbance footprint. The largest areal post-closure alteration in forest capability is the addition of approximately 75 ha of non-forested units on the mine site, in comparison to pre-development conditions. This change affects less than one tenth of one percent of the RSA, and thus is assessed as “negligible,” resulting in a low-magnitude rating. These effects are predicted to be permanent, and thus far future in duration and irreversible. Based on the magnitude, geographic extent and duration ratings, the project at the post-closure phase is rated as having no significant contribution to Residual Cumulative Effects.

Because of the finding that the project in all phases makes no significant contribution to Residual Cumulative Effects, and due to the relative size of all forest capability disturbances in the RSA, including the project, there is no difference in the ratings for Residual Cumulative Effects with the project included, in comparison to the Existing/Approved case discussed above. The effects of development of the Brule Mine Project on forest capability are assessed as not contributing significantly to cumulative effects in the region, due to the small area affected relative to the RSA, and due to the fact that effects do not cause a shift in the forest capability resource into unacceptable conditions.

# 10.3 Wildlife

## 10.3.1 Introduction

This section introduces the process for assessing potential effects of the Brule Mine Project on wildlife, describes the existing baseline wildlife conditions, summarizes the results of the project-specific and cumulative effects assessment for wildlife, and presents the approach for monitoring and mitigation related to wildlife issues. This information is detailed under the following subsections:

- Approach and Methods;
- Baseline Conditions;
- Mitigation Measures;
- Project Effects Assessment;
- Residual Project Effects: Summary and Characterization;
- Cumulative Effects Assessment;
- Residual Cumulative Effects: Summary and Characterization; and
- Monitoring.

## 10.3.2 Approach & Methods

### *10.3.2.1 Key Issues*

As described in Section 3, the proposed Project will involve the construction of various project components. In areas where existing footprints will be incorporated (e.g., Dillon Mine) or paralleled (e.g., Mine Power Supply right-of-way), the Project-related effects on wildlife are expected to be minimal, and will likely have little potential for affecting wildlife resources on a regional basis. More pronounced effects on wildlife might occur in areas of new development (e.g., Falling Creek Flats Loadout). These potential effects will be minimized through implementation of Project area-wide and site-specific mitigation measures (see Sections 10.1.9 and 4.11).

The Project's potential effects on wildlife are included under the following key issues:

- *Habitat availability* – changes resulting directly from vegetation clearing activities or indirectly from sensory disturbance (e.g., noise, human activity) and reduced patch size (e.g., increased habitat fragmentation).
- *Disruption to movement patterns* – resulting from increased landscape fragmentation (e.g., increased density of access corridors) or higher road use levels limiting daily or seasonal wildlife travel.
- *Mortality risk* – increases resulting directly from site development, road kills from mine traffic, increased hunting/poaching, and control of problem wildlife, or indirectly through reduction in secure habitat resulting from habitat fragmentation.

The consideration of potential effects on biodiversity has only recently been integrated into the environmental impact assessment process. Biological diversity, or biodiversity, is defined as the variety and variability of life, and includes the diversity of genes, species, ecosystems and landscapes. Effects on biodiversity may be assessed at various levels of biological organization. For purposes of most impact assessments, effects can be investigated at three levels, including:

- Species level – refers to the number and variety of animal species and their abundance.
- Community/ecosystem level – refers to the interrelationships between species and their habitats, focusing on the ecological units that sustain species.
- Landscape level – refers to the ability of the landscape to operate as a sustainable, integrated ecological unit, and is affected by such regional processes as habitat fragmentation.

For this assessment, potential effects on wildlife biodiversity at the species level were evaluated in the context of habitat availability and mortality risk. Additionally, the assessment of potential Project effects on selected vegetation focal features (i.e., ecosystem communities of conservation concern, old forest and wetlands) (Section 10.1) addressed biodiversity at the community and ecosystem level, and can be indirectly related back to wildlife biodiversity considerations. Finally, at the landscape level, potential effects on biodiversity were assessed by considering regional habitat fragmentation, and disruptions to wildlife movement patterns.

Potential Project effects associated with the key issues are described in more detail below.

#### 10.3.2.1.1 Habitat Availability

Mining developments can affect habitat availability in a number of ways. Changes to habitat availability may occur from the direct loss of habitat through vegetation removal (land clearing) or through vegetation management activities that alter the seral structure of existing habitats (e.g., along utility corridors). Also, the effects of habitat fragmentation alter habitat availability on a broader scale (see Section 10.3.2.1.2). Further, species that reside in the construction and operations area will be exposed to and potentially disturbed by various stimuli associated with project activities (e.g., noise and odours). Wildlife responses to such stimuli are affected by a variety of factors (e.g., species, topography, season, nature of the stimulus) and can vary from elevated heart rates to more overt reactions such as flight and abandonment of local habitat. This avoidance of habitat due to sensory disturbance can lead to temporary reductions in habitat availability. In all cases, the particular concern is the potential loss of a localized habitat feature that is important on a regional scale for a special status species.

Generally, mining projects result in temporary reductions in habitat quality (and therefore reduced habitat availability) next to centers of construction and operational activity. More permanent facilities, such as pits and buildings, typically reduce habitat availability for longer periods in these localized areas.

Over the long term, mine reclamation efforts can restore habitat availability, and the cessation of activities will decrease or eliminate sensory disturbances. In addition, some animals may habituate to mining-related activities, particularly those activities that are predictable in time and space.

#### 10.3.2.1.2 Disruption of Movement Patterns

Seasonal or daily movements may be blocked or disrupted due to construction and operational activities and, more specifically, the presence of vehicles and personnel in and around the development area. On a broader scale, mining activities, in conjunction with other regional developments and their associated access and utility corridors, may lead to habitat fragmentation where linear features are an impediment to wildlife crossings (i.e., too wide) or where suitable habitats become isolated and inaccessible or too small to be of functional value (Primack 1993). The cessation of activities will decrease disruptions to animal movements, and mine-related reclamation efforts may restore some degree of habitat connectivity.

#### 10.3.2.1.3 Mortality Risk

Mining-related wildlife mortality might be incurred directly through construction (e.g., nest, den, or hibernaculum destruction), from collisions with project vehicles, and by use of firearms by project personnel. On a broader scale, the creation of new access increases mortality risk from both legal hunting and poaching, and is of particular concern for large carnivores and ungulates. In particular, increased access on a regional scale (resulting in increased habitat fragmentation) may reduce secure patches of habitat for sensitive wildlife species (e.g., grizzly bear), thereby also increasing susceptibility to mortality. Although new access may be controlled during the life of a development, increased access over the long-term will increase mortality risk. Wildlife protection measures (e.g., control of on-site firearms), and deactivation of project-specific access features can reduce mortality risk.

#### *10.3.2.2 Focal Species Selection*

Priority wildlife species (i.e., focal species) were identified for the effects assessment for the Brule Mine Project based on previous discussions with agencies regarding the Dillon Mine, and considering the following criteria:

- conservation status;
- abundance and distribution in the Project area;
- vulnerability to effects of the proposed Project (e.g., presence of critical habitat within the proposed Project area);
- socio-economic importance; and
- regional importance.

Based on these criteria, the following nine wildlife focal species were selected:

- Woodland caribou (*Rangifer tarandus*, northern ecotype);
- Moose (*Alces alces*);
- Rocky Mountain elk (*Cervus elaphus nelsoni*);
- Grizzly bear (*Ursus arctos*);
- Wolverine (*Gulo gulo luscus*);
- Fisher (*Martes pennanti*);
- Marten (*Martes americana*);
- Northern goshawk (*Accipter gentilis atricapillus*); and
- Black-throated green warbler (*Dendroica virens*).

The process and rationale for the selection of the final list of focal species from the larger list of candidate focal species is summarized in Appendix E-5. No terrestrial invertebrates were considered as focal species because of lack of detailed information on their habitat requirements and distribution and abundance in the province. Wildlife groups not represented by focal species (i.e., small mammals, amphibians, and reptiles) were considered more generally in this assessment.

#### *10.3.2.3 Project Components Assessed*

All project components described for the Brule Mine Project (Section 3.0) were evaluated with respect to the key issues for wildlife and the selected focal species, to determine which project components were relevant for the wildlife project effects assessment. All six major project components were selected: Brule Mine, Mine Power Supply, Falling Creek Connector Haul Route, Falling Creek Flats Loadout; Falling Creek Flats Loadout Powerline, and Bullmoose Haul Road and Loadout. The Falling Creek Flats Loadout and powerline were combined for the purpose of the wildlife assessment. The Bullmoose Haul Route and Loadout differs from Falling Creek Connector Haul Route and Falling Creek Flats Loadout in that it will be a consideration for only part of the life of the mine, and as a well-established, pre-existing disturbance, is relevant only to mortality risk.

The rationale for the selection process is presented in Table 10.3.2-1.

**Table 10.3.2-1: Project Components Assessed & Rationale for Selection: Wildlife**

| Project Component | To be assessed? | Relevant Key Issue | Relevant focal species | Rationale |
|---|---|---|---|---|
| Brule Mine | Yes | Habitat availability<br>Disruption to movement patterns<br>Mortality risk | All | Clearing and sensory disturbance will affect habitat availability<br>Mine feature may disrupt localized wildlife movements<br>Vehicle traffic represents a possible mortality risk |
| Mine Power Supply | Yes | Habitat availability<br>Disruption to movement patterns<br>Mortality risk | All | Clearing and sensory disturbance will affect habitat availability<br>Linear feature may disrupt movements<br>Vehicle traffic represents a possible mortality risk |
| Falling Creek Connector Haul Route | Yes | Habitat availability<br>Disruption to movement patterns<br>Mortality risk | All | Clearing and sensory disturbance will affect habitat availability<br>Loadout feature may disrupt localized wildlife movements<br>Vehicle traffic represents a possible mortality risk |
| Falling Creek Flats Loadout and Power Transmission Line | Yes | Habitat availability<br>Disruption to movement patterns<br>Mortality risk | All | Clearing and sensory disturbance will affect habitat availability<br>Linear feature may disrupt movements<br>Increased access represents a possible mortality risk |
| Bullmoose Haul Route and Loadout | Yes | Habitat availability<br>Disruption to movement patterns<br>Mortality risk | N/A<br>N/A<br>All | No additional habitat alterations are required<br>Existing high use road; no change in effect on wildlife movement patterns<br>Increased vehicle traffic represents a possible mortality risk |

### *10.3.2.4 Temporal Boundaries*

To assess potential Project effects on the wildlife focal species, three development phases were used in the quantitative analyses:

*Baseline* – Represents conditions for wildlife prior to any Project-specific developments. Because habitat for the focal species was rated for different seasonal requirements (e.g., grizzly bear: spring, summer, and fall feeding habitat), baseline conditions were considered to be the relevant season prior to construction activities (e.g., fall 2005 for grizzly fall feeding habitat). The baseline conditions for wildlife incorporate the effects of existing human-caused disturbances, including the Dillon Mine footprint (assuming no reclamation) and its associated linear features.

*Phases 1 and 2* – Represents conditions for focal wildlife during construction and preliminary production, and subsequent full scale operations. Phase 2 begins with haulage of coal to the Falling Creek Flats Loadout. While recognizing that development will be progressive over this combined assessment phase, a ‘maximum build-out’ scenario is used to represent the ‘worst case’ (i.e., most conservative) assessment of the effects on wildlife, with the assumption that the primary effects on wildlife (direct and indirect habitat loss, and mortality risk) will be similar for each phase.

*Post-closure* – Represents conditions for wildlife forecast into the future following closure (i.e., decommissioning) of the mine. This timeframe includes all mitigation recommendations and represents conditions for optimal wildlife habitat potential (i.e., capability). Therefore, no specific timeframe was used.

Additionally, the Decommissioning/Reclamation phase was addressed qualitatively. This phase represents conditions during decommissioning/reclamation activities (starting in 2017 after operations cease). The results of reclamation (i.e., re-establishment of viable wildlife habitat) will not be apparent until the years following decommissioning. This phase is therefore considered to be similar with respect to its physical effect to Phases 1 and 2 except that the level of sensory disturbance is assumed to be less (i.e., decreased mine-related activity).

### *10.3.2.5 Spatial Boundaries*

#### 10.3.2.5.1 Local Study Areas

All Project components were assessed for wildlife (Table 10.3.2-1). As was done for vegetation (Section 10.1.2.5), Project component LSAs were delineated by the footprint or right-of-way of the Project component assessed plus a 1 km buffer, with one exception. The assessment for the Bullmoose Haul Route and Loadout focused on changes in traffic volume and did not require delineation of a LSA (see Section 10.3.2.7). The areas (ha) of the Project component LSAs are presented in Section 10.1.2.5. Again, as described for vegetation, the Project component LSAs are not mutually exclusive (Figure 10.1.2-1 in Section 10.1.2.5). When all four LSAs are considered together, the total area of the project LSA is 16,520 ha. The Project component LSAs are used in the descriptions of baseline habitat availability for the focal species (Section 10.3.3), and the overall Project LSA is used as the reporting area in the assessment of Project-specific effects (Section 10.3.5).

#### 10.3.2.5.2 Regional Study Area

The RSA was selected using the following criteria:

- geographic extent of potential project effects on wildlife that may interact with other existing or planned land use activities;
- ecological boundaries, including consideration of the home ranges of relevant wildlife focal species; and
- management boundaries used for regional planning (i.e., Landscape Units).

Based on a preliminary assessment of potential Project effects and wildlife issues, and on a review of the wildlife assessment for the Wolverine Coal Project (WCC 2004a), the two wildlife focal species most likely to be involved in the cumulative effects assessment for the Brule Mine are grizzly bear and woodland caribou. The RSA is primarily intended to reflect the large seasonal home ranges of grizzly bears[27] and woodland caribou[28], recognizing that these species are likely to be exposed to cumulative land use pressures beyond the localized Project-related effects. Thus, the RSA is used to assess the contribution of Project-related effects (e.g., direct habitat loss, sensory disturbance, increased mortality risk) to cumulative effects at the landscape level. In addition, the availability of habitat types in the RSA will provide a regional context for the LSA.

The RSA is 1010 $km^2$ (Figure 10.1.2-1 in Section 10.1.2.5). It is entirely within the Hart Foothills Ecoregion, and includes an adequate regional representation of all habitats that may be affected by the proposed development. Most of the RSA is within the Highhat Landscape Unit, and its northern, northeastern, and southwestern boundaries are shared with the boundaries of that Landscape Unit. The northwestern boundary of the RSA is formed by a 2 km buffer around the Falling Creek Flats Loadout and a 1 km buffer on the west side of the Falling Creek Connector Haul Route. The southeastern boundary of the RSA is formed by the combination of a 1 km buffer on either side of the Sukunka FSR between Highway 29 and the Lower Burnt Road junction, and a 1 km buffer on either side of the proposed Mine Power Supply route. Finally, the southern boundary of the RSA is defined by the northern boundary of the Rocky Creek watershed unit.

[27] A recent grizzly bear study in the vicinity of the Project estimated a female's home range size as 59 to 127 $km^2$ (Ciarniello et al 2003).
[28] Estimates of annual home range size for female caribou in the Moberly herd ranged from 108 to 278 $km^2$ after the first year of data collection (Jones et al 1994).

### *10.3.2.6 Project Effects Assessment*

The general approach for the Project effects assessment is described in Section 6. Specifically, for wildlife these steps were:

- Identify the key issues and potential Project effects for each focal species, in consideration of proposed management plans, design modifications, and mitigation measures intended to reduce potentially adverse effects.
- Identify and characterize Residual Project Effects[29] based on the assumption that technically and economically feasible mitigation measures have been implemented and are effective as described—these mitigation measures are to be considered before proceeding to the next step.
- Determine if Residual Project Effects might contribute incrementally to regional cumulative effects[30] and must, therefore, be considered in the cumulative effects assessment (Section 10.3.7).

The specific analytical tools used in the assessment of Project effects are described in Section 10.3.2.9. The local study area boundaries for the wildlife Project effects assessment are described in Section 10.3.2.5. The assessment considers four development phases: Baseline, Construction/Operations, Decommissioning, and Post-closure, as described in Section 10.3.2.4.

The character of each Residual Project Effect was evaluated using five criteria: magnitude, geographic extent, duration, frequency, and reversibility. These criteria were assessed in the context of the nature of potential effects, the mitigation strategies that are available for reducing or eliminating such effects, and the nature and anticipated severity of residual effects after mitigation. The classification schemes for each criterion are described in Table 10.3.2-2. Additionally, a confidence level (i.e., low, medium, high) was applied to each Residual Project Effect characterization (Table 10.3.2-2). This confidence rating considered the accuracy and application of analytical tools, an understanding of the effectiveness of mitigation measures, and an understanding of known responses of focal wildlife species to potential project effects.

If it was determined that a Residual Project Effect might contribute incrementally to regional cumulative effects then a cumulative effects assessment was conducted (Section 10.3.2.9). This determination was based on the aforementioned criteria, and on an evaluation of the Residual Project Effect (e.g., localized increase in access-related mortality risk) in a regional context (e.g., road density in the RSA).

[29] Residual Project Effects are Project effects not considered to be fully addressed by the proposed mitigation measures (e.g., increased mortality risk associated with new road access).

[30] The significance of Residual Project Effects was determined based on an understanding of localized effects in a regional context, as the arbitrary nature of local study areas typically overestimates adverse effects on a resource. Therefore, the relative contribution of Residual Project Effects to regional cumulative effects was evaluated.

The results of the Project effects assessment are presented in Section 10.3.5, and a summary of the Residual Project Effects is provided in Section 10.3.6.

**Table 10.3.2-2: Criteria for Residual Project Effects & Residual Cumulative Effects Characterization & Assessment of Residual Cumulative Effects Significance: Wildlife**

| Criterion | Description |
|---|---|
| Magnitude | **Low**: no or negligible measurable effects on the sustainability of the wildlife resource, and does not represent a management challenge for ecological values |
| | **Medium**: a measurable effect but unlikely to pose a serious risk to the sustainability of the wildlife resource or represent a management challenge from an ecological standpoint |
| | **High**: a measurable effect that is likely to pose a serious risk to the sustainability of the wildlife resource and represents a management challenge from an ecological standpoint |
| Geographic Extent | **Site-specific**: effect on wildlife resource confined to a single small area within the LSA |
| | **Local**: effect on wildlife resource occurs within the LSA |
| | **Regional**: effect on wildlife resource occurs within or beyond the RSA |
| Duration | **Short term**: effect on wildlife resources is limited to <1 year |
| | **Medium term**: effect on wildlife resource occurs >1 year, but not beyond the life of the project |
| | **Long term**: effect on wildlife resource lasts up to 10 years beyond the life of the project |
| | **Far future**: effect on wildlife resource extends >10 years beyond the life of the project |
| Frequency | **Once**: occurs once |
| | **Continuous**: occurs on a regular basis and regular intervals |
| | **Sporadic**: occurs rarely and at irregular intervals |
| Reversibility | **Reversible:** conditions will likely return to baseline conditions |
| | **Irreversible:** conditions will not likely return to baseline conditions |
| Significance (1) | **Significant**: effects with magnitude and duration combinations of:<br>• Medium magnitude and far future duration,<br>• High magnitude, local or regional geographic extent, and ay duration, or<br>• High magnitude, site-specific geographic extent, and far future duration |
| | **Not Significant:** effects of all other magnitude and duration combinations |
| Level of Confidence | **Low**: do not have confidence in prediction, could vary considerably |
| | **Medium**: confidence in prediction, moderate variability |
| | **High**: confidence in prediction, low variability |

**Notes: 1.** To determine the significance of residual project or cumulative effects, magnitude and duration are the primary determinants of the significance rating, with geographic extent used to qualify certain ratings.

### *10.3.2.7 Cumulative Effects Assessment*

The general approach for the cumulative effects assessment is described in Section 6. Specifically, for wildlife these steps included:

- Determine conditions for the focal species within the RSA in the absence of the Project (i.e., conditions at Baseline and into the foreseeable future[31]), and characterize and evaluate the significance of any Residual Cumulative Effects.
- Determine the incremental effects of the Project to cumulative effects ("Project contribution") on the focal species within the RSA for the development phases under consideration.
- Determine conditions for the focal species within the RSA and for the development phases under consideration, in the context of both the Project and all other projects and activities[32], and characterize and evaluate the significance of any RCEs and the Project's contribution to those RCEs.

A description of the analyses required to determine conditions for the focal species on a regional scale, with and without the Project, is presented in Section 10.3.2.9. The RSA boundaries for the wildlife cumulative effects assessment are described in Section 10.3.2.5, and, again, four development phases. Baseline, Construction/Operations, Decommissioning, and Post-closure – are considered (Section 10.3.2.4).

The nature of the Project contribution and each Residual Cumulative Effect (i.e., without and with the Project) are evaluated using the same five criteria used for the Residual Project Effects assessment (Table 10.3.2-2). Again, these criteria are assessed in the context of mitigation strategies that are available for reducing or eliminating such effects.

As described in Section 6.0, the determination of significance is usually related to recognized thresholds for a region. In northeastern British Columbia, no specific thresholds for wildlife have yet been established. Therefore, significance of cumulative effects was determined using more qualitative approaches, incorporating the best available information (e.g., proposed thresholds from other regions).

Results of the cumulative effects assessment are presented in Section 10.3.7, and a summary of the RCEs is provided in Section 10.3.8.

#### *10.3.2.8 Information Sources*

A variety of data sources were used to evaluate wildlife resources in the area and assess potential project-related and cumulative impacts. These included:

- published and unpublished wildlife government and scientific reports for the region;

[31] Although no spatial data was available for potential future developments in the RSA, the cumulative effects assessment considers these developments in a general sense with respect to this Project. For example, forestry activities by Canfor are expected to occur throughout the RSA, which may influence habitat availability, movement patterns, and mortality risk to wildlife; however, no information was available to incorporate into the spatial analyses.
[32] See footnote above.

- personal communications with regional biologists and local residents during public consultations and regulatory meetings;
- consultant reports;
- Dillon Mine *Mines Act* Permit application; and
- B.C. Conservation Data Centre (i.e., B.C. Species and Ecosystems Explorer[33] and Terrestrial Information Mapping Service[34]).

#### 10.3.2.8.1 Field Surveys

Fieldwork for the Brule Mine was conducted during the summers of 2002 and 2004 in conjunction with field sampling for the Dillon Mine. Field surveys were conducted in 2005 for other Brule Project components (e.g., Mine Power Supply, Falling Creek Flats Loadout). Field programs included:

- breeding bird surveys within the Dillon Mine footprint and across the general area of the Brule Mine footprint in June 2002 and 2004;
- breeding bird surveys in and around Brule project components (e.g., Mine Power Supply right-of-way) in June 2005;
- wildlife habitat evaluations (in support of wildlife habitat ratings, and identification of important wildlife features) in and around the Dillon Mine footprint in June 2002 and 2004; and
- wildlife habitat evaluations in and around Brule project components (e.g., Mine Power Supply right-of-way) in June 2005.

These field surveys are described in detail in Appendix E-1.

### *10.3.2.9 Analytical Techniques*

Four analytical tools were used to assess potential Project and/or cumulative effects (if required) on wildlife habitat availability, movement patterns, and mortality risk:

- wildlife habitat rating analysis;
- traffic volume analysis;
- core security habitat analysis; and
- road density analysis.

[33] http://srmapps.gov.bc.ca/apps/eswp/, accessed July 2005.
[34] http://maps.gov.bc.ca/imf406/imf.jsp?site=rrid_tib_ti, accessed July 2005.

An overview of the methods for the development and use of these tools is provided in the following sections.

#### 10.3.2.9.1 Wildlife Habitat Ratings

Potential effects of changes to wildlife habitat availability were assessed using wildlife habitat ratings (RIC 1999a). Habitat ratings were initially developed for the Dillon Mine (Keystone Wildlife Research Ltd.), with further refinement and ground-truthing conducted for this Project. An overview of this approach is described below and provided in detail in WCC (2004b) and Appendix E-1.

As part of the wildlife habitat rating, wildlife suitability and capability maps were developed for the 1:20,000 PEM/TEM ecosystem units identified within the RSA. Wildlife suitability is the ability of a habitat (or ecosystem unit) in its current condition to provide the life requisites of a species. This differs from wildlife capability, which is defined as the ability of a habitat under the optimal natural (seral) conditions for a species, to provide its life requisites, irrespective of the habitat's current condition (RIC 1999a). Changes in habitat suitability were used to assess potential short-term effects of the Project between Baseline and Phases 1 and 2. Changes in habitat capability were used to assess potential longer-term effects of the Project between the Baseline and Post-closure phases.

Habitat suitability and capability maps were generated from wildlife habitat ratings developed for given seasons and/or life requisites for each focal species (Section 10.3.2.8.2). The season and/or life requisites scenarios selected for each species were those considered as critical periods on an annual basis. Season and/or life requisite scenarios for each focal species were:

- Woodland caribou: spring feeding, summer/fall feeding, early winter feeding, and late winter feeding;
- Moose: winter feeding and winter shelter/thermal cover;
- Rocky Mountain elk: winter feeding and winter shelter/thermal cover;
- Grizzly bear: spring feeding, summer feeding, and fall feeding;
- Wolverine: winter feeding;
- Fisher: breeding;
- Marten: winter living;
- Northern goshawk: breeding; and
- Black-throated green warbler: breeding.

The ratings were developed using the TEM-based wildlife habitat rating protocol (RIC 1999a). A six-class rating system[35] was used for most species, except for the black-throated green warbler, which used a four-class system[36] (RIC 1999a). The Ecosystem-based Resource Mapping (ERM) System was used to generate habitat suitability and capability tables and map products (ERM Ratings Table Tool, 2002, Version 2.0.0, B.C. Ministry of Sustainable Resource Management, and ERM Mapping Tool, 2003, Version 1.66, B.C. Ministry of Sustainable Resource Management). Where TEM polygons were complex, averaging was used to arrive at a single rating for such polygon.

Wildlife habitat ratings were based on those developed for the Dillon Mine (WCC 2004b) and other projects in the same region (i.e., NDM 1998; Geowest 2000; WCC 2004a). Wildlife habitat field surveys were conducted in 2004 and 2005 to confirm habitat ratings (see Appendix E-1). The species-specific assumptions and adjustments used in developing the ratings are detailed in the Dillon *Mines Act* Permit Application (WCC 2004b). The reliability of the wildlife habitat suitability and capability rating schemes for the nine focal species is considered to be moderate (RIC 1999a).

In addition to the wildlife habitat ratings and disturbance buffers, the assessment of Project-specific and cumulative effects using habitat capability and suitability mapping used detailed project component footprints, including all related elements (e.g., pit boundaries, new or upgraded road sections, powerline rights-of-way); a regional spatial database of existing disturbances (disturbance coverage); and post-mining ecosystem units as per the Conceptual Reclamation Plan (Section 4.12).

#### 10.3.2.9.2 Traffic Volume Analysis

Potential Project effects on mortality risk to wildlife were assessed by estimating traffic volumes along access roads supporting the mine operations (i.e., Bullmoose and Falling Creek Connector haul routes). Three traffic volume rates were used along road segments to compare among baseline, construction, operations and post-closure conditions and included:

- Low: 0 to 5 vehicles per day;
- Medium: 6 to 10 vehicles per day; and
- High: >10 vehicles per day.

These traffic volumes rates were used to assess potential effects on more sensitive wildlife species (e.g., grizzly bear) that tend to avoid or respond poorly to traffic. The conservative approach to rating traffic volumes likely over-estimates potential effects on species that are less sensitive or may habituate to traffic (e.g., moose, birds).

[35] High (1), Moderately High (2), Moderate (3), Low (4), Very Low (5) and Nil (6), see RIC (1999a) for further definition of these classes.

[36] High (1), Moderate (2), Low (3) and Nil (4), again see RIC (1999a) for further definition of these classes.

The lack of specific data on traffic volume estimates during different Project phases necessitated this generalized approach. Therefore, best available information was used and ratings considered all potential road users, including existing Dillon Mine traffic volumes.

#### 10.3.2.9.3 Core Security Habitat Analysis

Potential effects of increased mortality on wildlife and effects of landscape level habitat fragmentation were assessed using core security habitat analysis. Core secure habitat is useable habitat within a species' range minus the habitat with reduced security due to human-caused disturbance, and of a size (area) that meets or exceeds species-specific minimum habitat patch requirements. Thus, core security habitat analysis is an assessment of the effect of landscape-level fragmentation on habitat patch size and is an effective analytical tool for assessing cumulative effects.

The core security habitat analysis approach was based on that recommended by the Interagency Grizzly Bear Committee (IGBC 1994) and used in previous assessments of human developments on grizzly bears (Gibeau et al 1996; Parks Canada 1997). Additional input on this approach was provided by Tony Hamilton (grizzly bear specialist, B.C. Ministry of Environment). While the approach used here is specific to grizzly bears, it can be applied to other landscape level species, such as caribou and wolverine.

Specifically, the analysis involved the following steps:

- *Identification of useable habitat* – for the grizzly bear, useable habitat was defined as any habitat rated as Suitability Class 1 to 5 for spring feeding.
- *Identification and buffering of disturbance features* – All disturbance features were assigned a level of use (high or low)[37] (Appendix E-6). High use features were buffered by 800 m and low use features were buffered by 400 m (see Table 10.3.2-3). Any habitat within the disturbance buffer was considered to be nil value as useable habitat.
- *Application of the disturbance buffers to habitat database and analysis of patch size distribution* – This step was applied to Baseline and Phases 1 and 2, and changes to the patch size distribution were determined and assessed relative to the species-specific minimum habitat patch size requirements. For grizzly bears, the daily minimum habitat patch size requirement is typically defined as 10 $km^2$ (Gibeau et al, 1996), and this was considered to be generally applicable to other landscape level species (e.g., caribou).

In addition to the habitat mapping and disturbance buffers, the analysis of core security habitat used the following data: detailed project component footprints, including all related elements (e.g., pit boundaries, new or upgraded road sections, powerline rights-of-way); regional spatial database of existing disturbances (disturbance coverage); and regional spatial database of

[37] In the absence of more specific information, all roads have been classified as high use.

future disclosed disturbances. This last requirement was not met for this assessment as no spatial data on future disclosed disturbances were available.

#### 10.3.2.9.4 Road Density Analysis

Similar to core security habitat analysis, potential effects of increased mortality on wildlife and effects of landscape level habitat fragmentation were assessed using road density analysis. Quantification of road densities can be used to infer changes in mortality risk to species such as caribou and grizzly bear at the landscape level. Thus, road density analysis is an effective analytical tool for assessing cumulative effects.

The road density analysis used a regional spatial database of existing and proposed[38] access features. The data sources for the road (linear features) density analyses were:

- TRIM (2001) linear features (e.g., public and industry roads, seismic lines, transmission lines);
- post-2001 Canfor's Forest Development Plan (FDP) roads;
- linear features associated with the Dillon Coal Project; and
- proposed linear features associated with the Brule Coal Project.

The road density analyses included consideration of both mortality and displacement effects (as per T. Hamilton, BCMOE, Victoria, B.C.) For this Project, features considered a mortality risk included all but airport features, and those considered to result in displacement included all but transmission lines, pipelines, seismic lines, and trails. The analyses involved using a moving (or roving) window density technique. Using this technique, four road density classes were applied (as per T. Hamilton, BCMOE, Victoria, B.C.):

- 0 $km/km^2$;
- > 0 to ≤ 0.6 $km/km^2$;
- > 0.6 to 1.2 $km/km^2$; and
- > 1.2 $km/km^2$.

Area summaries for each class were produced for watershed subunits, using a similar method employed by Gyug (2000) in the North Cascades. For each analysis, two development phases, Baseline and Construction/Operations, were considered.

[38] With the exception of the Project's new road segments, as noted in Section 10.3.2.9.4, a regional spatial database of proposed future developments was unavailable.

#### 10.3.2.9.5 Disturbance Buffers

A disturbance buffer defines the zone over which the effects of a disturbance feature (e.g., road, industrial site, seismic line) are presumed to extend beyond the actual footprint of the disturbance into adjacent habitats (due to actual habitat loss or avoidance as a result of sensory disturbance). This results in a reduction of effective habitat (i.e., habitat that provides the usual function of undisturbed areas) near disturbance features, and subsequently results in reduced available habitat.

The effect on habitat quality within a disturbance buffers was adjusted based on the nature of the disturbance feature. Two classes of disturbance features were used in the analyses: high use (e.g., all weather roads, active mine sites) and low use (e.g., seismic lines, utility corridors; Appendix E-6). Habitat quality was adjusted accordingly to the level of use associated with each disturbance type. That is, high use disturbances features will have a greater effect on habitat quality than low use disturbances features (Table 10.3.2-3). Disturbance features considered unused (e.g., overgrown roads, closed mines) were not buffered. The width of the disturbance buffer depends on the species' known or presumed sensitivity to the type of activity under consideration.

**10.3.2-3: Wildlife Focal Species Disturbance Buffers & Habitat Rating Reductions**

| Focal Species | Disturbance Buffer Width (m) | | Reduction in Habitat Rating | |
|---|---|---|---|---|
| | High use Feature | Low use Feature | High use Feature | Low use Feature |
| Woodland caribou | 800 | 400 | 2 classes | 1 class |
| Rocky Mountain elk | 100 | 0 | 1 class | - |
| Moose | 100 | 0 | 1 class | - |
| Grizzly bear | 800 | 400 | 2 classes | 1 class |
| Wolverine | 800 | 400 | 2 classes | 1 class |
| Fisher | 100 | 50 | 2 classes | 1 class |
| Marten | 100 | 50 | 2 classes | 1 class |
| Northern goshawk | 50 | 0 | 2 classes | - |
| Black-throated green warbler | 50 | 50 | 2 classes | 1 class |

More specifically, disturbance buffers are used to:

- Refine the habitat availability estimate for the Baseline and Post-closure phases—disturbance buffers are applied to existing disturbances and future disclosed activities (if available) as appropriate.
- Predict Project-specific effects under Phases 1 and 2 and the Post-closure phases—disturbance buffers are applied to all project component footprints for Phases 1 and 2, and to any project component footprints that are not reclaimed after mine closure for the Post-Closure phase.

Disturbance buffers were used in the wildlife habitat rating analyses (Section 10.3.2.9.1) and the core security habitat analysis (Section 10.3.2.9.4).

#### *10.3.2.10 Influence of Consultation on the Assessment*

Consultation conducted to support the development of the Terms of Reference (TOR) and Environmental Assessment, including the wildlife component is described in Section 2 of the Application. A Wildlife Environmental Study Plan was also prepared and provided to the Brule Mine EA Working Group, including the B.C. Ministry of Environment (MOE), Canadian Wildlife Service (Delta), First Nations, and the Kelly Lake Communities.

The proposed approach to assessing effects on wildlife was described during consultation and comments on the wildlife component were incorporated into this assessment. In general, the wildlife approach was considered to be appropriate and most comments during consultation were for clarification of technical issues. Two specific comments and responses were:

- Comment – why was the wolf not considered as a focal species for the assessment; Response – large predators, such as wolves, are considered indirectly in the assessment in the context of effects on their main prey species (i.e., ungulates, including moose, elk, and caribou).
- Comment – how will caribou be dealt with if they decide to calf on or near the mine site; Response – woodland caribou do not have specific calving grounds that are re-used annually, and would likely re-locate away from the mine area for calving purposes.

Additional comments and concerns raised during the Pre-Application period, and the response and status for each, were:

- Concern that wildlife will avoid the mine site, making guide/outfitting and trapping businesses less productive. Response / status – Many wildlife species are known to habituate, to varying extents, to the sensory disturbance associated with mine sites, and wildlife use of the Brule Mine site itself will increase over time as reclamation progresses. Among the wildlife focal species addressed in this assessment are several that are considered regionally important for hunting and trapping.
- Concern that the proposed Falling Creek Flats loadout site provides important habitat for bear, deer, moose, and elk. Response / status – Bear, moose, and elk are specifically included as focal species in the assessment. Habitat values for deer are considered indirectly in the assessment in the context of effects on other ungulates (i.e., moose and elk) with similar habitat requirements.
- For both the Bullmoose and proposed Falling Creek Flats Connector Haul routes, concern raised about wildlife corridors, wildlife monitoring, and mitigation of road kills. Response / status – This is addressed through the Wildlife Protection Plan (Section 4.11), which incorporates an incident monitoring program (e.g., record of wildlife-vehicle accidents), and

mitigation measures to minimize road kills (e.g., low speed limits, signage, and roadside clearing for increased visibility). Mortality risk associated with the haul routes and the disruption of wildlife movement corridors are also discussed in the Project effects assessment (Section 10.3.5).

Concern raised about dust affecting roadside vegetation, thereby affecting wildlife that may feed on berries and other plant parts. Response / status – WCC will use best practices to limit the production of dust on roadways, including watering and other dust suppression methods. Dust could reduce the palatability of roadside forage at certain times of the year (i.e., summer), but this effect would be spatially limited and, given their mobile nature wildlife could utilize better forage elsewhere (e.g., in undisturbed areas). Information on the direct effects (i.e., through inhalation) of coal dust on wildlife is limited, but has previously been ruled out as a concern in the region (BCEAO 2004a; BCEAO 2004b) [39].

### 10.3.3 Baseline Conditions

Over 40 mammals[40], possibly over 200 birds[41], 1 reptile[42], 5 amphibians[43], and an unknown number of invertebrate species may be present in the RSA at some time during the year. The list of candidate and selected focal species in Appendix E-5 provides an overview of the mammals, reptiles, amphibians, and some of the birds that are known or likely to occur in the RSA.

Multiple wildlife inventories and field studies have been conducted in and around the RSA beginning in the late 1970s (e.g., B.C. Research 1976) as part of the Northeast Coal Study. All but the most western section of the RSA (i.e., from Hasler Creek west) was included in that study. In the early 1980s, a resource inventory and analysis for the Burnt River Coal Property (which includes most of the present day minesite) was conducted (Pedology Consultants 1982). More recently, research and inventory efforts in the area have been focused on woodland caribou (e.g., Seip 2002; Jones et al 2004), the development of wildlife habitat models for Canfor's TFL 48 (e.g., Westworth 1998a, 1998b; Chytyk et al 2000; Chytyk et al 2001), and regional management issues (e.g., Anderson and Scheck 2004). There has also been some baseline wildlife work (e.g., surveys, habitat evaluations), covering various parts of the RSA, conducted for the Dillon Mine, immediately adjacent to the Brule footprint (i.e., WCC. 2004), for Pine Valley Coal's Willow Creek Project (e.g., NDM 1997) in the north-western section of the RSA, and in the Hasler Creek area as part of the Grizzly Valley pipeline expansion project (e.g., Hornbeck et al 1994a, Hornbeck et al 1994b). Baseline field surveys for this current Project

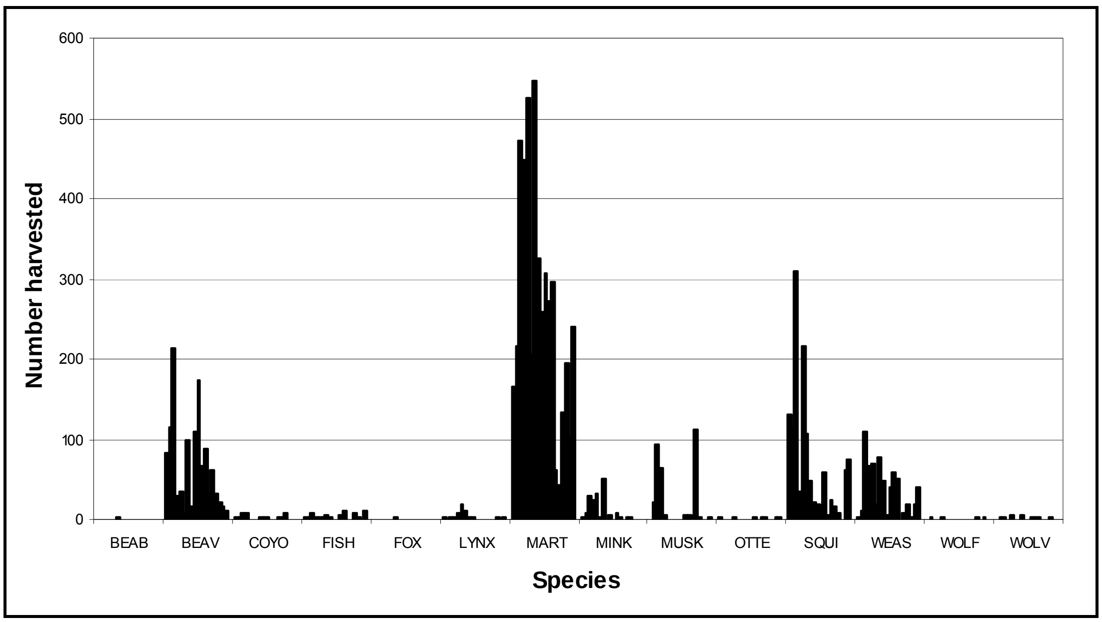
[39] However, airborne road dust as been implicated as contributing agent to bighorn sheep dieoffs in Colorado (Bailey 1986).
[40] Cowan and Guiguet (1973); Whitaker (1980); Westworth (1998a, 1998b); Shackleton (1999).
[41] A list of 213 spring and summer species compiled for Dawson Creek (Phinney et al n.d), and over 250 species listed for the Peace River region (Siddle 1989).
[42] St. John (2002).
[43] Corkran and Thoms (1996).

were conducted in June 2005 (see Section 10.3.2.5 and Appendix E-1), and supplement the previous work conducted within the RSA in 2002 and 2004, in support of the Dillon Mine.

The RSA is in provincial Management Unit (MU) 7-22. There is a hunting season in this MU for mule deer (*Odocoileus hemionus*), white-tailed deer (*Odocoileus virginianus*), moose, elk, mountain goat (*Oreamnos americanus*), black bear (*Ursus americanus*), grizzly bear, wolverine, coyote (*Canis latrans*), wolf (*Canis lupus*), cougar (*Puma concolor*), lynx (*Lynx canadensis*), snowshoe hare (*Lepus americanus*), grouse, ptarmigan (*Lagopus* spp.), raven (*Corvus corax*), and various waterfowl[44]. Trapping also occurs with the RSA. The provincial trapper harvest records for MU 7-22 from 1985-2003 show 14 species trapped, with marten being the most common, particularly in recent years (Figure 10.3.3-1).

The following sections provide an overview of baseline conditions for six wildlife groups (ungulates, large carnivores, furbearers, and small mammals, birds, amphibians and reptiles, and threatened and endangered species). Summaries are provided for each focal species including conservation status, selection rationale, local and regional distribution and abundance (population size if available), timing (season) of occurrence in the RSA (if applicable), general habitat use patterns, site-specific habitat use information (if available), and observation records from the 2002, 2004, and 2005 field sessions.

**Figure 10.3.3-1: Provincial Trapper Harvest Records for Management Unit 7-22, 1985 to 2003**




**Key:** BEAB = black bear, BEAV = beaver, COYO = coyote, FISH = fisher, FOX = red fox, LYNX = Canada lynx, MART = Marten, MINK = mink, MUSK = muskrat, OTTE = river otter, SQUI = red squirrel, WEAS = weasel, WOLF = wolf, WOLV = wolverine.
**Source:** (data from E. Lofroth, BCMOE, Victoria, B.C.).

[44] As per 2004/2005 Hunting and Trapping Regulations Synopsis (http://wlapwww.gov.bc.ca/fw/wild/documents/region_7b.pdf), and Limited Entry Hunting Regulations Synopsis 2004 to 2005 (http://wlapwww.gov.bc.ca/fw/wild/documents/leh_04_05.pdf).

### *10.3.3.1 Ungulates*

Moose are the most common ungulate in the RSA. Elk are less abundant but relatively large groups have been observed in the Hasler and Falling Creek Flats areas. The best moose and elk habitat in the area is located along the Sukunka and Pine rivers. Caribou appear to favour higher elevation habitats outside the RSA although there is likely some limited movement into the RSA along its western boundary. An ongoing telemetry program (Jones et al, 2004) will provide further information in this regard. White-tailed deer and mule deer also occur in the RSA, but do not appear to be very common. Pedology Consultants (1982) noted that the west side of the Sukunka River was identified as a major movement corridor for ungulates, and suggested that additional movement corridors exist along Blind Creek and probably Burnt River and Bluff Creek.

Westworth (1998b) identified two mineral lick sites and several potential link sites in the Burnt River LU, and during baseline data collection associated with this Project, the presence of a complex of mineral licks 50 m from either side of the Sukunka FSR was recorded (B. Hrychuk, pers. comm., May 2005).

Three of the focal species selected for detailed impact assessment purposes are ungulates: woodland caribou, moose, and Rocky Mountain elk (see Appendix E-5). These species are discussed in more detail below.

#### 10.3.3.1.1 Woodland Caribou

The northern ecotype of the woodland caribou occurs in the RSA (Jones et al, 2004; Goddard 2005). This ecotype is blue-listed in B.C. (CDC 2005a), designated as Threatened federally (COSEWIC 2005), and on Schedule 1 of SARA. The main rationale for the selection of this species as a focal species is: conservation status and regional interest.

The caribou found south of the Pine River and east of the continental divide have been included with the Moberly population in the past, but now the portion of this population south of the Pine River is thought to be a separate (unnamed) population (D. Seip, pers. comm., 2005), as the highway, railway and Pine River likely pose a significant barrier to caribou movement (Seip 2002). A February 2002 survey in the Burnt River/Pine River block – an area bounded by the continental divide in the west, the edge of the mountains to the east, Highway 97 to the north, and the Burnt River height of land in the south – recorded 20 caribou (1 calf, 19 adults) under poor observation conditions (Seip 2002). Eight caribou were seen in the upper Burnt River (outside the RSA) in parkland habitat, apparently feeding on arboreal lichen, and 12 more were seen on the windswept alpine ridges of Mt. Le Hudette (Seip 2002). Mt. Le Hudette is near but not within the western boundary of the RSA[45]. The corrected population estimate for this block is 45 animals (Seip 2002).

The northern ecotype of the woodland caribou is characterized by the dominance of terrestrial lichens in their winter diet (with some use of arboreal lichens depending on snow conditions), and by their seasonal movements, which typically involve both horizontal distance and elevation shifts (Cichowski et al, 2004). Alpine and subalpine habitats have been identified as areas of concentrated use (Sopuck 1985), in particular windswept alpine ridges (Sopuck 1985; Seip 2002; Jones et al 2004). Sopuck (1985) found that 40 to 55% of the Quintette population moved to winter ranges in the lowland boreal forest in the fall, and returned to the alpine and subalpine in the spring, whereas the remainder of the herd used alpine and subalpine areas year-round. Although the number of relocations was limited, data collected by Murray (1992) for a study area between the Sukunka and Narraway rivers are indicative of a similar pattern. Calving appears to take place at high elevation. For example, Sopuck (1985) observed females with newborn calves in mid-May and early June in open subalpine forest near treeline. There do not appear to be concentrations of calving caribou (Sopuck 1985).

The Moberly caribou south of the Pine River spent the winter on the alpine ridges of Mt. Le Hudette and moved west to the Mt. Le Moray area in spring and summer/fall (Jones et al, 2004). Annual home range sizes ranged from 108 to 278 $km^2$ ($n$ = 6 females) for the population as a whole (Jones et al, 2004). There have been no telemetry locations[46] in the RSA to date (E. Jones, unpublished data, July 2005). However, TERA (1997) recorded seven caribou along Falling Creek in February 1997 (but not in 1995 and 1996, TERA 1996). Thus, there appears to be occasional movement of caribou into lower elevation habitats along the western boundary of the RSA, although in general caribou are not believed to range into the area of gentler topography east of Falling Creek, and north of Burnt River (D. Seip, pers. comm.., November 2005).

Hornbeck et al (1994b) did not record any evidence of caribou in early or late winter in a study area located adjacent to and east of Hasler Creek. However, Westworth (1998b) observed caribou during winter aerial surveys in the vicinity of Brazion Peak, Milburn Peak, and Mt. Gillilano. No caribou or caribou sign was noted during the fieldwork related to this Project.

Within the RSA, habitat capability mapping prepared for the Northeast Coal Study identifies only a single area of class 3[47] caribou winter habitat, located south of Burnt River (RAB 1977). Recently, a draft caribou Wildlife Habitat Area (WHA) has been proposed for an alpine area east of Hasler Creek in the headwaters area of Highhat River (J. Anderson, pers. comm., August 2005; BCMSRM 2005).

[45] The B.C. Ministry of Environment has proposed an area around Mt. Le Hudette as a high priority caribou Ungulate Winter Range (UWR) (Goddard 2005; BCMSRM 2005).
[46] All the collared caribou are female (Jones et al, 2004).
[47] 4 caribou per $km^2$ per year (RAB 1977, 1979).

Caribou feeding habitat is found throughout the RSA, varying in elevation depending on the season. However, its suitability is markedly reduced, primarily by disturbance associated with roads and other linear access features. For all seasons, existing (baseline) availability of suitable feeding habitat is extremely limited within all project component LSAs (i.e., <1% of all rated moderate or better for habitat suitability) (e.g., see Figures 10.3.3-2 to 10.3.3-5 for late winter feeding habitat availability).

#### 10.3.3.1.2 Moose

The moose is not a species of concern in B.C. (CDC 2005a) nor is it listed federally (COSEWIC 2005). The main rationale for the selection of this species as a focal species is: socio-economic value as a hunted and subsistence species, and regional interest.

Moose are distributed throughout northeastern B.C. Their density is generally moderate within the RSA, with areas of low density to the west and high density to the east, along the Sukunka River (Shackleton 1999).

In general, moose use relatively open habitats with a productive shrub layer from early spring into late fall. Preferred habitats include wet meadows, shrub flats, riparian areas, muskeg, upland deciduous stands, and regenerating burns and clearcuts (Mytton and Keith 1981; Nietfeld et al, 1984; Pierce and Peek 1984; Risenhoover 1989). A mosaic of vegetation types in which foraging and security cover habitats are available in close proximity to each other is critical (Hamilton et al, 1980; Quinlan et al 1990). Under deep or crusted snow conditions, moose prefer areas that support both high browse-yield habitats and mature coniferous forests offering thermal cover and reduced snow depths (Doerr 1983; Nietfeld et al, 1984; Pierce and Peek 1984; Telfer 1984). Moose require winter range where snow depths are less than 90 cm (Kelsall and Prescott 1971). Home range sizes for non-migratory populations have been estimated at 6 to 27 $km^2$ during winter and 2 to 35 $km^2$ during summer (Petticrew and Munro 1979; Stevens and Lofts 1988).

Within the RSA, habitat capability mapping prepared for the Northeast Coal Study identifies class 1[48] moose winter habitat along the Sukunka River and lower Burnt River, and class 2[49] moose winter habitat along the Pine River and lower Hasler Creek (RAB 1977). Moose or moose sign have been commonly observed in these areas during various winter wildlife surveys (e.g., Westworth 1998b; Chytyk and Cooper 2001), and during the summer field programs associated with this Project.

Moose winter habitat is relatively common within the RSA, particularly in association with major river corridors. Figures 10.3.3-6 to 10.3.3-9 illustrates the existing (baseline) availability of suitable winter feeding habitat within the project component LSAs. Habitat availability is best

[48] 6.5 moose per $km^2$ per year (RAB 1977, 1979)
[49] 4 moose per $km^2$ per year (RAB 1977, 1979)

within the Mine Power Supply LSA (44% of area rated moderate or better for feeding suitability and 21% rated moderate or better for shelter/thermal cover suitability), and the Falling Creek Flats Loadout & Powerline LSA (30% of area rated moderate or better for feeding suitability and 17% rated moderate or better for shelter/thermal cover suitability). Habitat availability within the Falling Creek Connector Haul Route and Brule Mine LSAs is limited (<10% of both rated moderate or better for winter habitat suitability).

#### 10.3.3.1.3 Rocky Mountain Elk

The Rocky Mountain elk is not considered at risk in B.C. (CDC 2005a) nor is it listed federally (COSEWIC 2005). The main rationale for the selection of this species as a focal species is: socio-economic value as a hunted and subsistence species, and regional interest.

Rocky Mountain elk are most widely distributed in the province in the northeast (Shackleton 1999). Their density is considered generally low in and around the RSA (Shackleton 1999), although local residents report large numbers (i.e., 60 animals) in the Hasler Flats area in the winter (pers. comm., Chetwynd public meeting). The population in northeastern B.C. is apparently increasing in the Peace Sub-Region (Raedeke Associates, Inc. 1998).

Rocky Mountain elk prefer foraging in a mix of open grasslands and shrub areas or in open, mixed conifer and deciduous forests (Shackleton 1999). They use forested habitats for resting and may feed along avalanche chutes in the summer (Shackleton 1999). Most elk foraging occurs within 200 m of cover (Cairns and Telfer 1980; Lyon 1980). Elk in mountain habitats are typically migratory, moving to lower elevation habitats in response to increased snow accumulation (Adams 1982). Elk can tolerate a maximum of 50 to 60 cm of snow on their winter range (Simpson et al, 1993). Grasses dominated the winter diet of collared elk on the north side of the Peace Arm (over 40 km northwest of the RSA) (Corbould 1998).

Elk herds were regularly observed in the Pine and Sukunka River valleys during late winter fieldwork (Westworth 1998b), although they were not recorded during inventory conducted in the Burnt River LU at the same time (Westworth 1998b). Hornbeck et al (1994b) recorded elk in the SBSwk2 during early winter surveys in the Burnt River-Brazion Creek area. More elk were observed north of the Peace Arm than south of the Pine River—the majority along the south facing slopes on north side of Williston Lake (Chytyk and Cooper 2001). Chytyk and Cooper (2001) recorded 78 elk in March 2001 in and around Block 4[50] of TFL 48. Elk sign was observed frequently in the Falling Creek Flats loadout area during the June 2005 fieldwork.

Within the RSA, habitat capability mapping prepared for the Northeast Coal Study identifies class 2[51] elk winter habitat along the Pine River, lower Hasler Creek and lower Sukunka River, and

[50] The entire RSA is within Block 4 of TFL 48.
[51] 8.5 elk per $km^2$ per year (RAB 1977, 1979).

class 3[52] elk winter habitat in a broad band along and west of the middle section of the Sukunka River (primarily between Highhat River and Burnt River) (RAB 1977).

Elk winter habitat is less common within the RSA than it is for moose. Figures 10.3.3-10 to 10.3.3-13 illustrates the existing (baseline) availability of suitable winter feeding habitat within the project component LSAs. Shelter/thermal cover habitat availability is best within the Mine Power Supply LSA (15% of area rated moderate or better for habitat suitability). Elsewhere it is very limited (< 5% of all other LSAs rated moderate or better for shelter/thermal cover suitability). Winter feeding habitat availability is limited—the best availability is within the Falling Creek Flats Loadout & Powerline and Mine Power Supply LSAs (7% and 6% of area rated moderate or better for habitat suitability, respectively).

### *10.3.3.2 Large Carnivores & Furbearers*

Previous studies have recorded up to 11 species of furbearers in and around the RSA, with the most common being the red squirrel (*Tamiasciurus hudsonicus*) and snowshoe hare (Hornbeck et al 1994a; Westworth 1998b). Both grizzly and black bears occur in the RSA, although Pedology Consultants (1982) suggested that black bears were not that abundant on the Burnt River Property. Westworth (1998b) found wolverine to be relatively abundant and fisher uncommon in the Burnt River Landscape Unit. Other species recorded there included wolf, coyote, red fox (*Vulpes vulpes*), lynx, short-tailed weasel (ermine, *Mustela erminea*) least weasel (*M. nivalis*), and mink (*M. vison*) (Westworth 1998b). Several wolf packs may use the area in and around the RSA (Pedology Consultants 1982; Westworth 1998b). Habitat for aquatic furbearers appears to be limited (Pedology Consultants 1982), and confined to the larger watercourses (e.g., Sukunka River), however, Westworth (1998b) observed a beaver (*Castor canadensis*) in the Burnt River.

Four large carnivore and furbearer focal species were selected for detailed impact assessment purposes: grizzly bear, wolverine, fisher, and marten (see also Appendix E-5). These species are discussed in more detail below.

#### 10.3.3.2.1 Grizzly Bear

The grizzly bear is blue-listed in B.C. (CDC 2005a) and federally designated as a species of Special Concern (COSEWIC 2005). The main rationale for the selection of this species as a focal species is: conservation status, socio-economic value as a hunted species, strong regional and province-wide interest, and sensitivity to human disturbance.

The RSA is within the Hart Grizzly Bear Population Unit (GBPU). The current population estimate for the Hart GBPU is 386 bears, with a density of 20 bears per 1,000 $km^2$ (Hamilton et al, 2004; Mowat et al, 2004). This estimate is 71% of the habitat capability estimate (Hamilton et

[52] 5 elk per $km^2$ per year (RAB 1977, 1979).

al, 2004). This GBPU is considered viable (Hamilton et al, 2004), but is near the threshold for habitat effectiveness and is at risk of falling from viable to threatened status, the most substantive risk arising from increased mortality associated with improved access (letter from P. Johnstone, BCMWLAP, to B. Hart, BCEAO, dated 9 August 2004, re: Wolverine Coal Project Environmental Assessment[53]).

A multi-year grizzly bear research project was recently completed for a core study area focused on the Parsnip River watershed, but extending east into the Wolverine watershed (Ciarniello et al, 2003). Although none of the collared bears were known to range into the RSA, their findings on habitat use by 'mountain'[54] bears may have application to parts of the RSA[55] (Ciarniello et al, 2003). These bears were found to select for non-forested land cover types, including mid- to upper elevation grasslands (e.g., alpine meadows), avalanche chutes, and krummholz subalpine fir/slide alder/rhododendron communities (Ciarniello et al 2003). They also showed slight selection for younger age stands (i.e., burns, cutblocks), presumably because of the availability of *Vaccinium* fruit; however, the level of use of older forests at lower elevations remains unclear (Ciarniello et al, 2003). The mean annual home range sizes for females were 59 $km^2$ (100% Minimum Convex Polygon using VHF locations) and 127 $km^2$ (100% Minimum Convex Polygon using GPS locations), and 423 $km^2$ for males (100% Minimum Convex Polygon using VHF locations) (Ciarniello et al, 2003).

Westworth (1998a) conducted a pilot study to determine the feasibility of using DNA analysis from hair samples to examine the population characteristics of grizzly bears in the Burnt River Landscape Unit. Sites yielding the most grizzly bear hair samples were located near the upper Burnt River and the North Burnt River (Westworth 1998a). Westworth (1998a) suggests that this area contains the best grizzly bear habitat in the Landscape Unit. Although not indicative of overall population size, 15 different individuals were identified in the Landscape Unit in the single season of data collection (August to September 1997) (Westworth 1998a).

Anecdotal information collected by Pedology Consultants (1982) suggests that grizzly bears den in the Highhat valley as they were observed there in the spring. Also, TERA (1997) observed a female and cub in late April to the west of Falls Mountain (east of Falling Creek). Westworth (1998b) recorded a bear den in the ESSF parkland in the upper Burnt River.

Observations of grizzly bear sign have been made on the mine footprint during field programs associated with this Project, and a grizzly bear was observed in mid-July 2005 at Km 4.5 on the Blind Creek Road[56].

Grizzly bear active season[57] feeding habitat is found throughout the RSA, although, as for woodland caribou, its suitability is markedly reduced, primarily by disturbance associated with

[53] Available from: http://www.eao.gov.bc.ca/epic/output/html/deploy/epic_document_162_19102.html.
[54] As opposed to 'plateau' bears that ranged primarily west of the Rocky Mountains (Ciarniello et al 2003).
[55] Note that the study area of Ciarniello et al (2003) did not include any area in the BWBS zone.
[56] Dillon Mine Wildlife Sighting Sheet.

roads and other linear access features. Existing (baseline) availability of suitable active season feeding habitat is extremely limited within all project component LSAs (i.e., <1% of all LSAs rated moderate or better for habitat suitability) (e.g., see Figures 10.3.3-14 to 10.3.3-17 for spring feeding habitat availability).

#### 10.3.3.2.2 Wolverine

The wolverine is blue-listed in B.C. (CDC 2005a) and considered a species of Special Concern federally (COSEWIC 2005). The main rationale for the selection of this species as a focal species is: conservation status, socio-economic value as a trapped species, regional interest, and sensitivity to human disturbance.

Wolverines are widely distributed at low densities throughout much of B.C., although there is no current estimate of the provincial population size (Weir 2004). The density of wolverine in the northern Columbia Mountains was estimated to be 1 per 160 $km^2$ (Krebs and Lewis 2000); however, the applicability of this estimate to other parts of the province is unknown (Weir 2004). Their relative scarcity in the trapping records for MU 7-22 (Figure 10.3.3-1) may be indicative of their abundance in the region.

A relatively undisturbed wilderness setting is considered important for wolverines (Kelsall 1982; Weir 2004). They will use a wide variety of habitats and structural stages, although mature and old forests are used predominantly (Weir 2004). Most studies indicate that wolverine exhibit little, if any, selection for habitats at the stand level (reviewed by Weir 2004). In mountainous regions of B.C., females tend to use ESSF zones in the winter and the alpine in the summer, while males tend to use lower elevation zones during the winter and ESSF zones during the summer (reviewed by Weir 2004). The intensity and frequency of use of various habitats is linked to the ability of the habitat to support year-round food sources (e.g., ungulate carcasses, marmots, snowshoe hares) (Kelsall 1982; COSEWIC 2003; Weir 2004). Home range size varies widely, for example, from 311 $km^2$ for females to 1366 $km^2$ for males (Krebs and Lewis 2000; Lofroth 2001). Wolverines do not apparently exhibit strong site fidelity, except for females with natal or maternal dens (Weir 2004). However, these dens are not likely to be re-used between years (Weir 2004).

The RSA is located within an area of the province considered to have high potential wolverine habitat (Weir 2004). Surveys in and around the RSA indicate that wolverines are relatively abundant (Hornbeck et al, 1994a; Westworth 1998b) and a wolverine was observed on the Burnt River Property (Pedology Consultants 1982). No wolverines or wolverine sign were recorded during the fieldwork related to this Project.

Wolverine winter habitat is found at higher elevations throughout the RSA, although, as for the grizzly bear and woodland caribou, its suitability is markedly reduced, primarily by disturbance

[57] That is, spring, summer and fall.

associated with roads and other linear access features. Existing (baseline) availability of suitable winter habitat is extremely limited within all project component LSAs (i.e., <1% of all LSAs rated moderate or better for habitat suitability) (Figures 10.3.3-18 to 10.3.3-21).

#### 10.3.3.2.3 Fisher

The fisher is blue-listed in B.C. (CDC 2005a), but is not considered at risk federally (COSEWIC 2005). The main rationale for the selection of this species as a focal species is: conservation status, socio-economic value as a trapped species, and regional interest.

The current range of the fisher in B.C. is primarily within the Boreal Plains, Sub-Boreal Interior, Central Interior, and Taiga Plains ecoprovinces (Weir 2003). There are likely four genetically isolated fisher subpopulations in B.C., including one in the Peace Region (Weir 2003). The Peace Region subpopulation is estimated to be 548 to 1,300 animals (Weir 2003). This population estimate is based on the density of fisher in the Williston area (1 per 146 $km^2$), which may not be applicable to other parts of its range (Weir 2003). The relative scarcity of fisher in the trapping records for MU 7-22 (Figure 10.3.3-1) may be indicative of their abundance in the region.

Fishers inhabiting the coniferous-dominated forests of western Canada appear to have a close association with late successional stands (Weir 2003). They have a well-documented requirement for overhead (canopy) cover, both for security from predators, and interception of snow (reviewed by Weir 2003), although they may be found in low canopy stands where patches of higher cover exist (Weir 2003). Fishers use a wide variety of habitats for foraging, but tend to avoid openings (Powell 1982; Weir 2003). In B.C., rest sites have been identified as branches (e.g., brooms), cavities, coarse woody debris, and ground sites (e.g., rock piles), and natal and maternal den sites appear to be confined exclusively to cavities in large diameter, declining black cottonwoods or balsam poplars (Weir 2003). Natal dens may be reused (Weir 2003). Mean annual home ranges were 26.4 $km^2$ for females and 46.5 $km^2$ for males in south-central B.C. (Weir 1995).

The RSA is within an area of high fisher habitat capability (Weir 2003). However, they were considered uncommon in the Burnt River Landscape Unit (Westworth 1998b) and elsewhere in the RSA (Hornbeck 1994a; NDM 1997). No fishers or fisher sign were recorded during the fieldwork related to this Project.

Suitable fisher breeding habitat is limited within the RSA to older forests along major river corridors. Figures 10.3.3-22 to 10.3.3-25 illustrates the existing (baseline) availability of suitable breeding habitat within the project component LSAs. Habitat availability is best within the Mine Power Supply LSA (15% of area rated moderate or better for habitat suitability, Figure 10.2.3-23), and the Falling Creek Flats Loadout & Powerline LSA (10% of area rated moderate or better for habitat suitability, Figure 10.3.3-25). Habitat availability within the Falling

Creek Connector Haul Route and the Brule Mine LSAs is extremely limited (<1% of both rated moderate or better for habitat suitability) (Figures 10.3.3-24 and 10.3.3-22, respectively).

#### 10.3.3.2.4 Marten

The marten is not listed provincially (CDC 2005a) or federally (COSEWIC 2005). The main rationale for the selection of this species as a focal species is: socio-economic value as a trapped species and regional interest.

Marten occur in forested habitats throughout most of B.C., with their greatest densities in coastal old-growth forests, but are generally common across their range (Stevens and Lofts 1988; Stevens 1995). Prey abundance (e.g., voles) appears to be a critical factor affecting marten population dynamics (Mech and Rogers 1977; Fryxell et al, 1999). The marten's prominence in the trapping records for MU 7-22 (Figure 10.3.2-1) indicates that it is likely relatively abundant in the region.

Marten are often referred to as old-growth dependent; however, they may occur in second-growth stands (Buskirk and Powell 1994; Bowman and Robitaille 1997), including those that are deciduous-dominated (Poole et al, 2004). Marten in the northern boreal forest are closely associated with late successional coniferous stands, especially those dominated by spruce and fir, with complex structure near the ground (i.e., coarse woody debris) (Slough 1989; Buskirk and Powell 1994). Commonly reported refuge sites include ground burrows, rock piles and crevices, downed logs, stumps, snags, brush or slash piles and squirrel middens (Mech and Rogers 1977; Steventon and Major 1982; Buskirk 1984; Ruggiero et al 1994; Bull and Heater 2000). Home range sizes are 2.0 to 15.7 $km^2$ for males and 0.8 to 8.4 $km^2$ for females (Strickland and Douglas 1987).

Marten are abundant in and around the RSA (Hornbeck 1994a; NDM 1997; Westworth 1998b). However, no martens or marten sign were recorded during the field sessions associated with this Project.

Suitable marten winter habitat is found in mid-elevation forested areas throughout the RSA. Figures 10.3.3-26 to 10.3.3-29 illustrates the existing (baseline) availability of suitable winter habitat within the project component LSAs. Habitat availability is best within the Falling Creek Connector Haul Route LSA (23% of area rated moderate or better for habitat suitability, Figure 10.3.3-28), and the Brule Mine LSA (19% of area rated moderate or better for habitat suitability, Figure 10.3.3-26). Habitat availability within the Falling Creek Flats Loadout & Powerline and Mine Power Supply LSAs is limited (≤10% of both rated moderate or better for habitat suitability) (Figures 10.3.3-29 and 10.3.3-27, respectively).

#### *10.3.3.3 Small Mammals*

There is limited information available on small mammals in and around the RSA. Westworth (1998a) conducted a bat inventory in late July 1997 in the ESSFwk2 and SBSwk2 in the Burnt River Landscape Unit. Seven little brown myotis (*Myotis lucifugus*) were captured in mist nets, and *Myotis* spp., larger-bodies bats (e.g., big brown bats [*Eptesicus fuscus*], and silver bats[58] [*Lasionycteris noctivagrans*]) and hoary bats (*Lasiurus cinereus*) were heard on bat detectors. In the same year, Westworth (1998a) also conducted a small mammal inventory in the late summer, that included transects in all biogeoclimatic units in the Landscape Unit. The deer mouse (*Peromyscus maniculatus*) had the highest relative abundance, followed by the common shrew (*Sorex cinereus*), and southern red-backed vole (*Clethrionomys gapperi*). Other species captured were: dusky shrew (*S. monticolus*), meadow vole (*Microtus pennsylvanicus*), heather vole (*Phenacomys intermedius*), long-tailed vole (*M. longicaudus*), western jumping mouse (*Zapus princeps*), red squirrel, northern flying squirrel (*Glaucomys sabrinus*), black-backed shrew (*S. arcticus*), and pygmy shrew (*S. hoyi*). To date, no small mammals of conservation concern have been documented in the RSA.

No small mammal species were selected as focal species for detailed impact assessment purposes (see also Appendix E-5).

#### *10.3.3.4 Birds*

A wide variety of birds (e.g., waterfowl, shorebirds, raptors, songbirds) occur in the RSA. There were 82 bird species recorded in the RSA during 2002, 2004, and 2005 (Table 10.3.3-1). Most observations were of songbirds and included five listed species; the black-throated green warbler, bay-breasted warbler (*Dendroica castanea*), Philadelphia vireo (*Vireo philadelphicus*), lark sparrow (*Chondestes grammacus*), and Canada warbler (*Wilsonia canadensis*) (see Section 10.3.3.7). Four nests were located: hairy woodpecker (*Picoides villosus*), orange-crowned warbler (*Vermivora celata*), northern saw-whet owl (*Aegolius acadicus*), and red-breasted nuthatch (*Sitta canadensis*).

Other surveys in the region have recorded additional species. Chytyk et al (2001) recorded 119 bird species over two years in Block 4 of TFL 48, an area that includes the entire RSA. Raptors detected and considered to be breeding in the study area were osprey (*Pandion haliaetus*), bald eagle (*Haliaeetus leucocephalus*), northern harrier (*Circus cyaneus*), sharp-shinned hawk (*Accipter striatus*), red-tailed hawk (*Buteo jamiacensis*), American kestrel (*Falco sparverius*), merlin (*Falco columbiarius*), and barred owl (*Strix varia*) (Chytyk et al, 2001). Raptors were found in low numbers and were generally concentrated in the open areas in the northeast portion of the study area (Chytyk et al, 2001). The most common and widespread species in the Burnt River Landscape Unit were chipping sparrow (*Spizella passerina*), Wilson's warbler (*Wilsonia pusilla*), yellow-rumped warbler (*Dendroica coronata*), Swainson's thrush (*Catharus ustulatus*),

[58] Or silver-haired bat (as per CDC 2005a).

Townsend's warbler (*Dendroica townsendi*), pine siskin (*Carduelis pinus*), and hermit thrush (*Catharus guttatus*) (Westworth 1998a).

The Project area is not along a major migratory flyway. Most of the waterfowl habitat in the vicinity of the proposed mine is along the Sukunka River, east of the Brule Mine footprint. Previous work suggests that areas in and around the RSA are of marginal or low value for migratory shorebirds and waterfowl (i.e., Pedology Consultants 1982; Westworth 1998a).

Two bird focal species were selected for detailed impact assessment purposes: northern goshawk and black-throated green warbler (see also Appendix E-5). These species are discussed in more detail in Table 10.3.3-1.

**10.3.3-1: Bird Species Documented in the RSA during 2002, 2004 & 2005 Surveys (Compiled from Keystone Wildlife Research Ltd., Unpublished Data, & Appendix E-1)**

| | |
|---|---|
| Alder flycatcher | Northern saw-whet owl |
| American crow | Northern waterthrush |
| American kestrel* | Olive-sided flycatcher |
| American redstart | Orange-crowned warbler |
| American robin | Ovenbird |
| Bank swallow | Pacific-slope flycatcher |
| Barn swallow | Philadelphia vireo |
| Bay-breasted warbler | Pileated woodpecker |
| Black-and-white warbler | Pine grosbeak |
| Black-capped chickadee | Pine siskin |
| Blackpoll warbler | Purple finch |
| Black-throated green warbler | Red-breasted nuthatch |
| Blue-headed vireo | Red crossbill |
| Boreal chickadee | Red-eyed vireo |
| Brown-headed cowbird | Red-tailed hawk |
| Calliope hummingbird | Red-winged blackbird |
| Canada goose | Rose-breasted grosbeak |
| Canada warbler | Ruby-crowned kinglet |
| Cedar waxwing | Northern waterthrush |
| Chipping sparrow | Ruffed grouse |
| Common merganser | Rufous hummingbird |
| Common raven | Savannah sparrow |
| Common snipe | Sora |
| Common yellowthroat | Spotted sandpiper |
| Dark-eyed junco | Steller's jay |
| Downy woodpecker | Swainson's thrush |
| Fox sparrow | Tennessee warbler |
| Golden-crowned kinglet | Three-toed woodpecker |
| Golden-crowned sparrow | Townsend's warbler |
| Gray jay | Varied thrush |
| Hairy woodpecker | Warbling vireo |
| Hammond's flycatcher | Western tanager |
| Hermit thrush | Western wood-peewee |
| Lark sparrow | White-throated sparrow |
| Least flycatcher | White-winged crossbill |

| | |
|---|---|
| Lincoln's sparrow | Wilson's warbler |
| MacGillivray's warbler | Winter wren |
| Magnolia warbler | Yellow warbler |
| Mourning warbler | Yellow-bellied flycatcher |
| Northern flicker | Yellow-bellied sapsucker |
| Northern goshawk | Yellow-rumped warbler |
| Northern pygmy-owl | |

**Note:** * Recorded along Highway 97.

#### 10.3.3.4.1 Northern Goshawk

The "interior" northern goshawk[59] is not a species of concern provincially (CDC 2005a) or federally (COSEWIC 2005). The main rationale for the selection of this species as a focal species is regional interest.

The northern goshawk is rare to uncommon, but is widely distributed and breeds throughout the province (Campbell et al, 1990). Northern interior populations are thought to be more abundant than coastal or southern interior populations (Campbell et al, 1990), but supporting data in this regard are lacking (Cooper and Stevens 2000). Population estimates based on detection of birds or nests have not been attempted in the province (Cooper and Stevens 2000). However, goshawk densities in other parts of North America range from 1.4 to 10.7 pairs per 100 $km^2$ (Squires and Reynolds 1997).

The goshawk's breeding season spans from early April to late August (Campbell et al, 1990). They are likely year-round residents of the RSA, although in some years may migrate to more southern latitudes within the province (Campbell et al, 1990).

A northern goshawk inventory conducted for TFL 48 in 2000 and 2001 found 12 sticks nests that were tentatively identified as goshawk nests[60] in and around Block 4 of the TFL (Chytyk and Cooper 2001). The majority of these nests were within the RSA. Incidental observations or detections in response to call playback surveys were recorded in the SBSwk2, BWBSmw1, BWBSwk1, and ESSFmv2 in and around Block 4 (Chytyk et al, 2001; MCA 2001). Half of these records were within the RSA. Detection rates were considered to be moderately high in 2001 (Chytyk et al, 2001), up from moderately low in 2000 (MCA 2001).

Goshawks avoid early successional stages and immature forests for nesting and foraging (review by Cooper and Stevens 2000). The three confirmed goshawk nests located during the TFL 48 study were found in structural stage 6 (80 to 140 years old) of the BWBSwk1 01 site series (Chytyk et al, 2001; MCA 2001). One of these nests was located within the RSA, near the junction of the Sukunka FSR and Highway 29.

[59] The 'coastal' northern goshawk (*A. g. laingi*) is red-listed in B.C. (CDC 2005a), and designated as threatened federally (COSEWIC 2004).

[60] Subsequent ground searches confirmed one of these as an active red-tailed hawk nest; the other nests remain unconfirmed as to species (Chytyk et al, 2001).

A northern goshawk was observed in June 2005 flying across a road in the proposed mine footprint.

Suitable breeding habitat for the northern goshawk is found in lower elevation forested areas throughout the RSA. Figures 10.3.3-30 to 10.3.3-33 illustrates the existing (baseline) availability of suitable breeding habitat within the project component LSAs. Habitat availability is best within the Mine Power Supply LSA (42% of area rated moderate or better for habitat suitability, Figure 10.3.3-31), and the Falling Creek Flats Loadout & Powerline LSA (28% of area rated moderate or better for habitat suitability, Figure 10.3.3-33). Habitat availability within the Falling Creek Connector Haul Route LSA and the Brule Mine LSAs is limited (<15% of both rated moderate or better for habitat suitability) (Figures 10.3.3-32 and 10.3.3-30, respectively).

#### 10.3.3.4.2 Black-throated Green Warbler

The black-throated green warbler is not federally listed (COSEWIC 2005), but it is blue-listed in B.C. (CDC 2005a). The main rationale for the selection of this species as a focal species is: conservation status, wildlife viewing value, and regional interest.

This neotropical migrant's breeding range in B.C. is restricted to the northeastern corner of the province (Cooper et al, 1997). It is generally uncommon throughout this area, with the exception of local areas in the Peace Lowland Ecosection, where the majority of its B.C. population apparently occurs (Cooper et al, 1997; Campbell et al, 2001). Originally thought to occur almost exclusively in the Boreal Plains Ecoprovince, with a few records for the Taiga Plains Ecoprovince (Cooper et al 1997; Campbell et al, 2001), there are now multiple records for this species in the Sub-Boreal Interior Ecoprovince (e.g., Chytyk et al, 2001).

Relative to other rare northeastern warblers (e.g., bay-breasted warbler) this species is considered to have a moderate-size population (Cooper et al, 1997).

The breeding ecology of the black-throated green warbler in B.C. is poorly known (Cooper et al, 1997). Based on information from Alberta, the majority of migrants probably first arrive in northeastern B.C. in late May and early June and adults probably start to head south after mid July, followed by the juveniles in August (Cooper et al, 1997). Most birds have likely left the region by early September (Campbell et al, 2001).

In northeastern B.C., the black-throated green warbler mainly inhabits mature riparian white spruce or mixed wood forests, although they will forage in younger forests (Cooper et al, 1997). They have also been recorded in mature upland spruce forests and pine forests in this region (Strom et al, 1995; Booth and Merkens 1999). This warbler has been recorded in the BWBSmw1, BWBSwk1, and SBSwk2 in the Hart Foothills Ecosection (Chytyk et al, 2001; MCA 2001; Keystone Wildlife Research Ltd., unpublished data). The majority of black-throated green warblers observations in this region were in site series 01 of the BWBSmw1, site series 01 and 05 of the BWBSwk1 (Chytyk et al, 2001; MCA 2001), and site series 01 and 03 of the SBSwk2

(Chytyk et al, 2001; Keystone Wildlife Research Ltd., unpublished data). Stand structural stage was typically 6 (80 to 140 years old), but ranged from 3b to 7 (i.e., from tall shrub to >140 years old) (Chytyk et al, 2001; MCA 2001; Keystone Wildlife Research Ltd., unpublished data). This warbler was considered uncommon in Block 4 of TFL 48 (Appendix D in Chytyk et al 2001).

Within the RSA, MCA (2001) detected black-throated green warblers along the Hasler FSR in June 2001. This species was also recorded along the Mink Creek road right-of-way in June 2002 (Keystone Wildlife Research Ltd., unpublished data), near Hasler in June 2004 (WCC 2004b), and in the Falling Creek Flats loadout area in June 2005 (Appendix E-1).

Suitable breeding habitat for the black-throated green warbler is found in lower elevation forested areas in the RSA, particularly in association with major river corridors.
Figures 10.3.3-34 to 10.3.3-37 illustrates the existing (baseline) availability of suitable breeding habitat within the project component LSAs. Habitat availability is best within the Mine Power Supply LSA (36% of area rated moderate or better for habitat suitability, Figure 10.3.3-35), and the Falling Creek Flats Loadout & Powerline LSA (33% of area rated moderate or better for habitat suitability, Figure 10.3.3-37). Habitat availability within the Falling Creek Connector Haul Route and the Brule Mine LSAs is very limited (<5% of both rated moderate or better for habitat suitability) (Figures 10.3.3-36 and 10.3.3-34, respectively).

### *10.3.3.5 Amphibians & Reptiles*

There have been no inventories for reptiles and amphibians in and around the RSA. One reptile may occur, (common garter snake (*Thamnophis sirtalis*)) and five amphibians may be present, (long-toed salamander (*Ambystoma macrodactylum*), western toad (*Bufo boreas*), Columbia spotted frog (*Rana pretiosa*), wood frog (*R. sylvatica*), and boreal chorus frog (*Pseudacris triseriata*)). Only one amphibian species has been confirmed in the RSA; a western toad was recorded in 2002 in the Dillon footprint area. The western toad is yellow-listed in B.C., but is considered to be Special Concern by COSEWIC, and is on Schedule 1 of SARA (COSEWIC 2005).

No amphibian or reptile species were selected as focal species for detailed impact assessment purposes (see also Appendix E-5).

### *10.3.3.6 Threatened & Endangered Species*

As noted in Section 10.3.2.2, conservation status is one of the criteria for focal species selection.

There is, at present, only two vertebrate species known from the RSA that are listed under Schedule 1 of SARA[61]: the woodland caribou (Southern Mountain National Ecological Area population), which is designated as Threatened; and the western toad, which is designated as

[61] Schedule 1 of SARA is the 'Legal List' of species at risk, and the species on it are covered under SARA legislation.

Special Concern[62]. The grizzly bear and wolverine are listed as Special Concern[63] federally (COSEWIC 2005). With respect to provincial conservation status, five focal species are blue-listed[64] (woodland caribou, grizzly bear, wolverine, fisher, and black-throated green warbler) (CDC 2005a). More information on each of these focal species is found under their respective subsections (see above).

In addition to the aforementioned focal species, four other provincially listed species were recorded in the RSA in June 2005. The Philadelphia vireo (Blue List) and bay-breasted warbler (Red List) were detected along the proposed mine power supply route and in the Falling Creek Flats loadout area. The Canada warbler (Blue List) and lark sparrow (Red List) were recorded along the proposed Mine Power Supply route. Also, two listed bird species have been recorded in the RSA during other studies. A single observation of a broad-winged hawk (*Buteo platypterus*, Blue List) was recorded in 2001 along lower Burnt River (MCA 2001), and several observations of the Connecticut warbler (*Oporornis philadelphia*, Red List) along the west side of the Sukunka River, north of Burnt River, and one near Willow Flats, were recorded in 2001 (Chytyk et al, 2001).

To date, there are no CDC wildlife occurrence records in the RSA[65].

### 10.3.4 Mitigation Measures

The main effects of the Project will be on mortality risk and habitat availability, particularly during Phases 1 and 2. The potential disruption of movement patterns will generally be localized and relatively short term. As a result, wildlife mitigation measures are primarily directed at minimizing Project-related wildlife mortalities. Potential sources of mortality might include wildlife-vehicle collisions, lethal control of problem wildlife, destruction of nests and dens, and unrestricted use of firearms. Additionally, mitigation measures will be implemented that reduce direct and indirect habitat loss. The cornerstone of this is the Conceptual Reclamation Plan (Section 4.12), but other measures include timing of construction activities to avoid sensitive periods (e.g., nesting) and high value habitats (e.g., see Figures 10.3.3-2 to 10.3.3.-34), as well as avoidance of sensitive wildlife areas (e.g., mineral licks), when known, during construction.

While the focus of the mitigation measures will be the focal species, the implementation of these measures will generally have universal application to a wide range of species (e.g., reduction of traffic speeds will reduce the mortality risk to all ungulates).

[62] Added to Schedule 1 in January 2005 (Government of Canada 2005).
[63] Both species were under consideration for addition to Schedule 1 of SARA, but based on the results of public consultation were not added (Government of Canada 2005). They are presently on Schedule 2b ('not added to Legal List pending further consultation by government', COSEWIC 2005).
[64] Blue-listed = special concern (formerly vulnerable) in B.C.; Red-listed = extirpated, endangered or threatened in B.C.
[65] B.C. Conservation Data Centre: Terrestrial Information Mapping Service [web application]. 2004. Victoria, B.C. Available: http://maps.gov.bc.ca/imf406/imf.jsp?site=rrid_tib_ti (accessed September 2005).

There are two main mechanisms for mitigation of Project-related effects on wildlife. The first is the Wildlife Protection Plan described in Section 4.11. Proposed measures for mitigation and prevention of project-related effects are presented in detail in Section 4.11. As already noted, the second is the Reclamation Plan, which is fully described in Section 4.12.

To varying degrees, enforcement, adherence, and chance will influence the results of mitigation efforts. Thus, the key to successful mitigation is a monitoring program that can identify issues of concern (e.g., where a planned mitigation is ineffective), and prompt adaptive management practices. Monitoring recommendations are presented in Section 10.2.9.

### 10.3.5 Project Effects Assessment

Potential effects on wildlife from the proposed Project are related to three key issues: habitat availability, disruption of movement patterns, and mortality risk. The predicted Residual Project Effects[66] for each of these key issues are described below for five species groups (ungulates, large carnivores, furbearers and small mammals, birds, amphibians and reptiles) with emphasis on the nine focal wildlife species.

#### *10.3.5.1 Habitat Availability*

In general, the greatest direct loss of habitat occurs as a result of vegetation clearing for the Brule Mine and the Falling Creek Flats Loadout. Reclamation efforts will be directed at the majority of this cleared area and can be expected to result in recovered habitat values over time (Section 4.12). Indirect habitat loss through displacement as a result of sensory disturbance is associated with all project components but can be expected to decrease beginning in the Decommissioning phase and continuing into the Post-closure phase.

It is important to note that the estimates of habitat availability derived from the habitat suitability mapping are conservative, particularly for the focal species with large disturbance buffers (i.e., caribou, grizzly bear, and wolverine). The model applied here predicts that the effect of the disturbance buffer on habitat value is the same throughout the buffer (see Table 10.3.2-3) when, in reality, habitat avoidance within disturbance buffers adjacent to features such as roads might range from complete to none based on a variety of factors (e.g., sex and age class of animal, type of vegetative cover, time of day, level of habituation).

The results of habitat suitability[67] and capability[68] analyses are discussed here, with tabular results summaries presented in Appendix E-8.

[66] As noted previously, Residual Project Effects are Project effects not considered to be fully addressed by the proposed mitigation measures (Section 10.3.2.6).
[67] As described in Section 10.3.2.9.1, wildlife suitability is the ability of a habitat (or ecosystem unit) in its current condition to provide the life requisites of a species. Changes in habitat suitability were used to assess potential short-term effects of the Project between Baseline and Phases 1 and 2.

#### 10.3.5.1.1 Ungulates

Project-related activities during Phases 1 and 2 will decrease ungulate habitat availability through direct habitat loss and sensory disturbance (habitat avoidance). Ungulates will demonstrate some displacement (generally less than 1 km in wooded or hilly terrain) away from the immediate vicinity of human activities (Horejsi 1979; Morgantini 1984; Jalkotzy et al 1997). However, there is no evidence to suggest that such short-term displacement results in significant decreases in local animal numbers (Bangs and Bailey 1982), provided that increased hunting pressures are not associated with the development. Given the relatively homogeneous habitat conditions in the Project area, displaced animals will have the ability to temporarily relocate away from the development footprints without being forced into sub-optimal habitats. The Project area intercepts winter range for some species (e.g., moose and elk in the loadout area); however, construction is not expected to overlap the critical winter period for ungulates. Clearing at the loadout will be minimized.

Project effects will be reduced with the lower activity levels during the Decommissioning/Reclamation phase and progressive reclamation efforts (Section 4.11) through to Post-closure. Disturbed areas as they are being reclaimed may provide foraging areas for ungulates such as elk and moose, particularly when in close proximity to escape cover.

Residual Project Effects on the three ungulate focal species are described in detail below.

##### Woodland Caribou

Existing caribou feeding habitat is extremely limited within the LSA (i.e., <1% of all LSAs rated moderate or better for habitat suitability). Most seasonal habitat suitability and capability is rated as low to nil quality, with no or little higher quality habitat (Figure 10.3.5-1). Similarly, the area of moderate or better suitability caribou habitat within the LSA is a small proportion of that available within the RSA during the spring and summer/fall (6.9% in both seasons), and even less during early and late winter (1.7% and 3.9%, respectively) (Appendix E-8.1).

The effects of Phases 1 and 2 (i.e., effects on habitat suitability) are relatively large (based on percent changes), although only on small areas (44.9 ha in spring, 63.8 ha in summer/fall, 12.4 ha in early winter, 50.3 ha in late winter) (Figure 10.3.5-1, Appendix E-8.1). When present, the area of moderately high suitability habitat decreases by 100% and the area of moderate suitability habitat decreases by 64.9% to 100% depending on the season (Figure 10.3.5-1, Appendix E-8.1). The majority of this effect is related to sensory disturbance from mine-related activities so there will likely be some recovery of habitat suitability during the Decommissioning/Reclamation phase.

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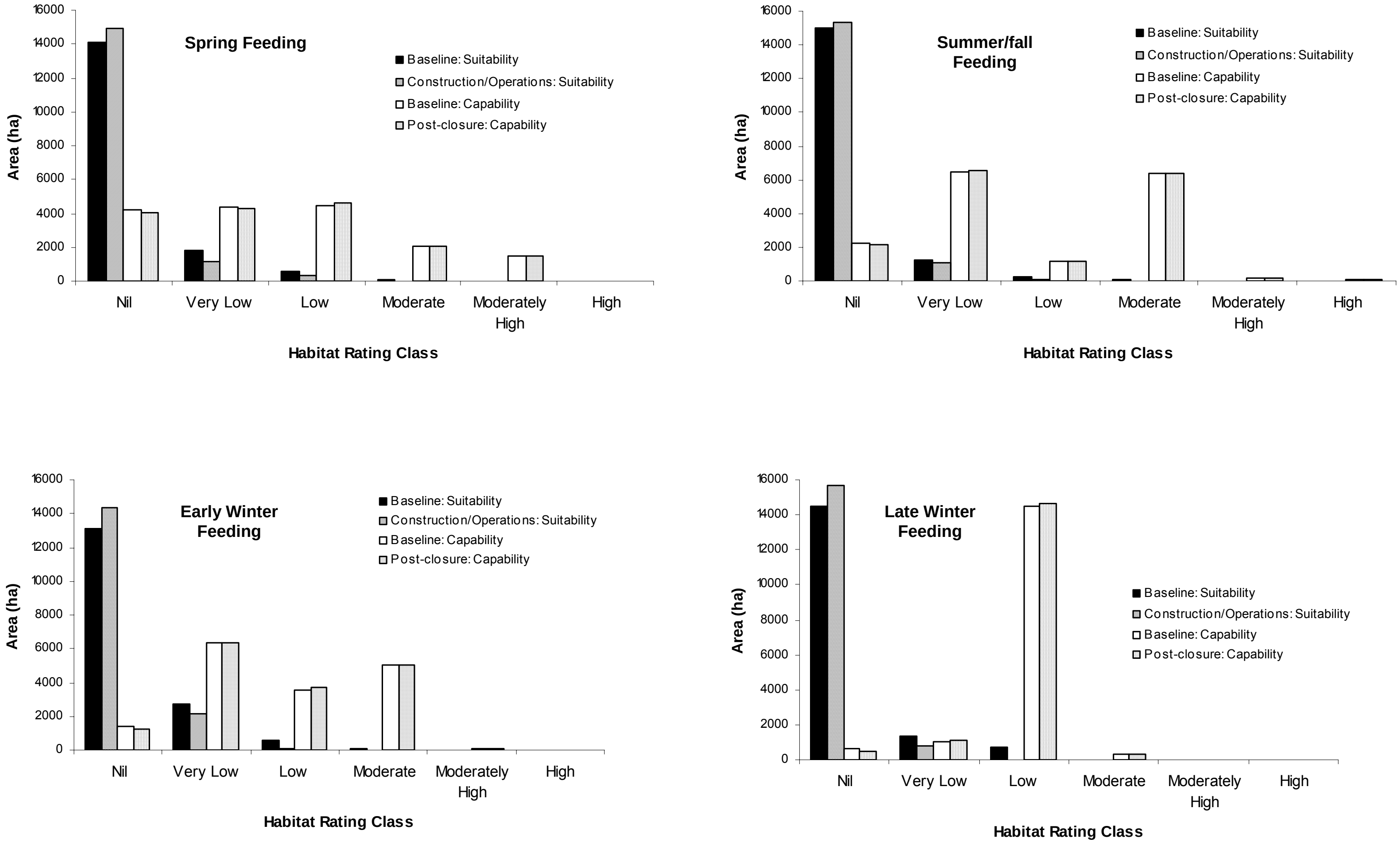
[68] As described in Section 10.3.2.9.1, wildlife capability is the ability of a habitat under the optimal natural (seral) conditions for a species, to provide its life requisites, irrespective of the habitat's current condition. Changes in habitat capability were used to assess potential longer-term effects of the Project between the Baseline and Post-closure phases.

**Figure 10.3.5-1: Woodland Caribou Habitat Availability Trends in the Local Study Area**



Longer-term Project effects on habitat availability (i.e., effect on habitat capability through to Post-closure) are much less pronounced than for habitat suitability (Figure 10.3.5-1, Appendix E-8.1). In summer/fall and the two winter seasons, the availability of moderate or better capability caribou habitat is almost unchanged at Post-closure from the baseline prediction, while in the spring there is a modest increase (6.5%) in the area of moderately high capability habitat at Post-closure (Figure 10.3.5-1, Appendix E-8.1).

### Moose

The area of moderate or better suitability moose winter habitat within the LSA represents a substantial proportion of that available within the RSA (17.5% for winter feeding and 9.2% for winter shelter/thermal cover) (Appendix E-8.2). Habitat availability is best within the Mine Power Supply LSA (44% of area rated moderate or better for feeding suitability and 21% rated moderate or better for shelter/thermal cover suitability), and the Falling Creek Flats Loadout & Powerline LSA (30% of area rated moderate or better for feeding suitability and 17% rated moderate or better for shelter/thermal cover suitability). Habitat availability within the Falling Creek Connector Haul Route and Brule Mine LSAs is limited (<10% of both rated moderate or better for winter habitat suitability).

The effects of Phases 1 and 2 on habitat availability (i.e., effects on habitat suitability) are relatively small (based on percent changes). For feeding, the area of high suitability habitat decreases by 4.7%, the area of moderately high suitability habitat decreases by 2.0%, and the area of moderate suitability habitat decreases by 0.3% (Figure 10.3.5-2, Appendix E-8.2). For shelter/thermal cover, the area of high suitability habitat decreases by 9.2%, the area of moderately high suitability habitat decreases by 7.2%, and the area of moderate suitability habitat decreases by 3.5% (Figure 10.3.5-2, Appendix E-8.2). The majority of this effect is related to habitat alteration rather than sensory disturbance so this effect is expected to remain the same during the Decommissioning/Reclamation phase.

Longer-term Project effects on habitat availability (i.e., effects on habitat capability through to Post-closure) are much less pronounced than for habitat suitability (Figure 10.3.5-2, Appendix E-8.2). The availability of moderate or better capability moose winter habitat is almost unchanged at Post-closure from the baseline prediction (Figure 10.3.5-2, Appendix E-8.2).

### Rocky Mountain Elk

Existing elk habitat is limited within the LSA. Most seasonal habitat suitability and capability is rated as low to nil quality, with little or no higher quality habitat (Figure 10.3.5-3). The area of moderate or better suitability elk winter shelter/thermal habitat within the LSA is a relatively small proportion of that available within the RSA (7.9%), but the area of moderate or better suitability elk winter feeding habitat within the LSA is a large proportion of that available within the RSA (28.6%) (Appendix E-8.2). Shelter/thermal cover habitat availability is best within the Mine Power Supply LSA (15% of area rated moderate or better for habitat suitability). Elsewhere it is

**Figure 10.3.5-2: Moose Habitat Availability Trends in the Local Study Area**

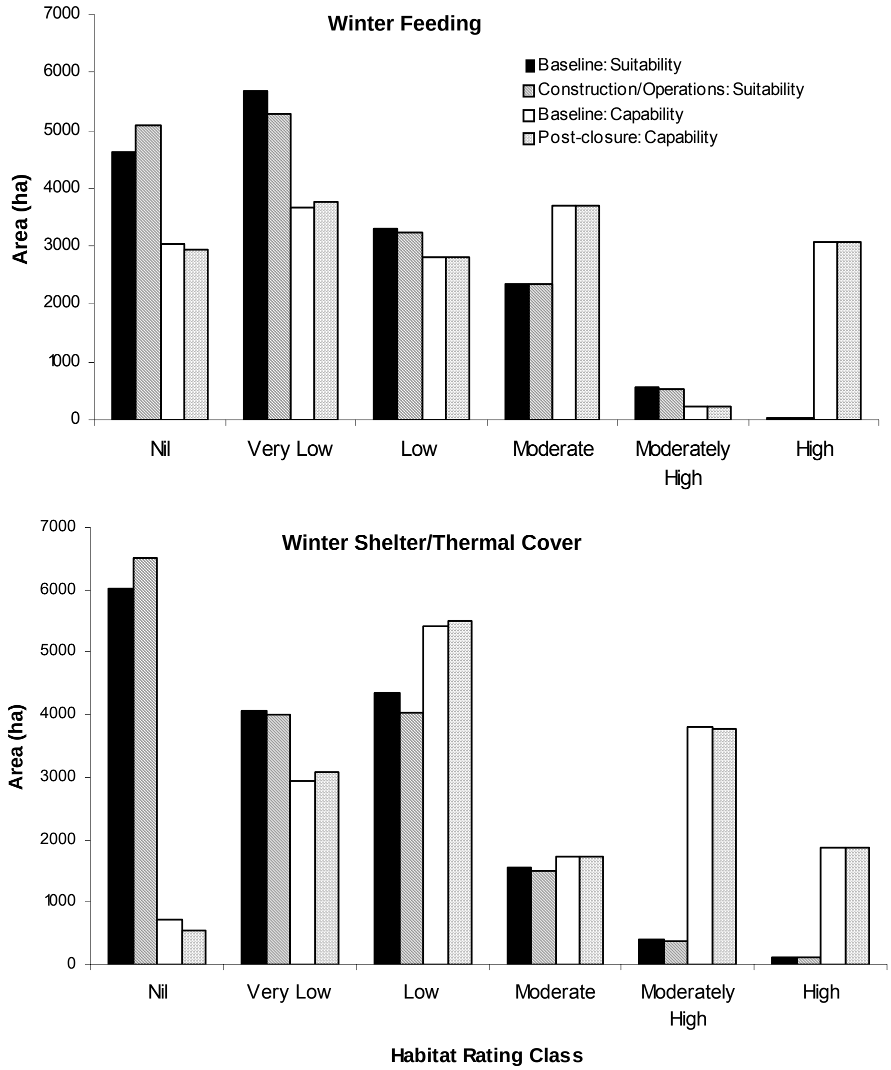
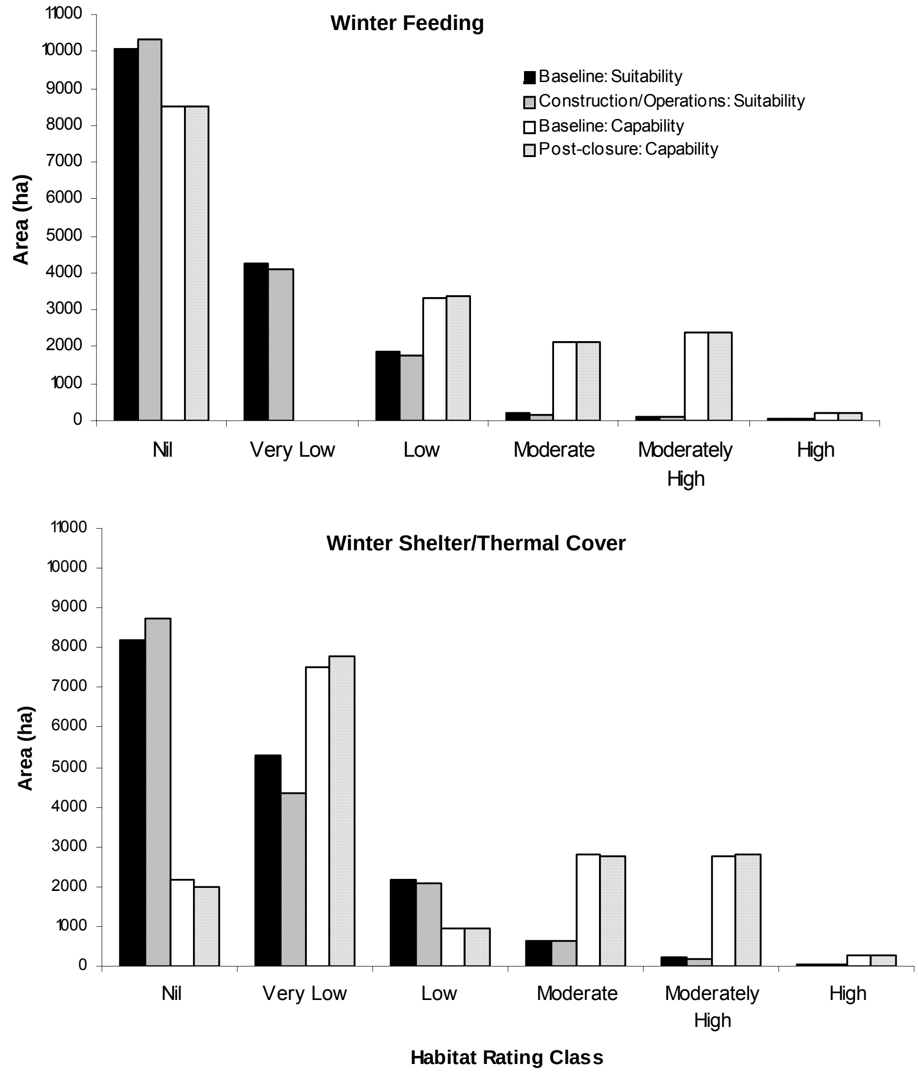


**Figure 10.3.5-3: Rocky Mountain Elk Habitat Availability Trends in the Local Study Area**



very limited (< 5% of all other LSAs rated moderate or better for shelter/thermal cover suitability). Winter feeding habitat availability is limited—the best availability is within the Falling Creek Flats Loadout & Powerline and Mine Power Supply LSAs (7% and 6% of LSA area rated moderate or better for habitat suitability, respectively).

The effects of Phases 1 and 2 on habitat availability (i.e., effects on habitat suitability) are relatively small (based on percent changes) for feeding habitat—the area of high suitability habitat decreases by 4.2%, the area of moderately high suitability habitat decreases by 1.7%, and the area of moderate suitability habitat decreases by 7.6% (Figure 10.3.5-3, Appendix E-8.2). The effect of Phases 1 and 2 is more pronounced for shelter/thermal habitat, but only for a small area (33.6 ha) of high suitability habitat, which decreases by 28.3% (Figure 10.3.5-3, Appendix E-8.2). The area of moderately high suitability shelter/thermal habitat decreases by 2.8%, and the area of moderate suitability habitat decreases by 4.0% (Figure 10.3.5-3, Appendix E-8.2). The majority of this effect is related to habitat alteration rather than sensory disturbance so this effect is expected to remain the same during the Decommissioning/Reclamation phase.

Longer-term Project effects on habitat availability (i.e., effects on habitat capability through to Post-closure) are much less pronounced than for habitat suitability (Figure 10.3.5-3, Appendix E-8.2). The availability of moderate or better capability elk winter habitat is almost unchanged at Post-closure from the baseline prediction (Figure 10.3.5-3, Appendix E-8.2).

#### 10.3.5.1.2 Large Carnivores

Project-related activities during Phases 1 and 2 will decrease large carnivore habitat availability through direct habitat loss and sensory disturbance (habitat avoidance). Large carnivores (e.g., wolf, bears, wolverine) are typically landscape level species that use a variety of habitat types within relatively large territories, thus diminishing (but not precluding) the effects of localized activities on habitat availability. The relatively short term of the sensory disturbance period associated with this Project in combination with the high mobility of species suggests that there are unlikely to be significant effects from disturbance. For bears, disturbance effects within the proposed Project area may be similar to displacement and tolerance effects observed for other industrial activities, including road construction, seismic testing, drilling, and helicopter traffic. For example, in south-eastern B.C. and Montana, grizzly bears were displaced from 100 to over 900 m from open roads (McLellan and Shackleton 1988, 1989; Kasworm and Manley 1990).

The significance of potential short-term disturbance and reductions in habitat availability will depend on the relative value of habitats to the species of concern. For example, bears will use forage on roadside vegetation in the spring and summer despite associated sensory disturbance.

Project effects will be reduced with the lower activity levels during the Decommissioning / Reclamation phase and progressive reclamation efforts (Section 4.11) through to Post-closure.

Residual Project Effects on the two large carnivore focal species are described in detail below.

### Grizzly Bear

Existing grizzly bear feeding habitat is extremely limited within the LSA. Most seasonal habitat suitability and capability is rated as low to nil quality, with little or no higher quality habitat (Figure 10.3.5-4. The area of moderate or better suitability[69] grizzly bear feeding habitat within the LSA is a small proportion of that available within the RSA during the summer and fall (5.2% and 4.2%, respectively), but a somewhat greater proportion of that available within the RSA during the spring (13.0%) (Appendix E-8.3).

The effects of Phases 1 and 2 (i.e., effects on habitat suitability) are relatively large (based on percent changes), although only on small areas (67.2 ha in spring, 66.6 ha in summer, 80.7 ha in fall) (Figure 10.3.5-4, Appendix E-8.3). The area of moderately high suitability habitat decreases by 100% in all three seasons, and the area of moderate suitability habitat decreases by 65.5% to 82.3% depending on the season (Figure 10.3.5-4, Appendix E-8.3). The majority of this effect is related to sensory disturbance from mine-related activities so there will likely be some recovery of habitat suitability during the Decommissioning/Reclamation phase.

Longer-term Project effects on habitat availability (i.e., effect on habitat capability through to Post-closure) are much less pronounced than for habitat suitability (Figure 10.3.5-4, Appendix E-8.3). The availability of moderate or better capability[70] grizzly bear feeding habitat is almost unchanged at Post-closure from the baseline prediction (Figure 10.3.5-4, Appendix E-8.3).

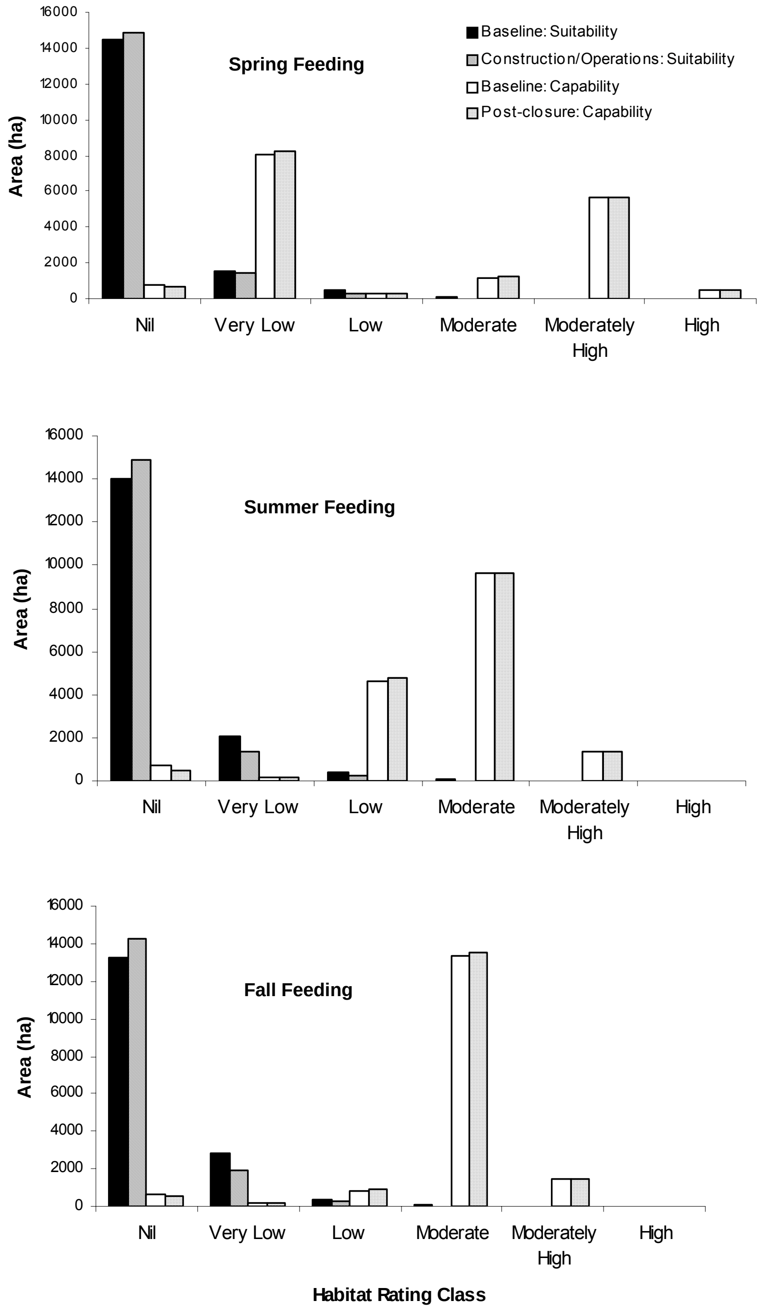
### Wolverine

Existing wolverine winter habitat is extremely limited within the LSA. Most seasonal habitat suitability and capability is rated as low to nil quality, with little or no higher quality habitat (Figure 10.3.5-5. The area of moderate or better suitability wolverine winter feeding habitat within the LSA is just 1.6% of that available within the RSA (Appendix E-8.4).

The effects Phases 1 and 2 (i.e., effects on habitat suitability) are relatively large (based on percent changes), although only very small areas (1.3 ha of moderate habitat and 3.8 ha of moderately high habitat)[71] (Figure 10.3.5-4, Appendix E-8.3). The area of moderate suitability habitat decreases by 55.5%, and the area of moderately high suitability habitat decreases by 7.7% (Figure 10.3.5-5, Appendix E-8.4). The majority of this effect is related to sensory disturbance from mine-related activities so there will likely be some recovery of habitat suitability during the Decommissioning/Reclamation phase.

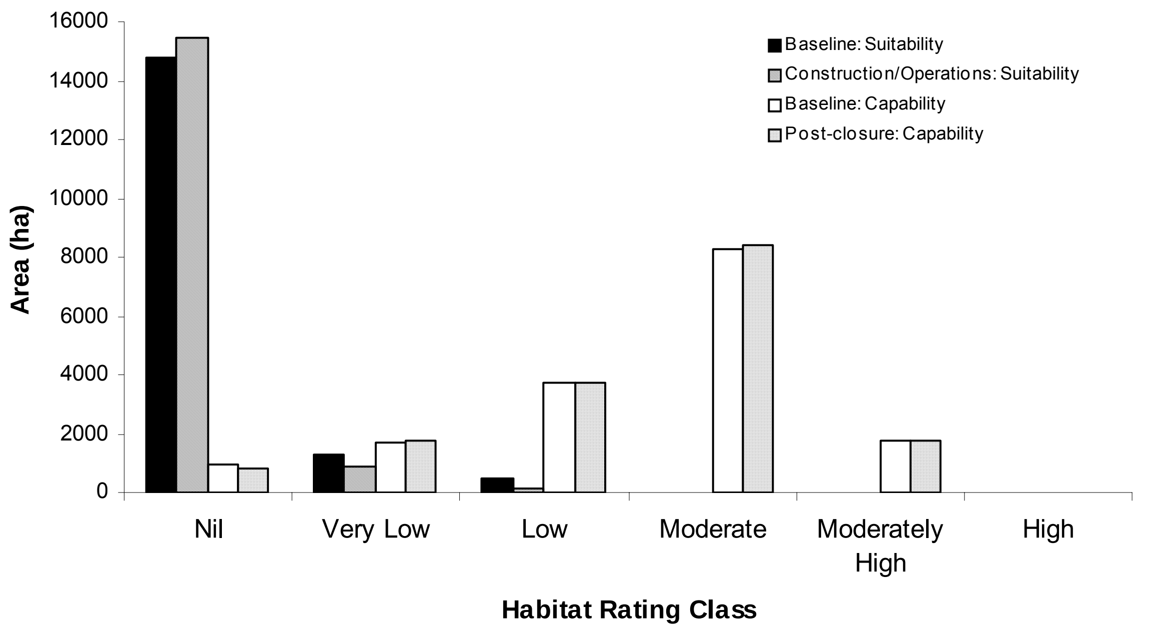
[69] No high suitability habitat was identified in the LSA in any active season.
[70] No high capability habitat was identified in the LSA in the summer and fall.
[71] No high suitability habitat was identified in the LSA.

**Figure 10.3.5-4: Grizzly Bear Habitat Availability Trends in the Local Study Area**



Longer-term Project effects on habitat availability (i.e., effect on habitat capability through to Post-closure) are much less pronounced than for habitat suitability, although in neither case was any high value habitat identified (Figure 10.3.5-5, Appendix E-8.4). The availability of moderate or better[72] capability wolverine winter feeding habitat is almost unchanged at Post-closure from the baseline prediction (Figure 10.3.5-5, Appendix E-8.4).

**Figure 10.3.5-5: Wolverine Winter Feeding Habitat Availability Trends in the Local Study Area**




### 10.3.5.1.3 Furbearers & Small Mammals

Project-related activities in Phases 1 and 2 will decrease furbearer and small mammal habitat availability through direct habitat loss and sensory disturbance (habitat avoidance). Mine construction and operations will result in some losses of forest habitats and potential habitat fragmentation for furbearers and small mammals. Because the proposed Project components occur in proximity to existing disturbances, and because the haul route is predominantly located along existing road rights-of-way, the effects of habitat alteration and fragmentation will be minimized. The risk of significant construction-related sensory disturbance (and reduced habitat availability) will be minimal for furbearers and small mammals in the Project area. While small territorial animals such as most furbearers will avoid Project footprints during actual construction, these animals will not significantly shift their territorial distributions in response to rights-of-way

[72] No high capability habitat was identified in the LSA.

activities (Morgantini 1984; Eccles and Duncan 1987). Mine site activity, however, will likely preclude small mammals during the operational life of the mine.

Project effects on furbearer and small mammal habitat availability will be reduced with the lower activity levels during the Decommissioning/Reclamation phase and progressive reclamation efforts (Section 4.11) through to Post-closure.

Residual Project Effects on the two furbearer focal species are described in detail below.

### Fisher

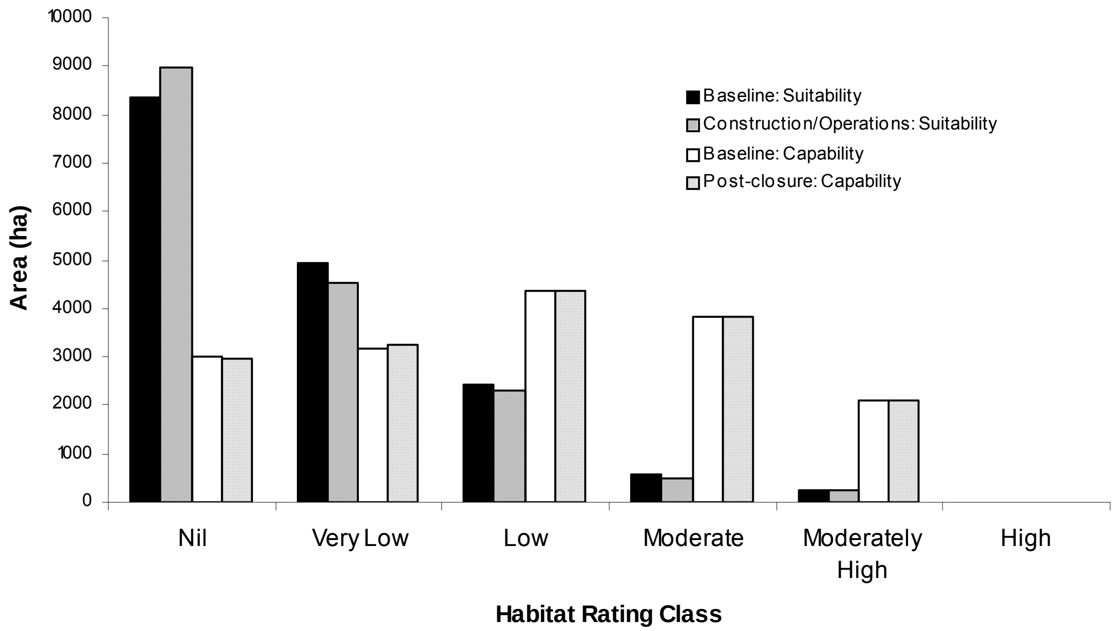
The area of moderate or better suitability[73] fisher breeding habitat within the LSA represents a substantial proportion of that available within the RSA (12.0%) (Appendix E-8.4). Habitat availability is best within the Mine Power Supply LSA (15% of area rated moderate or better for habitat suitability), and the Falling Creek Flats Loadout & Powerline LSA (10% of area rated moderate or better for habitat suitability). Habitat availability within the Falling Creek Connector Haul Route and the Brule Mine LSAs is extremely limited (<1% of both rated moderate or better for habitat suitability).

The effects of Phases 1 and 2 on habitat availability (i.e., effects on habitat suitability) are relatively small (based on percent changes). The area of moderately high suitability habitat decreases by 6.3%, and the area of moderate suitability habitat decreases by 9.1% (Figure 10.3.5-6, Appendix E-8.4). The majority of this effect is related to habitat alteration rather than sensory disturbance so this effect is expected to remain the same during the Decommissioning/Reclamation phase.

Longer-term Project effects on habitat availability (i.e., effects on habitat capability through to Post-closure) are much less pronounced than for habitat suitability (Figure 10.3.5-6, Appendix E-8.4). The availability of moderate or better capability[74] fisher breeding habitat is almost unchanged at Post-closure from the baseline prediction (Figure 10.3.5-6, Appendix E-8.4).

[73] No high capability habitat was identified in the LSA.
[74] No high capability habitat was identified in the LSA.

**Figure 10.3.5-6: Fisher Breeding Habitat Availability Trends in the Local Study Area**



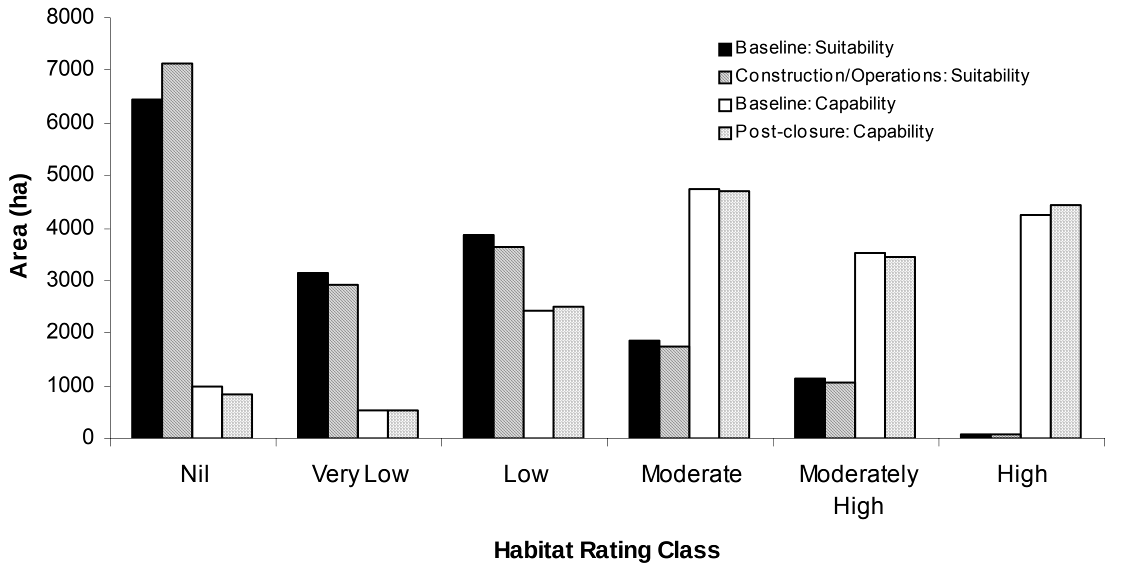

## Marten

The area of moderate or better suitability marten winter habitat within the LSA represents a relatively small proportion of that available within the RSA (9.5%) (Appendix E-8.4). Habitat availability is best within the Falling Creek Connector Haul Route LSA (23% of area rated moderate or better for habitat suitability), and the Brule Mine LSA (19% of area rated moderate or better for habitat suitability). Habitat availability within the Falling Creek Flats Loadout & Powerline and Mine Power Supply LSAs is limited (≤ 10% of both rated moderate or better for habitat suitability).

The effects of Phases 1 and 2 on habitat availability (i.e., effects on habitat suitability) are relatively small (based on percent changes). The area of high suitability habitat decreases by 4.9%, the area of moderately high suitability habitat decreases by 7.6%, and the area of moderate suitability habitat decreases by 7.5% (Figure 10.3.5-7, Appendix E-8.4). The majority of this effect is related to habitat alteration rather than sensory disturbance so this effect is expected to remain the same during the DecommissioningReclamation phase.

Longer-term Project effects on habitat availability (i.e., effects on habitat capability through to Post-closure) are much less pronounced than for habitat suitability (Figure 10.3.5-7, Appendix E-8.4). The availability of moderate or better capability marten winter habitat is somewhat improved at Post-closure from the baseline prediction with a modest increase in high capability habitat (Figure 10.3.5-7, Appendix E-8.4).

**Figure 10.3.5-7: Marten Winter Habitat Availability Trends in the Local Study Area**




### 10.3.5.1.4 Birds

Project-related activities in Phases 1 and 2 will decrease bird habitat availability primarily due to direct habitat loss, but also through species-specific responses (e.g., habitat avoidance) to sensory disturbance. Some loss of forested nesting habitat will occur due to Project-related clearing, but the potential for this to add to the regional fragmentation of such habitat is minimal, as most clearing will occur in proximity to existing disturbances or along existing forest edges and other linear clearings. Clearing at the loadout will be timed to avoid the breeding period for most bird species (Section 4.11). While some bird species are more tolerant of sensory disturbance than others, in general they are highly mobile and will be able to relocate away from the sources of disturbance to equivalent habitats in the vicinity.

Project effects on bird habitat availability will be reduced with the lower activity levels during the Decommissioning/Reclamation phase and progressive reclamation efforts (Section 4.11) through to Post-closure.

Residual Project Effects on the two bird focal species are described in detail below.

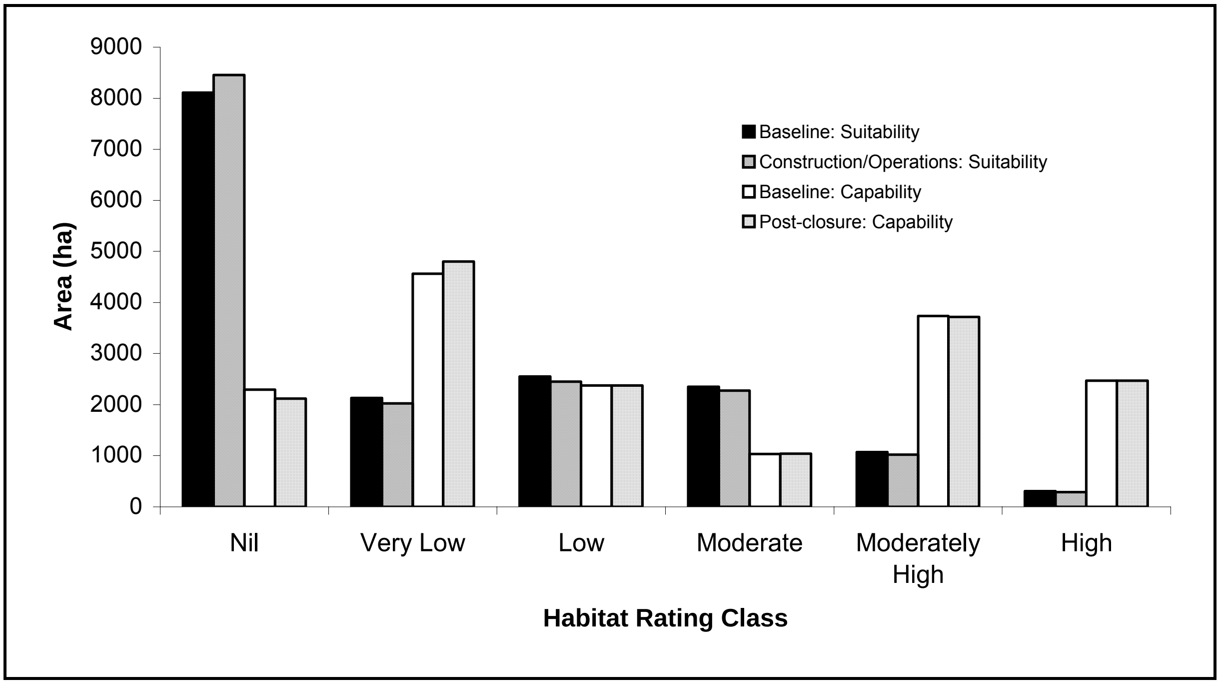
#### Northern Goshawk

The area of moderate or better suitability goshawk breeding habitat within the LSA represents a substantial proportion of that available within the RSA (12.0%) (Appendix E-8.5). Habitat availability is best within the Mine Power Supply LSA (42% of area rated moderate or better for habitat suitability), and the Falling Creek Flats Loadout & Powerline LSA (28% of area rated moderate or better for habitat suitability). Habitat availability within the Falling Creek Connector Haul Route LSA and the Brule Mine LSAs is limited (<15% of both rated moderate or better for habitat suitability).

The effects of Phases 1 and 2 on habitat availability (i.e., effects on habitat suitability) are relatively small (based on percent changes). The area of high suitability habitat decreases by 4.7%, the area of moderately high suitability habitat decreases by 4.6%, and the area of moderate suitability habitat decreases by 3.1% (Figure 10.3.5-8, Appendix E-8.5). The majority of this effect is related to habitat alteration rather than sensory disturbance so this effect is expected to remain the same during the Decommissioning phase.

Longer-term Project effects on habitat availability (i.e., effects on habitat capability through to Post-closure) are much less pronounced than for habitat suitability (Figure 10.3.5-8, Appendix E-8.5). The availability of moderate or better capability goshawk breeding habitat is almost unchanged at Post-closure from the baseline prediction (Figure 10.3.5-8, Appendix E-8.5).

**Figure 10.3.5-8: Northern Goshawk Breeding Habitat Availability Trends in the Local Study Area**



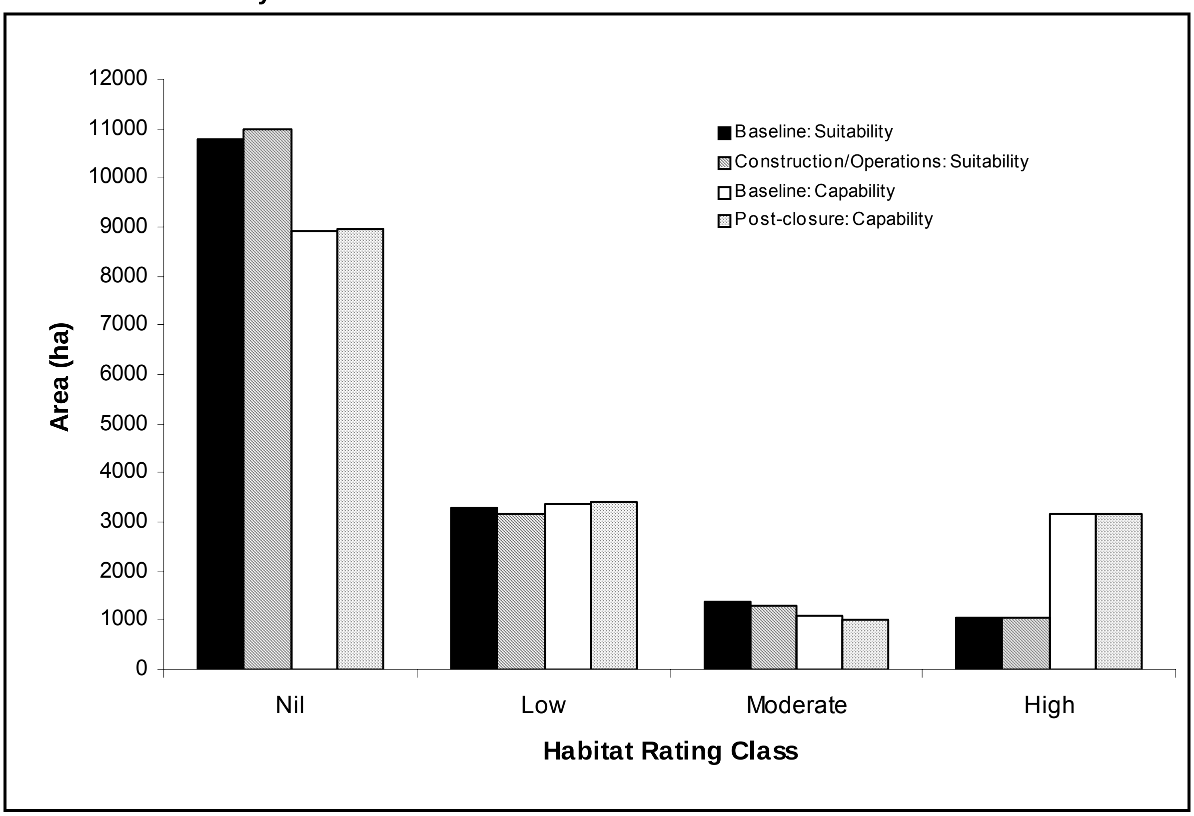

### Black-throated Green Warbler

The area of moderate or better suitability warbler breeding habitat within the LSA represents a substantial proportion of that available within the RSA (17.5%) (Appendix E-8.5). Habitat availability is best within the Mine Power Supply LSA (36% of area rated moderate or better for habitat suitability), and the Falling Creek Flats Loadout & Powerline LSA (33% of area rated moderate or better for habitat suitability). Habitat availability within the Falling Creek Connector Haul Route and the Brule Mine LSAs is very limited (< 5% of both rated moderate or better for habitat suitability).

The effects of Phases 1 and 2 on habitat availability (i.e., effects on habitat suitability) are relatively small (based on percent changes). The area of high suitability habitat decreases by 1.8% and the area of moderate suitability habitat decreases by 5.4% (Figure 10.3.5-9, Appendix E-8.5). The majority of this effect is related to habitat alteration rather than sensory disturbance so this effect is expected to remain the same during the Decommissioning/Reclamation phase.

Longer-term Project effects on habitat availability (i.e., effects on habitat capability through to Post-closure) are much less pronounced than for habitat suitability (Figure 10.3.5-9, Appendix E-8.5). The availability of moderate or better capability warbler breeding habitat is almost unchanged at Post-closure from the baseline prediction (Figure 10.3.5-9, Appendix E-8.5).

**Figure 10.3.5-9: Black-throated Green Warbler Breeding Habitat Availability Trends in the Local Study Area**



#### 10.3.5.1.5 Amphibians & Reptiles

Reptiles and amphibians could be affected if the proposed Project intersects key localized habitats such as snake hibernacula and amphibian breeding ponds and over wintering areas. However, the project components avoid rock outcrops that would be associated with potential snake hibernacula, and Project effects on wetlands will be relatively small (Section 10.1.5.3).

Project-related activities in Phases 1 and 2 may affect the localized distribution of reptiles and amphibians as the result of sensory disturbance. Due to the relative lack of behavioural response (i.e., flight) to industrial activity and vehicles, habitat avoidance due to sensory disturbance is not likely an issue for reptiles and amphibians. However, artificial noise may interfere with intra-species communication during the breeding season for some amphibians (e.g., Barrass 1985).

### *10.3.5.2 Mortality Risk*

Project-related mortality to wildlife is most likely to be the result of vehicle collisions, but their incidence will be minimized through mitigation (e.g., speed limit restrictions).

Traffic-related mortality risk will vary during the life of Project. Traffic volumes along the Bullmoose Haul Route are medium to high even in the absence of the Dillon Mine traffic, with the majority of the route (62.7 km [67%]) being along Highway 29 (Appendix E-9). Changes in traffic volume during Phases 1 and 2 are not expected to affect mortality risk further, as they remain in the high volume category. This route will be used until the Falling Creek Connector Haul Route is opened. Maximum speed limits will be 60 km/h and the average speed of coal haul trucks along this route is expected to be 30 km/h. Traffic volumes along the Bullmoose Haul Route can then be expected to decrease to pre-mine levels. Mortality risk due to high traffic volumes along the Bullmoose Haul Route is likely already substantial and Project-related changes in traffic volume are not appreciable.

In contrast, traffic volumes along certain sections of the Falling Creek Connector Haul Route will increase substantially from baseline conditions during the Operations phase (Appendix E-9). Existing segments will increase in traffic volume during road construction of new segments. Consequently, mortality risk will increase within the LSA. This effect will be present throughout the life of the mine. Once decommissioning begins, traffic volumes will drop off considerably. WCC intends to deactivate the five road segments built specifically for this Project along this haul route (i.e., 22.1 km of road will be deactivated) (Appendix E-9, also see Section 4.12). The first of these segments (Segment 1) will be included within the minesite boundaries, and reclaimed as part of the minesite. This will return access to pre-mine levels, thereby reducing mortality risk and not contributing to cumulative effects over the long term. Post-closure traffic volumes should return to baseline conditions.

Additional Project-related effects on mortality risk may come from unrestricted use of firearms by Project personnel, increased access for hunters and poachers, and problem wildlife situations. A variety of mitigation measures outlined in the Wildlife Protection Plan (Section 4.11) are intended to minimize these effects, and, as noted above, deactivation of road segments will be an important part of this mitigation, particularly with respect to access-related mortality risk.

#### 10.3.5.2.1 Ungulates

Project-related mortality to ungulates during Phases 1 and 2 is most likely to result from collisions with mine-related vehicles, and to a lesser extent from unrestricted use of firearms by Project personnel. Additionally, the completion of the Falling Creek Connector Haul Route will increase access for hunters and poachers, thereby, increasing mortality risk to local ungulate populations. As previously discussed, mitigation measures described in the Wildlife Protection Plan (Section 4.11), and post-mine road segment deactivation will minimize effects. Given that there is already a relatively well-established road network in the RSA, and assuming traffic restrictions are followed (particularly regarding speed limits), the change in mortality risk associated with the Project should be relatively minor during Phases 1 and 2 and decreasing through the Decommissioning/Reclamation phase to baseline levels after mine closure.

#### 10.3.5.2.2 Large Carnivores

Similar to ungulates, Project-related mortality to large carnivores during Phases 1 and 2 is most likely to result from collisions with mine-related vehicles, and to a lesser extent from unrestricted use of firearms by Project personnel. Additionally, the completion of the Falling Creek Connector Haul Route will increase access for hunters and poachers, thereby, increasing mortality risk to local populations. This particular risk is expected to be greater for bears than for other large carnivores, such as the wolverine, as bears are more likely to be targeted or involved in human encounters that may result in mortality. As previously discussed, mitigation measures described in the Wildlife Protection Plan (Section 4.11), and post-mine road segment deactivation will either minimize or prevent these effects. Given that there is already a relatively well-established road network in the RSA, and assuming traffic restrictions are followed (particularly regarding speed limits), the change in mortality risk associated with the Project should be relatively minor during Phases 1 and 2 and decreasing through the Decommissioning/Reclamation phase to baseline levels after mine closure.

Denning is a site-specific activity that is difficult to predict from habitat mapping. There is very limited information on bear denning areas in the Project area (Section 10.3.3.2.1). Industrial activities have been shown to have adverse effects on denning bears in some cases (Linnell et al 2000). Den sites are most susceptible to adverse effects during the construction phase, when denning animals may be disturbed by noise and vibration, or den sites inadvertently destroyed. The development of the Brule Mine footprint has the greatest potential to affect grizzly bear denning. However, a study by Ciarniello et al (2003) suggests that bears in this region may be more likely to select alpine habitats for denning. There is no alpine habitat identified in the Brule Mine LSA.

In addition, problem wildlife situations may result in the lethal control of animals. This is a particular concern with respect to bears, and issues related to bear safety, and problem bear prevention are detailed in the Wildlife Protection Plan (Section 4.11).

#### 10.3.5.2.3 Furbearers & Small Mammals

Project-related mortality may occur as a result of collisions with project vehicles or direct destruction of hibernacula, roosts, or maternal dens. Mortalities incurred from destruction of roosts and den sites are expected to be minimal. For example, fractured rock outcrops that are used by bats for roost sites are rarely encountered along the proposed haul routes. Similarly, preferred denning habitat for some furbearers (e.g., old forests for marten and fisher) are generally uncommon in areas where construction activities may occur.

#### 10.3.5.2.4 Birds

Project-related mortality may occur as a result of collisions with Project vehicles. These incidents are essentially unavoidable, although adherence to speed limits will reduce this risk. There is also the potential for destruction of active nests during construction activities. This concern will be minimized in the Falling Creek Flats Loadout area, as clearing will occur outside the breeding season (i.e., outside the May 1 to July 31 period) (Section 4.11).

Longer-term Project effects on mortality related to nest predation and parasitism along new rights-of-way in forested habitats may locally affect avian species' distributions and abundance.

#### 10.3.5.2.5 Amphibians & Reptiles

The risk of direct Project-related mortalities to reptiles and amphibians is of concern if construction intersects seasonal population concentrations (e.g., breeding ponds or over-wintering sites). Efforts will be made to avoid or limit disturbance at riparian and wetland areas.

### *10.3.5.3 Disruption to Movement Patterns*

Disruptions to movement patterns for wildlife may occur from developments that restrict or impede localized daily or seasonal movements. Given the nature of the proposed Project (e.g., using existing road systems, development in existing footprints, paralleling existing utility corridors), the likelihood of disruptions to movement patterns is generally low.

#### 10.3.5.3.1 Ungulates

While construction and operation activities may result in the blockage and/or deviation of ungulate daily seasonal movements, such effects are expected to be localized, and to some extent, mitigatable (e.g., recommendations for snow clearing, Section 4.11). At the regional scale, there is no evidence to indicate that the Project will disrupt any migration corridors for caribou, moose, or elk. The use of existing road systems will also limit the potential for disruption to movement patterns. In general, the Project is not anticipated to measurably affect ungulate movement patterns.

#### 10.3.5.3.2 Large Carnivores

Landscape level species, such as grizzly bear and wolverine, use a variety of habitats as they move through their large territories. The addition of new road segments along the Falling Creek Connector Haul Route is not expected to affect their daily or seasonal movement patterns. Similarly, the localized habitat effects of the mine and loadout in close proximity to existing disturbances are also not expected to disrupt movement patterns for large carnivores.

#### 10.3.5.3.3 Furbearers & Small Mammals

Most furbearers and small mammals typically have relatively small home ranges, and the Project components are not expected to create impediments to movements. Most small mammals will relocate if in close proximity to Project components. Some furbearers, such as fisher and marten, may be attracted to edge features (e.g., roads, powerline rights-of-way), but may be reluctant to cross large openings. Increased rights-of-way width may also limit movements for other smaller mammal species. The use of existing roads and rights-of-way will limit the creation of new openings. The possible negative effect of wider openings from multiple adjacent linear developments is offset by the reduction in fragmentation effects that would result were there to be many separate linear features.

#### 10.3.5.3.4 Birds

The ability to fly essentially eliminates any potential for the Project to disrupt movement patterns for birds. Similar to small mammals, some interior forest dwelling bird species may be reluctant to move across large openings within their territories during the breeding season. However, the use of existing roads and rights-of-way will limit the creation of new openings.

#### 10.3.5.3.5 Amphibians & Reptiles

Physical blockage of movements may occur locally where mine construction temporarily inhibits movements by reptiles and amphibians. The localized nature of the construction and operation activities at the mine will limit the probabilities of such an event occurring. Existing road systems will be used to the extent possible, again limiting additional effects on movement patterns of amphibians or reptiles. Increased rights-of-way width may limit movements for some smaller species.

## 10.3.6 Residual Project Effects: Summary & Characterization

Based on the Project Effects Assessment described in Section 10.3.5, Residual Project Effects are further characterized[75] and collated below for each of the nine each focal species, and for each of the key issues (habitat availability, disruption of movement patterns, and mortality risk). These Residual Project Effects are summarized in Table 10.3.6-1, and those that have the potential to contribute incrementally to cumulative effects in the RSA are subsequently identified for more detailed cumulative effects assessments.

In general, Residual Project Effects are local in geographic extent, frequency is continuous, and most effects are considered to be reversible. The exception is where some Project components may remain and effects on habitat availability will persist. Confidence ratings are generally medium to high for quantitative-based assessments (e.g., wildlife habitat ratings) and medium for qualitative-based assessments (e.g., disruption to movement patterns, mortality risk from increases in traffic volumes).

### *10.3.6.1 Woodland Caribou*

In general, the LSA is mostly nil to low value for caribou (Section 10.3.3.1.1). Also, available evidence indicates that caribou likely do not occur in the RSA year-round, and when present occur in low numbers (Section 10.3.3.1.1). While the reduction in moderate or better suitability caribou habitat during Phases 1 and 2 is relatively large (as a percentage), the actual area affected is small (Section 10.3.5.1.1), and equivalent value habitat is relatively common outside the LSA (i.e., within the RSA) in all seasons (particularly in the winter) (Section 10.3.3.1.1, Appendix E-8.1). Further, long-term habitat capability is not predicted to be affected measurably following mine closure (Section 10.3.5.1.1). Overall then, the Residual Project Effect on habitat availability is considered to be low magnitude and far future in duration (Table 10.3.6-1). Given this assessment, this Residual Project Effect is not expected to contribute incrementally to Regional Cumulative Effects and is, therefore, considered not significant (Table 10.3.6-1).

Project-related effects on mortality risk are considered to be of medium magnitude for caribou during Phases 1 and 2 (Table 10.3.6-1), due to the increase in accessibility through the area (Sections 10.3.5.2 and 10.3.5.2.1). This effect is only medium term in duration (Table 10.3.6-1), as deactivation of the new road segments following mine closure should return the risk to pre-Project levels (Sections 10.3.5.2 and 10.3.5.2.1). However, given the general absence or low density of caribou in the region (Section 10.3.3.1.1), the Residual Project Effect on mortality risk is not expected to contribute incrementally to Regional Cumulative Effects and is, therefore, considered not significant (Table 10.3.6-1).

[75] As per Table 10.3.2-2.

**Table 10.3.6-1: Residual Project Effects Matrix for Wildlife Focal Species. Residual Project Effects that might contribute incrementally to cumulative effects area highlighted.**

| Focal species | Project phase[1] | Potential Project effect | Planned mitigation | Residual Project Effects (RPE) characterization[2] | | | | | RPE might contribute incrementally to cumulative effects? | RPE significance | Level of confidence in assessment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Magnitude | Geographic extent | Duration | Frequency | Reversibility | | | |
| Woodland caribou | C/O/D | Reduction in seasonal habitat availability | Progressive reclamation | Low | Local | Far future | Continuous | Reversible | No | Not significant | Medium-High |
| | | Increased mortality risk | Traffic and firearm restrictions | Medium | Local | Medium term | Continuous | Reversible | No | Not significant | Medium |
| | | Disruption to movement patterns | Road maintenance to facilitate movements | Low | Local | Far future | Continuous | Reversible | No | Not significant | Medium |
| | P | Reduction in seasonal habitat availability | -- | Low | Local | Far future | Continuous | Irreversible | No | Not significant | Medium-High |
| | | Increased mortality risk | Road deactivation | Low | Local | Far future | Continuous | Reversible | No | Not significant | Medium |
| | | Disruption to movement patterns | -- | Low | Local | Far future | Continuous | Reversible | No | Not significant | Medium |
| Rocky Mountain elk | C/O/D | Reduction in seasonal habitat availability | Progressive reclamation | Low | Local | Far future | Continuous | Reversible | No | Not significant | Medium-High |
| | | Increased mortality risk | Traffic and firearm restrictions | Medium | Local | Medium term | Continuous | Reversible | Yes | See Section 10.2.8 | Medium |
| | | Disruption to movement patterns | Road maintenance to facilitate movements | Low | Local | Far future | Continuous | Reversible | No | Not significant | Medium |
| | P | Reduction in seasonal habitat availability | -- | Low | Local | Far future | Continuous | Irreversible | No | Not significant | Medium-High |
| | | Increased mortality risk | Road deactivation | Low | Local | Far future | Continuous | Reversible | No | Not significant | Medium |
| | | Disruption to movement patterns | -- | Low | Local | Far future | Continuous | Reversible | No | Not significant | Medium |
| Moose | C/O/D | Reduction in seasonal habitat availability | Progressive reclamation | Low | Local | Far future | Continuous | Reversible | No | Not significant | Medium-High |
| | | Increased mortality risk | Traffic and firearm restrictions | Medium | Local | Medium term | Continuous | Reversible | Yes | See Section 10.2.8 | Medium |
| | | Disruption to movement patterns | Road maintenance to facilitate movements | Low | Local | Far future | Continuous | Reversible | No | Not significant | Medium |
| | P | Reduction in seasonal habitat availability | -- | Low | Local | Far future | Continuous | Irreversible | No | Not significant | Medium-High |
| | | Increased mortality risk | Road deactivation | Low | Local | Far future | Continuous | Reversible | No | Not significant | Medium |
| | | Disruption to movement patterns | -- | Low | Local | Far future | Continuous | Reversible | No | Not significant | Medium |

| Focal species | Project phase[1] | Potential Project effect | Planned mitigation | Residual Project Effects (RPE) characterization[2] Magnitude | Geographic extent | Duration | Frequency | Reversibility | RPE might contribute incrementally to cumulative effects? | RPE significance | Level of confidence in assessment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Grizzly bear | C/O/D | Reduction in seasonal habitat availability | Progressive reclamation | Low | Local | Far future | Continuous | Reversible | No | Not significant | Medium-High |
| | | Increased mortality risk | Traffic and firearm restrictions, problem bear prevention | Medium | Local | Medium | Continuous | Reversible | Yes | See Section 10.2.8 | Medium |
| | | Disruption to movement patterns | None planned | Low | Local | Far future | Continuous | Reversible | No | Not significant | Medium |
| | P | Reduction in seasonal habitat availability | -- | Low | Local | Far future | Continuous | Irreversible | No | Not significant | Medium-High |
| | | Increased mortality risk | Road deactivation | Low | Local | Far future | Continuous | Reversible | No | Not significant | Medium |
| | | Disruption to movement patterns | -- | Low | Local | Far future | Continuous | Reversible | No | Not significant | Medium |
| Wolverine | C/O/D | Reduction in seasonal habitat availability | Progressive reclamation | Low | Local | Far future | Continuous | Reversible | No | Not significant | Medium-High |
| | | Increased mortality risk | Traffic and firearm restrictions | Low | Local | Medium term | Continuous | Reversible | No | Not significant | Medium |
| | | Disruption to movement patterns | None planned | Low | Local | Far future | Continuous | Reversible | No | Not significant | Medium |
| | P | Reduction in seasonal habitat availability | -- | Low | Local | Far future | Continuous | Irreversible | No | Not significant | Medium-High |
| | | Increased mortality risk | Road deactivation | Low | Local | Far future | Continuous | Reversible | No | Not significant | Medium |
| | | Disruption to movement patterns | -- | Low | Local | Far future | Continuous | Reversible | No | Not significant | Medium |
| Fisher | C/O/D | Reduction in seasonal habitat availability | Progressive reclamation | Low | Local | Far future | Continuous | Reversible | No | Not significant | Medium-High |
| | | Increased mortality risk | Traffic and firearm restrictions | Low | Local | Medium term | Continuous | Reversible | No | Not significant | Medium |
| | | Disruption to movement patterns | None planned | Low | Local | Far future | Continuous | Reversible | No | Not significant | Medium |
| | P | Reduction in seasonal habitat availability | -- | Low | Local | Far future | Continuous | Irreversible | No | Not significant | Medium |
| | | Increased mortality risk | Road deactivation | Low | Local | Far future | Continuous | Reversible | No | Not significant | Medium |
| | | Disruption to movement patterns | -- | Low | Local | Far future | Continuous | Reversible | No | Not significant | Medium |

| Focal species | Project phase[1] | Potential Project effect | Planned mitigation | Residual Project Effects (RPE) characterization[2] | | | | | RPE might contribute incrementally to cumulative effects? | RPE significance | Level of confidence in assessment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Magnitude | Geographic extent | Duration | Frequency | Reversibility | | | |
| Marten | C/O/D | Reduction in seasonal habitat availability | Progressive reclamation | Low | Local | Far future | Continuous | Reversible | No | Not significant | Medium-High |
| | | Increased mortality risk | Traffic and firearm restrictions | Low | Local | Medium term | Continuous | Reversible | No | Not significant | Medium |
| | | Disruption to movement patterns | None planned | Low | Local | Far future | Continuous | Reversible | No | Not significant | Medium |
| | P | Reduction in seasonal habitat availability | -- | Low | Local | Far future | Continuous | Irreversible | No | Not significant | Medium-High |
| | | Increased mortality risk | Road deactivation | Low | Local | Far future | Continuous | Reversible | No | Not significant | Medium |
| | | Disruption to movement patterns | -- | Low | Local | Far future | Continuous | Reversible | No | Not significant | Medium |
| Northern goshawk | C/O/D | Reduction in seasonal habitat availability | Progressive reclamation, leave areas | Low | Local | Far future | Continuous | Reversible | No | Not significant | Medium-High |
| | | Increased mortality risk | Clearing windows | Low | Local | Medium term | Continuous | Reversible | No | Not significant | Medium |
| | | Disruption to movement patterns | None planned | Low | Local | Medium term | Continuous | Reversible | No | Not significant | Medium |
| | P | Reduction in seasonal habitat availability | -- | Low | Local | Far future | Continuous | Irreversible | No | Not significant | Medium-High |
| | | Increased mortality risk | Road deactivation | Low | Local | Far future | Continuous | Reversible | No | Not significant | Medium |
| | | Disruption to movement patterns | -- | Low | Local | Far future | Continuous | Reversible | No | Not significant | Medium |
| Black-throated green warbler | C/O/D | Reduction in seasonal habitat availability | Progressive reclamation, leave areas | Low | Local | Far future | Continuous | Reversible | No | Not significant | Medium-High |
| | | Increased mortality risk | Clearing windows | Low | Local | Medium term | Continuous | Reversible | No | Not significant | Medium |
| | | Disruption to movement patterns | None planned | Low | Local | Medium term | Continuous | Reversible | No | Not significant | Medium |
| | P | Reduction in seasonal habitat availability | -- | Low | Local | Far future | Continuous | Irreversible | No | Not significant | Medium-High |
| | | Increased mortality risk | Road deactivation | Low | Local | Far future | Continuous | Reversible | No | Not significant | Medium |
| | | Disruption to movement patterns | -- | Low | Local | Far future | Continuous | Reversible | No | Not significant | Medium |

**Notes: 1.** B=Baseline, C=Phase 1 (Construction), O=Phase 2 (Operations), D=Decommissioning/Reclamation, P=Post-Closure. **2.** Based on the assumption that mitigation measures are effective as planned. Refer to Table 10.3.2-2 for the classification schemes for these criteria. **3.** The significance of Residual Project Effects are determined in the context of the potential to contribute incrementally to cumulative effects. Where a RPE may contribute incrementally to cumulative effects, the determination of significance is advanced to the Residual Cumulative Effects assessment stage (see Section 10.3.8).

Project-related effects on movement patterns are generally considered to be relatively minor because of the use of pre-existing road, pipeline and powerline corridors (Section 10.3.5.3.1). The decrease in habitat availability during Phases 1 and 2 may result in some habitat fragmentation, but the areas affected are small and unlikely to disrupt caribou movement patterns (Section 10.3.5.3.1). Thus, this Residual Project Effect is not expected to contribute incrementally to Regional Cumulative Effects and is, therefore, considered not significant (Table 10.3.6-1).

#### *10.3.6.2 Moose*

The area of moderate or better suitability moose winter habitat within the LSA is a relatively large proportion of that available in the RSA (Section 10.3.3.1.2), particularly for feeding habitat, however; the decrease in its availability during Phases 1 and 2 is relatively minor (Section 10.3.5.1.1). Long-term habitat capability is also not predicted to be affected measurably following mine closure (Section 10.3.5.1.1), Overall then, the Residual Project Effect on habitat availability is considered to be low magnitude and far future in duration (Table 10.3.6-1). Given this assessment, this Residual Project Effect is not expected to contribute incrementally to Regional Cumulative Effects and is, therefore, considered not significant (Table 10.3.6-1).

Project-related effects on mortality risk are considered to be of medium magnitude for moose during Phases 1 and 2 (Table 10.3.6-1), due to the increase in accessibility through the area (Sections 10.3.5.2 and 10.3.5.2.1). This effect is only medium term in duration (Table 10.3.6-1), as deactivation of the new road segments following mine closure should return the risk to pre-Project levels (Sections 10.3.5.2 and 10.3.5.2.1). However, given the general susceptibility of moose and other ungulates to hunting pressures and interactions with vehicles in the region, the Residual Project Effect on mortality risk may contribute incrementally to Regional Cumulative Effects (Table 10.3.6-1). A cumulative effects assessment is subsequently required (see Section 10.3.7).

Project-related effects on movement patterns are generally considered to be relatively minor because of the use of pre-existing road, pipeline and powerline corridors (Section 10.3.5.3.1). The decrease in habitat availability during Phases 1 and 2 may result in some habitat fragmentation, but the areas affected are small and unlikely to disrupt moose movement patterns (Section 10.3.5.3.1). Thus, this Residual Project Effect is not expected to contribute incrementally to Regional Cumulative Effects and is, therefore, considered not significant (Table 10.3.6-1).

#### *10.3.6.3 Rocky Mountain Elk*

While the reduction in moderate or better suitability elk winter shelter/thermal habitat within the LSA during Phases 1 and 2 is large (as a percentage), the actual area affected is relatively small (Section 10.3.5.1.1), and equivalent value habitat is relatively common within the RSA

(Section 10.3.3.1.3). In contrast, moderate or better suitability elk winter feeding habitat within the LSA is a large proportion of that available in the RSA (Section 10.3.3.1.3), but the decrease in its availability during Phases 1 and 2 is relatively minor (Section 10.3.5.1.1). Further, long-term habitat capability is not predicted to be affected measurably following mine closure (Section 10.3.5.1.1). Overall then, the Residual Project Effect on habitat availability is considered to be low magnitude andfar future in duration (Table 10.3.6-1). Given this assessment, this Residual Project Effect is not expected to contribute incrementally to Regional Cumulative Effects and is, therefore, considered not significant (Table 10.3.6-1)

Project-related effects on mortality risk are considered to be of medium magnitude for elk during Phases 1 and 2 (Table 10.3.6-1), due to the increase in accessibility through the area (Sections 10.3.5.2 and 10.3.5.2.1). This effect is only medium term in duration (Table 10.3.6-1), as deactivation of the new road segments following mine closure should return the risk to pre-Project levels (Sections 10.3.5.2 and 10.3.5.2.1). However, given the general susceptibility of elk and other ungulates to hunting pressures and interactions with vehicles in the region, the Residual Project Effect on mortality risk may contribute incrementally to Regional Cumulative Effects (Table 10.3.6-1). A cumulative effects assessment is subsequently required (see Section 10.3.7).

Project-related effects on movement patterns are generally considered to be relatively minor because of the use of pre-existing road, pipeline and powerline corridors (Section 10.3.5.3.1). The decrease in habitat availability during Phases 1 and 2 may result in some habitat fragmentation, but the areas affected are small and unlikely to disrupt elk movement patterns (Section 10.3.5.3.1). Thus, this Residual Project Effect is not expected to contribute incrementally to Regional Cumulative Effects and is, therefore, considered not significant (Table 10.3.6-1).

#### *10.3.6.4 Grizzly Bear*

In general, the LSA is mostly nil to low value for grizzly bears (Section 10.3.3.2.1). While the reduction in moderate or better suitability grizzly bear habitat within the LSA during Phases 1 and 2 is large (as a percentage), the actual area affected is small (Section 10.3.5.1.2), and equivalent value habitat is relatively common within the RSA in all seasons(although slightly less so in the spring) (Section 10.3.3.2.1, Appendix E-8.3). Further, long-term habitat capability is not predicted to be affected measurably following mine closure (Section 10.3.5.1.2). Overall then, the Residual Project Effect on habitat availability is considered to be low magnitude and far future in duration (Table 10.3.6-1). Given this assessment, this Residual Project Effect is not expected to contribute incrementally to Regional Cumulative Effects and is, therefore, considered not significant (Table 10.3.6-1).

Project-related effects on mortality risk are considered to be of medium magnitude for grizzly bears during Phases 1 and 2 (Table 10.3.6-1), due to the increase in accessibility through the area (Sections 10.3.5.2 and 10.3.5.2.2). This effect is, only medium term in duration (Table 10.3.6-1), as deactivation of the new road segments following mine closure should return the risk to pre-Project levels (Sections 10.3.5.2 and 10.3.5.2.2). However, given the sensitivity of grizzly bears to increased access in the region and their susceptibility to adverse interactions with humans (Section 10.3.5.2.2), the Residual Project Effect during Phases 1 and 2 may contribute incrementally to Regional Cumulative Effects (Table 10.3.6-1). A cumulative effects assessment is subsequently required (see Section 10.3.7).

Project-related effects on movement patterns are generally considered to be relatively minor because of the use of pre-existing road, pipeline and powerline corridors (Section 10.3.5.3.1). The decrease in habitat availability during Phases 1 and 2 may result in some habitat fragmentation, but the areas affected are small and unlikely to disrupt grizzly bear movement patterns (Section 10.3.5.3.1). Thus, this Residual Project Effect is not expected to contribute incrementally to Regional Cumulative Effects and is, therefore, considered not significant (Table 10.3.6-1).

#### *10.3.6.5 Wolverine*

In general, the LSA is mostly nil to low value for wolverine (Section 10.3.3.2.2). While the reduction in moderate or better suitability wolverine winter habitat within the LSA during Phases 1 and 2 is large (as a percentage), the actual area affected is very small (Section 10.3.5.1.2), and equivalent value habitat is common within the RSA (Section 10.3.3.2.2). Further, long-term habitat capability is not predicted to be affected measurably following mine closure (Section 10.3.5.1.3). Thus, the Residual Project Effect on habitat availability is considered to be low magnitude and far future in duration (Table 10.3.6-1). Given this assessment, this Residual Project Effect is not considered to contribute incrementally to Regional Cumulative Effects and is, therefore, considered not significant (Table 10.3.6-1).

Unlike grizzly bears, Project-related effects on mortality risk are considered to be of low magnitude for wolverine during Phases 1 and 2, as human encounters that may result in mortality are expected to be rare (Section 10.3.5.2.2, Table 10.3.6-1). Given this assessment, this Residual Project Effect is not expected to contribute incrementally to Regional Cumulative Effects and is, therefore, considered not significant (Table 10.3.6-1).

While the Project effects on movement patterns are generally considered to be relatively minor because of the use of pre-existing road, pipeline and powerline corridors (Section), the large decrease in habitat availability within the LSA during Phases 1 and 2 may result in some habitat fragmentation and potential disruptions of wolverine patterns due to habitat fragmentation (Section). However, as for habitat availability, the Residual Project Effect on movement patterns is considered to be of low magnitude, but far future in duration (Table 10.3.6-1). Given this assessment, this Residual Project Effect is not expected to contribute incrementally to Regional Cumulative Effects and is, therefore, considered not significant (Table 10.3.6-1).

#### *10.3.6.6 Fisher*

The area of moderate or better suitability fisher breeding habitat within the LSA is a relatively large proportion of that available in the RSA (Section 10.3.3.2.3); however, the decrease in its availability during Phases 1 and 2 is relatively minor (Section 10.3.5.1.3), and is considered low magnitude (Table 10.3.6-1). Long-term habitat capability is also not predicted to be affected measurably following mine closure (Section 10.3.5.1.3), and is again considered low magnitude (Table 10.3.6-1). Further, Project-related effects on mortality risk and movement patterns are unlikely to be a concern for the fisher at any phase of development (Sections 10.3.5.2.3 and 10.3.5.3.3). Given these assessments, no Residual Project Effects are expected to contribute incrementally to Regional Cumulative Effects and are, therefore, considered not significant (Table 10.3.6-1).

#### *10.3.6.7 Marten*

The area of moderate or better suitability marten winter habitat within the LSA is a relatively minor proportion of that available in the RSA (Section 10.3.3.2.4), and the decrease in its availability during Phases 1 and 2 is relatively minor (Section 10.3.5.1.3), and is considered low magnitude (Table 10.3.6-1). Long-term habitat capability is also not predicted to be affected measurably following mine closure (Section 10.3.5.1.3), and is again considered low magnitude (Table 10.3.6-1). Further, Project-related effects on mortality risk and movement patterns are unlikely to be a concern for the marten at any phase of development (Sections 10.3.5.2.3 and 10.3.5.3.3). Given these assessments, no Residual Project Effects are expected to contribute incrementally to Regional Cumulative Effects and are, therefore, considered not significant (Table 10.3.6-1).

#### *10.3.6.8 Northern Goshawk*

In general, the LSA is mostly low value for northern goshawk except at lower elevations (Section 10.3.3.4.1). The area of moderate or better suitability northern goshawk breeding habitat within the LSA is a relatively large proportion of that available in the RSA (Section 10.3.3.4.1); however, the decrease in its availability during Phases 1 and 2 is relatively minor (Section 10.3.5.1.4), and is considered low magnitude (Table 10.3.6-1).Long-term habitat capability is also not predicted to be affected measurably following mine closure (Section 10.3.5.1.4), and is again considered low magnitude (Table 10.3.6-1). Further, Project-related effects on mortality risk and movement patterns are unlikely to be significant for the goshawk at any phase of development (Sections 10.3.5.2.4 and 10.3.5.3.4). Given these assessments, no Residual Project Effects are expected to contribute incrementally to Regional Cumulative Effects and are, therefore, considered not significant (Table 10.3.6-1).

### *10.3.6.9 Black-throated Green Warbler*

In general, the LSA is mostly low value for black-throated green warbler except at lower elevations (Section 10.3.3.4.2). The area of moderate or better suitability black-throated green warbler breeding habitat within the LSA is a relatively large proportion of that available in the RSA (Section 10.3.3.4.2); however, the decrease in its availability during Phases 1 and 2 is relatively minor (Section 10.3.5.1.4), and is considered low magnitude (Table 10.3.6-1). Long-term habitat capability is also not predicted to be affected measurably following mine closure (Section 10.3.5.1.4), and is again considered low magnitude (Table 10.3.6-1). Further, as for the northern goshawk, Project-related effects on mortality risk and movement patterns are unlikely to be significant for the warbler at any phase of development (Sections 10.3.5.2.4 and 10.3.5.3.4). Given these assessments, no Residual Project Effects are expected to contribute incrementally to Regional Cumulative Effects and are, therefore, considered not significant (Table 10.3.6-1).

## 10.3.7 Cumulative Effects Assessment

As discussed in Section 10.3.6, Residual Project Effects on mortality risk during construction and operation phases might contribute incrementally to regional cumulative effects for three focal species: moose, Rocky Mountain elk, and grizzly bear (Table 10.3.6-1). Mortality risk is affected by human access and the availability of secure habitat. In general, larger habitat patches are presumed to be more secure than smaller habitat patches, primarily related to distance from human access and the associated mortality risks. The main concern with increased human access is the increased legal and illegal hunting risk to the wildlife population, but mortality risk related to vehicle collisions is also a concern. Core security habitat analysis and road density analyses applied to the RSA (Section 10.3.2.9) were used to assess potential cumulative effects on mortality risk.

Core secure habitat availability and road density estimates are indicators of compromised habitat quality across a landscape. Habitat fragmentation and traffic likely already disrupts the daily and seasonal movement patterns of ungulates and grizzly bears. In many cases, habituation to roads and/or relocation of movement corridors and/or alteration of daily activity patterns (e.g., increased nocturnal activity) may be taking place. The population level implications of these behavioural and ecological changes are, however, generally unknown. Again, the use of existing road systems, efforts to parallel existing pipeline and powerline corridors, and development of facilities within or near existing development minimizes the effect of the Project on wildlife movement patterns at the regional level.

As included in an earlier discussion on methods, determination of the significance of cumulative effects is based on a consideration of both ecological thresholds for maintaining populations and social policy for land use and species management. With respect to land use policy, management guidelines in British Columbia (LRMP) qualitatively stipulate the need for conservation efforts for grizzly bear in areas that are also considered enhanced resource use zones. In the absence of quantitative goals for habitat protection and road access development, and undefined terms for overall land use direction, a clear determination of the significance of cumulative regional effects with specific respect to provincial land use policy needs to be based on professional judgement and best available information.

In the absence of identified regional thresholds, results of analyses can also be compared to available and applicable ecological thresholds that have been adopted for the purposes of sustaining species populations over the long term in other regions. For grizzly bear, such thresholds are available from other jurisdictions in similar mountainous ecosystems. For example, habitat security goals for grizzly bear population maintenance in Jasper and Banff National Parks typically range between 80% and 100% (Parks Canada 1997). Federal recovery efforts for grizzly bear in key areas of north-western United States have stipulated the need to restrict high-density roading (i.e., >2 mi/mi$^2$)[76] to between zero and 20% in primary conservation areas (USFWS 1993; IGBC 1995).

The assessment approach for core security habitat analyses is specific to grizzly bear, but is applicable to ungulates as they also require large seasonal territories or ranges and, hence, have the potential to interact with multiple land use activities at the individual animal and population level.

### *10.3.7.1 Core Security Habitat Analysis*

The results of the core security analysis indicated that there is little core secure habitat available within the RSA under Baseline conditions—only 3,852 ha are included in patches ≥10 km$^2$, representing 3.8% of the RSA. This is largely due to extensive linear developments that have occurred in the region prior to the Brule Mine Project. Phases 1 and 2 have almost no measurable effect (decrease of 0.3%) on the availability of these patches (Table 10.3.7-1, Figure 10.3.7-1). However, this analysis provides a very conservative estimate of core secure habitat availability—with the exception of roads related to WCC activities, the spatial data on linear features were obtained from TRIM and no information on road use levels was available. Thus, all roads were considered to be high use and buffered accordingly (i.e., by 800 m). In addition, all low use features were buffered (by 400 m). In reality, some linear features may actually receive little or even no use. In particular, the accessibility of seismic lines - which are relatively common in the area - to motorized traffic is unknown. Though the approach was conservative, it is clear that, in accordance with the enhanced resource development plans for the region; cumulative land use activities have already resulted in reduced core security habitat.

**Table 10.3.7-1: Change in Core Security Habitat in the Regional Study Area**

| Patch Size | Baseline (ha) | C/O Phase* (ha) | Change at C/O Phase* (%) |
|---|---|---|---|
| Patches ≥10 km$^2$ | 3,853 | 3,840 | -0.3 |
| Patches <10 km$^2$ | 12,903 | 12,420 | +3.7 |

**Note:** * Phases 1 and 2.

[76] Equivalent to approximately 0.6km/km$^2$, for comparative purposes to results from this analysis.

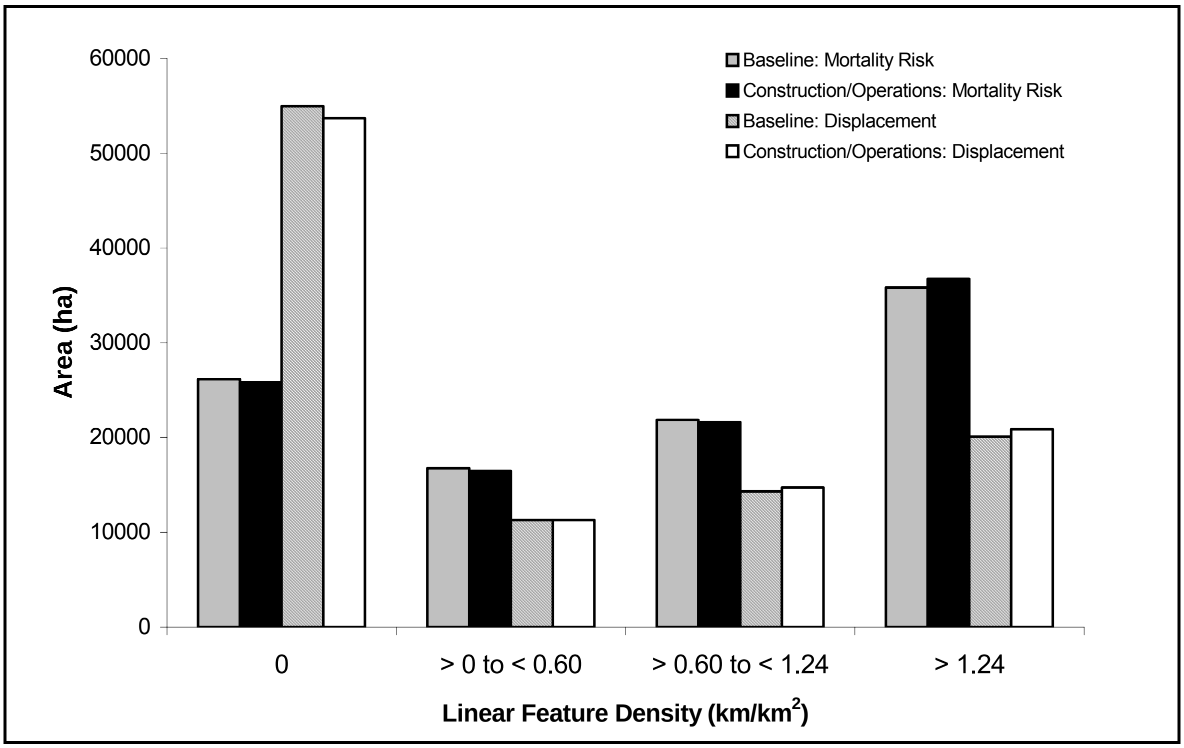
### *10.3.7.2 Road Density Analyses*

Closely related to core secure habitat availability is the density of road (linear) features and their effects on wildlife. The effects can include both mortality risk (i.e., assumed to result from all linear features, except airport features; T. Hamilton, pers. comm.) and habitat displacement (i.e., assumed to result from only high use linear features, T. Hamilton, pers. comm.).

With respect to baseline conditions, cumulative land use activities have already resulted in high road densities classes (and greatly reduced core security habitat, see previous section) over a large portion of the RSA. Specifically, for displacement effects related to roads under baseline conditions, 34.7% of the RSA has road densities >0.6km/km$^2$. Similarly for mortality risk, 57.3% of the RSA has road densities >0.6 km/km$^2$.

Project effects during Phases 1 and 2 result in a 4.1% increase in the area with displacement effects from high road densities (i.e., exceeding 1.24 km/km$^2$) (Figure 10.3.7-2, Appendix E-10.1). By comparison, there is a 2.5% increase in the area with mortality risk effect of roads exceeding 1.24 km/km$^2$ during the same development phase (Figure 10.3.7-2, Appendix E-10.2). The majority of the increase in both types of road effect occurs in three watershed units: 045, 080, and 082 (see Appendix E-7).

**Figure 10.3.7-2: Change in Road (Linear Feature) Density in the Regional Study Area for Mortality Risk & Displacement: Baseline to Construction/Operations[77]**




[77] Phases 1 and 2

### 10.3.8 Residual Cumulative Effects: Summary & Characterization

Based on the Cumulative Effects Assessment described in Section 10.3.7, Residual Cumulative Effects are further characterized for mortality risk for the three focal species of concern. Table 10.3.8-1 summarizes these effects, and any Residual Cumulative Effects are identified and assessed for their significance, and the Project's contribution to RCEs is evaluated.

Even though the Baseline conditions likely over-estimated adverse effects due to the conservative modeling approach, the change in core secure habitat is predicted to be minor during Phases 1 and 2. With the decommissioning of the mine, closure of the loadout, and deactivation of new road segments (see Section 4.12), the availability of core secure habitat during the Post-closure phase is predicted to return to Baseline conditions (assuming no other developments occur in the RSA). Similarly, the increase in road density effects (mortality risk and displacement) during Phases 1 and 2 is predicted to return to Baseline conditions, again, assuming no further linear developments occur in the RSA. Therefore, the incremental contribution of the Project to existing Residual Cumulative Effects in the RSA is considered not significant for ungulates or grizzly bears (Table 10.3.8-1).

The cumulative effects assessment analyses for core habitat security and road density indicated that significant Residual Cumulative Effects exist in the RSA, even in the absence of the incremental effects of future projects[78]. Despite the absence of regional thresholds for comparison, existing core security habitat (3.8% of the RSA) is substantially below that recommended for conservation areas (i.e., 80 to 100%, Parks Canada 1997). Likewise, the existing relatively high road densities (57.3% for mortality, 34.1% for displacement) are above those recommended for primary conservation areas (i.e., 20%, USFWS 1993; IGBC 1995). While this region in northeastern British Columbia is identified as an Enhanced Resource Development Zone[79] (and not a conservation area), sustainability for wildlife resources are encouraged (B.C. Government 1999). Although the modelling exercise were likely conservative and over-estimated adverse effects, it is likely that existing cumulative effects have already exceeded a threshold, resulting in significant cumulative effects.

These effects of increased access have substantially reduced secure habitat areas within the RSA. To ensure that intact habitat areas remain, and thus to help ensure long-term maintenance of wildlife populations, regional scale planning may be required to mitigate or reverse trends in linear development. As part of their overall mitigation planning, WCC has utilized existing roads and other linear corridors to the extent practical, and has committed to deactivate road segments to reduce increased access and limit potential effects of mortality risk to wildlife. WCC would be willing to participate in regional based programs directed by government and including other stakeholders to further reduce the effects of access proliferation.

[78] As discussed in Section 10.3.2.9, no projects were identified for the foreseeable future in this cumulative effects assessment. However, forestry-related activities, as well as those of other industries (e.g., oil and gas) are expected to occur.
[79] This zone is managed for the development of resources such as timber, minerals and oil and gas, while minimizing impacts on other resource values (B.C. Government 1999).

**Table 10.3.8-1: Summary of Residual Cumulative Effects: Moose, Rocky Mountain Elk, & Grizzly Bear**

| EvaluationScenario[1] | Potential Cumulative Effect | Planned Mitigation | Residual Cumulative Effects (RCE) characterization[2] | | | | | RCE Significance | Project contribution to RCE | Level of Confidence |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Magnitude | Geographic Extent | Duration | Frequency | Reversibility | | | |
| RCE without the Project (B through foreseeable future) | Increased mortality risk | Unknown - potential regional access control, directed by government and involving other stakeholders | Moderate to High | Regional | Far future | Continuous | Irreversible | Significant | -- | Medium |
| Project Contribution (C, O, D) | | Traffic and firearm restrictions | Low | Local | Medium term | Continuous | Reversible | -- | Not significant | High |
| Project Contribution (P) | | Road deactivation | Low[3] | Local | Short to Medium term | Continuous | Reversible | -- | Not significant | High |
| RCE with the Project (C, O, D, P) | | Unknown - potential regional access control, directed by government and involving other stakeholders | Moderate to High | Regional | Far future | Continuous | Irreversible | Significant | -- | Medium |

**Notes: 1.** B=Baseline, C=Phase 1(Construction), O=Phase 2 (Operations), D=Decommissioning/Reclamation, P=Post-Closure. **2.** Based on the assumption that mitigation measures are effective as planned. Refer to Table 10.3.2-2 for the classification schemes for these criteria. **3.** The magnitude of Project contributions to increased mortality risk during Post-closure is negligible, due to the deactivation of road segments.

### 10.3.9 Monitoring

The monitoring program will be initiated during Phase 1 and is intended to target particular Project-related effects (e.g., mortality), and species of concern (e.g., grizzly bear and caribou), and to assist in the implementation and evaluation of mitigation measures as outlined in the Wildlife Management Plan (Section 4.11).

The main monitoring tool will be a record of wildlife observations (i.e., wildlife exhibiting normal behaviour and not posing a safety concerns), and incidents (e.g., wildlife-vehicle collision, aggressive bear observation). To this end, a 'wildlife log' will be maintained by WCC. Mine staff will be encouraged to report sightings of wildlife in or near the Project area. Ideally, reports will include the date, time, description of location, species, number of individuals, and the activity (e.g. feeding, nesting). The reporting of wildlife observations and incidents is described in more detail in Section 4.11.

The following monitoring programs and, where applicable, adaptive management strategies, are proposed:

- *Wildlife-vehicle mortalities* – Large mammal mortalities or accidents along the haul routes will be recorded. If unacceptable numbers of road kills occur, revised or additional mitigation measures (e.g., lower speed limits, warning signs, improvement of visibility, worker advisories) may be implemented.
- *Problem wildlife* – Problem wildlife incidents will be monitored, and if required, the issue will be dealt with according to established protocols (Section 4.11). A high number of incidents would precipitate a re-evaluation of the effectiveness and enforcement of existing prevention measures.
- *Grizzly bears* – Observations of grizzly bears or their sign (e.g., tracks, scat) in and around the Project area will be recorded. These observations will informally track grizzly bear use patterns within the Project area through all development phases. *Woodland caribou* – WCC has supported an ongoing caribou research project in the Hart Foothills region with the purchase of several telemetry collars. This research is a component of the provincial Recovery Strategy for Mountain Caribou (MCTAC 2002)[80]. Observation of caribou or their sign in and around the Project area will be recorded and provided to the research team.
- *Woodland caribou* – WCC has supported an ongoing caribou research project in the Hart Foothills region with the purchase of several telemetry collars. This research is a component of the provincial Recovery Strategy for Mountain Caribou (MCTAC 2002)[81]. Observation of caribou or their sign in and around the Project area will be recorded and provided to the research team.

[80] A provincial Recovery Strategy for the terrestrial lichen–winter feeding ecotype (i.e., northern ecotype) is under development.
[81] A provincial Recovery Strategy for the terrestrial lichen–winter feeding ecotype (i.e., northern ecotype) is under development