

# 18 Wildlife and Wildlife Habitat

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The effects assessment for wildlife describes the existing wildlife and wildlife habitat in the regional study area (RSA; Section 18.1), historical activities within the RSA (Section 18.2), objectives of relevant land use plans (Section 18.3), and the spatial and temporal boundaries of the assessment (Section 18.4). The list of valued components (VCs) and the potential effects on these VCs raised by First Nations, government regulators, regional planning strategies, and scientific research are listed in Sections 18.5 and 18.6, respectively. Each potential effect is addressed in a separate section of this chapter (Section 18.7). Each section describing potential effects is subdivided according to the wildlife VCs deemed to be of concern for that potential effect. Where issues are directly and indirectly linked, sections are cross-referenced to avoid redundancy.

The assessment then evaluates the significance of the residual effects on each wildlife VC (Section 18.8) and provides a cumulative effects assessment which combines the potential residual effects of the KSM Project (the Project) with other residual effects of human activities in this region (Section 18.9). A summary of the effects assessment results and conclusions are presented at the end of this chapter in Sections 18.10 and 18.11.

## 18.1 Wildlife and Wildlife Habitat Setting

This section provides an overview of 1) the regional ecology; 2) protected areas; 3) relevant legislation and guidelines; 4) characterization of the mammal, bird, and amphibian populations in the Project area; 5) species of conservation concern or of local interest; and 6) habitats of concern for wildlife. Wildlife information is presented for both the local study area (LSA; 44,983 ha) and RSA (approximately 338,080 ha; see Figure 18.4-1 in Section 18.4.1). The LSA and RSA defined the area for wildlife baseline studies and also for the effects assessment. Details on the boundaries of the LSA and RSA, as well as a rationale for the extent and boundaries of these areas, are presented in Section 18.4.1.

The 2008 and 2009 Wildlife Baseline Reports ([Appendices 18-A](#), [18-B](#), and [18-C](#)) provide details on methods and results for wildlife studies conducted in 2008 and 2009 for the Project.

An initial series of wildlife VCs and proposed methods for wildlife baseline surveys were presented at a working group meeting in winter 2008. This meeting was held to allow members of the working group to provide feedback on baseline survey methodology, scope, and VC selection. Working group members included Nisga'a Nation and First Nations representatives (Tahltan Nation, Gitksan Nation, Gitanyow First Nation, and wilp Skii km Lax Ha), provincial and federal government regulators (e.g., British Columbia Ministry of Environment [BC MOE], Canadian Wildlife Service [CWS], Natural Resources Canada), and representatives from the British Columbia Environmental Assessment Office and Canadian Environmental Assessment Agency.

Comments made by members of the working group in 2008 were incorporated into the study design. For example, the RSA boundary was expanded to include the mountain range to the east of Coulter Creek to ensure that mountain goats in that area could be surveyed. An additional

survey unit was also added for mountain goats to include canyon habitats along the Unuk Valley in response to working group member requests. At the request of First Nations, hoary marmots were added as a baseline VC and baseline surveys were implemented.

Following baseline fieldwork, results were presented at subsequent working group meetings in 2010, 2011, and 2012, where the framework for the Environmental Assessment was also presented and discussed. As a result of direction from the working group, black bear was added as a VC for the assessment. Also, as a result of comments regarding corridors for moose and bear movement, design changes were made to the Project (e.g., maintaining the Mitchell-Treaty Saddle Area [Saddle Area] clear of infrastructure and minimizing infrastructure near the Unuk River). More information on the process of VC selection is available in Section 18.5, and design changes are described in Sections 18.7 and 26.21.

### **18.1.1 Regional Ecology**

The Project RSA is within the Boundary Ranges Ecoregion, the Skeena Mountains Ecoregion, and the Nass Ranges Ecoregion (D. A. Demarchi 1996). Starting from the coast, the Boundary Ranges consist of a large block of rugged, ice-capped, granitic mountains that are dissected by several major river valleys. Inland and east of the Boundary Ranges lies the Skeena Mountains Ecoregion, which consists of high rugged mountains and a moist, coast/interior transition climate, supporting many glaciers. The Nass Ranges Ecoregion is a mountainous area south of the Project. Its climate is somewhat transitional between coastal and interior regimes (D. A. Demarchi 1996).

The biogeoclimatic ecosystem classification (BEC) zones present within the RSA include Boreal Altai Fescue Alpine (BAFA), Coastal Mountain-heather Alpine (CMA), Coastal Western Hemlock (CWH), Engelmann Spruce–Subalpine Fir (ESSF), Interior Cedar Hemlock (ICH), and Mountain Hemlock (MH). These BEC zones and sub-zones present in the RSA are further described in Section 17.9.2 (Terrestrial Ecosystems and Vegetation Setting).

Wildlife and wildlife habitat have been characterized for a LSA and RSA surrounding the Project (see Figure 18.4-1). Almost half (46%) of the RSA is comprised of non-vegetated units such as water, glaciers, rock outcrops, and sparsely vegetated alpine areas. Mesic forests are the dominant forest type in both the LSA and RSA. Shrub-dominated areas such as avalanche track systems are also very common. More details regarding the distribution of general ecosystem types in the LSA and RSA are provided in [Appendix 17-A](#) (Vegetation Baseline).

At a broad scale, the RSA can be divided into three general areas, which are referred to throughout the document. The first is the coastal-influenced area along the Unuk River. The second is the large icefield, located between the Unuk River, Treaty Creek, and the Bowser River (called the massif). The third is the interior-influenced area including the Bell-Irving River, Treaty Creek, Snowbank Creek, Teigen Creek, and surrounding Bowser Lake. The coastal and interior zones support different BEC zones, vegetation types, and therefore different habitat types for wildlife. Wildlife data are often summarized into coastal and interior zones in this document.

Mature forests, wetlands, alpine areas, and riparian forests provide high-value habitat to a diverse wildlife community. Common species or groups that occur in the RSA include ungulates

(e.g., moose, mountain goat), omnivores/carnivores (e.g., grizzly bear, black bear, wolves), furbearers (e.g., fisher, marten, wolverine), hoary marmots, bats, birds (forest and alpine birds, raptors, waterfowl), and amphibians (e.g., Columbia spotted frog, western toad).

Forest harvesting within the RSA is minimal compared to many other areas in British Columbia (BC) due to the remoteness of the area and the relatively poor productivity of the forests. Since 1985, 6,129 ha in the RSA (which is 338,000 ha) have been harvested, concentrated along the Bell-Irving River and Highway 37.

Natural disturbances to terrestrial ecosystems and vegetation in the Project region include windthrow and avalanches. Stand-initiating natural disturbances such as large wildfires are rare and infrequent in the region (BC MOF 1995); the forested area is classified as natural disturbance type 1 or 2 (i.e., ecosystems with rare stand-initiating events, and ecosystems with infrequent stand-initiating events, respectively; BC MOF 1995).

### 18.1.2 Protected Areas

There are two provincial parks and one ecological reserve within the RSA boundary:

- Border Lake Provincial Park (800 ha; 18.8 km from the Project footprint on the Unuk River in the southwest extreme of the RSA);
- Ningunsaw Provincial Park (15,000 ha; 12.5 km from the Project footprint at the northern tip of the RSA); and
- Ningunsaw River Ecological Reserve (2,372 ha; 24.1 km from the Project footprint at the northern tip of the RSA).

Ecological reserves are areas selected to preserve representative and special natural ecosystems, plant species, and animal species. The Ningunsaw River Ecological Reserve was established for the preservation of an elevational sequence of three BEC zones in a transition between coastal and interior climates. Resource extraction (e.g., commercial logging, mining, and hydroelectric development) within these protected areas is prohibited. These parks and the ecological reserve do not overlap with the LSA (see Section 18.4.1 for a description of the LSA and RSA).

### 18.1.3 Wildlife Legislation

The British Columbia Ministry of Forests, Lands and Natural Resource Operations (BC MFLNRO) Region 6 (Skeena) manages wildlife in the area. The Pacific/Yukon Region of Environment Canada is the federal agency responsible for wildlife and species at risk in the area. Wildlife and wildlife habitat are protected under several federal and provincial acts and regulations, including the:

- *Canada Migratory Birds Convention Act* (1994);
- *Canada Species at Risk Act* (2002b);
- *BC Wildlife Act* (1996c);
- *BC Water Act* (1996b);

- *BC Forest and Range Practices Act* (FRPA; 2002a);
- Forest Planning and Practices Regulation (BC Reg.14/2004); and
- Government Actions Regulation (BC Reg. 582/2004)

In particular, Section 34 of the *Wildlife Act* (1996c) protects most vertebrate animals from direct harm and harassment and specifically protects birds, eggs, and occupied nests from possession, molestation, injury, or destruction. The *Canada Migratory Birds Convention Act* (1994) prohibits the killing of migratory birds or depositing harmful substances in areas frequented by migratory birds, and also protects their eggs and nests. Under the FRPA, areas that are important or critical to ungulates and sensitive wildlife, such as Ungulate Winter Ranges (UWRs) and Wildlife Habitat Areas (WHAs) are designated and managed for forest and range practices. General wildlife measures are established for UWRs and WHAs, which includes regulations such as prohibiting road construction and/or disturbance within established buffers around UWR and/or WHA boundaries, unless an exemption under section 146 of the FRPA and section 92(1) of the Forest Planning and Practices Regulation is granted. One Ungulate Winter Range established under Order U-6-002 for the Nass Timber Supply Area overlaps with KSM Project activities. The procedure to acquire an exemption from prescribed general wildlife measures contained within Order U-6-002 is described in Appendix 1, section 2 of the Order.

Standards and best practices are guiding statements that allow development to occur in a way that will avoid, limit, or mitigate effects on aquatic and riparian habitats, water quality and quantity, fish and wildlife species, and public safety and property. Standards are defined as a regulatory requirement that must be followed or achieved in the design and completion of developments (BC MWLAP 2004d). Best management practices are recommended methods or techniques that should be followed to ensure the standards are met and effects are mitigated. Best management practices and guidelines relevant to the Project include, but are not limited to:

- Best Management Practices for Amphibians and Reptiles in Urban and Rural Environments in British Columbia (BC MWLAP 2004a);
- Best Management Practices for Raptor Conservation during Urban and Rural Land Development in British Columbia (BC MWLAP 2005);
- Migratory Birds Environmental Assessment Guideline (Milko 1998a);
- British Columbia Environmental Assessment Guidelines for Grizzly Bears and Black Bears (MacHutchon 2001);
- *Develop with Care: Environmental Guidelines for Urban and Rural Land Development in British Columbia* (BC MOE 2006a);
- *Environmental Best Management Practices for Urban and Rural Land Development: Special Wildlife and Species at Risk* (BC MOE 2004);
- *Wildlife Guidelines for Backcountry Tourism/Commercial Recreation* (BC MOE 2006b);
- *Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006* (APLIC 2006);

- Standards and Best Practices for Instream Works (BC MWLAP 2004d);
- Wetlands Environmental Assessment Guideline (Milko 1998b); and
- Wetland Ways: Interim Guidelines for Wetland Protection and Conservation in British Columbia (WSP 2009).

### 18.1.4 Overview of Baseline Study Methods

A range of methods and data sources for the Project were used, including a detailed literature review, baseline field surveys, habitat suitability modelling, and a deoxyribonucleic acid (DNA) program. These methodologies and results will be discussed in more detail below and in Sections 18.1.5 to 18.1.7. Potentially occurring species at risk were identified from the *Species at Risk Act* (2002b) and the BC Conservation Data Centre (BC CDC 2012), and species of interest were identified through traditional knowledge/traditional use (TK/TU) studies (as explained in Chapters 29 and 30), and by First Nations and provincial and federal government regulators.

A review of the available literature, particularly of the Nass South Sustainable Resource Management Plan (SRMP; BC MFLNRO 2012b) and Cassiar Iskut-Stikine Land and Resource Management Plan (LRMP; BC ILMB 2000), provided existing information and data for the RSA. Habitat mapping has been conducted for moose and mountain goat (UWR), grizzly bear (WHA), northern goshawk (Habitat Suitability Index), and important wildlife habitat (e.g., wetlands) in the Nass South SRMP area (M. W. Demarchi 2000; BC ILMB 2009; BC MFLNRO 2012b). More information on relevant SRMP and LRMPs is provided in Section 18.3.

Field surveys were conducted for moose, mountain goats, grizzly bears, furbearers, groundhogs (a term used by the Tahltan to describe both hoary marmots and Arctic ground squirrels), small mammals, bats, songbirds, raptors, waterfowl, and amphibians, following the inventory standards established by the BC Resources Information Standards Committee (RISC). Wildlife studies were conducted within the LSA and RSA during the spring, summer, and fall of 2008, and during the winter, spring, and summer of 2009 ([Appendix 18-A](#), Wildlife Characterization Baseline Report). Methods and results from baseline surveys are summarized for each wildlife group in Sections 18.1.5 through 18.1.7.

Studies to develop habitat suitability models for moose, mountain goats, grizzly bears, marten, and hoary marmots were undertaken for the RSA and/or LSA in conjunction with ecosystem mapping studies ([Appendix 17-A](#)), following BC RISC standards. Habitat suitability models provide a means of identifying the area and distribution of important habitats across the landscape and can be used to assess the potential effects of the proposed Project. The results of the habitat suitability models are reported in the Wildlife Habitat Suitability Baseline Report ([Appendix 18-B](#)), and summarized in Section 18.1.5. Results from habitat suitability mapping are integrated into the effects assessment (Sections 18.7.2 through 18.7.7).

A grizzly bear population study was also conducted in 2008 and 2009. DNA techniques were used to estimate the number of grizzly bears that occupied the RSA in 2008 and 2009. The results of the grizzly bear DNA study are reported in the Grizzly Bear DNA Baseline Study ([Appendix 18-C](#)), and summarized in Section 18.1.5.2.

### 18.1.5 Mammal Characterization

Mammals were identified as important species by federal and provincial governments and by Nisga'a Nation and Aboriginal groups because of their social, economic, and/or biological importance (see Section 18.5, Valued Components). Mammal species in the Project area are described in the following sections, summarized by the following six groups: ungulates, furbearers, bears, groundhogs, small mammals, and bats. More information on each species, including distribution maps for each species in the RSA and LSA, is available in the wildlife baseline reports ([Appendices 18-A, 18-B, and 18-C](#)).

#### 18.1.5.1 Ungulates

##### 18.1.5.1.1 Moose

Moose (*Alces alces*) are common throughout BC's forested areas with an estimated population size of 170,000 animals (Blood 2000a). Habitat suitability modelling and winter aerial surveys identified moose habitat in the RSA. Winter habitat has been identified as critical for maintaining moose populations and both habitat modelling and population censuses focused on this season (Safford 2004). The majority of good-quality winter habitat for moose occurs along river valleys within the interior survey area on the eastern side of the RSA, including the Bell-Irving River, Treaty Creek, Snowbank Creek, Teigen Creek, and surrounding Bowser Lake. A smaller amount of moose habitat occurs in the western, coastal-influenced part of the RSA, along the Unuk River.

Baseline study results from 2008 and 2009 indicate that, during the winter, moose selected flat, riparian habitat and areas of gentle to moderate slopes that produced abundant shrub forage at higher elevations, where topographic relief resulted in lower snow packs. The low elevation and gentle topography of much of the river drainages in the RSA represent suitable moose early and late winter habitat. Figure 18.1-1 summarizes high-quality (HSR 1 and 2) early and late winter habitat in the RSA (see [Appendix 18-B](#) for the detailed habitat suitability models). Late winter habitat is surveyed and modelled separately because accumulating snow packs further limit the area of moose habitat compared to early winter.

As part of the FRPA (2002a), moose winter range has also been mapped in the eastern half of the RSA to produce proposed UWR polygons, that cover areas along the Bell-Irving River, Bowser Lake, and parts of Treaty Creek (UWR 6-018; McElhanney 2007b). These proposed winter range polygons overlap areas identified as Moderately High to Highly suitable in the LSA and the RSA during habitat suitability modelling for baseline studies (Figure 18.1-1; [Appendix 18-B](#)).

The southern tip of the RSA overlaps with the Nass Wildlife Area (NWA), which covers an area of approximately 3,677 km<sup>2</sup> immediately south of the RSA (M. W. Demarchi 2011). Surveys for moose in the NWA have been conducted; and an estimate of 517 moose was developed for the NWA in 2011 (M. W. Demarchi 2011). The Nass South SRMP area, which overlaps a small portion of the RSA near Bowser River and Treaty Creek, provides high-value moose habitat, including important calving, rutting, and winter habitat (BC MFLNRO 2012b).

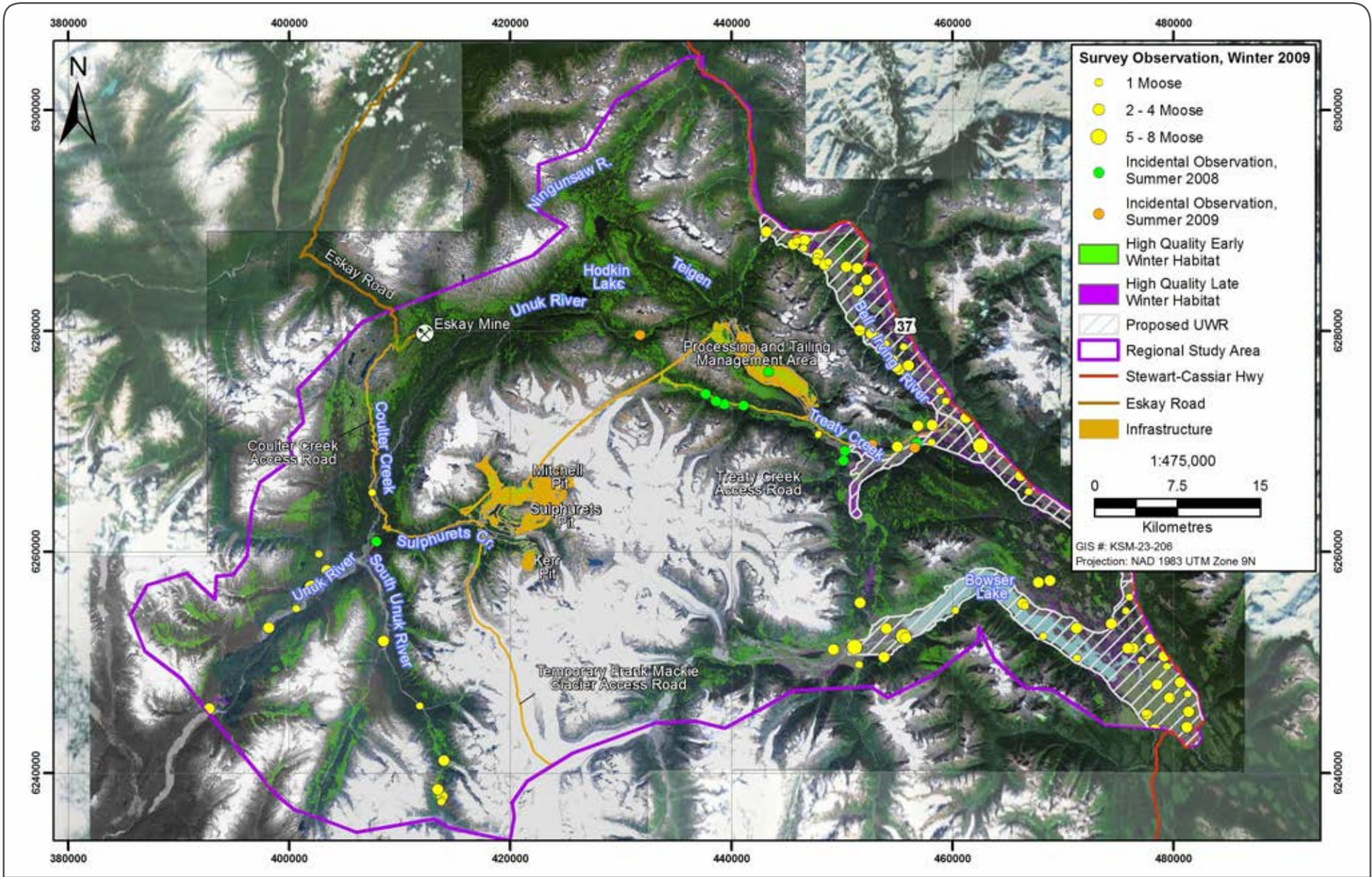


Figure 18.1-1

Moose Observed during Baseline Surveys and High Quality Winter Habitat

Figure 18.1-1

Winter habitat is generally the limiting factor in the carrying capacity for moose in BC because of increased energy demands from moving through snow pack and reduced nutritional quality of forage. Moose winter range within the RSA consists primarily of low elevation wetland-timber complexes, floodplains of main rivers, and large tributary streams adjacent to coniferous stands. Past timber development near Bowser Lake has also resulted in areas of regenerating forest which supports shrubs used by moose during winter.

Overall, there is more High and Moderately High-rated early winter habitat in the RSA compared to late winter habitat. The early winter habitat model was not influenced by snow pack, while late winter habitat models were. Moderately High to Highly suitable early winter habitat for moose was mapped across 13% (5,864 ha) of the LSA, which is a similar proportion of Moderately High to Highly suitable habitat represented in the RSA (12%). Due to higher elevation, there is less suitable late winter habitat for moose in the LSA (7%) compared to the entire RSA (12%). Within the RSA, the wetland complex along the lower Teigen Creek drainage near Bell 2 Lodge and the large floodplains along the Bell-Irving and Bowser rivers were identified as highly suitable early and late winter habitat. Within the LSA, the most suitable early winter habitat was located in the Processing and Tailing Management Area (PTMA), particularly the wetlands within the proposed Tailing Management Facility (TMF), and riparian areas along the length of Treaty Creek, including the Saddle Area and the Treaty Creek access road (TCAR). The most suitable late winter habitat was located along the TCAR in the LSA and the Bell-Irving River (Figure 18.1-1).

Moose are known to move along river drainages between seasonal ranges. Areas likely to be used by moose as movement corridors were identified by reviewing topographic connectivity between river valleys. Movement corridors are expected to occur along several of the drainages in the LSA and RSA; e.g., between Treaty and Teigen creeks and the Unuk River, and along the Bell-Irving and Bowser rivers. Moose can move considerable distances during season movements and juvenile dispersion; in this assessment it is assumed that the population within the RSA is unbounded and connected to adjacent moose populations.

Baseline aerial surveys for moose in winter 2009 indicate that the density and number (adjusted for sightability) of moose was higher in the river valleys of the eastern interior area near the PTMA, Treaty Creek, Bell-Irving River, and Bowser Lake (0.59 moose/km<sup>2</sup>; 198 moose) than in the western coastal area near the Mine Site in the Unuk River valley (0.27 moose/km<sup>2</sup>; 33 moose; Figure 18.1-1). In the coastal area, the highest density was observed at the upper tributaries of the South Unuk River (0.44 moose/km<sup>2</sup>) and near the confluence of the Unuk and South Unuk rivers (0.31 moose/km<sup>2</sup>).

The highest density in the interior survey area was observed along the lower reaches of Teigen Creek to its confluence with Snowbank Creek and the Bell-Irving River (0.92 moose/km<sup>2</sup>), further south along the Bell-Irving River (0.78 moose/km<sup>2</sup>), and along Treaty Creek (0.87 moose/km<sup>2</sup>). In addition, a lower male to female ratio was observed in the interior area (47 bulls for 100 cows), which is indicative of harvest pressure on males where access to high-quality moose habitat is available from Highway 37 along the Bell-Irving River and along forestry roads near Bowser Lake ([Appendix 18-A](#)).

### 18.1.5.1.2 Mountain Goats

The total number of mountain goats (*Oreamnos americanus*) in BC was estimated at approximately 50,000 individuals in 2000 (Blood 2000b), of which 16,000 to 35,000 occur within the Skeena Region (BC ILMB 2009). Mountain goats are a popular hunting species and are important for cultural and resource use.

Habitat suitability mapping was conducted for mountain goats to identify summer and winter habitat. The most suitable year-round habitat in the RSA occurs in the eastern RSA along the Snowslide Range and in the western RSA around John Peaks to the west of the Mine Site. Within the LSA, suitable habitat was identified in the Mine Site and southeast of the TMF. Overall, Moderately High to Highly suitable winter habitat was mapped across 15% (6,687 ha) of the LSA ([Appendix 18-B](#)), which is similar to the proportion of Moderately High to Highly suitable winter habitat present in the entire RSA (17%; Figure 18.1-2).

A total of 9,028 ha (20%) of the LSA was identified as Moderately High to Highly suitable summer habitat (Figure 18.1-3). The proportion of suitable summer habitat in the LSA is similar to the availability in the entire RSA (20 and 23%, respectively; [Appendix 18-B](#)). The majority (4,424 ha of the 9,028 ha in the LSA; 49%) of Moderately High and Highly suitable winter and summer habitat occurs within the Mine Site.

The BC MOE has identified areas of high-quality mountain goat winter range that are deemed necessary for the winter survival of the species throughout the province, and have designated these areas as goat UWR. Within the Skeena Region, designated mountain goat UWR is established within the Nass Timber Supply Area (TSA) (u-6-002; BC MOE 2008). These UWR polygons overlap areas identified during baseline habitat suitability modelling ([Appendix 18-B](#)) as Moderately High to Highly suitable in the LSA and the RSA (Figure 18.1-2). UWR polygons occur along Sulphurets Creek, near McTagg Creek, on the north side of the Unuk River, and directly east of the proposed TMF at higher elevations.

When UWR u-6-002 was compared to Rescan Environmental Services Ltd. (Rescan) winter habitat models, there was approximately 70% overlap with High and Moderately High rated areas for winter habitat (Figure 18.1-2). Modelling for UWR also identified canyon goat habitat along the northern reaches of the Unuk River and north of Bowser Lake. Canyon goat habitat was not modelled by Rescan, but was surveyed. Goats were confirmed in one canyon habitat on the Unuk River in the RSA (outside of the LSA).

Mountain goat populations were surveyed for the Project in the RSA during the summer of 2008 and the winter of 2009 (referred to as KSM surveys). Surveys were also conducted within some of the same survey units (SUs) for the proposed Brucejack Mine in summer 2010 and winter 2011; these survey results are included in [Appendix 18-D](#), and in the assessment of effects on mountain goats. Winter surveys were conducted to ground-truth winter habitat modelling and estimate number of goats in the winter, while summer surveys were used to both ground-truth the habitat models and establish the baseline number of goats in the RSA. Sightability during winter is lower when goats occupy forested areas; therefore, summer surveys are used to quantify the goat population.

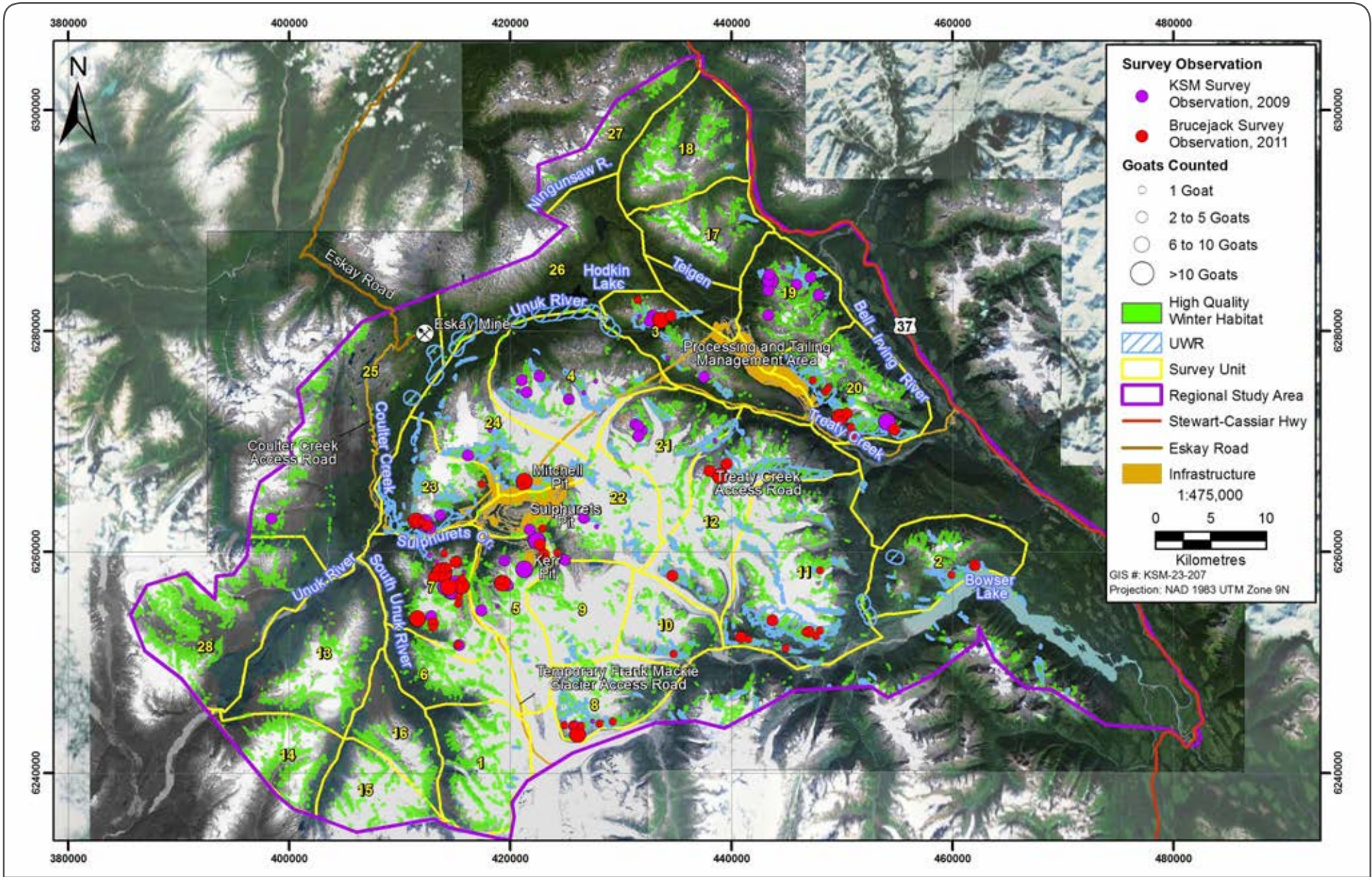


Figure 18.1-2

Mountain Goats Observed during Winter Baseline Surveys (2009 and 2011) and High Quality Winter Habitat

Figure 18.1-2

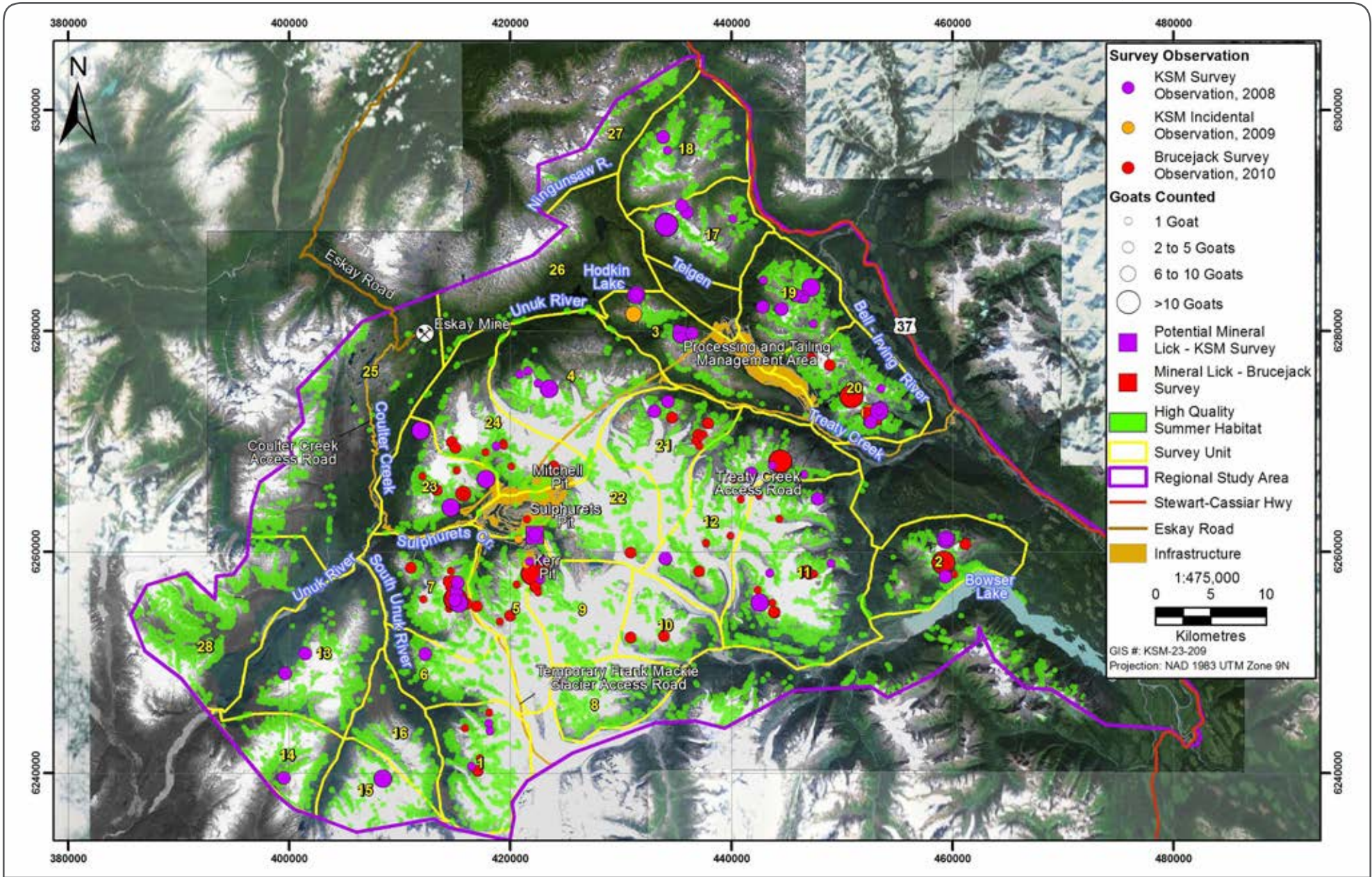


Figure 18.1-3

Mountain Goats Observed during Summer Baseline Surveys (2008 to 2010) and High Quality Summer Habitat

Figure 18.1-3

During the KSM summer 2008 survey, 230 goats were observed in 62 groups in the RSA (Figure 18.1-3), and during the winter 2009 survey, 178 goats were observed in 69 groups in the RSA (Figure 18.1-2). The summer kidding ratio was recorded as 28 kids per 100 adults, which is comparable to other study areas in the region, and an average density of approximately 0.2 goats/km<sup>2</sup> of capable habitat during both the winter and summer. Goats were observed near the Mine Site during winter and summer surveys. In the PTMA, goats were observed on the Snowslide Range (i.e., the mountain range between the PTMA and the Bell-Irving River). In addition, a potential mineral lick was identified in the valley between the Sulphurets and Kerr pits (Figure 18.1-3). An additional mineral lick was observed during baseline surveys for the Brucejack Mine on the Snowslide Range (Figure 18.1-3; [Appendix 18-D](#)).

During the Brucejack summer survey in 2010 ([Appendix 18-D](#)), 265 goats were observed in 110 groups within 20 SUs (Figure 18.1-3), and during the winter survey in 2011, 202 goats were observed in 82 groups within 17 SUs (Figure 18.1-2). The summer kidding ratio was recorded as 26 kids per 100 adults, similar to the ratio observed during KSM surveys in 2008. The average density of goats was also similar, with 0.26 goats/km<sup>2</sup> of capable habitat during summer and 0.24 goats/km<sup>2</sup> of capable habitat during winter. Overall, the two years of summer surveys (2008 and 2010) and two years of winter surveys (2009 and 2011) provide an accurate estimate of mountain goat numbers and distribution in the RSA.

### 18.1.5.2 Bears

#### 18.1.5.2.1 Grizzly Bears

Grizzly bears (*Ursus arctos*) are found throughout BC, from sea level and river valleys to alpine regions. BC contains more than 50% of the Canadian population of grizzly bears, with an estimated 13,800 grizzlies in the province (Gyug, Hamilton, and Austin 2004). The distribution of grizzly bears is often related to food supply, with higher densities in areas with abundant food (Hamilton 1987), such as along streams during salmon runs and on alpine and subalpine slopes when berries are abundant.

Grizzly bears are considered a species of special concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and are blue-listed in BC (COSEWIC 2002b; BC CDC 2010a). Grizzly bears were also assessed sub-nationally in 2010 by NatureServe Explorer, and were given an “S3” status, which means they are vulnerable to extinction. Under the provincial BC Conservation Framework priority system, this species was rated on a 6-point scale, with 1 signifying the highest priority, for its contribution to achieving three key conservation goals: (1) global efforts for species and ecosystem conservation, (2) preventing species and ecosystem function from becoming at risk, and (3) maintaining the diversity of native species and ecosystems. Grizzly bears were given the ratings 3, 2, and 3 for each of these respective goals, with the highest rating given to their role in helping to achieve conservation goal (2).

As an Identified Wildlife Element under the Government of BC Identified Wildlife Management Strategy, grizzly bears require special conservation measures within the province. Grizzly bear populations are managed for harvest throughout BC and are a significant social and economic

element for Aboriginal peoples, resident hunters, and non-resident hunters. Grizzly bears also play an important biological role within ecosystems as predators and scavengers, and are considered an umbrella species for their conservation potential (Roberge and Angelstam 2004).

Habitat suitability modelling was conducted for grizzly bears in the RSA during the spring, summer, and fall. The habitat suitability models were developed with emphasis on the production of vegetation forage and on the value of sites within the RSA during different seasons. Suitability of winter hibernating habitat was also modelled within the LSA. Animal protein (e.g., salmon, moose, and marmots) was used to assist in identifying areas of high value to bears. Habitat suitability ratings (HSRs) were ranked relative to the value within the RSA rather than provincial benchmarks.

Overall, between 7.8 and 38% of habitat within the RSA was identified as Moderately High and High rated habitat for spring (27%), summer (38%), and fall (7.8%; Figure 18.1-4). In addition, 5% of the LSA was identified as suitable denning habitat for grizzly bears, particularly in the PTMA (Figure 18.1-4). The area near the proposed TMF and TCAR has also been identified as a candidate/proposed grizzly bear WHA (WHA 6-282).

Twenty-seven percent of the RSA was identified as Moderately High to Highly suitable habitat for grizzly bears in the spring. Spatially, these areas were distributed within mid-elevation habitat across the RSA, as well as low elevation riverine habitats around Bowser Lake in the southeastern RSA ([Appendix 18-B](#)). Large wetland areas also rated highly, such as those along the Bowser River (west of Bowser Lake), Todedada Creek, and within the proposed TMF.

The majority of Highly suitable habitat within the LSA occurred in the Coulter Creek access road (CCAR) corridor below the Eskay Creek Mine, on the slopes above the proposed TMF, and along the TCAR. Additional high-quality spring habitat was identified in areas that were highly suitable for moose during the winter, as these areas may provide easy access to moose carrion for grizzly bears in the spring. These areas include the Unuk River drainage, Treaty Creek, and the Bell-Irving River.

Much of the low elevation area of the RSA was rated as Moderately High to Highly suitable summer habitat, occupying 38% of the total area of the RSA ([Appendix 18-B](#)). Within the LSA, most of the suitable summer habitat occurred within the PTMA, Treaty Creek Access Corridor, and Coulter Creek Access Corridor.

In the fall, suitable habitat for grizzly bears in the RSA occurred in the wetland-timber complex at the confluence of Teigen and Snowbank creeks, around Bell-Irving River near Bell II, and in the floodplain forests of the Bowser River west of Bowser Lake ([Appendix 18-B](#)). In addition, salmon spawning areas were identified as important summer and fall habitat for grizzly bears occurring in streams and rivers within the LSA and RSA, including the Unuk River, Teigen and Treaty creeks, and the Bell-Irving and Bowser rivers ([Appendix 18-B](#)).

Patches of winter denning habitat, within the LSA, occurred on the small mountain between the TMF and the Treaty Creek drainage, near the Mitchell Rock Storage Facility (RSF), McTagg RSF and Kerr Pit in the Mine Site, and north of the Mitchell-Treaty Twinned Tunnels ([Appendix 18-B](#)).

During the 2008 and 2009 baseline studies, a DNA-based mark-recapture study was used to estimate the number of grizzly bears in the RSA. This study identified 31 grizzly bears: 15 females and 16 males. The superpopulation (i.e., the total number of grizzly bears that used the RSA during the course of the study) was estimated based on this information and the capture and recapture rates for hair samples from bears, including individuals identified from adjacent projects and compulsory inspection tissue samples. The superpopulation estimate was 31 females (range 11 to 50, 95% Confidence Interval) and 27 males (11 to 43, 95% Confidence Interval) for a total of 58 bears (22 to 93) during 2008 and 2009. Two-thirds of these bears were located in the coastal zone along the Unuk River, presumably due to the salmon resource in this river.

### 18.1.5.2.2 *Black Bears*

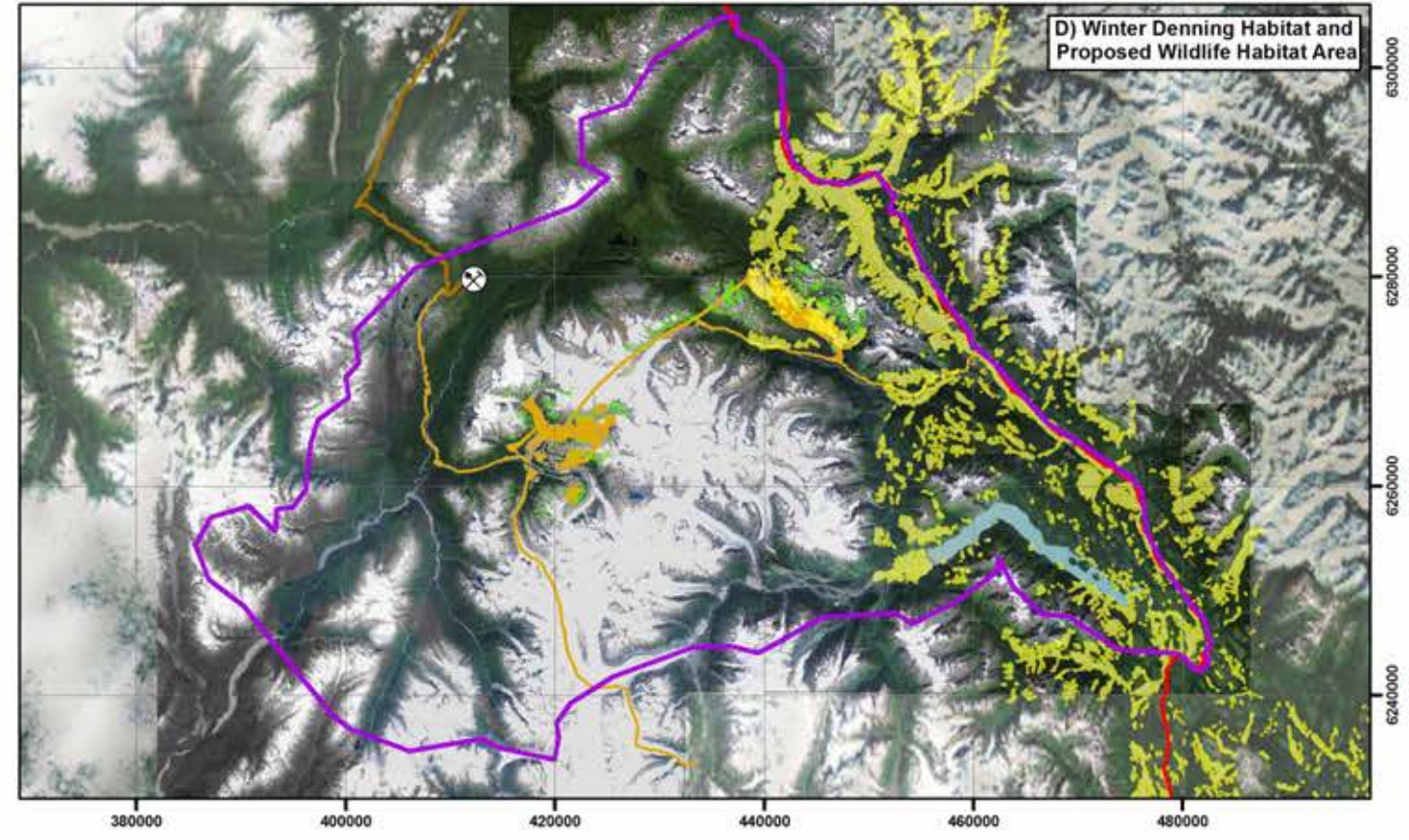
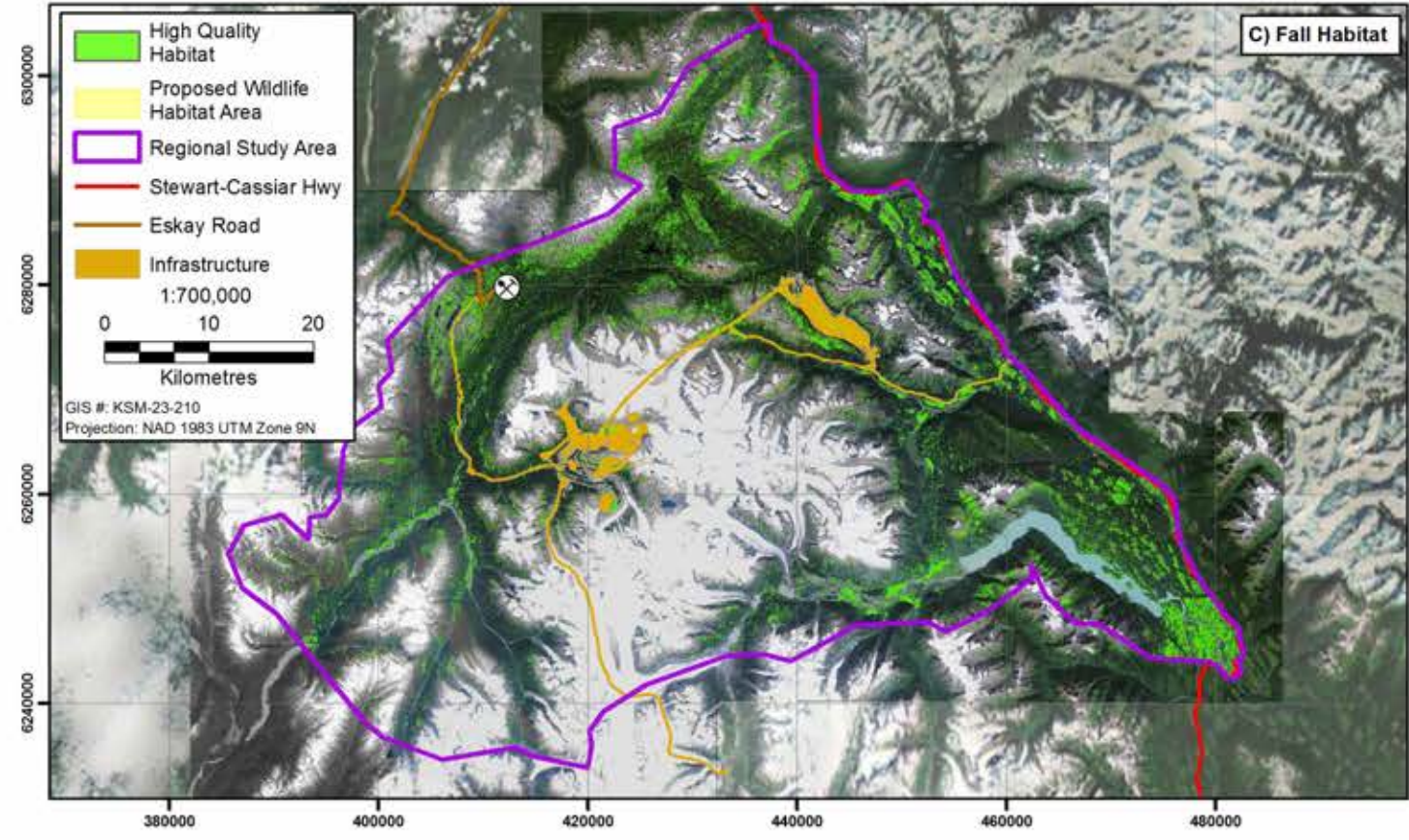
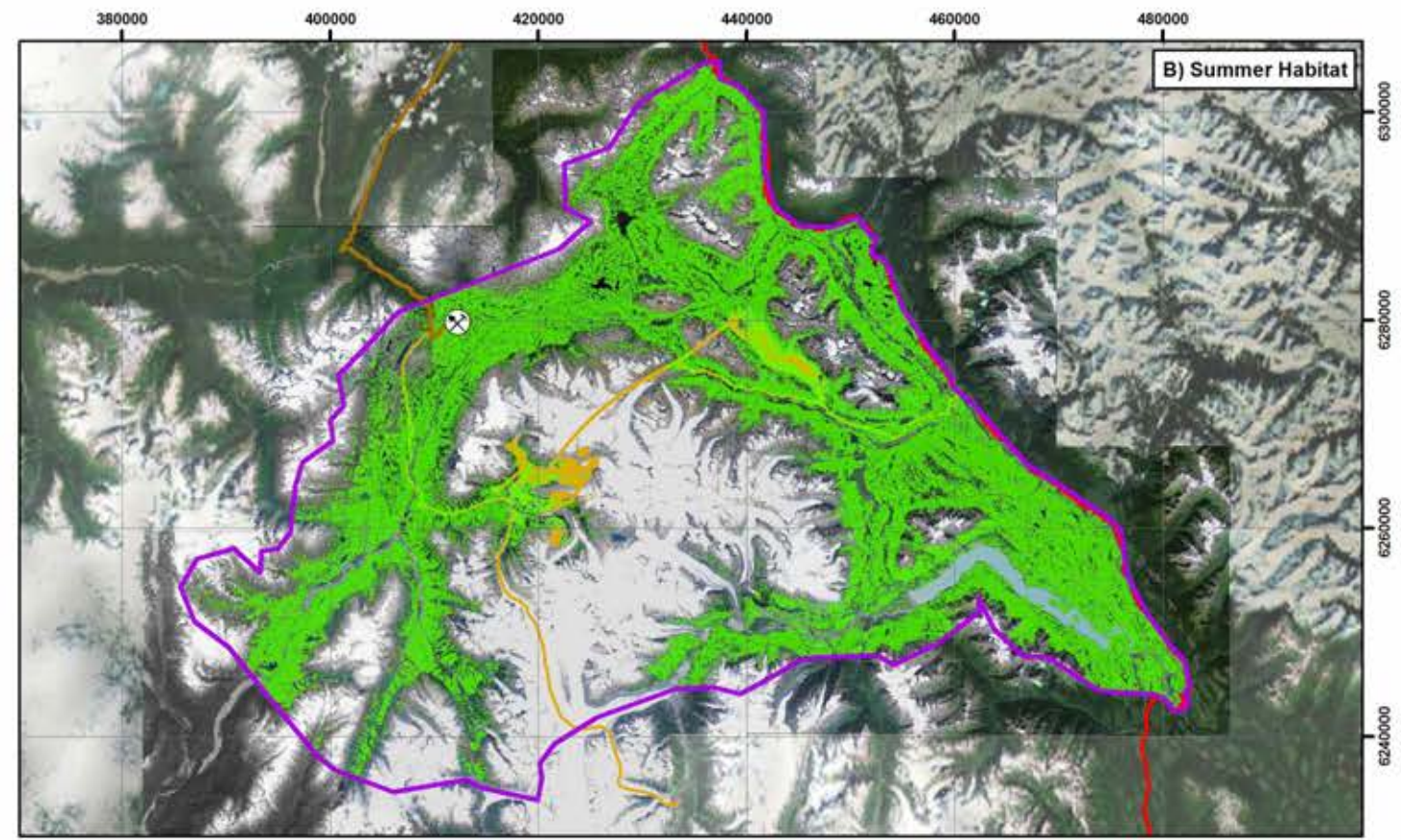
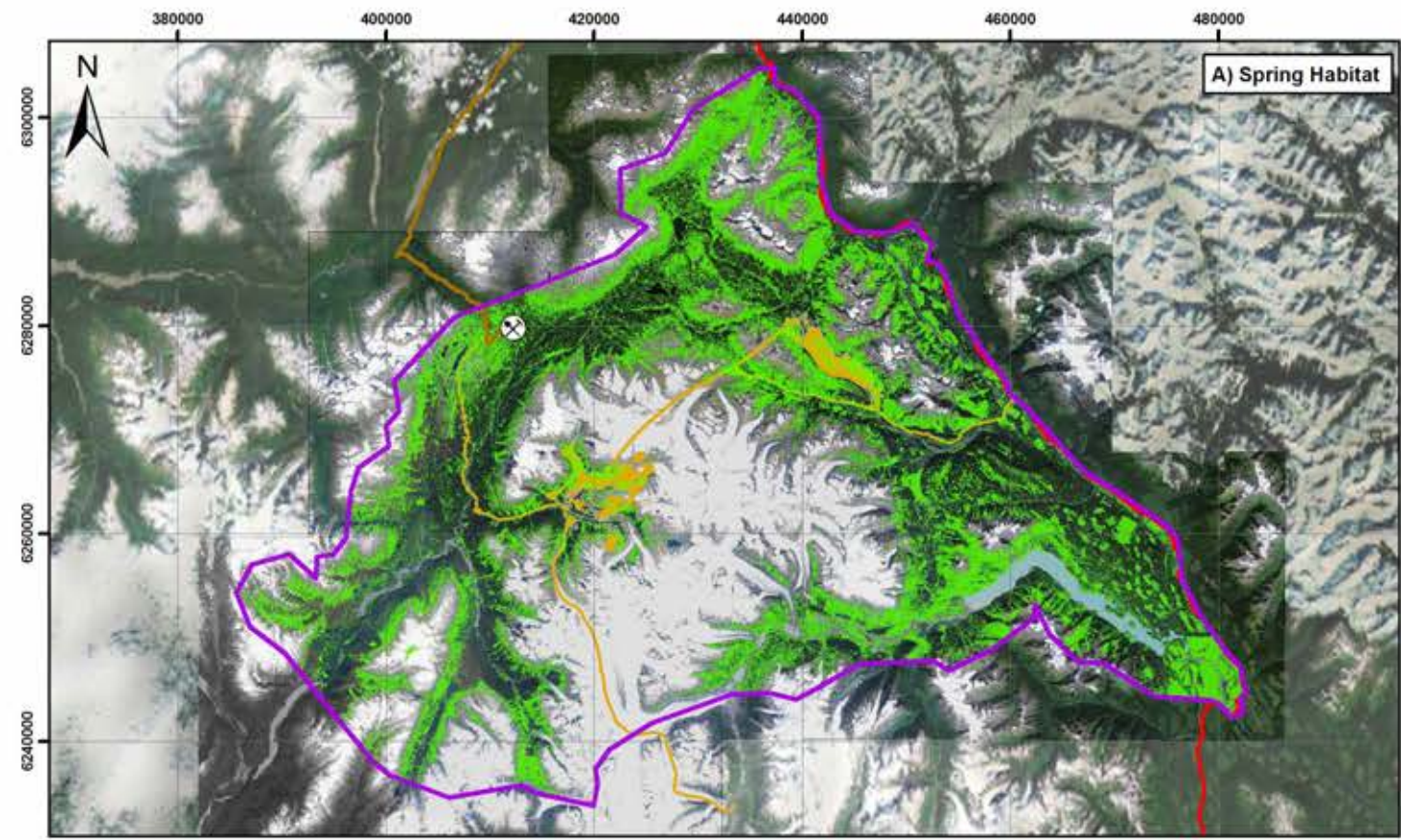
Black bears (*Ursus americanus*) are common and widespread in BC. The population estimate in 2001 was between 120,000 and 160,000 in the province, with highest densities along the coast including the RSA (Blood 2001). Black bears have similar foraging patterns to grizzly bears during the growing season. Black bear spring, summer, and fall foraging habitat is represented by the grizzly bear spring and summer habitat for the purposes of this assessment (Figure 18.1-5).

Black bears exploit different habitat than grizzly bears for denning; therefore, black bear denning habitat suitability was modelled separately in the RSA. Black bear dens are typically in or beneath large diameter trees or wooden structures derived from trees. Cavities in old-growth structures, including large old trees, stumps, root bolls, and logs with a diameter greater than 85 cm, are suitable for dens. Yellow cedar and western red cedar are important hibernating sites, although sites are likely based on tree structure, rather than tree species (Pelton 1982). A large amount (approximately 59,740 ha) of high-rated denning habitat was identified for black bear in the RSA, particularly along the Unuk and Bell-Irving rivers (Figure 18.1-5).

During the grizzly bear DNA baseline study, black bear hairs were collected incidentally. Black bears were detected throughout the RSA and LSA along all river drainages, particularly along the Unuk, Bell-Irving, and Bowser rivers; and near Bowser Lake, Treaty, and Teigen creeks. In addition, black bears were the species most frequently observed incidentally in the LSA and RSA. Field studies for vegetation recorded large-diameter trees suitable for black bear denning along the Bell-Irving River, Treaty Creek, Bowser River, and at the confluence of Snowbank and Teigen creeks and Bell-Irving River.

### 18.1.5.3 *Furbearers*

Furbearers are important economic and cultural resources within the RSA. An evaluation of the BC Fur Harvest Database identified 14 furbearer species that were harvested in areas within and surrounding the RSA. The most commonly trapped species included American marten (*Martes americana*), American beaver (*Castor canadensis*), and red squirrel (*Tamiasciurus hudsonicus*). Trapped species also include the provincially blue-listed fisher (*Martes pennant*) and the federally listed wolverine (*Gulo gulo*; special concern).



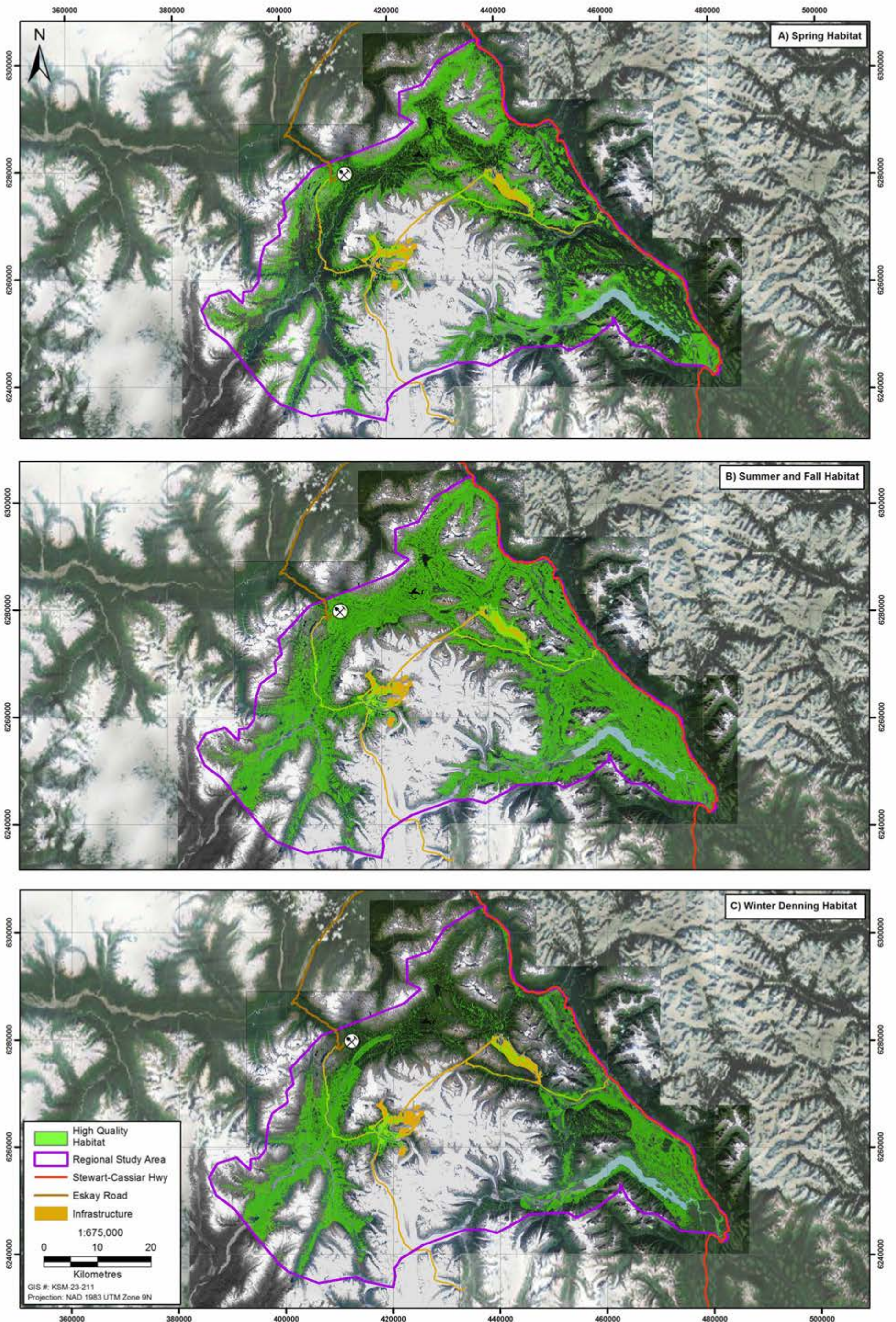


Figure 18.1-5

BC MOE harvest data collected between 1985 and 2009 show that American marten constituted the majority of the reported harvest. American marten is the most valuable component of the regional fur harvest and has been identified in the Cassiar Iskut-Stikine LRMP (BC ILMB 2000) as requiring increased management consideration. American marten are abundant throughout most of the province and are not a species of conservation concern. However, the American marten was given a high priority rating (2 out of 6) for goal 2 of the provincial Conservation Framework, highlighting the importance that the province has placed on preventing this species and its habitat from becoming at risk. Marten use mature and old-growth conifer forest as winter habitat, which is common in the low elevations of the LSA.

Fisher were also identified as a species of interest during issues scoping for the proposed Project (Application Information Requirements [AIR]). Fisher exploit low elevation (below 1,000 m) and dense old-growth forests with high canopy cover. Fisher have similar winter habitat requirements to marten, although fisher exploit a wider range of habitats, such as medium and young pine stands if prey such as porcupine are abundant. This blue-listed species has also been assigned a high priority rating of 2 for goal 3 of the Conservation Framework, highlighting the recognized importance to conserve this species as part of the overall goal of conserving native species and ecosystems in BC. For the scope of the assessment, it was assumed that the habitat model produced for marten also identifies the majority of suitable winter habitat for fisher.

The majority of the forested habitat within the RSA was modelled as Highly suitable winter habitat for marten ([Appendix 18-B](#)). Within the RSA, continuous blocks of Highly suitable habitat were distributed across low elevation habitat within all major watersheds, particularly in mature forests along the Unuk River watershed. A third of the LSA (31%; 13,801 ha) was identified as Highly suitable winter habitat for marten, including most of the forest habitat within the TMF and low elevation old forests along the Coulter Creek and Treaty Creek access corridors (Figure 18.1-6).

During wildlife baseline studies in 2008 and 2009, nine furbearer species or their sign were observed. The most frequently observed species and/or sign were black bears, red squirrel, and marten. Animals or sign observed within the LSA include American marten, black bear, red squirrel, fisher, grey wolf, mink, and beaver. Wolverine sign and red fox were only observed within the RSA. Wolverine sign was observed near Border Lake Provincial Park and a red fox was observed near Todedada Creek.

### 18.1.5.4 Small Mammals

Small mammals are an important prey source for predatory birds and other mammals (Cross 1988). Small mammal trapping surveys were conducted to identify species at risk occurring in the LSA. Trapping surveys were conducted in 2008 and 2009. Over the two-year baseline study, seven small mammal species were identified in the LSA, none of which are of conservation concern in BC. Species observed included Keen's mouse (*Peromyscus keeni*), Northern red-backed vole (*Myodes rutilus*), meadow vole (*Microtus pennsylvanicus*), meadow jumping mouse (*Zapus hudsonius*), Cinereus shrew (*Sorex cinereus*), dusky shrew (*Sorex monticolus*), and Nearctic brown lemming (*Lemmus trimucronatus*). Productive habitats for small mammals were identified within low elevation riparian areas and adjacent coniferous forests.

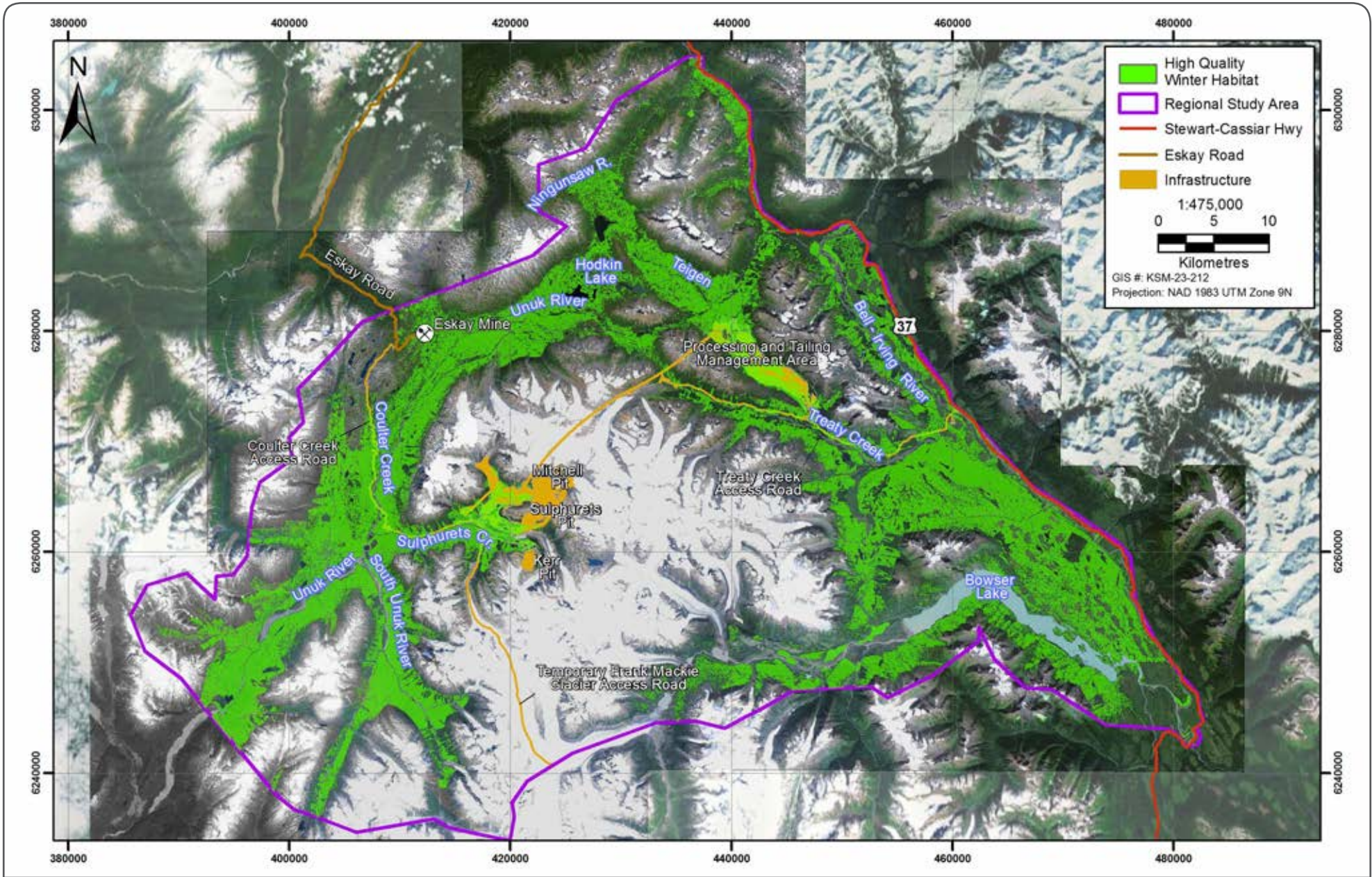


Figure 18.1-6

Figure 18.1-6

Baseline metals content in small mammals near the proposed Mine Site and TMF and in respective control areas located away from proposed Project infrastructure were also assessed to determine baseline levels that could be used in future monitoring programs, if required. The target tissue for sampling metals was the liver, and only Keen's mice were used for metals analyses. There are currently no provincial or federal environmental guidelines for acceptable metal levels in wildlife. Most metals fell below detection levels in control and treatment groups. For those metals that were above detection limits in both treatment and control groups, there were no consistent differences in metal contents between the two groups ([Appendix 18-A](#)). During working group meetings, it was concluded that conducting vegetation sampling for metals analyses was a better methodology than small mammal trapping since larger samples could be collected with a lower variance in metals content between samples.

### 18.1.5.5 Groundhogs

Representatives of the Tahltan Nation requested that studies be conducted on the presence of hoary marmot (*Marmota caligata*) and Arctic ground squirrel (*Spermophilus parryii*), which are valued cultural and subsistence species. Aboriginal people in the region collectively refer to these species as "groundhogs." The overall objective of this study was to collect baseline information on hoary marmot and Arctic ground squirrel distribution and habitat use within the RSA.

Field studies were conducted in 2008 and 2009 to assess the presence, distribution, and density of hoary marmots and Arctic ground squirrels through helicopter and ground-based surveys. Arctic ground squirrels were not observed during the ground survey, nor was any evidence of their presence documented (e.g., tracks, scat). Marmot colonies were distributed throughout the alpine in both the Mine Site and PTMA (Figure 18.1-7), with the highest densities observed in alpine areas (e.g., Snowslide Range) near the PTMA (average 0.62 colonies/km<sup>2</sup>) and surrounding the proposed TMF. Hoary marmot home ranges are small, as they generally restrict their foraging to areas within 100 m of their dens (Banfield 1981). However, home ranges can be up to 13.5 ha (Armitage 2000). The Mine Site is characterized by steep and rugged coastal mountain terrain, compared to the PTMA that has larger areas of alpine meadow and gentler mountain topography. The more expansive areas of alpine meadows in the east may provide marmots with a larger area containing appropriate denning habitat.

The hoary marmot habitat suitability model was restricted to the LSA, as soil surficial material information was only available for this area. A small portion of habitat outside of the LSA boundary also had soils information and was included in the model. High and Moderate quality habitat comprised 29% (12,992 ha) of the LSA (Figure 18.1-7). These high-quality habitats (High and Moderate) were distributed across the alpine near the Mine Site and PTMA, as well as in the Coulter Creek Access Corridor below Eskay Creek Mine.

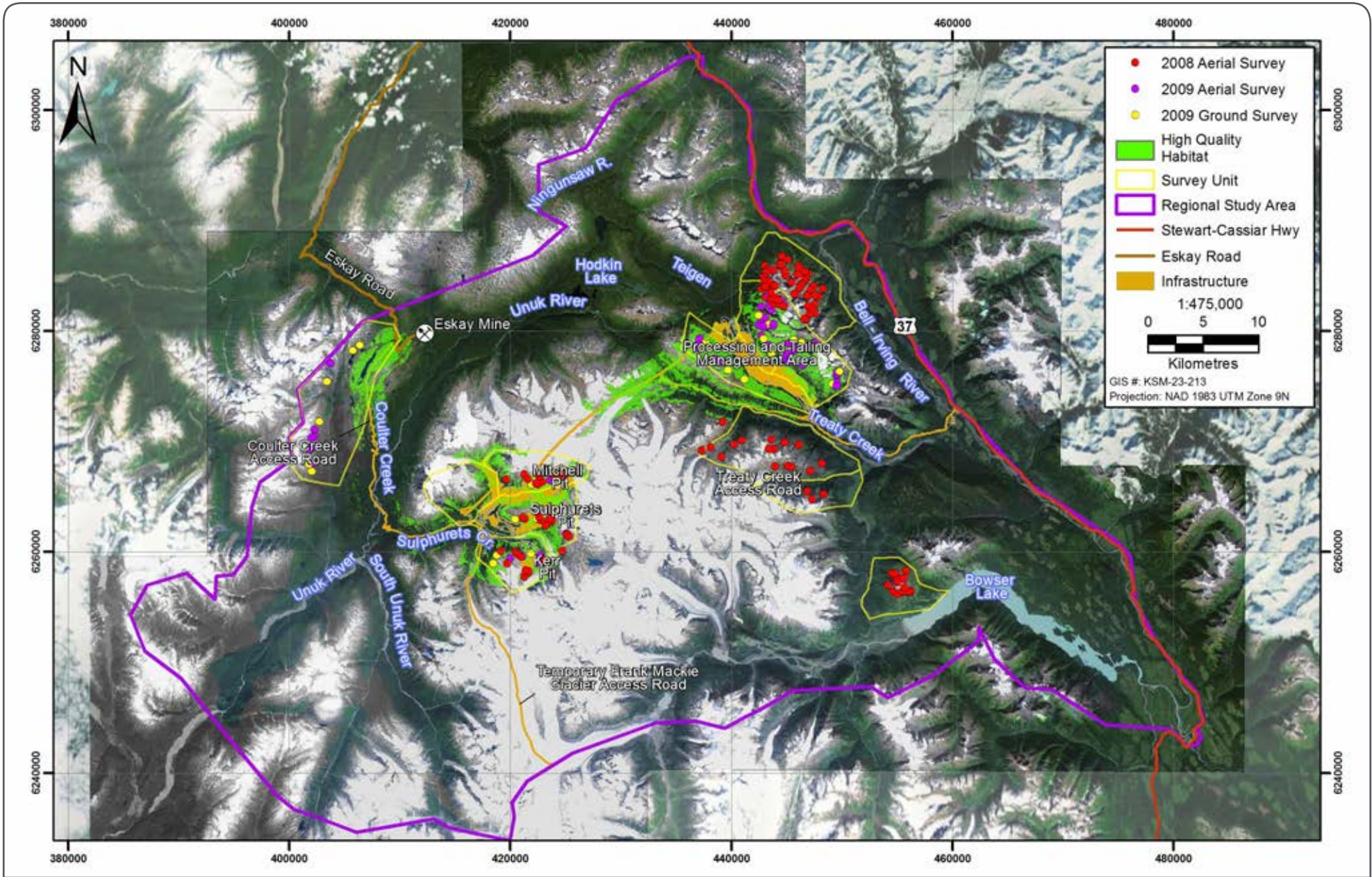


Figure 18.1-7

Hoary Marmot Colonies Observed during Baseline Surveys (2008 and 2009) and High Quality Habitat

Figure 18.1-7

### 18.1.5.6 Bats

An inventory for bats was conducted in 2009 to identify the presence of bats (including species of conservation concern) within suitable habitat in the LSA. Based on known species distributions, nine bat species potentially occur within the LSA, two of which were categorized as likely occurring: little brown myotis (*Myotis lucifugus*) and western long-eared myotis (*M. evotis*). The remaining seven were categorized as possibly occurring: California myotis (*M. californicus*), Keen's long-eared myotis (*M. keenii*), northern long-eared myotis (*M. septentrionalis*), long-legged myotis (*M. volans*), Yuma myotis (*M. yumanensis*), silver-haired bat (*Lasionycteris noctivagans*), and big brown bat (*Eptesicus fuscus*).

Four of the nine species potentially occurring in the LSA are of provincial or federal conservation concern: northern long-eared myotis, Keen's long-eared myotis, silver-haired bat, and little brown myotis.

The northern long-eared myotis is blue-listed in BC, and was given a high priority rating of 2 for goal 3 (maintaining native species diversity) under BC's Conservation Framework. Keen's long-eared myotis is provincially red-listed (BC CDC 2010a) and federally listed as special concern under the *Species at Risk Act* (SARA; 2002b), Schedule 3 (2002b). Keen's long-eared myotis has also been granted the highest priority level (1 out of 6) under BC's Conservation Framework for goals 1 (global efforts for species conservation) and 3 (maintaining native species diversity). In addition, the silver-haired bat has been identified by BC MOE/MFLNRO as regionally important in the Skeena Region due to concerns with maintaining maternal roosts in tree cavities, and has been given a priority rating of 2 for goal 2 (preventing native species from becoming at risk) under BC's Conservation Framework. In February 2012, COSEWIC assessed the little brown myotis as Endangered due to population risks associated with white-nose syndrome.

Two species of myotis (little brown myotis and western long-eared myotis) were observed within the LSA, mainly within riparian habitat. Two other species, long-legged myotis and silver haired bat, may have been recorded using the Anabat in the field; however, sonograms could not provide definitive species identification. Mature and old-growth conifer forests near moist areas and at lower elevations along waterways have been identified as sensitive bat habitat. Important habitat for bats provides a combination of roosting and open foraging spots (i.e., abundant insect prey), such as riparian areas. In general, large diameter trees and snags, where cavities and areas underneath rugged bark are used as roosting sites, are important for a number of bat species. The most important habitat features for bats are cave-based hibernacula, typically associated with karst (limestone) topography. The only area in the LSA with exposed limestone is in McTagg Creek, extending south to Sulphurets Creek (Figure 4.4-2).

### 18.1.6 Bird Characterization

Avian species that migrate seasonally out of Canada, excluding raptors, receive protection under the federal *Migratory Birds Convention Act* (1994). Some bird species, including raptors, are afforded protection under the BC *Wildlife Act* (1996c). Avian species listed as at risk by COSEWIC are protected under SARA. The bird community within the RSA was characterized according to three avian groups: raptors, wetland birds, and forest and alpine birds.

During 2008 and 2009 baseline studies, 93 bird species were detected: eight raptor species, 25 wetland bird species, and 60 forest and alpine bird species. Raptors include hawks, falcons, owls, and other birds of prey. Wetland birds include ducks, geese, shorebirds, and other bird families associated with waterbodies. Forest and alpine birds include songbirds, hummingbirds, woodpeckers, and game birds in terrestrial areas. Baseline study results of each avian group are discussed in the following sections.

### 18.1.6.1 Raptors

Raptors, particularly northern goshawk (*Accipiter gentiles*), are identified as important species in both the Cassiar Iskut-Stikine LRMP (BC ILMB 2000) and the Nass South SRMP (BC MFLNRO 2012b). Surveys for raptors were conducted in the RSA in 2008 and 2009, including call-playback surveys for northern goshawk and stand-watch surveys (Figure 18.1-8; [Appendix 18-A](#)). Incidental observations of raptors were also recorded.

Eight raptor species were recorded in the RSA, including bald eagles (*Haliaeetus leucocephalus*), golden eagles (*Falco chrysaetos*), northern goshawks, ospreys (*Pandion haliaetus*), red-tailed hawks (*Buteo jamaicensis*), merlin (*Falco columbarius*), rough-legged hawk (*Buteo lagopus*), and Swainson's hawk (*Buteo swainsoni*). The rough-legged hawk is blue-listed and the Swainson's hawk is red-listed in BC. In addition, the northern goshawk *laingi* subspecies is red-listed in BC and Threatened on Schedule 1 of SARA; however, it is unknown if the northern goshawks observed during baseline surveys are the *laingi* subspecies, as genetic analyses are required to differentiate between the two subspecies.

One Swainson's hawk was observed in 2009 above the north end of the proposed TMF. One rough-legged hawk was observed in 2008 passing through the RSA, as rough-legged hawks do not breed in the area. One northern goshawk was observed along Sulphurets Creek in the Mine Site during call-playback surveys in 2008, and one adult was incidentally observed along Unuk River in 2009 in the Coulter Creek Access Corridor (Figure 18.1-8). The habitat along the Unuk River and Sulphurets Creek is considered suitable northern goshawk nesting habitat.

Raptor nests were observed in riparian areas during 2008 and 2009 (Figure 18.1-8). One osprey nest, occupied by two adults, was observed at Border Lake outside of the LSA in June 2008. In May 2009, a female bald eagle was observed on a nest approximately 10 km west of Bell II at the confluence of Teigen and Snowbank creeks outside of the LSA. Both of these species' nests are protected under the *Wildlife Act* (1996).

### 18.1.6.2 Wetland Birds

Wetland birds include waterfowl and wading birds such as ducks, geese, swans, loons, and grebes. Waterfowl (ducks and geese) are an important game species for local First Nations. The Cassiar Iskut-Stikine LRMP identified trumpeter swan (*Cygnus buccinator*) winter habitat as important areas to conserve. Another species, harlequin duck (*Histrionicus histrionicus*), is of particular interest to the CWS, as it occupies a unique habitat niche, nesting near fast-flowing rivers and mountain streams (Campbell et al. 1990b).

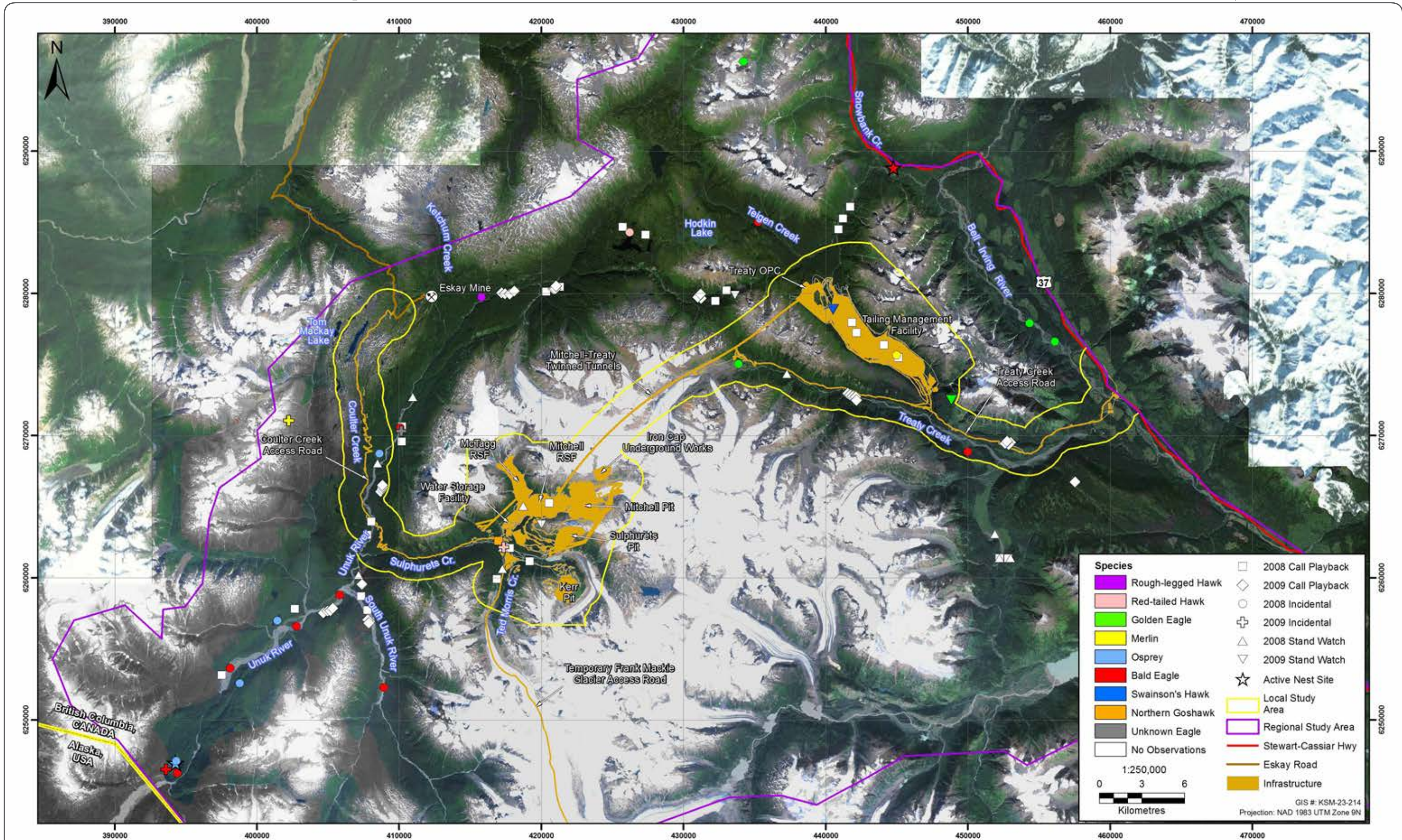


Figure 18.1-8

To determine presence and distribution of wetland birds, surveys were conducted during spring breeding (June 2008 and June 2009), summer brood (July 2008 and July 2009), fall migration (September 2008), and spring migration (April 2009). The goal of these surveys was to characterize wetland bird diversity and to identify habitats used for staging and breeding in the RSA and LSA.

Overall, 25 species of wetland bird were identified during the 2008 and 2009 baseline surveys ([Appendix 18-A](#)). Three species identified in the RSA are of regional or provincial conservation concern: harlequin duck (provincially ranked as vulnerable during the non-breeding season), surf scoter (*Melanitta perspicillata*; blue-listed and provincially ranked as vulnerable during the breeding season), and trumpeter swan (blue-listed and provincially ranked as vulnerable during the non-breeding season; BC MSRM 2002; BC CDC 2010b). Harlequin ducks were observed on the Bell-Irving River and Teigen Creek during the spring. A group of seven surf scoters was observed on Treaty Creek during fall 2008, and trumpeter swans were detected along Treaty Creek and on Border Lake.

Areas with particularly high species diversity during the breeding period were identified in wetland complexes associated with the confluence of Teigen Creek and Bell-Irving River, and along Treaty and Todedada creeks (Figure 18.1-9). In contrast, the habitat associated with the Mine Site (e.g., Mitchell and Sulphurets drainages around the proposed Mine Site), does not appear to provide good breeding habitat for wetland birds.

During summer breeding surveys, 17 broods of six species were detected, including mallard (*Anas platyrhynchos*), lesser scaup (*Aythya affinis*), goldeneye species (likely Barrows goldeneye, *Bucephala islandica*), merganser species (likely common merganser, *Mergus merganser*), Canada goose (*Branta canadensis*), and loon species (likely common loon, *Gavia immer*). Lakes, ponds, and marshes were identified as the areas of greatest importance to wetland birds with young.

Areas that were occupied during the fall staging survey, while birds are migrating south, included the habitat around Unuk Lake, Treaty Creek, and near the Teigen Creek/Bell-Irving River confluence. During the spring staging surveys, the majority of birds were observed near the Teigen Creek/Bell-Irving confluence and at Border Lake along the Unuk River near the BC-Alaska border.

### 18.1.6.3 Forest and Alpine Birds

Baseline studies were conducted for forest and alpine birds (i.e., passerines, hummingbirds, swifts, woodpeckers, grouse, and ptarmigan; Figure 18.1-10) because in addition to migratory bird and species at risk protection, active breeding bird nests are protected under the *Wildlife Act* (1996).

Sixty forest and alpine bird species were observed in the RSA in 2008 and 2009 ([Appendix 18-A](#)). Areas with the greatest richness of species, high numbers of individual birds, and high diversity of birds were recorded within the proposed TMF, along the CCAR adjacent to the Unuk River, and near Bowser Lake. The olive-sided flycatcher (*Contopus cooperi*), which is federally listed

as threatened (Schedule 1), was observed within the RSA adjacent to Unuk Lake. This species breeds in montane and northern coniferous forests, often at forest edges and openings near meadows or wetlands (Altman and Sallabanks 2000).

Nine nests belonging to five different species were observed during field surveys. Seven nests were in the Mine Site and two in the RSA near Teigen Creek. The five species with confirmed nests were yellow warblers (*Dendroica petechia*), dark-eyed juncos (*Junco hyemalis*), Swainson's thrush (*Catharus ustulatus*), American three-toed woodpecker (*Picoides dorsalis*), and red-breasted sapsucker (*Sphyrapicus ruber*).

### 18.1.7 Amphibian (Western Toad) Characterization

The western toad (*Anaxyrus boreas*) is a federally listed species of special concern that is protected under Schedule 1 of the *Species at Risk Act* (2002b; Government of Canada 2010). It is also internationally recognized as a near-threatened species by the International Union for the Conservation of Nature (IUCN 2010). In British Columbia the western toad is considered secure but is afforded protection under the *Wildlife Act* (1996c), and it has been given a relatively high priority rating of 2 for goal 2 (preventing native species from becoming at risk) of BC's Conservation Framework. Considering the conservation status of western toads and its potential sensitivity to development, a study was conducted to assess the distribution and breeding status of toads within the RSA.

Western toads are one of the few amphibian species to occupy alpine areas and can be found from sea level up to 3,660 m elevation (COSEWIC 2002a). Western toads are capable of moving over 5 km between breeding sites; occasional long-distance excursions of up to 7.2 km have been noted for this species (Wind and Dupuis 2002). Young toads (toadlets) spend the first period of their terrestrial lives within the riparian area, eventually dispersing upland. Little is known of the mechanisms that determine the direction and magnitude of toadlet dispersal.

In 2008, 136 open-water sites were surveyed aerially to assess their suitability for western toad breeding (Figure 18.1-11; [Appendix 18-A](#)). During subsequent ground-based surveys in 2008, 21 sites were visited and no western toad tadpoles were observed (Figure 18.1-12). During 2009, 44 sites were surveyed on the ground and three sites with toad breeding were observed—all of which were outside of the LSA in ponds at low elevation, in shallow open water, with an open canopy, and warm water temperatures (Figure 18.1-12). Two toad breeding sites were found on West Teigen Lake 200 m apart; therefore, these two sites may be a single breeding site. The third breeding site was detected at low elevation on the lower reaches of Teigen Creek, near the confluence with the Bell-Irving River. Other breeding sites likely occur in the RSA, though no high-quality potential sites were identified within the Project footprint or LSA, only moderately suitable habitat was identified. In 2011, the proposed fish compensation sites ([Appendix 15-H](#)) were surveyed for breeding by western toad. No breeding evidence was observed within the Project footprint (Figure 18.1-12).

During baseline surveys, two additional amphibian species were observed within the RSA near Teigen and Treaty creeks: Columbia spotted frogs (*Rana luteiventris*) and wood frogs (*Lithobates sylvaticus*). Neither of these two species is of conservation concern.

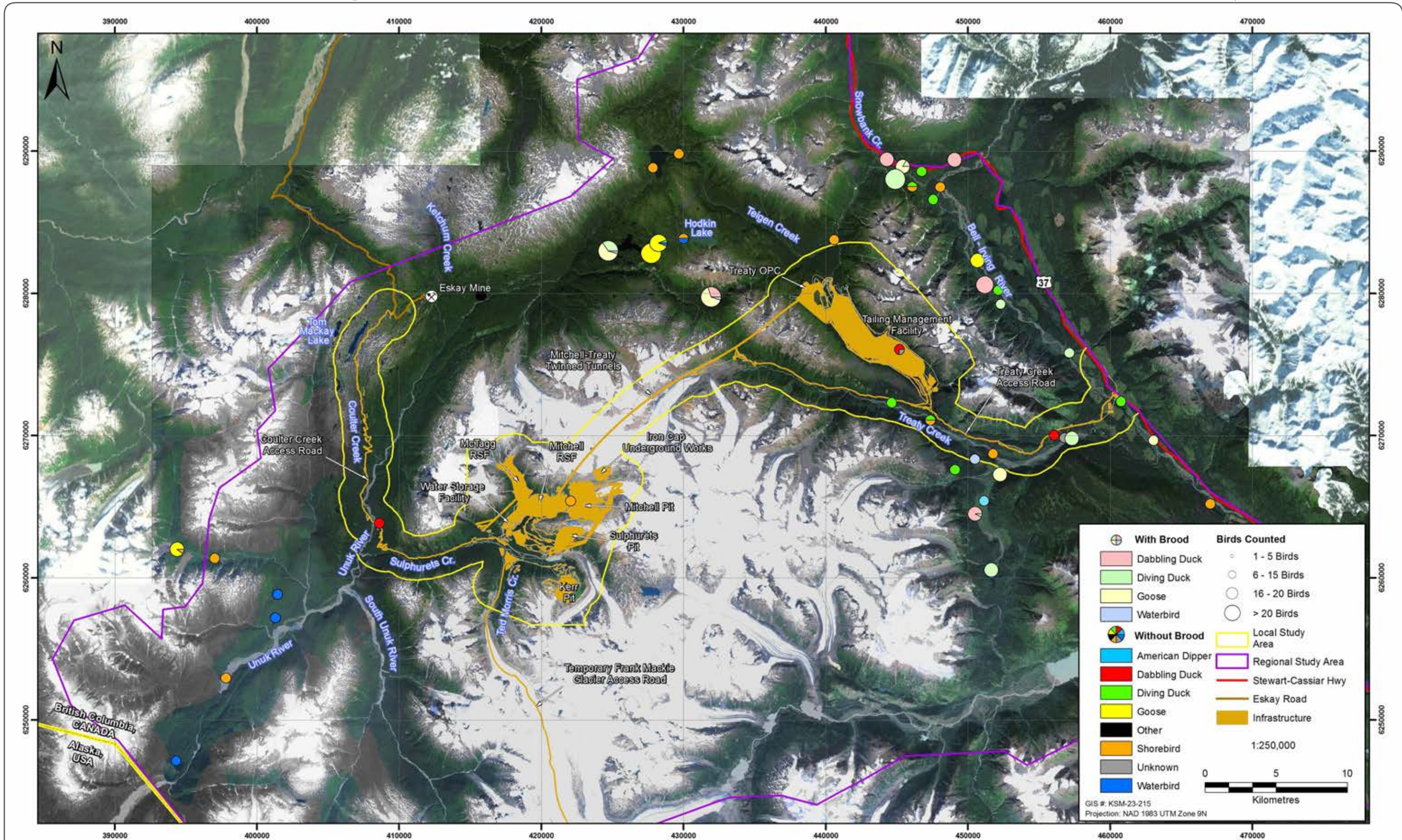
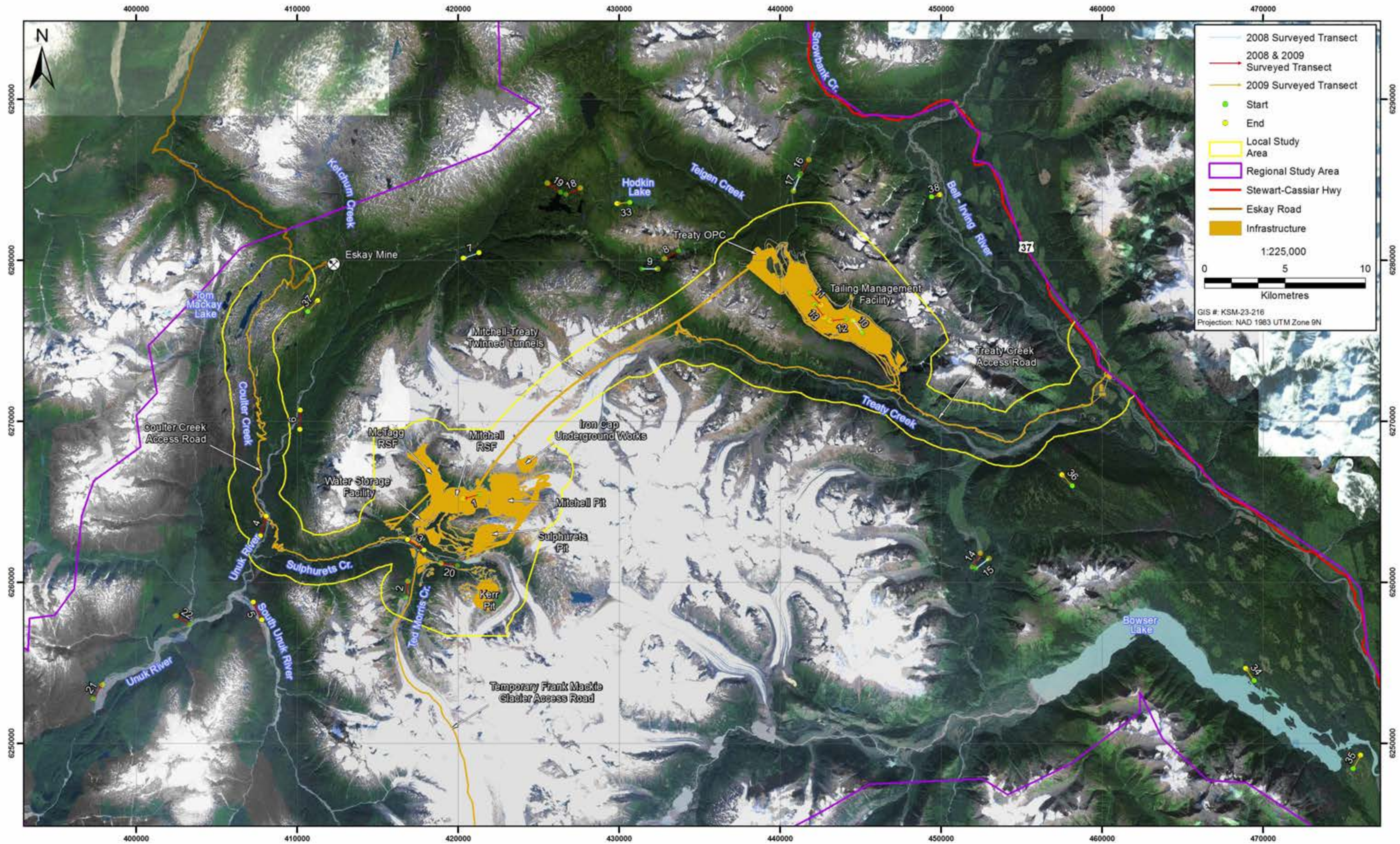


Figure 18.1-9



GIS #: KSM-23-216  
Projection: NAD 1983 UTM Zone 9N

Figure 18.1-10

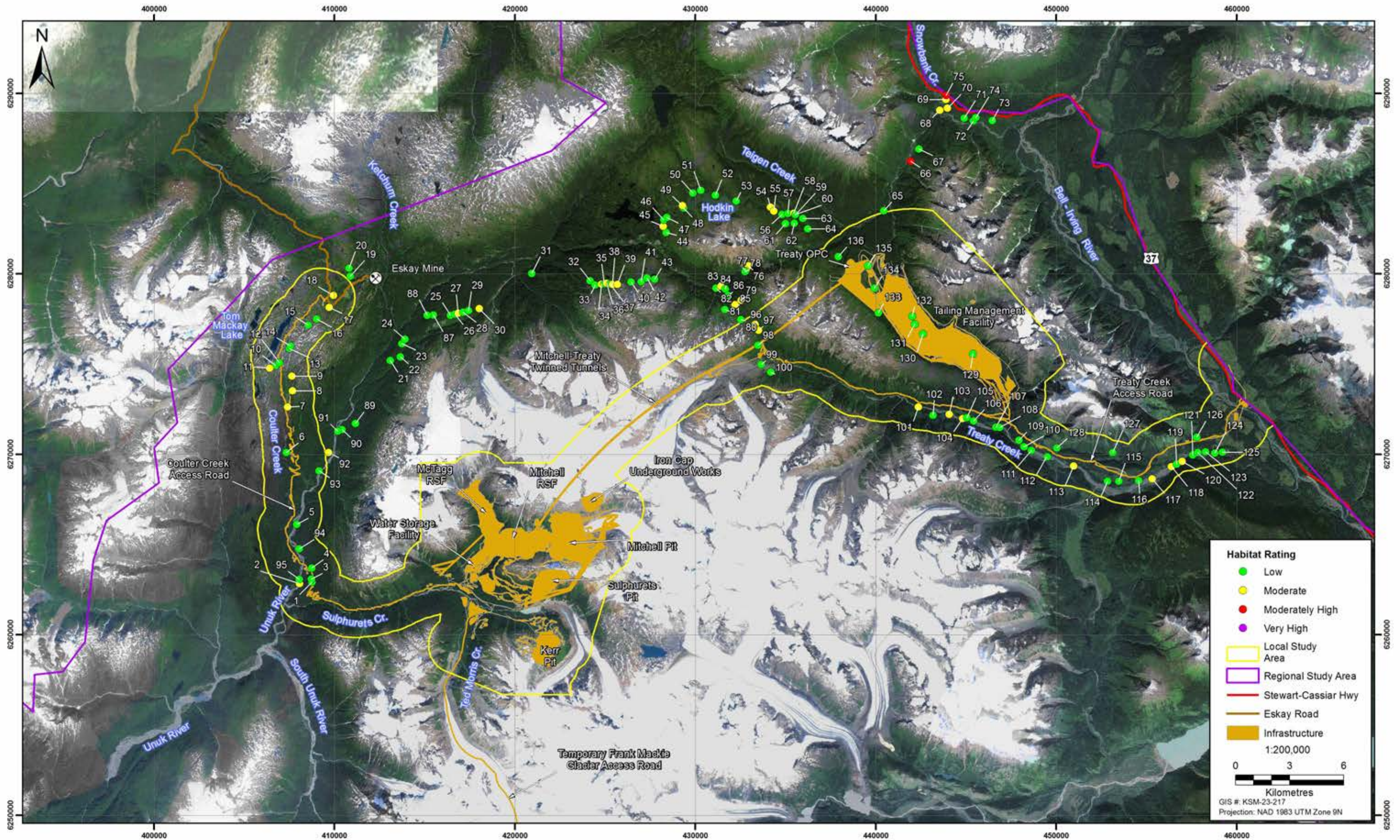
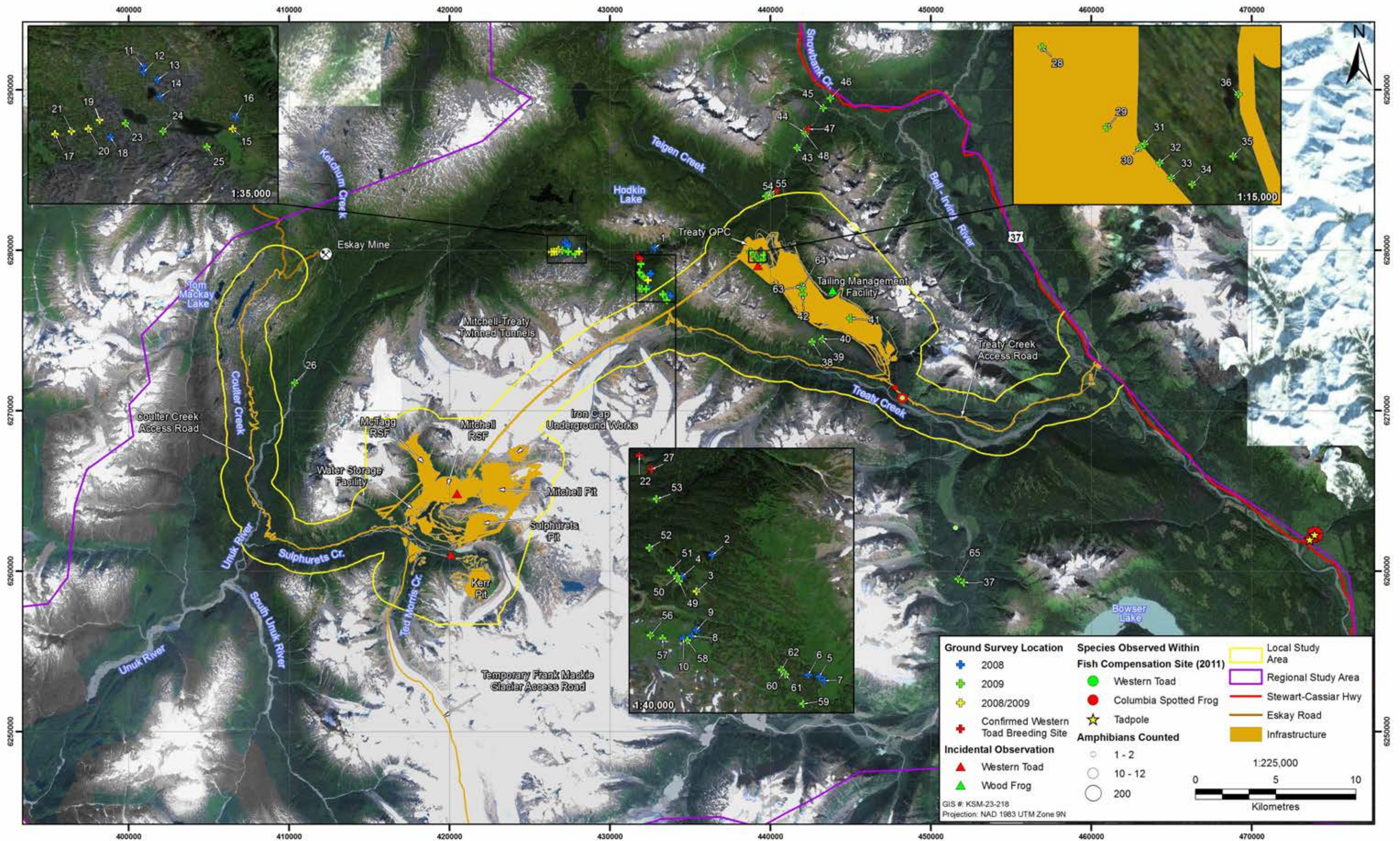


Figure 18.1-11



<b>Ground Survey Location</b>	<b>Species Observed Within Fish Compensation Site (2011)</b>	<b>Local Study Area</b>
2008	Western Toad	Regional Study Area
2009	Columbia Spotted Frog	Stewart-Cassiar Hwy
2008/2009	Tadpole	Eskay Road
Confirmed Western Toad Breeding Site	<b>Amphibians Counted</b>	Infrastructure
Incidental Observation	1 - 2	
Western Toad	10 - 12	
Wood Frog	200	

Scale: 1:225,000  
0 5 10 Kilometres

GIS #: KSM-23-218  
Projection: NAD 1983 UTM Zone 9N

Figure 18.1-12

### 18.1.8 Species at Risk

Species of conservation concern include species or populations federally listed as endangered, threatened, or of special concern as designated by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and SARA (2002b). Provincially, species are designated on the red and blue lists by the BC MOE under the *Wildlife Act* (1996c). Forty listed species (Table 18.1-1) occur or potentially occur (considered likely or possible occurrence) within the RSA/LSA, based on species distribution maps. Five species are listed on Schedule 1 of SARA (2002b) that are likely to occur, or were confirmed. Western toad and olive-sided flycatcher were observed during baseline surveys, and rusty blackbird and common nighthawk likely occur. The northern goshawk *laingi* subspecies is listed on Schedule 1 of SARA (2002b) and occurs in coastal BC, mainly on islands. Although northern goshawks were observed during baseline surveys, it is unknown whether they were the *laingi* subspecies, or the *atricapillus* subspecies, which is not at risk. However, for the assessment, northern goshawk *laingi* are considered likely to occur in the RSA or LSA.

### 18.1.9 Species or Groups of Local Interest

Several species or wildlife groups of interest occur within the LSA and/or RSA (Table 18.1-2). Species or groups of interest include wildlife species/groups that are identified as regionally important for biological, economic, social, or cultural reasons. Regionally important species or groups have been identified by biologists, Aboriginal peoples, local community members, and from information included in land and resource management documents, such as the LRMPs and SRMPs (see Table 18.3-1 for details of applicable plans).

### 18.1.10 Important Wildlife Habitat

Important wildlife habitats in the RSA include: (1) sensitive habitats, (riparian habitat and old-growth forests) and (2) high-quality habitats and features (WHAs, UWRs, salmon spawning areas, mineral licks, and movement corridors).

#### 18.1.10.1 Sensitive Habitats

Certain types of vegetation communities/wildlife habitat are sensitive to disturbances and have legislation or best management practices that guide development in these areas. These include riparian communities and old-growth forests.

##### 18.1.10.1.1 Riparian Habitat

Riparian habitat supported by wetlands provides high-quality habitat to a diverse wildlife community. Riparian habitats also serve as important movement corridors for wildlife. For example, an objective of the Unuk River Zone (a Resource Management Zone within the Cassiar-Iskut Stikine LRMP) is to apply best management practices to wetlands, floodplains, and riparian habitat (BC ILMB 2000). The Unuk River Zone covers an area of 10,000 ha and lies south of Sulphurets Creek along the Unuk River valley. Wetlands may also be used by rutting moose in the fall, and waterfowl may nest in tree cavities or in sedge/grass meadows around these areas.

**Table 18.1-1. Species at Risk Potentially Occurring within the Wildlife Local Study Area and Regional Study Area**

Common Name	Scientific Name	Global Rank	Provincial Rank	BC List	COSEWIC	SARA	Likelihood of Occurrence	Highest BC Conservation Framework Priority (Goal #)
<b>Large Mammals</b>								
Grizzly bear	<i>Ursus arctos</i>	G4	S3	Blue	SC		C	2 (goal 2)
Wolverine, <i>luscus</i> ssp.	<i>Gulo gulo luscus</i>	G4T4	S3	Blue	SC		C	2 (goal 2)
<b>Furbearers</b>								
Fisher	<i>Martes pennanti</i>	G5	S2S3	Blue			C	2 (goal 3)
Least weasel	<i>Mustela nivalis</i>	G5	S4	Yellow			L	4 (goals 2 and 3)
<b>Birds</b>								
American bittern	<i>Botaurus lentiginosus</i>	G4	S3B	Blue			P	2 (goal 2)
American golden-plover	<i>Pluvialis dominica</i>	G5	S3S4B	Blue			P	4 (goals 2 and 3)
Band-tailed pigeon	<i>Patagioenas fasciata</i>	G4	S3S4B	Blue	SC	1	P	2 (goal 2)
Barn swallow	<i>Hirundo rustica</i>	G5	S3S4B	Blue	T		L	2(goal 2)
Black swift	<i>Cypseloides niger</i>	G4	S4B	Yellow	C		P	2 (goal 2)
Common nighthawk	<i>Chordeiles minor</i>	G5	S4B	Yellow	T	1	L	2(goal 2)
Double-crested cormorant	<i>Phalacrocorax auritus</i>	G5	S3B	Blue	NAR		P	2 (goal 2)
Great blue heron, <i>fannini</i> ssp.	<i>Ardea herodias fannini</i>	G5T4	S2S3B,S4N	Blue	SC	1	P	2 (goal 2)
Gyrfalcon	<i>Falco rusticolus</i>	G5	S3S4B	Blue	NAR		P	4 (goal 3)
Harlequin duck	<i>Histrionicus histrionicus</i>	G4	S4B,S3N	Yellow			C	1 (goal 2)
Horned grebe	<i>Podiceps auritus</i>	G5	S4B	Yellow	SC		P	4 (goals 1 and 2)
Northern goshawk, <i>laingi</i> ssp	<i>Accipiter gentilis laingi</i>	G5T2	S2B	Red	T	1	L	3 (goal 2)
Olive-sided flycatcher	<i>Contopus cooperi</i>	G4	S3S4B	Blue	T	1	C	2 (goal 2)
Peregrine falcon, <i>anatum</i> ssp.	<i>Falco peregrinus anatum</i>	G4T4	S2B	Red	SC	1	P	2 (goal 3)

(continued)

**Table 18.1-1. Species at Risk Potentially Occurring within the Wildlife Local Study Area and Regional Study Area (completed)**

Common Name	Scientific Name	Global Rank	Provincial Rank	BC List	COSEWIC	SARA	Likelihood of Occurrence	Highest BC Conservation Framework Priority (Goal #)
Peregrine falcon, <i>pealei</i> ssp.	<i>Falco peregrinus pealei</i>	G4T3	S3B	Blue	SC	1	P	1 (goal 2)
Red-necked phalarope	<i>Phalaropus lobatus</i>	G4G5	S3S4B	Blue	C		P	2 (goal 2)
Rough-legged hawk	<i>Buteo lagopus</i>	G5	S2S3N	Blue	NAR		C	2 (goal 3)
Rusty blackbird	<i>Euphagus carolinus</i>	G4	S3S4B	Blue	SC	1	L	2 (goal 2)
Sandhill crane	<i>Grus canadensis</i>	G5	S4B	Yellow	NAR		P	5 (goal 3)
Short-billed dowitcher	<i>Limnodromus griseus</i>	G5	S2S3B	Blue			P	3 (goal 3)
Short-eared owl	<i>Asio flammeus</i>	G5	S3B,S2N	Blue	SC	1	P	2 (goal 2)
Snowy owl	<i>Bubo scandiacus</i>	G5	S3N	Blue	NAR		P	4 (goals 2 and 3)
Sooty grouse	<i>Dendragapus obscurus</i>	G5	S3S4	Blue			C	2 (goal 2)
Surf scoter	<i>Melanitta perspicillata</i>	G5	S3B,S4N	Blue			C	4 (goals 2 and 3)
Swainson's hawk	<i>Buteo swainsoni</i>	G5	S2B	Red			C	2 (goal 3)
Tundra swan	<i>Cygnus columbianus</i>	G5	S3N	Blue			P	4 (goal 3)
Upland sandpiper	<i>Bartramia longicauda</i>	G5	S1S2B	Red			P	1 (goal 3)
Wandering tattler	<i>Tringa incana</i>	G5	S3S4B	Blue			P	4 (goals 2 and 3)
Western grebe	<i>Aechmophorus occidentalis</i>	G5	S1B,S2N	Red	C		P	1 (goal 3)
Western screech-owl, <i>kennicottii</i> ssp.	<i>Otus kennicottii kennicottii</i>	G5T4	S3	Blue	T	1	P	2 (goal 2)
Yellow-billed loon	<i>Gavia adamsii</i>	G4	S2S3N	Blue	NAR		P	3 (goal 3)
<b>Amphibians</b>								
Western toad	<i>Anaxyrus boreas</i>	G4	S3S4	Blue	SC	1	C	2 (goal 2)
<b>Small Mammals</b>								
Keen's myotis	<i>Myotis keenii</i>	G2G3	S2S3	Red	DD	3	P	1 (goals 1 and 3)
Little brown myotis	<i>Myotis lucifugus</i>	G5	S5	Yellow	E		C	5 (goal 3)
Northern myotis	<i>Myotis septentrionalis</i>	G4	S2S3	Blue			P	2 (goal 3)

C = Confirmed presence; P = Potentially occur; L = Likely Occur; U = Unlikely to occur

**Table 18.1-2. Species or Groups of Interest Potentially Occurring within the Wildlife Local Study Area and Regional Study Area**

<b>Species Name (Scientific name)</b>	<b>Reason</b>	<b>Likelihood of Occurrence</b>
Moose ( <i>Alces alces</i> )	Identified as culturally significant and hunted by Aboriginal peoples. Economically important species to local hunters and guide outfitters. Potential UWR for moose identified in the RSA. Identified as an important species requiring increased management consideration by the Nass South SRMP (BC MFLNRO 2012b) and Cassiar Iskut-Stikine LRMP (BC ILMB 2000).	Confirmed
Mountain goat ( <i>Oreamnos americanus</i> )	Rated as priority of 1 for goal 2 of BC's Conservation Framework, meaning that the province has strongly prioritized the conservation of this species and its habitat to prevent it from becoming at risk in the future. Identified as culturally significant and hunted species by Aboriginal peoples. Economically important species to local hunters and guide outfitters. UWR for goat identified within the RSA and LSA. Identified as an important species requiring increased management consideration by the Nass South SRMP (BC MFLNRO 2012b) and Cassiar Iskut-Stikine LRMP (BC ILMB 2000).	Confirmed
Waterfowl	Individuals, eggs, and active nests protected under <i>Migratory Birds Convention Act</i> (1994) and <i>Wildlife Act</i> (1996c).	Confirmed (Several species)
American marten ( <i>Martes americana</i> )	Rated as priority of 2 for goal 2 of BC's Conservation Framework, meaning that the province has prioritized the conservation of this species and its habitat to prevent it from becoming at risk in the future. Identified as a culturally significant species and trapped by Aboriginal and non-Aboriginal trappers. Economically important furbearer to local trappers. Identified as an important species requiring increased management consideration by land management plans including the Nass South SRMP (furbearers; BC MFLNRO 2012b) and Cassiar Iskut-Stikine LRMP (BC ILMB 2000). Biologically important as an indicator species.	Confirmed
Bats	Silver-haired bats ( <i>Lasionycteris noctivagans</i> ) identified by BC MOE as regionally important in the Skeena Region due to concerns with maintaining maternal roosts in tree cavities. Little brown myotis ( <i>Myotis lucifugus</i> ) identified by COSEWIC as Endangered.	Confirmed
Northern goshawk ( <i>Accipiter gentilis</i> )	Component of biodiversity, reduced conservation concern down listed to yellow, identified in the Nass South SRMP (BC MFLNRO 2012b) as requiring additional consideration. Identified as culturally significant species. Also listed as a species at risk both provincially and federally.	Confirmed
Songbirds	Component of biodiversity, individuals, eggs, and active nests protected under <i>Migratory Birds Convention Act</i> (1994) and <i>Wildlife Act</i> (1996c).	Confirmed (several species)
Raptors	Nests and certain raptors protected under <i>Wildlife Act</i> (1996c). Group includes culturally significant raptors identified by Aboriginal peoples. Identified as an important species requiring increased management consideration by the Nass South SRMP (northern goshawk; BC MFLNRO 2012b) and Cassiar Iskut-Stikine LRMP (BC ILMB 2000).	Confirmed (several species)

### **18.1.10.1.2 Old-growth Forests**

Old-growth forests are structurally diverse, supporting a wide variety of plant and animal species. Old-growth forests provide important winter habitat function for some ungulates through provision of thermal and snow interception cover and winter forage (e.g., litter fall for goat); denning habitat for bears; nesting habitat for various waterfowl, raptor, and other bird species; and habitat for furbearers. Most of the RSA has not been harvested and valley bottoms support old-growth forests, except in the Bowser Lake area, where logging has occurred with access from Highway 37. Approximately 10,970 ha of old forest greater than 250 years old (see Table 17.7-15) occur within the Terrestrial Ecosystem's LSA (Section 17.4-1).

Old growth within the CWH and ICH BEC zones in the moist and nutrient rich areas is particularly important for wildlife. Mature and old forested riparian habitat, particularly cottonwood, is also important as it supports black bear dens, fisher dens, and has value as nesting, roosting, and feeding habitat for various other species. Project-related alterations to old-growth forests are evaluated in detail in Chapter 17, Terrestrial Ecosystems.

Some old-growth areas are protected through the establishing of Old Growth Management Areas (OGMAs), which are permanent old-growth retention areas, reserved from industrial modification such as clearing, harvesting, and activities that may cause blowdown within the boundaries of the OGMA. These areas are established through consultations with Aboriginal groups, the BC MOE, and other individuals. OGMAs are a critical component of most integrated resource management plans, and are legal objectives of those plans and enforceable under the *Forest Range and Practices Act* (2002a) and the *Land Act* (1996a). In 1999, the Landscape Unit Planning Guide identified retention of old-growth forest as a priority for biodiversity planning (BC MOF and BC MELP 1999). No legislated OGMAs are present within the LSA or RSA. Three OGMAs have been proposed in the Nass South SRMP (BC MFLNRO 2012b) that overlap the southern portion of the RSA.

### **18.1.10.2 High-quality Habitats and Features**

Certain habitats and habitat features have been identified by provincial legislation, SRMPs, and LRMPs, and have associated management objectives. These habitats include WHAs, UWRs, salmon spawning habitat, ungulate mineral licks, and movement corridors.

#### **18.1.10.2.1 Wildlife Habitat Areas**

WHAs represent the essential habitat necessary to sustain wildlife species considered for management under the Identified Wildlife Management Strategy (BC MWLAP 2004c). There are no designated WHAs for grizzly bear or fisher in the Skeena Region, but candidate grizzly WHA polygons have been suggested. Candidate grizzly WHA polygons of relevance to the Project occur along the Bell-Irving River, along Teigen Creek, overlapping the PTMA, and along the TCAR (WHA 6-282).

#### **18.1.10.2.2 Ungulate Winter Ranges**

UWRs, like WHAs, are established through a land use planning process and are defined by the BC MOE under the authority of sections 9(2) and 12(1) of the Government Actions Regulation (BC Reg. 582/2004) and the *Forest and Range Practices Act* (2002a). UWRs ensure

environmental sustainability across a landscape by: (1) identifying suitable habitat, and (2) integrating habitats that provide a variety of functions (including considerations for habitat interspersion). A designated mountain goat UWR (u-6-002) was established in December 2008 for the Nass TSA that overlaps the RSA and LSA. UWR u-6-002 includes polygons near Sulphurets, Gingras, and McTagg creeks, near the PTMA, Mine Site, and the Unuk River, and throughout the RSA and LSA. Candidate UWRs for moose are proposed along the Bell-Irving River and Treaty Creek (UWR 6-018).

### **18.1.10.2.3 Salmon Spawning Areas**

Areas of particular importance to grizzly bears are salmon-bearing streams and spawning areas. During fisheries baseline studies, salmon were documented in the Unuk and Bell-Irving rivers and Teigen, Treaty, and Coulter creeks ([Appendix 15-C](#)). Other areas identified as important for salmon spawning include the lower Bowser River to its confluence with the Bell-Irving River, and the large floodplain associated with the Bell-Irving River and Teigen Creek drainages (M. W. Demarchi and Johnson 2000). DNA baseline studies on grizzly bears showed individual bears moving long distances, in one case across the RSA, to salmon-bearing streams in the Bell-Irving and Unuk rivers during the fall, presumably to feed on salmon.

### **18.1.10.2.4 Ungulate Mineral Licks**

Natural mineral licks are habitat features that are important for maintaining the health of ungulates. Mineral licks are important for mountain goats, which they use primarily during the summer to compensate for mineral deficiencies or imbalances in their diet (Ayotte, Parker, and Gillingham 2008). A significant mineral lick may be designated as a Wildlife Habitat Feature and managed under the *Forest and Range Practices Act* (2002a). These areas are likely used annually and are important for the local mountain goat population. A potential, but unconfirmed, mineral lick has been identified in the LSA in the Mine Site. An additional mineral lick was observed during baseline surveys for the Brucejack Mine on the Snowslide Range in the RSA ([Appendix 18-D](#)).

### **18.1.10.2.5 Movement Corridors**

Movement corridors connect habitats that are exploited during different times of the year, while movements within daily or seasonal ranges may also occur along specific routes (e.g., pathways to mineral licks). Corridors increase animal movement between habitat patches, which can facilitate healthy population sizes, enable gene flow, and maintain biodiversity (Haddad et al. 2003). Migratory movements of moose, for example, often follow traditional routes, where animals use the same movement corridors every year (Bowyer, Ballenberghe, and Kie 2003). Moose and grizzly bear likely use the major drainages in the study areas, such as the Bell-Irving, Teigen, Treaty, Unuk, and Bowser drainages and the landscape features (e.g., saddles) which connect these valleys, when moving between their seasonal ranges.

## **18.2 Historical Activities**

Past activities in the RSA that may have or continue to affect wildlife and/or wildlife habitat include industrial projects (two underground mines), timber harvesting, guide outfitting,

aboriginal wildlife harvest, resident trapping, and backcountry recreation. These activities are summarized below.

### 18.2.1 Past Industrial Projects

Past industrial projects within the RSA are confined to mining activities. Two mining projects are within the RSA but are now closed: Eskay Creek Mine and Sulphurets Project.

The Eskay Creek Mine was an underground gold-silver mine located approximately 18 km from the KSM Project site. The mine footprint was 27 ha, which was cleared between 1998 and 2004. Of this 27 ha, 9 ha were reclaimed by 2004 (Barrick Gold Corp. 2004). The mine was closed in the first quarter of 2008. During the decommissioning phase, restoration activities included removing buildings and infrastructure and re-vegetating some of the project footprint.

The Sulphurets Project was an advanced exploration project located near Brucejack Lake. Newhawk Gold Mines Ltd. excavated underground workings between 1986 and 1990 as part of an advanced exploration and bulk sampling program. The operation never went into production and in 1996 the Sulphurets property was placed in care and maintenance.

### 18.2.2 Timber Harvesting (Forestry)

The KSM Project is within 10 km of the northwestern part of the Nass TSA, parts of which have historically been clear-cut. The closest historical logging activity to the Project is located along Highway 37, approximately 8 km east of the TMF. Forestry activity in the vicinity of the KSM Project has included an area near Bob Quinn, and from Meziadin to Bell II.

### 18.2.3 Guide Outfitting (Hunting)

Non-resident hunters are required to employ the services of a guide outfitter to hunt in the province. Big-game hunting for animals such as Stone's Sheep, mountain goat, moose, and grizzly bear can be a significant source of revenue for the area. Three guide-outfitting tenures overlap the RSA. The Mine Site and PTMA overlap the guide outfitting licence registered to Misty Mountain Outfitters. To the west, the RSA crosses the guide outfitting licence held by Northwest Ranching and Outfitting. To the south, the RSA crosses the guide outfitting licence held by Coast Mountain Outfitters. Overall, relatively low unregulated hunting pressure has been noted by guide outfitters, who attributed the low pressure to the largely inaccessible state of the area. Areas identified as important by tenure holders include: Teigen Creek area, the Unuk and South Unuk Rivers, Meziadin Lake, Bowser Lake and Mt. Anderson, and Bowser River ([Appendix 23-A, Non-traditional Land Use Baseline Report](#)).

### 18.2.4 Wildlife Harvesting

The province is divided into 225 Wildlife Management Units (WMUs). Approximately half of the RSA overlaps WMU 6-16 (PTMA) and the other half overlaps WMU 6-21 (Mine Site). In addition, the eastern border of the RSA crosses into Upper Skeena WMU 6-17 between the Bell-Irving River and Highway 37. The Fish, Wildlife and Habitat Management Branch collects and aggregates harvest data for each WMU. Non-resident harvest in the RSA is primarily concentrated on moose in WMU 6-21 and black bear and grizzly bear in WMU 6-16 and 6-17,

and resident harvest in the region focuses primarily on moose, followed by black bear ([Appendix 22-A](#)).

Hunting, which has historically occurred and is currently occurring in the area associated with the Project, can affect population sizes, age ratios, sex ratios, sizes, and behaviours of harvested populations. Hunting activities may have historically and currently affected existing wildlife populations within the LSA and RSA. Wildlife species currently harvested in the RSA include moose, black bear, mountain goat, grizzly bear, and waterfowl. Local hunting activities focus on moose. Harvest rates by recreational hunters, including both guided and resident hunters, are regulated by a permitting and licensing system that is administered by the Province of BC.

The RSA is accessible from Highway 37, and along forestry roads that extend from the highway into the areas surrounding Bowser Lake and lower reaches of Treaty Creek. Moose are actively hunted in this area, which likely explains the reduced male to female sex ratio of 47 bulls per 100 cows observed during surveys along the Bell-Irving River and in the Bowser Lake area. Limited access is available along the Eskay Creek Mine road in the northwest of the RSA (the road is currently gated at km 4 and 43.5), although this road does not provide direct access to high-quality moose or goat range in the RSA.

### 18.2.5 Aboriginal Harvest

#### 18.2.5.1 Nisga'a Nation

The Project falls within the Nass Area and is upstream from the NWA, which surround Nisga'a Lands as defined in the *Nisga'a Final Agreement*. Nisga'a people continue to carry out traditional activities such as fishing, hunting, trapping, and trade ([Appendix 29-A](#)), and hold certain rights with respect to trade in wildlife resources within these areas (NLG, Province of BC, and Government of Canada 1998).

#### 18.2.5.2 Tahltan Nation

Tahltan Nation-asserted traditional territory includes the areas surrounding the Stikine River drainage basin in the Coast and Cassiar Mountains. The southern boundary of the territory follows the Unuk River drainage from the Alaska/Canada border and along Treaty Creek, where it overlaps the LSA. The closest Tahltan community to the Project is the Iskut First Nation located in the village of Iskut north of the Bob Quinn area along Highway 37 (Rescan 2010a).

#### 18.2.5.3 Gitanyow

The RSA overlaps with approximately 0.2% of total Gitanyow First Nation traditional territory. Interviews with wilp Wii'litsxw did not reveal any current land-based activities within the RSA ([Appendix 30-C](#)).

#### 18.2.5.4 Skii km Lax Ha

The Skii km Lax Ha, deemed by the British Columbia Environmental Assessment Office as a wilp of the Gitxsan, asserted territorial boundary extends from the north side of Cranberry River

to Ningunsaw Pass, along the Nass and Bell-Irving rivers ([Appendix 30-B](#)). Within this boundary, Skii km Lax Ha actively engage in hunting and trapping ([Appendix 30-B](#)).

### 18.2.6 Resident Trapping

The Project footprint directly overlaps three trapping tenures, and three others are in the RSA. Species commonly harvested in these traplines include marten, squirrel, beaver, lynx, weasel, mink, and wolverine (BC MOE 2004 cited in Rescan 2010c). Trapline owners have noted that access for trapping is gained along the Eskay Creek Mine road, by helicopter, and by foot (Rescan 2010c).

### 18.2.7 Backcountry Recreation

Backcountry recreation can impact wildlife due to increased visual and auditory sensory disturbance, and mechanical disruption of habitat. For example, helicopters and skiers are both known to cause changes in behaviour in moose, mountain goat (Canfield et al. 1999), and mountain caribou (Simpson and Terry 2000). Impacts of backcountry recreation on wildlife may already be occurring in the LSA and RSA due to existing and past use of the area.

There are seven commercial recreation licences that intersect or lie within the RSA, including heli-skiing, river rafting, and backcountry expeditions ([Appendix 23-A](#)). Last Frontier Heliskiing, for example, has use areas close to Bell 2 Lodge, including ski runs to the northeast and southwest of the Lodge. The Snowslide Range (adjacent to the PTMA) and the proposed pit locations overlap with ski runs.

## 18.3 Land Use Planning Objectives

The Project area is situated within the Regional District of Kitimat-Stikine, and is subject to the Cassiar Iskut-Stikine Land and Resource Management Plan (BC ILMB 2000) and the Nass South Sustainable Resource Management Plan (BC MFLNRO 2012b). The Mine Site will fall within the Cassiar-Iskut-Stikine LRMP area, while the PTMA falls within the Nass Land Use area. The south and central portions of the RSA falls within the Nass South SRMP. Wildlife-related management objectives of both the Cassiar Iskut-Stikine LRMP and the Nass South SRMP are described in Table 18.3-1.

The Project would overlap three WMUs within Skeena Region 6, including 6-16, 6-21, and minor portions of 6-17 ([Appendix 23-A](#), Non-traditional Land Use Baseline). The Fish and Wildlife Branch of the BC MFLNRO collects and aggregates raw harvest data for resident and non-resident hunters for each WMU. WHAs for grizzly bear and UWR for moose have been proposed, and UWR for mountain goats have been established for the area (see preceding section on WHAs and UWRs).

**Table 18.3-1. Wildlife Objectives of the Cassiar Iskut-Stikine Land and Resource Management Plan and Nass South Sustainable Resource Management Plan**

Management Direction	Wildlife-related Resource	Wildlife-related Management Objectives
<i>Cassiar Iskut-Stikine LRMP (BC ILMB 2000)</i>		
General Management Direction – Access Management	Access Management	<p>Keep to minimum potential impacts on wildlife habitat and sensitive ecosystems during road construction and use.</p> <p>Manage game populations by controlling hunting and fishing access, where required.</p> <p>Provide access for long-term resource management and economic development needs while minimizing impacts on environmental social, cultural heritage, and wildlife habitat values and commercial activities.</p> <p>Minimize disturbance to wildlife due to aircraft use, particularly during sensitive periods.</p>
General Management Direction – Biodiversity/Ecosystem Health	<p>Aquatic Ecosystems and Riparian Habitat</p> <p>Endangered Plants and Animals</p> <p>Special Landforms: Plateaus</p> <p>Wildlife: General</p> <p>Wildlife: Moose</p>	<p>Conserve riparian habitat by minimizing disturbance to the structural and functional features of riparian habitat, including critical habitat features.</p> <p>Maintain habitats of rare, threatened, and endangered animals, plants and plant communities as described in the BC Conservation Data Centre lists.</p> <p>Maintain habitat of fisher where populations are known to exist.</p> <p>Maintain nesting and foraging habitat for nest sites of raptors, including northern goshawk, short-eared owl, gyrfalcon, peregrine falcon.</p> <p>Minimize disturbance of critical habitat areas for trumpeter swans (e.g., nesting and over-wintering areas, including early spring migration stops).</p> <p>Minimize impacts of motorized activities on plateaus and their habitats.</p> <p>Maintain connectivity for wildlife between plateaus and adjacent plateaus and mountain ranges.</p> <p>Maintain habitat to support healthy wildlife populations.</p> <p>Manage development and access to conserved important habitat features and wildlife.</p> <p>Maintain functional integrity of moose winter range by maintaining critical habitat features (i.e., thermal and snow interception cover, winter forage, and visual screening), and by managing harvesting activities to minimize impact on winter habitat.</p>

(continued)

**Table 18.3-1. Wildlife Objectives of the Cassiar Iskut-Stikine Land and Resource Management Plan and Nass South Sustainable Resource Management Plan (continued)**

Management Direction	Wildlife-related Resource	Wildlife-related Management Objectives
<i>Cassiar Iskut-Stikine LRMP (BC ILMB 2000) (cont'd)</i>		
General Management Direction – Biodiversity/Ecosystem Health <i>(cont'd)</i>	Wildlife: Caribou	<p>Maintain large areas of high value caribou habitat including spring, summer and winter habitat by maintaining the integrity of important habitat characteristics such as forests with lichen, areas of contiguous mature and old forest, and wetland complexes.</p> <p>Maintain functional integrity of mapped caribou winter range, with particular reference to the Three Sisters, Kehlechoa River and the Stikine. Also the range north and east of Spatsizi Park by maintaining winter forage opportunities and snow interception cover, and managing access and harvesting activities to minimize impact to winter habitat.</p>
	Wildlife: Mountain Goat and Stone's Sheep	<p>Maintain large areas of high value Stone's sheep and mountain goat habitat and avoid disturbing animals during kidding and lambing.</p> <p>Maintain functional integrity of mapped winter range for mountain ungulates by maintaining critical habitat features (i.e., thermal and snow interception cover and winter forage), and by managing access to minimize impact to winter habitat.</p>
	Wildlife: Grizzly Bear	<p>Maintain large areas of high value habitat by maintaining areas of well-distributed, seasonally important habitats for grizzly bear across the landscape and through time.</p> <p>Reduce human-bear interactions.</p> <p>Manage hunting and other activities to limit bear mortality from all human causes to less than 4% of the estimated population so harvest of females does not exceed 30% of annual allowable harvest and the total kill is not area-concentrated.</p> <p>Minimize bear/human conflicts and disruption of bear habitat use.</p> <p>Monitor overall effectiveness of habitat management for grizzly bear.</p>
	Wildlife: Marten	<p>Maintain large areas of high value marten habitat by maintaining important habitat characteristics (i.e., forest structural attributes and mature and old forest providing interior forest conditions).</p>
Area-specific Resource Management Zone – Unuk River Zone	General	<p>Maintain high quality and quantity of grizzly bear habitat while allowing commercial timber harvesting and mineral exploration and development to occur.</p>

(continued)

**Table 18.3-1. Wildlife Objectives of the Cassiar Iskut-Stikine Land and Resource Management Plan and Nass South Sustainable Resource Management Plan (completed)**

<b>Management Direction</b>	<b>Wildlife-related Resource</b>	<b>Wildlife-related Management Objectives</b>
<i>Nass South SRMP (BC MFLNRO 2012b)</i>		
Water Resources	Water	Maintain ecological functioning of streams, rivers, wetland complexes and lakes, including those that do not support populations of fish. Maintain functional integrity of floodplains and alluvial fans.
Biodiversity Resources	Biodiversity	Maintain or recruit structural attributes of old forests to support stand-level biodiversity.
Wildlife	Moose	Maintain, enhance or restore moose winter range habitats. Through access management, minimize mortality and disturbance to moose within and adjacent to the moose winter ranges identified.
	Mountain Goat	Minimize adverse disturbance to goats within identified mountain goat winter range. Minimize number of roads within 500 m of winter range and 1,000 m of canyon-dwelling goat winter range. Minimize adverse disturbance to mountain goat winter range from helicopter logging activities.
	Grizzly Bear	Preserved highest value grizzly bear habitat. Maintain quality and effectiveness of grizzly bear foraging habitat. Minimize human-bear conflicts. Minimize long-term displacement of grizzly bears from industrial access development.
	Furbearers	Minimize impact to known high-value fisher and wolverine habitat.
	Northern Goshawk	Maintain nesting and post-fledgling habitat at known goshawk nest areas, to support continued use and reproduction in those areas. Maintain foraging habitat around known goshawk nest and post-fledgling areas.
	General Wildlife	Maintain effectiveness of riparian habitats adjacent to wetlands.

## **18.4 Spatial and Temporal Boundaries**

### **18.4.1 Spatial Boundaries**

The wildlife and wildlife habitat effects assessment considered two study areas for wildlife inventories for the Project; a local study area (LSA) and regional study area (RSA) (Figure 18.4-1). The LSA includes a buffer extending 1.5 km around the outer limits of the proposed infrastructure (i.e., the process plant, open pits, and TMF), as described in the AIR for the Project. This boundary was selected based on considerations of the sensitivity of wildlife, and it approximates the height of land. The LSA also includes a buffer extending to 1.5 km along either side of the centre line of the linear developments (i.e., access road, tunnels, pipelines, and transmission line), as described in the AIR for the Project. The LSA covers 44,983 ha.

The RSA was delineated to reflect the area anticipated to provide habitat for wildlife species that may come in contact with proposed Project infrastructure during the course of a season or lifetime. Species information, including home range sizes, habitat use, and seasonal movement patterns, were considered when selecting the RSA boundary. Other ecological factors, such as height of land or valley bottoms, which can act as barriers to movement, were also considered when delineating boundaries. Sufficient area was included to provide areas beyond the influence of the Project for future monitoring. The RSA covers approximately 338,000 ha, extending approximately 24 km north 24.5 km south of the Project footprint.

The initial RSA was established to include at least one mountain range outside of any Project-related infrastructure. In some cases, the boundary of the RSA was then adjusted following Nisga'a, First Nation, regulator, public, and stakeholder input:

- The northern boundary of the RSA was set as the northern boundary of Ningunsaw Provincial Park so as to include the Ningunsaw and Snowbank creeks.
- The eastern boundary of the RSA includes the Bell-Irving River, an important fisheries and wildlife habitat, and was set as Highway 37. The highway was used as a boundary because BC MOE indicated that they were conducting a study on mountain goat disturbance by helicopters east of Highway 37 and asked the Project to confine helicopter traffic to the west side of the highway.
- The southeastern boundary of the RSA was set as the confluence of the Bowser River and the Bell-Irving River, so as to encompass the lower reaches of the Bowser River drainage.
- The southern boundary includes the height of land south of Bowser Lake and the Bowser River because these waterbodies are important for fisheries. From the confluence of the Bowser River and the Bell-Irving River, the boundary extends northwest along the height of land of the Longview Range, south of Bowser Lake, and then west following the height of land south of the Bowser River to Mount Jacowski, then across the Bowser River and up the Frank Mackie Glacier to Mount Pearson.

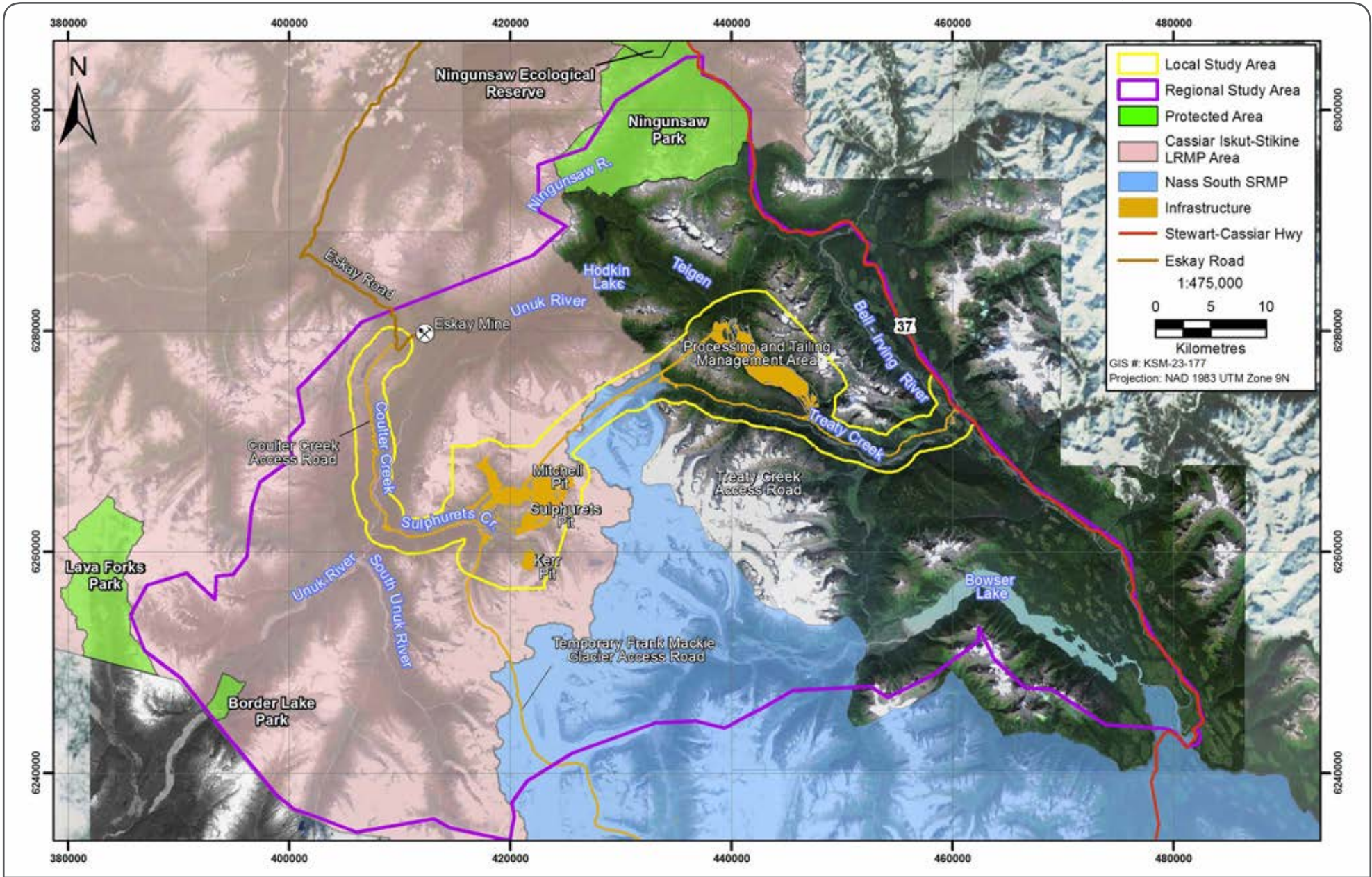


Figure 18.4-1

Figure 18.4-1

- The southwest extent follows the BC-Alaska border for jurisdictional reasons. From the Mount Pearson glacier, the boundary follows the icefield to Mount Blane, Mount Middleton, and Mount Stoecki, west of the Unuk River.
- The western extent was set to the height of land west of the Unuk River so as to include the Unuk River and two mountain ranges from the primary Project infrastructure. From the Alaska border at Mount Stoecki, the western boundary encompasses Canyon Creek; connecting Mosheim Dome, The Volcano, western Nevis Ridge and Mount Dunn. The boundary then follows the height of land north along McQuillan Ridge to Mount Rube to include Coulter Creek, Tom Mackay Lake and the Eskay Creek Mine.
- From Mount Rube, the northwestern extent of the RSA follows northeast to the unnamed mountains northwest of Unuk Lake and west of Teigen Lake, on the north side of the Unuk River. This northwestern extent of the RSA was initially set as the Unuk River, but was expanded northwest following a request from the Tahltan to examine this area for mountain goats, which was conducted in 2009.

Potential interactions with other proposed or existing projects are discussed in the cumulative effects assessment section for wildlife (Section 18.9).

### **18.4.2 Temporal Boundaries**

Some of the wildlife species considered in the effects assessment follow seasonal migration patterns (e.g., moose), while other species (e.g., grizzly bears) travel long distances to establish their home ranges. Some species, such as the western toad and some resident forest birds, may spend their entire life cycle within the RSA, while other species, such as some raptors and waterfowl, inhabit the area only during specific seasons. Therefore, potential Project effects will vary temporally for each wildlife species, depending on the amount of time each spends in the area.

The assessment considered four Project phases: (1) construction phase, assumed to last five years, (2) operation phase, with an assumed mine life of 51.5 years, (3) a closure phase lasting three years, and (4) post-closure, including site reclamation and post-closure monitoring (250 years). The effects on wildlife during the closure and post-closure phases of the Project are assessed together for the wildlife assessment.

## **18.5 Valued Components**

VCs are used to focus the environmental assessment on the issues of highest concern and on the effects that may be linked to the Project. To be considered a VC for assessment purposes, a component must meet the following criteria:

- it must be known to occur in, or be applicable to, the RSA;
- it must be of recognized importance to society, the local community, or the environmental system; and
- there is a perceived likelihood that the VC will be affected by the Project.

A number of wildlife and wildlife habitat VCs were selected to focus the effects assessment. These species or focal groups were chosen because they met one or more of the following criteria:

- species at risk or of conservation concern;
- species or focal groups requiring enhanced consideration under the mandates of regulatory agencies such as the BC MFLNRO, the FRPA (2002a), the BC Conservation Framework priority, or the CWS;
- species identified as having a strong biological importance for the functioning of the ecosystem in the Project area, including importance as keystone, indicator, and/or umbrella species; and/or
- species of cultural, social, and/or economic importance.

Each potential VC was screened for inclusion in the Application for an Environmental Assessment Certificate/Environmental Impact Statement (Application/EIS) and interests and issues that governments (Aboriginal and non-Aboriginal), local interest groups, and the general public identified during the engagement process were considered in VC selection. VCs were selected based on the results of these activities, reflecting a balanced and knowledgeable synthesis of a wide range of information. Any species or wildlife group considered as a VC is known to occur in the Project area and is reasonably likely to be affected by, or have an influence on, the Project.

The following sections review the selection criteria used, and identify selected VCs. The following section also discusses potential VCs that were considered, but ultimately not included in the effects assessment, and reasons for their exclusion.

### Species of Conservation Concern or of Regional Importance

The following legislation, land and resource use plans, and reports were consulted to identify species at risk or of conservation concern, species or focal groups of regional importance, or those of particular interest to regulatory agencies:

- COSEWIC (2010);
- SARA (2002b);
- *Migratory Birds Convention Act* (1994);
- *BC Wildlife Act* (1996c);
- BC FRPA (2002a);
- BC red- and blue-list (BC Conservation Data Centre; BC CDC 2012);
- BC Conservation Framework (BC CDC 2012);
- Nass South SRMP (BC MFLNRO 2012b); and
- Cassiar Iskut-Stikine LRMP (BC ILMB 2000).

### Species of Biological Importance

Species were considered during the VC selection process based on the role that a species or group plays in the health of its local ecosystem, including its role as a keystone, indicator, or umbrella species. Keystone species are those that have relatively low population numbers compared to their importance in maintaining a balanced ecosystem (Helfield and Naiman 2006). For example, moose are considered a biologically important species, as they are capable of modifying the local ecology, especially wetland vegetation (McLaren et al. 2000).

The composition and/or health of an ecosystem can be assessed by analyzing the presence, fitness, or changes occurring in the population of an “indicator species” (Niemi and McDonald 2004). As a result, assessing the potential for effects on indicator species, such as the American marten (Fecske, Jenks, and Smith 2002) or amphibians (Collins and Storfer 2003) can lead to knowledge about the state of the local ecosystem or general environmental health. Umbrella species, such as grizzly bear, were also considered because an evaluation of the effects on these species results, directly or indirectly, in the evaluation and protection of many other species with similar or smaller home ranges or that require similar life requisites as the umbrella species (Roberge and Angelstam 2004).

### Species of Cultural, Social, or Economic Importance

Aboriginal traditional knowledge / traditional use (TK/TU) can provide valuable information on the historical and current presence and distribution of wildlife, as well as identify species or groups of cultural importance within or adjacent to a project area. A goal of the Application/EIS was to integrate TK/TU into Project development wherever possible.

TK/TU information was sought from the Aboriginal groups noted on the Section 11 order and includes information from the Gitxsan Nation, the Gitanyow First Nation and wilp Wii'litsxw, the Skii km Lax Ha, and the Tahltan Nation. Following efforts to engage First Nations in TK/TU studies, information was primarily obtained through desk-based research using publicly available sources. Aboriginal groups were provided copies of desk-based reports for review and comment. The availability of site-specific TK/TU information is limited to the eastern portion of the Project and downstream areas. Information can be found in [Appendices 30-A, 30-B, 30-C, and 30-D](#).

Nisga'a Lisims Government (NLG) does not support the concept of a Nisga'a knowledge and use study, due to the existence of the *Nisga'a Final Agreement*. [Appendix 29-A](#) addresses interests and concerns, including land and resource use activities, that pertain to the *Nisga'a Final Agreement* (NLG, Province of BC, and Government of Canada 1998). The information was obtained from publicly available sources as well as primary data gathering done in the communities with support of NLG.

### **18.5.1 Valued Components Included in Assessment**

The wildlife and wildlife habitat VCs selected for the Project are presented in Table 18.5-1, along with a rationale for their inclusion in the assessment. Potential VCs that were considered but were not included in the assessment are presented in Table 18.5-2, with a rationale for their exclusion. The group or body which identified each potential VC is also referenced in the table, including Aboriginal groups; government; public/stakeholder; or other (e.g., legislation, technical expertise).

**Table 18.5-1. Identification and Rationale for Wildlife Valued Component Selection**

Wildlife Group	Valued Component	Identified by*				Rationale for Inclusion
		AG	G	P/S	O	
Ungulates	Moose	√	√	√	√	<p>Moose are identified as a culturally important and hunted species for First Nations and Nisga'a Nation. Moose were identified as a species requiring increased management consideration in land management plans, including the Nass South SRMP (BC MFLNRO 2012b), and Cassiar Iskut-Stikine LRMP (BC ILMB 2000).</p> <p>Moose is also a biologically important species. High and Moderately High moose winter habitat is located throughout the RSA and moose presence was confirmed during baseline studies. Candidate moose Ungulate Winter Ranges (UWRs) have been identified in the RSA and LSA.</p>
	Mountain Goat	√	√	√	√	<p>Mountain goat is a culturally important and hunted species for First Nations and Nisga'a Nation. Mountain goat have been identified as an important species requiring increased management consideration by land management plans including the Nass South SRMP (BC MFLNRO 2012b), and Cassiar Iskut-Stikine LRMP (BC ILMB 2000).</p> <p>Mountain goats are provincially listed as S4 and Yellow (apparently secure), globally listed as G5 (demonstrably widespread, abundant, and secure), and BC Conservation Framework Priority-listed as 1 (highest conservation priority) due to a ranking of 1 on the Conservation Framework goal of "Prevent species and ecosystems from becoming at risk"(BC CDC 2012).</p> <p>Mountain goats use habitats throughout the RSA, wherever suitable high elevation habitat occurs.</p>
Bears	Grizzly Bear	√	√	√	√	<p>Grizzly bear are provincially blue-listed, federally listed species of Special Concern, and are a species of cultural importance for First Nations and Nisga'a Nation.</p> <p>Grizzly bears are biologically important as an umbrella species.</p> <p>Economically important to local hunters and guide outfitters.</p> <p>Identified as an important species requiring increased management consideration by land management plans including the Nass South SRMP (BC MFLNRO 2012b), and Cassiar Iskut-Stikine LRMP (BC ILMB 2000).</p> <p>Foraging habitat for grizzly bear for vegetation resources and spawning salmon reaches exist in the LSA and RSA.</p>
	Black Bear	√				<p>Black bears were identified as a culturally important and hunted species for First Nations and Nisga'a Nation.</p> <p>Black bear presence was confirmed during the grizzly bear DNA hair capture study and incidental observations.</p>

(continued)

**Table 18.5-1. Identification and Rationale for Wildlife Valued Component Selection (continued)**

Wildlife Group	Valued Component	Identified by*				Rationale for Inclusion
		AG	G	P/S	O	
Furbearers	American Marten	√		√	√	American marten was identified as a culturally important and trapped species for First Nations and Nisga'a Nation. Economically important furbearer to local trappers. Identified as an important species requiring increased management consideration by land management plans including the Nass South SRMP (BC MFLNRO 2012b) and Cassiar Iskut-Stikine LRMP (BC ILMB 2000). Biologically important as an indicator species. Presence was confirmed during baseline studies.
Groundhogs	Hoary Marmot	√				Groundhog (hoary marmot) was identified as a culturally important and hunted species for First Nations and Nisga'a Nation and their presence was confirmed during baseline studies.
Bats	Bat Species at Risk and Silver-haired Bat		√		√	Provincially blue-listed northern long-eared myotis ( <i>Myotis septentrionalis</i> ) could occur within the LSA and RSA. The silver-haired bat ( <i>Lasionycteris noctivagans</i> ) was identified by BC MOE as regionally important in the Skeena Region because of concerns with maintaining maternal roosts in tree cavities. The little brown myotis ( <i>Myotis lucifugus</i> ) is listed as Endangered by COSEWIC (COSEWIC 2012) over concerns with white-nose syndrome. Keen's long-eared myotis is red-listed in BC and in BC's Conservation Framework as priority-listed as goal 1. Because of the lack of regional knowledge about this wildlife group and their ability to habituate to anthropogenic structures, bats are included as a VC.
Birds	Wetland Birds	√	√		√	Individual birds, eggs and active nests are protected under <i>Migratory Birds Convention Act</i> (1994) and <i>Wildlife Act</i> (1996c). Wetland bird group includes culturally important waterfowl (e.g., gulls, geese, ducks, and swans) for First Nations and Nisga'a Nation. There were 25 bird species confirmed on wetlands during baseline studies, including wetland birds (e.g., ducks, geese), cavity-nesting waterfowl (e.g., goldeneyes), and riverine birds (e.g., harlequin duck).
	Forest and Alpine Birds	√	√		√	Individual birds, eggs, and active nests are protected under <i>Migratory Birds Convention Act</i> (1994) and <i>Wildlife Act</i> (1996c). This VC includes culturally important species (e.g., grouse, ptarmigan, and woodpeckers) for First Nations and Nisga'a Nation. There were 60 species of forest and alpine birds confirmed in the RSA during baseline studies.

(continued)

**Table 18.5-1. Identification and Rationale for Wildlife Valued Component Selection (completed)**

Wildlife Group	Valued Component	Identified by*				Rationale for Inclusion
		AG	G	P/S	O	
Birds (cont'd)	Raptors	√	√		√	Nests (year round) and certain raptors are protected under BC <i>Wildlife Act</i> (1996c). Group includes culturally important raptors (e.g., bald eagle, golden eagle, northern goshawk) identified by the First Nations and Nisga'a Nation.  Identified as important species requiring increased management consideration by land management plans including the Nass South SRMP (BC MFLNRO 2012b) and Cassiar Iskut-Stikine LRMP (BC ILMB 2000). Raptors and raptor nests have been confirmed in the RSA.
Amphibians	Western Toad		√		√	Western toad is a species of Special Concern under Schedule 1 of SARA (2002b). Confirmed presence in wetlands during baseline studies. This species has a priority rating of 2 for goal 2 in BC's Conservation Framework, meaning that the province is interesting in preventive conservation to keep this species from becoming at risk.

\*AG = Aboriginal Group; G = Government; P/S = Public/Stakeholder; O = Other (e.g., legislation, professional judgment).

**Table 18.5-2. Rationale for Wildlife Valued Components Considered and Excluded from Further Analysis or Reflected by Other Species Assessments**

Wildlife Species Group	Proposed Valued Component	Identified by*				Rationale for Exclusion
		AG	G	P/S	O	
Ungulates	Deer (Mule and White-tailed)	√			√	Deer are culturally important for First Nations and Nisga'a Nation, and hunted by local residents.  Excluded because white-tailed deer and mule deer populations are secure and not at risk in BC and presence was not confirmed during baseline surveys.
	Caribou		√			First Nations and Nisga'a Nation identified caribou as culturally important. This species was excluded because the Project area is not within the generally acknowledged current caribou range. Some individuals may disperse into the area (evidenced by a shed antler found near the Mine Site). However, no caribou were observed during aerial surveys for mountain goat or moose. This area may be part of the historical caribou range, but caribou in this area have since been functionally extirpated (BC MWLAP 2004b) .
	Stone's sheep		√			Stone's sheep are culturally important for First Nations. Excluded because, while incidental presence of individuals may occur, presence was not confirmed during baseline studies.

(continued)

**Table 18.5-2. Rationale for Wildlife Valued Components Considered and Excluded from Further Analysis or Reflected by Other Species Assessments (continued)**

Wildlife Species Group	Proposed Valued Component	Identified by*				Rationale for Exclusion
		AG	G	P/S	O	
Carnivores	Wolverine	√	√	√	√	<p>Wolverine are blue-listed in BC and of Special Concern by COSEWIC (May 2003), and are a culturally important species for First Nations and Nisga'a Nation. Also identified in the Nass South SRMP (BC MFLNRO 2012b) as requiring enhanced management consideration.</p> <p>Excluded because wolverine are habitat generalists and wolverine's low population density and large home-range size mean there would be limited interaction with the proposed Project. Wolverine habitat use and potential effects of the Project on wolverine are considered to be accounted for in the effects assessment by relying on models of grizzly bear and marten habitat. Potential Project effects are reflected in American marten and bear assessments.</p>
	Fisher	√		√	√	<p>Fisher are provincially blue-listed, and are a culturally important species trapped by First Nations and Nisga'a Nation. Identified as an important species requiring increased management consideration by land management plans including the Nass South SRMP (BC MFLNRO 2012b) and Cassiar Iskut-Stikine LRMP (BC ILMB 2000).</p> <p>Fisher are excluded as a VC, because their habitat use and potential effects of the Project are reflected in the American marten and bear effects assessments and mitigation for black bears (e.g., avoiding den sites).</p>
Carnivores	Lynx	√				<p>These carnivore species were identified as culturally important (lynx, fox, wolf, coyote, weasel, ermine, mink, river otter) for First Nations and Nisga'a Nation.</p> <p>Lynx, fox, coyote and weasels were excluded because their populations are considered stable and not at risk, have low population density, are able to adapt to and tolerate human disturbance well. Moreover, their populations are largely determined by prey availability. Because prey species (small mammals) and habitat requirements for this group (i.e., forest habitat) are similar to prey and habitat requirements of American marten, the potential Project effects on these species would be captured by the marten effects assessment.</p> <p>Wolf were excluded because the potential Project effects on wolves could be evaluated by examining their main source of prey (e.g., moose), which will be evaluated by the moose effects assessment.</p>
	Fox	√				
	Wolf	√				
	Coyote	√				
	Weasel	√				
	Ermine	√				
	Mink	√				
	River Otter	√				

(continued)

**Table 18.5-2. Rationale for Wildlife Valued Components Considered and Excluded from Further Analysis or Reflected by Other Species Assessments (completed)**

Wildlife Species Group	Proposed Valued Component	Identified by*				Rationale for Exclusion
		AG	G	P/S	O	
Rodents Rabbits, and Hares	Beaver Squirrels (red and flying) Muskrat Gophers Porcupine Snowshoe Hare	√				Rodent species (beaver, rabbit, porcupine, snowshoe hare, red squirrel, flying squirrel, and muskrat) were identified as culturally important for First Nations and Nisga'a Nation). These species were excluded because all of the aforementioned populations are considered stable and not at risk. Further, important habitats for some of these species, specifically beaver and muskrat dams and lodges, are protected under a separate permitting process under the <i>Wildlife Act</i> (1996c). Other potential effects of the Project on beaver and muskrat would be captured by analyses of changes in wetland habitat within the waterfowl assessment.
Small Mammals			√			No species of concern were identified during the 2008 or 2009 summer inventories. Small mammals (e.g., mice, shrews, voles) were excluded from the effects assessment.
Birds	Northern Goshawk Grouse Ptarmigan	√				Potential Project effects reflected by raptor assessments.  Potential Project effects reflected by forest and alpine bird assessment because they use similar habitats.  Potential Project effects reflected by forest and alpine bird assessment because they use similar habitats.
Birds	Trumpeter Swan	√	√			Trumpeter swans are a yellow-listed species in BC. They have been highlighted by the CWS as a species requiring increased consideration, and species of interest for First Nations and by the CIS LRMP (BC ILMB 2000). Six observations of trumpeter swan were made during staging surveys and one observation was made during the spring pair survey, all outside of the LSA. No breeding was confirmed in the area. Potential Project effects will be reflected by the wetland bird effects assessment.
Amphibians	Wood Frog, Columbia Spotted Frog	√				Wood frogs and Columbia spotted frogs were excluded from the effects assessment because any potential effects on the species would be addressed in the assessment of alteration to wetland extent in the wetlands section (Section 15) and the western toad effects assessment.

\*AG – Nisga'a Nation and Aboriginal Groups, including traditional knowledge; G - Government; P/S - Public and other stakeholders; O - Other (e.g., legislation, professional judgment).

**18.5.2 Valued Components Excluded from Assessment or Reflected by Other Species Assessments**

A number of potential VCs were considered for assessment but were not included; the rationale for their exclusion are presented in Table 18.5-2.

**18.6 Scoping of Potential Effects for Wildlife and Wildlife Habitat**

Potential effects on wildlife and wildlife habitat by the Project have been raised during working group meetings by Aboriginal groups and government, and have been identified through best management practices, scientific literature, and technical expertise/professional judgment (Table 18.6-1). How and when these potential effects may arise due to the Project are shown in [Appendix 18-E](#), and are summarized in Sections 18.6.1 to 18.6.4. A detailed description of the potential effects is provided in Section 18.7. Each issue is addressed in a separate section and is subdivided according to the wildlife VCs deemed to be of concern. Ultimately, the effects are evaluated for their potential to alter survival and reproduction of VC species, and therefore, of the population within the effects assessment boundary.

**Table 18.6-1. Wildlife Issues Identified during Scoping**

Issue	Identified by*				
	AG	G	P/S	O	AIR
Habitat Loss and Alteration	X			X	x
Disruption of Movement				X	
Sensory Disturbance	X			X	X
Direct Mortality	X	X		X	X
Indirect Mortality (Access)	X	X		X	X
Attractants				X	
Chemical Hazards (Health Effects)	X	X		X	X

\*AG – Nisga’a Nation and First Nations comments, including traditional knowledge; G – Government (including legislation); P/S = Public/stakeholder comments; O = other (SRMP, LRMP, best management practices, professional judgment); AIR – Application Information Requirements

From the scoping assessment, seven potential effects were identified. These potential effects included habitat loss and alteration, sensory disturbance, disruption of movement patterns, direct mortality, indirect mortality, attractants, and chemical hazards (Tables 18.6-2 to 18.6-13). Each of these potential effects, including proposed mitigation and residual effects is discussed in further detail in Section 18.7.

**18.6.1 Construction**

During construction, direct habitat loss and alteration, sensory disturbance, direct mortality, indirect mortality, disruption of movement patterns, and attractants were identified as potential effects that could impact wildlife and wildlife habitat. Potential effects would occur in association with construction of Project infrastructure within the PTMA and Mine Site ([Appendix 18-E](#) and Tables 18.6-2 to 18.6-13). Potential Project-related effects during construction that were assessed in the wildlife and wildlife habitat effects assessment include:

**Table 18.6-2. Summary of Potential Project Effects on Wildlife Valued Components**

Potential Effect	Potentially Affected Valued Component	Phase in which Effect is Initiated		
		Construction	Operation	Closure and Post-closure
Habitat Loss and Alteration	All VCs	√	√	√
Disruption of Movement	Moose	√	√	√
	Mountain Goat	√	√	
	Grizzly Bear	√	√	√
	Black Bear	√	√	
	American Marten	√	√	
	Western Toad	√	√	
Sensory Disturbance	Moose	√	√	
	Mountain goat	√	√	
	Grizzly Bear	√	√	
	Black Bear	√	√	
	Bats	√	√	
	Raptors	√	√	
	Wetland Birds	√	√	
	Forest and Alpine Birds	√	√	
Western Toad	√	√		
Direct Mortality	All VCs	√	√	√
Indirect Mortality	Moose	√	√	√
	Mountain Goat	√	√	√
	Grizzly Bear	√	√	√
	Black Bear	√	√	√
Attractants	Moose	√	√	√
	Mountain Goat	√	√	
	Grizzly Bear	√	√	
	Black Bear	√	√	
	American Marten	√	√	
	Bats	√	√	√
	Raptors	√	√	
	Wetland Birds	√	√	
	Western Toad	√	√	
Chemical Hazards	All VCs	√	√	√

- **Habitat Loss and Alteration:** potential adverse effect on wildlife species and populations caused by the direct removal or alteration of wildlife habitat. This effect would occur in association with the clearing of the Project footprint and would include any potential effects on wildlife from vegetation clearing for construction of infrastructure within the Project footprint.
- **Disruption of Movement:** adverse effect on wildlife movement from direct means such as wildlife movement barriers (e.g., the TMF and TMF dams or the Saddle Area) or

corridors (e.g., access roads or transmission line) and indirect means such as traffic disturbance causing habitat fragmentation and edge effects.

- **Sensory Disturbance:** sensory disturbance to wildlife could occur from any disturbance — noise or visual, — with the potential to adversely affect an animal, most commonly through a behavioural, endocrine (acute or chronic stress reaction), or energetic response.
- **Direct Mortality:** potential effects of wildlife mortality caused by vegetation clearing, construction machinery, and vehicle traffic.
- **Indirect Mortality:** potential effects on wildlife from mortality caused by increased access and hunting pressure.
- **Attractants:** wildlife may be attracted to the Project area by attractants such as food wastes and other anthropogenic attractants from construction crews and camps.
- **Chemical Hazards:** some wildlife may uptake chemicals of potential concern from construction camps, from ingestion of dust, or via bioaccumulation from vegetation with dust.

### 18.6.2 Operation

During operation, direct habitat loss and alteration, disruption of movement, sensory disturbance, direct mortality, indirect mortality, attractants, and chemical hazards were identified as potential effects for wildlife and wildlife habitat ([Appendix 18-E](#) and Tables 18.6-2 to 18.6-13):

- **Habitat Loss and Alteration:** additional habitat loss and alteration will occur as a result of the ongoing construction and growth of Project features (e.g., pits, TMF, etc.).
- **Disruption of Movement:** wildlife movement may be impacted indirectly due to habitat fragmentation and edge effects or avoidance of movement corridors due to disturbance, or due to direct means, such as by creating physical movement barriers or corridors.
- **Sensory Disturbance:** potential effect on wildlife and wildlife habitat avoidance caused by noise from operation machinery, vehicles, helicopter, blasts, processing plant, and human activity, as well as avoidance of or attraction to artificial lighting of the facilities, roads, and Mine Site.
- **Direct Mortality:** potential effects of direct wildlife mortality due to vehicle traffic or bird mortality caused by transmission line electrocution or collision.
- **Indirect Mortality/Access:** potential effects on wildlife from mortality caused by increased access and hunting pressure, or range shifts leading to competition for resources.
- **Attractants:** wildlife attracted to the Project area by odours of food wastes or other anthropogenic attractants from crews and camps.
- **Chemical Hazards:** wildlife may uptake chemicals of potential concern from camp or industrial sites, water in the Water Storage Facility (WSF), TMF, or receiving environments, from ingestion of dust, or via bioaccumulation from vegetation or prey species.

**Table 18.6-3. Potential Effects from Project on Moose**

Project Region	Project Area	Habitat Loss	Disruption of Movement	Sensory Disturbance	Direct Mortality	Indirect Mortality	Attractants	Chemical Hazards
Mine Area	Camp 3: Eskay Staging Camp	x						
	Camp 7: Unuk North Camp	x	x	x				x
	Camp 8: Unuk South Camp	x	x	x				x
	Coulter Creek Access Corridor	x	x	x	x	x	x	x
	Mitchell Operating Camp							x
	McTagg Rock Storage Facility	x		x				
	McTagg Twinned Diversion Tunnels							
	McTagg Power Plant			x				
	Mitchell Rock Storage Facility	x						x
	Camp 4: Mitchell North Camp (for MTT construction)							
	Mitchell Ore Preparation Complex	x						x
	Mine Site Avalanche Control							
	Iron Cap Block Cave Mine							
	Mitchell Pit							
	Mitchell Block Cave Mine							
	Mitchell Diversion Tunnels							
	Upper Sulphurets Power Plant							
	Mitchell Truck Shop							x
	Water Storage Facility	x						x
	Camp 9: Mitchell Initial Camp							
	Camp 10: Mitchell Secondary Camp							
	Water Treatment & Energy Recovery Area	x						
	Sludge Management Facilities							x
	Sulphurets Laydown Area	x						x
	Sulphurets-Mitchell Conveyor Tunnel							
	Sulphurets Pit	x						
	Kerr Rope Conveyor							
	Kerr Pit	x						
	Camp 2: Ted Morris Camp							
	Explosives Manufacturing Facility							
Temporary Frank Mackie Glacier Access Route								
Camp 1: Granduc Staging Camp								
Processing and Tailing Management Area	Mitchell-Treaty Twinned Tunnels							
	Construction Access Adit			x				
	Mitchell-Treaty Saddle Area	x	x	x				
	Camp 6: Treaty Saddle Camp	x	x	x				x
	Camp 5: Treaty Plant Camp	x	x	x				x
	Treaty Operating Camp	x	x	x				x
	Treaty Ore Preparation Complex	x	x	x				x
	Concentrate Storage and Loadout	x	x	x				x
	North Cell Tailing Management Facility	x	x	x				x
	East Catchment Diversion	x	x					
	Centre Cell Tailing Management Facility	x	x	x				x
	South Cell Tailing Management Facility	x	x	x				x
	Treaty Creek Access Corridor	x	x	x	x	x	x	x
	Camp 11: Treaty Marshalling Yard Camp	x	x	x				x
Camp 12: Highway 37 Construction Camp	x	x	x	x		x	x	
Off-site Transportation	Highway 37 and 37A		x	x	x			x

x = interaction between component and effect.

**Table 18.6-4. Potential Effects from Project on Mountain Goat**

Project Region	Project Area	Habitat Loss	Disruption of Movement	Sensory Disturbance	Direct Mortality	Indirect Mortality	Attractants	Chemical Hazards
Mine Area	Camp 3: Eskay Staging Camp							
	Camp 7: Unuk North Camp							
	Camp 8: Unuk South Camp							
	Coulter Creek Access Corridor	x	x		x	x	x	
	Mitchell Operating Camp		x	x				
	McTagg Rock Storage Facility	x	x	x				x
	McTagg Twinned Diversion Tunnels		x	x				
	McTagg Power Plant		x	x				
	Mitchell Rock Storage Facility		x	x				x
	Camp 4: Mitchell North Camp (for MTT construction)			x	x			
	Mitchell Ore Preparation Complex			x	x			
	Mine Site Avalanche Control	x	x	x	x			
	Iron Cap Block Cave Mine	x	x	x				
	Mitchell Pit	x	x	x	x		x	x
	Mitchell Block Cave Mine	x	x	x	x			
	Mitchell Diversion Tunnels			x				
	Upper Sulphurets Power Plant	x	x	x				
	Mitchell Truck Shop			x				
	Water Storage Facility			x				
	Camp 9: Mitchell Initial Camp			x	x			
	Camp 10: Mitchell Secondary Camp			x	x			
	Water Treatment & Energy Recovery Area			x				
	Sludge Management Facilities			x				x
	Sulphurets Laydown Area			x				x
	Sulphurets-Mitchell Conveyor Tunnel			x				
	Sulphurets Pit	x	x	x	x	x	x	x
	Kerr Rope Conveyor	x	x	x	x			
	Kerr Pit	x	x	x	x	x	x	x
	Camp 2: Ted Morris Camp			x	x			
	Explosives Manufacturing Facility			x	x			
	Temporary Frank Mackie Glacier Access Route	x	x	x	x	x		
Camp 1: Granduc Staging Camp								
Processing and Tailing Management Area	Mitchell-Treaty Twinned Tunnels			x				
	Construction Access Adit	x	x	x				
	Mitchell-Treaty Saddle Area	x		x				
	Camp 6: Treaty Saddle Camp			x				
	Camp 5: Treaty Plant Camp							
	Treaty Operating Camp							
	Treaty Ore Preparation Complex				x			
	Concentrate Storage and Loadout							
	North Cell Tailing Management Facility				x			
	East Catchment Diversion	x	x	x				
	Centre Cell Tailing Management Facility							
	South Cell Tailing Management Facility							
	Treaty Creek Access Corridor	x	x	x	x	x	x	
	Camp 11: Treaty Marshalling Yard Camp							
Camp 12: Highway 37 Construction Camp					x		x	
Off-site Transportation	Highway 37 and 37A				x			

x = interaction between component and effect.

**Table 18.6-5. Potential Effects from Project on Grizzly Bear**

Project Region	Project Area	Habitat Loss	Disruption of Movement	Sensory Disturbance	Direct Mortality	Indirect Mortality	Attractants	Chemical Hazards
Mine Area	Camp 3: Eskay Staging Camp	x		x			x	x
	Camp 7: Unuk North Camp	x		x			x	x
	Camp 8: Unuk South Camp	x		x			x	x
	Coulter Creek Access Corridor	x	x	x	x	x	x	x
	Mitchell Operating Camp	x	x	x			x	x
	McTagg Rock Storage Facility	x	x	x				x
	McTagg Twinned Diversion Tunnels	x	x	x				
	McTagg Power Plant	x	x	x				x
	Mitchell Rock Storage Facility	x	x					x
	Camp 4: Mitchell North Camp (for MTT construction)	x			x		x	x
	Mitchell Ore Preparation Complex	x	x	x				x
	Mine Site Avalanche Control	x			x	x		
	Iron Cap Block Cave Mine	x			x			
	Mitchell Pit	x	x	x	x	x		x
	Mitchell Block Cave Mine	x			x			
	Mitchell Diversion Tunnels	x	x					
	Upper Sulphurets Power Plant	x	x	x				x
	Mitchell Truck Shop	x	x	x			x	x
	Water Storage Facility	x	x					x
	Camp 9: Mitchell Initial Camp	x			x		x	x
	Camp 10: Mitchell Secondary Camp	x			x		x	x
	Water Treatment & Energy Recovery Area	x	x					x
	Sludge Management Facilities	x	x					x
	Sulphurets Laydown Area	x	x					x
	Sulphurets-Mitchell Conveyor Tunnel	x						
	Sulphurets Pit	x	x	x	x	x		
	Kerr Rope Conveyor	x	x	x	x			
	Kerr Pit	x	x	x	x	x		
	Camp 2: Ted Morris Camp	x			x		x	x
	Explosives Manufacturing Facility	x	x	x	x			x
	Temporary Frank Mackie Glacier Access Route		x	x	x			
Camp 1: Granduc Staging Camp						x	x	
Processing and Tailing Management Area	Mitchell-Treaty Twinned Tunnels							
	Construction Access Adit	x	x	x				x
	Mitchell-Treaty Saddle Area	x	x	x				x
	Camp 6: Treaty Saddle Camp	x		x			x	x
	Camp 5: Treaty Plant Camp	x		x			x	x
	Treaty Operating Camp	x		x			x	x
	Treaty Ore Preparation Complex	x	x				x	x
	Concentrate Storage and Loadout	x	x	x				x
	North Cell Tailing Management Facility	x	x	x				x
	East Catchment Diversion	x	x	x				
	Centre Cell Tailing Management Facility	x	x	x				x
	South Cell Tailing Management Facility	x	x	x				x
	Treaty Creek Access Corridor	x	x	x	x	x	x	x
Camp 11: Treaty Marshalling Yard Camp	x		x			x	x	
Camp 12: Highway 37 Construction Camp	x			x	x	x	x	
Off-site Transportation	Highway 37 and 37A		x	x	x		x	x

x = interaction between component and effect.

**Table 18.6-6. Potential Effects from Project on Black Bear**

Project Region	Project Area	Habitat Loss	Disruption of Movement	Sensory Disturbance	Direct Mortality	Indirect Mortality	Attractants	Chemical Hazards
Mine Area	Camp 3: Eskay Staging Camp			x			x	x
	Camp 7: Unuk North Camp	x		x			x	x
	Camp 8: Unuk South Camp	x		x			x	x
	Coulter Creek Access Corridor	x	x	x	x	x	x	x
	Mitchell Operating Camp	x	x	x			x	x
	McTagg Rock Storage Facility	x	x					x
	McTagg Twinned Diversion Tunnels		x					
	McTagg Power Plant		x	x				x
	Mitchell Rock Storage Facility	x	x					x
	Camp 4: Mitchell North Camp (for MTT construction)	x			x		x	x
	Mitchell Ore Preparation Complex	x	x	x				x
	Mine Site Avalanche Control			x	x			
	Iron Cap Block Cave Mine			x				
	Mitchell Pit		x	x	x	x		x
	Mitchell Block Cave Mine			x	x			
	Mitchell Diversion Tunnels		x					
	Upper Sulphurets Power Plant		x	x	x			x
	Mitchell Truck Shop	x	x	x			x	x
	Water Storage Facility	x	x					x
	Camp 9: Mitchell Initial Camp	x			x		x	x
	Camp 10: Mitchell Secondary Camp	x			x		x	x
	Water Treatment & Energy Recovery Area	x	x					x
	Sludge Management Facilities	x	x					x
	Sulphurets Laydown Area	x	x					x
	Sulphurets-Mitchell Conveyor Tunnel							
	Sulphurets Pit		x	x	x	x		
	Kerr Rope Conveyor		x	x	x			
	Kerr Pit	x	x	x	x	x		
	Camp 2: Ted Morris Camp	x			x		x	x
	Explosives Manufacturing Facility	x	x		x			x
Temporary Frank Mackie Glacier Access Route		x		x				
Camp 1: Granduc Staging Camp						x	x	
Processing and Tailing Management Area	Mitchell-Treaty Twinned Tunnels							
	Construction Access Adit	x	x	x				x
	Mitchell-Treaty Saddle Area	x	x	x				x
	Camp 6: Treaty Saddle Camp	x		x			x	x
	Camp 5: Treaty Plant Camp	x		x			x	x
	Treaty Operating Camp	x		x			x	x
	Treaty Ore Preparation Complex	x	x				x	x
	Concentrate Storage and Loadout	x	x	x				x
	North Cell Tailing Management Facility	x	x	x				x
	East Catchment Diversion	x	x	x				
	Centre Cell Tailing Management Facility	x	x	x				x
	South Cell Tailing Management Facility	x	x	x				x
	Treaty Creek Access Corridor	x	x	x	x	x	x	x
Camp 11: Treaty Marshalling Yard Camp	x		x			x	x	
Camp 12: Highway 37 Construction Camp	x			x	x	x	x	
Off-site Transportation	Highway 37 and 37A		x	x	x		x	x

x = interaction between component and effect.



**Table 18.6-8. Potential Effects from Project on Hoary Marmot**

Project Region	Project Area	Habitat Loss	Direct Mortality	Chemical Hazards
Mine Area	Camp 3: Eskay Staging Camp			x
	Camp 7: Unuk North Camp			
	Camp 8: Unuk South Camp			
	Coulter Creek Access Corridor	x	x	
	Mitchell Operating Camp			
	McTagg Rock Storage Facility	x	x	x
	McTagg Twinned Diversion Tunnels			
	McTagg Power Plant			
	Mitchell Rock Storage Facility	x	x	x
	Camp 4: Mitchell North Camp (for MTT construction)			
	Mitchell Ore Preparation Complex			
	Mine Site Avalanche Control			
	Iron Cap Block Cave Mine			
	Mitchell Pit	x	x	x
	Mitchell Block Cave Mine			
	Mitchell Diversion Tunnels			
	Upper Sulphurets Power Plant			
	Mitchell Truck Shop			
	Water Storage Facility			
	Camp 9: Mitchell Initial Camp			
	Camp 10: Mitchell Secondary Camp			
	Water Treatment & Energy Recovery Area			
	Sludge Management Facilities			x
	Sulphurets Laydown Area	x		x
	Sulphurets-Mitchell Conveyor Tunnel			
	Sulphurets Pit	x	x	x
	Kerr Rope Conveyor			
	Kerr Pit	x	x	x
	Camp 2: Ted Morris Camp			
	Explosives Manufacturing Facility			x
Temporary Frank Mackie Glacier Access Route	x	x	x	
Camp 1: Granduc Staging Camp				
Processing and Tailing Management Area	Mitchell-Treaty Twinned Tunnels			
	Construction Access Adit	x	x	
	Mitchell-Treaty Saddle Area	x		
	Camp 6: Treaty Saddle Camp			
	Camp 5: Treaty Plant Camp			
	Treaty Operating Camp			
	Treaty Ore Preparation Complex			
	Concentrate Storage and Loadout			
	North Cell Tailing Management Facility	x		
	East Catchment Diversion	x		
	Centre Cell Tailing Management Facility	x		x
	South Cell Tailing Management Facility	x		x
	Treaty Creek Access Corridor	x		
	Camp 11: Treaty Marshalling Yard Camp			
Camp 12: Highway 37 Construction Camp				
Off-site Transportation	Highway 37 and 37A			

x = interaction between component and effect.

**Table 18.6-9. Potential Effects from Project on Bats**

Project Region	Project Area	Habitat Loss	Sensory Disturbance	Direct Mortality	Attractants	Chemical Hazards
Mine Area	Camp 3: Eskay Staging Camp		x			x
	Camp 7: Unuk North Camp	x	x	x		x
	Camp 8: Unuk South Camp	x	x	x		x
	Coulter Creek Access Corridor	x		x		x
	Mitchell Operating Camp		x			x
	McTagg Rock Storage Facility					x
	McTagg Twinned Diversion Tunnels				x	x
	McTagg Power Plant					x
	Mitchell Rock Storage Facility					x
	Camp 4: Mitchell North Camp (for MTT construction)					x
	Mitchell Ore Preparation Complex					x
	Mine Site Avalanche Control					
	Iron Cap Block Cave Mine					x
	Mitchell Pit					
	Mitchell Block Cave Mine					x
	Mitchell Diversion Tunnels					x
	Upper Sulphurets Power Plant					x
	Mitchell Truck Shop					x
	Water Storage Facility					x
	Camp 9: Mitchell Initial Camp					x
	Camp 10: Mitchell Secondary Camp					x
	Water Treatment & Energy Recovery Area					x
	Sludge Management Facilities					x
	Sulphurets Laydown Area	x		x		x
	Sulphurets-Mitchell Conveyor Tunnel					x
	Sulphurets Pit	x		x		
	Kerr Rope Conveyor					
	Kerr Pit	x		x		
	Camp 2: Ted Morris Camp					x
	Explosives Manufacturing Facility					
Temporary Frank Mackie Glacier Access Route						
Camp 1: Granduc Staging Camp					x	
Processing and Tailing Management Area	Mitchell-Treaty Twinned Tunnels				x	x
	Construction Access Adit		x		x	x
	Mitchell-Treaty Saddle Area	x	x	x	x	x
	Camp 6: Treaty Saddle Camp	x	x	x		x
	Camp 5: Treaty Plant Camp	x	x	x		x
	Treaty Operating Camp	x	x	x		x
	Treaty Ore Preparation Complex	x	x	x		x
	Concentrate Storage and Loadout	x	x	x		x
	North Cell Tailing Management Facility	x	x	x		x
	East Catchment Diversion	x	x	x		
	Centre Cell Tailing Management Facility	x	x	x		x
	South Cell Tailing Management Facility	x	x	x		x
	Treaty Creek Access Corridor	x	x	x		x
	Camp 11: Treaty Marshalling Yard Camp	x	x	x		x
Camp 12: Highway 37 Construction Camp	x	x	x		x	
Off-site Transportation	Highway 37 and 37A					x

x = interaction between component and effect.

**Table 18.6-10. Potential Effects from Project on Raptors**

Project Region	Project Area	Habitat Loss	Sensory Disturbance	Direct Mortality	Attractants	Chemical Hazards
Mine Area	Camp 3: Eskay Staging Camp			x		x
	Camp 7: Unuk North Camp	x	x	x		x
	Camp 8: Unuk South Camp	x	x	x		x
	Coulter Creek Access Corridor	x	x	x		x
	Mitchell Operating Camp			x		x
	McTagg Rock Storage Facility	x	x	x		x
	McTagg Twinned Diversion Tunnels					
	McTagg Power Plant		x	x		x
	Mitchell Rock Storage Facility	x	x	x		x
	Camp 4: Mitchell North Camp (for MTT construction)			x		x
	Mitchell Ore Preparation Complex			x		x
	Mine Site Avalanche Control					
	Iron Cap Block Cave Mine					
	Mitchell Pit					x
	Mitchell Block Cave Mine					
	Mitchell Diversion Tunnels					
	Upper Sulphurets Power Plant			x	x	x
	Mitchell Truck Shop			x	x	x
	Water Storage Facility			x	x	x
	Camp 9: Mitchell Initial Camp			x		x
	Camp 10: Mitchell Secondary Camp			x		x
	Water Treatment & Energy Recovery Area			x	x	x
	Sludge Management Facilities				x	x
	Sulphurets Laydown Area	x	x	x		x
	Sulphurets-Mitchell Conveyor Tunnel					
	Sulphurets Pit	x	x	x		x
	Kerr Rope Conveyor			x		
	Kerr Pit	x	x	x		x
	Camp 2: Ted Morris Camp	x		x		x
	Explosives Manufacturing Facility			x		
	Temporary Frank Mackie Glacier Access Route					
Camp 1: Granduc Staging Camp					x	
Processing and Tailing Management Area	Mitchell-Treaty Twinned Tunnels					
	Construction Access Adit		x	x		
	Mitchell-Treaty Saddle Area	x	x	x		x
	Camp 6: Treaty Saddle Camp	x	x	x		x
	Camp 5: Treaty Plant Camp	x	x	x		x
	Treaty Operating Camp	x	x	x		x
	Treaty Ore Preparation Complex	x	x	x		x
	Concentrate Storage and Loadout	x	x	x		x
	North Cell Tailing Management Facility	x	x	x		x
	East Catchment Diversion	x	x	x		
	Centre Cell Tailing Management Facility	x	x	x		x
	South Cell Tailing Management Facility	x	x	x		x
	Treaty Creek Access Corridor	x	x	x		x
	Camp 11: Treaty Marshalling Yard Camp	x	x	x		x
Camp 12: Highway 37 Construction Camp	x	x	x		x	
Off-site Transportation	Highway 37 and 37A					x

x = interaction between component and effect.



**Table 18.6-12. Potential Effects from Project on Forest and Alpine Birds**

Project Region	Project Area	Habitat Loss	Sensory Disturbance	Direct Mortality	Chemical Hazards
Mine Area	Camp 3: Eskay Staging Camp	x		x	x
	Camp 7: Unuk North Camp	x		x	x
	Camp 8: Unuk South Camp	x		x	x
	Coulter Creek Access Corridor	x		x	x
	Mitchell Operating Camp	x		x	x
	McTagg Rock Storage Facility	x		x	x
	McTagg Twinned Diversion Tunnels				
	McTagg Power Plant	x		x	x
	Mitchell Rock Storage Facility	x		x	x
	Camp 4: Mitchell North Camp (for MTT construction)	x		x	x
	Mitchell Ore Preparation Complex	x		x	x
	Mine Site Avalanche Control				
	Iron Cap Block Cave Mine				
	Mitchell Pit	x		x	
	Mitchell Block Cave Mine				
	Mitchell Diversion Tunnels				
	Upper Sulphurets Power Plant	x		x	x
	Mitchell Truck Shop	x		x	x
	Water Storage Facility	x		x	x
	Camp 9: Mitchell Initial Camp	x		x	x
	Camp 10: Mitchell Secondary Camp	x		x	x
	Water Treatment & Energy Recovery Area	x		x	x
	Sludge Management Facilities	x		x	x
	Sulphurets Laydown Area	x		x	x
	Sulphurets-Mitchell Conveyor Tunnel				
	Sulphurets Pit	x		x	
	Kerr Rope Conveyor				
	Kerr Pit	x		x	
	Camp 2: Ted Morris Camp	x		x	x
	Explosives Manufacturing Facility	x		x	
	Temporary Frank Mackie Glacier Access Route				
Camp 1: Granduc Staging Camp					x
Processing and Tailing Management Area	Mitchell-Treaty Twinned Tunnels				
	Construction Access Adit	x	x	x	
	Mitchell-Treaty Saddle Area	x	x	x	x
	Camp 6: Treaty Saddle Camp	x	x	x	x
	Camp 5: Treaty Plant Camp	x	x	x	x
	Treaty Operating Camp	x	x	x	x
	Treaty Ore Preparation Complex	x	x	x	x
	Concentrate Storage and Loadout	x	x	x	x
	North Cell Tailing Management Facility	x	x	x	x
	East Catchment Diversion	x	x	x	x
	Centre Cell Tailing Management Facility	x	x	x	x
	South Cell Tailing Management Facility	x	x	x	x
	Treaty Creek Access Corridor	x	x	x	x
	Camp 11: Treaty Marshalling Yard Camp	x	x	x	x
Camp 12: Highway 37 Construction Camp	x	x	x	x	
Off-site Transportation	Highway 37 and 37A				x

x = interaction between component and effect.

**Table 18.6-13. Potential Effects from Project on Western Toad**

Project Region	Project Area	Habitat Loss	Disruption of Movement	Direct Mortality	Attractants	Chemical Hazards
Mine Area	Camp 3: Eskay Staging Camp					X
	Camp 7: Unuk North Camp	X	X			X
	Camp 8: Unuk South Camp	X	X			X
	Coulter Creek Access Corridor	X	X	X	X	X
	Mitchell Operating Camp					X
	McTagg Rock Storage Facility					X
	McTagg Twinned Diversion Tunnels					
	McTagg Power Plant					X
	Mitchell Rock Storage Facility					X
	Camp 4: Mitchell North Camp (for MTT construction)					X
	Mitchell Ore Preparation Complex					X
	Mine Site Avalanche Control					
	Iron Cap Block Cave Mine					
	Mitchell Pit					
	Mitchell Block Cave Mine					
	Mitchell Diversion Tunnels					
	Upper Sulphurets Power Plant					X
	Mitchell Truck Shop					X
	Water Storage Facility					X
	Camp 9: Mitchell Initial Camp					X
	Camp 10: Mitchell Secondary Camp					X
	Water Treatment & Energy Recovery Area					X
	Sludge Management Facilities					X
	Sulphurets Laydown Area					X
	Sulphurets-Mitchell Conveyor Tunnel					
	Sulphurets Pit					
	Kerr Rope Conveyor					
	Kerr Pit					
	Camp 2: Ted Morris Camp					X
	Explosives Manufacturing Facility					
Temporary Frank Mackie Glacier Access Route						
Camp 1: Granduc Staging Camp					X	
Processing and Tailing Management Area	Mitchell-Treaty Twinned Tunnels					
	Construction Access Adit					
	Mitchell-Treaty Saddle Area	X	X			X
	Camp 6: Treaty Saddle Camp					X
	Camp 5: Treaty Plant Camp					X
	Treaty Operating Camp					X
	Treaty Ore Preparation Complex					X
	Concentrate Storage and Loadout					X
	North Cell Tailing Management Facility					X
	East Catchment Diversion					X
	Centre Cell Tailing Management Facility					X
	South Cell Tailing Management Facility					X
	Treaty Creek Access Corridor	X	X	X	X	X
Camp 11: Treaty Marshalling Yard Camp					X	
Camp 12: Highway 37 Construction Camp				X	X	
Off-site Transportation	Highway 37 and 37A			X		X

x = interaction between component and effect.

### 18.6.3 Closure

The assessment for the closure phase of the Project will be the same as post-closure; therefore, the effects scoping summary for closure also applied to the post-closure phase (see Section 18.6.4 below). A portion of the Project infrastructure will be removed and some of the areas will be re-vegetated. The following infrastructure will remain open or partially open:

- Mitchell operating camp;
- Mine Site closure channels and associated access roads;
- McTagg Twinned Diversion Tunnels;
- McTagg Power Plant;
- Mitchell RSF fuel storage;
- Mitchell-Treaty Twinned Tunnels closure portal;
- substations and 25 kV transmission lines;
- Mine Site Avalanche Control;
- Iron Cap return air portal;
- Mitchell Pit closure dam and spillway;
- Mitchell Diversion Tunnels;
- Upper Sulphurets Power Plant;
- Water Storage Facility, Water Treatment Plant, and Energy Recovery Facility;
- sludge warehouse and sludge storage;
- Mitchell-Treaty Twinned Tunnels;
- Treaty Adit road;
- Saddle portal;
- Treaty Saddle road;
- Treaty operating camp;
- Mitchell-Treaty Twinned Tunnels east portal;
- Treaty office complex, ambulance building, and Administration Building;
- North and South Cell seepage collection dams; and
- Treaty Creek Access Corridor (including TCAR and transmission line).

During closure and post-closure, indirect mortality and chemical hazards were identified as potential effects regarding wildlife and wildlife habitat ([Appendix 18-E](#) and Tables 18.6-2 to 18.6-13). Project-related effects during closure and post-closure assessed within the wildlife and wildlife habitat effects assessment include:

- **Indirect Mortality:** potential effects on wildlife from mortality caused by increased access and hunting pressure. Access would be retained along the TCAR and potentially along the transmission line right-of-way (ROW) clearing; the TCAR will remain controlled.
- **Chemical Hazards:** wildlife may uptake chemicals of potential concern from camp or industrial sites, water in the WSF, TMF, or receiving environments, from ingestion of dust, or from via bioaccumulation from vegetation or prey species.

### 18.6.4 Post-closure

The assessment for the post-closure phase of the Project is the same as the assessment for the closure phase of the Project. Therefore, the two phases are presented together throughout the effects assessment. Please refer to Section 18.6.4 above for the scoping summary for the post-closure phase.

## 18.7 Potential for Residual Effects for Wildlife and Wildlife Habitat

Given the hierarchical nature of biological systems, potential wildlife effects are discussed at two levels: the individual animal level (e.g., behaviour, physiological condition, and survival) and the population level (population size, distribution, mortality rate, reproductive fitness). A population is defined as “a group of organisms coexisting at the same time and place and capable of interbreeding” or “as a group of non-specific organisms that occupy a loosely defined geographic region and exhibit reproductive continuity from generation to generation” (Futuyma 1979). Because the geographic population boundaries for local populations considered in this assessment are unknown and dynamic, some portions of the assessment are qualitative. Effects at the population level are considered more heavily, and hence have a greater rating magnitude, compared to those at the individual level. Thus, the assessment primarily focuses on potential effects on local populations within the RSA, or in some cases (e.g., for species with small home ranges such as hoary marmot), within the LSA.

The assessment considers the statutory requirements and policy statements which influence wildlife management. These include provincial and federal legislation, policies, and best management practice guidelines applicable to wildlife and wildlife habitat in BC. The assessment also considers wildlife objectives and management direction outlined in relevant LRMPs, SRMPs, and wildlife policy documents.

The wildlife and wildlife habitat effects assessment was prepared according to applicable best management guidelines and the *Environmental Assessment Best Practice Guideline for Wildlife at Risk in Canada* (Environment Canada 2004), and in accordance with Section 12.10 of the AIR (Rescan 2010b). The assessment is based on current available knowledge of species behaviour, presence, distribution, population biology, and ecology. Consideration is also given to linkages between potential effects from the proposed development that occur on both the individual (e.g., an animal’s response to noise) and local population level (e.g., population change due to altered habitat), where applicable.

From the scoping assessment, seven potential effects were identified: habitat loss and alteration, sensory disturbance, disruption of movement patterns, direct mortality, indirect mortality, attractants, and chemical hazards. Each of these potential effects, including proposed mitigation and residual effects is discussed in further detail in the following sections.

### **18.7.1 Habitat Loss and Alteration**

Habitat will be lost or altered within the Project footprint during construction and operation. The amount of habitat affected for each of the 11 VCs was calculated by overlaying the Project footprint on Habitat Suitability Modelling for each wildlife VC. The results of this analysis are described in Sections 18.7.1.1 to 18.7.1.9.

The Project RSA is located in an area with old-growth forests, wetlands, riparian forests, and alpine terrain, which provide habitat to a diverse wildlife community. The Project will result in the loss or alteration of varying amounts of all habitat types. Various Project components including, but not limited to, roads, transmission line, TMF, process plant, camps, and waste rock storage contribute to the overall habitat loss and alteration.

Habitat is defined as the suite of resources (e.g., food and shelter) and environmental conditions (both abiotic and biotic) that determine the presence, survival, and reproduction of a population. Habitat quality can be rated by the suitability of the habitat to provide important life requisites, namely feeding and shelter. Habitat suitability models were created during baseline studies for five wildlife VCs using standard provincial methods (RISC), and ground-truthed against survey data ([Appendix 18-B](#)). A sixth VC (black bear) was modelled for the environmental setting. After the habitat suitability baseline report was completed, a request was made by working group members that habitat suitability models for black bears be completed; therefore, these models were completed for the environmental setting (Section 18.1.5.2).

Direct habitat loss and alteration was calculated using habitat suitability models developed for the following six VCs:

- moose (early winter and late winter);
- mountain goat (winter and summer);
- grizzly bear (spring, summer, fall, denning);
- black bear (spring, summer, fall, denning);
- American marten (winter); and
- hoary marmot (growing season: spring, summer, and fall combined).

Habitat suitability mapping was not undertaken for raptors, wetland birds, forest, and alpine birds, or western toads. Habitat loss and alteration assessments for these species were evaluated from habitat features surveyed in the field and identified from vegetation mapping (Chapter 17).

The habitat loss and alteration assessment was based on the Project footprint and a 300-m buffer area around all infrastructure in the event that small changes are made to the infrastructure

layout. The outcome of the effects assessment will not be affected by any minor adjustments of infrastructure within the evaluated Project footprint and 300-m buffer.

The amount of suitable habitat that will be lost or altered due to the Project was calculated by overlaying the Project footprint on habitat suitability maps developed using HSRs for each of the assessed species. The habitat assessment considers habitat loss as areas permanently lost (direct loss due to the footprint), degraded (habitat within a 300-m buffer of the Project footprint), and fragmented (habitat surrounded on three or more sides by development or infrastructure). A 300-m buffer was used to include the maximum extent of the areas where vegetation is expected to be degraded due to the Project (See Chapter 17; Forman and Alexander 1998; Seiler 2001) or wildlife are expected to avoid due to a combination of disturbance, scents, etc.

The habitat rankings for the areas associated with the species-specific habitat models provided the basis for discussion of the availability and quality of habitat to be lost or altered as a result of the proposed Project. In addition to habitat suitability and vegetation analysis, important wildlife habitat or features (e.g., salt licks) identified through baseline studies, land and resource management plans, existing inventories, academic studies, and TK/TU studies were considered when assessing potential effects of habitat loss and alteration on wildlife VCs.

Direct habitat loss and alteration will begin during the construction phase of the Project and will continue throughout the operation phase. Some habitat loss, such as mine development and the TMF, will be incremental from construction throughout operation. The discussion of habitat loss and figures presented focus on the total amounts lost and altered at the end of the operation phase, as this will represent the largest extent of the Project footprint. Wherever possible, reclamation activities will be undertaken to restore habitat following closure. The areas to be reclaimed and reclamation plans are described in Chapter 27.

### **18.7.1.1 Mitigation for Habitat Loss and Alteration**

Mitigation for direct habitat loss and alteration varies with each VC species. Project mitigation for habitat will include, but is not limited to:

- avoidance of important habitat where practicable alternatives are available (e.g., habitat loss and alteration was minimized through Project design changes in the Saddle Area by placing the conveyor underground, and in the PTMA by moving the process plant out of wetland habitat);
- avoidance of clearing vegetation during wetland bird, forest bird, and raptor breeding periods and working within timing windows as required and possible (BC *Wildlife Act* [1996c]);
- implementation of pre-construction surveys when required (e.g., if construction activities occur during the breeding season or hibernation);
- implementation of buffer zones free of activity when necessary (e.g., around active nests, breeding ponds, or dens); and
- re-vegetation of some reclaimed components post-closure.

Detailed information regarding mitigation and management of habitat loss and alteration for wildlife VCs is described in the Wildlife and Wildlife Habitat Management Plan (Section 26.21.1).

### **18.7.1.2 Potential for Residual Effects**

Of the 11 VCs assessed for habitat loss effects, 10 VCs (with the exception of bats) are predicted to have residual effects due to habitat loss and alteration, as described in the following sections (Table 18.7-1).

### **18.7.1.3 Ungulates (Moose and Mountain Goats): Potential Residual Effects due to Habitat Loss and Alteration**

This assessment evaluates the effects of habitat loss and alteration on two ungulate species: moose and mountain goat. Potential effects due to habitat loss will likely occur in areas where Project infrastructure overlaps high-quality moose and goat habitat.

Most ungulates have large home ranges and use a variety of elevations and habitat types throughout the seasons. Winter habitat is generally considered to limit the number of animals, such as moose and mountain goat that can be supported by a land base. Metabolic demands increase in winter because of the effort required to move through deep snow packs and tolerate colder weather (Safford 2004), and this occurs during a season where forage has a lower nutritional value. The quality and quantity of forage available in winter influences how quickly summer fat reserves are depleted, thereby affecting changes of survival and reproduction (BC MELP 2000). Conservation of ungulate winter range is an objective of the land and resource management plans associated with the LSA and RSA for these reasons (i.e., Nass South SRMP, Cassiar Iskut-Stikine LRMP). Therefore, the assessment of habitat loss and alteration due to the Project focuses on the loss and alteration of winter range for moose and mountain goat. Loss and alteration of mountain goat UWR u-6-002 in the RSA was also assessed. The mountain goat assessment also includes an evaluation of summer habitat loss and alteration because mountain goats are also susceptible to disturbance during the kidding season in spring and summer, and since kidding habitat requires very specific and limited topographic features.

High and Moderately High suitability habitat (HSR 1 and 2) from Habitat Suitability Modeling ([Appendix 18-B](#)) is hereafter referred to collectively as “high-quality habitat” for moose and mountain goat.

#### **18.7.1.3.1 Moose**

##### Moose Habitat Requirements and Availability

The assessment of habitat loss and alteration for moose focuses on early and late winter habitat. The habitat ratings use a combination of the availability of high-quality winter browse, snow depth, thermal cover, and predation risk (Dussault, Ouellet, et al. 2005) which is a RISC-standard approach. Early winter habitat is largely defined by forage availability. However, during late winter, the building snow pack restricts moose range into a smaller area.

Overall, 40,637 ha of high-quality early winter moose habitat was identified within the RSA, and 5,864 ha was identified within the LSA. High-quality habitat was largely concentrated in the

interior-influenced area of the RSA; along the Bell-Irving River, the lower Treaty Creek drainage, and around Bowser Lake, particularly within areas of recent logging near Highway 37, and within large wetlands complexes (e.g., the complex located at the confluence of Teigen Creek, Snowbank Creek, and the Bell-Irving River ([Appendix 18-B](#)).

Within the RSA, 20,928 ha of high-quality late-winter habitat were identified, while 2,082 ha of late-winter habitat was present in the LSA. The distribution of high-quality late-winter habitat was similar to the early winter habitat, particularly along Highway 37 from Bell II south to Bowser Lake, and along Treaty Creek. These areas were also proposed as an UWR for moose (UWR 6-018) under the FRPA, which is 51,476 ha; 25,270 ha are within the RSA and 2,069 ha are within the LSA along Treaty Creek. Aerial survey data from late winter confirms that areas modelled as high-quality winter habitat contained the majority of moose in the RSA ([Appendix 18-A](#)).

During baseline surveys conducted in winter 2009 ([Appendix 18-A](#)), 180 moose (not adjusted for sightability) were observed, the majority of which (84%) were along the Bell-Irving River, Treaty Creek, and Bowser Lake. Three survey units (SUs) overlap with the TCAR and the PTMA (SUs 12, 13, and 20) and three SUs overlap with the CCAR and Mine Site (SUs 3, 7, and 8; [Appendix 18-A](#)). Only one moose was observed within the three SUs near the Mine Site (i.e., coastal area) near the Unuk River, suggesting that the Mine Site contains relatively poor-quality habitat. Within the three SUs that overlap the TCAR and PTMA, 19 moose (11%) were observed along Treaty Creek ([Appendix 18-A](#)).

### Moose Habitat Loss and Alteration

*Early Winter:* Habitat mapping identified 40,637 ha of high-quality early winter habitat for moose in the RSA. Of this area, 2,554 ha (6.3%) will be lost or altered as a result of Project development (Table 18.7-2; Figures 18.7-1a, b). Habitat loss and alteration will begin during the construction phase (2,365 ha) and continue through the operation phase, when an additional 189 ha will be lost. Most of this loss and alteration (1,723 ha, 67%) will occur during vegetation clearing for the PTMA (TMF, TCAR, and process plant site; Figure 18.7-1b).

*Late Winter:* Of the 20,928 ha of high-quality late-winter habitat identified in the RSA for moose, 648 ha (3.1% of the RSA) will be lost or altered during the construction phase (Table 18.7-2). No further alteration will occur as a result of Project development during the operation phase. Most of the habitat loss and alteration will occur in association with the development of the TCAR (546 ha). This area overlaps with proposed UWR 6-018, 443 ha of which will be affected.

In total, 6.8% of combined early and late-winter habitat will be lost or altered within the RSA during the operation phase (Table 18.7-2), and 42% within the LSA. At post-closure, some portions of the TMF will be reclaimed to moose early winter habitat. During the life of the Project, 867 ha of high-quality (HSR 1 and 2) early winter habitat will be lost or altered within the TMF footprint. Some of this (62 ha) may be suitable for reclamation if monitoring indicates the water and vegetation are safe for wildlife (Chapter 26). If deemed safe for wildlife, 62 ha of the PTMA will be reclaimed to riparian edge, which will have an early winter habitat rating of HSR 2. No late-winter habitat will be reclaimed (Chapter 27).

**Table 18.7-1. Potential Residual Effects on Wildlife and Wildlife Habitat Valued Components due to Habitat Loss**

Valued Component	Timing Start	Project Area(s)	Project Component(s)	Description of Effect due to Project Component(s)	Type of Project Mitigation	Project Mitigation Description	Potential Residual Effect	Description of Residuals
Moose	Construction	PTMA and Mine Site	TMF, access roads, plant site	Direct habitat loss and alteration	Management Practices, Monitoring and Adaptive Mangement	Partial deactivation of some mine components (e.g., Coulter Creek access road) and partial revegetation post-closure. Majority of TMF will be reclaimed; however, during the early years of closure phase wildlife may need to be prevented from accessing the TMF until monitoring programs indicate water quality and associated vegetation are safe.	Yes	The effect of direct habitat loss is predicted to result in a residual effect on moose. However, the amount of highly suitable winter habitat for moose that will be lost (particularly associated with the TMF and Treaty Creek access road) represents a relatively small portion (7%) of the total amount of winter habitat available in the study area, and reclamation activities will be designed to restore comparable habitat upon closure. Despite mitigation, a residual effect of habitat loss on the moose population is predicted.
Mountain Goat	Construction	PTMA and Mine Site	Mine Site (excluding Coulter Creek access road) and small portions of the higher elevations of the TMF	Direct habitat loss and alteration	Management Practices, Monitoring and Adaptive Mangement	In the Mine Site, rock storage suitable for reclamation post-closure.	Yes	Permanent and temporary loss of high quality winter (1,150 ha) and summer (1,703 ha) habitat, including a portion of UWR u-6-002 (547 ha). The effect of direct habitat loss is predicted to result in a residual effect on mountain goats. During the winter, mean mountain goat home range size can be as small as 20 ha, up to 271 ha; therefore, the loss of winter habitat associated with the Project could be equivalent to a maximum of 69.4 home ranges, or as little as five home ranges (average 37 homeranges).
Grizzly Bear	Construction	PTMA and Mine Site	TMF, access roads, plant site, RSFs	Direct habitat loss and alteration	Management Practices, Monitoring and Adaptive Mangement	Partial deactivation of some mine components (Coulter Creek access road) and partial revegetation at mine closure. Majority of TMF will be reclaimed but wildlife will be excluded until monitoring programs indicate water quality and associated vegetation are safe.	Yes	The effect of direct habitat loss is predicted to result in a residual effect on grizzly bears. Habitat loss will occur in the proposed grizzly bear WHA (1,807 ha), salmon spawning habitat (493 ha of stream), and high quality spring, summer, fall, and denning habitat (10,886 ha); the majority of the area will not return to baseline conditions; therefore residual effects are expected.
Black Bear	Construction	PTMA and Mine Site	TMF, access roads, plant site, RSFs	Direct habitat loss and alteration	Management Practices, Monitoring and Adaptive Mangement	Partial deactivation of some mine components (Coulter Creek access road) and revegetation post closure. Majority of TMF will be reclaimed but wildlife excluded until monitoring programs indicate water quality and associated vegetation are safe.	Yes	Permanent (RSFs, TMF) and temporary (Coulter Creek access road) loss of high quality denning habitat (4,653 ha) will occur (7.8% of the RSA). Spring, summer, fall, and denning combined will result in the loss of 11,132 ha of habitat (6.4% of the RSA). Despite mitigation, the effect of direct habitat loss is predicted to result in a residual effect on the black bear population.
American Marten	Construction	PTMA and Mine Site	TMF, access roads, RSFs	Direct habitat loss and alteration	Management Practices, Monitoring and Adaptive Mangement	Partial reclamation of Coulter Creek access road. Majority of TMF will be reclaimed but wildlife excluded until monitoring programs indicate water quality and associated vegetation are safe.	Yes	Loss of mature forest (6,317 ha), which is high-value habitat that represents a small proportion of available habitat in the RSA. The amount of highly suitable marten habitat that will be altered represents the home ranges for 12 male and 20 female American marten, based on average home ranges of 525 ha for males and 316 ha for females. Despite mitigation, a residual effect on the American marten population is predicted.
Hoary Marmot	Construction	PTMA and Mine Site	TMF (high elevation), Treaty Creek access road, Mitchell-Treaty Saddle Area, pits, RSFs, and site roads	Direct habitat loss and alteration	Management Practices, Monitoring and Adaptive Mangement	Partial deactivation of some mine components and partial revegetation at mine closure	Yes	Nine colonies will be lost due to habitat removal, and 3,845 ha of suitable habitat will be lost. Despite mitigation, a residual effect on the marmot population is predicted.
Bats	Construction	PTMA and Mine Site	TMF, Treaty Creek access road, Coulter Creek access road, McTagg RSF, and Sulphurets RSF	Direct habitat loss and alteration	Management Practices, Monitoring and Adaptive Mangement	Prior to Project construction, the McTagg valley will be surveyed for bat hibernacula; if a cave-based bat hibernacula is found, MFLRO or the applicable agency will be notified and mitigation enacted, as possible.	No	Loss of 4,435 ha of habitat is not likely to affect local population. The carrying capacity of the landscape for bats is therefore unlikely to be affected by habitat loss given the large amount of habitat available in the study area. No residual effects for bat habitat loss are anticipated after mitigation.
Raptors	Construction	PTMA and Mine Site	TMF, Treaty Creek access road, Coulter Creek access road, RSFs, site roads	Direct habitat loss and alteration	Management Practices, Monitoring and Adaptive Mangement	Conduct clearing outside raptor sensitive periods where active raptor nests are present and establish and adhere to buffer zones and working procedures established for working around identified active raptor nests during raptor sensitive periods. Pre-clearing surveys to identify active and non-active raptor nests. If an active nest cannot be avoided or work must be undertaken within buffer areas, a nest monitoring program would be initiated. Inactive raptor nests or nests found outside of the breeding season would be maintained or relocated, in consultation with BC MFLNRO, or the appropriate agency.	Yes	Loss of 6,341 ha of suitable habitat (7.4% of available habitat in the RSA and 46% of available habitat in the LSA). The effect of direct habitat loss is predicted to result in a residual effect on raptors. In general, most raptors (e.g., American kestrel, red-tailed hawk, merlin, and great horned owls) are robust to some habitat alteration near their nests. Despite mitigation, a residual effect is predicted.
Wetland Birds	Construction	PTMA and Mine Site	TMF, Treaty Creek access road, Coulter Creek access road, and Sulphurets RSF	Direct habitat loss and alteration	Management Practices, Monitoring and Adaptive Mangement	Avoid active wetland bird nests by conducting clearing outside breeding periods (April 1 to July 31; Section 34 of the <i>Wildlife Act</i> ) or through pre-clearing surveys for wetland bird nests in suitable habitat when clearing is required within the breeding period. If nests are found, a buffer area, free of noise and construction activity, would be established and implemented around wetland bird nests for the duration of the breeding period. Majority of TMF will be reclaimed but wildlife excluded until monitoring programs indicate water quality and associated vegetation are safe.	Yes	Permanent loss of suitable wetland habitat (311 ha), cavity nesting habitat (4,435 ha) and riverine habitat (14.3 ha) not likely to affect local population; however, despite mitigation, a residual effect is anticipated.
Forest and Alpine Birds	Construction	PTMA and Mine Site	All	Direct habitat loss and alteration	Management Practices, Monitoring and Adaptive Mangement	Avoid active forest bird nests by conducting clearing outside breeding periods (April 1 to July 31; Section 34 of the <i>Wildlife Act</i> ) or through pre-clearing surveys for bird nests in suitable habitat when clearing is required within the breeding bird period. If a nest is found, a buffer area, free of noise and construction activity, would be established and implemented around nests for the duration of the breeding period.	Yes	Forest bird abundance relatively low in the LSA; loss of relatively small portion of habitat not likely to affect local population. Habitat alteration would likely affect nesting opportunities for forest birds on a local scale. However, it is expected that birds will move to other territories and the disruption will be temporary in nature. Despite mitigation, a residual effect is anticipated.
Western Toad	Construction	PTMA and Mine Site	Treaty Creek access road and Coulter Creek access road	Direct habitat loss and alteration	Management Practices, Monitoring and Adaptive Mangement	Partial deactivation of some mine components and partial revegetation at mine closure.	No	Toad breeding along Teigen Creek and Hodkin Lake, outside of the LSA, none located in the footprint. Loss of relatively small amount of potentially suitable habitat (3 suitable wetlands) not likely to affect local population; therefore, no residual effect is predicted.

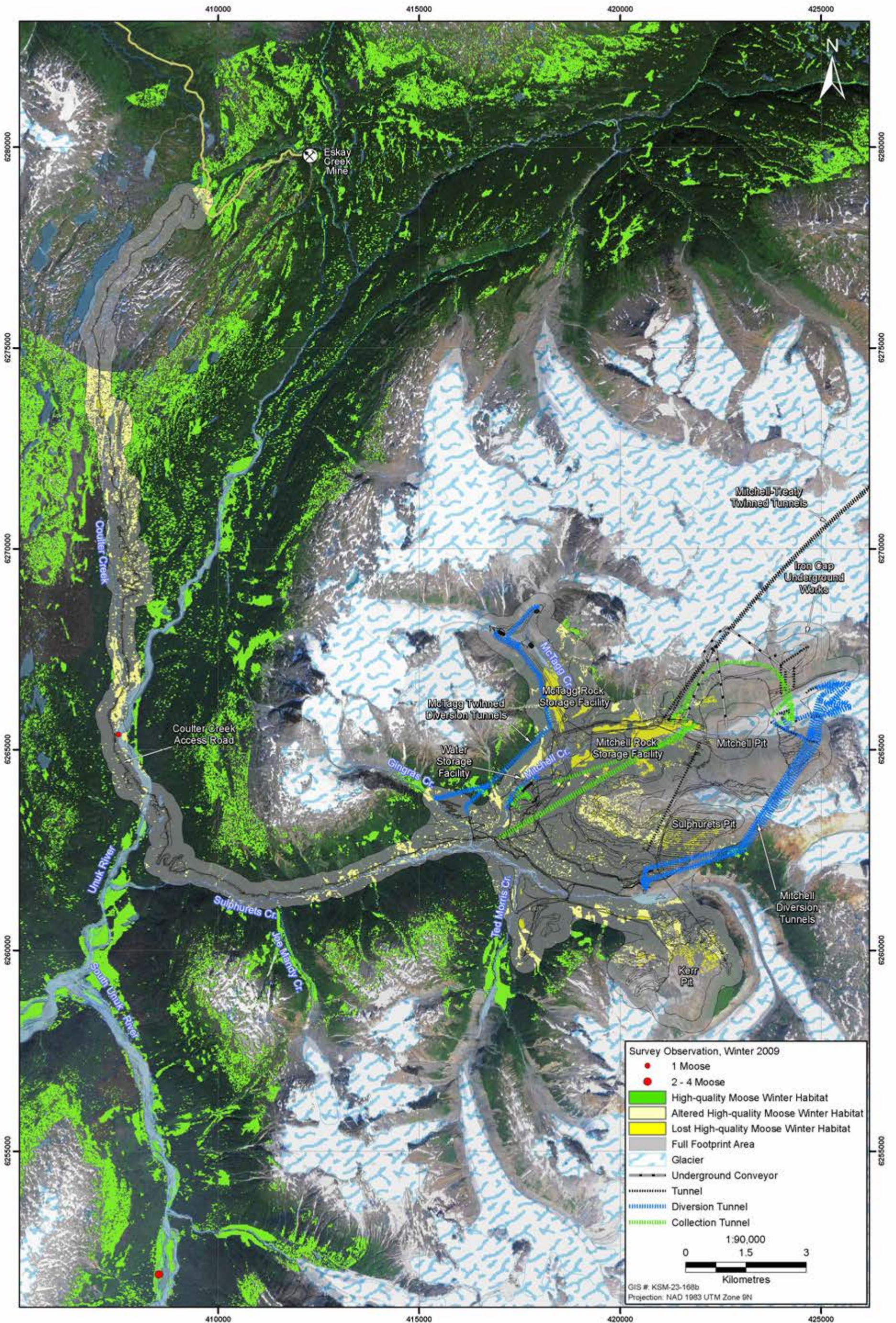
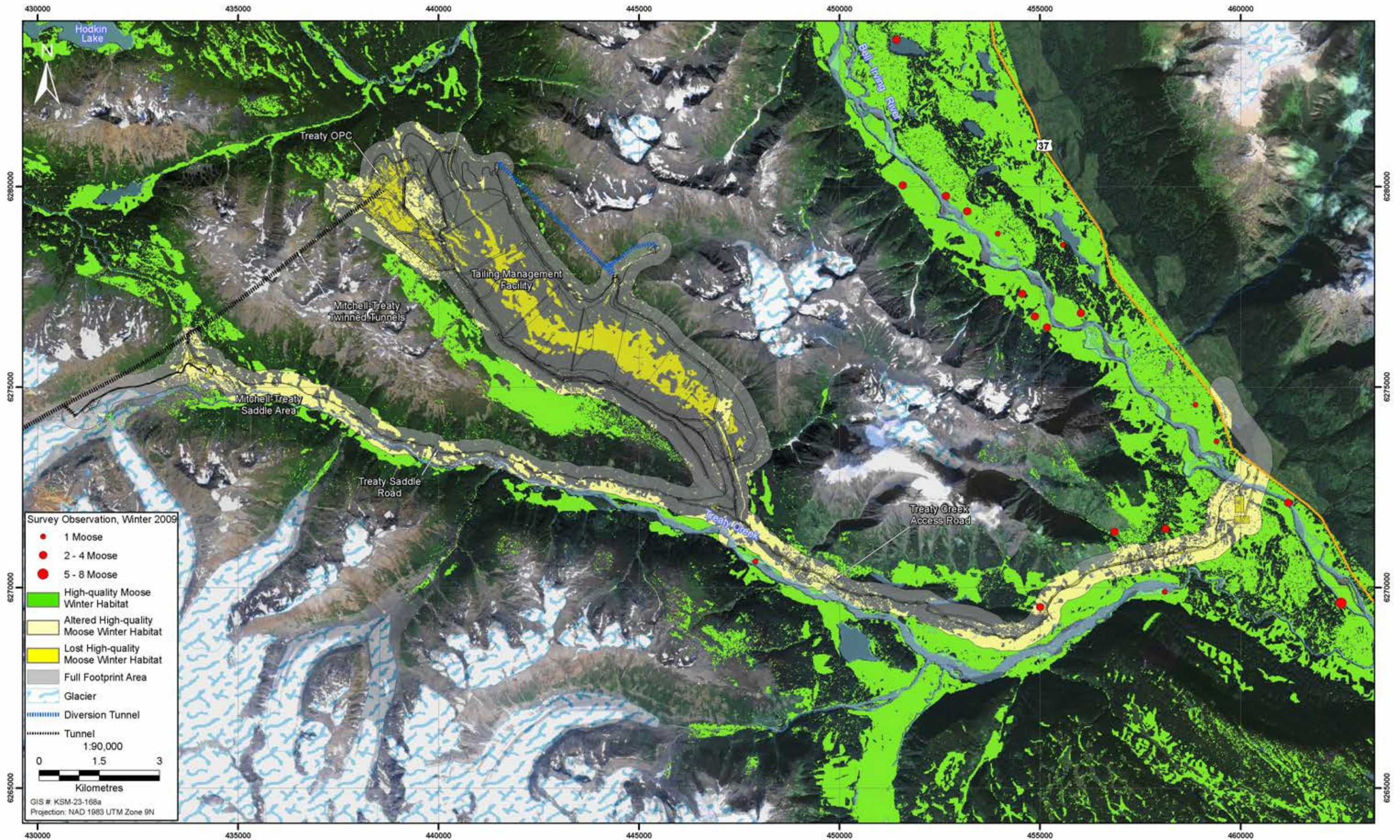


Figure 18.7-1a



Survey Observation, Winter 2009

- 1 Moose
- 2 - 4 Moose
- 5 - 8 Moose
- High-quality Moose Winter Habitat
- Altered High-quality Moose Winter Habitat
- Lost High-quality Moose Winter Habitat
- Full Footprint Area
- Glacier
- Diversion Tunnel
- Tunnel

1:90,000

0 1.5 3  
Kilometres

GIS # KSM-23-168a  
Projection: NAD 1983 UTM Zone 9N

Figure 18.7-1b

**Table 18.7-2. Moose Habitat Loss and Alteration<sup>1</sup> due to the Project**

Season	Habitat Lost and Altered (ha)	RSA		LSA	
		Total Habitat <sup>2</sup> (ha)	Habitat Lost/Altered (%)	Total Habitat <sup>2</sup> (ha)	Habitat Lost/Altered (%)
Early Winter	2,554	40,637	6.3	5,864	43.6
Late Winter	648	20,928	3.1	2,082	31.1
Total Early and Late Winter <sup>3</sup>	2,765	40,623	6.8	6,581	42.0
Proposed UWR 6-018	443	25,270	1.8	2,069	21.4

<sup>1</sup>Maximum loss and alteration of habitat is given whether it occurs during the construction or operation phases; see text for definition of habitat loss.

<sup>2</sup>Total habitat refers to high-quality habitat in the RSA and LSA; see text for definition of high-quality habitat.

<sup>3</sup>An additional 162 ha of early and late winter habitat will be lost during the construction phase outside of the RSA due to construction of the Transmission Line Connector near Treaty Creek.

Residual Effects for Moose due to Habitat Loss and Alteration

Direct habitat loss and alteration is predicted to result in a residual effect on moose. The amount of high-quality winter habitat that will be affected (2,765 ha) is 7% of the total amount of winter habitat available in the RSA, and 42% of the total amount of winter habitat available in the LSA. In addition, 443 ha (0.9%) of the proposed moose UWR 6-018 will be altered due to the TCAR. Mean multiannual home range size for moose south of the RSA (NWA) is 17,130 ha, but can be as small as 990 ha, or as large as 79,170 ha (M. W. Demarchi 2003); therefore, the loss and alteration of winter habitat associated with the Project (2,765 ha) could be equivalent to 16% of a moose’s home range (maximum of 2.8 home ranges, or as little as 3.5% of a home range). Reclamation activities may restore 62 ha of high-quality early winter habitat upon closure within the TMF footprint if the water and vegetation are deemed safe for wildlife consumption. Despite mitigation, a residual effect of habitat loss and alteration on moose is predicted.

**18.7.1.3.2 Mountain Goat**

Mountain Goat Habitat Requirements and Availability

Habitat selection by mountain goats is largely driven by topographical features. Steep escape terrain (i.e., cliff habitat) is a critical factor that drives selection of both summer and winter goat habitats (Herbert and Turnbull 1977). High-quality habitats are areas close to escape terrain that support high-quality forage, such as shrubs, herbs, and krumholtz. Summer habitats tend to be vegetated areas near escape terrain above treeline on south and west-facing slopes. Winter habitats tend to be similar areas, but downslope, below the treeline. Within the RSA, 58,511 and 76,718 ha of high-quality winter and summer habitat, respectively, were identified through habitat suitability mapping.

Within the LSA, 6,687 ha and 9,028 ha of high-quality winter and summer habitat, respectively, were identified. In addition, 14,195 ha of UWR u-6-002 overlap with the RSA, 9,832 ha (69%) of which overlaps with the high-quality winter habitat mapped using habitat suitability mapping. Of the 14,195 ha of UWR in the RSA, 3,094 ha (21.8%) falls within the LSA. These high-quality habitats were distributed across most of the mountainous terrain of the LSA, with large blocks in the east along the Snowslide Range, and throughout the massif of mountains and icefield defined

by the Unuk and Bowser rivers and Treaty Creek, with a concentration surrounding John Peaks and the Unuk Finger, north and south of the proposed Mine Site.

**Mountain Goat Habitat Loss and Alteration**

*Winter Habitat:* Habitat mapping identified 58,511 ha of high-quality winter habitat for mountain goats in the RSA. Of this area, 1,150 ha (2% of the RSA, 17.2% of the LSA) will be lost or altered as a result of Project development (Figures 18.7-2a, b). Habitat loss and alteration will begin during the construction phase (522 ha) and continue through the operation phase, when an additional 628 ha will be affected. Most of this loss and alteration (1,013 ha, 88%) is due to development of the Mine Site, including the pits, waste rock storage, and roads (Figure 18.7-2a).

A total of 547 ha (3.8%) of the 14,195 ha of UWR u-6-002 within the RSA will be lost or altered during the operation phase (Figure 18.7-3a, b), 309 ha of which is also considered high-quality winter habitat based on suitability models. To avoid double counting the area of winter habitat from the models that overlap with the UWR, this leaves an additional 238 ha of UWR that was not already considered lost based on the habitat suitability model calculations. A total of 1,388 ha of winter habitat (1,150 ha of high-quality winter habitat and 238 ha of UWR) will be lost or altered by the end of the operation phase. At post-closure, 357 ha of winter habitat may be suitable for reclamation at the Mine Site (Chapter 27). Reclamation activities would occur near the pits and RSFs.

*Summer Habitat:* In the RSA, 76,718 ha of high-quality summer habitat was identified for mountain goats. Of this area, 1,703 ha (2.2% of the RSA, 18.9% of the LSA) will be lost or altered as a result of Project development. Habitat loss and alteration will begin during the construction phase (841 ha) and continue through the operation phase, when an additional 862 ha will be affected (Table 18.7-3). Of this area, 1,413 ha (83%) is due to the development of the Mine Site.

**Table 18.7-3. Mountain Goat Habitat Loss and Alteration<sup>1</sup> due to the Project**

Season	Habitat Lost and Altered (ha)	RSA		LSA	
		Total Habitat <sup>2</sup> (ha)	Habitat Lost/Altered (%)	Total Habitat <sup>2</sup> (ha)	Habitat Lost/Altered (%)
Winter	1,150	58,511	2.0	6,687	17.2
Summer	1,703	76,718	2.2	9,028	18.9
Total Winter and Summer	1,703	76,757	2.2	9,028	18.9
UWR	547	14,195	3.8	3,094	17.7

<sup>1</sup>Maximum loss and alteration of habitat is given whether it occurs during the construction or operation phases; see text for definition of habitat loss.

<sup>2</sup>Total habitat refers to high-quality habitat in the RSA and LSA; see text for definition of high-quality habitat.

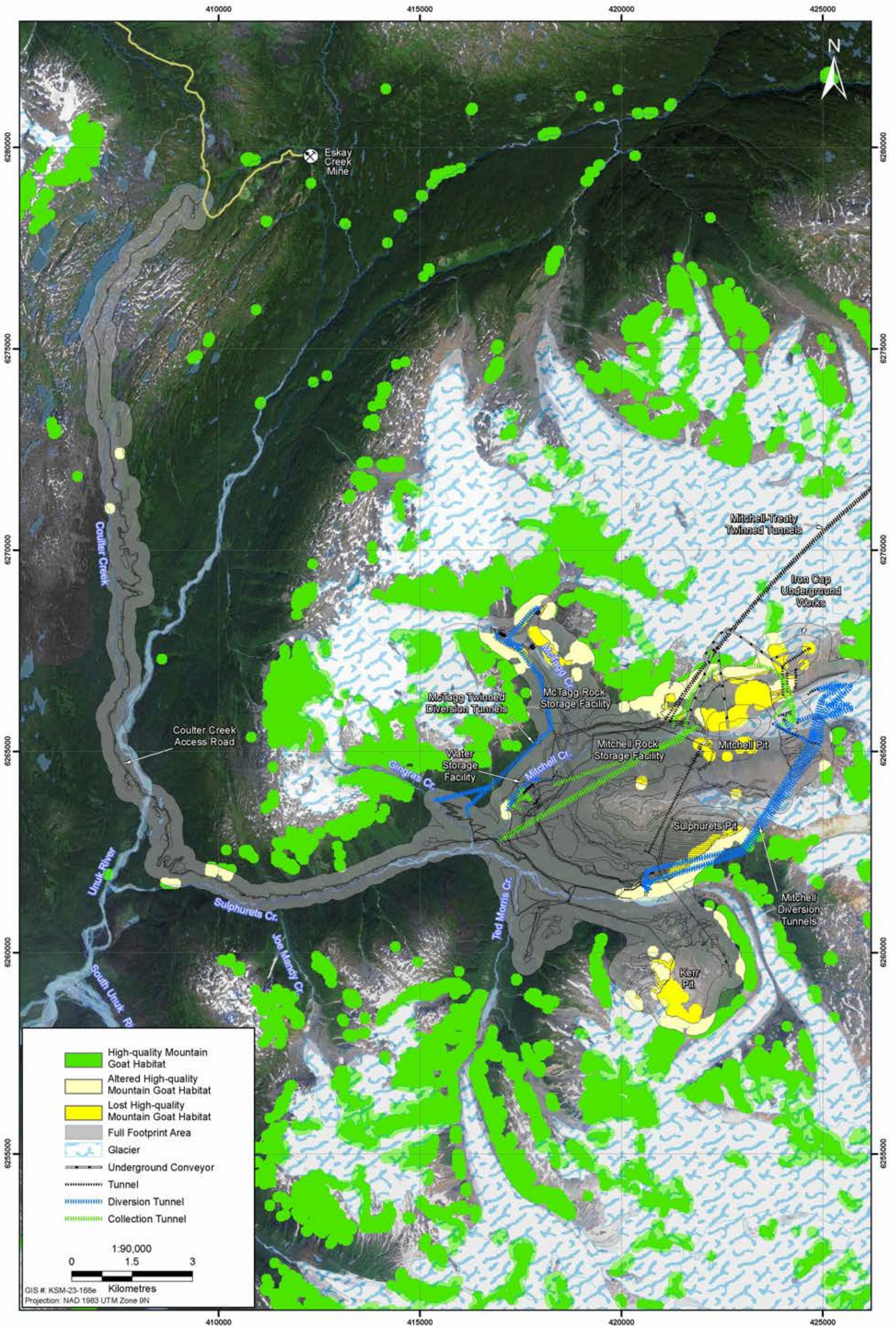


Figure 18.7-2a

Figure 18.7-2a

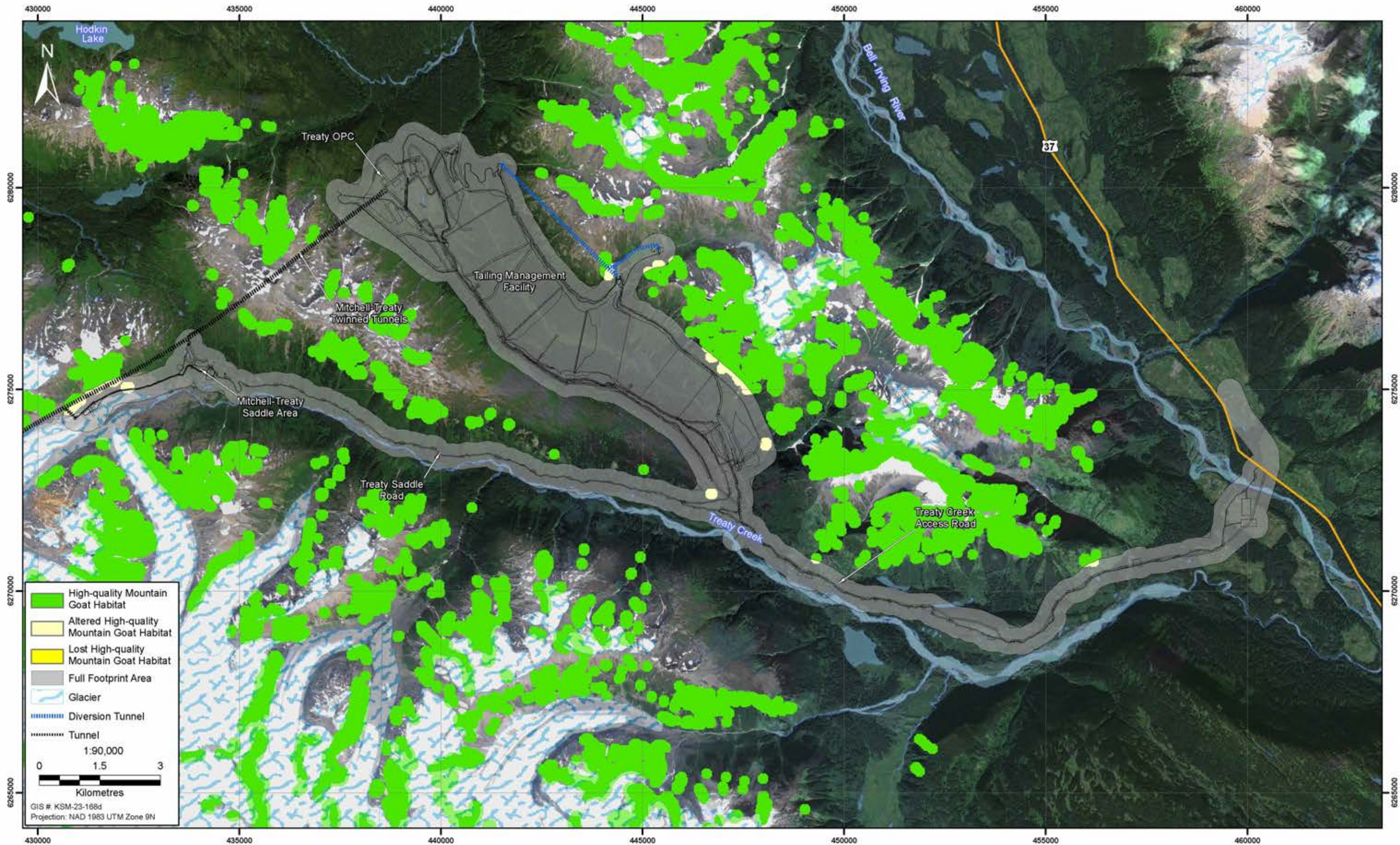


Figure 18.7-2b

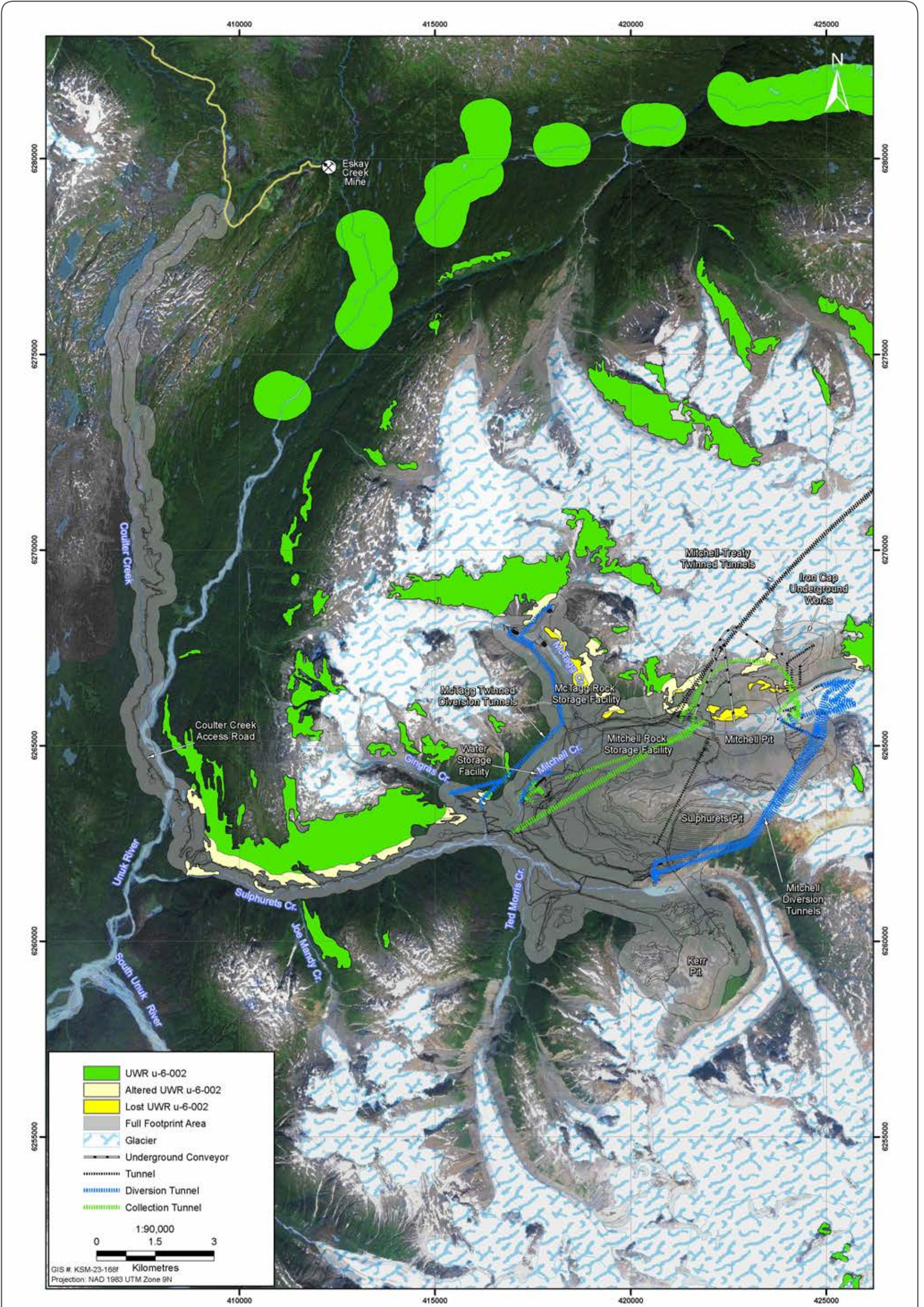
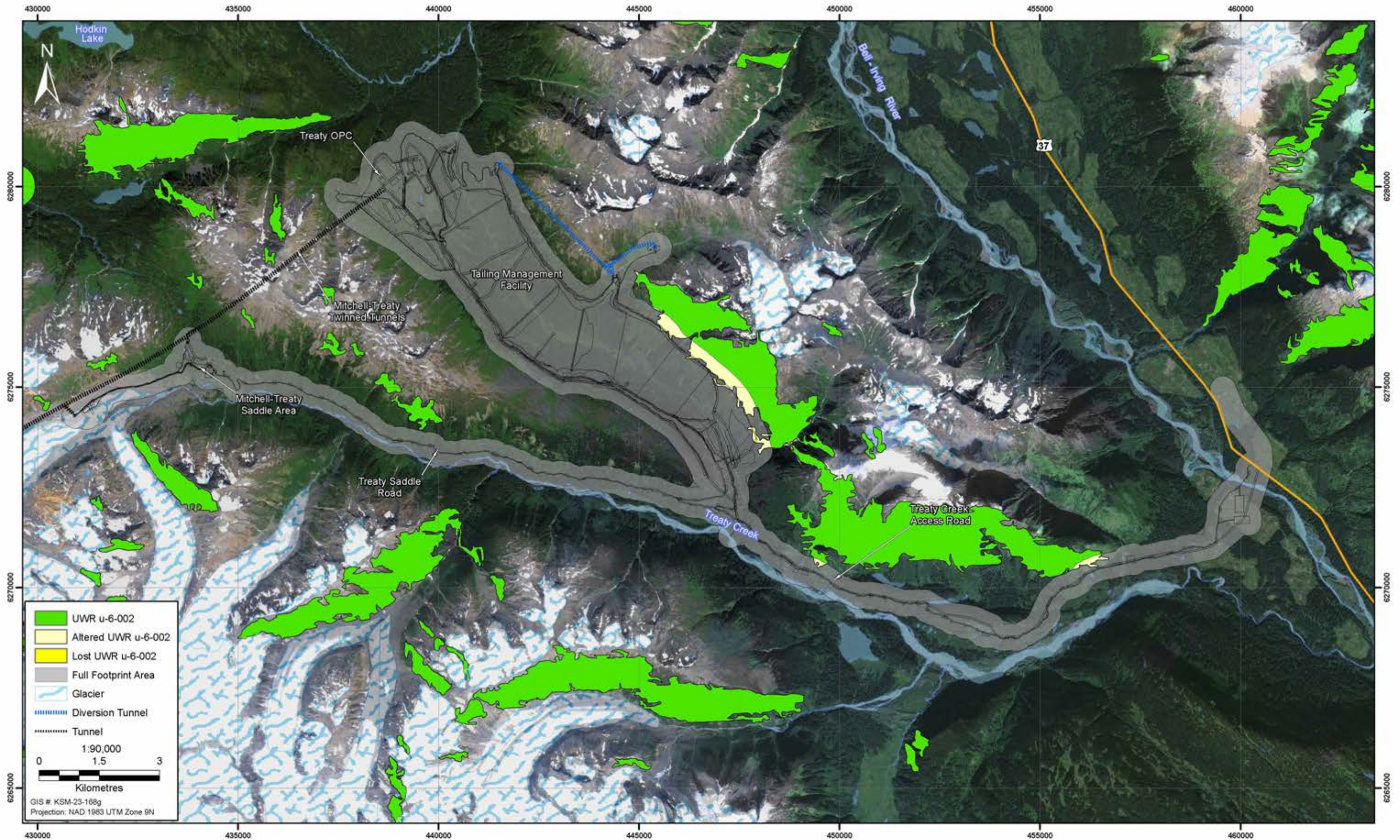


Figure 18.7-3a

Figure 18.7-3a



	UWR u-6-002
	Altered UWR u-6-002
	Lost UWR u-6-002
	Full Footprint Area
	Glacier
	Diversion Tunnel
	Tunnel

1:90,000  
0 1.5 3  
Kilometres

GIS # KSM-23-168g  
Projection: NAD 1983 UTM Zone 9N

Figure 18.7-3b

At post-closure, 334 ha of summer habitat may be suitable for reclamation at the Mine Site (Chapter 27). Reclamation activities would occur near the pits and the RSFs. In total, 2.2% of habitat available for mountain goats within the RSA will be lost (Table 18.7-3), and 18.9% of available habitat within the LSA will be lost.

### Residual Effects for Mountain Goats due to Habitat Loss and Alteration

The effect of direct habitat loss and alteration is predicted to result in a residual effect on mountain goats. During the winter, mean mountain goat home range size is approximately 140 ha for females and 271 ha for males (Taylor, Wall, and Kulis 2006), but can be as small as 20 ha (Fox, Smith, and Schoen 1989); therefore, the loss and alteration of winter habitat from habitat suitability modelling and the UWR associated with the Project (1,388 ha) could be equivalent to a maximum of 69.4 home ranges, or as little as five home ranges (average 37 home ranges). In addition, the Project development overlaps approximately 547 ha of designated UWR; UWRs are legislatively protected and development may not occur within these areas, unless an exemption permit is issued.

#### **18.7.1.4 Bears: Potential Residual Effects due to Habitat Loss and Alteration**

To evaluate the potential effects of the proposed Project on bear habitat, the RSA was mapped using habitat suitability models. The availability of suitable habitat for grizzly and black bears varies within and between seasons. Habitat loss and alteration for grizzly and black bears was therefore assessed for spring, summer, fall, and winter denning habitat. Loss and alteration of proposed WHA for grizzly bear in the RSA was also assessed. Habitats ranked as High or Moderately High was considered the most suitable habitat and is referred to as high-quality habitat hereafter. For denning habitat, habitat ranked as High or Moderate for the models was considered high-quality habitat.

##### **18.7.1.4.1 Grizzly Bear**

###### Grizzly Bear Habitat Requirements and Availability

Approximately two-thirds of the 31 grizzly bears identified using DNA mark-recapture techniques were detected in the coastal-influenced portion of the RSA, principally along the Unuk River, where considerable salmon resources draw bears to the river. The remaining one-third of grizzly bears were in the interior-influenced portion of the RSA in the large areas of high-quality foraging habitat for vegetation along Treaty and Teigen creeks, the Bell-Irving River, and Bowser Lake. The interior-influenced area provides abundant high-quality vegetation forage but does not provide the same level of salmon resources as the Unuk River.

*Spring:* Within the RSA, 90,377 ha of high-quality spring habitat was identified, 14,214 ha of which is within the LSA. High-quality habitat was identified in low elevation riverine habitat around Bowser Lake in the southeast section of the RSA, in the Coulter Creek Access Corridor below Eskay Creek, and in the Treaty Creek Access Corridor, on the slopes above the proposed TMF. High-quality habitat was also identified in mid to high elevation habitats such as open avalanche chutes. In early spring, high-quality grizzly bear habitat is typically limited to lower elevations due to the deeper snow packs at higher elevations. Early spring habitat in the RSA supports occupied moose winter range, and moose carrion from winter kills enhances the value of this habitat for grizzly bears.

*Summer:* A total of 129,309 ha of high-quality summer habitat was identified within the RSA, 20,176 ha of which is within the LSA. Most of this habitat occurred in the PTMA, along Treaty Creek (a salmon stream), and the Coulter Creek Access Corridor below Eskay Creek. High-quality summer habitat includes areas capable of producing abundant *Vaccinium* species, devils club, or other berry-producing plants, and is generally upslope from spring habitat.

*Fall:* As the amount of high-quality vegetation declines in the fall, so does the area of fall habitat for bears. The amount of high-quality fall habitat available within the RSA is much lower than the amount of high-quality summer habitat. Within the RSA, 26,532 ha of high-quality fall habitat was identified, 3,804 ha of which falls within the LSA. For the most part, these habitats were located along the Bell Irving River south of Bell II, along the Lower Treaty Creek drainage (a salmon spawning stream), and along the Bowser River and on both sides of Bowser Lake. A small amount was identified in the Coulter Creek Access Corridor just below Eskay Creek, and on east-facing slopes above the proposed TMF.

*Denning:* Overall, 2,346 ha of high-quality winter denning habitat were identified for grizzly bears at high elevation in the LSA. Denning habitat was only modelled in the LSA because soil depth information was required from TEM mapping, as opposed to spring, summer, and fall habitats which were mapped for the RSA. The majority of the high-quality denning habitat occurred in pockets along slopes above Ted Morris and McTagg creeks, and on the small mountain between the proposed TMF and the Treaty Creek drainage. There was no high-quality denning habitat identified within the proposed pits and other infrastructure within the Mine Site.

### *Proposed Wildlife Habitat Area (WHA)*

A proposed grizzly bear WHA overlaps with the RSA. WHA 6-282 covers an area of 47,941 ha. A total of 21,008 ha of the proposed WHA 6-282 overlaps the RSA, 3,779 ha of which are within the LSA. The proposed WHA is primarily within the TMF and TCAR.

### Grizzly Bear Habitat Loss and Alteration

Habitat loss and alteration will begin during the construction phase and continue through the operation phase. Most habitat loss and alteration will occur due to the proposed TMF, the TCAR, and the CCAR (Figure 18.7-4a, b). Table 18.7-4 shows the maximum amount of high-quality habitat for grizzly bear that will be affected due to the Project for the four seasons and for the proposed WHA. Across the four seasons, 6.3% of grizzly bear habitat within the RSA (39.3% within the LSA) will be lost or altered due to Project development (Table 18.7-4).

In addition, a proposed grizzly bear WHA overlaps with the RSA. Of the 21,008 ha of proposed WHA that overlaps the RSA (3,779 ha within the LSA), 1,807 ha (8.6% of the RSA and 47.8% of the LSA) will be lost or altered by the end of the operation phase, particularly within the TMF and the TCAR. The loss represents 3.8% of the entire proposed WHA (total size of the WHA is 41,941 ha).

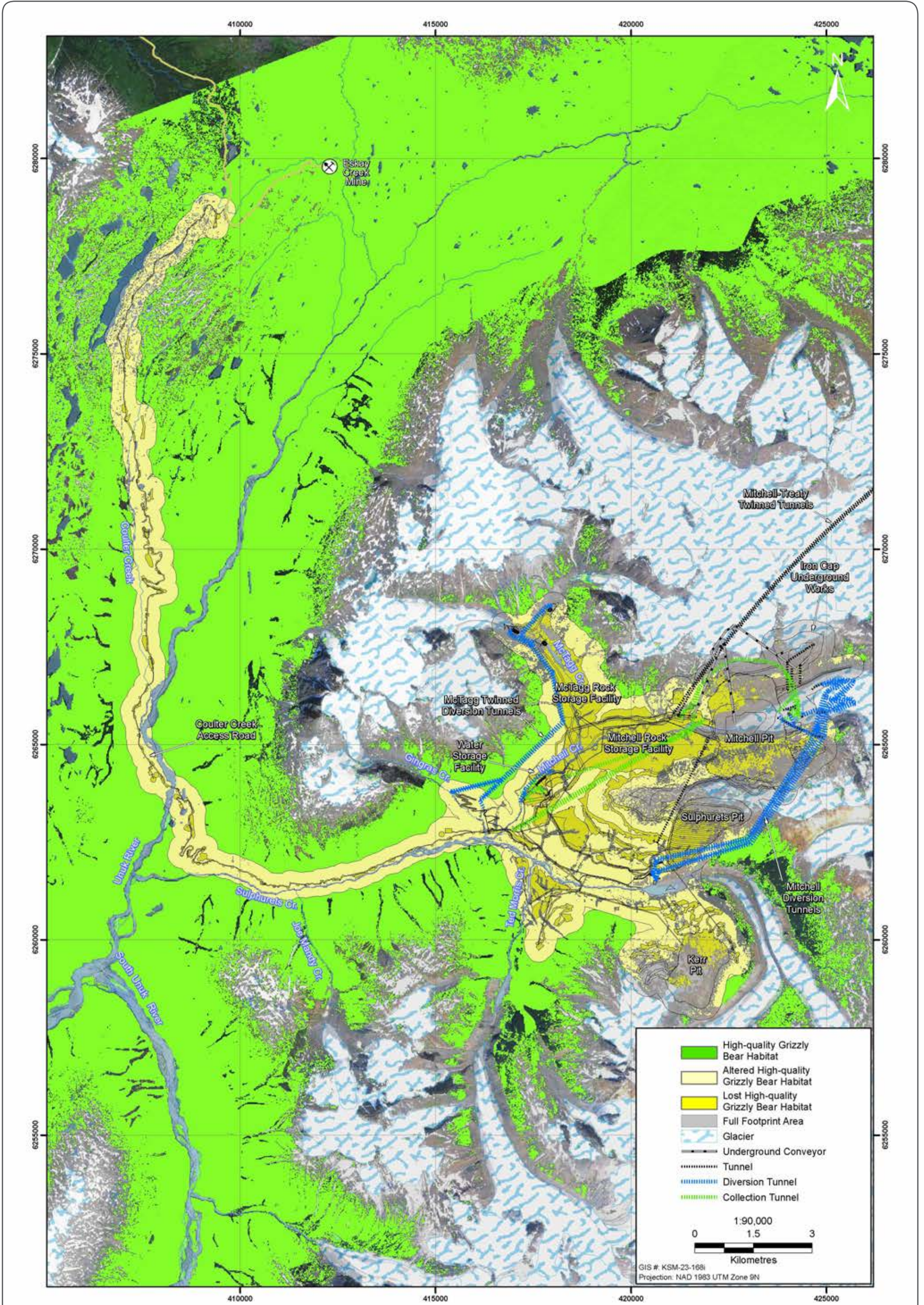


Figure 18.7-4a

Figure 18.7-4a

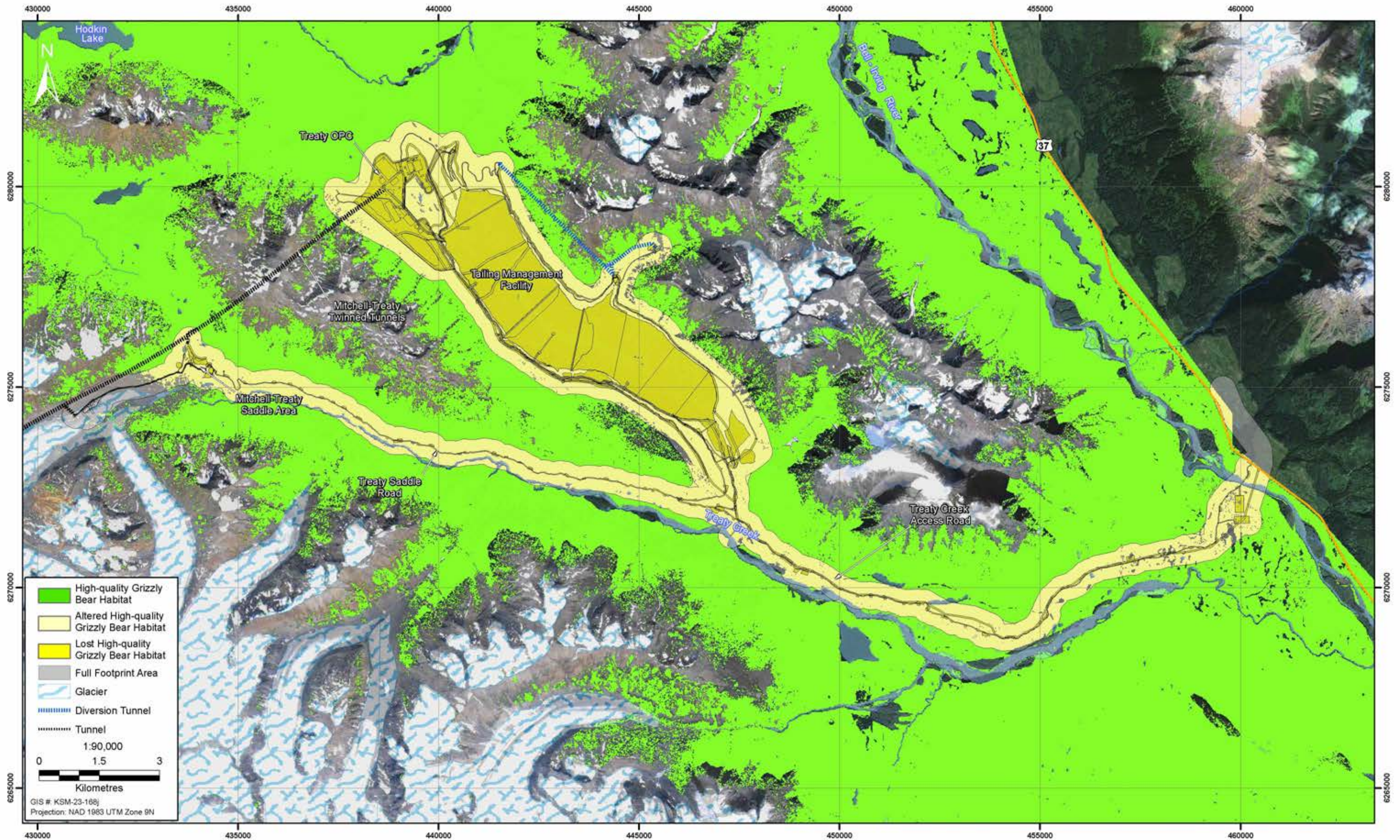


Figure 18.7-4b

**Table 18.7-4. Grizzly Bear Habitat Loss and Alteration<sup>1</sup> due to the Project**

Season	Habitat Lost and Altered (ha)	RSA		LSA	
		Total Habitat <sup>2</sup> (ha)	Habitat Lost/Altered (%)	Total Habitat <sup>2</sup> (ha)	Habitat Lost/Altered (%)
Spring	5,000	90,377	5.5	14,214	35.2
Summer	7,874	129,309	6.1	20,176	39.0
Fall	1,077	26,532	4.1	3,804	28.3
Winter (denning) <sup>3</sup>	308	-- <sup>3</sup>	-- <sup>3</sup>	2,346	13.1
Four season combined <sup>4</sup>	10,886	172,614	6.3	27,734	39.3
Proposed WHA <sup>5</sup>	1,807	21,008	8.6	3,779	47.8

<sup>1</sup>Maximum loss and alteration of habitat is given whether it occurs during the construction or operation phases; see text for definition of habitat loss.

<sup>2</sup>Total habitat refers to high-quality habitat in the RSA and LSA; see text for definition of high-quality habitat.

<sup>3</sup>The winter denning area was mapped for the LSA because soils information was required, which was collected in the LSA, but not in the RSA (Chapter 17).

<sup>4</sup>An additional 158 ha of habitat will be lost during construction phase outside of the RSA due to construction of the Transmission Line Connector near Treaty Creek.

<sup>5</sup>The WHA habitat loss and alteration calculation does not consider where the WHA overlaps with high-quality habitat previously counted as lost; therefore, some areas have been counted twice.

At post-closure, approximately 849 ha of the TMF will be suitable for reclamation for grizzly bear spring and/or summer habitat if monitoring indicates the water and vegetation are safe for wildlife (Chapter 26). The TMF dam face may provide 132 ha of summer habitat and PTMA may provide 717 ha of spring habitat (both expected to be HSR 2). At the Mine Site, 186 ha will be suitable for reclamation, consisting of sloped and flat herb meadow within the RSFs (spring habitat). No denning habitat will be reclaimed (Chapter 27).

Residual Effects for Grizzly Bears due to Habitat Loss and Alteration

Direct habitat loss and alteration is predicted to result in a residual effect on grizzly bears. Overall, the estimated superpopulation of grizzly bears in the RSA is 58 bears (Appendix 18-C). Grizzly bears move seasonally over large home ranges during the growing seasons. Within the RSA, mean home range was estimated to be 11,200 ha (Appendix 18-C). Home ranges for coastal grizzly bears have been estimated as 5,200 ha for females and 13,700 ha for males (Khutzymateen: MacHutchon, Himmer, and Bryden 1993), while interior grizzly bears have been estimated at 10,300 ha for females and 18,700 ha for males (Simpson, Terry, and Hamilton 1997; Ciarniello 2006). A proposed grizzly bear WHA also occurs within the RSA and will be affected. The overall loss and alteration of approximately 10,886 ha is roughly equivalent to 58% of the home range of a single male grizzly bear in the interior of BC, or up to two female coastal grizzly bear home ranges. Based on the estimated grizzly bear superpopulation in the RSA (58 bears; Appendix 18-C), 188 ha of high-quality habitat (10,886 ha) per bear may be altered. Despite mitigation, a residual effect on grizzly bears is predicted.

### 18.7.1.4.2 Black Bear

#### Black Bear Habitat Requirements and Availability

*Spring:* Spring habitat for black bears was assessed by using the spring habitat modelled for grizzly bears. Within the RSA, 90,377 ha of high-quality spring habitat was identified, 14,214 ha of which are within the LSA. High-quality habitat was identified in low elevation riverine habitat around Bowser Lake in the southeast section of the RSA, in the Coulter Creek Access Corridor below Eskay Creek, and in the Treaty Creek Access Corridor, on the slopes above the proposed TMF. High-quality habitat was also identified in mid- to high-elevation habitats such as open avalanche chutes. In early spring, high-quality black bear habitat is typically limited to lower elevations due to the deeper snow packs at higher elevations. Early spring habitat for bears in the RSA overlaps moose winter range, and moose carrion from winter kills enhances the value of this habitat for black bears.

*Summer and Fall:* A total of 129,309 ha of high-quality summer and fall habitat was identified within the RSA, 20,176 ha of which is within the LSA. This habitat was evaluated by using the area modelled as grizzly bear summer habitat. Most of this habitat occurred in the PTMA and Coulter Creek Access Corridor below Eskay Creek. High-quality summer and fall habitat includes areas capable of producing abundant *Vaccinium* species, devils club, or other berry-producing plants.

*Denning:* Black bears den at low elevations in mature and old-growth forest, often within cavities in large diameter cedar and cottonwood trees. Approximately 59,740 ha of high-quality denning habitat were identified for black bears in the RSA and 10,356 ha within the LSA, particularly along the Unuk and Bell-Irving rivers. Large diameter cottonwood trees and snags also occur along the floodplains within the RSA ([Appendix 17-A Vegetation Baseline](#)).

#### Black Bear Habitat Loss and Alteration

Habitat loss and alteration will begin during the construction phase and continue through the operation phase. Most habitat loss and alteration will occur due to the proposed TMF, TCAR, and CCAR (Figure 18.7-5a, b). Table 18.7-5 shows the maximum amount of high-quality habitat for black bears that will be affected due to the Project for the four seasons. Across the four seasons, 6.4% of black bear habitat within the RSA (39.5% within the LSA) will be affected due to Project development (Table 18.7-5).

At post-closure, approximately 849 ha of the TMF will be suitable for reclamation for black bear spring and/or summer habitat if monitoring indicates the water and vegetation are safe for wildlife (Chapter 26). If deemed safe for wildlife, the TMF dam and PTMA will be reclaimed to HSR 2. At the Mine Site, 186 ha will be suitable for reclamation, consisting of sloped and flat herb meadow within the RSFs. No denning habitat will be reclaimed (Chapter 27).

#### Residual Effects for Black Bears due to Habitat Loss and Alteration

The effect of habitat loss and alteration is predicted to result in a residual effect on black bears. A small amount of the proposed Project is predicted to result in the alteration of 6.4% of the available high-quality black bear habitat in the RSA; any habitat alteration would be a limited area of a bear's large home range. Despite mitigation, a residual effect of habitat loss on black bears is predicted.

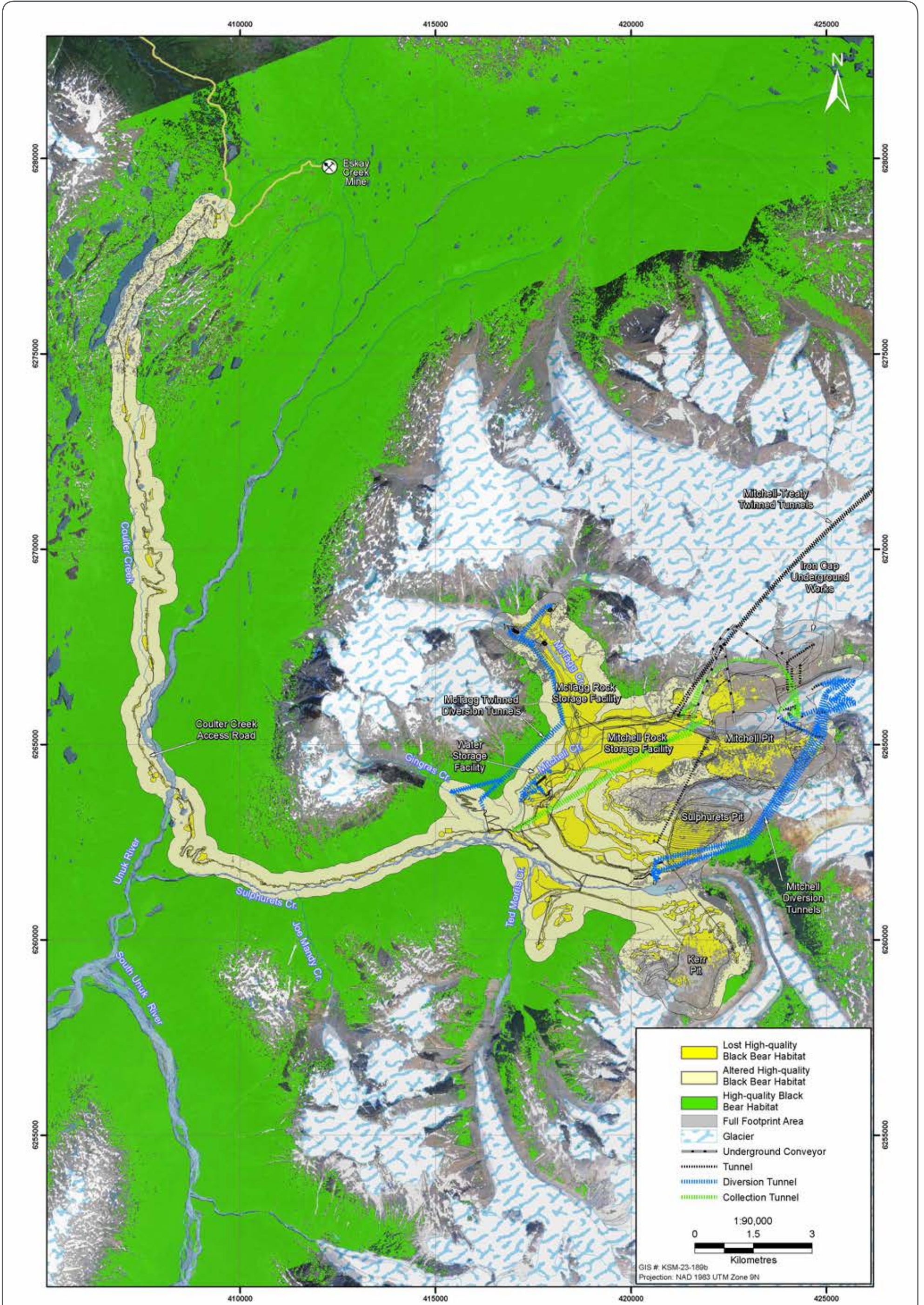


Figure 18.7-5a

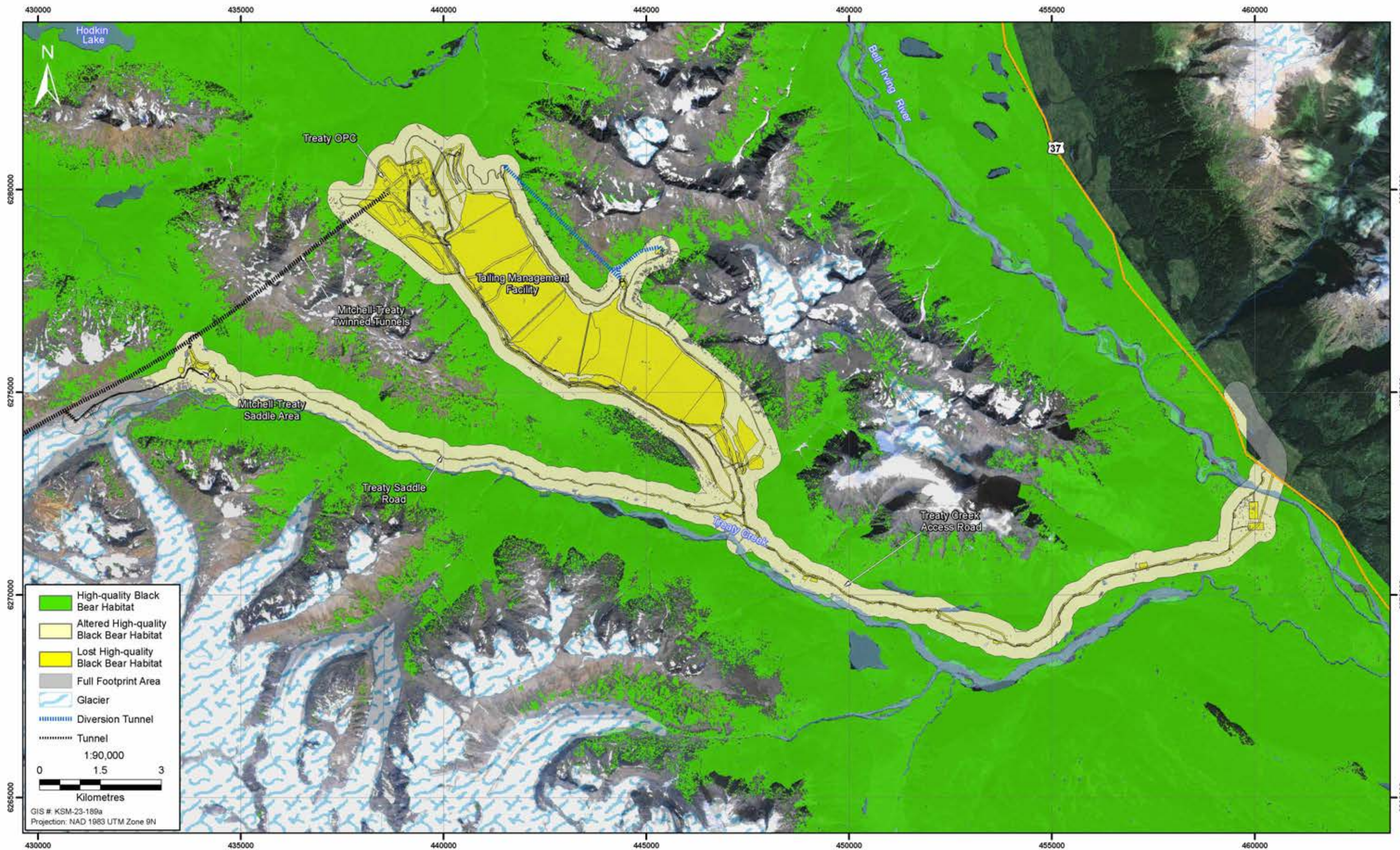


Figure 18.7-5b

**Table 18.7-5. Black Bear Habitat Loss and Alteration<sup>1</sup> due to the Project**

Season	Habitat Lost and Altered (ha)	RSA		LSA	
		Total Habitat <sup>2</sup> (ha)	Habitat Lost/Altered (%)	Total Habitat <sup>2</sup> (ha)	Habitat Lost/Altered (%)
Spring	5,000	90,377	5.5	14,214	35.2
Summer and Fall	7,874	129,309	6.1	20,176	39.0
Winter (denning)	4,653	59,740	7.8	10,356	44.9
Four Season Combined <sup>3</sup>	11,132	174,880	6.4	28,191	39.5

<sup>1</sup>Maximum loss and alteration of habitat is given whether it occurs during the construction or operation phase; see text for definition of habitat loss.

<sup>2</sup>Total habitat refers to high-quality habitat in the RSA and LSA; see text for definition of high-quality habitat.

<sup>3</sup>An additional 158 ha of habitat will be lost during construction outside of the RSA due to construction of the Transmission Line Connector near Treaty Creek.

### **18.7.1.5 American Marten: Potential Residual Effects due to Habitat Loss and Alteration**

#### **18.7.1.5.1 American Marten**

##### American Marten Habitat Requirements and Availability

American marten depend on old forests that contain large trees and coarse woody debris to provide denning and foraging habitat (Strickland and Douglas 1987; Ruggiero et al. 1994; Thompson and Harested 1994). These areas are particularly important during the winter as they host relatively high numbers of voles, which marten take as prey (Koehler, Blakesley, and Koehler 1990). American marten use a more diverse range of structural stage habitat during summer and foraging opportunities increase during this season (Spencer 1987; Buskirk and Powell 1994). Given that American marten show restricted habitat use in the winter compared to other seasons, habitat suitability modelling focused on winter habitat ([Appendix 18-B](#)). Habitats ranked as High or Moderate for the models were considered the most suitable habitat for American marten, and are referred to as high-quality habitat hereafter.

Overall, 84,968 ha of high-quality habitat were identified within the RSA, 13,799 ha of which was in the LSA. Much of the suitable habitat forms large contiguous patches, especially in mature forests along the Unuk River watershed and across lower elevation habitat in the majority of the LSA.

##### American Marten Habitat Loss and Alteration

Of the 84,968 ha of high-quality habitat identified in the RSA, 6,317 ha (7.4% of this habitat in the RSA, 45.8% in the LSA) will be lost or altered as a result of Project development (Figure 18.7-6a, b). Habitat loss and alteration will begin during the construction phase (5,955 ha) and continue through the operation phase, when an additional 362 ha will be affected. Post-closure, the majority will not be reclaimed to mature forest, but 65 ha may be reclaimed to subalpine fir (moderate quality habitat) within the PTMA and 31 ha within the Mine Site (Chapter 27).

### Residual Effects for American Marten due to Habitat Loss and Alteration

The effect of direct habitat loss and alteration is predicted to result in a residual effect on American marten. Reclamation at closure will be designed to restore habitat of comparable value to that lost during mine development and operation. The succession of reclaimed habitat to high-value old forest habitat will take many years and will not be possible in areas such as the TMF and RSFs. To assist in minimizing impacts to individual marten, coarse woody debris will be maintained in adjacent areas where possible, such as along the transmission line ROW (Wildlife Management and Monitoring Plan, Section 26.21).

Changes to American marten home range location and size have been noted in several studies associated with forest development where greater than 25% of the habitat is modified (Hargis, Bissonette, and Turner 1999; Potvin, Courtois, and Belanger 1999; Poole et al. 2004). American marten may also abandon an area, even in the presence of increased prey abundance or low levels of fragmentation, where habitat modification exceeds 25% (Hargis and Bissonette 1997). Development of the Project will not approach this level of habitat change on a landscape scale (i.e., 7.4% of habitat in the RSA will be modified), but will exceed this level within the LSA (46%). In addition, the amount of highly suitable marten habitat that will be altered (6,352 ha) represents the home ranges for a minimum of 12 male and 20 female American marten, based on average home ranges of 525 ha for males and 316 ha for females (Lofroth 1993). Despite mitigation, a residual effect of habitat loss and alteration is predicted for American marten.

### **18.7.1.6 Hoary Marmot: Potential Residual Effects due to Habitat Loss and Alteration**

Loss and alteration of hoary marmot habitat was assessed within the LSA due to the small size of their home ranges. This differs from the assessments for the other 10 VCs, which were assessed in the RSA.

#### ***18.7.1.6.1 Hoary Marmot***

##### Hoary Marmot Habitat Requirements and Availability

Hoary marmots generally live in family colonies that occupy several burrows in mountainous alpine and subalpine habitats with small home range sizes (Nagorsen 2005). Hoary marmots are found on rocky mountain slopes and hillsides and in alpine meadows where they feed on the leaves and blossoms of a variety of alpine grasses and forbs in spring and early summer. In late summer, they feed on seeds (D. S. Lee and Funderburg 1982). In fall, hoary marmots enter dens where they hibernate for up to eight months of the year (Nagorsen 2005). A single habitat model was produced for this species for the growing season; a combination of habitat requirements during spring, summer, and fall ([Appendix 18-B](#)). The hoary marmot model was restricted to the LSA, because soil surficial material information was available for this area and because marmots have a small home range size. Habitats ranked as High or Moderate for the models were considered the most suitable habitat for hoary marmot, and are referred to as high-quality habitat hereafter.

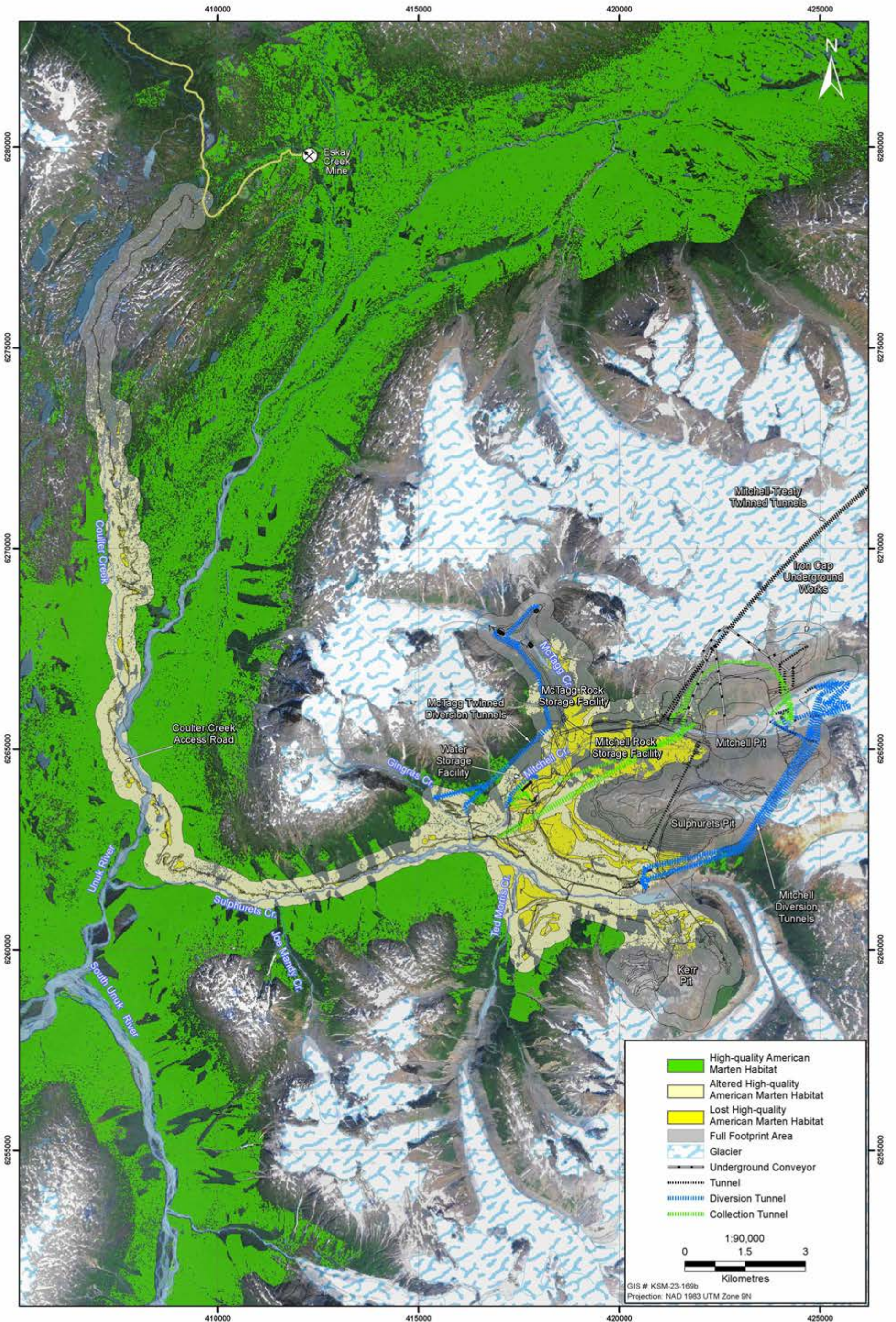


Figure 18.7-6a

Figure 18.7-6a

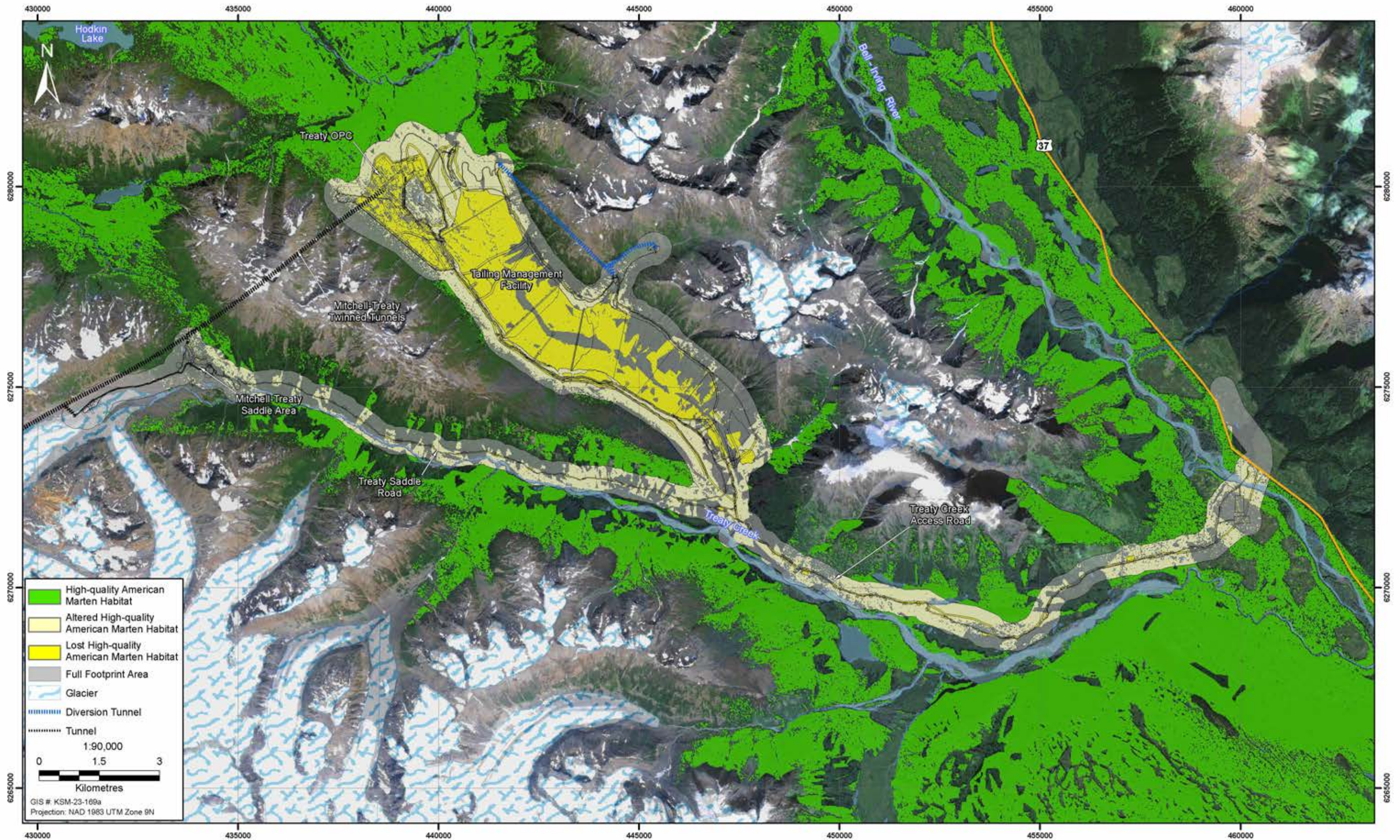


Figure 18.7-6b

A total of 12,992 ha of high-quality habitat for hoary marmot were identified in the LSA, mostly at elevations well above the alignment of the access roads and above the majority of Mine Site infrastructure. High-quality habitats were distributed across the alpine in the LSA. In addition, 49 colonies were identified in the LSA during baseline aerial surveys.

### Hoary Marmot Habitat Loss and Alteration

Of the 12,992 ha of high-quality habitat identified for hoary marmots in the LSA, 3,845 ha (29.6%) will be lost or altered due to the Project. Habitat loss and alteration will begin during the construction phase, when 2,982 ha will be affected, and an additional 863 ha will be affected during the operation phase (Figures 18.7-7a, b). Four colonies were observed in the area that will be altered during construction, and a further five colonies in the area that will be altered during operation. Two of these colonies directly overlap the Project footprint, and the remaining seven are within the 300-m buffer. Most of the habitat loss or alteration will occur in association with the development of pits within the Mine Site (1,828 ha; 48% of the LSA; 7 colonies; Figure 18.7-7a). Post-closure, 186 ha may be suitable for reclamation at the Mine Site, consisting of sloped and flat herb meadow within the RSFs and Sulphurets Pit.

### Residual Effects for Hoary Marmots due to Habitat Loss and Alteration

Habitat loss and alteration is predicted to result in a residual effect on hoary marmots within the LSA. Based on aerial surveys conducted for baseline work, approximately nine of the 49 colonies observed (18%) may be displaced from habitat that will be affected by the development of the Project. However, only two of these colonies directly overlap with the footprint, while the remaining seven are within the 300-m buffer (five colonies) or within fragmented habitat (two colonies).

## **18.7.1.7 Bats: Potential Residual Effects due to Habitat Loss and Alteration**

### ***18.7.1.7.1 Bats***

Although habitat suitability mapping was not done for bats, a qualitative evaluation of habitat loss and alteration on this group was used to infer potential effects and a quantitative evaluation was captured using the assessment for habitat loss and alteration of cavity-nesting waterfowl habitat.

### Bat Habitat Requirements and Availability

Bats in the RSA can roost in both caves/crevices and trees. Caves are an important habitat feature, since they can support large populations in these hibernacula. Caves in this region are typically associated with karst (limestone) topography. The only area in the LSA with exposed limestone is in McTagg Creek, extending south to the Sulphurets Creek. Drilling indicates that the limestone is discontinuous and vertically oriented in a matrix of other sedimentary rock types and contains voids. Therefore there is an unconfirmed potential for cave-based bat hibernacula to occur in the McTagg Valley.

Day roosts are found in tree cavities and crevices close to foraging grounds. Typically, *myotis* species forage over waterbodies, feeding on aquatic insects. Therefore, potential effects associated with loss of maternal roosts from the Project are captured by analyses of loss of cavity-nesting waterfowl habitat, which capture the same habitat features (Section 18.7.1.8).

### Bat Habitat Loss and Alteration

A total of 4,435 ha of mature forest within 1 km of wetland habitat will be lost or altered, which represents 7.9% of available mature forest present within the RSA and 46% within the LSA.

### Residual Effects for Bats due to Habitat Loss and Alteration

Approximately 8% of old and mature seral stage habitat will be lost or altered in the RSA (46% in the LSA). Prior to construction, the McTagg Valley will be surveyed for bat hibernacula; if a cave-based bat hibernaculum is found, BC MFLNRO or the applicable provincial government agency will be notified and mitigation enacted, as possible. After mitigation, no residual effects for bat habitat loss or alteration are anticipated.

### **18.7.1.8 Birds: Potential Residual Effects due to Habitat Loss and Alteration**

Three VCs were selected to evaluate the potential effects of the Project on avifauna: (1) raptors, (2) wetland birds (water dependent birds, waterfowl, shorebirds, and riverine birds), and (3) forest and alpine birds (songbirds and game birds). Habitat loss and alteration within the LSA could adversely affect all three avian VCs. However, as raptors, wetland birds, and forest and alpine birds select and occupy habitat on different spatial and temporal scales, the potential effects of habitat loss and alteration differ between each group. Habitat suitability mapping was not done for birds. Instead, bird habitat was assessed from known habitat preferences and the results of vegetation/ecosystem mapping.

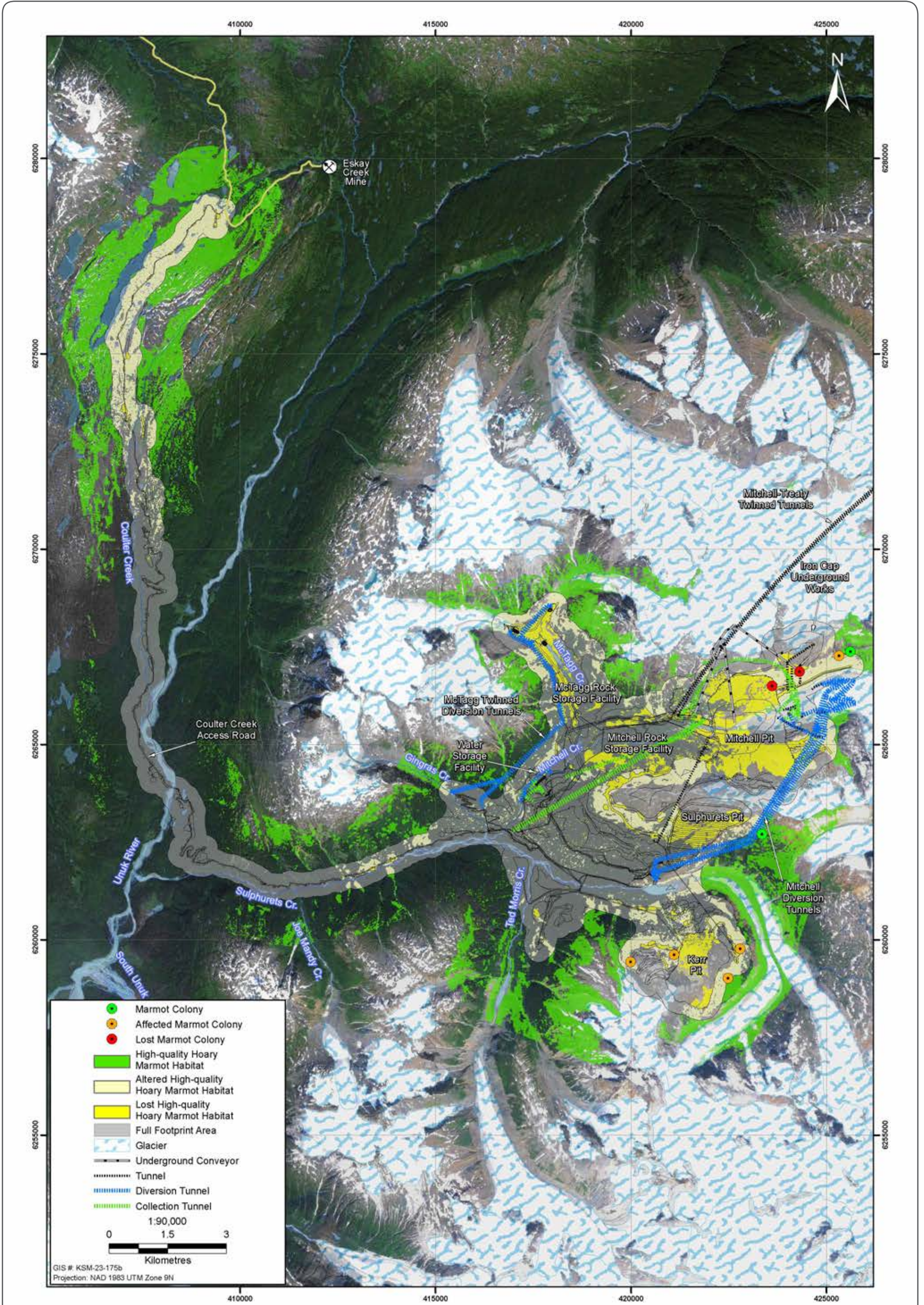
#### ***18.7.1.8.1 Raptors***

##### Raptor Habitat Requirements and Availability

The RSA is known to support at least eight different species of raptors. All raptors are afforded legal protection in BC. Raptor nests and surrounding habitat are sensitive elements, which are protected under the *Wildlife Act* (1996c) and managed through provincial Best Management Practices (BC MWLAP 2005). Appropriate mitigation will be applied to ensure compliance with the *Wildlife Act* (1996c).

Raptors have a variety of nesting patterns. Northern goshawks, for example, typically prefer to nest in large tracts of contiguous mature or old-growth forest, which are found along river and creek drainages (e.g., Unuk, Sulphurets, Teigen, and Treaty creeks) within the RSA (BC MWLAP 2005; BC ILMB 2009). Other species such as northern hawk owls and American kestrels build their nests in tree cavities, often using cavities previously excavated by woodpeckers in old, large diameter trees. Bald eagles and ospreys, on the other hand, build large stick platform nests at the tops of large, old trees. Some raptors, including northern harrier and short-eared owls do not nest in trees, instead creating nests on the ground.

Suitable nesting habitat for raptors was identified as mature and old-growth forests from ecosystem mapping, including structural stages 6 and 7 in all BEC zones, and old, large deciduous trees (structural stage 5) in floodplain forests in the ICH and CWH BECs. A large amount of suitable raptor habitat was modelled within the RSA (86,256 ha) and throughout the LSA (13,927 ha).



Hoary Marmot Habitat Lost or Altered due to the Project

Figure 18.7-7a

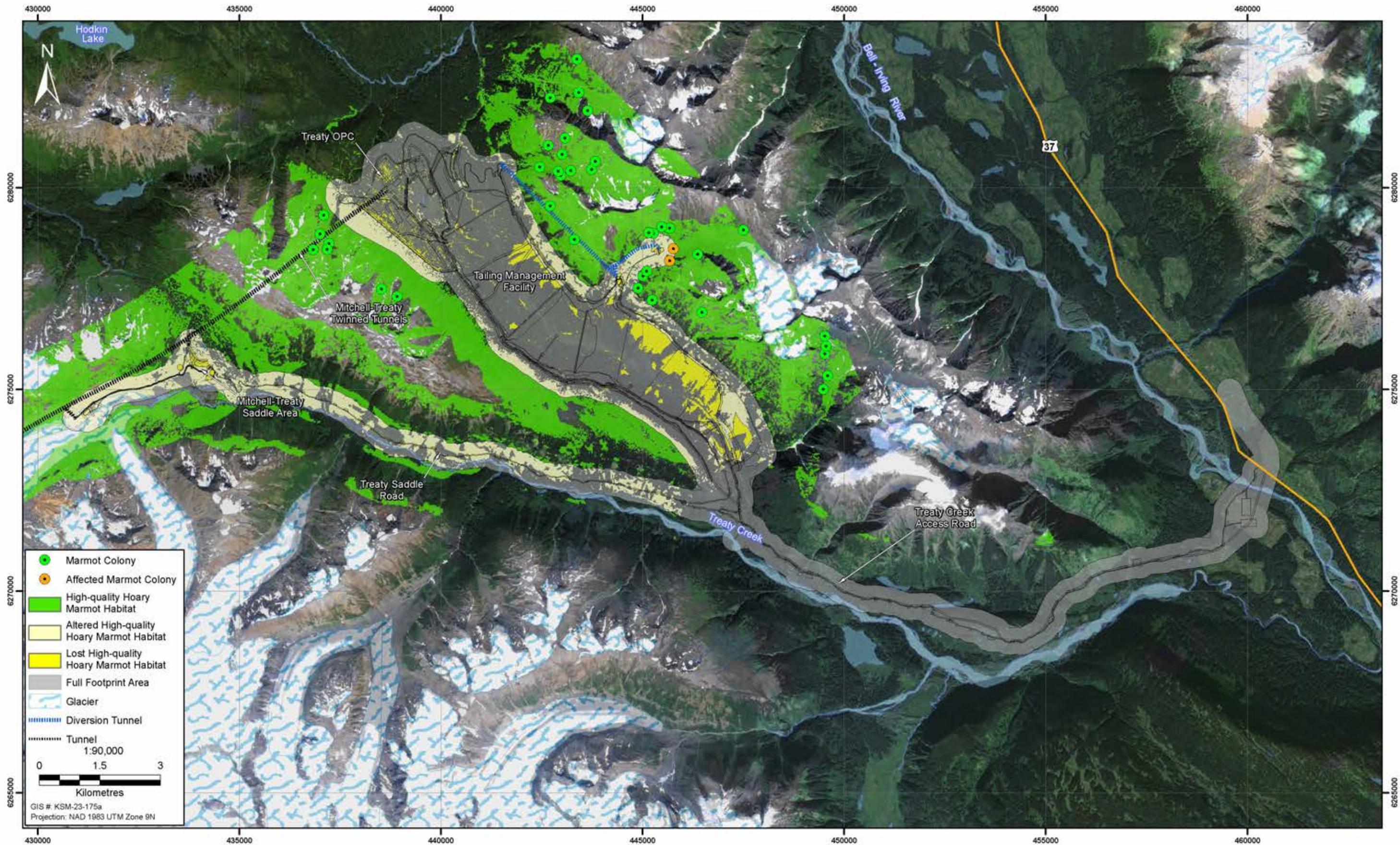


Figure 18.7-7b

Salmon spawning reaches are an important source of protein for raptors such as bald eagles. Multiple bald eagles may feed collectively in areas with a high abundance of spawning salmon during the fall. These feeding locations are typically found along rivers with large spawning salmon populations, and at locations where there are barriers to fish passage, or where fish are forced to the surface, and where large riparian trees are present for hunting raptors to perch. Riparian areas at major stream and river crossings that are known to support salmon spawning include Teigen Creek, and Unuk and Bell-Irving rivers. There were no seasonal congregations of bald eagles on salmon streams observed during baseline studies.

### Raptor Habitat Loss and Alteration

Of the 86,256 ha of suitable nesting habitat identified for raptors within the RSA, 6,341 ha (7.4% of the RSA, 45.5% of the LSA) would be lost or altered due to Project development (Figures 18.7-8 a, b). Habitat loss and alteration will begin during the construction phase (5,975 ha) and continue through the operation phase, when an additional 366 ha will be affected. Within the Mine Site and CCAR combined, 2,992 ha of suitable raptor habitat will be affected, and 3,353 ha will be affected in the PTMA and TCAR. Overall, the proposed Project will result in the loss and alteration of 7.4% of the suitable habitat in the RSA and 46% in the LSA.

### Residual Effects for Raptors due to Habitat Loss and Alteration

Direct habitat loss and alteration is predicted to result in a residual effect on raptors, including northern goshawk. However, most raptors (e.g., American kestrel, red-tailed hawk, merlin, and great horned owls) are robust to some habitat alteration near their nests (Berry, Bock, and Haire 1998; BC MWLAP 2005; Warkentin et al. 2005). The construction and operation phases of the Project would remove 7.4% of the available habitat within the RSA and 46% within the LSA.

Mitigation for nests in trees will include: (1) pre-clearing surveys to identify active and non-active raptor nests, (2) clearing trees outside of the raptor breeding period where active nests are present, and (3) establishing and adhering to buffer zones around active raptor nests during raptor sensitive periods (typically March to August). BC MFLNRO recommends an undisturbed buffer of 200 m around active bald eagle nests and 500 m around active nests of other raptors (BC MWLAP 2005). If an active nest cannot be avoided or work must be undertaken within buffer areas, the BC MFLNRO would be consulted and a nest monitoring program initiated where necessary. Inactive raptor nests or nests found outside of the breeding season would be maintained or relocated, where practical, in consultation with the BC MFLNRO (Section 26.21, Wildlife Management and Monitoring Plan). At closure, no reclamation will be conducted specifically for raptor habitat. Despite mitigation, a residual effect due to habitat loss and alteration is predicted.

### **18.7.1.8.2 Wetland Birds**

The RSA supports at least 25 different species of wetland birds ([Appendix 18-A](#)). Potential effects due to direct habitat loss and alteration on wetland birds were considered because species in this group are afforded protection under the *Migratory Birds Convention Act* (1994). The nests and eggs of wetland birds are afforded protection under the *Wildlife Act* (1996c).

Three groups of wetland birds that occupy different types of habitat have been observed in the RSA during baseline studies: (1) wetland birds, (2) cavity-nesting waterfowl, and (3) riverine birds. Wetland birds (e.g., dabbling ducks, geese, etc.) occupy lakes, swamps, marshes, and shallow open water wetlands. Cavity-nesting waterfowl (e.g., common goldeneye) occupy mature forested areas, usually within 1 km of suitable wetlands. Riverine birds (e.g., harlequin duck) occupy montane rivers and streams. Habitat loss and alteration assessments were conducted separately for each of these three wetland bird groups.

### Wetland Bird Habitat Requirements and Availability

During migration (spring and fall), the highest concentrations of avifauna were observed in calm, low flowing waterbodies within the RSA along the Treaty Creek drainage and surrounding Unuk Lake. The strongest habitat affinity of migrating wetland birds was observed in lakes.

Waterfowl typically breed in nests constructed along the edges of waterbodies such as wetlands, marshes, or lakes. Nests are commonly concealed in grasses, clumps of emergent vegetation such as cattails and bulrush, or under riparian vegetation (Campbell et al. 1990a). Mallards may nest on the ground up to several hundred metres from water. Cavity-nesting species, such as bufflehead and mergansers, may nest up to 800 m from water in forested habitat (Pierre, Bears, and Paszkowski 2001). Goldeneyes may nest up to 1.3 km from water (Eadie, Mallory, and Lumsden 1995). Suitable cavities for these species occur in mature and old-growth forest with large trees near water (Campbell et al. 1990a). Harlequin ducks, which were observed in pairs in the Teigen River drainage in the RSA ([Appendix 18-A](#)), build their nests on the ground in riparian areas on mid-stream islands (Robertson and Goudie 1999).

Suitable habitat for migrating and breeding wetland birds was identified within the RSA as lakes, wetlands, marshes, swamps, and shallow open-water wetlands. Suitable habitat for cavity-nesting waterfowl was identified as riparian areas and mature forested habitat within 1 km of an appropriate waterbody (lakes, marshes, swamps, shallow open-water wetlands). Suitable habitat for riverine birds was identified as rivers and streams of order two and larger.

*Wetland Bird Habitat Availability:* Within the RSA, 7,976 ha of wetlands were considered suitable for wetland birds, with 804 ha within the LSA. The majority of suitable wetland bird habitat within the LSA was modelled along the TCAR and within the PTMA.

*Cavity-nesting Waterfowl Habitat Availability:* Within the RSA, 56,153 ha of suitable cavity-nesting waterfowl habitat was identified, and 9,697 ha within the LSA. The majority of suitable cavity-nesting habitat within the LSA was modelled along the TCAR and within the PTMA, and in the south end of the Mine Site.

*Riverine Bird Habitat Availability:* Overall 2,896 km (2,526 streams) of riverine bird habitat were identified in the RSA, and 467 km (478 streams) were identified in the LSA. The majority (57%) of suitable riverine bird habitat within the LSA was modelled along the Treaty Creek and Coulter Creek access roads.

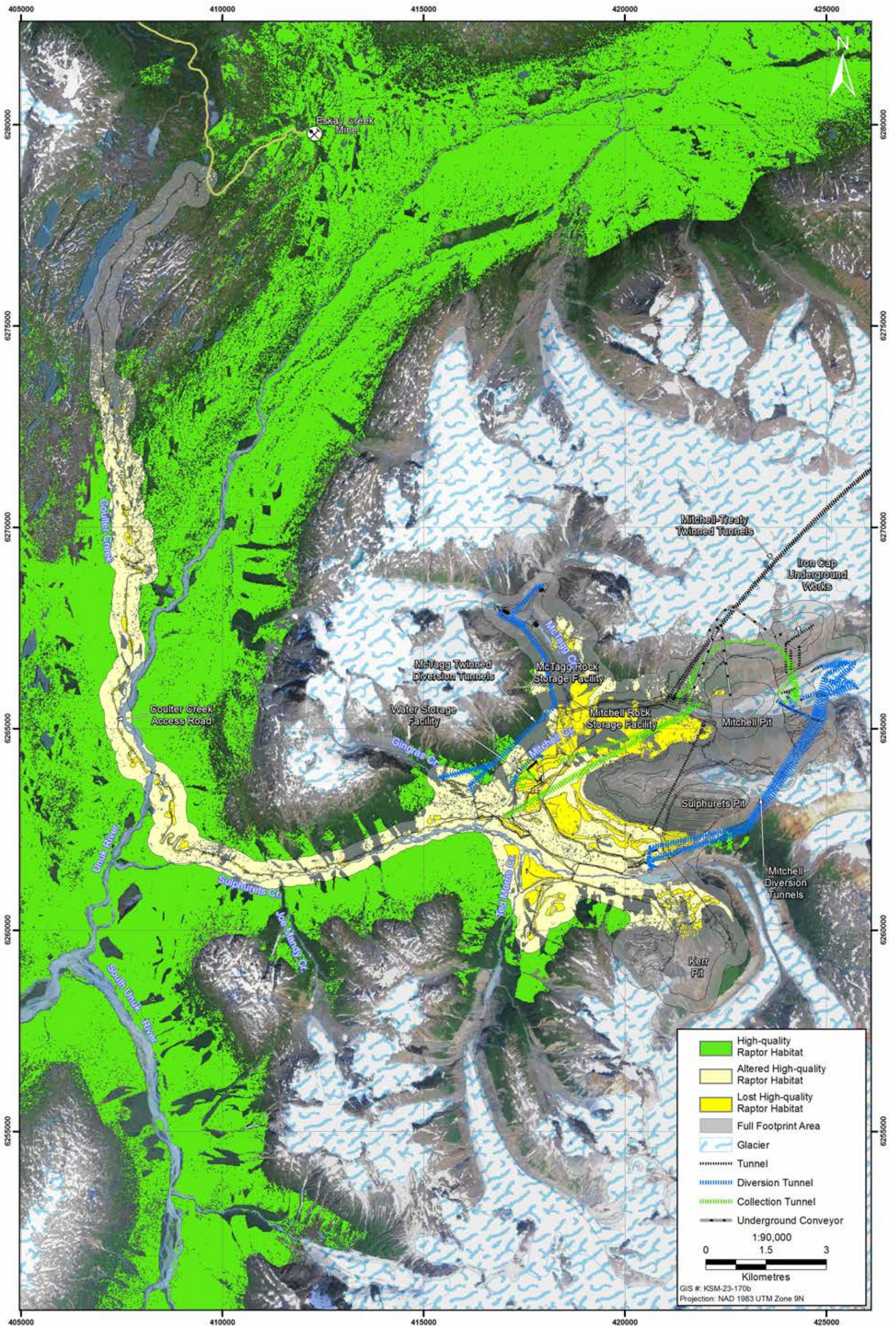


Figure 18.7-8a

### Raptor Habitat Lost or Altered due to the Project

Figure 18.7-8a

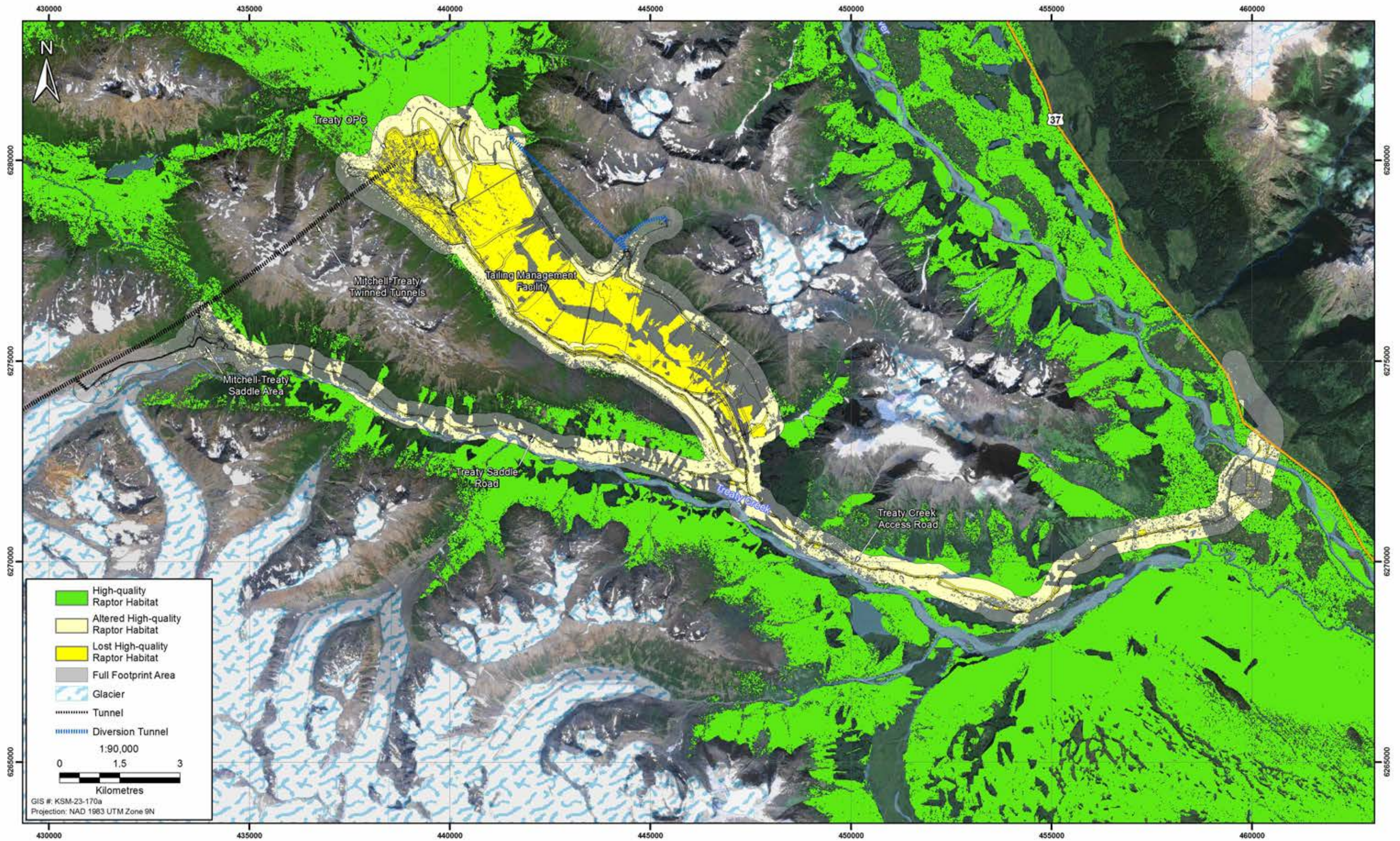


Figure 18.7-8b

Wetland Bird Habitat Loss and Alteration

An analysis was conducted to determine the magnitude of wetland loss and alteration for locally breeding wetland birds, cavity-nesting waterfowl, and riverine birds in the RSA and LSA. The total area of suitable habitat lost or altered within this boundary was calculated. Habitat loss and alteration for all wetland birds in the RSA is summarized in Table 18.7-6.

**Table 18.7-6. Wetland Bird, Cavity-nesting Waterfowl, and Riverine Bird Habitat Loss and Alteration<sup>1</sup> due to the Project**

	Habitat Lost and Altered (ha)	RSA		LSA	
		Total Habitat <sup>2</sup> (ha)	Habitat Lost/Altered (%)	Total Habitat <sup>2</sup> (ha)	Habitat Lost/Altered (%)
Wetland birds	311	7,976	3.9	804	38.7
Cavity-nesting waterfowl	4,435	56,153	7.9	9,697	45.7
Riverine birds <sup>3</sup>	144 km	2,896 km	5.0	467 km	30.8

<sup>1</sup>Maximum loss and alteration of habitat is given whether it occurs during the construction or operation phases; see text for definition of habitat loss.

<sup>2</sup>Total habitat refers to high-quality habitat in the RSA and LSA; see text for definition of high-quality habitat.

<sup>3</sup>Area of lost or altered is given in length of stream (km) rather than area.

*Wetland Bird Habitat Loss and Alteration:* A total of 311 ha of wetland bird habitat will be lost or altered due to the Project; 290 ha during construction and an additional 21 ha during operation (Figure 18.7-9a, b). This area represents 3.9% of the suitable wetland habitat in the RSA and 39% in the LSA. The majority of wetland loss will occur within the proposed TCAR (140 ha; 45%) and the PTMA (88 ha; 28%; Figure 18.7-9b).

*Cavity-nesting Waterfowl Habitat Loss and Alteration:* For cavity-nesting waterfowl, the loss or alteration of mature forest within 1 km of wetlands was calculated. A total of 4,435 ha of suitable cavity-nesting habitat will be lost due to the Project; 4,252 ha during the construction phase and an additional 183 ha during the operation phase. This represents approximately 8% of available mature forest within 1 km of suitable wetland habitat within the RSA (56,153 ha total; Figure 18.7-10a, b), and 46% in the LSA. The majority (68%; 3,025 ha) of the cavity-nesting habitat will be lost due to the PTMA and along the TCAR (Figure 18.7-10b).

*Riverine Bird Habitat Loss and Alteration:* A total of 144 km of suitable riverine habitat will be lost or altered due to Project development. Habitat loss and alteration will begin during the construction phase, when all 139 km will be affected. The length of lost or altered stream habitat will increase to 144 km (i.e., an additional 5 km of stream affected) during the operation phase. The total lost or altered habitat represents 5% of available riverine habitat in the RSA and 31% in the LSA (Figure 18.7-11a, b).

Residual Effects for Wetland Birds due to Habitat Loss and Alteration

The effect of direct habitat loss and alteration is predicted to result in a residual effect on wetland birds. Mitigation would include avoiding active waterfowl nests by conducting clearing outside breeding periods (April 1 to July 31) or through pre-construction surveys for waterfowl nests in suitable habitat when clearing is required within the breeding bird period. If waterfowl nests are

found during the pre-construction surveys, an undisturbed buffer area would be established around nests. If necessary to work within the buffer during the breeding season, a monitoring program would be developed and implemented (Section 26.21). Despite mitigation, a residual effect on wetland birds is predicted due to habitat loss and alteration.

### ***18.7.1.8.3 Forest and Alpine Birds***

#### Forest and Alpine Bird Habitat Requirements and Availability

Sixty species of forest and alpine birds were identified during baseline studies. These species occupy a diverse array of habitats, including intact forest stands, forest edges, alpine habitat above the treeline, and wetlands ([Appendix 18-A](#)). As active forest bird nests and eggs are protected under the *Wildlife Act* (1996c) and *Migratory Birds Convention Act* (1994), effects of habitat loss and alteration are considered for this group, and mitigation is required to prevent the removal of active nests during construction. Given the diversity of habitats occupied by this group, a qualitative assessment of habitat loss was performed. The majority of bird species comprising this group were observed within the CWHwm and ICHvc BEC zones, but species were also detected within the ESSFwv and MHmm2 BEC zones. Within the RSA, BAFAunp and CMAunp also occur and ptarmigan and other alpine species are likely to occur in these areas; therefore these BEC zones are included in the analysis of habitat loss and alteration for forest and alpine birds.

#### Forest and Alpine Bird Habitat Loss and Alteration

Direct habitat loss and alteration would occur wherever forest stands are cleared or where roads and/or infrastructure replace open spaces. Most songbirds are sensitive to habitat features such as vegetation composition and vertical stratification, snags, and the age of trees within a stand (Harrison, Schmiegelow, and Naidoo 2005). In addition to direct removal of forest stands, removal of snags and other debris from otherwise open areas can constitute direct habitat loss for species that rely on these features.

It is anticipated that Project development as a whole will result in the loss or alteration of the following amount of each habitat type (and percentage loss of the available habitat in the RSA and LSA) by the end of the operation phase (Chapter 17):

- 47 ha of CWHwm (0.3% of RSA, 1.5 % of LSA);
- 88 ha of ICHvc (0.2% of RSA, 2% of LSA);
- 1,618 ha of ESSFwv (2% of RSA, 13% of LSA);
- 1,513 ha of MHmm2 (4% of RSA, 18% of LSA);
- 2.2 ha of BAFAunp (0.003% of RSA, 0.03 of LSA); and
- 778 ha of CMAunp (1% of RSA, 7.8% of LSA).

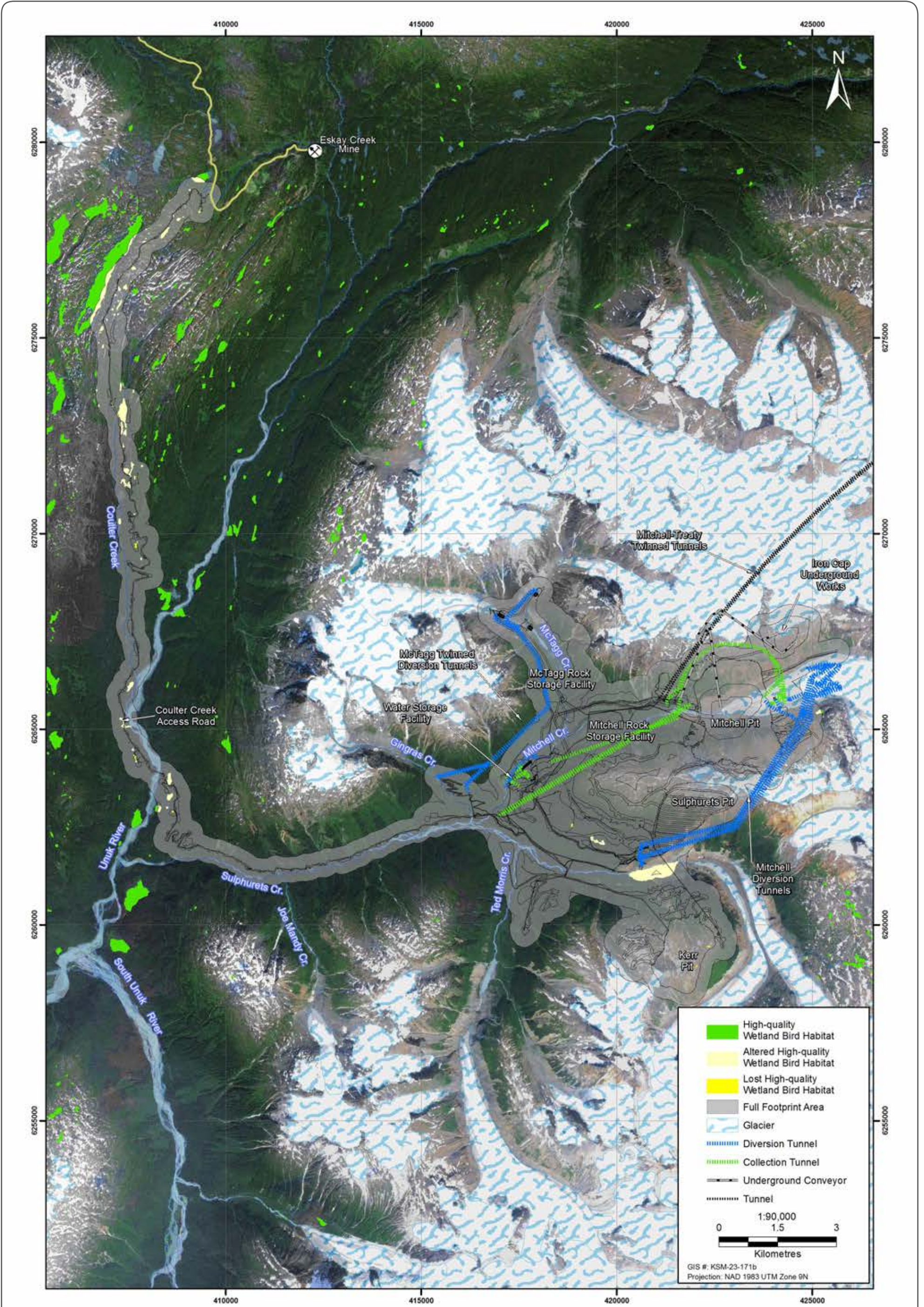
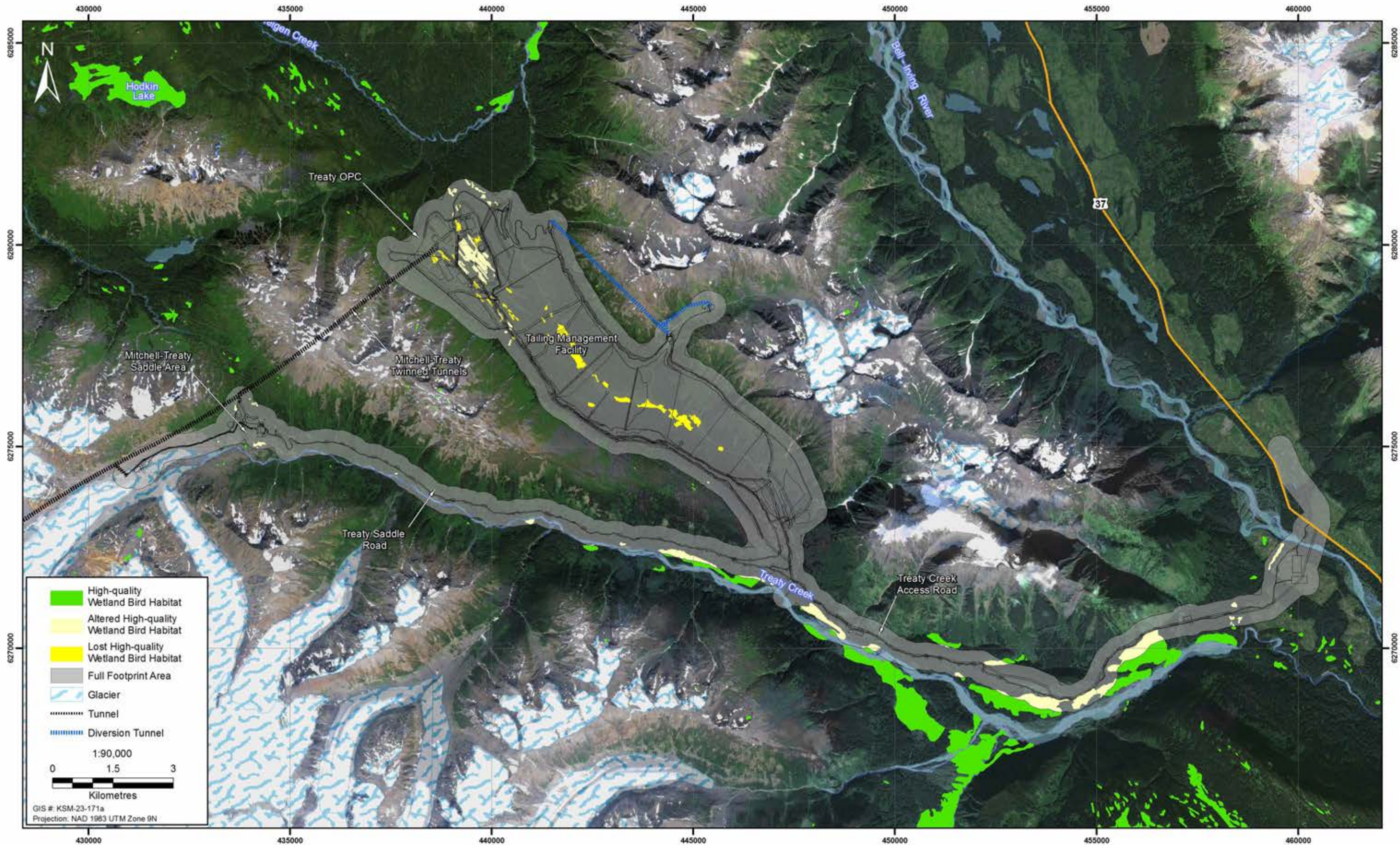


Figure 18.7-9a

Figure 18.7-9a



■ High-quality Wetland Bird Habitat  
■ Altered High-quality Wetland Bird Habitat  
■ Lost High-quality Wetland Bird Habitat  
  Full Footprint Area  
  Glacier  
 Tunnel  
 Diversion Tunnel  
 1:90,000  
 0 1.5 3  
 Kilometres  
 GIS #: KSM-23-171a  
 Projection: NAD 1983 UTM Zone 9N

Figure 18.7-9b

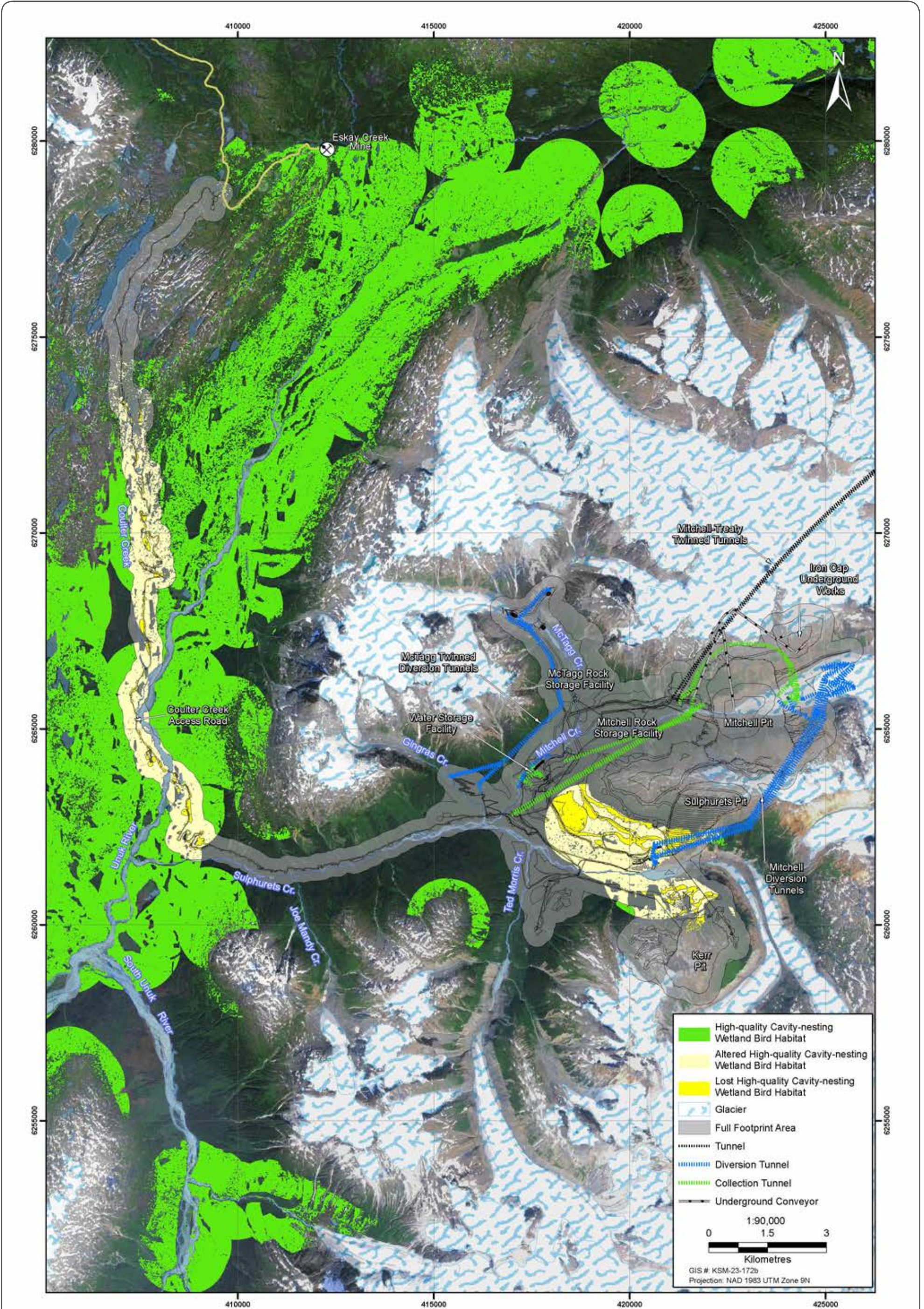


Figure 18.7-10a

Cavity-nesting Wetland Bird Habitat Lost or Altered due to the Project

Figure 18.7-10a

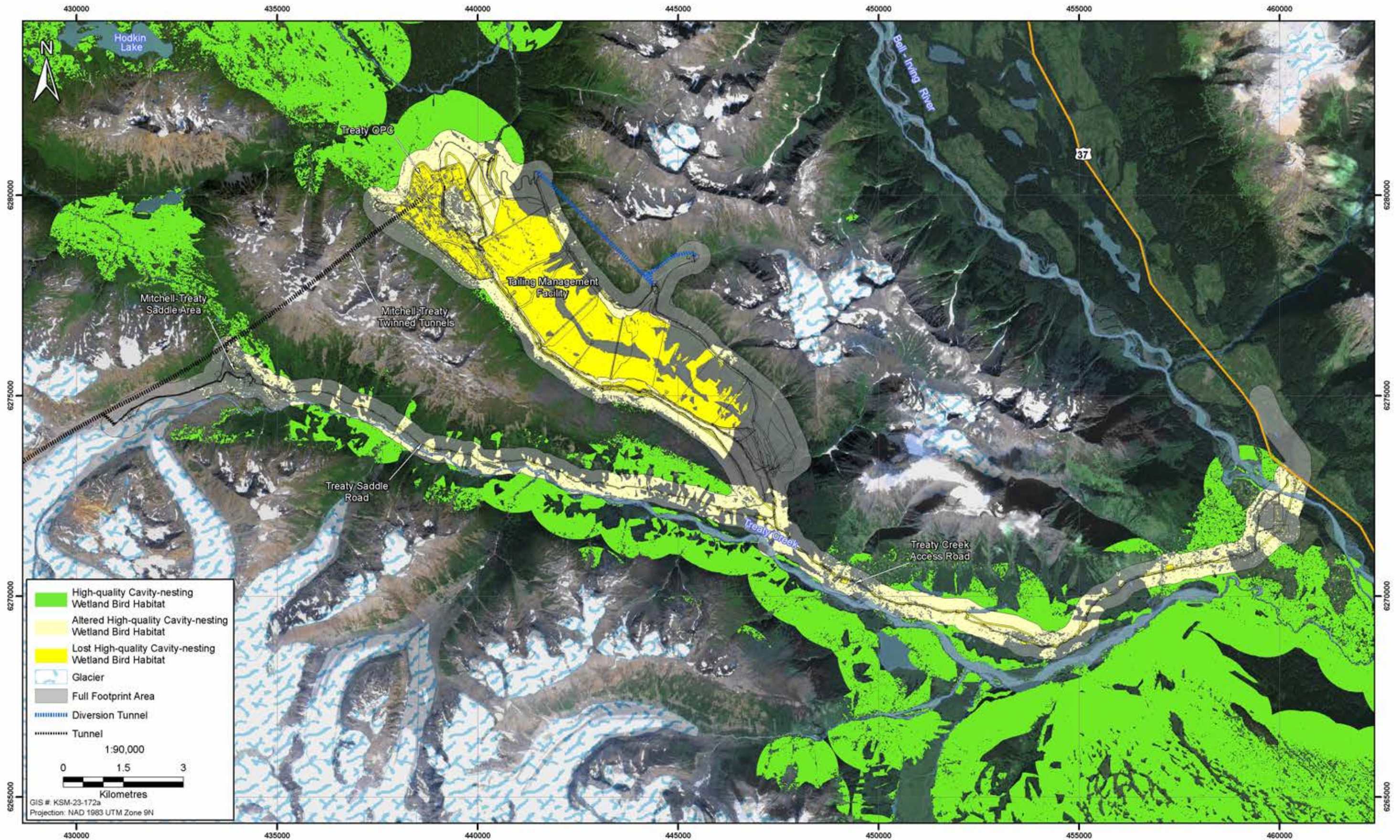


Figure 18.7-10b

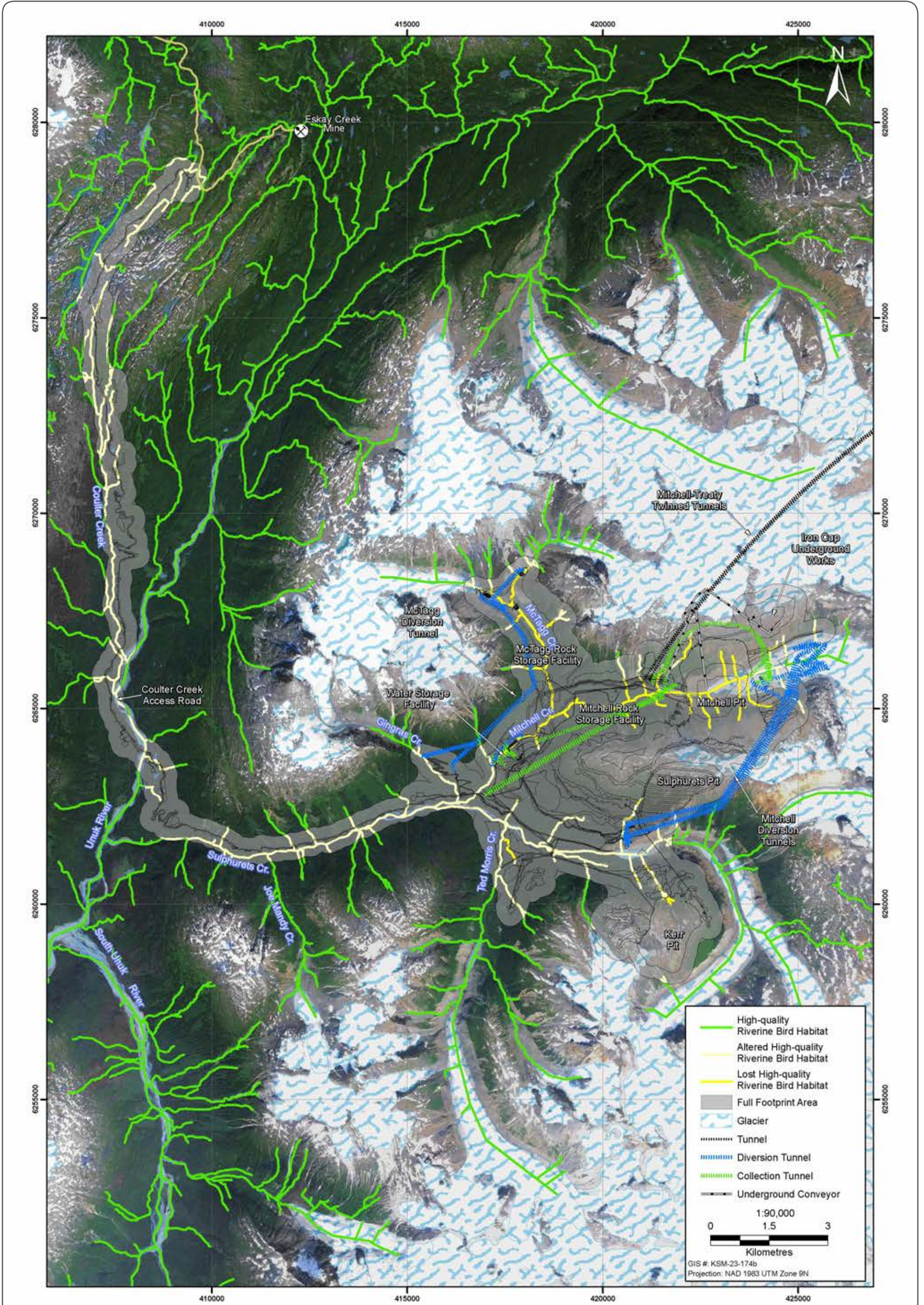


Figure 18.7-11a

Figure 18.7-11a

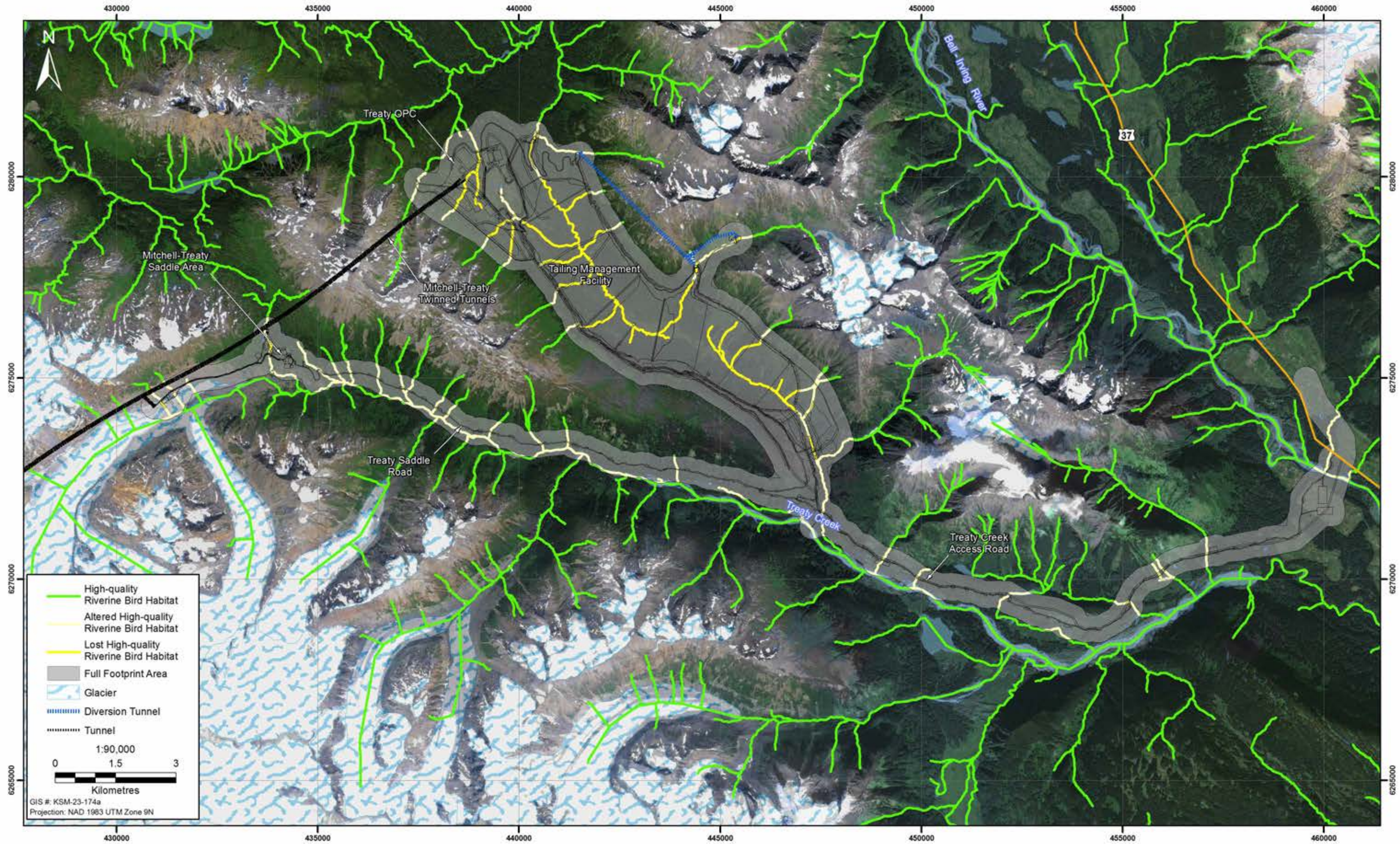


Figure 18.7-11b

Overall, at the end of the operation phase, 4,046 ha of forest and alpine bird habitat would be removed or altered.

### Residual Effects for Forest and Alpine Birds due to Habitat Loss and Alteration

Direct habitat loss and alteration is predicted to result in a residual effect on forest and alpine birds, including the SARA-listed rusty blackbird, olive-sided flycatcher, and common nighthawk. Nesting territories are usually small (1 to 10 ha) for forest and alpine birds. Therefore, habitat alteration would likely affect nesting opportunities for forest birds on a local scale. However, it is expected that birds will establish other territories and the disruption will be temporary. Mitigation for this group will include pre-clearing surveys within seven days prior to vegetation clearing, if clearing is to take place during the breeding season (April 1 to July 31, but modified based on elevation and phenology). Buffer distances will be established and implemented around identified active nests and will be avoided during the breeding season until nestlings have fledged (Section 26.21). Mitigation cannot completely eliminate the potential for the loss of some nesting habitat. However, the majority of the available forested habitat within the RSA will remain and birds will likely move to other available territories in the area. Despite mitigation, a residual effect of direct habitat loss and alteration is predicted for forest and alpine birds.

### **18.7.1.9 Western Toad: Potential Residual Effects due to Habitat Loss and Alteration**

#### ***18.7.1.9.1 Western Toad***

##### Western Toad Habitat Requirements and Availability

Western toads are listed as a Species of Special Concern by COSEWIC and they are listed under Schedule 1 of SARA (2002b). Western toads require a variety of terrestrial and aquatic habitats to complete the different stages of their life cycle. Spring breeding requires aquatic sites such as ponds, lakes, quiet stream sides, and other wetland areas, while summer foraging and winter hibernation occur in terrestrial habitat.

Toads migrate over relatively long distances each spring (i.e., May through June) from their winter hibernation sites to aquatic breeding sites, and then to forested foraging areas during the summer. Eggs develop into tadpoles in ponds and toadlets emerge in late July or August and disperse into surrounding terrestrial areas. Toads are capable of moving over 5 km to breeding sites (T. M. Davis 2000). Females typically move farther away from breeding sites because they do not breed annually, while males remain closer to breeding sites as they do breed annually (Muths 2003). Muths (2003) reported the mean distance of females and males from their breeding site to be approximately 700 and 200 m, respectively.

Toads often breed in areas of shallow open water, with an open tree canopy and warm water. However, predicting the actual locations of toad breeding ponds cannot be done with confidence and would require intensive surveys of each waterbody in the RSA. Hence, using the precautionary principle, it is assumed that wetlands with suitable features in the RSA could support toad breeding. A total of 38 wetlands, totalling 645 ha were identified during baseline surveys as suitable western toad breeding habitat in the RSA, 16 of which (221 ha) are within the LSA. In addition to these 16 suitable sites, 14 more sites that were rated as poor-quality habitat

were ground inspected within the PTMA during baseline surveys to ensure no suitable habitat was within the PTMA, and no toad breeding was observed. Maintaining aquatic breeding sites is essential to maintaining amphibian populations, as amphibian population dynamics are driven largely by the success of recruitment of new terrestrial juveniles into the local population. Maintaining breeding sites requires preserving both the extent of the breeding waterbody and the ecological community within that waterbody that supports the development of juveniles.

### Western Toad Habitat Loss and Alteration

Of the 38 wetlands suitable for breeding identified for western toads in the RSA, three wetlands would be lost or altered within the 300-m buffer during the construction phase of the Project; this would remain the same through the end of the operation phase (Figure 18.7-12a, b). The habitat that will be lost or altered occurs within a 300 m around the CCAR (two wetlands) and along the TCAR (one wetland). Overall, the proposed Project will result in the loss or alteration of 7.9% of the potentially suitable wetlands in the RSA and 18.8% of the suitable wetlands in the LSA.

### Residual Effects for Western Toads due to Habitat Loss and Alteration

A small percentage (8%) of the suitable wetland habitat for western toad in the RSA and LSA (18.7%) will be lost or altered due to the Project. The wetlands effects assessment (Chapter 16) determined that wetlands appropriate for western toad breeding, such as marshes and shallow open waters, would not be substantially altered through development of the proposed Project. Fens and swamps will be affected (Chapter 16); however, the fens that will be affected are in the proposed TMF and are not considered suitable western toad breeding habitat. Mitigation measures include special management practices in riparian areas surrounding wetlands. Examples of mitigation include hand felling of trees, siltation control when working in riparian areas, and avoiding alteration of wetland conditions by limiting machinery use in these areas, particularly during the period when adults and tadpoles are present (May to August). Despite the 8% of potentially suitable wetland habitat being altered in the RSA, baseline surveys indicate that much fewer of these wetlands actually support breeding toads. No toad breeding ponds were found in the TMF site during 2009 surveys, despite visiting 14 potential breeding ponds. After mitigation, no residual effects for western toad habitat loss and alteration are anticipated.

## **18.7.2 Disruption of Movement**

Disruption of wildlife movement was identified as a potential effect where the Project footprint and associated infrastructure would interrupt animal movements. Disruption of movement was identified as a potential effect for six VCs, including moose, mountain goats, grizzly bears, black bears, American marten, and western toads (Section 18.7.2.3 to 18.7.2.6).

Disruption of movement is not considered a potential effect for birds or bats, as these species can avoid infrastructure by flying around or over obstacles. Furthermore, Project infrastructure is not anticipated to disrupt the movement of hoary marmots due to the relatively small home range size (13.5 ha) of this species (Armitage 2000).

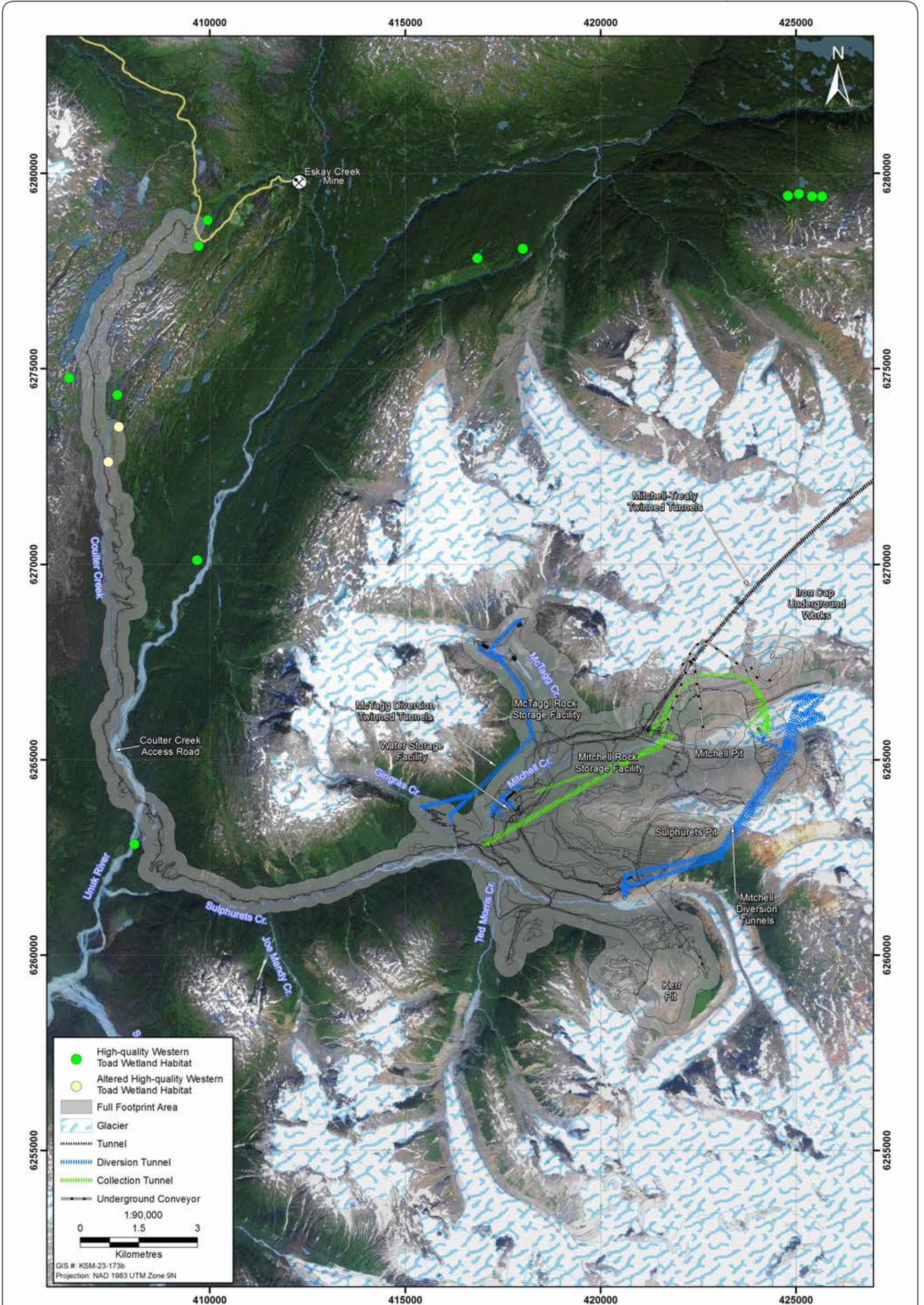


Figure 18.7-12a

Figure 18.7-12a

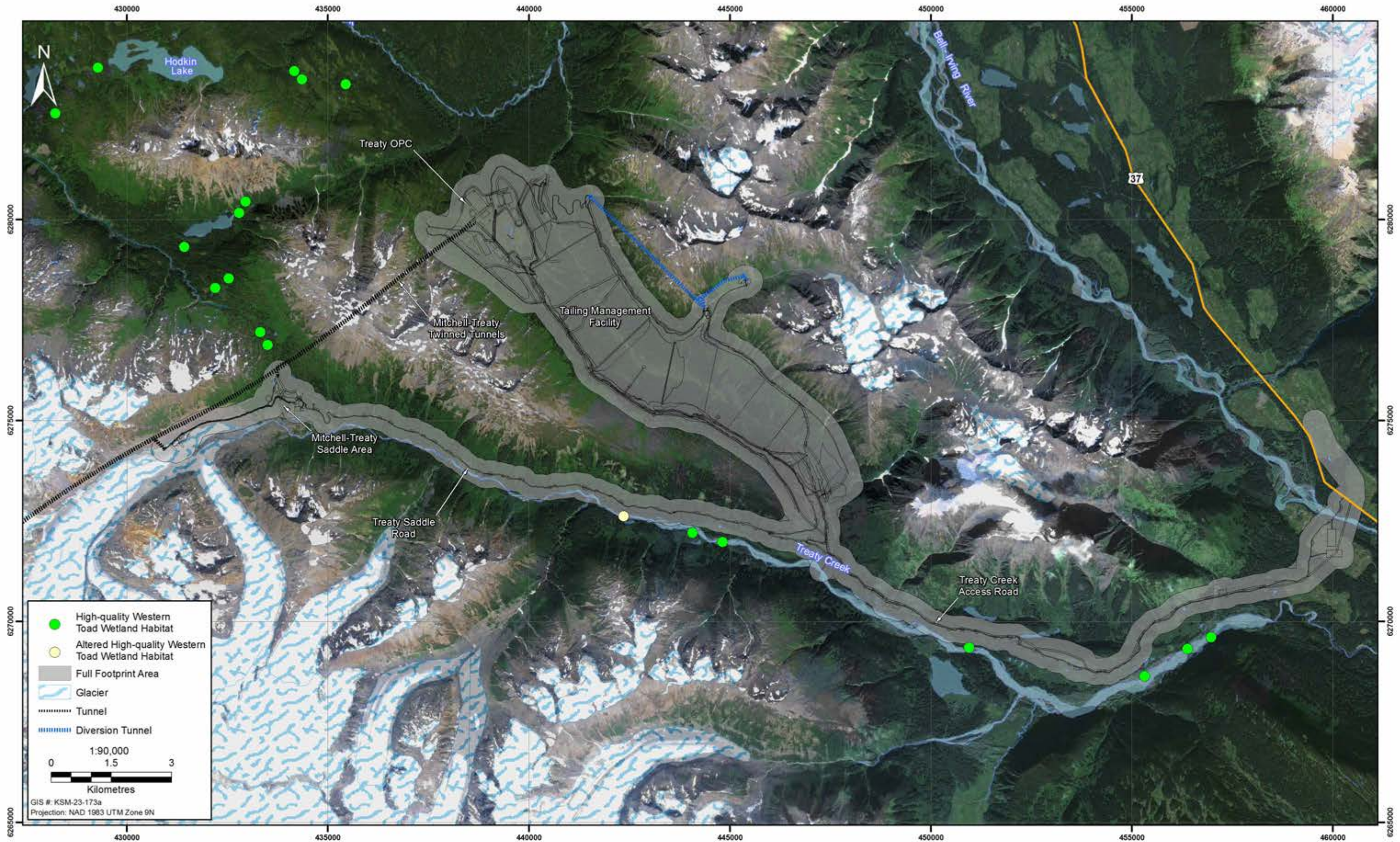


Figure 18.7-12b

Wildlife movement corridors provide a linkage between daily or seasonal habitats. Disruption of movement can occur through fragmentation of habitat (e.g., a road may separate two blocks of forest habitat) and through blockage of topographically restricted movement corridors (e.g., infrastructure or roads restrict movement through a narrow valley or trail that connects two distinct habitats). Baseline studies were not conducted specifically to identify movement corridors. Instead, a precautionary approach (see Chapter 5 for definition) was used to identify likely areas that function as movement corridors.

Movement between patches of habitat is important to maintain wildlife populations and biodiversity (Bennett 2003). Disruption of movement patterns is often the result of increased habitat fragmentation (e.g., increased density of human access corridors such as roads, and increased cleared area) or higher road use levels limiting daily or seasonal wildlife travel. Various Project components may contribute to the overall disruption of movement, including roads and mine infrastructure (e.g., the TMF, the Saddle portal, camps, pits, and RSFs). This section outlines the potential effects of Project development on wildlife movement.

Roads may act as a potential barrier to movement for some wildlife species. By preventing movement of different species or portions of a population, habitat barriers can have population-level effects (Fahrig and Rytwinski 2009). The width, substrate, and volume of vehicle traffic along a road may also affect species differently. In general, large roads with relatively high traffic volume have the greatest effect on wildlife crossing, while roads with lower volumes may be crossed or used as travel pathways.

Increased traffic volumes along the access roads and Highway 37 may decrease the crossing by certain species. Comments from Nisga'a Nation and First Nations representatives at working group meetings and incidental observations during baseline studies suggest that the Treaty and Teigen drainages may act as north to south and east to west travel corridors, respectively, for wildlife. As the TCAR extends north to south along Treaty Creek, increased traffic volume could affect wildlife movement. Vehicles will be used during the construction, operation, and closure phases, 365 days a year and 24 hours per day. The numbers of vehicles on the road per day, and per hour, are summarized in Table 18.7-7. Only KSM Project traffic is evaluated in this section of the Application/EIS; the assessment of KSM Project traffic along with existing background traffic along Highway 37 is evaluated in Section 18.9, Potential Cumulative Effects for Wildlife. For additional information on traffic along the highways outside of the RSA, see [Appendix 22-C](#).

Road-clearing activities that create earth berms in the summer or high snowbanks in the winter may also prevent certain species from crossing roads. High snowbanks can restrict the movement of ungulates across the road, thus creating a movement barrier. If an ungulate is successful in gaining access to the road, the animal may become trapped on the road by snowbanks, increasing the likelihood of mortality. Roads can also facilitate movement and act as travel routes for both prey animals and predators such as wolves, indirectly increasing predation on ungulate prey (Whittington, St Clair, and Mercer 2005; McKenzie et al. 2012).

**Table 18.7-7. KSM Project Vehicle Traffic (One-way Trips) during Construction, Operation, Closure, and Post-closure Phases of the Mine**

Project Phase	Number of KSM Project Vehicles per Day and per Hour (Traffic 365 Days/Year and 24 Hours/Day)					
	CCAR		TCAR		Highway 37	
	#/day	#/hr	#/day	#/hr	#/day	#/hr
Construction (Average)	8	0.3	14	0.6	22	0.9
Operation (Average)	3	0.1	82	3.4	85	3.5
Closure (Average)	0	0	16	0.7	16	0.7
Post-closure (Average)	0	0	6	0.3	6	0.3

Mine Site infrastructure other than roads (e.g., conveyor, TMF, pits, etc.) may also create a physical barrier to movement for wildlife, or may be avoided by wildlife due to disturbance. Sensory disturbance (Section 18.7.3) may result in wildlife avoiding the area, and as a result, creating a movement barrier to species such as bears and ungulates (Dyer et al. 2002; Vistness and Nellemann 2008).

Disruption of movement is evaluated as beginning during the construction phase of the Project and continuing through the operation and closure phases. Wherever possible, reclamation activities will be undertaken and designed to remove barriers and accommodate movement following mine closure. Wildlife VCs that may be affected by disruption of movement include:

- moose;
- mountain goat;
- grizzly bear;
- black bear;
- American marten; and
- western toad.

**18.7.2.1 Mitigation for Disruption of Movement**

A number of mitigation strategies will be used to reduce the disruption to wildlife movement. Strategies will include, but are not limited to:

- minimizing human activity in identified high-quality wildlife habitats and movement corridors;
- managing roadside vegetation (e.g., clearing along the edges and planting vegetation that is unattractive to wildlife) to minimize attractiveness to wildlife and for providing good line of sight to avoid potential wildlife encounters;
- avoiding trapping wildlife on Mine Site and PTMA roads, and CCAR and TCAR, by managing snowbank height and creating escape pathways (i.e., gaps) in snowbanks;

- creating and maintaining road culverts to facilitate wildlife movement/habitat connectivity;
- incorporating wildlife passages into road and bridge design over river and creek crossings to allow wildlife to move underneath;
- applying reduced speed limit restrictions on traffic in parts of the CCAR and TCAR that bisect potential movement corridors;
- educating employees to assess and adaptively manage driving activities during crepuscular hours (i.e., dawn and dusk), which are periods of high wildlife activity; and
- busing or shuttling staff to the site and encouraging trucks to travel in convoys on the highways, where possible, to limit traffic disturbance over the course of a day.

Due to concerns over the Saddle Area as a potential wildlife corridor between the Unuk River valley and the Treaty Creek valley, design changes were made during the Project planning process to limit the amount of infrastructure in this location:

- the process plant, Treaty operating camp, and supporting infrastructure were moved from the Saddle Area to the north end of the PTMA;
- ancillary infrastructure will be removed (e.g., construction access adit) from this area to minimize the human presence in the Saddle Area during operation;
- the tunnel will no longer daylight across the valley, eliminating the potential barrier, as it will remain underground; and
- the access road from the south end of the TMF, along Treaty Creek, to the portal will only be used as an emergency access, minimizing the amount of traffic along the TCAR from the south end of the TMF to the Saddle Area.

A description of mitigation and management to address disruption of movement to wildlife VCs is presented in the Wildlife and Wildlife Habitat Management Plan (Section 26.21.1).

### **18.7.2.2 Potential for Residual Effects**

Of the six wildlife VCs evaluated for potential effects due to disruption of movement, four (moose, mountain goats, grizzly bears, and black bears) have the potential for residual effects, as described in the following sections (Table 18.7-8).

### **18.7.2.3 Ungulates (Moose and Mountain Goats): Potential Residual Effects due to Disruption of Movement**

#### **18.7.2.3.1 Moose**

Disruption of moose movement may occur as a result of development of access roads along Treaty, Coulter, and Sulphurets creeks, as well as the Saddle Area and PTMA.

Moose generally have two seasonal home ranges. During summer, moose prefer wetlands and open areas where forage is abundant, but during winter they prefer closed forests where snow depth is shallower than in open areas (Dussault, Courtois, et al. 2005). In the NWA, collared

moose were observed migrating up and down river drainages, moving between their seasonal ranges (M. W. Demarchi 2003). Migratory behaviour in moose is apparently learned, as young individuals follow the movement patterns of their mothers, both in terms of seasonal home ranges and migration routes (Sweaner and Sandegren 1989). As a result, migratory movements often follow traditional routes, using the same migration corridor every year, but patterns of migration may vary from year to year, depending on extent and duration of snowfall (Bowyer, Ballenberghe, and Kie 2003).

The effects of the CCAR and TCAR on moose are likely to be related primarily to both the physical presence of vehicles and humans and to the presence of the road itself (Beazley et al. 2004; Beazley et al. 2005). During winter, the plowed access roads will provide relatively effective and energy efficient means of travel for moose; however, the presence of moose along the road will increase the risk of moose/vehicle-related interactions (Section 18.7.4, Direct Mortality). Planned mitigation measures include the plowing of refuge areas and the inclusion of gaps at regular intervals along the barriers and earth berms to provide escape routes for moose (Wildlife and Wildlife Habitat Management Plan, Section 26.21.1).

The Unuk, Bell-Irving, and Treaty valleys all contain high-quality habitat for moose. The Saddle Area, Teigen Creek, and the TMF valley connect these valley systems together and may represent movement corridors between these high-quality habitats. Moose have been observed in each of these areas during surveys and incidentally ([Appendix 18-A](#)). Using the precautionary principle, this assessment evaluates these three areas as movement corridors for moose.

No development is planned in Teigen Creek, and so this connection between the Bell-Irving Valley and the Unuk Valley will be unaffected. The TMF valley will effectively be blocked during construction through to closure, but will be reclaimed during post-closure and may function as a movement corridor for moose at that time (Chapter 27). The Saddle Area includes the Treaty Saddle road and the Treaty Saddle Camp. Wildlife, however, can still transit between the Unuk and Treaty valleys, as the tunnel does not daylight and the Saddle Area infrastructure will only be temporarily used during construction and as emergency access to the portals.

### Residual Effects for Moose due to Disruption of Movement

Despite mitigation presented in Section 18.7.2.1, the effect of disruption of movement is predicted to result in a residual effect on moose. The distribution of infrastructure within the PTMA along Treaty Creek (the TCAR running north-south and the Saddle Area), the TMF valley (the TMF and Processing Plant site within the north-south valley), and increased traffic along Highway 37 near the Bell-Irving River, are expected to act synergistically to disrupt and partially limit moose movement through these areas.

#### **18.7.2.3.2 Mountain Goats**

Most suitable mountain goat habitat and established UWR in the LSA occur at high elevation surrounding the Mine Site. Some disruption of movement may occur as a result of development of this area. Helicopter flight noise associated with various aspects of mine construction and operation may also act as a barrier to movement (see Section 18.7.3, Sensory Disturbance).

**Table 18.7-8. Potential Residual Effects on Wildlife and Wildlife Habitat Valued Components due to Disruption of Movement**

Valued Component	Timing Start	Project Area(s)	Project Component(s)	Description of Effect due to Project Component(s)	Type of Project Mitigation	Project Mitigation Description	Potential Residual Effect	Description of Residuals
Moose	Construction	PTMA and Mine Site	TMF, Treaty Creek access road, Coulter Creek access road, Saddle portals	Disruption of movement along Treaty drainage, Unuk River, TMF valley, and Saddle portal. Access road acting as a movement corridor for moose.	Management Practices, Monitoring and Adaptive Mangement	Partial revegetation post closure, including development of movement corridor across the valley on TMF dams; design bridges over Unuk river crossings to allow animals to move under and the Mitchell-Treaty tunnel will no longer daylight across the valley, eliminating the potential barrier, as it will remain underground. Refuge areas along access roads will be ploughed along the road during winter; gaps in snow on roads will be created at best spacing to allow an escape for moose; partial decommissioning of roads and linear corridors; implement speed limits; road signs in areas where road traverses suitable wildlife habitats; monitor saddle area for moose movement.	Yes	The distribution of infrastructure within the PTMA along Treaty Creek (the Treaty Creek access road running north-south and the Mitchell-Treaty Saddle Area), the TMF valley (the TMF and plant site within the north-south valley), and increased traffic along Highway 37 near the Bell-Irving River, will synergistically act as a barrier to movement for moose. Despite mitigation, the effect of disruption of movement is predicted to result in a residual effect on moose. Potential for moose/vehicle interactions - addressed in Direct Mortality section
Mountain Goat	Construction	PTMA and Mine Site	All Mine Site (excluding access road), helicopter flight lines, Saddle portals	Disruption of movement due to development of the Mine Site and Saddle portals; blockage of movement to a potential salt lick around mine site.	Management Practices, Monitoring and Adaptive Mangement	Implement helicopter flight plan to minimize disturbance. Partial revegetation post-closure.	Yes	Disruption of movement to mountain goats in the mining area is anticipated. Partial reclamation in the Mine Site may minimize disruption of mountain goat movement in the long term. Management of helicopter flight plans to avoid mountain goat habitat may minimize disruption of mountain goat movement. Despite mitigation, the effect of disruption of movement is predicted to result in a residual effect on mountain goats.
Grizzly Bear	Construction	PTMA and Mine Site	All components	Disruption of movement due to development in high quality bear habitat and increased human presence (e.g., roads and vehicles).	Management Practices, Monitoring and Adaptive Mangement	Development of movement corridor on TMF dam across the valley during post-closure phase of the Project; partial reclamation of Coulter Creek access road during closure phase; implement speed limits on access roads; road signs in areas where road traverses suitable wildlife habitats.	Yes	Disruption of movement in the TMF and access roads may occur due to sensory disturbance. The section of the Coulter Creek access road between the Unuk River and Eskay Creek Mine will be reclaimed during the decommissioning and closure phase of the project, eliminating the barrier represented by this road alignment in the long term. Traffic volumes will decrease to <1 KSM vehicle/day along Treaty Creek access road, Coulter Creek access road, and Highway 37 post-closure. However, despite mitigation, the effect of disruption of movement is predicted to result in a residual effect on grizzly bears.
Black Bear	Construction	PTMA and Mine Site	All components	Disruption of movement due to development in high quality bear habitat and increased human presence (e.g., roads and vehicles).	Management Practices, Monitoring and Adaptive Mangement	Development of movement corridor on TMF dam across the valley during post-closure phase of the Project; partial reclamation of Coulter Creek access road during closure phase; implement speed limits on access roads; road signs in areas where road traverses suitable wildlife habitats.	Yes	Disruption of movement in the TMF and access roads may occur due to sensory disturbance. The section of the Coulter Creek access road between the Unuk River and Eskay Creek Mine will be reclaimed during the decommissioning and closure phase of the project, eliminating the barrier represented by this road alignment in the long term. Traffic volumes will decrease to <1 KSM vehicle/day along Treaty Creek access road, Coulter Creek access road, and Highway 37 post-closure. However, despite mitigation, the effect of disruption of movement is predicted to result in a residual effect on black bears.
American Marten	Construction	PTMA and Mine Site	TMF, Treaty Creek access road, Coulter Creek access road, RSFs	Disruption of movement along Unuk River, Sulphurets Creek, Teigen Creek, TMF valley	Management Practices, Monitoring and Adaptive Mangement	Ensuring corridors of mature forest for dispersal whenever possible during development, development of corridors through TMF valley, decommissioning of access roads. American marten are known to use drainage culverts to access habitats on either side of roads and will therefore likely use such culverts placed along the access road. In general, drainage culverts assist in mitigating the potentially harmful effects of roads by providing a vital habitat linkage.	No	During the decommissioning and closure phase of the project, provision will be made for re-establishing habitat corridors through the TMF to prevent disruption of American marten movements in the long term, movement corridors will be maintained throughout the Project area where possible. It is therefore expected that the access roads will not act as a barrier to the movements of American marten in the study area. After mitigation, disruption of movement is predicted to have no residual effect on American marten.
Western Toad	Construction	PTMA and Mine Site	Treaty Creek access road and Coulter Creek access road	Disruption of movement from aquatic breeding habitat to terrestrial habitat along Treaty Creek and Coulter Creek access roads	Management Practices, Monitoring and Adaptive Mangement	Monitoring to identify locations along the access roads where there is a high probability of bisecting any movement corridors between terrestrial and aquatic habitat. Where these corridors are identified road construction will include provisions for toad movement such as culverts under the road (toad tunnels) to facilitate movement. During construction, monitoring will direct placement of tunnels if mass migration events occur. Monitoring for road mortality during operations.	No	With monitoring and mitigation of movement corridors, if identified, no residual effects on western toad movement are anticipated.

Mountain goats maintain separate seasonal habitats and movements between and within habitats, which are typically infrequent and short in distance (Côté and Festa-Bianchet 2003). Because occupied goat habitat is strongly associated with escape terrain and favourable aspects (south and west), summer and winter habitats often overlap spatially, which limits the need for extensive movements. Longer movements do occur, however, when mountain goats move between isolated patches of suitable habitat. In addition, goats may travel long distances to access mineral licks (Côté and Festa-Bianchet 2003).

Mountain goats tend to use ridge tops to move between seasonal habitats and between suitable habitats within a particular season. Mountain goats are also known to use traditional trails to move between seasonal ranges (Wilson 2005). Disruption of movement may result from development of infrastructure (e.g., pits, RSFs, and Mine Site roads) at high elevation. However, as mountain goats tend to travel along ridge tops, the CCAR and TCAR and the PTMA, all of which are located in valleys, are unlikely to affect movement patterns.

Mountain goats are sensitive to helicopter disturbance and may avoid areas up to 2 km from helicopter traffic (BC MOE 2010a; Cadsand 2012). As a result, disruption of movement may occur if goats are unwilling to cross areas with frequent helicopter traffic. During construction, there will be approximately 30 helicopter round trips per month.

### Residual Effects for Mountain Goats due to Disruption of Movement

Partial reclamation in the Mine Site may minimize disruption of mountain goat movement in the long term. Management of helicopter flight plans to avoid mountain goat habitat (Wildlife Management and Monitoring Plan, Section 26.21) will also reduce disruption of mountain goat movement. Despite mitigation, the effect of disruption of movement is predicted to result in a residual effect on mountain goats.

#### **18.7.2.4 Bears: Potential Residual Effects due to Disruption of Movement**

Bears (grizzly bears and black bears) maintain large individual home ranges that include separate seasonal habitats, such as wetlands in early spring and alpine areas in the late summer. Travel routes within and between habitats are variable and in most cases not easily identifiable in the landscape. The greatest potential impacts to bear movements are therefore when one seasonal habitat is isolated from another.

Research indicates that roads may act as barriers to grizzly bear and black bear movements, effectively isolating seasonal habitats. Female grizzly bears are particularly sensitive and avoid crossing large roads (Ross 2002; Waller and Servheen 2005). In contrast, low-usage roads can act as an attractant for black bears, offering high-quality vegetation forage along the roadside (Section 18.7.6, Attractants). Thus, the crucial point for bears is the amount of traffic on roads. When traffic volume rises above a threshold point (over 10 vehicles per hour for grizzly bears; Waller and Servheen 2005), bears may avoid a particular road, making it a barrier to movement. Over seven years of research, grizzly bears were shown to avoid areas within 100 m of roads, independent of traffic volume, suggesting that even low levels of traffic can displace grizzly bears (B. N. McLellan and Shackleton 1988). Mueller (2001) also reported that bears used areas closer to roads during human inactive periods (6 p.m. to 7 a.m.) than during active periods (7 a.m. to 6 p.m.).

The numbers of vehicles on the CCAR, TCAR, and Highway 37 per day, and per hour, are summarized in Table 18.7-4. During operation, the average traffic volume will be 3.5 vehicles per hour along Highway 37, 3.4 per hour along the TCAR, and 0.1 per hour along the CCAR. Grizzly bears have been shown to continue to cross roads when traffic volumes are less than 10 vehicles per hour (Waller and Servheen 2005).

The Saddle Area and PTMA may also function as a movement corridor for bears. Mitigation for disturbance in this area is described in Section 18.7.3.1. Baseline surveys found that grizzly bears moved between the Treaty and Unuk valleys, presumably to access the large salmon resources in the Unuk during the late summer and fall. Grizzly bears use alpine areas, particularly in the summer and fall (more so than moose), and are likely to move around the Project infrastructure in the Saddle Area at high elevation. Black bears use alpine areas less so than grizzly bears but are more amenable to becoming acclimated to human and industrial presence.

### Residual Effects for Bears due to Disruption of Movement

The section of the CCAR between the Unuk River and Eskay Creek Mine will be reclaimed during the closure phase of the Project (Chapter 27, Closure and Reclamation), eliminating any barrier effects represented by this road alignment in the long term. Post-closure, traffic volumes will decrease to 6 vehicles per day along the TCAR and Highway 37. However, despite mitigation, the effect of disruption of movement is predicted to result in a residual effect on both grizzly bears and black bears.

#### **18.7.2.5 American Marten: Potential Residual Effects due to Disruption of Movement**

American marten maintain a medium-sized home range that does not change through the seasons. They prefer forests more than 40 years of age, avoid forest edges and road verges, and are rarely found in smaller patches of forest (Poole et al. 2004). The PTMA, RSFs, transmission line ROW, and access roads all have the potential to disrupt the movement of American marten, as these features intersect high-quality marten habitat.

Large tracts of treeless, early seral stage habitat can act as barriers for American marten (Hawley and Newby 1957; Gibilisco 1994). The extent of the development in the TMF valley, the transmission line ROW, and the CCAR and TCAR may create such barriers. Snow tracks reveal that American marten movements display a clumped pattern away from roads (Robitaille and Aubry 2000). This suggests that marten avoid roads, and is consistent with observations that they avoid areas that lack overhead cover (Poole et al. 2004).

### Residual Effects for American Marten due to Disruption of Movement

During the closure phase of the Project, provisions will be made for re-establishing habitat corridors through the TMF (Chapter 27, Closure and Reclamation) to prevent disruption of American marten movements in the long term. Ensuring that existing corridors of mature conifer forest remain available for dispersal whenever possible will help to mitigate this potential effect. American marten are known to use drainage culverts to access habitats on either side of roads and will therefore likely use such culverts placed along the access roads. In general, drainage culverts assist in mitigating the potentially harmful effects of roads by providing a vital habitat

linkage (Clevenger, Chruszcz, and Gunson 2001). It is therefore expected that the access roads will not act as a barrier to the movements of American marten in the RSA. After mitigation, disruption of movement is not predicted to have a residual effect on American marten.

### **18.7.2.6 Western Toad: Potential Residual Effects due to Disruption of Movement**

Western toads use terrestrial habitats for most of the year (Bartelt and Peterson 1994) but return to aquatic habitats to breed.

Wetlands within the KSM Project LSA were generally rated as low likelihood for breeding ponds during aerial surveys of potential western toad habitat, and ground-truthed during ground surveys for western toads. Several wetlands close to the TCAR were identified as moderately suitable breeding habitat for toads. The roads and infrastructure located near wetlands suitable for western toads (e.g., near the TCAR and CCAR, Figure 18.7-12a and b) could potentially create barriers for toad movements through direct mortality (vehicle-toad collisions). Toads are terrestrial animals and prefer open, sunny areas to dense forests. Hence, toads are at risk of vehicle—toad collisions when sunning themselves on roads or crossing roads to access breeding ponds (Section 18.7.4, Direct Mortality).

#### Residual Effects for Western Toads due to Disruption of Movement

Monitoring is proposed in the LSA to identify locations along the TCAR and CCAR and other site roads where there is a high probability of bisecting toad movement corridors between terrestrial and aquatic habitats. Where corridors are identified, access road construction will incorporate provisions such as specialized toad tunnels or amphibian culverts under the road to facilitate movement (Wildlife Management and Monitoring Plan, Section 26.21). Monitoring for western toad mortality along the road will also form a component of the Wildlife Effects Monitoring Program (Section 26.21.3). After mitigation, no residual effects on western toad movement are anticipated.

### **18.7.3 Sensory Disturbance**

Sensory disturbance from Project-related light or noise and human presence may alter the behaviours of wildlife species, resulting in behavioural changes or habitat avoidance. Hence, sensory disturbance can be considered functional habitat loss for wildlife VCs. Eight VCs were identified as being susceptible to Project-related sensory disturbance, including moose, mountain goats, grizzly bears, black bears, bats, raptors, wetland birds, and forest and alpine birds, as described in Sections 18.7.3.3 to 18.7.3.6.

Sensory disturbance is not considered a potential effect for American marten, hoary marmot, or western toad. A study of the effects of off-road vehicles on American marten distribution, sex ratios, and circadian activity found no difference in noise-affected versus unaffected areas; affected areas had up to five-fold increases in the frequency of noisy (greater than 60 dB) disturbances per hour (Zielinski, Slauson, and Bowles 2008). Therefore, sensory disturbance is not considered to affect American marten.

Marmots and small mammals in general have been shown to habituate to significant human presence, and have comparable reproductive and survival rates compared to marmots not exposed to human presence (Griffin 2007). In addition, potential effects due to sensory disturbance to marmots appears to lessen with repeated exposure, suggesting that marmots habituate to human disturbances relatively well (Li et al. 2011). Therefore, sensory disturbance is not considered to affect hoary marmots.

Effects of sensory disturbance on western toad are not considered in this assessment. Anecdotal information generally suggests that amphibians will continue to use habitats adjacent to human-caused disturbances. In addition, it is generally believed that western toads do not use acoustic communication for breeding (Hammerson 1999). Therefore, sensory disturbance is not considered to affect western toads.

The two main forms of sensory disturbance associated with the Project are noise and light. Wildlife reactions to these disturbances can include habitat avoidance or behaviour alteration, which can have serious consequences for various species. This section discusses the potential effects of sensory disturbance on the various wildlife VCs in the Project area.

### Noise

Noise affects wildlife species in three primary ways. The source, duration, and intensity of noise all influence the nature and magnitude of observed effects and determine if wildlife exhibit an acute response (flight), a chronic response (altering behaviour and abandoning an area), or habituation (developed tolerance). First, an acute effect of noise—brief, intense, localized noise (such as blasting)—can result in physiological damage to an animal's ears or flight from adjacent habitats.

Second is a behavioural response, where animals may become disturbed and may lose time and energy from key behaviours such as feeding, breeding, or watching for predators. The loss of time devoted to essential activities can ultimately lead to reduced body condition or health (Kraabel and Miller 1997), reduced reproductive success, and/or mortality of offspring and parent—a chronic effect. A behavioural response can also occur when animals avoid important habitats near disturbance sources resulting in the functional loss of that habitat (D. H. Ward et al. 1999; Gibeau et al. 2002; Bautista et al. 2004). The disturbance may cause animals to abandon their current range and relocate. These range shifts can result in mortality due to unfamiliarity with new habitat. Noise can also mask the sounds that animals use to find prey, mates, and avoid predators. Masking can reduce fitness (breeding success), especially for species that are highly reliant on their acoustic environment.

Third, in some cases, habituation and adaptation can allow wildlife to accommodate, and even take advantage of, the presence of noise in their environment.

Effects of sound on a species most commonly depends on amplitude (volume) and frequency (pitch). Sound levels decrease with distance from the source, and as such it is important to reference the distance between the source and the location of a sound pressure level reading. Different animals are sensitive to different frequency ranges; bats are sensitive to ultrasound (above 20 kJ) frequencies, whereas some birds (Kreithen and Quine 1979), amphibians (Hetherington 1992), and large mammals are sensitive to infrasound (below 20 Hz).

Some species have been found to respond to specific levels of noise above background noise, termed a “threshold level.” For example, grizzly bears are reported to avoid areas (78 to 80% of the time) with noise levels greater than 60 dBC (Archibald, Ellis, and Hamilton 1987). Ungulates respond to aircraft overflights and sonic booms at noise levels between 85 and 108 dB Lpeak (Manci et al. 1988; Weisenberger et al. 1996; Reimers and Colman 2006). Bird densities have been found to decrease within 1 km of infrastructure areas (Benitez-Lopez, Alkemade, and Verweij 2010), and a series of studies on birds in grasslands reported that the abundance and diversity of birds began to drop when noise levels reached  $47 \pm 3.5$  dBA near roads (baseline  $38 \pm 5$  dBA; Reijnen and Foppen 1994, 1995; Reijnen, Foppen, and Meeuwsen 1996).

During construction, potential sources of continuous Project noise include vehicle traffic, vegetation clearing, and infrastructure construction. Instantaneous noise includes construction blasting and helicopter overflights. During operation, potential sources of Project noise include vehicle and haul traffic, processing plant, and industrial day-to-day operation, while instantaneous noise includes helicopter overflights, blasting, and avalanche control.

### Light

Artificial lighting can have negative effects for migratory birds when combined with high towers or buildings (Trapp 1998; FLAP 2010). Migratory birds can become disoriented by lighted towers, and mortality events may result (Longcore and Rich 2004). Human disturbance can cause nest abandonment and subsequent higher predation rates (Hockin et al. 1992). All of these disturbance types can reduce reproduction rates and local population size.

### **18.7.3.1 Mitigation for Sensory Disturbance**

The effects of sensory disturbance on wildlife are considered by mitigating effects of noise (Noise Management Plan, Section 26.22) and light (e.g., infrastructure design). Guidelines will be followed to minimize the effects on wildlife (Milko 1998a; BC MOE 2006a).

#### **18.7.3.1.1 Noise**

During construction and operation, wildlife may be disturbed by traffic noise and mine operation noise (e.g., blasting, haul trucks, processing plant). A noise management plan will be developed with the objective to ensure that noise levels during all phases of the Project are acceptably low for human and wildlife receptors and receptors of concern in the vicinity of the Project, as per human health guidelines (Health Canada 2011). The following noise mitigation measures will be implemented:

- noise specifications will be considered when selecting equipment to purchase;
- vehicles will be maintained regularly;
- speed limits will be imposed;
- mufflers will be installed on vehicles and maintained;
- noise dampening measures will be applied where possible; and
- noise will be monitored periodically at various human and wildlife receptor locations, as part of the Noise Management Plan (Section 26.22) and mitigation strategies will be adjusted accordingly, if required. Noise monitoring locations will be at locations to enable confirmation of noise modelling and effects assessment.