

Seabridge Gold Inc.

KSM PROJECT 2009 Wildlife Characterization Baseline Report

SEABRIDGE GOLD



KSM PROJECT 2009 WILDLIFE CHARACTERIZATION BASELINE REPORT

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Executive Summary

This report presents the baseline wildlife studies undertaken for Seabridge Gold Inc's (Seabridge) proposed KSM (Kerr-Sulphurets-Mitchell) Project. The proposed KSM Project is a gold/copper mining project in the mountainous terrain of northwestern British Columbia (BC), approximately 950 km northwest of Vancouver, BC, and approximately 65 km northwest of Stewart, BC. The proposed Project lies approximately 20 km southeast of Barrick Gold's recently closed Eskay Creek Mine and 30 km northeast of the Alaska border.

The wildlife baseline studies included a literature review of management plans specific to the region, identification of species of conservation concern or of interest potentially occurring within the area, and field surveys. Field surveys conducted in 2008 and 2009 focused on the mammalian, avian, and amphibian communities. Surveys for mammals included moose (*Alces alces*), mountain ungulates (mountain goat (*Oreamnos americanus*), Stone's sheep (*Ovis dalli stonei*), and northern caribou (*Rangifer tarandus*)), grizzly bear (*Ursus arctos*), furbearers, hoary marmot (*Marmota caligata*), and Arctic ground squirrel (*Spermophilus parryi*), and bats. Surveys for birds included raptors, terrestrial breeding birds, and water dependent birds. Surveys for amphibians focused on western toad. The results of grizzly bear baseline studies are presented in a separate report (Rescan 2010a).

Aerial surveys were conducted for moose in the winter of 2009 and focused on lower elevation habitats in the eastern and western portions of the study area. These two areas were described as interior (eastern) and coastal (western) survey areas based on Biogeoclimatic Ecosystem Classification (BEC) zones. The adjusted population of moose in interior and coastal survey areas was 198 moose (± 28 at 90% CI) and 33 moose (± 6 at 90% CI), respectively. Across both survey areas, all moose were observed in habitat below 750 m in elevation and less than 51% slope. Generally, moose were more densely distributed across capable winter habitat, defined as areas below 750 m and 60% slope, in the interior survey area than in the coastal survey area. During winter surveys, four moose were seen near proposed Project components while the vast majority were observed to the east (Teigen Creek to its confluence with Snowbank Creek and the Bell-Irving River) and to the south of the proposed development (lower Treaty Creek and Bell-Irving River drainages). Moose were observed incidentally during the summer of 2008 and 2009, many of which were recorded along Treaty Creek. A few moose were observed within the proposed tailing management facility area and along the Unuk River during the summer.

Aerial surveys for mountain ungulates (mountain goat, Stone's sheep, and northern caribou) were conducted during the summer (2008) and winter (2009). Mountain goats were the only mountain ungulate observed during these surveys. Across the 2-year baseline, 408 goats were observed in 131 groups in 23 survey units (SUs) within the study area. Summer surveys were considered total counts, while winter surveys were conducted to evaluate the use of winter habitat. The majority of goats were observed along the Snowslide Range (SU 17 (14% of total goats observed) and SU 19 (11%)) and on the north side of Sulphurets Creek (SU 23 (13%)) during the summer survey. During the winter survey, most goats were observed south of Sulphurets Creek (SU 7 (21% of total goats observed) and SU 5 (17%)) and along the Snowslide Range adjacent to Bell II (SU 19 (13%)). The ratio of kids per 100 adults was similar between the two surveys. Most mountain goat groups exhibited seasonal habitat selection preferences that are typical for mountain goats within the region.

The furbearer harvest database was consulted to assess the diversity of harvest within the seven registered trap line tenures in the study area. An analysis of harvest records suggested 14 species were present and marten constituted the majority of the harvest effort. Two blue-listed furbearer species occur within the study area (fisher and wolverine). Four furbearers, including black bear, wolverine, grey wolf, and red fox, were also incidentally observed during wildlife baseline studies in 2008 and 2009.

Aerial inventories of marmot and ground squirrel colonies within the study area were conducted in 2008 and 2009. In addition, ground surveys supplemented aerial surveys in 2009. There were 240 colony locations observed during aerial surveys across both years. Hoary marmots were observed on a number of occasions. Arctic ground squirrels were not observed nor any evidence of their presence documented. Habitat information was collected during ground surveys at 31 colonies. Colonies were generally in alpine areas with warmer exposures on a wide variety of steep and gentle gradients. The areas around colonies typically supported moist herb vegetation on well-drained soils of loamy texture.

An inventory of bats was conducted in 2009 using an electronic bat detector at three survey locations across the study area. Bats' echolocation calls were recorded at two locations; sonograms of echolocation calls were characteristic of those produced by little brown myotis and western long-eared myotis. Two other species, long-legged myotis and silver haired bat, may also be present; however, sonograms could not provide definitive species identification.

Several survey methodologies were implemented for raptors in 2008 and 2009 to detect the widest range of species that may be present in the study area. Methods, which included a call-playback survey (CPS) for northern goshawks, were performed in conjunction with terrestrial breeding bird surveys in 2008 and 2009. Stand watches (SW) were also conducted in portions of the study area that supported suitable cliff or forest nesting raptor habitat. Incidental observations of raptors were also documented. Eight species of raptors were detected in the study area in 2008 and 2009, the majority of which were recorded incidentally. The most commonly seen species were bald eagles, ospreys, and golden eagles. One northern goshawk was detected along Sulphurets Creek near the proposed mining area during CPS surveys in 2008 and one northern goshawk was detected incidentally along the Unuk River in 2009. Two species of conservation concern were observed: rough-legged hawk (2008) and Swainson's hawk (2009).

Surveys for terrestrial breeding birds were conducted in June of 2008 and 2009, using variable radius point counts (VRPC) along 1 kilometre long transects. Sixty species of birds were identified over the two-year baseline, including incidental observations. Overall, the most abundant species in both years were Townsend's warbler, yellow warbler, hermit thrush, and varied thrush; fewer birds were observed in general in 2009. In 2008, the most diverse species communities were associated with transects within the proposed tailing management facility and along the Coulter Access Corridor. In 2009, the highest diversity, species richness, and abundance was associated with transects near Bowser Lake. On a landscape level, the highest relative abundance of species and species diversity was observed in the Interior Cedar-Hemlock (ICH) and Engelmann Spruce-Subalpine Fir (ESSF) BECs, followed by CWH (Coastal Western Hemlock) and Mountain Hemlock (MH) BECs. One species of conservation concern was observed: olive-sided flycatcher (2009).

Four aerial surveys were conducted for water dependent birds in 2008 and 2009, which were timed during the general breeding and migration periods for water dependent birds in northern BC. Specific survey dates were selected to collect evidence of breeding and reproduction and assess the extent of habitat use by migrating birds. Twenty-five water dependent bird species were positively identified, of which three were identified as species of provincial or regional conservation concern: surf scoter, harlequin duck, and trumpeter swan. During the breeding surveys, water dependent birds were fairly evenly distributed across habitat types in the study area in the spring, whereas the distribution of birds

became confined to certain areas later in the summer. Concentrations of a diversity of species were identified in wetland complexes (marshes, swamps, and ponds) associated with the confluence of Teigen Creek and Bell-Irving River, particularly during the spring. The results of staging surveys indicate that the study area contains more usable habitat for staging birds on their winter migration as opposed to those migrating northwards; fewer species and less than half of the total number of birds were recorded during the spring staging survey than in the fall survey. Two areas were used by a variety of water dependent bird species during the staging surveys: Teigen Creek/Bell-Irving River confluence and Border Lake. Overall, there appears to be a limited amount of breeding and staging habitat within areas of proposed Project development that was used consistently by water dependent birds during and between surveys.

Aerial and ground-based surveys were conducted in 2008 and 2009 to identify western toad breeding sites within the study area. In 2008, an aerial reconnaissance survey was conducted to identify ponds with high potential as toad breeding sites within areas of proposed Project infrastructure and within one kilometre of all proposed roads. A total of 136 ponds were identified during the aerial survey and were rated for suitability based on characteristics such as size, type of surrounding vegetation, flow, and presence of a muddy bank. Ground-based surveys were conducted in both 2008 and 2009 at a subset of wetlands and ponds identified during the aerial reconnaissance survey to collect evidence of western toad breeding (tadpoles and toadlets). A total of 21 sites were ground surveyed in 2008. No evidence of toad breeding was found; however, Columbia spotted frog adults were observed at four sites. In 2009, 6 sites sampled in 2008 were re-surveyed and 44 new sites were surveyed. Three western toad breeding sites were observed: two sites on West Teigen Lake and one site at low elevation on the lower reaches of Teigen Creek near the confluence with the Bell-Irving River, all within the local study area. In addition, western toad adults were observed at five sites, one Columbia spotted frog breeding site was observed outside the local study area, and adult spotted frogs were observed at three locations within the local study area.

KSM PROJECT

2009 WILDLIFE CHARACTERIZATION BASELINE REPORT

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Glossary, Acronyms, and Abbreviations

The following presents a glossary of terms as well as acronyms and abbreviations used in this document. Acronyms and abbreviations are defined where they are first used. The following list will assist readers who may choose to review only portions of the document.

Abiotic Characteristic	Refers to non-living chemical and physical properties that describe the terrestrial and aquatic environment around surveyed locations, such as temperature, weather, pH, or water flow.
Accidental	Species occurring infrequently and unpredictably, outside their usual range. Accidental species are excluded from the Red, Blue, and Yellow list.
Alpine	High-elevation land above the treeline. Alpine vegetation on zonal sites is dominated by low shrubs, herbs, bryophytes, and lichens. Although treeless by definition, patches of stunted (krummholz) trees may occur. Much of the alpine is covered by rock and ice rather than vegetation.
Avian	Of, relating to, or characteristic of birds.
Avifuana	The birds of a specified region or time.
BAFA	Boreal Altai Fescue Alpine BEC zone.
BC	British Columbia
BC CDC	British Columbia Conservation Data Centre: collects and disseminates information on plants, animals, and ecosystems (ecological communities) at risk at the provincial level, and is tied to NatureServe, an international, non-profit organization of cooperating Conservation Data Centres and Natural Heritage Programs all using the same methodology to gather and exchange information on the threatened elements of biodiversity.
BC ILMB	British Columbia Integrated Land Management Bureau.
BC MAL	British Columbia Ministry of Agriculture and Lands.
BC MOE	British Columbia Ministry of Environment.
BC <i>Wildlife Act</i> (1996a)	The main provincial law for protecting wildlife, endangered species, and wildlife habitat. The Act has a number of provisions for protecting, managing, and purchasing habitat areas as well as protecting endangered and threatened species. The Act is administered by the Ministry of Environment.
BEC	Biogeoclimatic Ecosystem Classification: a standard, hierarchical classification system for mapping terrestrial ecosystems in British Columbia.

Biogeoclimatic subzone	A level of the biogeoclimatic classification system that defines the climate of an area, as characterized by the plant association occurring on zonal sites, e.g., Engelmann Spruce - Subalpine Fir Zone - Very Cold Subzone (ESSFwv) (BC Ministry of Forests and Range 2007).
Biogeoclimatic units	A general term referring to any level of Biogeoclimatic zones, subzones, variants, or phases. Biogeoclimatic units are inferred from a system of ecological classification based on a floristic hierarchy of plant associations. The recognized units are a synthesis of climate, vegetation, and soil data (Pojar, Klinka, and Meidinger 1987).
Biogeoclimatic variant	A further subdivision of biogeoclimatic subzone reflecting further differences in regional climate. Variants are described as warmer, colder, drier, wetter, or snowier than the 'typical' subzone, e.g., Mountain Hemlock-Leeward Moist Maritime variant (MHmm2), where leeward (2) is the particular variant.
Biogeoclimatic zone	Geographical areas having similar patterns of energy flow, vegetation and soils as a result of a broadly homogeneous macroclimate. Biogeoclimatic zones are composed of biogeoclimatic subzones with similar zonal climax ecosystems (BC Ministry of Forests and Range 2007).
Biotic Characteristic	Refers to biological properties that describe the terrestrial and aquatic environment around surveyed locations, such as species composition and vegetation structure.
Blue-list	A list of ecological communities, and indigenous species and subspecies of special concern in British Columbia.
CMA	Coastal Mountain-heather Alpine BEC zone.
COSEWIC	Committee on the Status of Endangered Wildlife in Canada: A federal committee of experts that assesses and designates the level of threat to wildlife and vegetation species in Canada.
CPS	Call Playback Survey. A survey method for detecting inconspicuous, scarce, or nocturnal species known to respond to calls during the breeding season. Pre-recorded calls or call playbacks simulate the presence of an "intruder" into an already claimed territory and often elicit a response in the target species. The response of the bird allows the observer to record the presence of the species.
CWH	Coastal Western Hemlock BEC zone.
DEM	Digital Elevation Model: a digital array of elevations for a number of ground positions at regularly spaced intervals.
Ecological Community	A term used by the BC CDC and NatureServe to include natural plant communities and plant associations and the full range of ecosystems that occur in British Columbia.

Ecosystem (terrestrial)	A volume of earth-space that is composed of non-living parts (climate, geologic materials, groundwater, and soils) and living or biotic parts, which are all constantly in a state of motion, transformation, and development. No size or scale is inferred.
ESSF	Engelmann Spruce - Subalpine Fir BEC zone.
Exotic	Species that have been moved beyond their natural range as a result of human activity. Exotic species are also known as alien species, foreign species, introduced species, non-indigenous species, and non-native species. Exotic species are excluded from the Red, Blue, and Yellow lists.
GPS	Global Positioning System.
Habitat	Land and water surface used by wildlife. This may include biotic and abiotic aspects such as vegetation, exposed bedrock, water, and topography.
Hectare	10,000 m ² or 0.01 km ² or 2.47 acres.
ICH	Interior Cedar Hemlock BEC Zone.
IWMS	Identified Wildlife Management Strategy. An initiative of the Ministry of Environment in partnership with the Ministry of Forests and Range. The IWMS provides direction, policy, procedures, and guidelines for managing Identified Wildlife. The goals of the strategy are to minimize the effects of forest and range practices on Identified Wildlife on Crown land and to maintain their limiting habitats throughout their current ranges and, where appropriate, their historic ranges.
KSM	Kerr-Sulphurets-Mitchell
LSA	Local Study Area, 55,187 ha in size.
Mesic	Water removed somewhat slowly in relation to supply; soil may remain moist for a significant, but sometimes short period of the year. Available soil moisture reflects climatic inputs (BC Ministry of Environment Lands and Parks and BC Ministry of Forests Research Branch 1998).
MH	Mountain Hemlock BEC zone.
Migration	The regular seasonal or daily movement of animal populations to and from different areas, often considerable distances apart. Migration often occurs in corridors between preferred habitat types.
<i>Migratory Birds Convention Act (1994b)</i>	A federal government commitment established in 1917 to protect most migrating birds found in Canada. The Act fulfilled the terms of the Migratory Birds Convention of 1916 between Canada and the U.S.A. The Canadian government has the authority to pass and enforce regulations to protect those species of migratory birds that are included in the Convention.

Moisture regime	Indicates, on a relative scale, the available moisture for plant growth in terms of the soil's ability to hold, lose, or receive water. Described as moisture classes from Very Xeric (0) to Hydric (8) (BC Ministry of Environment Lands and Parks and BC Ministry of Forests Research Branch 1998).
NatureServe	NatureServe represents an international network of biological inventories known as natural heritage programs or conservation data centres operating in all 50 U.S. states, Canada, Latin America and the Caribbean. NatureServe is a non-profit conservation organization whose mission is to provide the scientific basis for effective conservation action.
NWA	Nass Wildlife Area, as defined in the Nisga'a Final Agreement (NFA).
Nutrient regime	Indicates the available nutrient supply for plant growth on a site, relative to the supply on all surrounding sites. Nutrient regime is based on a number of environmental and biotic factors, and is described as classes from very poor (A) to very rich (E) and saline (F) (BC Ministry of Environment Lands and Parks and BC Ministry of Forests Research Branch 1998).
Parkland	Subalpine area characterized by forest clumps interspersed with open subalpine meadows and shrub thickets. Vegetation cover may vary in the proportion of treed patches, meadows, and shrub thickets. The term parkland can also be used for lower elevation forest that are open due to restricted moisture availability, such as occurs in the Ponderosa Pine zone.
PEM	Predictive Ecosystem Mapping: a modelled approach to ecosystem mapping using various spatial datasets as input. Mapping follows provincial standards and a pre-defined classification system.
Red-list	List of ecological communities and indigenous species and subspecies that are extirpated, endangered, or threatened in British Columbia. Red listed species and sub-species have—or are candidates for—official Extirpated, Endangered, or Threatened Status in BC. Not all Red-listed taxa will necessarily become formally designated. Placing taxa on these lists flags them as being at risk and requiring investigation.
RIC	Resource Inventory Committee. A body of the BC government that develops survey standards for BC wildlife and ecosystems.
RISC	Resource Information Standards Committee, formerly the Resource Inventory Committee.
RSA	Regional Study Area, 338,080 ha in size.

SARA	<i>Species at Risk Act</i> (2002b). A Canadian federal statute that is designed to meet one of Canada's commitments under the International Convention on Biological Diversity. The goal of the Act is to protect endangered or threatened organisms and their habitats. It also manages species that are not yet threatened, but whose existence or habitat is in jeopardy.
Shannon's Diversity and Equitability	Shannon's Diversity Index is a mathematical measure of species diversity in a community. Diversity indices provide more information about community composition than species richness as they also take the relative abundance of different species into account, along with the number of species (Magurran 1988; Rosenzweig 1995). Shannon's Equitability reports how proportionate the number of individuals is within a community as a measure of the evenness.
Site series	Describes all land areas capable of producing the same late seral or climax plant community within a biogeoclimatic subzone or variant (Banner et al. 1993). Site series can usually be related to a specified range of soil moisture and nutrient regimes within a subzone or variant, but other factors, such as aspect or disturbance history may influence it as well. Site series form the basis of ecosystem units. Definition is taken directly from the RISC standards for Terrestrial Ecosystem Mapping.
SRMP	Sustainable Resource Management Plan.
Stand Watch Survey	A survey method for detecting species and any associated breeding activity by predicting where the species is most likely to occur and then observing the species at the selected location.
Standard Error	A statistical measure of the spread or variability of a set of data.
Structural Stage	Describes the structural characteristics, and often the age, of vegetated ecosystems (RIC 1998f).
SU	Survey Unit. A delineated polygon for the purposes of wildlife surveys.
TEM	Terrestrial Ecosystem Mapping. Delineation and attribution of ecosystem units based on air photo interpretation. Mapping follows provincial standards and a pre-defined classification system.
Topography	The configuration of a surface, including its relief and the position of its natural and man-made features.
TSA	Timber Supply Area.
TRIM	Terrain Resource Information Management. Refers to the digital dataset of geographic base mapping completed for the province of BC in 1996 at a scale of 1:20,000. The dataset includes elevational data, stream networks, and so on.
UTM	Universal Transverse Mercator.

UWR	Ungulate Winter Range. An area identified by the BC Ministry of Environment as “an area that contains habitat that is necessary to meet the winter habitat requirements of an ungulate species.”
VRPC	Variable Radius Point Count. A survey method used for identifying species and estimating relative abundances of species in an area. An observer stands at fixed locations within the study area and records any birds detected and estimates horizontal distance to species detected.
Wetland	Sites dominated by hydrophytic vegetation where soils are water-saturated for a sufficient length of time such that excess water and resulting low soil oxygen levels are principal determinants of vegetation and soil development (MacKenzie and Moran 2004).
WHA	Wildlife Habitat Area. Mapped areas that are necessary to meet the habitat requirements of an Identified Wildlife species under the Identified Wildlife Management Strategy. WHAs designate habitats in which activities are managed to minimize their effect on the Identified Wildlife for which the area was established.
WMU	Wildlife Management Unit. The BC government divides the province into regions (i.e., WMU) for purposes of managing wildlife harvest.
Yellow List	List of ecological communities and indigenous species that are not at risk in British Columbia.

1. Introduction

1.1 PROJECT PROPONENT

The proponent for the KSM (Kerr-Sulphurets-Mitchell) Project is Seabridge Gold Inc. (Seabridge), a publicly traded junior gold company with common shares trading on the Toronto Stock Exchange in Canada and on the American Stock Exchange in the United States.

1.2 KSM PROJECT LOCATION

The KSM Project is a gold/copper project in the mountainous terrain of northwestern British Columbia, approximately 950 km northwest of Vancouver, British Columbia, and approximately 65 km northwest of Stewart, British Columbia (Figure 1.2-1). The proposed Project lies approximately 20 km southeast of Barrick Gold's recently closed Eskay Creek Mine and 30 km northeast of the Alaska border. The proposed processing plant and tailings management facility (TMF) will be about 15 km southwest of the community of Bell II on Highway 37.

The northern and western parts of the Project area drain towards the Unuk River, which crosses into Alaska and enters the Pacific Ocean at Burroughs Bay. The eastern part of the Project area drains towards the Bell-Irving River, which joins the Nass River and empties into the Canadian waters of Portland Inlet. Elevations in the Project area range from under 240 m at the confluence of Sulphurets Creek with the Unuk River, to over 2,300 m at the nearby peak of the Unuk Finger.

1.3 KSM PROJECT DESCRIPTION

The KSM Project is a large proposed gold-copper mining project. Reserve figures released in a preliminary feasibility study announced on March 31, 2010 include 1.6 billion tonnes of ore containing 30.2 million ounces of gold, 7 billion pounds of copper, 133 million ounces of silver, and 210 million pounds of molybdenum in the proven and probable categories. This environmental baseline study was designed to address a wide range of alternatives that have been assessed from engineering and cost perspective at various times during the baseline studies. The following project description is the base case for the March 2010 Preliminary Feasibility Study. Maps in subsequent sections of this baseline report may depict slightly different footprint configurations relating to earlier designs that prevailed at the time the fieldwork was completed.

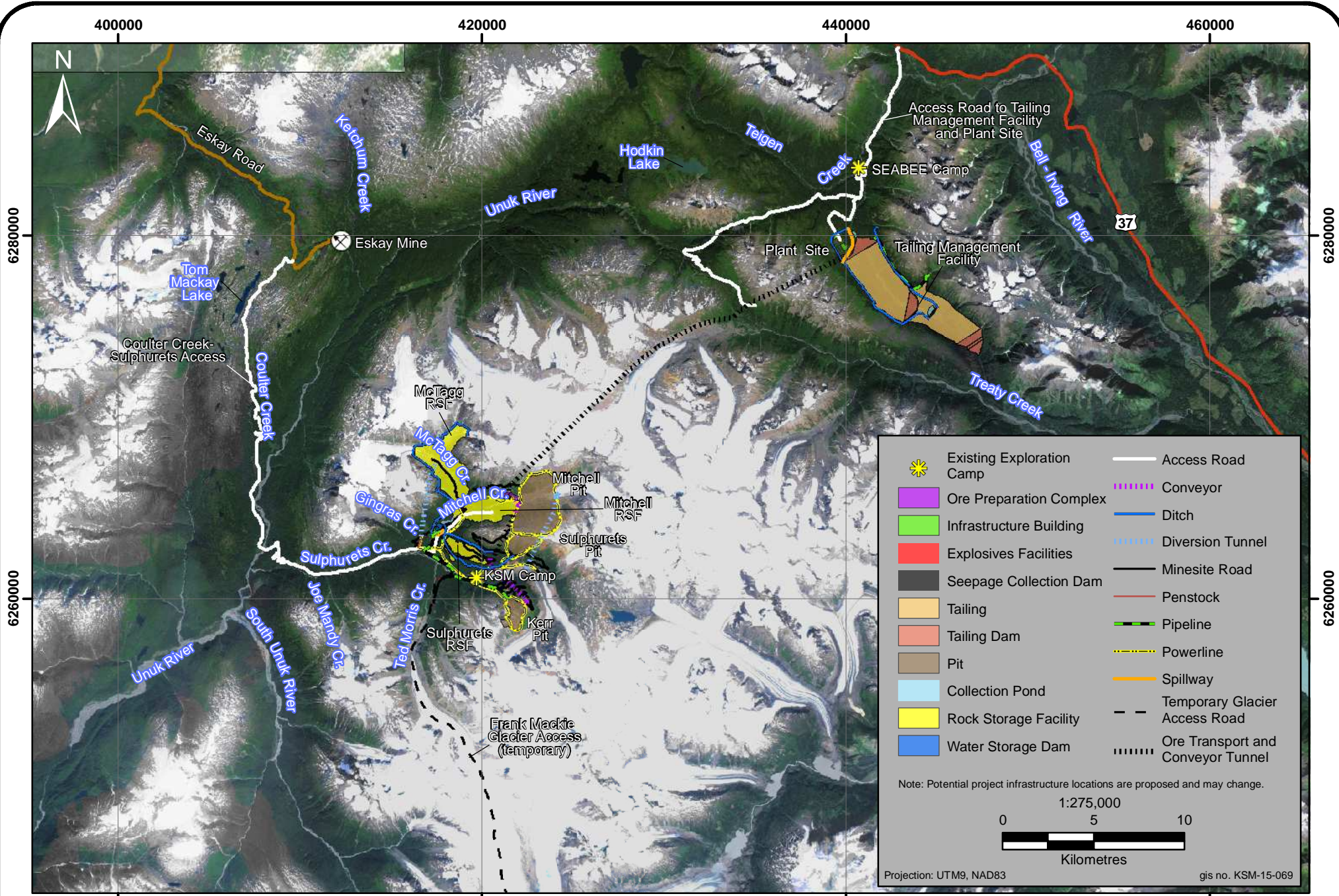
The proposed Project as defined for the purposes of this environmental baseline study will comprise two distinct and geographically separate areas (the mining area and processing plant and tailing management area), shown in Figure 1.3-1. The proposed mining area is in the drainage basin of Sulphurets Creek, a major tributary of the Unuk River. The proposed location of the processing plant and TMF is in the headwaters of tributaries of Teigen and Treaty Creeks, which flow to the Bell-Irving River. The two areas will be connected by a pair of parallel tunnels. An overview of these proposed mine components is provided in the following two sections.

1.3.1 Mining Area

It is proposed that the mining area will be accessed by a new road to be constructed from the current Eskay Creek mine road. The access road will be used to transport personnel, heavy mining equipment, mining supplies, and explosives. This new road will trend southwestwards to the headwaters of Coulter Creek and then follow the general course of Coulter Creek to the Unuk River. After crossing the Unuk



FIGURE 1.2-1



River it will follow the north side of the Sulphurets Creek Valley and cross Mitchell Creek. The Unuk River is considered navigable water under the *Navigable Waters Protection Act*. Branch roads will lead to each of the Kerr, Sulphurets, and Mitchell deposits. Another branch road will head south parallel to Ted Morris Creek towards the toe of the north flowing tongue of Frank Mackie Glacier to provide access to the explosives manufacturing plant and related explosives magazines.

The support facilities for the mining area are proposed to be near the confluence of Sulphurets and Mitchell creeks. They will include accommodation for mine employees and administration and maintenance facilities.

The ore deposits will be bulk mined with large shovels and trucks and will use conventional drilling and blasting methods. The Kerr deposit is on a ridge south of Sulphurets Lake. It is proposed that ore and non-ore mined rock will be transported from the Kerr deposit by conveyor to a tunnel portal (Sulphurets Mitchell tunnel) on the northern side of Sulphurets Creek. These materials will be transported through the tunnel by conveyor to the Mitchell Creek Valley where they will be transported to the ore preparation complex or the Mitchell-McTagg rock storage facilities, respectively.

The Sulphurets deposit is on the southern side of the ridge north of Sulphurets Lake. It is proposed that ore will be transported by truck to the Sulphurets Mitchell tunnel and then by conveyor to the ore preparation complex. Non-ore mined rock will be transported to the Sulphurets rock storage facility on the south side of the ridge between the Mitchell Creek and Sulphurets Creek valleys, or to the Mitchell-McTagg rock storage facilities.

The Mitchell deposit straddles the Mitchell Creek Valley in an area recently exposed by the receding Mitchell Glacier. Mining of the deposit is proposed on both sides of the valley and to a depth of over 400 m below the current valley bottom. Seabridge proposes to construct a diversion tunnel from near the toe of the Mitchell Glacier, southwards towards the Sulphurets Creek Valley upstream of Sulphurets Lake to divert the flow of Mitchell Creek away from the proposed open pit area. It is proposed that the significant hydraulic head created by this tunnel will be used to drive a hydro-electric plant to generate a small portion of the electricity requirements of the Project.

Large volumes of low grade or barren rock will be removed to access the ore in each of the deposits. Non-ore rock removed to access ore will consist of both potentially acid generating (PAG) and not potentially acid generating (not PAG) rock. Rock storage areas have been defined in the Mitchell Creek and McTagg Creek valleys and on the southern facing side of the ridge between Sulphurets Creek and Mitchell Creek valleys. Runoff and seepage from the rock storage areas will be collected in a water storage facility contained behind a dam, to be located in the lower reaches of Mitchell Creek, and treated before discharge to the environment. The piped flow from the storage facility to the water treatment plant may be used to drive a hydro-electric plant.

A second diversion tunnel is proposed to direct the flow of McTagg Creek to the Sulphurets Creek Valley, thus avoiding the rock storage areas. The discharge from this tunnel will be available to drive a hydro-electric plant.

A run-of-river hydro-electric plant is proposed to harness the hydraulic head of the cascade in the lower reaches of Sulphurets Creek.

Ore from the deposits will be transported to an ore preparation complex, consisting of crushing and grinding facilities and related ore storage stockpiles, on the northern side of the Mitchell Creek Valley west of the Mitchell pit. Prepared ore will be mixed with water and pumped through one of two parallel 23 km-long tunnels to the process plant, proposed to be located in the drainage of a north-

flowing tributary of Teigen Creek. The tunnels will daylight for a short distance near the divide between the Unuk River drainage and Treaty Creek before proceeding to the plant site in the Teigen Creek drainage. They will accommodate two pipelines to transport ore slurry as well as a return water pipeline, a diesel fuel pipeline, and a transmission line. The tunnels will slope towards Mitchell Creek so that all drainage can be controlled at the mine site and treated as necessary before release to the environment.

1.3.2 Processing and Tailing Management Area

The tunnel from the Mitchell Creek Valley will terminate on the southern side of the valley formed by a north flowing tributary of Teigen Creek (South Teigen Creek) and a south flowing tributary of Treaty Creek (North Treaty Creek Tributary), adjacent to the plant site.

The plant will use a conventional grinding and flotation flowsheet to produce separate copper/gold and molybdenum concentrates, gold doré, and tailings. It will process up to 120,000 tonnes per day of ore to produce an average of 1,200 tonnes per day of concentrate. The concentrate will be dried and transported to the Port of Stewart by truck. It is anticipated that approximately 20 to 30 round trips per day will be required using 40 tonne payload trucks.

Vehicle access to the plant site will be by a 14 km long road along Teigen Creek from Highway 37. This road will require bridges to cross Teigen Creek, which may be considered to be navigable water, and smaller tributaries.

The tailings will be pumped through pipelines to the TMF in the upper reaches of the Teigen Creek Valley, extending southeast over the divide into a tributary of the Treaty Creek drainage. The facility will be constructed in two phases: the north cell will be developed between a north dam, to be located across the valley of the south tributary of Teigen Creek near the plant site, and a south dam, to be located near the crest of the valley floor; and a south cell that will be retained by a southeast dam, to be located in the headwaters of the north tributary of Treaty Creek. The proposed facility will have storage capacity for the life of the Project within an area about 8 km long and 1.5 km wide. Seepage from the south and southeast dams will be pumped back into the impoundment to reduce any potential impact on the Treaty Creek drainage. Water diversion channels will be constructed on both flanks of the impoundment, where feasible, to divert clean water away from the impoundment. Supernatant water will be recovered from the impoundment using barge mounted pumps and recycled to the plant for process water. In the event that discharge is required, the excess water in the impoundment will be pumped over the northern dam towards the Teigen Creek drainage. Treatment of discharge water may be required to meet permit conditions.

It is assumed that electricity to power the plant and mine site will be obtained from the provincial electricity grid. A secondary transmission line will be constructed from a switching station, to be located near the point where Highway 37 crosses Snowbank Creek. The secondary line will follow the general alignment of the access road, to the plant site, and then pass through the tunnel to the mine site.

1.4 WILDLIFE CHARACTERIZATION BASELINE STUDIES OVERVIEW

Seabridge initiated a series of baseline environmental and socio-cultural studies in preparing an Environmental Assessment Certificate application for the Project. A number of desk-based and field inventory studies have been undertaken to collect baseline data on wildlife within the Project area. These studies included a literature review for existing relevant information on wildlife and wildlife habitats within the area, and a desk-based evaluation of the potential presence of species at risk (according to the federal *Species at Risk Act*) and species of concern (as identified by regulators and stakeholders). Field surveys focused on moose (*Alces alces*); mountain ungulates including mountain

goat (*Oreamus americanus*), Stone's sheep (*Ovis dalli stonei*), and northern caribou (*Rangifer tarandus*); grizzly bear (*Ursus arctos*); hoary marmot (*Marmota caligata*); Arctic ground squirrel (*Spermophilus parryi*); small mammals, bats, raptors, terrestrial breeding birds, water dependant birds, and amphibians. The results of the 2008 program are reported in the *KSM Project 2008 Baseline Studies Report* (Rescan 2009). The current report also summarizes results of baseline wildlife studies conducted within the Project area during the spring, summer, and fall of 2008, as well as during the winter, spring, and summer of 2009.

A grizzly bear mark-recapture study using hair samples was undertaken in the Project area to estimate grizzly bear abundance and record movement of individuals. The results of this study are reported separately in the *2008 and 2009 Grizzly Bear DNA Baseline Report* (Rescan 2010a). Studies to develop habitat suitability models for moose, mountain goat, grizzly bear, marten (*Martes americana*), and hoary marmot were also undertaken for the Project area, in conjunction with ecosystem mapping studies (Rescan 2010c). The results of wildlife habitat suitability models are reported separately in the *2009 Wildlife Habitat Suitability Baseline Report* (Rescan 2010d).

1.5 STUDY AREA

Two study areas were considered for wildlife inventories for the Project, a local study area (LSA) and a regional study area (RSA) (Figure 1.5-1). The LSA is based on the terrestrial ecosystem mapping (TEM) area (Rescan 2010c) and includes a buffer extending at least to the height of land or 1.5 km around the outer limits of the proposed infrastructure (i.e., for the plant site, open pits, and TMF), whichever comes first. The LSA also includes a buffer extending at least to the height of land or 1.5 km along either side of the centre line of the linear development (i.e., access road, pipelines, and transmission line), whichever comes first. For the purposes of this environmental baseline studies report, the LSA is divided into four distinct and geographically separate areas: western, eastern, Mitchell-Teigen corridor, and the Coulter access corridor. The Coulter access corridor and western area represent a more coastal influenced climate. The Coulter access corridor defines the Coulter Creek access road and the Sulphurets Canyon small hydro plant and the western area defines the mining area (i.e., pits, rock disposal areas, accommodation, associated maintenance facilities, and related access). The eastern area represents a transitional climate from coastal to interior and defines the TMF, plant site, Teigen access road, and associated facilities. The Mitchell-Teigen corridor is glacier, rock, or alpine tundra and defines the 23 km long parallel tunnels between the Mitchell and Teigen valleys. The LSA covers approximately 552 km², including all four sections.

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 (which can act as a barrier to movement) were also considered when delineating boundaries. The RSA covers approximately 3,380 km² or 338,080 ha.

Ecologically, the RSA is divided into two distinct climatic regions. The western portion of the study area (including the western LSA and Coulter access corridor) represents moist coastal ecosystems, including Coastal Western Hemlock-Wet Maritime (CWHwm), Mountain Hemlock-Leeward Moist Maritime (MHmm2), and Coastal Mountain-heather Alpine-Undifferentiated Parkland (CMAunp) biogeoclimatic ecosystem classification (BEC) units. The eastern portion of the study area (including the eastern LSA and Mitchell-Teigen corridor) represents a transitional climate from coastal to interior ecosystems, including Engelmann Spruce - Subalpine Fir-Wet Very Cold (ESSFwv), Boreal Altai Fescue Alpine-Undifferentiated Parkland (BAFA), and Interior Cedar Hemlock- Very Wet Cold BEC units. Elevations in the RSA range from about 240 m at the confluence of Sulphurets Creek with the Unuk

River, to over 2,300 m at the peak of the Unuk Finger. Habitat types are diverse, with mature forests and wetlands at lower elevations and shrubs/stunted trees and drier sparsely vegetated subalpine and alpine habitat at higher elevations.

Provincial forests within the RSA are administered by the Ministry of Forests and Range. The Project overlaps two forest districts (Skeena Stikine and Kalum), as well as two timber supply areas (TSA) including Cassiar and Nass. Wildlife is managed provincially by the Ministry of Environment (BC MOE) Region 6 (Skeena), and the Pacific/Yukon division of Environment Canada is the federal agency responsible for wildlife and species at risk in the area. The Project overlaps with three Wildlife Management Units (WMUs) within Skeena Region 6, including 6-16, 6-21, and minor portions of 6-17.

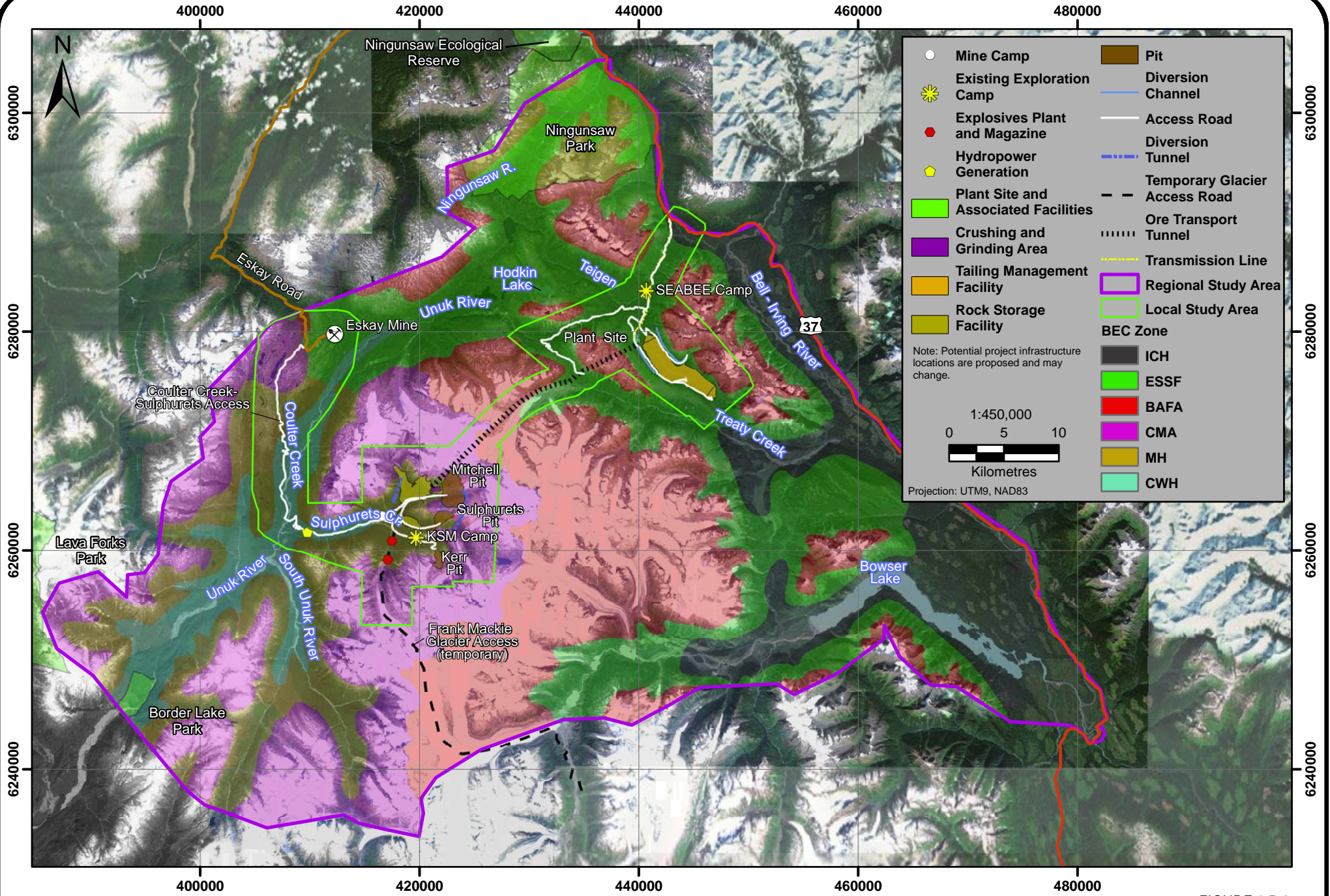
The western portion of the RSA is in the Cassiar Iskut-Stikine Land and Resource Management Plan (LRMP) (BC ILMB 2000). A small part of the eastern portion of the RSA, including the eastern LSA near the divide between Unuk River and Treaty Creek drainages, is within the Nass South Sustainable Resource Management Plan (SRMP)(BC ILMB 2009). The RSA also lies partially within the Nass Area as defined in the *Nisga'a Final Agreement*.

There are three provincial parks in or near the proposed Project wildlife RSA. Nigunsaw Provincial Park and Border Lake Provincial Park are within 15 km and 25 km, respectively, of proposed Project infrastructure. Lava Forks Provincial Park is outside of the RSA, adjacent to the boundary of the westernmost part of the RSA.

1.6 OBJECTIVES

The overall goal of conducting wildlife baseline inventories was to characterize the wildlife community in preparation for the Environmental Assessment to assess and mitigate the potential effects of the proposed Project on wildlife species and habitat in the area. The specific objectives of the wildlife baseline study were to:

- identify and examine current wildlife land use management objectives and existing wildlife inventories associated with the Project study area;
- identify wildlife species of conservation concern and focal species and/or groups in the study area;
- characterize the mammal community and collect baseline information on focal species' presence, distribution, and habitat quality and/or use in the study area;
- characterize the avian community and collect baseline information on species' presence and rarity, reproductive timing, diversity and avian community structure, and community habitat associations in the study area; and
- characterize the amphibian community to determine species' presence and identify species of conservation concern in the study area.



2. Background Information

2.1 OVERVIEW

Baseline data collection for resource development projects provides current information about the wildlife species that can be found within a proposed project area. However, baseline efforts can only provide a snapshot of the current condition of the locale. Baseline data collection should be supplemented with available wildlife literature, which can offer a range of additional information on wildlife species in the region, including information on historical distributions, population estimates and trends, habitat preferences, important legislation relevant to wildlife, or information on sensitive wildlife species.

In BC, there are two main provincial resources providing wildlife information: the BC MOE and Ministry of Agriculture and Lands (BC MAL). Within the BC MOE, the Ecosystems Branch provides information on the biodiversity of BC and the Fish and Wildlife Branch provides legislation and management practices for BC's biodiversity. The Integrated Land Management Bureau (BC ILMB) is under the ministerial accountability of the BC MAL and is responsible for developing LRMPs or SRMPs, which provide information and management strategies for wildlife within the LRMP or SRMP area.

Outside of the BC MOE and BC MAL, the Resource Information Standards Committee (RISC), which was the Resource Inventory Committee (RIC) before 2004, also provides wildlife information, particularly regarding developing proper and efficient inventory techniques and protocols for BC's biodiversity. RISC is a provincially funded agency that is composed of representatives from various ministries and agencies of the Canadian and the British Columbia governments and includes academic, industry, and First Nations involvement.

In addition to land management plans, scientific literature (i.e., academic and peer-reviewed research), grey literature (i.e., reports that have not been peer-reviewed such as government reports), and First Nations Traditional Use and Knowledge (TU/TK) are important sources of existing wildlife information. This chapter reviews and identifies relevant wildlife legislation, land management plan wildlife objectives, and existing wildlife inventories and traditional knowledge associated with the study area.

2.2 WILDLIFE LEGISLATION

Wildlife and wildlife habitat are protected under several forms of federal and provincial legislation, such as the BC *Wildlife Act* (1996b), the Canada *Migratory Birds Convention Act* (1994a), the Canada *Species at Risk Act* (2002c), the BC *Forest and Range Practices Act* (2002a), and the BC *Water Act* (1988) (Table 2.2-1). These provincial and federal acts, along with good practice guidelines and standards, help ensure developments are designed and carried out in compliance with applicable legislation and in a manner that will not affect the natural environment.

In general, standards and good 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. Following definitions in the *Standards and Best Practices for Instream Works* (BC MWLAP 2004c), "standard" is a regulatory requirement that must be followed or achieved in the design and completion of developments. Good (or 'best') practice is a recommended method or technique that should be followed to ensure the standards are met and effects are mitigated. Good management practices and guidelines relevant to the Project include the following:

- *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).
- *Develop with Care: Environmental Guidelines for Urban and Rural Land Development in British Columbia* (BC MOE 2006a).
- *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 2004c).
- *Wetlands Environmental Assessment Guideline* (Milko 1998).
- *Wetland Ways: Interim Guidelines for Wetland Protection and Conservation in British Columbia* (WSP 2009).

Table 2.2-1. Summary of Relevant Acts or Regulations for Wildlife and Wildlife Habitat

Act or Regulation	Implications for Management
BC <i>Wildlife Act</i> (1996b)	<ul style="list-style-type: none"> • Protects most vertebrate animals from direct harm or harassment except as allowed by regulation (e.g., hunting or trapping). Legal designation provides additional protection for selected red- and blue-listed species and their residences. • Section 34 of the Act specifically protects birds and their eggs from possession, molestation, injury, or destruction; the nests of eagles, peregrine falcons, gyrfalcons, ospreys, herons, and burrowing owls year-round; and the nests of all other birds when the bird or their egg are in the nest. • Section 9 of the Act specifically protects a beaver or muskrat house, den, or dam from disturbance, molestation, or destruction, except in the case of trappers licensed under the Act. • Alteration or removal of a beaver dam is permitted under the <i>Wildlife Act</i> "to provide irrigation or drainage under lawful authority for the protection of property" and for drainage purposes with specific restrictions. To remove a beaver dam or muskrat house, the Ministry must be notified at least 45 days in advance of the removal project.
Canada <i>Migratory Birds Convention Act</i> (1994a)	<ul style="list-style-type: none"> • Prohibits the taking or killing of migratory birds, their nests, and eggs, and the deposition of harmful substances in areas frequented by migratory birds. • Species protected include waterfowl, cranes, rails and coots, shorebirds including gulls and terns, pigeons and doves, insectivorous songbirds (excluding blackbirds), seabirds, loons, grebes, herons, egrets, and bitterns.
Canada <i>Species at Risk Act</i> (2002c)	<ul style="list-style-type: none"> • Protects wildlife present on the "List of Wildlife Species at Risk" on federal lands as well as the critical habitat of those species. • Section 137 amends the <i>Canadian Environmental Assessment Act</i> (CEAA) to clarify, for greater certainty, that EAs must always consider effects to listed wildlife species, their critical habitat, or the residences of individuals of that species. • Section 79(2) states "the person must identify the adverse effects of the project on the listed wildlife species and its critical habitat and, if the project is carried out, must ensure that measures are taken to avoid or lessen those effects and to monitor them. The measures must be taken in a way that is consistent with any applicable recovery strategy and action plans."

(continued)

Table 2.2-1. Summary of Relevant Acts or Regulations for Wildlife and Wildlife Habitat (completed)

Act or Regulation	Implications for Management
BC <i>Forest and Range Practices Act</i> (2002a)	<ul style="list-style-type: none"> • Section 149.1 of the Act authorizes the minister responsible for the <i>Wildlife Act</i> to establish one or more of the following: <ul style="list-style-type: none"> • An area as an ungulate winter range and objectives for the ungulate winter range; • An area as a wildlife habitat area and objectives for the wildlife habitat area; • A general wildlife measure (i.e., wildlife habitat feature); • Categories of wildlife for the purposes of subparagraphs above; • Section 150.5 of the Act authorizes the establishment of riparian reserve zones, riparian management zones, and riparian management areas for different classes of streams, wetlands, and lakes.
BC <i>Water Act</i> (1988)	<ul style="list-style-type: none"> • Any proposed works in or about a stream must protect fish and wildlife habitat. • The Act applies to the quantity and quality of water on which fish or wildlife depend directly or indirectly to carry out their life processes, and spawning grounds and the nursery, rearing, food supply, and migration areas. • Under Part 7 of the BC <i>Water Act Regulation</i>, works must meet the standards under Section 42 (1) and (2), regardless of the type of work, including: <ul style="list-style-type: none"> • the timing window or the period(s) of time in the year during which the change can proceed without causing harm to fish, wildlife, or habitat; • the minimum instream flow or the minimum flow of water that must remain in the stream while the change is made; • the removal of material from the stream or stream channel in connection with the change; • the addition of substance, sediment, debris, or material to the stream or stream channel in connection with the change; • the salvage or protection of fish or wildlife during or after the change is made; • the protection of natural materials and vegetation that contribute to habitat or stream channel stability; • the restoration of the worksite after the change has been made; • the requirement to obtain an approval from the federal Department of Fisheries and Oceans in connection with the change.

2.3 LAND MANAGEMENT PLANS

The Project area is within the Regional District of Kitimat-Stikine (RDKS), and contains extensive areas of Crown land and areas subject to the Cassiar Iskut-Stikine LRMP (BC ILMB 2000) and draft Nass South SRMP (BC ILMB 2009). LRMPS are sub-regional, integrated resource plans that establish the framework for land use and resource management objectives and strategies, and provide a basis for detailed management planning. Regional plans or LRMPS (sub-regional plans) result in several main products including: broad land/coastal use zones delineated on a map; resource management objectives for land/coastal use zones; broad strategies for integrating resource use; socio-economic analysis; and plan monitoring, implementation, and interpretation mechanisms. SRMPs focus on similar issues and values as regional plans or LRMPS but at a more detailed level. For example, SRMPs are used to identify Old Growth Management Areas (OGMAs), a priority component of biodiversity planning; to address specific economic development issues such as agriculture or tourism developments; and to manage values such as spiritual and cultural resources as identified by First Nations.

The western portion of the RSA falls within the General Management Direction (GMD) of the Cassiar Iskut-Stikine LRMP. Objectives and strategies of the GMD apply throughout the LRMP area, outside of Protected Areas. In addition to the GMD, there are objectives and strategies for area-specific Resource Management Zones (RMZs). One RMZ occurs within the RSA, the Unuk River RMZ. The eastern portion of the RSA falls within the Nass South SRMP (draft). Wildlife-related management objectives of both the GMD and Unuk River RMZ of the Cassiar Iskut-Stikine LRMP, and the Nass South SRMP are described in Table 2.3-1.

Table 2.3-1. Wildlife Objectives of the Cassiar Iskut-Stikine LRMP and Nass South SRMP

Management Direction	Wildlife-Related Resource	Wildlife-Related Management Objectives
<ul style="list-style-type: none"> Cassiar Iskut-Stikine LRMP (BC ILMB 2000) 		
General Management Direction - Access Management	Access Management	<ul style="list-style-type: none"> Minimize impacts on wildlife habitat and sensitive ecosystems during road construction and use. Manage game populations by controlling hunting and fishing access, where required. 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. Minimize disturbance to wildlife due to aircraft use, particularly during sensitive periods.
General Management Direction - Biodiversity/ Ecosystem Health	Aquatic Ecosystems and Riparian Habitat	<ul style="list-style-type: none"> Conserve riparian habitat by minimizing disturbance to the structural and functional features of riparian habitat, including critical habitat features.
	Endangered Plants and Animals	<ul style="list-style-type: none"> Maintain habitats of rare, threatened, and endangered animals, plants, and plant communities as described in the BC Conservation Data Centre lists. Maintain habitat of fisher where populations are known to exist. Maintain nesting and foraging habitat for nest sites of raptors, particularly rare and endangered species, including northern goshawk, short-eared owl, gyrfalcon, peregrine falcon. Minimize disturbance of critical habitat areas for trumpeter swans (e.g., nesting and over-wintering areas, including early spring migration stops).
	Special Landforms: Plateaus	<ul style="list-style-type: none"> Minimize impacts of motorized activities on plateaus and their habitats. Maintain connectivity for wildlife between plateaus and adjacent plateaus and mountain ranges.
	Wildlife: General	<ul style="list-style-type: none"> Maintain habitat to support healthy wildlife populations. Manage development and access to conserved important habitat features and wildlife.
	Wildlife: Moose	<ul style="list-style-type: none"> 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 the impact on winter habitat.
	Wildlife: Caribou	<ul style="list-style-type: none"> 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.

(continued)

Table 2.3-1. Wildlife Objectives of the Cassiar Iskut-Stikine LRMP and Nass South SRMP (continued)

Management Direction	Wildlife-Related Resource	Wildlife-Related Management Objectives
		<ul style="list-style-type: none"> Maintain the functional integrity of mapped caribou winter range, with particular reference to the Three Sisters, Kehlechoa River, and the Stikine. Also address 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 effects on winter habitat.
	Wildlife: Mountain Goat and Stone's Sheep	<ul style="list-style-type: none"> Maintain large areas of high value Stone's sheep and mountain goat habitat and avoid disturbing animals during kidding and lambing. 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.
	Wildlife: Grizzly Bear	<ul style="list-style-type: none"> 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. Reduce human-bear interactions. 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. Minimize bear/human conflicts and disruption of bear habitat use. Monitor overall effectiveness of habitat management for grizzly bear.
	Wildlife: Marten	<ul style="list-style-type: none"> 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).
Area-Specific Resource Management Zone - Unuk River Zone	General	<ul style="list-style-type: none"> Maintain high quality and quantity of grizzly bear habitat while allowing commercial timber harvesting and mineral exploration and development to occur.
		<ul style="list-style-type: none"> Draft Nass South SRMP (BC ILMB 2009)
Water Resources	Water	<ul style="list-style-type: none"> Maintain ecological functioning of streams, rivers, wetland complexes and lakes, including those that do not support fish populations. Maintain the functional integrity of floodplains and alluvial fans.
Biodiversity Resources	Biodiversity	<ul style="list-style-type: none"> Maintain or recruit structural attributes of old forests to support stand-level biodiversity.
Wildlife	Moose	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Minimize adverse disturbance to goats within identified mountain goat winter range. Minimize the number of roads within 500 m of winter range and 1000 m of canyon-dwelling goat winter range. Minimize adverse disturbance to mountain goat winter range from helicopter logging activities.

(continued)

Table 2.3-1. Wildlife Objectives of the Cassiar Iskut-Stikine LRMP and Nass South SRMP (completed)

Management Direction	Wildlife-Related Resource	Wildlife-Related Management Objectives
	Grizzly Bear	<ul style="list-style-type: none"> • Preserved the highest value grizzly bear habitat. • Maintain the quality and effectiveness of grizzly bear foraging habitat. • Minimize human-bear conflicts. • Minimize long-term displacement of grizzly bears from industrial access development.
	Furbearers	<ul style="list-style-type: none"> • Minimize impact to known high value fisher and wolverine habitat.
	Northern Goshawk	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Maintain effectiveness of riparian habitats adjacent to wetlands.

2.4 EXISTING WILDLIFE INVENTORIES

An initial review was undertaken to assess the available sources of information that would be useful for supplementing baseline inventory results and to aid in determining the wildlife species that potentially occur within the study area.

Specifically, the objectives of this review were to:

- identify any historical or current research conducted on wildlife in the study area;
- identify reports and databases that may provide information on the wildlife and habitat within the study area;
- assess areas that may have legislative protection within the wildlife study area under the *Forest and Range Practices Act* (2002a) and *BC Wildlife Act* (1996a), such as Ungulate Winter Ranges (UWRs) or Wildlife Habitat Areas (WHAs); and
- document the wildlife species that may be present in the study area with specific emphasis on species of conservation concern.

The scope of the review was restricted to the available online provincial databases and information provided by regional wildlife inventory specialists. The following information sources were consulted:

- BC MOE Ecosystem Branch website: publishes various reports on wildlife and identified wildlife under the Identified Wildlife Management Strategy (IWMS);
- BC MOE Fish and Wildlife Branch: harvest data from provincial WMUs;
- BC ILMB: manages and provides LRMPs, and geographic information;
- iMapBC: a spatial information tool that can be used to assess the presence and locations of wildlife in an area through occurrence reports and telemetry locations; it also helps identify important wildlife habitat, such as UWRs and WHAs.
- Ecological Reports Catalogue (EcoCat): provides access to a database of published wildlife research reports from across the province.

- Wildlife Species Inventory (WSI): maintains a database for submitting information from wildlife inventory studies in BC, in the form of reports and datasets. Completed datasets and reports are available to the public using the Species Inventory Web Explorer (SIWE).
- BC Conservation Data Centre (BC CDC) database: an online database that collects and disseminates information on plants, animals, and ecosystems (ecological communities) at risk in British Columbia. This information provides a centralized and scientific source of information on the status, locations, and level of protection of these organisms and ecosystems (BC CDC 2010d).
- BC Species and Ecosystems Explorer: an online source for authoritative conservation information on approximately 6,000 plants and animals and almost 600 ecological communities (ecosystems) in BC;
- Web of Science: university library catalogue with peer-reviewed literature.

A literature review revealed the availability of existing wildlife information and data for the Project study area. The wildlife inventories and studies that have been conducted in the area, along with their main objectives are listed in Table 2.4-1. Details of the results from the documents are discussed under each species specific section of the baseline report (Section 4 to 6). Further information on wildlife habitat suitability can be found in the *2009 Wildlife Habitat Suitability Baseline Report* (Rescan 2010d).

Table 2.4-1. Summary of Existing Wildlife Inventories within or near the Project Study Area

Wildlife Inventory	Location	Wildlife Resource	Objectives and Outcomes
Draft Nass South SRMP (BC ILMB 2009)	Nass South SRMP area	Moose, Mountain Goat, Grizzly Bear, Northern Goshawk	<ul style="list-style-type: none"> • Identified moose winter range as Ungulate Winter Range under the <i>Forest and Range Practices Act</i> • Identified mountain goat winter range as Ungulate Winter Range under the <i>Forest and Range Practices Act</i> • Identified high value grizzly bear habitat through the Wildlife Habitat Area (WHA) process under the <i>Forest and Range Practices Act</i> • Identified high value northern goshawk habitat through Habitat Suitability Index modelling
Cassiar Iskut-Stikine LRMP (BC ILMB 2000)	Cassiar Iskut-Stikine LRMP area	Moose, Mountain Goat, Grizzly Bear, Marten	<ul style="list-style-type: none"> • Identified high value moose habitat • Identified high value mountain goat habitat and kidding areas • Identified high value grizzly bear habitat • Identified high value marten habitat
Keim (2004a)	Bell II area	Mountain Goats	<ul style="list-style-type: none"> • Assessed late winter distribution of mountain goats in the Bell II areas using helicopter survey observations to validate and verify a winter mountain goat habitat suitability index model.
Keim (2004b)	Taku River drainage	Mountain Goats	<ul style="list-style-type: none"> • Determined mountain goat winter movements, winter habitat selection, and core winter habitat using GPS collared mountain goats in the Taku River drainage.

(continued)

Table 2.4-1. Summary of Existing Wildlife Inventories within or near the Project Study Area (completed)

Wildlife Inventory	Location	Wildlife Resource	Objectives and Outcomes
BC MOE (2008)	Nass TSA and Upper Portion of Ningunsaw and Unuk watersheds	Mountain Goats	<ul style="list-style-type: none"> Identified Ungulate Winter Range (#U-6-002).
McElhanney (2007a)	Northern Nass TSA	Grizzly Bears	<ul style="list-style-type: none"> Conducted grizzly bear habitat suitability to support the designation of grizzly bear Wildlife Habitat Areas (WHA).
McElhanney (2007b)	Northern Nass TSA	Moose	<ul style="list-style-type: none"> Conducted moose winter habitat suitability to support the designation of moose UWR in the northern Nass TSA.

3. Species of Conservation Concern

A desk-based literature and database search was conducted to develop a list of wildlife species potentially occurring within the study area (Appendix 3-1). The list of potentially occurring wildlife species was evaluated to assess the potential for species to occur in the study area (i.e., the likelihood that species will be observed). The likelihood of occurrence was based on distribution and habitat requirements according to multiple sources (V. Stevens 1995; Sibley 2000; Stebbins 2003; Alderfer 2006; Reid 2006; CARCNET 2009; BC CDC 2010a; NatureServe 2010). The likelihood of occurrence was placed into three categories of each potentially occurring species: likely, possible, and unlikely (Table 3-1).

Table 3-1. Criteria for Assessing the Likelihood of Occurrence in the Study Area

Category	Definition and Criteria for Assessment ¹
Likely (L)	Species that are likely to occur. Species in the category have overlapping seasonal ranges with the study area, are known to occur within the BEC zones associated with the study area, and seasonal habitat requirements are met within the study area.
Possible (P)	Species that possibly occur. Species in this category may or may not have overlapping seasonal ranges with the study area, seasonal habitat requirements may or may not be met within the study area, but have been detected in BEC zones associated with the study area. Many migratory bird species can be placed in this category as species are expected to pass over or near the study area during spring and fall migrations, and as such, their presence would be possible but infrequent.
Unlikely (U)	Species that are unlikely to occur. Species in this category have seasonal ranges that near the study area (within 100 km) and may or may not have been detected in BEC zones associated with the study area. However, seasonal habitat requirements are not met within the study area. Species with low population sizes are also placed in this category.

¹ Likelihood that species occur in the study area was based upon range maps and ecological information according to various sources (V. Stevens 1995; Sibley 2000; Stebbins 2003; Alderfer 2006; Reid 2006; CARCNET 2009; BC CDC 2010a; NatureServe 2010).

Each species was also assessed for their presence relative to the study area, based on migratory patterns (Table 3-2). Many different species of birds migrate along or near the Pacific coastline (Lincoln, Peterson, and Zimmerman 1998), sometimes referred to as the Pacific Flyway. As such, bird species known to use terrestrial and aquatic habitat (including marine and estuarine habitats) along the Pacific Flyway during migration were considered during the assessment of potentially occurring wildlife species. Estuarine habitats occur within 50 to 70 km of the study area, and open water marine habitats occur within 100 to 150 km.

The conservation status of potentially occurring wildlife species was assessed according to provincial (BC Status [red, blue, or yellow list]), federal (Committee on the Status of Endangered Wildlife in Canada (COSEWIC); *Species at Risk Act* (SARA)), and international (NatureServe) assessment bodies (Table 3-3). Species of concern include species or populations on the provincial red and blue lists and/or provincially ranked as critically imperilled, imperilled, and vulnerable; classified as endangered, threatened, or special concern as designated by COSEWIC; on Schedule 1 of SARA; and/or are globally ranked as imperilled or vulnerable by NatureServe.

Table 3-2. Criteria for Assessing the Presence of Species in Relation to the Study Area

Category	Definition and Criteria for Assessment
Resident	Species is present and active year-round and species seasonal range overlaps with the study area.
Resident_hibernator	Species is present year-round but hibernates during the winter months (e.g., marmot and bat species). Species seasonal range overlaps with the study area.
Resident_migrant	Species is present during most of the year but migrates south for the winter (e.g., bat species). Species seasonal range overlaps with the study area.
Breeder	Species is present during the spring, summer, and fall (i.e., breeding) season. Species seasonal range overlaps with the study area.
Migrant	Species is present only during spring and/or fall migrations. Species seasonal range overlaps with the study area.
Winter	Species is present only during the winter. Species seasonal range overlaps with the study area.
Migratory Bird Species Specific Category	
Offshore	Identifies marine species, i.e., species that use offshore ocean-associated habitats during the year (e.g., estuaries, open water)
(none)	Identifies all other species, i.e., species that use onshore terrestrial and aquatic habitats during the year (e.g., forests, alpine, lakes, rivers)

Table 3-3. Conservation Statuses and Definitions

BC Status/List		
Status	Definition	
Red list	List of species that are extirpated, endangered, or threatened	
Blue list	List of species that are special concern	
Yellow list	List of species that are not at risk	
Accidental	Species occurring infrequently and unpredictably, outside their usual range. Accidental species are excluded from the Red, Blue, and Yellow list.	
Exotic	Species that have been moved beyond their natural range as a result of human activity. Exotic species are also known as alien species, foreign species, introduced species, non-indigenous species, and non-native species. Exotic species are excluded from the Red, Blue and Yellow lists.	
Provincial Rank (Prov Rank)		
Rank	Definition	
S#S#:	Range Rank	A numeric range rank (e.g., S2S3) is used to indicate the range of uncertainty about the status of the species or community.
S?:	Unranked	Province conservation status not yet assessed.
SU:	Unrankable	Currently unrankable due to lack of information or substantially conflicting information about status or trends.
S1:	Critically Imperilled	Critically imperilled in the province because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the province.
S2:	Imperilled	Imperilled in the province because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the province.
S3:	Vulnerable	Vulnerable in the province due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.

(continued)

Table 3-3. Conservation Statuses and Definitions (completed)

Provincial Rank (Prov Rank) (cont'd)		
Rank		Definition
S4:	Apparently Secure	Uncommon but not rare; some cause for long-term concern due to declines or other factors.
S5:	Secure	Common, widespread, and abundant in the province.
SNA:	Not Applicable	A conservation status rank is not applicable because the species is not a suitable target for conservation activities.
<i>Breeding Status Qualifier</i>		
B:	Conservation status refers to the breeding population of the species in the province.	
N:	Conservation status refers to the non-breeding population of the species in the province.	
M:	Migrant species occurring regularly on migration. Conservation status refers to the aggregating transient population of the species in the province.	
COSEWIC		
Status		Definition
E:	Endangered	A species facing imminent extirpation or extinction.
T:	Threatened	A species that is likely to become endangered if limiting factors are not reversed.
SC:	Special Concern	A species of special concern because of characteristics that make it is particularly sensitive to human activities or natural events.
NAR:	Not at Risk	A species that has been evaluated and found to be not at risk.
DD:	Data Deficient	A species for which there is insufficient scientific information to support status designation.
SARA		
Schedule		Definition
1:	Protected under SARA as of proclamation in June 2003. These species were assessed by COSEWIC using the revised assessment criteria. The list classifies the species as being extirpated, endangered, threatened, or a special concern.	
2 and 3:	Assessed before October 1999, and require re-assessment using the revised criteria, following which the Governor in Council may, on the recommendation of the Minister, add the species to the Federal List of Wildlife Species at Risk.	
NatureServe (Global rank)		
Rank		Definition
G#G#:	Range Rank	A numeric range rank (e.g., G2G3) is used to indicate the range of uncertainty about the status of the species or community.
G2:	Imperilled	At high risk of extinction due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors.
G3:	Vulnerable	At moderate risk of extinction due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread.
G4:	Apparently Secure	Uncommon but not rare; some cause for long-term concern due to declines or other factors.
G5:	Secure	Common, widespread, and abundant.
T:	Infraspecific Taxon (trinomial)	The status of infraspecific taxa (subspecies or varieties) are indicated by a "T-rank" following the species' global rank. e.g., the global rank of a critically imperilled subspecies of an otherwise widespread and common species would be G5T1.

A total of 6 amphibians, 1 reptile, 222 birds, and 54 mammals potentially occur within the study area (Appendix 3-1). Of these species, 49 species including 1 amphibian, 40 birds, and 8 mammals are identified as a conservation concern (Table 3-4). Forty-five species are provincially listed and 18 species are federally listed; 31% of provincially listed species are also listed at the federal level. Overall, 39 species of conservation concern were considered likely occurring (L) or possibly occurring (P) within the RSA.

The western toad (*Anaxyrus boreas*) is the only amphibian of conservation concern that likely occurs in the study area. This species was observed during baseline studies. While ranked as apparently secure by the provincial government and NatureServe, the western toad is listed as a species of special concern by COSEWIC and is on Schedule 1 of SARA.

Of the bird species with conservation status, 6 (15%) were categorized as likely occurring species: the majority of species were categorized as possible (63%) or unlikely (22%). Those that are likely to occur in the study area are: harlequin duck (*Histrionicus histrionicus*), which is provincially ranked as vulnerable during the non-breeding season (i.e., non-breeding status); common nighthawk (*Chordeiles minor*) and olive-sided flycatcher (*Contopus cooperi*), both listed as threatened by COSEWIC; barn swallow (*Hirundo rustica*), which is on the blue list and ranked as vulnerable to apparently secure during the breeding season (i.e., breeding status); rusty blackbird (*Euphagus carolinus*), which is a species of special concern according to COSEWIC, is present on the blue list, and is provincially ranked as vulnerable to apparently secure during the breeding season; and sooty grouse (*Dendragapus obscurus*), which is present on the blue list and is provincially ranked as vulnerable to apparently secure during the breeding season.

Five of the 40 potentially occurring bird species of conservation concern were detected during baseline studies: harlequin duck, olive-sided flycatcher, rough-legged hawk (*Buteo lagopus*), Swainson's hawk (*Buteo swainsoni*), and surf scoter (*Melanitta perspicillata*). Rough-legged hawk is provincially ranked as imperilled to vulnerable during the non-breeding season. Swainson's hawk is red listed and provincially ranked as imperilled during the breeding season. Surf scoter is blue-listed and provincially ranked as vulnerable during the breeding season.

Four of the mammal species of conservation concern were categorized as likely occurring species (Table 3-4). Three species of conservation concern were detected during baseline studies: grizzly bear and wolverine *Luscius ssp*, both of which are blue-listed and ranked as vulnerable, as well as listed as a species of special concern according to COSEWIC; and fisher, which is blue-listed and ranked as imperilled to vulnerable by the BC government.

A second list was developed for species or wildlife groups of interest potentially occurring within the Project RSA (Table 3-5). 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 through consultation with biologists, Aboriginal peoples, local community members, and from information included in land and resource planning documents, such as the LRMPs and SRMPs.

Table 3-4. Potentially Occurring Vertebrate Species of Conservation Concern

Common Name	Scientific Name	Conservation Status ¹						Likelihood of Occurrence ²	Detected During Baseline Studies
		Global Rank	Provincial Rank	BC List	BC Identified Wildlife	COSEWIC	SARA		
Amphibians									
Western toad	<i>Anaxyrus boreas</i>	G4	S4	Yellow		SC	1	L	Y
Birds									
Barn swallow	<i>Hirundo rustica</i>	G5	S3S4B	Blue				L	N
Common nighthawk	<i>Chordeiles minor</i>	G5	S4B	Yellow		T	1	L	N
Harlequin duck	<i>Histrionicus histrionicus</i>	G4	S4B, S3N	Yellow				L	Y
Olive-sided flycatcher	<i>Contopus cooperi</i>	G4	S3S4B	Blue		T	1	L	Y
Rusty blackbird	<i>Euphagus carolinus</i>	G4	S3S4B	Blue		SC	1	L	N
Sooty Grouse	<i>Dendragapus obscurus</i>	G5	S3S4	Blue				L	N
American bittern	<i>Botaurus lentiginosus</i>	G4	S3B	Blue				P	N
American golden-plover	<i>Pluvialis dominica</i>	G5	S3S4B	Blue				P	N
Brant	<i>Branta bernicla</i>	G5	S3M	Blue				P	N
Caspian tern	<i>Hydroprogne caspia</i>	G5	S3B	Blue		NAR		P	Y
Double-crested cormorant	<i>Phalacrocorax auritus</i>	G5	S3B	Blue		NAR		P	N
Great blue heron, <i>fannini</i> ssp	<i>Ardea herodias fannini</i>	G5T4	S2S3B, S4N	Blue	Y	SC	1	P	N
Gyr Falcon	<i>Falco rusticolus</i>	G5	S3S4B	Blue		NAR		P	N
Horned grebe	<i>Podiceps auritus</i>	G5	S4B	Yellow		SC		P	N
Northern goshawk, <i>laingi</i> ssp	<i>Accipiter gentilis laingi</i>	G5T2	S2B	Red	Y	T	1	P	N
Peregrine Falcon, <i>anatum</i> ssp	<i>Falco peregrinus anatum</i>	G4T4	S2B	Red		SC	1	P	N
Peregrine Falcon, <i>pealei</i> ssp	<i>Falco peregrinus pealei</i>	G4T3	S3B	Blue		SC	1	P	N
Red-necked phalarope	<i>Phalaropus lobatus</i>	G4G5	S3S4B	Blue				P	N
Rough-legged hawk	<i>Buteo lagopus</i>	G5	S2S3N	Blue		NAR		P	Y
Sandhill crane	<i>Grus canadensis</i>	G5	S4B	Yellow	Y	NAR		P	N
Short-billed dowitcher	<i>Limnodromus griseus</i>	G5	S2S4B	Blue				P	N
Short-eared owl	<i>Asio flammeus</i>	G5	S3B, S2N	Blue	Y	SC	3	P	N
Snowy owl	<i>Bubo scandiacus</i>	G5	S3N	Blue		NAR		P	N
Surf scoter	<i>Melanitta perspicillata</i>	G5	S3B, S4N	Blue				P	Y
Swainson's hawk	<i>Buteo swainsoni</i>	G5	S2B	Red				P	Y
Tundra swan	<i>Cygnus columbianus</i>	G5	S3N	Blue				P	N
Upland sandpiper	<i>Bartramia longicauda</i>	G5	S1S2B	Red				P	N
Wandering tattler	<i>Tringa incana</i>	G5	S3S4B	Blue				P	N
Western grebe	<i>Aechmophorus occidentalis</i>	G5	S1B, S2N	Red				P	N
Western screech-owl, <i>kennicottii</i> ssp	<i>Otus kennicottii kennicottii</i>	G5	S3	Blue		SC	1	P	N
Yellow-billed loon	<i>Gavia adamsii</i>	G4	S2S3N	Blue		NAR		P	N
Ancient murrelet	<i>Synthliboramphus antiquus</i>	G4	S2S3B, S4N	Blue	Y	SC	1	U	N
Brandt's cormorant	<i>Phalacrocorax penicillatus</i>	G5	S1B, S4N	Red				U	N
Cassin's auklet	<i>Ptychoramphus aleuticus</i>	G5	S2S3B, S4N	Blue	Y			U	N
Common murre	<i>Uria aalge</i>	G5	S2B, S4N	Red				U	N
Hudsonian godwit	<i>Limosa haemastica</i>	G4	S2B	Red				U	N
Marbled murrelet	<i>Brachyramphus marmoratus</i>	G3G4	S2B, S4N	Red	Y	T	1	U	N
Red knot	<i>Calidris canutus</i>	G4	S1S2M	Red		E/T	1	U	N
Smith's longspur	<i>Calcarius pictus</i>	G5	S3S4B	Blue				U	N
Tufted puffin	<i>Fratercula cirrhata</i>	G5	S3B, S4N	Blue				U	N

¹ See Table 3-3 for Conservation Status definitions² see Table 3-1 for Likelihood of Occurrence definitions

(continued)

Table 3-4. Potentially Occurring Vertebrate Species of Conservation Concern (completed)

Common Name	Scientific Name	Conservation Status ¹						Likelihood of Occurrence ²	Detected During Baseline Studies
		Global Rank	Provincial Rank	BC List	BC Identified Wildlife	COSEWIC	SARA		
<i>Mammals</i>									
Fisher	<i>Martes pennanti</i>	G5	S2S4	Blue	Y			L	Y
Grizzly bear	<i>Ursus arctos</i>	G4	S3	Blue	Y	SC		L	Y
Least weasel	<i>Mustela nivalis</i>	G5	S3S5	Blue				L	N
Wolverine, <i>luscus</i> ssp	<i>Gulo gulo luscus</i>	G4T4	S3	Blue	Y	SC		L	Y
Caribou (northern populations)	<i>Rangifer tarandus pop. 15</i>	G5T4Q	S3S4	Blue	Y	T/SC	1	P	N
Keen's myotis	<i>Myotis keenii</i>	G2G3	S1S3	Red	Y	DD	3	P	N
Northern myotis	<i>Myotis septentrionalis</i>	G4	S2S3	Blue				P	N
Meadow jumping mouse, <i>alascensis</i> ssp	<i>Zapus hudsonius alascensis</i>	S3	G5T4T5	Blue				U	N

¹ See Table 3-3 for Conservation Status definitions

² see Table 3-1 for Likelihood of Occurrence definitions

Table 3-5. Species or Groups of Interest within the Project RSA

Species Name (<i>Scientific name</i>)	Reason	Likelihood of Occurrence
Moose (<i>Alces alces</i>)	Identified as culturally significant and hunted by Aboriginal peoples. Economically important species to local hunters and guide outfitters. Ungulate winter ranges (UWR) for moose identified in the RSA. Identified as an important species requiring increased management consideration by the draft Nass South SRMP (BC ILMB 2009) and Cassiar Iskut-Stikine LRMP (BC ILMB 2000).	Confirmed
Mountain goat (<i>Oreamnos americanus</i>)	Identified as culturally significant and hunted species by Aboriginal peoples. UWR for goat identified within the RSA and LSA. Identified as an important species requiring increased management consideration by the draft Nass South SRMP (BC ILMB 2009) and Cassiar Iskut-Stikine LRMP (BC ILMB 2000).	Confirmed
Waterfowl	Individuals, eggs, and active nests protected under <i>Migratory Birds Convention Act</i> and BC <i>Wildlife Act</i> .	Confirmed (Several species)
Marten (<i>Martes americana</i>)	Identified as a culturally significant species and trapped by Aboriginal peoples. Economically important furbearer to local trappers. Identified as an important species requiring increased management consideration by land management plans including the draft Nass South SRMP (furbearers; BC ILMB 2009) and Cassiar Iskut-Stikine LRMP (BC ILMB 2000). Biologically important as an indicator species.	Confirmed
Silver-haired bat (<i>Lasionycteris noctivagans</i>)	Identified by BC MOE as regionally important in the Skeena region because of concerns with maintaining maternal roosts in tree cavities.	Likely
Northern goshawk (<i>Accipiter gentilis</i>)	Component of biodiversity, reduced conservation concern down listed to yellow, identified in the Nass South SRMP (BC ILMB 2009) as requiring additional consideration. Identified as culturally significant species by Aboriginal peoples.	Confirmed
Songbirds	Component of biodiversity, individuals, eggs, and active nests protected under <i>Migratory Birds Convention Act</i> (1994b) and BC <i>Wildlife Act</i> (1996a)	Confirmed (several species)
Raptors	Nests and certain raptors protected under BC <i>Wildlife Act</i> . Group includes culturally significant raptors identified by Aboriginal peoples. Identified as an important species requiring increased management consideration by land management plans including the draft Nass South SRMP (northern goshawk; BC ILMB 2009) and Cassiar Iskut-Stikine LRMP (BC ILMB 2000).	Confirmed (several species)

4. Mammal Community

4.1 OVERVIEW

Identification and characterization of mammalian species in the proposed Project area is a necessary step in meeting the obligations of federal and provincial regulations for species protection. Baseline studies were conducted in 2008 and 2009 and included desk-based and field research. This inventory focused on mammal species or groups of species considered to occur in the Project study area that were identified as a species or groups of provincial or federal conservation concern or of social, economic, or biological importance within the province according to various sources (e.g., BC MOE, regional management plans (Cassiar Iskut-Stikine LRMP and Nass South SRMP), Aboriginal peoples). Baseline studies focused on grizzly bear, moose, mountain ungulates, furbearers, hoary marmot and Arctic ground squirrel, small mammals, and bats. Studies were designed with the following objectives:

- to establish baseline information on species presence, distribution, and habitat use in the area;
- to identify the characteristics of occupied habitats as a basis for Habitat Suitability Modelling; and
- to identify species of conservation concern in the area, such that appropriate conservation steps may be taken to meet statutory requirements under relevant wildlife acts and guidelines.

The following sections summarize the aerial and ground-based surveys conducted in 2008 and 2009 within the RSA (Section 1.5). The results of the grizzly bear study are reported separately in the *KSM Project 2008 and 2009 Grizzly Bear DNA Baseline Report* (Rescan 2010a).

4.2 MOOSE

4.2.1 Introduction

Moose occur commonly throughout the forested areas of BC. The provincial population estimate for moose in 2000 was approximately 170,000 animals, over 70% of which live in northern BC (Blood 2000a). Moose populations in BC are generally rated as apparently secure and not susceptible to extirpation or extinction under present conditions (BC CDC 2010c). Moose were selected as a focal species for baseline surveys because of their social, economical, and biological importance to the region.

Moose are protected by the provincial *Wildlife Act* (1996a) whereby harvesting activities by non-Aboriginals are permitted under hunting licences. The proposed development and associated RSA overlaps with three WMUs within Skeena Region 6, including 6-21 and 6-16, and minor portions of 6-17. There are three categories of hunters in BC: resident, non-resident, and Aboriginal hunters. The Fish and Wildlife Branch of the BC MOE collects and aggregates raw harvest data for resident and non-resident hunters for each WMU. Overall, moose, particularly bulls, form a large portion of the resident and non-resident hunters' harvest within these WMU: 96% of the 1,778 moose harvested from 1976 to 2005 were males (see Rescan 2010f). Aboriginal hunting rights are associated with either a treaty or an asserted territory. Harvest data from Aboriginal hunting is not collected by the BC MOE and is therefore not included in harvest estimates or hunting levels.

Local conservation initiatives for moose are integrated into regional resource management plans. For example, the Cassiar Iskut-Stikine LRMP (BC ILMB 2000) provides specific guidelines for managing habitat for six species including moose. Management objectives are to maintain the functional integrity

of moose winter range by maintaining critical habitat features, managing harvesting activities, and minimizing road construction in moose winter range.

Moose are browsers, foraging on stems and twigs of woody plants in winter, and the leaves of succulent shoots of shrubs and trees during the rest of the year (Bowyer, Ballenberghe, and Kie 2003). Individual moose may migrate seasonally, the timing of which is dependent on weather events such as snowfall. Approximately 71% of the moose population in the nearby Nass Wildlife Area (NWA) was identified as migratory individuals, with bulls and cows moving considerable distances between seasonal ranges within the NWA (M. W. Demarchi 2000). Migratory moose have a mean multiannual home range of 218 km², while non-migratory moose have a mean multiannual home range of 42 km² (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).

4.2.2 Objectives

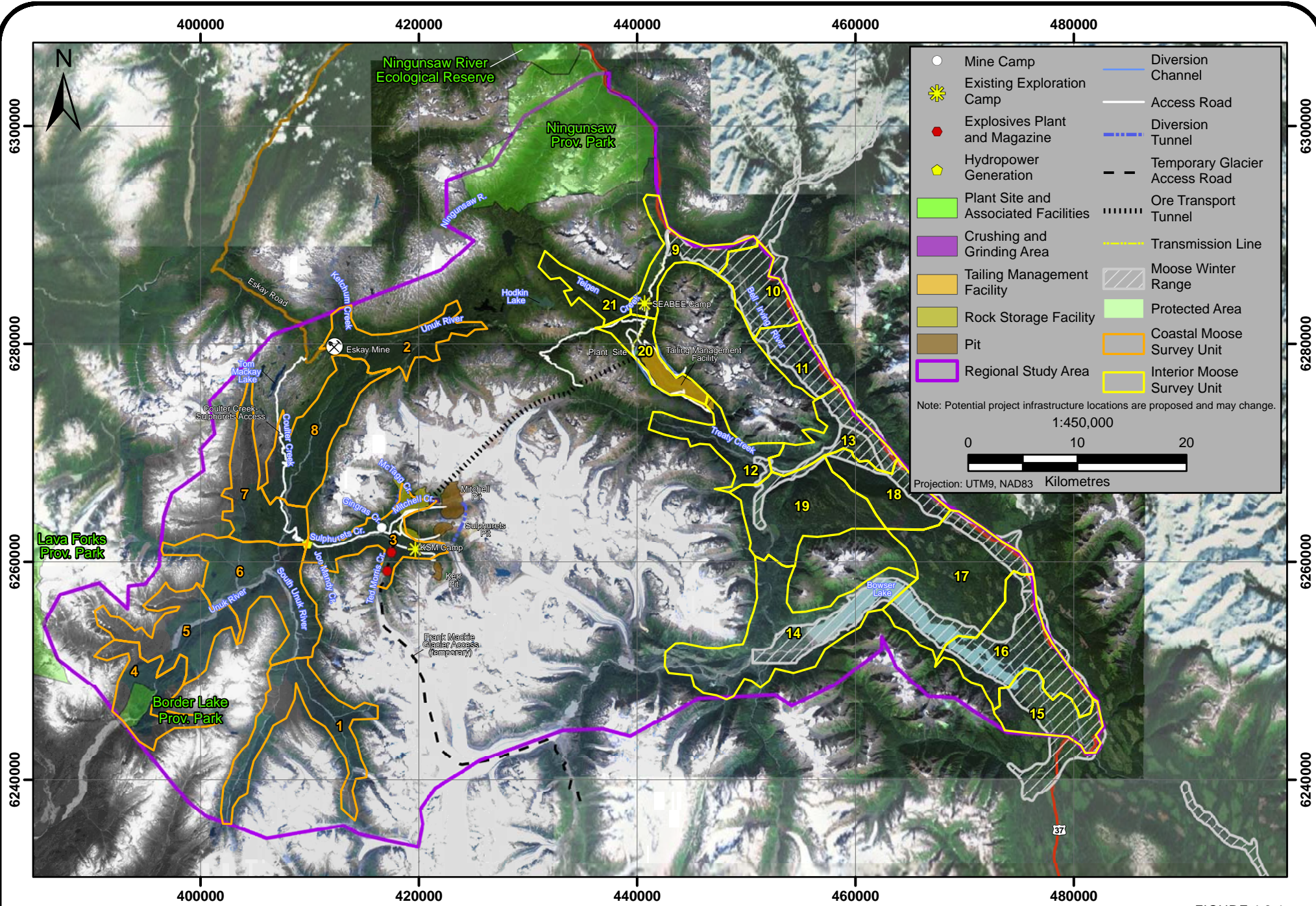
The objectives of this study were to assess the late winter abundance and distribution of moose within the RSA and to identify the characteristics of capable winter habitat to be used in developing habitat suitability models. Aerial surveys during the late winter are recommended by RIC (2002) to assess population size and calf recruitment. Winter surveys are preferable because moose visibility is high against snow cover. In addition, the availability of winter habitat is also considered to be a limiting factor for moose and surveys at this time permit the identification of winter habitat for moose.

4.2.3 Methods

4.2.3.1 Field Surveys

Aerial surveys for moose were flown over 17.1 hours of helicopter time on February 27 and from March 1 to 4, 2009. Before fieldwork, the RSA was sub-divided into 21 survey units (SUs), covering approx. 1,070 km² of the RSA (Figure 4.2-1). SUs were classified as coastal or interior-influenced habitat, because physical (e.g., snow accumulation, elevation, topography) and vegetation characteristics vary between these two regions. Coastal and interior habitat was identified using BEC zones. Eight SUs (SU 1 to 8) fall within two coastal BEC zones: Coastal Western Hemlock (CWH) and Mountain Hemlock (MH). Collectively, SUs 1 through 8 are referred to as the coastal survey area for the purposes of this report. SUs 9 to 21 fall within the Interior Cedar Hemlock (ICH) and Engelmann Spruce Subalpine Fir (ESSF) BECs, which are representative of drier interior habitat. Collectively, SUs 9 through 21 are referred to as the interior survey area.

The field methods used to inventory moose adhered to the aerial survey protocol outlined in the RISC standards (RIC 2002). A Bell 206 helicopter with two observers, a pilot, and navigator was used, maintaining a flying height between 50 and 100 m above ground level and a flying speed between 20 and 60 km/hour. This rate changed with conditions: it was faster over open areas where sightability was greater and slower over closed forest. Surveys were conducted when daytime high temperatures were below freezing and snow cover was complete. Surveys were conducted within SUs from valley bottoms up to an elevation of approximately 1,000 m. Surveys were not conducted in areas where moose occupancy was limited including elevations above 1,000 m, as well as areas of steep topography or deep snowpack. Helicopter flight paths within each SU were recorded using a hand-held Garmin 76 GPS (advertised accuracy 3 to 15 m) with an external antenna adapted for helicopter use.



Moose observations were recorded and individuals were identified as calves or adults (including yearlings). Adults were classified by sex (bulls or cows). Cows were distinguished from bulls based on the presence of a vulva patch—a white patch of hair seen on the rump. For each moose group (one or more individuals) observers estimated percent vegetative cover around the first animal seen in the group. Vegetative cover was measured within a 9 to 10 m radius around each moose group (Anderson and Lindzey 1996; Unsworth et al. 1998; Quayle, MacHutchon, and Jury 2001). A habitat suitability rating (HSR) was also made based on the presence of topographic and vegetative features used for habitat suitability modelling in the region. Moose observations were geo-referenced using a hand-held Garmin GPS.

Observations of moose were noted and geo-referenced when they were detected incidentally during other wildlife field inventories in 2008 and 2009. Incidental moose observations were also documented by field staff in other disciplines.

4.2.3.2 Data Analysis

Aerial Survey Effort

The total area, area surveyed (referred to as the census area), and the total capable moose habitat in each SU were calculated. The total area for each SU included the whole area within the boundaries of the SU. Census area included the area covered by helicopter flight lines, with a maximum extent of 200 m on either side of the helicopter flight line on the ground. Helicopter flight lines were downloaded and analyzed with ArcView®, Version 9.1 (Environmental Systems Research Institute). Capable habitat is defined by RIC (1999a) as “the ability of the habitat, under the optimal natural (seral) conditions for a species to provide its life requisites, irrespective of the current condition of the habitat.” For moose, this definition was modified as the habitat type that is most able to provide for the winter life requisites, due to the limiting nature of winter habitat and its relative importance to moose.

Survey effort was determined in three ways: as the ratio of survey time to total area within each SU, the ratio of survey time to the census area within each SU, and as the ratio of survey time to the amount of capable habitat within each SU.

Moose Observations

The total number of moose observed during the aerial surveys and the composition of each group (i.e., bull, cow, calf) was calculated. Sightability correction was applied to each moose group observation using the program AERIAL SURVEY (Unsworth et al. 1998). Detection probabilities were determined using sightability data from a British Columbia moose model (Quayle, MacHutchon, and Jury 2001). Observations of moose collected incidentally were totalled and discussed separately from survey results.

Spatial Distribution

Spatial survey data were examined to define the local winter habitat capability for moose, using three topographic features: elevation, aspect, and slope. These three features interact to influence the physical (e.g., snow accumulation, solar radiation) and biotic (e.g., plant species present) conditions of an area, which in turn influences the habitat value for moose. Topographical features at each moose group observation during the winter survey were derived from Digital Elevation Model (DEM) with 1:20,000 Terrain Resource Inventory Mapping (TRIM) data. Aspect is reported in the observed aspect or aspect bearing, separated into the cardinal directions (e.g., N, NE, E). The BEC zone classification at each group observation was also examined.

The distribution of frequency of observations was used to evaluate habitat selection and the topographic values that defined 100% of moose observations (e.g., an elevation below which 100% of moose groups were observed) were selected as the definition of capable habitat. Capable habitat definitions for moose in nearby areas of similar ecology were also reviewed and compared to results of the spatial distribution analysis to ensure consistency and allow for any adjustments to be made (RTEC 2006b, 2007b).

The results of the spatial distribution analysis were also used to assist ecosystem mapping and habitat suitability modelling (refer to Rescan 2010d).

Population Characteristics

Two population characteristics were analyzed for moose: demographics and density. Population demographics including sex ratio (number of males per females) and productivity (number of calves per female) were calculated from observed moose data and moose observations adjusted for sightability. Density estimates, based on both observed and adjusted data, were also calculated for the total area, census area, and area of capable habitat. Analyses were run separately on moose observed in coastal and interior survey areas.

4.2.4 Results

4.2.4.1 Aerial Survey Effort

Moose surveys were conducted over five days during late February and early March, 2009. During this period, 21 SUs were surveyed for 7 to 108 minutes each, based on their size, for a total of 17.1 hours of survey time (Appendix 4.2-1). During the survey, 4.4 hrs were directed at 426 km² of habitat (total area within SUs) in the coastal survey area. Within the interior survey area, 12.7 hrs of survey time was directed at 644 km² of habitat (total area) (Appendix 4.2-1). Survey effort is summarized by total area, census area, and capable habitat (Table 4.2-1). Maps of survey flight lines are included in Appendix 4.2-2.

Table 4.2-1. Summary of Survey Effort by Total Area, Census Area, and Area of Capable Habitat, 2009

	Survey Effort (min/km ² ± Standard Error)	
	Coastal Survey Area	Interior Survey Area
<i>Total Area</i>		
Range within SUs	0.17 -1.11	0.34 -2.75
Average	0.59 ± 0.12	1.38 ± 0.21
<i>Census Area</i>		
Range within SUs	1.64 - 2.72	0.81 - 14.27
Average	2.14 ± 0.12	3.12 ± 0.95
<i>Capable Habitat</i>		
Range within SUs	0.44 - 1.98	0.46 - 22.73
Average	1.24 ± 0.18	3.73 ± 1.60

4.2.4.2 Moose Observations

Within the coastal survey area, 29 moose were observed in 14 groups across 5 of the 8 SUs (Figure 4.2-2; Table 4.2-2; Appendix 4.2-3). Bulls were most frequently seen (55% of observations), followed by cows (38%), and calves (7%); no moose were unclassified (Table 4.2-2; Appendix 4.2-3). Within the interior survey area, 151 moose were observed in 74 groups across 11 of the 13 SUs (Figure 4.2-3; Table

4.2-2; Appendix 4.2-3). Cows accounted for the majority (52%) of moose observed, followed by bulls (24%), calves (22%), and unclassified moose (2%) (Table 4.2-2; Appendix 4.2-3). Of the 92 groups recorded during winter surveys, only two groups were recorded near proposed Project infrastructure. A lone moose was observed on the Unuk River near the Coulter Creek Access Road in the coastal survey area and a group of three moose were seen near the Teigen Creek Access Road in the interior survey area (Figures 4.2-2 and 4.2-3).

Following adjustments made for sightability, a total of 33 moose (± 6 at 90% CI) were estimated for the coastal survey area and 198 moose (± 28 at 90% CI) for the interior survey area (Table 4.2-2). The adjusted numbers of bulls, cows, and calves are presented in Table 4.2-2.

Table 4.2-2. Summary of Winter Moose Observations within Coastal and Interior Survey Areas, 2009

Parameter	Coastal Survey Area			Interior Survey Area		
	Observed Number	Adjusted Number ^(a)	90% Confidence Interval ^(b)	Observed Number	Adjusted Number ^(a)	90% Confidence Interval ^(b)
Bulls	16	19	5	36	47	12
Cows	11	12	3	79	93	10
Calves	2	2	2	33	40	8
Unclassified	0	0	0	3	17	20
Total	29	33	6	151	198	28

^(a) Adjustments for sightability and estimates of variance were derived using the program *Aerial Survey* (Unsworth et al. 1998) with the BC moose model (Quayle et al. 2001).

^(b) 90% confidence intervals = $1.65 \times (\text{variance})^{0.5}$.

A total of 25 moose, including 6 bulls, 7 cows, 2 calves, and 10 unclassified moose were recorded incidentally in 15 groups during the summer of 2008 and 2009 by Rescan field staff (Figures 4.2-2 and 4.2-3; Appendix 4.2-4; Plate 4.2-1). Many of these observations were recorded along Treaty Creek (Figure 4.4-3). A few moose were observed within the proposed TMF and along the Unuk River during the summer (Figures 4.4-2 and 4.4-3).



(a) Moose observed near Treaty Creek, June 2008



(b) Moose group observed on Treaty Creek, September 2008

Plate 4.2-1. Incidental Observation of Moose in the RSA.

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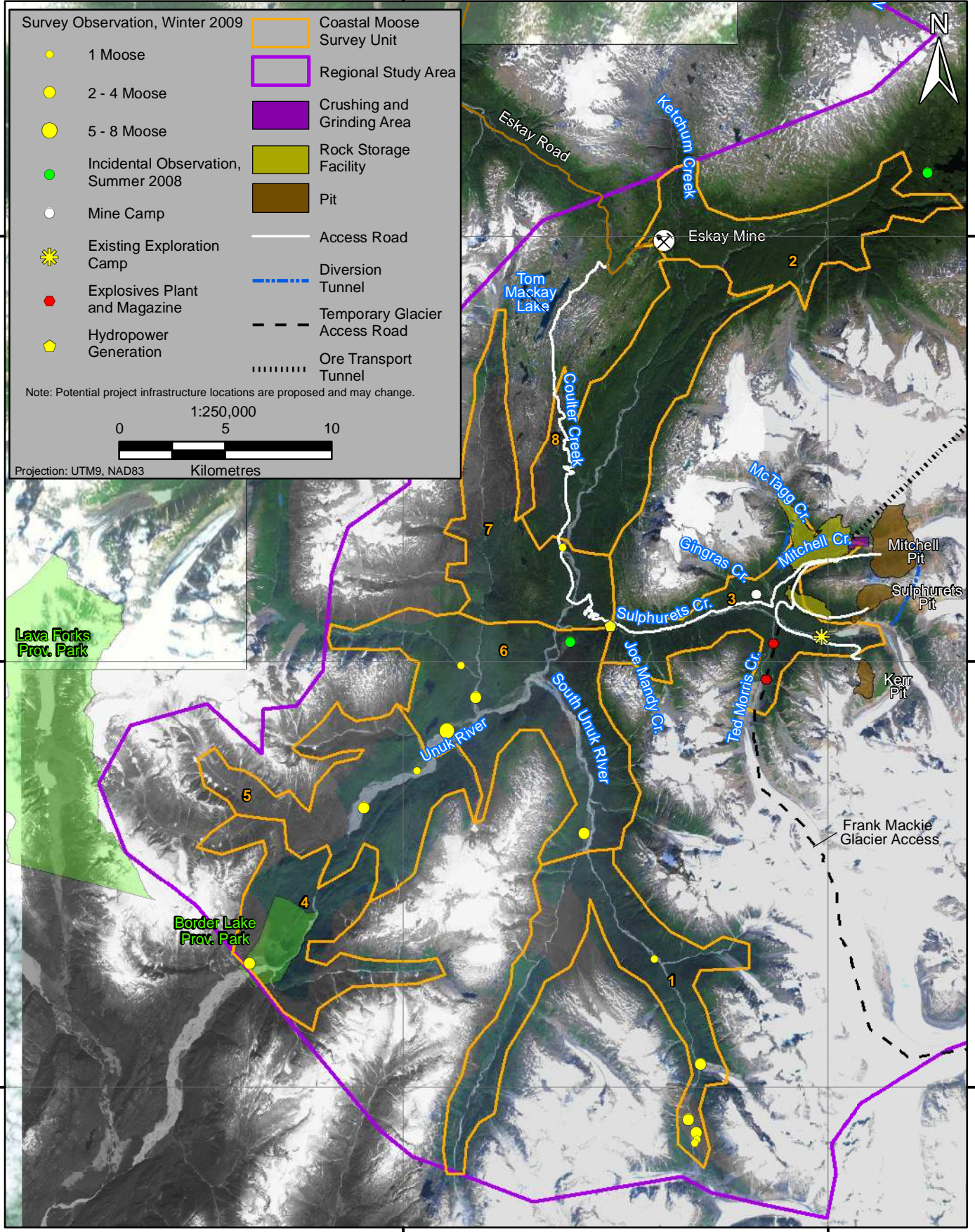
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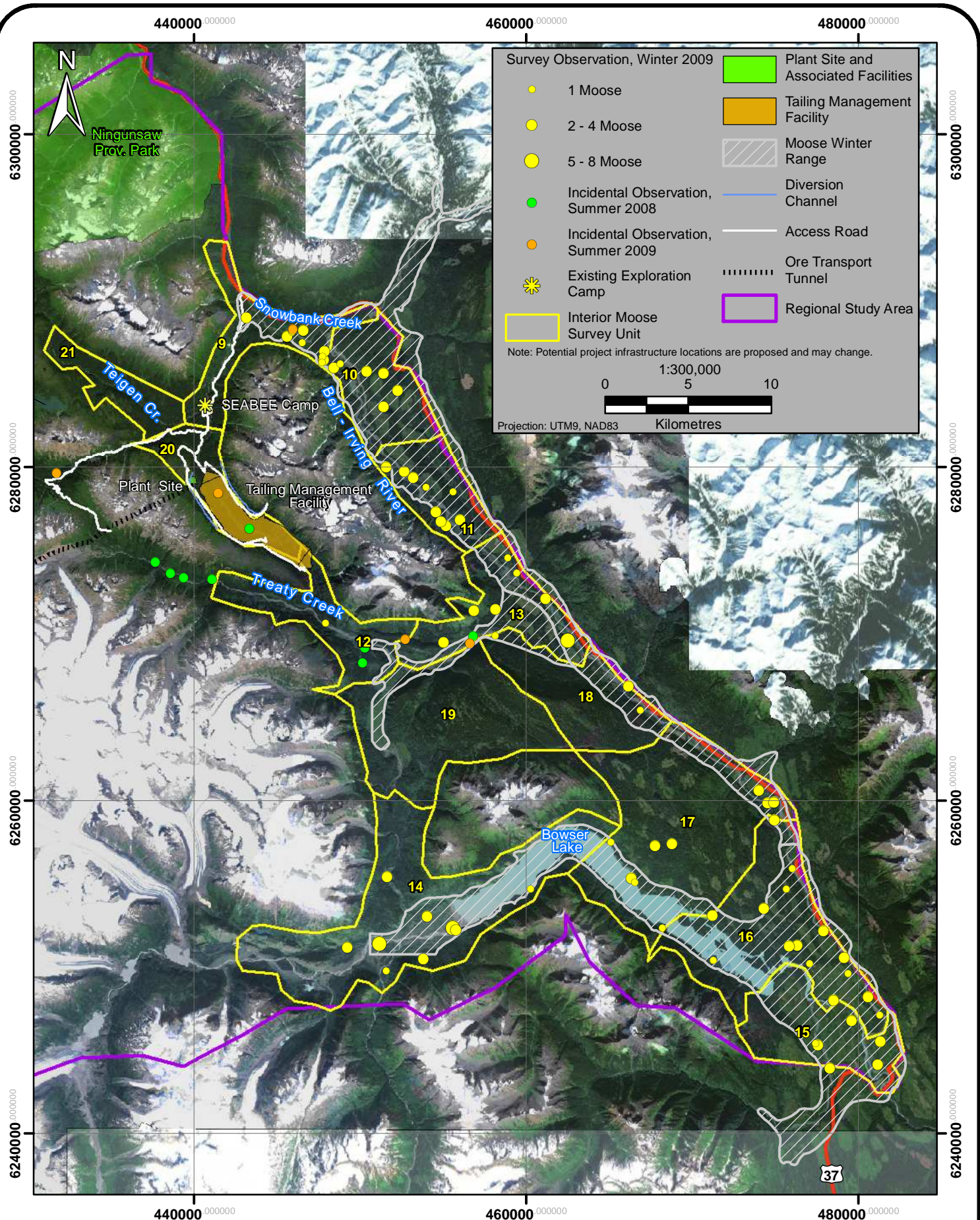
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Moose Winter Survey Observations in the Coastal Survey Area, 2009 and Summer Incidental Observations, 2008 and 2009

Figure 4.2-2



4.2.4.3 Spatial Distribution

The topographic features associated with each group of moose observed in the coastal and interior survey areas were analyzed to determine the characteristics of “capable habitat.” In the coastal survey area, 71% of moose groups were observed at elevations below 600 m, with moose observations ranging between 96 and 747 m elevation (avg. \pm SE; 394 ± 69.3 m, $n = 14$) (Figure 4.2-4a). However, there was a bimodal elevation distribution that was largely driven by four groups of bulls observed near the headwaters of the South Unuk River (Figures 4.2-2 and 4.2-4a; Plate 4.2-2). These four groups were observed at the highest elevations across both survey areas. There appeared to be no selection for aspect: moose were seen on both cooler (northerly and westerly) and warmer (easterly and southerly) aspects (Figure 4.2-4b). The slopes associated with observed moose ranged from 1 to 38% with an average of $9\% \pm 3\%$ (SE). The majority (71%) of moose were seen on flat landscape with slopes between 1 and 6%: only 4 groups were observed on slopes greater than 20% (Figure 4.2-4c). Moose were observed with nearly equal frequencies in the CWHwm BEC unit (57% of groups) and MHun BEC unit (43%).

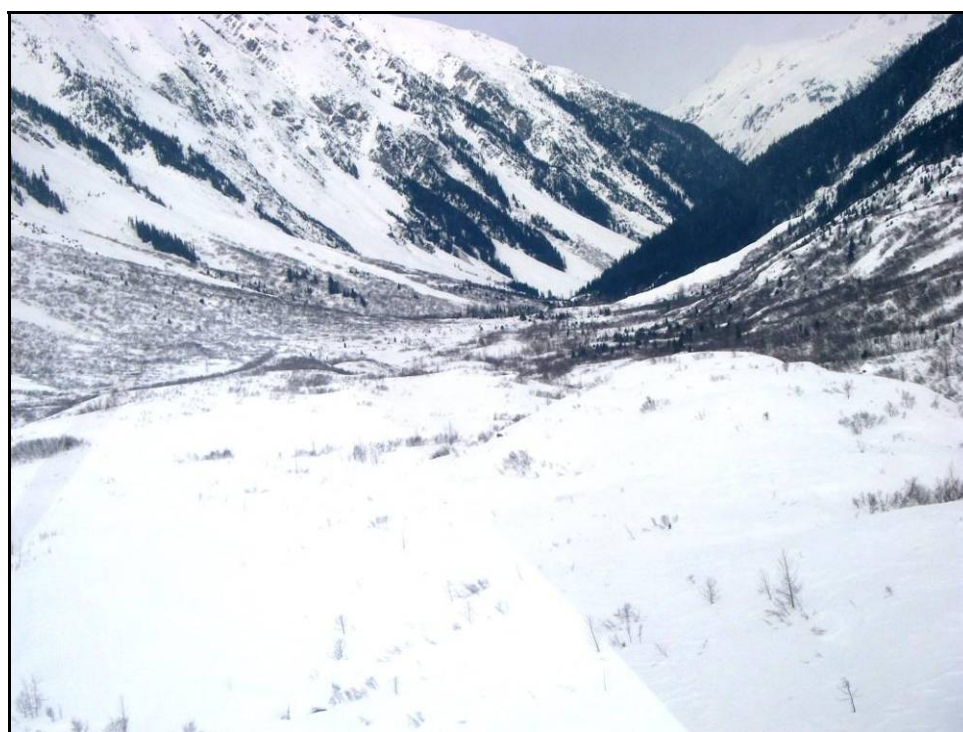


Plate 4.2-2. Example of habitat near the headwaters of the South Unuk River where the highest elevation of moose observations were recorded across both survey areas.

Groups of moose in the interior survey area were observed across an elevation range of 347 to 718 m, with an average of $477 \text{ m} \pm 10.4 \text{ m}$ (\pm SE, $n = 70$)¹ (Figure 4.2-4a). The majority (90%) of moose groups observed were below 600 m. Like the coastal survey area, there did not appear to be any selection from cooler or warmer aspects (Figure 4.2-4b). Moose were observed on slopes that ranged from 0 to 51%, with an average of $11\% \pm 1.4\%$ (\pm SE). The majority of moose were observed on gentle to moderate

¹ A total of 74 groups of moose were observed in the interior survey area; however, four groups of moose were observed in areas where no TRIM and DEM information was available and could not be classified for topographic features (BEC information was available).

slopes, with 90% of group observations recorded on gradients less than 31% (Figure 4.2-4c). Moose were recorded in the ICHvc BEC unit on 72 occasions (97%) and in the ESSFwv BEC unit on two occasions (3%).

The spatial distribution analysis provided the basis for defining the elevation and slope limits of capable habitat: aspect was not considered as no particular selection was observed. Across both survey areas, all moose were observed in habitat below 750 m in elevation and less than 51% slope. To ensure consistency with capable habitat definitions in nearby coastal and interior influenced habitat (RTEC 2006b, 2007b), the upper limit of the slope was adjusted to 60%.

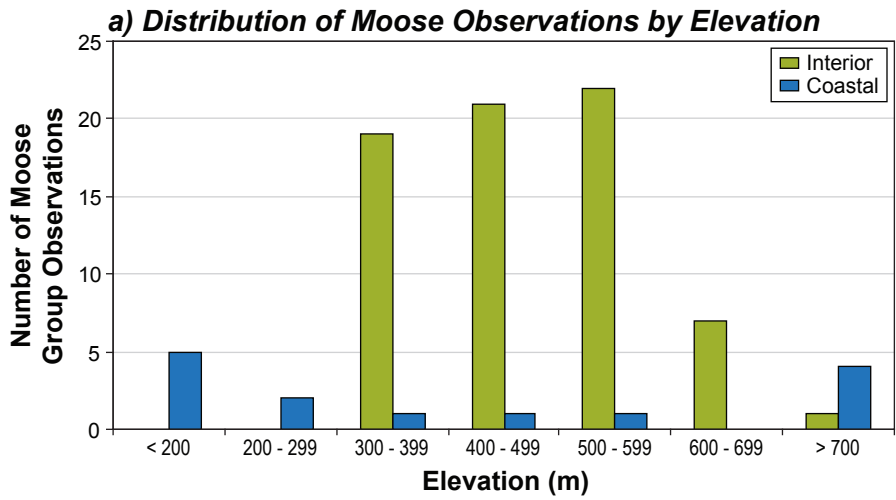
4.2.4.4 *Population Characteristics*

The sex ratio of observed moose in the coastal survey area was 145 bulls per 100 cows. Once adjusted for sightability, the sex ratio was 155 bulls (± 51 at 90% CI) per 100 cows. Productivity from observed coastal moose data was 18 calves per 100 cows, and 20 calves per 100 cows (± 11 at 90% CI) once adjusted for sightability. In the interior survey area, the sex ratio of observed moose was 45 bulls per 100 cows, and 47 bulls per 100 cows (± 12 at 90% CI) once adjusted for sightability. Productivity for the interior survey area was 42 calves per 100 cows, and 43 calves per 100 cows (± 9 at 90% CI) once adjusted for sightability.

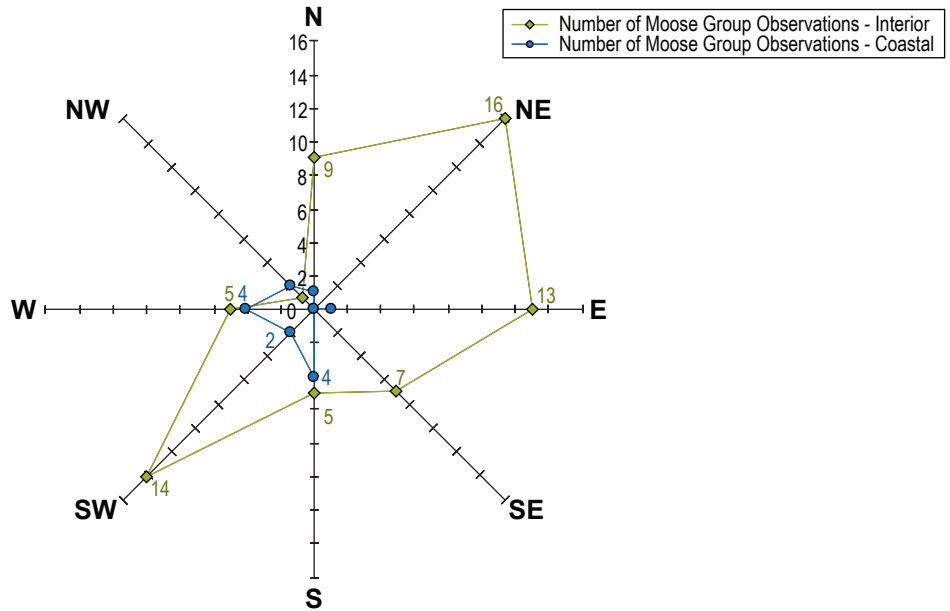
The density of moose was calculated for observed and adjusted moose data across three scales: total area, census area, and area of capable habitat (Appendix 4.2-5). For the purposes of this report, density is discussed by adjusted density (i.e., based on moose numbers adjusted for sightability) and by capable habitat, since this provides a better, biologically relevant comparison between SUs and survey areas. In general, the density of moose was two times higher in the interior survey area than in the coastal survey area (Table 4.2-3; Appendix 4.2-5). In the coastal survey area, the highest density was observed in SU 1 at the headwaters of the South Unuk River (0.44 moose/km² ± 0.15 at 90% CI) (Appendix 4.2-5). The area near the confluence of the Unuk and South Unuk rivers (SU 6) also supported a high density of moose (0.31 moose/km² ± 0.08 [at 90% CI] of capable habitat) (Appendix 4.2-5). 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 (SU 9; 0.92 moose/km² ± 0.53 at 90% CI); high densities were also observed further south along the Bell-Irving River in SU 11 (0.78 moose/km² ± 0.27 at 90% CI) and SU 13 (0.87 moose/km² ± 0.43 at 90% CI) (Appendix 4.2-5).

4.2.5 Discussion

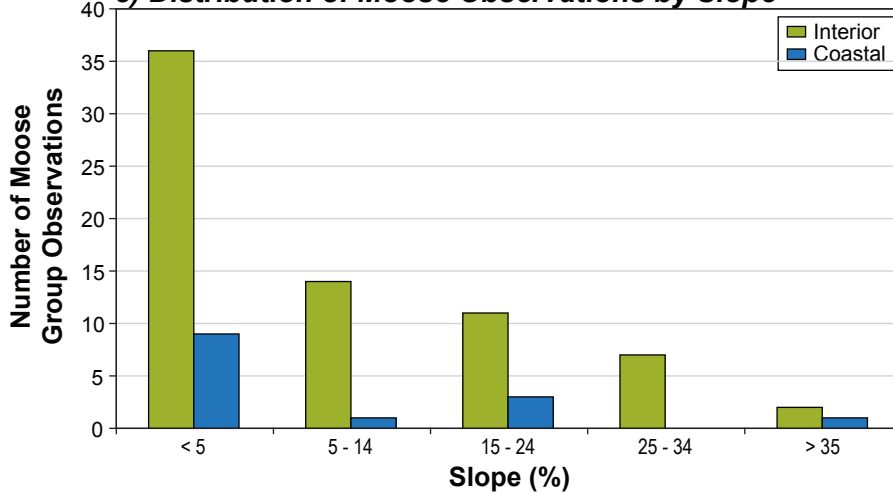
The Cassiar Iskut-Stikine LRMP has identified moose as an important wildlife resource, with overall objectives aimed at maintaining winter habitat, managing access, and providing security from unregulated harvest to ensure long-term population stability (BC ILMB 2000). There are several areas in the RSA that have been identified as winter range for moose. A small amount of winter range is identified within the Unuk RMZ of the Cassiar Iskut-Stikine LRMP, specifically along the floodplain of the Unuk River below the confluence of the South Unuk River (BC ILMB 2000). A large amount of winter range has been mapped in the North Nass TSA along the Highway 37 corridor (Figure 4.2-1) (McElhanney 2007b). These areas can be adopted as approved UWR under the BC FRPA after the results are reviewed by representatives from the BC MOFR and appropriate stakeholder groups.



b) Distribution of Moose Observations by Aspect



c) Distribution of Moose Observations by Slope



Spatial Distribution of Moose Observations, 2009

FIGURE 4.2-4

Table 4.2-3. Summary of Winter Moose Density within Coastal and Interior Survey Areas, 2009

	Coastal Survey Area			Interior Survey Area		
	Observed Density (moose/km ²)	Adjusted Density (moose/km ²)	90% Confidence Interval	Observed Density (moose/km ²)	Adjusted Density (moose/km ²)	90% Confidence Interval
Total Area	0.07	0.08	0.01	0.23	0.30	0.04
Census Area	0.24	0.27	0.05	0.42	0.59	0.08
Capable Habitat	0.14	0.16	0.03	0.34	0.44	0.06

The results of the baseline study provided information regarding the local population and distribution of moose in the RSA. Moose occupied a consistent elevation and slope range, but did not select for a particular range of aspects. In general, moose in the coastal and interior survey areas occupied habitat to an upper elevation limit of 747 m and an upper slope limit of 51%. However, the upper elevation limit was influenced by five groups of moose observed above 700 m within the coastal survey area, particularly the four groups of bull moose observed near the headwaters of the South Unuk River. Moose in the coastal survey area were expected to use lower elevation habitat during the winter, as with the majority of moose observations within the coastal SU, all of which were recorded below 600 m. Deep snow packs are typical for coastal ecosystems. During the winter moose are in their poorest body condition, and experience high metabolic demands when moving through deep snow (Safford 2004). Moose in the NWA typically responded to increasing snowpack by moving to lower elevation where the snow depth was shallower (M. W. Demarchi 2000, 2003).

Capable habitat for the Project was defined as habitat below 750 m and less than 60% slope, which was based on the results of spatial distribution analysis with an adjustment made for slope. The adjustment from 51% to 60% was made based the results of the moose habitat capability analysis in the Schaft and Mess Creek watersheds, which confirmed that habitat on gradients up to 60% can have suitable vegetative, security, and thermal characteristics for moose during the winter (RTEC 2007b). No adjustments were necessary for the upper elevation limit, as moose are generally constrained to a well defined elevation range dictated by the local snowpack.

The interior survey area had a larger adjusted population of moose that were more densely distributed across capable habitat than moose in the coastal survey area. The interior survey area also had more productive females. However, a lower male:female sex ratio was recorded in the interior survey area. This sex ratio is also lower compared to other interior areas with similar degrees of isolation (e.g., Schaft and Mess Creek watersheds (RTEC 2007b); Table 4.2-4). A low male to female ratio is indicative of harvest pressure on males. This conclusion is supported by resident and non-resident harvest data, which shows a focus on males within the WMUs associated with the Project (Rescan 2010b)

The coastal survey area falls entirely within the Cassiar Iskut-Stikine LRMP area. Under the General Management Direction of the LRMP, demographic targets are set out for moose under Strategy 1.1 to "manage game wildlife populations to be a sustainable renewable," specifically a sex ratio of at least 50 bulls per 100 cows and a late winter productivity of 30 calves per 100 cows (BC ILMB 2000). The sex ratio in the coastal survey area is well above the target set in the LRMP while the productivity ratio is slightly below (Table 4.2-4). However, results from the coastal survey area should be interpreted with caution, because the small sample size (n = 33) and small amount of capable habitat (less than half of the total size of the coastal survey area is capable habitat) may have skewed the population characteristics.

Table 4.2-4. Winter Moose Population Characteristics within Northwestern British Columbia

Adjusted Population Characteristics	Interior Survey Area	Coastal Survey Area	Schaft/Mess Creek ^(a)	Stikine / Iskut River ^(b)	More Creek/Bob Quinn ^(b)	Nass Wildlife Area ^(c)
Number	198	33	314	481	148	-
Productivity Ratio (calves/100 cows)	43	20	31	64	46	47
Sex Ratio (bulls/100 cows)	47	155	93	74	93	38
Capable Habitat Density (moose/km ²)	0.44	0.16	0.67	0.42	0.67	-

^a RTEC (2007b)

^b RTEC (2006b)

^c Demarchi (2000), taken from population surveys in 1997.

Incidental observations of moose were recorded during the summer of 2008 and 2009 (Figures 4.2-2 and 4.2-3). Some of the moose were observed in the same areas that were occupied in the winter, while others were observed in some higher elevation areas such as within the location of the proposed TMF (which is above capable winter habitat elevation of 750 m). Many of the moose in the nearby NWA were migratory individuals, moving from distinct summer and winter ranges (M. W. Demarchi 2000, 2003). These seasonal ranges were separated on the basis of differences in annual snowpack and duration of snow cover (influenced primarily by elevation or latitude) and migration between the two was triggered by either an increasing snowpack (winter migration) or a rapidly decreasing snowpack (summer migration) (M. W. Demarchi 2003). Moose tended to concentrate in a small amount of habitat with shallower snow during the winter, which were generally at lower elevations, while summer ranges were larger and included a wider range of elevations and habitat types (M. W. Demarchi 2003).

4.3 MOUNTAIN UNGULATES

4.3.2 Introduction

In northwestern BC, there are three mountain ungulate species: mountain goat (*Oreamnos americanus*), thinhorn sheep (*Ovis dalli*), and northern mountain caribou (*Rangifer tarandus*). Mountain ungulates receive particular conservation focus from the BC government. Mountain ungulates are important economic and social resources for traditional harvest by Aboriginal peoples and recreational harvest for resident and non-resident hunters. The Cassiar Iskut-Stikine LRMP (BC ILMB 2000) provides specific guidelines for managing habitat for mountain ungulates including mountain goat, Stone's sheep (thinhorn sheep subspecies; *O. d. stonei*), and caribou. Management objectives for each species includes maintaining large areas of high value habitat and the functional integrity of winter range, as well as minimizing disturbance to animals during kidding (for goats) and lambing (for sheep) periods.

The total number of mountain goats in BC was estimated at approximately 50,000 individuals in 2000 (Blood 2000b; Côté and Festa-Bianchet 2003), of which approximately 16,000 to 35,000 occur within the Skeena Region (BC ILMB 2009). Mountain goats are widely distributed throughout the province and can be found in most major mountain ranges except those on coastal islands (e.g., Vancouver and Queen Charlotte Islands) (Blood 2000b). While suitable habitat for mountain goats is found throughout the province, mountain goats are most numerous in northern BC. The southern Rocky Mountain and Coast Mountain ranges also support substantial populations (Blood 2000b; M. W. Demarchi, Johnson, and Searing 2000). Because they are widespread and abundant, mountain goats are yellow-listed in the

province (BC CDC 2010b, 2010c). However, mountain goats are protected under the provincial *Wildlife Act* (1996a) whereby harvesting activities are only permitted under hunting licences.

Winter is generally an important season for mountain goats as there is limited availability of habitats that provide a combination of escape terrain, forage, and cover. Escape terrain includes steep cliffs, rocky outcrops, and talus slopes where goats can escape from predators. The BC MOE has mapped UWR in many areas of the province. UWR and associated objectives are mandated under the authority of Sections 9(2) and 12(1) of the *Government Actions Regulation* (BC Reg. 582/ 2004b) and *Forest and Range Practices Act* (Section 149.1; 2004a). Within the RSA, approved mountain goat UWR is established within the Nass TMF (UWR u-6-002; BC MOE 2008).

Habitat requirements for thinhorn sheep broadly overlap those of mountain goat, where sheep are also reliant on the presence of escape terrain for cover and predator avoidance. However, sheep may also exploit lower elevation habitats than mountain goat, such as subalpine meadows and the forested areas below them, provided that escape terrain is nearby (R. A. Demarchi and Hartwig 2004). Northern mountain caribou typically select more rolling terrain throughout the year than do mountain goat. The RSA is considered unsuitable for these two species because of the absence of rolling topography and lower elevation escape terrain. Therefore, local populations of sheep and caribou are not expected to occupy habitat year round within the RSA.

4.3.3 Objectives

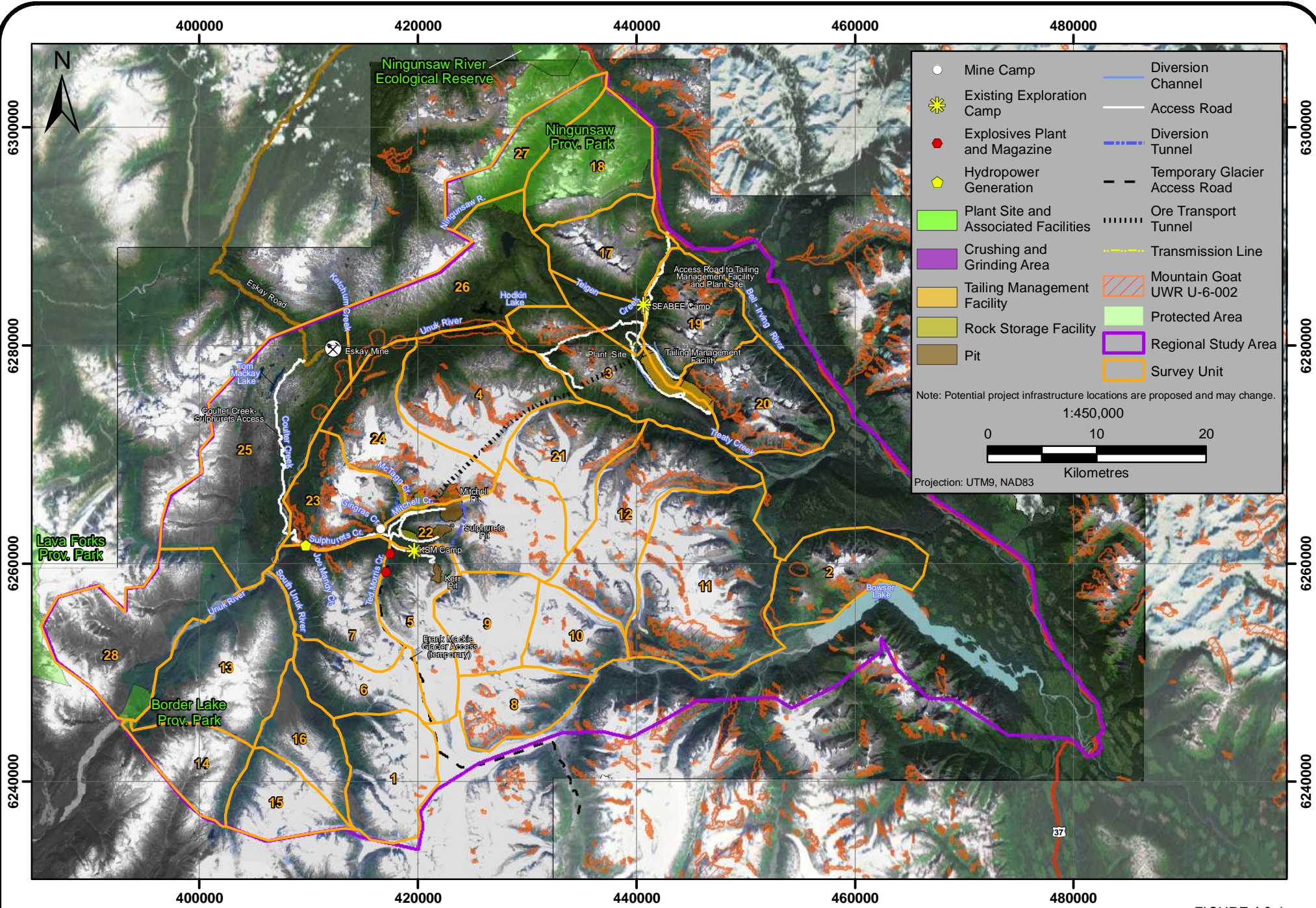
The overall objective of this study was to collect baseline information on mountain goat distributions within the study area, and to identify whether two other mountain ungulates (Stone's sheep and northern caribou) occur in the RSA. The specific objectives of this study were to:

- establish a baseline estimate of the summer and winter population size and herd composition of mountain goats within the study area;
- establish baseline information on the distribution of mountain goats and other mountain ungulates (Stone's sheep and northern caribou) potentially occurring within the study area; and
- identify characteristics of occupied summer and winter habitat.

4.3.4 Methods

4.3.4.1 Aerial Surveys

In early 2008, mountainous terrain within the RSA was divided into 24 distinct SUs before aerial surveys, covering approximately 2,113 km² of the RSA (Figure 4.3-1). SUs encompassed suitable habitat that could be used by mountain ungulates during the summer and winter. SUs were delineated using topographic features that could limit the movement of mountain ungulates between units. For example, low elevation valleys would be unfavourable habitat for mountain ungulates such as mountain goats, as goats are more vulnerable to predation in the absence of escape terrain. Delineating SUs in this way aids in reducing inter-unit movement within the survey period and increases the independence of each unit, which increases the accuracy of population estimates for mountain ungulates within the RSA. In December 2008, local Aboriginal groups identified a need to collect more information on the distribution of mountain ungulates within the western RSA through the review of the 2008 Baseline Studies Field Program Plan. To accommodate this request, four additional SUs covering 563 km² were delineated on the west side of the Unuk River (SUs 25 to 28) for the winter survey in 2009 (Figure 4.3-1).



Aerial surveys for mountain ungulates were flown during the summer of 2008 on July 17 and from July 22 to 24, over 14.1 hours of helicopter time and covering all SUs delineated in 2008 (SUs 1 to 24) (Table 4.3-1; Appendix 4.3-1). During the winter of 2009, 21.6 hours of helicopter time was used for surveys on February 25, 26, 28, and March 5, covering 16 of the 28 SUs (Table 4.3-1; Appendix 4.3-1). Surveys were suspended for safety reasons following March 5 on account of poor weather.

Table 4.3-1. Survey Units Flown in Summer 2008 and Winter 2009

Survey Unit	Summer 2008	Winter 2009	Survey Unit	Summer 2008	Winter 2009
1	√	√	15	√	
2	√		16	√	
3	√	√	17	√	√
4	√	√	18	√	
5	√	√	19	√	√
6	√	√	20	√	√
7	√	√	21	√	√
8	√	√	22	√	√
9	√		23	√	√
10	√		24	√	√
11	√		25*		√
12	√		26*		√
13	√		27*		
14	√		28*		

* survey units added following summer 2008 survey. In 2009, surveys could not be safely flown in SU 27 and 28 due to poor weather.

The methods used to inventory mountain ungulates adhered to the aerial survey protocol as established by the RISC (2002). This involved using a helicopter with two observers, a pilot, and a navigator. The helicopter maintained an average speed of approximately 100 km/hour. Helicopter speed changed with mountain ungulate sightability—faster over open areas where sightability was good and slower over areas where visibility was obscured by vegetation cover. Survey effort was predominately directed in areas above the treeline due to difficulty in observing mountain ungulates under closed canopy forest. Flight lines followed topographic contours or identifiable features and were spaced at intervals of approximately 200 m. Flight paths were recorded using a handheld Garmin GPS 76 unit (advertised accuracy 3 to 15 m) with an external antenna.

For each observation of mountain ungulate(s), a GPS waypoint was recorded and animals were classified by age (i.e., goats were classified as adults or kids) (RIC 2002). Animals that could not be classified by age with confidence were recorded as unidentified. For each observation, the dominant vegetation cover type and HSR were recorded, based on the presence of topographic and vegetative features used for habitat suitability modelling in the region. A HSR of one represented the most suitable habitat based on provincial benchmarks, while a HSR of six represented habitat devoid of habitat features that could be used by mountain ungulates.

Incidental observations of mountain ungulates were noted and geo-referenced when they were detected during other wildlife field inventories in 2008 and 2009. Incidental mountain ungulate observations were also documented by field staff in other disciplines.

4.3.4.2 Data Analysis

Survey Effort

The total area and the total capable habitat in each SU were calculated (Appendix 4.3-1). The total area for each SU included the entire area within the boundaries of the SU. Capable habitat was calculated for mountain goats as the area of suitable escape terrain and all area within 500 m of the escape terrain within each SU. Escape terrain was identified using satellite image classification and DEM with 1:20,000 TRIM data; defined as rocky, barren areas that have a slope of 40° to 70°. Survey effort was determined as the ratio of survey time to total area and the amount of capable habitat within each SU.

Population Characteristics

The total number of mountain ungulates observed during aerial surveys was calculated, in addition to group size, recruitment, and density. Group size included a total count of animals seen at each observation. The number of young (e.g., kids) per 100 adults was calculated for the summer (kidding/calving ratio) and winter surveys (recruitment ratio). Density was calculated for each SU by dividing the number of ungulates observed by the total area and the area of capable habitat of each. Survey estimates were not adjusted for sightability, as no suitable model exists for establishing sightability for mountain ungulates in BC (RIC 2002; Ayotte 2005). Observations of mountain ungulates collected incidentally were totalled and discussed separately from survey results.

Spatial Distribution

Spatial survey data were examined for evidence that mountain ungulates were selecting particular topographic features, including elevation, slope, aspect, and distance to escape terrain. Mountain ungulate group observations provided the basis for analysis: the topographical features at each observation were derived from DEM with 1:20,000 TRIM data.

Aspect is reported as the observed aspect or aspect bearing. For analytical purposes, the aspect bearing was separated into the cardinal directions (e.g., N, NE, E), which included a range of degrees shown in Plate 4.3-1. The observed aspect was adjusted to make aspect linear (i.e., taking the absolute value of the observed aspect minus 180°). The result gives aspect values ranging from 0 to 180. Values near 90 are considered neutral (i.e., east or west) while those less than 90 indicate a warmer south aspect and greater than 90 indicate cooler northerly aspects. Using this transformation allowed for the assessment of whether ungulate groups were more frequently observed along warmer or cooler aspects.

4.3.5 Results

4.3.5.1 Survey Effort

Summer surveys were conducted over the course of four days in July, 2008. Approximately 2,113 km² of habitat across 24 SUs (total area) was surveyed over a period of 14.1 hours (Appendix 4.3-1). Winter surveys were conducted over four days during February and March, 2009. A total of 21.6 hours of survey time was directed at 1,189 km² of habitat (total area) in 16 SUs (Appendix 4.3-1). Fourteen SUs were surveyed in both the summer and winter (Table 4.3-1). No surveys were flown in SU 27 and 28.

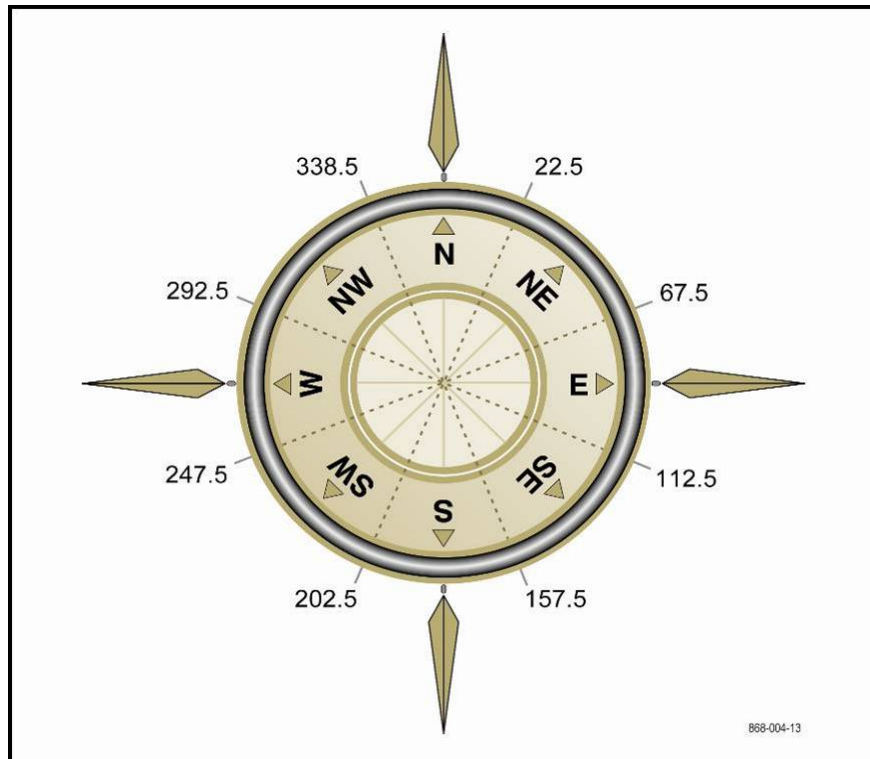


Plate 4.3-1. Definitions for Cardinal Aspects.

Survey effort is summarized by total area and area of capable habitat (Table 4.3-2). In 2008, SUs 8 and 9, as well as SUs 15 and 16, were combined for analyzing survey effort because of their similarity in topography and ecology for the summer season. Maps of survey flight lines are included in Appendix 4.3-2.

Table 4.3-2. Summary of Survey Effort by Total Area and Area of Capable Habitat, 2008 and 2009

	Survey Effort (min/km ² ± Standard Error ^(A))	
	Summer 2008	Winter 2009
Total Area		
Range within SUs	0.23 - 0.80	0.32 - 1.57
Average	0.40 ± 0.03	0.89 ± 0.010
Capable Habitat		
Range within SUs	0.31 - 1.21	0.40 - 2.27
Average	0.65 ± 0.06	1.60 ± 0.14

^(A) ± Standard Error (SE). All subsequent variation (±) is reported in standard error unless otherwise stated.

4.3.5.2 Population Characteristics

Summer

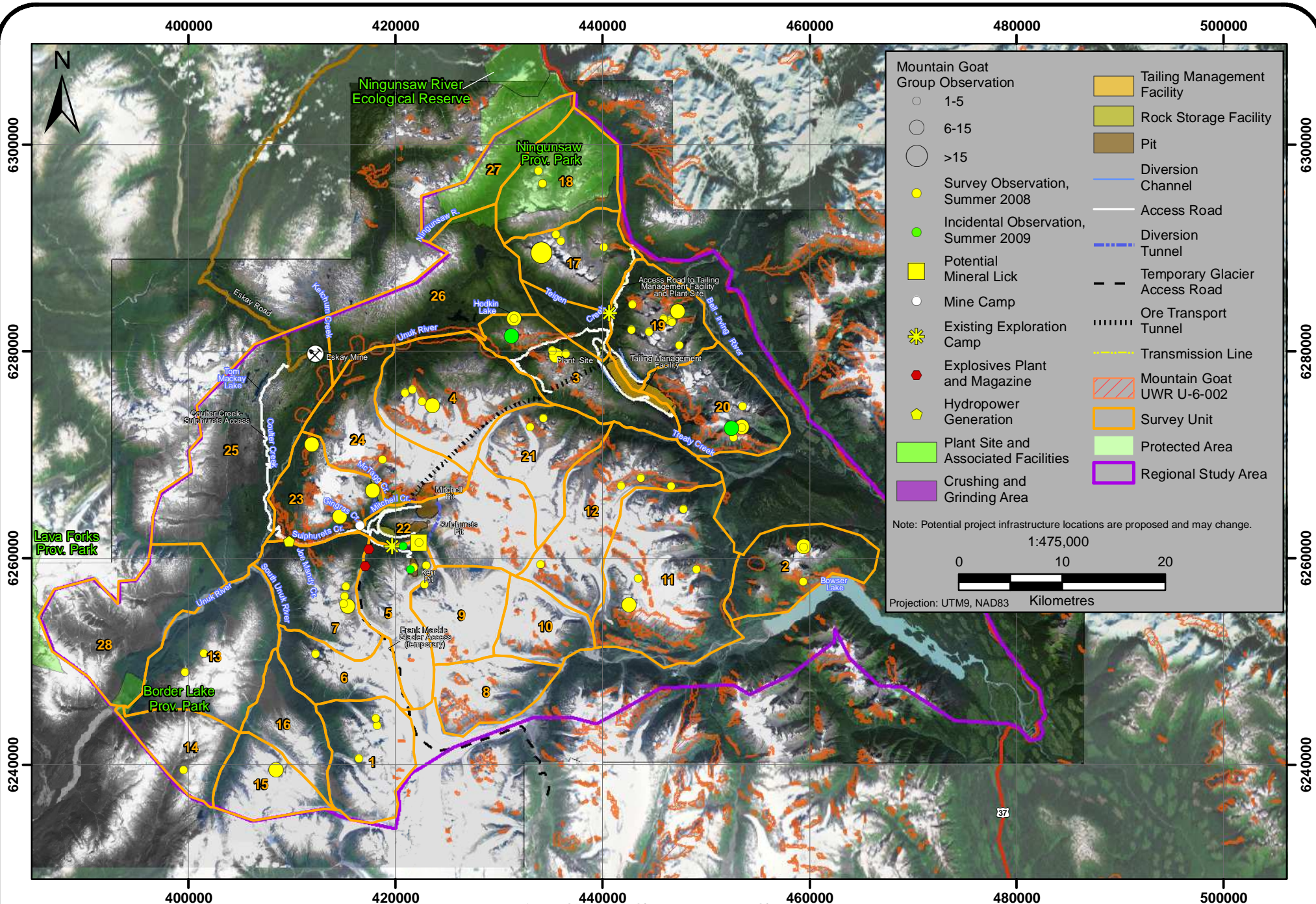
During summer surveys in 2008, 230 goats were observed in 62 groups over 20 SUs and 1,150 km² of capable habitat (Figure 4.3-2; Table 4.3-3; Appendices 4.3a and 4.3c). No caribou or Stone's sheep were observed during summer surveys. Goats were not observed in SUs 8, 10, 16, and 22 during summer (Table 4.3-3; Appendix 4.3-2). Adults accounted for 78% of all goats observed and kids accounted for 22%; the summer kidding ratio was 28 kids per 100 adults. The group size of mountain goats ranged

from 1 to 28 individuals, averaging 3.7 ± 0.6 individuals (all variance reported as Standard Error). Most observations consisted of more than one individual (63%) (Appendix 4.3-3). One potential mineral lick was identified on the border of SU 5 and 23 during the summer survey (Figure 4.3-2). Several signs of mountain goat use (i.e., distinct paths, trails, bedding sites, digging activity) were noted and two adult goats were observed licking at the soil.

The density of goats was calculated across two scales: total area and area of capable habitat (Section 4.3.3.2). However, for the purposes of this report, density is discussed only for area of capable habitat, since this provides a biologically relevant comparison between SUs. Summer density across 24 SUs averaged 0.20 ± 0.05 goats/km² (range: 0 and 0.89) (Table 4.3-3). Four SUs were devoid of goats (SUs 8, 10, 16, and 22); the average density of goats increased to 0.24 ± 0.06 goats/km² when these SUs were dropped from calculations. The majority of goats were observed in SU 17 (14%), 23 (13%), 19 (11%), and 3 (10%). SUs 17 and 23 also supported the highest density of goats (Table 4.3-3). Seventy-five percent of all goats (172 individuals) were observed in what was considered in capable habitat.

Table 4.3-3. Mountain Goat Observations and Population Characteristics by Survey Unit, Summer 2008

Survey Unit	No. Goats			Kidding (kid/adult)	Density (goat/km ²)	
	Total	Adults	Kids		Total Area	Capable Habitat
1	3	3	0	-	0.04	0.05
2	17	12	5	0.42	0.21	0.43
3	23	19	4	0.21	0.28	0.59
4	10	7	3	0.43	0.07	0.16
5	4	4	0	-	0.05	0.08
6	4	4	0	-	0.07	0.10
7	15	15	0	-	0.18	0.27
8	0	0	0	-	0	0
9	1	1	0	-	0.01	0.02
10	0	0	0	-	0	0
11	11	9	0	0	0.06	0.08
12	8	7	1	0.14	0.06	0.08
13	4	2	2	1	0.03	0.06
14	2	1	1	1	0.03	0.04
15	11	6	5	0.83	0.19	0.26
16	0	0	0	-	0	0
17	33	25	8	0.32	0.44	0.89
18	5	5	0	-	0.05	0.09
19	26	19	7	0.37	0.33	0.53
20	14	9	5	0.56	0.15	0.21
21	7	7	0	-	0.08	0.12
22	0	0	0	-	0	0
23	31	22	9	0.41	0.41	0.74
24	1	1	0	-	0.01	0.02
Total	230	178	50	0.28		
Average					0.11 ± 0.03	0.20 ± 0.05



A total of 22 mountain goats, including 18 adults and 4 kids, were recorded incidentally in 4 groups during the summer of 2009 by Rescan field staff (Figures 4.3-2; Appendix 4.3-4; Plate 4.3-2a and 4.3-2b). Six goats were seen near the proposed mining area in July and August, including a solitary goat observed on a north facing slope above Sulphurets Lake (Plate 4.3-2a) and a group of five goats seen near the Kerr Pit (Figure 4.3-2). A large group (10 individuals) was observed on a south facing slope above West Teigen Creek in June (Plate 4.3-2b). The remaining six goats were seen in one group on a southwest facing slope of the Snowslide Range in July.



(a) Single goat observed above Sulphurets Lake, July 2, 2009.



(b) Group of 10 goats (8 adults, and 2 kids) observed above West Teigen Creek, June 27, 2009.

Plate 4.3-2. Incidental Observations of Mountain Goat in the RSA during the summer of 2009.

Winter

During winter surveys (2009), 178 goats were observed in 69 groups over 11 SUs and 676 km² of capable habitat (Figure 4.3-3; Table 4.3-4; Appendices 4.3a and 4.3c). No caribou or Stone's sheep were observed during winter surveys. Goats were not observed in SUs 1, 6, 17, 23, and 26 during winter surveys. Adults accounted for 79% and kids accounted for 21% of the total number of goats. Winter recruitment was 26 kids per 100 adults (Table 4.3-4). The average group size of mountain goats was 2.6 ± 0.3 and ranged from 1 and 16 individuals. Sixty-four percent of the groups consisted of more than one individual (Appendix 4.3-3).

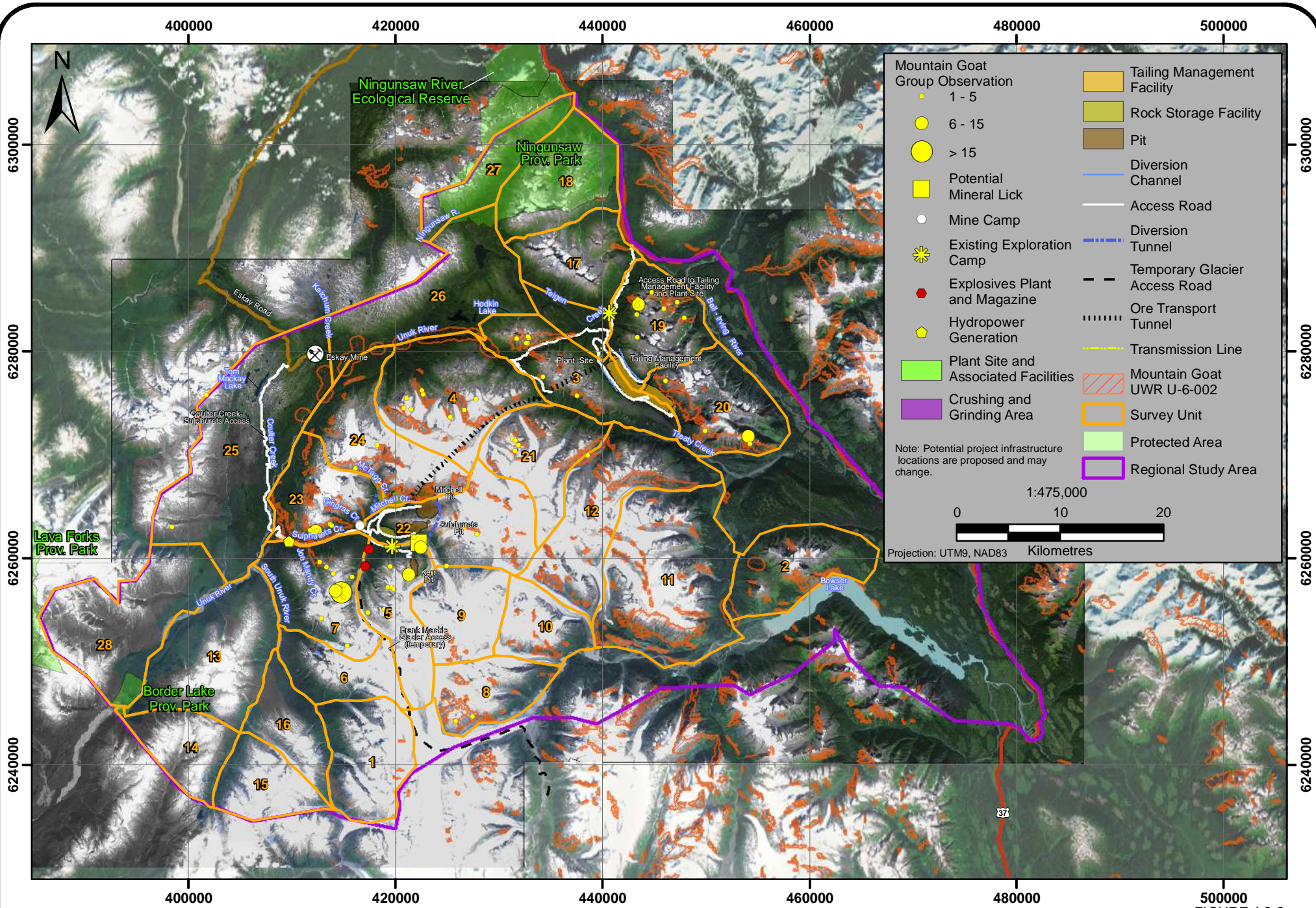
Table 4.3-4. Mountain Goat Observations and Population Characteristics by Survey Unit, Winter 2009

Survey Unit	No. Goats			Recruitment (kid/adult)	Density (goat/km ²)	
	Total	Adults	Kids		Total Area	Capable Habitat
1	0	0	0	-	0	0
3	16	13	3	0.23	0.19	0.41
4	14	13	1	0.08	0.10	0.22
5	30	22	8	0.36	0.40	0.58
6	0	0	0	-	0	0
7	37	29	8	0.28	0.44	0.67
8	5	4	1	0.25	0.08	0.09
17	0	0	0	-	0	0
19	23	17	6	0.35	0.29	0.47
20	10	8	2	0.25	0.11	0.15
21	9	6	3	0.50	0.11	0.15
22	10	8	2	0.25	0.10	0.15
23	18	17	1	0.06	0.24	0.43
24	3	2	1	0.50	0.03	0.05
25	3	2	1	0.50	0.01	0.04
26	0	0	0	-	0	0
Total	178	141	37	0.26		
Average					0.13 ± 0.04	0.21 ± 0.06

Winter density (based on capable habitat) averaged 0.21 ± 0.06 goats/km² (range: 0 to 0.67) (Table 3.3-4). When the five SUs without goats (SUs 1, 6, 17, 23, and 26) were removed from calculations, density increased to 0.26 ± 0.06 goats/km². The majority of goats were observed in SU 7 (21%), 5 (17%), and 19 (13%) (Table 4.3-4). These three SUs also supported high densities of goats; however, the highest density was recorded in SU 3 (Table 4.3-4). Ninety-four percent of goats were observed in what was considered as capable habitat.

4.3.5.3 Spatial Distribution

The topographic features associated with all sightings of mountain goats groups from summer and winter surveys of 2008 and 2009 (n = 131) were analyzed to determine suitable habitat conditions for habitat suitability modelling. Mountain goats were observed at similar elevations in summer and winter. During summer, the average elevation of goat observations was $1,354 \pm 25$ m (n = 62) and 90% of goat observations were recorded between 1,116 and 1,663 m (Figure 4.3-4a; Appendix 4.3-3). During winter, 90% of observations were recorded between 1,059 and 2,064 m, with an average of $1,603 \pm 37$ m (n = 69; Figure 3.3-5b; Figure 4.3-5a; Appendix 4.3-3). Of all observations, 75% were above 1,210 m in the summer and 1,371 m in the winter.



Mountain goats were frequently observed on cooler, northerly aspects of mountain ridges in the summer (Figure 4.3-4b); 67% of goat groups were observed with a transformed aspect of greater than 90. Conversely, goats were more frequently observed on warmer, southern aspects in the winter (Figure 4.3-5b); 80% of goat groups were observed with a transformed aspect of less than 90.

Goats were observed on an average slope of $31^\circ \pm 2^\circ$ in the summer, with 90% of observations on slopes between 9° and 48° (Figure 4.3-4c). Goats were observed on steeper slopes during winter than in summer. The average slope of goat observations in winter was $38^\circ \pm 1^\circ$, with 90% of all sightings between 19° and 52° (Figure 4.3-5c; Appendix 4.3-3). Of all observations, 75% were recorded on slopes steeper than 26° in the summer and steeper than 34° in the winter (Figures 4.3-4c and 4.3-5c).

During summer, the average observed distance of goats to escape terrain was 326 ± 41 m, with 75% of all observations recorded within 476 m of escape terrain and 90% within 627 m (Figure 4.3-4d). Three groups of goats were observed directly in escape terrain (Appendix 4.3-3). During the winter, goats were closer to escape terrain, with an average distance to escape terrain of 142 ± 29 m and 75% of all observations falling within 160 m of escape terrain and 90% within 278 m (Figure 4.3-5d). Nine groups were observed directly in escape terrain (Appendix 4.3-3).

Habitat ratings assigned at each goat group observation were also analyzed. Many goats were observed in HSR 1 or 2 habitat in the summer (32% of observations) and in the winter (50%). HSR 1 and 2 habitat supports preferred forage species, such as shrub and conifer vegetation, and occurs within 200 m of escape terrain (RTEC 2006e).

4.3.6 Discussion

During the mountain ungulate baseline study, 408 goats were observed in 131 groups in 23 SUs within the RSA. Summer surveys were considered total counts, while winter surveys were conducted to evaluate the use of winter habitat.

The population demographics recorded in both the summer and winter surveys are consistent with those recorded for other mountain goat studies in the region (M. W. Demarchi, Johnson, and Searing 2000; RTEC 2006c). In the current study, the summer kidding ratio was recorded as 28 kids per 100 adults, while in areas of similar topography and ecology to the Project, kidding ratios of 27 kids to 100 adults have been recorded (RTEC 2006c). Summer densities of 0.57 goats/ km^2 and winter densities 0.27 goats/ km^2 have been recorded in areas near the Project (RTEC 2006c), which are slightly higher than values reported here. Other studies have recorded even higher densities. Over a two year study (1996 and 1997) of goats in west-central BC just north of Terrace, the mean population density was estimated at 0.7 goats/ km^2 , based on areas of suitable habitat (M. W. Demarchi, Johnson, and Searing 2000). Suitable habitat for that study was generally all habitat above 1,000 m elevation within survey blocks (M. W. Demarchi, Johnson, and Searing 2000).

Neither Stone's sheep nor northern caribou were identified during summer or winter surveys. The RSA does not support adequate year-round habitat for these two species (S. Freeman, pers. obs.). Anecdotal evidence of caribou presence in the RSA has been documented, as a shed antler was found in 2008 near the Kerr deposit; however, it is likely that this individual was a dispersing male, since no other shed antlers have been found in the study area, the area does not support appropriate upland habitat for caribou, and no animals were observed.

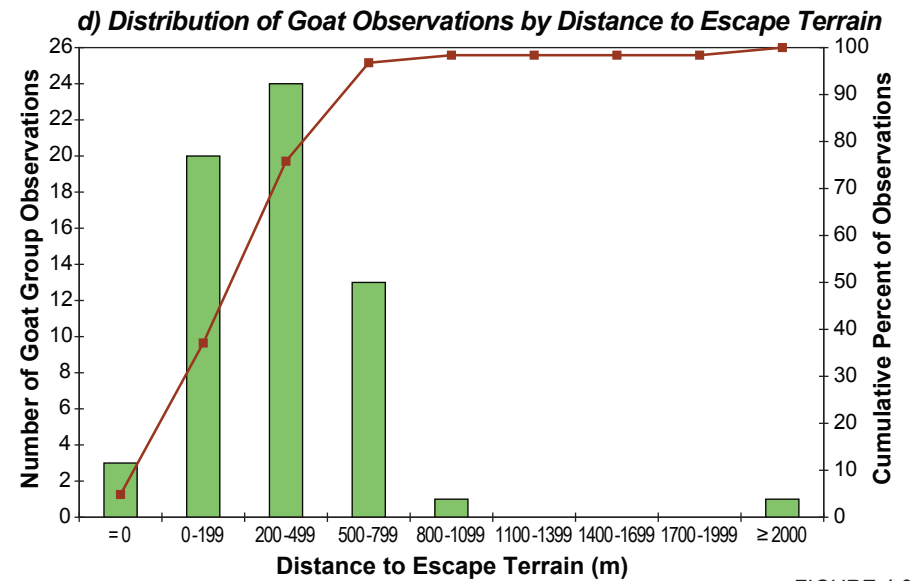
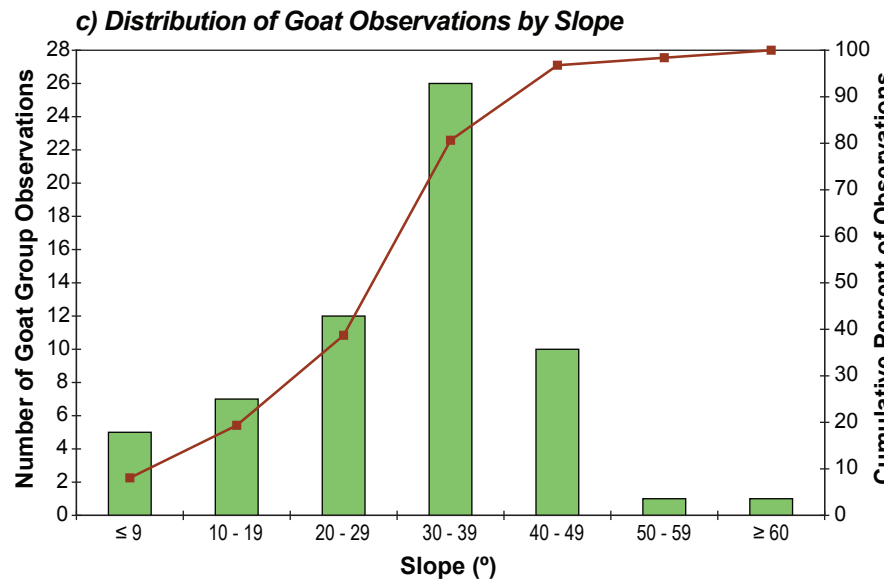
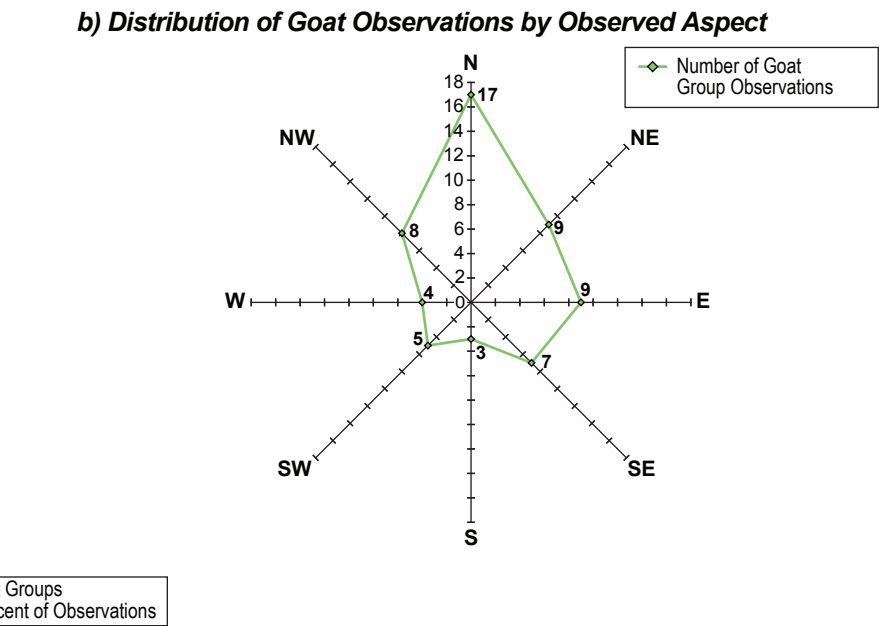
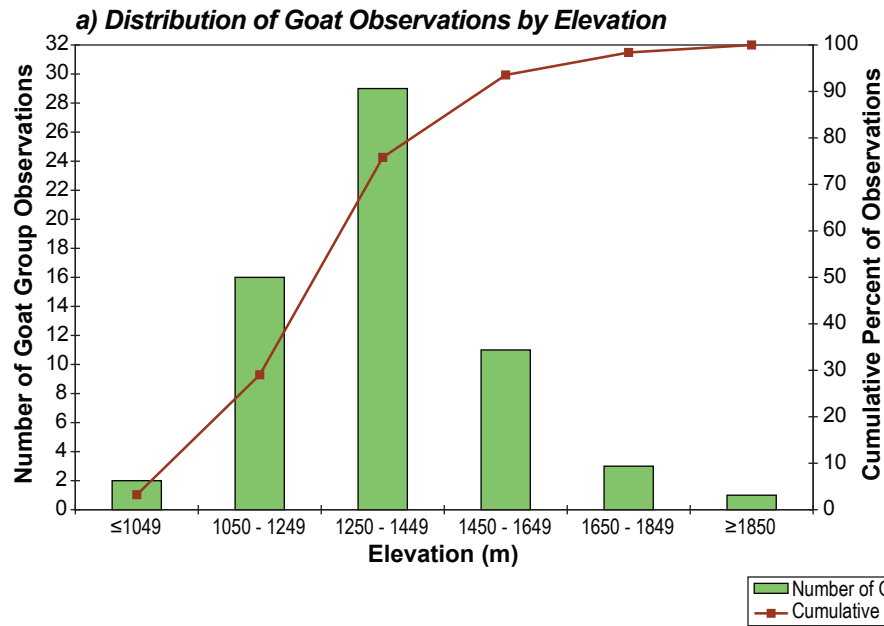


FIGURE 4.3-4

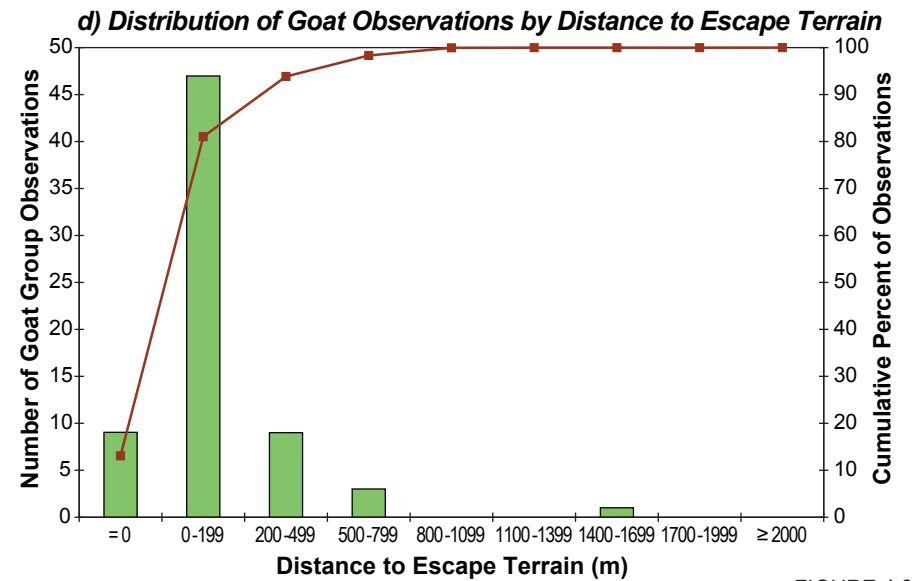
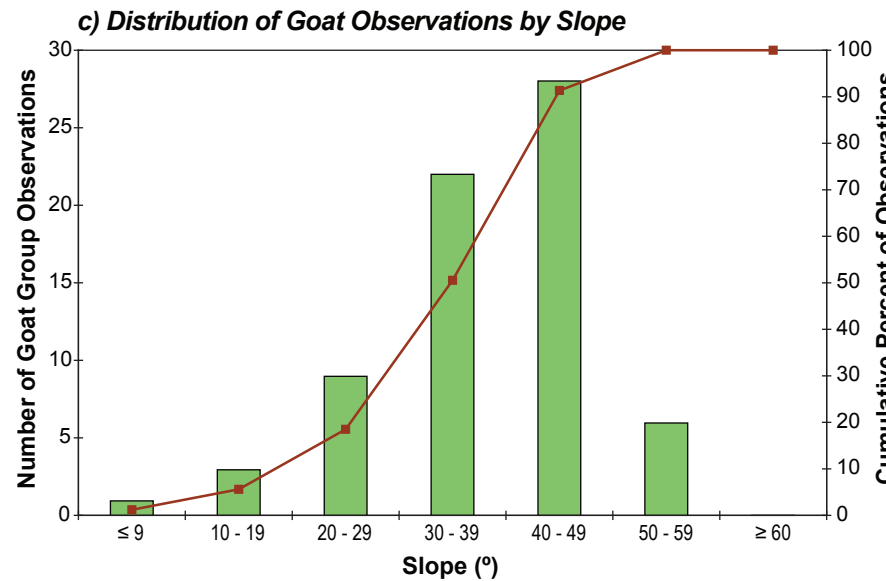
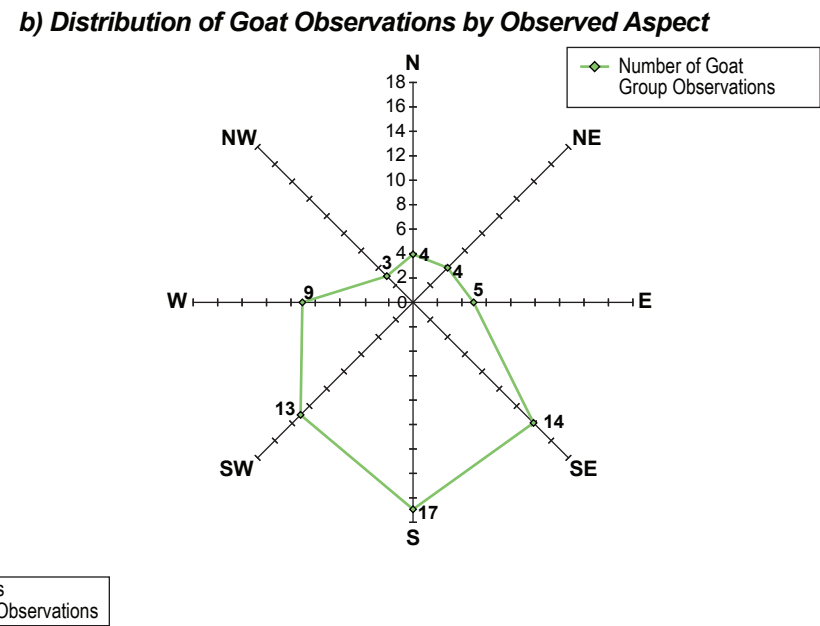
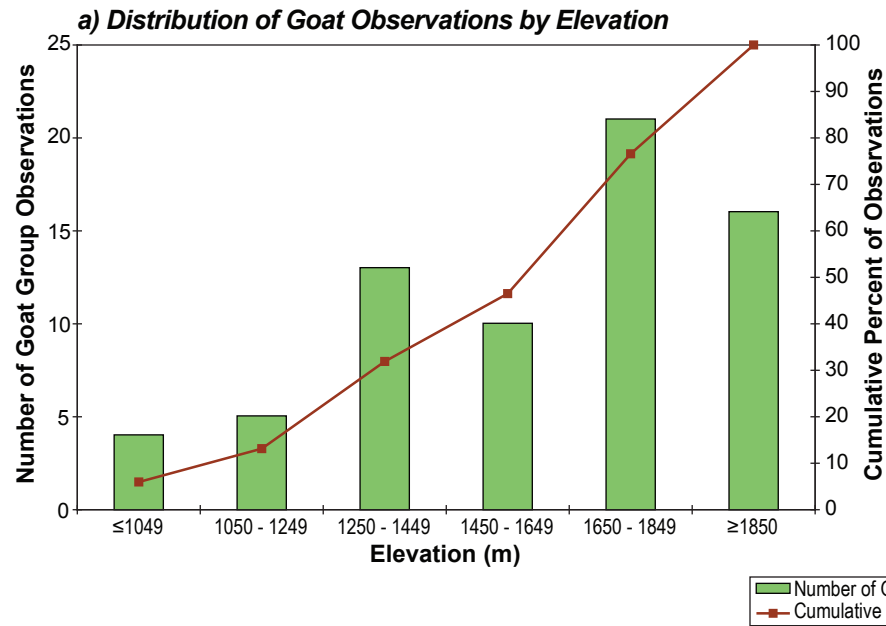


FIGURE 4.3-5

The distribution of mountain goat observations during the summer and winter surveys is consistent with the expected topographic selection for goats. Goats occupied areas with different elevation, slope and distance to escape terrain in different seasons. In general, goats move to lower elevations in winter to avoid higher snowpack (Schoen and Kirchoff 1982; J.L. Fox, Smith, and Schoen 1989), and during the growing season, goats move to higher elevations, following the snowmelt and emergence of vegetation. In this study, however, goats occupied similar elevational ranges in the winter and summer, with goats being slightly higher in the winter than in the summer. In general, goats were observed in habitat above 700 m in both the summer and winter; between 717 and 1,875 m in summer and 865 and 2,194 m in winter.

It has been well documented that mountain goats are usually found near escape terrain: rocky bluffs and cliffs that provide goats with good visibility and are generally inaccessible to predators (Shackleton 1999). Goats are seldom found farther than 500 m from escape terrain (J. L. Fox 1983; Gross et al. 2002; RTEC 2006e). In this study, mountain goats in the winter were well within the range found by Fox (1983), Gross et al. (2002), and RTEC (2006e), with 90% of all goat observations within 278 m of escape terrain. However, goats were farther away from escape terrain in the summer, with 90% of all observations falling within 678 m of escape terrain.

As a consequence of habitat preference for suitable escape terrain, goats are rarely found on slopes of less than 25° during the winter and summer seasons (J.L. Fox 1978; Schoen and Kirchoff 1982). The results of the 2008 and 2009 surveys are consistent with the expected slope range for goats. In the summer, 75% of all groups were on slopes greater 26° (Figure 4.3-4c). In the winter, goats were on steeper gradients, with 75% of groups on slopes greater than 33° (Figure 4.3-5c). Goats typically only use lower slope areas to travel to other preferred habitat, such as other mountains or mineral licks (RTEC 2006e).

Aspect also plays an important role in dictating the habitat use for mountain goats during the winter, and less so during the summer. In particular, windswept south facing slopes are preferred because snow accumulation is lower and therefore food can be found more readily (Wilson 2005). Tree and shrub cover on steep, rocky ledges affords thermal advantage during sunny weather and during storms (RTEC 2006e). During the summer, goats may select a wide range of aspects. Snow will melt sooner on warmer southern aspects and vegetation phenology progresses quicker than on northern faces (J. Shewan, pers. obs.). However, cooler northern faces may provide animals with a refuge from heat and flying insects during summer (G. Sharam, pers. obs.) particularly on hot days. This pattern was generally observed during this study. Goat groups were observed on all aspects during the July survey with the majority occurring on northerly aspects (Figure 4.3-4b). During the winter survey, goat groups were mostly observed on southerly aspects (Figure 4.3-5b).

4.4 FURBEARERS

4.4.1 Introduction

Furbearers include all mammals with hair that have traditionally been hunted or trapped for their fur. Furbearers of interest that could occur near the Project include two species of conservation concern: the federally listed (special concern) wolverine (*Gulo gulo*) and provincially blue-listed fisher (*Martes pennanti*). The draft Nass South SRMP (BC ILMB 2009) also identifies these two furbearer species as requiring additional management consideration. American marten (*Martes americana*) has been identified in the Cassiar Iskut-Stikine LRMP (BC ILMB 2000) as requiring increased management consideration and is the most valuable component of the regional fur harvest, despite being abundant throughout most of the province and not a species of conservation concern. High value habitat areas

for marten are identified in the *2009 Wildlife Habitat Suitability Baseline Report* (Rescan 2010d), and in the Cassiar Iskut-Stikine LRMP (2000).

Furbearers are economic and cultural resources within the Project area. The Project RSA overlaps seven trapline licences (Rescan 2010b). One of the most effective ways of assessing wolverine and fisher distribution within the study area is through investigating wolverine and fisher harvest returns from the provincial Fur Harvest Database (RIC 1999b; BC MWLAP 2004b, 2004d).

4.4.2 Objectives

The overall objective of this study was to assess the presence/absence of furbearer species in the study area, with emphasis on determining whether the fisher and wolverine occur in habitats associated with the RSA and LSA. The furbearer harvest database provides an opportunity to assess the presence of furbearers within an area. However, it cannot be used to quantify the extent and level of harvest in the area (i.e., population demographics, relative abundance of species in an area) as the level of harvest recorded in the Fur Harvest Database is underreported for various reasons. In addition, since the decline of the fur trade in the 1980s, provincial regulation of traplines and monitoring harvest has lapsed.

4.4.3 Methods

Two methodologies were implemented to determine the furbearer species present within the study area. First, the provincial Fur Harvest Database was used to investigate the registered harvest associated with identified trapline tenures overlapping the study area. The BC MOE has divided the province into regions for the purpose of managing wildlife harvest and the study area falls within Region 6 (Skeena). Trapline tenure areas overlapping the study area were identified using provincial databases (Integrated Land and Resource Registry and Land and Resource Data Warehouse). The available version of the Fur Harvest Database includes fur returns from 1985 to 2007. Over the 22 year period, the species and numbers of individuals registered within tenures were evaluated. Secondly, incidental observations of furbearers were recorded and geo-referenced (wherever possible) when they were detected during wildlife field studies in 2008 and 2009 to supplement the Fur Harvest Database investigation.

4.4.4 Results

4.4.4.1 Furbearer Harvest

There are seven trapline tenures that overlap the RSA: TR0616T011, TR0616T012, TR0616T013, TR0617T15, TR0621T001, TR0621T003, and TR0621T004 (Figure 4.4-1). No data were available for trapline tenure TR0616T013. For the six trapline tenures with available data, 14 furbearer species were recorded during the 22 year period, including fisher, wolverine, and marten (Table 4.4-1).

Marten constituted the majority of the reported trapper harvest (73% of total animals). Fisher are often caught in marten sets; however, the reported fisher harvest was relatively low with only three individuals harvested, despite the apparent effort directed at marten. Wolverine constituted less than 1% of the harvest, with only 26 animals harvested over 25 years. Substantial effort on certain lines was also directed at aquatic furbearers, such as beaver, mink, muskrat, and otter.

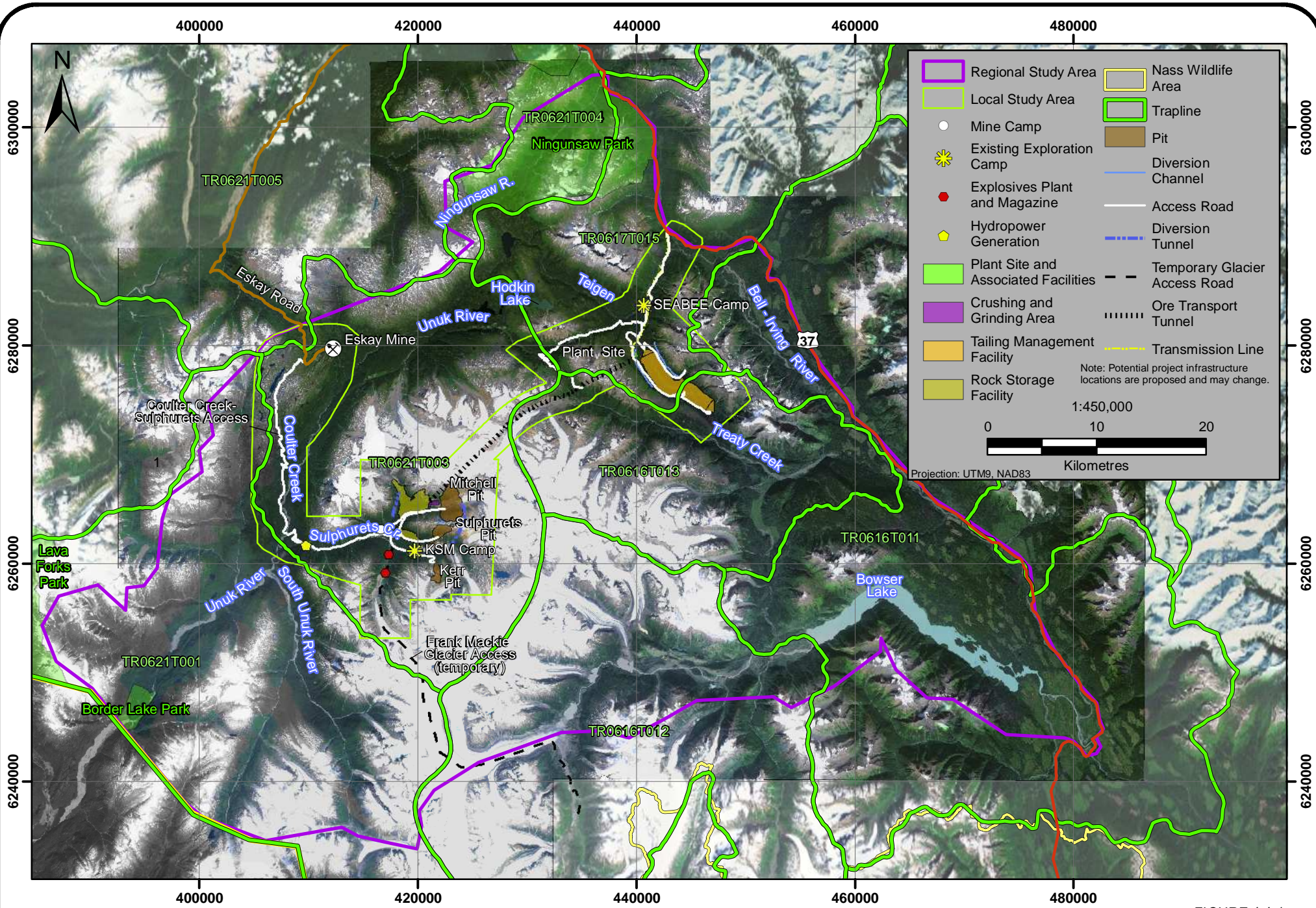


Table 4.4-1. Registered Harvest of Furbearer Species in Trapline Tenures within the RSA

Species	Scientific Name	Total Harvest (1985-2007)
American Beaver	<i>Castor canadensis</i>	601
American Black Bear	<i>Ursus americanus</i>	16
American Marten	<i>Martes americana</i>	4,032
Coyote	<i>Canis latrans</i>	25
Fisher	<i>Martes pennanti</i>	3
Mink	<i>Neovision vison</i>	111
Grey Wolf	<i>Canis lupus</i>	18
Muskrat	<i>Ondatra zibethicus</i>	36
Red Fox	<i>Vulpes vulpes</i>	34
Red Squirrel	<i>Tamiasciurus hudsonicus</i>	402
River Otter	<i>Lontra canadensis</i>	35
Short-tailed Weasel (Ermine)	<i>Mustela erminea</i>	215
Skunk	<i>Mephitis mephitis</i>	1
Wolverine	<i>Gulo gulo</i>	26
Total		5,555

4.4.4.2 Incidental Observations of Furbearers during Baseline Studies

During wildlife baseline studies in 2008 and 2009, 9 furbearer species or their sign were observed on 75 occasions (Figure 4.4-2; Table 4.4-2; Plate 4.4-1; Appendix 4.4-1). Of the 75 observations, 65 (all of which were sign except for four red squirrels) were observed during TEM field surveys (see 2009 Wildlife Habitat Suitability Baseline Report, Rescan 2010d), while the remaining 10 were incidental observations during other wildlife surveys. Observations of sign (e.g., tracks, scat) were more frequently recorded than observations of animals (Table 4.4-2). The species with the most observations of animals and/or sign were black bears, red squirrel, and marten (Figure 4.4-2; Table 4.4-2). Fisher sign was documented in July 2008, a wolverine was observed in April 2009, along the lower Unuk River in the extreme southwestern corner of the RSA at the United States-Canada border, and American marten sign were observed on numerous occasions in July 2008, and August 2009 (Figure 4.4-2; Plate 4.4-1).

4.4.5 Discussion

The evaluation of the BC Fur Harvest Database identified 14 furbearer species that were harvested within and surrounding the study area. Several of these species or their sign were observed and documented during wildlife baseline studies in 2008 and 2009. The harvest evaluation also confirmed the presence of the blue-listed fisher and the federally listed wolverine. A wolverine was also observed in the south end of the RSA during 2009 and fisher sign was observed in the LSA in 2008 (Figure 4.4-2).

Habitat requirements limit the populations of fishers and wolverines that can be supported by an area. Fishers select dense older growth forests with high canopy cover, which provide snow interception during the winter as well as security habitat during the snow-free months (Weir 1995). Preferred fisher habitat occurs in Sub-Boreal Spruce (SBS), Spruce-Willow-Birch (SWB), and Boreal White and Black Spruce (BWBS) BEC zones (BC MWLAP 2004b), none of which occur in the study area. Also, fishers tend to be found below 1,000 m elevation (Powell and Zielinski 1994). Habitat below 1,000 m does occur in both the LSA and RSA, particularly surrounding valley bottoms and river corridors (e.g., Unuk River and Treaty Creek drainages); however, these habitats are within the Coastal Western Hemlock (CWH), Engelmann Spruce-Subalpine Fir (ESSF), and Interior Cedar Hemlock (ICH) BEC zones, where comparatively less fisher habitat use has been recorded.

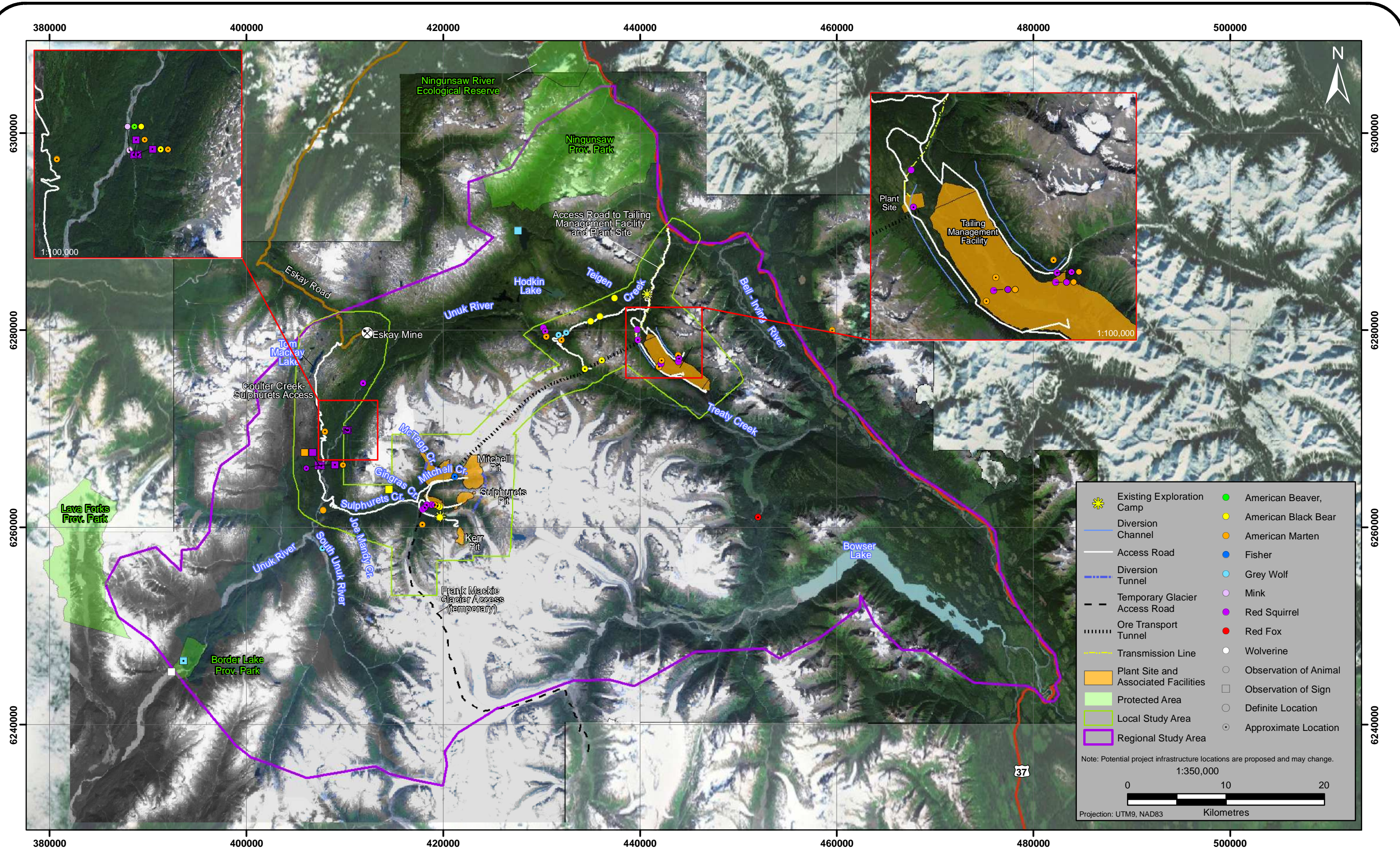


Table 4.4-2. Observations of Furbearers during Wildlife Baseline Studies, 2008 and 2009

Species	No. Observations in 2008		No. Observations in 2009		Total
	Animal	Sign	Animal	Sign	
American Beaver	-	1	-	-	1
American Black Bear	3	16	-	7	26
American Marten	1	21	-	3	25
Fisher	-	1	-	-	1
Grey Wolf	2	5	1	-	8
Mink	-	1	-	-	1
Red Fox	-	1	-	-	1
Red Squirrel	5	21	-	-	26
Wolverine	-	-	1	-	1
Total	9	65	2	10	90



(a) Wolverine observed on the Lower Unuk River near the US-Canada border



(b) Grey Wolf Tracks at West Teigen Lake



(c) Grey Wolf observed on the lower Unuk River near Border Lake

Plate 4.4-1. Incidental Observations of Furbearers and Furbearer Sign during Baseline Studies.

Wolverines exhibit a far greater range of plasticity in habitat selection. Wolverines exploit habitat from valley bottoms to alpine meadows, meaning that they can be found in both early and late successional forest types. The wolverine observed during 2009 baseline studies was detected in a low elevation riparian area along the lower Unuk River within the CWH BEC zone. Wolverines are known to use variants of the ESSF and Boreal Atlatl Fescue Alpine (BAFA) BEC zones as well, depending on the season (Krebs and Lewis 2000; Lofroth 2001).

The results of this evaluation cannot be assumed to identify the level of harvest in the area, as harvest levels are often underreported; however, a relative comparison between harvested species can be made. The results do show that the emphasis of fur harvest is directed at arboreal furbearers, such as American marten (73% of all animals reported in trapline tenures), red squirrel (*Tamiasciurus hudsonicus*; 7% of reported harvest), and short-tailed weasel or ermine (*Mustela erminea*; 4% of reported harvest). Marten, a species requiring mature conifer forest, is found in the highest proportions in the harvest records and is the most important species to local trappers. Also, nil harvests should not be interpreted to mean that a species does not occur in an area, as the absence may be due to: (a) an inactive trapline; (b) the inability of the trapper to catch the species; (c) a conscious decision by the trapper not to set traps for the species; or (d) the absence of the species (RIC 1999b). In addition, a species may be trapped in a region but trapline owners may not report the harvest. Land use research in the area provides additional information with respect the local trapping activity and fur harvest within the study area (Rescan 2010b).

4.5 HOARY MARMOT AND ARCTIC GROUND SQUIRREL

4.5.1 Introduction

Local Aboriginal peoples requested that studies be conducted on the presence of hoary marmot (*Marmota caligata*) and Arctic ground squirrel (*Spermophilus parryii*) within the study area, which are valued cultural and subsistence species. These species are collectively referred to as 'groundhogs' by Aboriginal people in the region.

The hoary marmot is named for the white tips on the fur of mature individuals. This species occupies high elevation open habitat in the region, including herb-dominated meadows and boulder/talus fields with appropriate soil conditions (RTEC 2006e). Marmots also use boulders to watch for danger and to sun themselves (Banfield 1981). In areas of abundant food resources, hoary marmots tend to live in colonies. Hoary marmots feed on a variety of herbaceous plants, grasses, and seeds, and usually restrict their foraging to areas within 100 m of their dens (Banfield 1981). Plants commonly eaten by hoary marmots in British Columbia are western anemone (*Anemone occidentalis*), common red paintbrush (*Castilleja miniata*), avalanche lily (*Erythronium grandiflorum*), lupine (*Lupinus* spp.), wood betony (*Pedicularis bracteosa*), ragwort (*Senecio* spp.), grouseberry (*Vaccinium scoparium*), and Indian hellebore (*Veratrum viride*) (Gray 1967 in Hansen 1975).

Arctic ground squirrels inhabit many of the same areas as hoary marmots (Reid 2006), but may also exploit lower elevations and may be able to use a wider variety of habitats that are less suitable for hoary marmots (e.g., more shallow soils). Like hoary marmots, Arctic ground squirrels are a social species, often living in large colonies (Reid 2006). Typical food items in the diet of Arctic ground squirrels include forbes, such as lupine and paintbrush, and the roots of grass species (Forsyth 1985). The leaves and stems of willow (*Salix* spp.) may also be eaten during the summer (Forsyth 1985; Reid 2006). Seeds form a component of the late summer diet of Arctic ground squirrels as they are readily available at that time. Seeds are also stored in dens and form the major component of the squirrel's winter diet (Reid 2006). Unlike hoary marmots, Arctic ground squirrels appear to be more generalist in their food habits, occasionally including carrion, bird's eggs, and woody plant material (Forsyth 1985).

4.5.2 Objectives

The overall objective of this study was to collect baseline information with respect to hoary marmot and Arctic ground squirrel distribution and habitat use within the study area. The specific objectives of the inventory were to:

- identify the numbers and locations of colonies in representative areas within RSA and LSA; and
- conduct site-specific surveys at colony locations to identify habitat characteristics associated with occupied colonies.

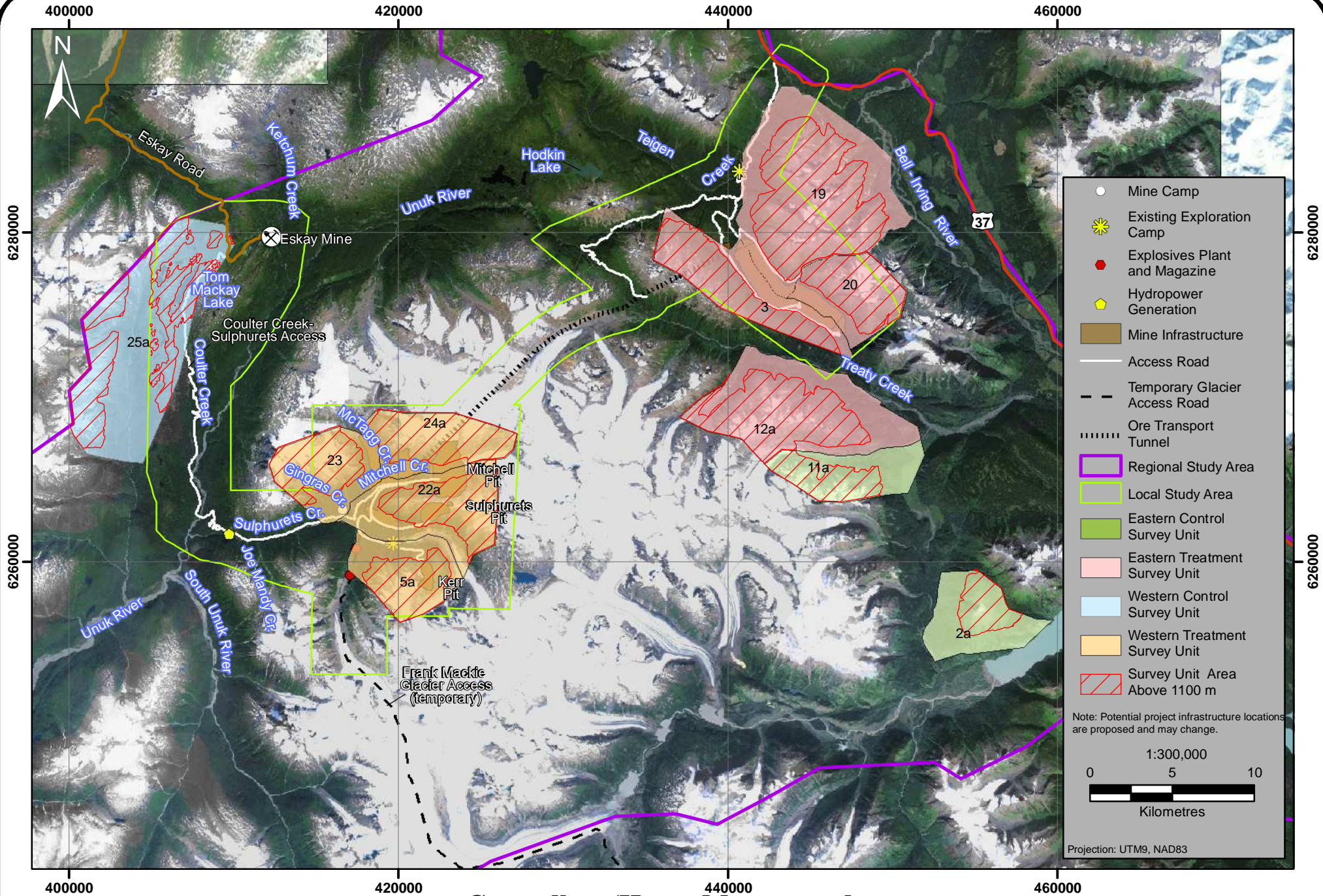
4.5.3 Methods

4.5.3.1 Aerial Survey

Aerial surveys were conducted in 2008 and 2009 to identify the location and distribution of hoary marmot and Arctic ground squirrel colonies within the Project area, with a focus on the areas close to Project infrastructure (referred to as “treatment” sites) and at a greater distance, to act as future control sites. Direct observation of sign (including burrows) is a useful inventory measurement for marmots and ground squirrels (RIC 1998c). Hoary marmot and ground squirrel colonies can be very conspicuous and easily spotted from the air, particularly in barren high elevation areas. The study area was sub-divided into 11 SUs, covering 444 km² of the RSA (Figure 4.5-1). Treatment sites (encompassed by SUs) were delineated in the eastern area surrounding the proposed TMF and the western area around the proposed mine site. Control sites (encompassed by SUs) were also established outside of the expected zone of influence from the development (i.e., outside of the LSA). Survey effort was focused in areas above the tree line (~1,100 m) in both years to ensure colony visibility (Figure 4.5-1).

In 2008, surveys for groundhog colonies were flown on August 15 and 16, using 7.1 hrs of helicopter time and covering 7 of the 13 SUs (Appendix 4.5-1). The survey used a Bell 206 helicopter with a pilot and two observers. Observers recorded evidence of colonies, visually represented as a continuous cluster of burrow entrances reasonably close to one another to be associated with one family unit (i.e., colony) (Plate 4.5-1). Colony locations were geo-referenced with a handheld Garmin GPS 60Cx (advertised accuracy 3 to 15 m). There is evidence that colonies of hoary marmot and Arctic ground squirrel often overlap each other (S. Freeman, pers. obs.), thus an observed colony could support both species.

In 2009, aerial surveys for colonies were flown using a Bell 206 helicopter with 2 observers over a period of 5 days between August 14 and 19, using 8.1 hrs of helicopter time and covering 8 of the 13 SUs (Appendix 4.5-1). Surveys were conducted following the same methodology as in 2008, except that observers also recorded habitat features associated with colony locations, including an estimate of slope, aspect, soil texture, and moisture regime, and general vegetation cover and plant species present (Table 4.5-1). Observers also recorded a WHR at each colony location, based on the presence of topographic and vegetative features used for habitat suitability modelling for hoary marmots. A WHR of one represented the most suitable habitat based on provincial benchmarks, while a WHR of four represented habitat devoid of habitat features that could be used by marmots (RIC 1999a).



Groundhog (Hoary Marmot and Arctic Ground Squirrel) Survey Units



Plate 4.5-1. Example of a colony identified from the air (highlighted burrow entrances associated with the single colony).

Table 4.5-1. Habitat Features Recorded During Aerial Surveys

Features	Definition	Value/Descriptor
Slope	-	Percent (%)
Aspect	-	Cardinal Direction (N, NE, etc.)
Soil Texture*	Soil particle size	Fine (clay) to Coarse (skeletal)
Soil Moisture Regime*	Soil moisture available for plant growth	Dry (very xeric) to Wet (hydric)
Vegetation	General ground cover class and species	Herb, Shrub, Tree, or Barren
WHR	Suitability of the habitat for marmots and ground squirrels	1 to 4

*Source: (BC MELP and BC MOF 1998).

4.5.3.2 Ground Survey

Ground-based surveys were conducted on a sample of 31 randomly selected and accessible colonies identified during aerial surveys in 2009 (Plate 4.5-2). At each location, observers recorded all habitat features collected during the aerial survey and additional information on habitat features that are difficult to classify from the air, including elevation, soil nutrient regime, and soil drainage (Table 4.5-2). Habitat features were collected over an area of approximately one hectare around colony locations. Observers also recorded information on the presence of landforms (talus or boulder) and their proximity to the colony (Table 4.5-2), as well as any evidence of species occupancy (e.g., observations, sign). Boulders or talus are often used for cover by both marmots and ground squirrels at entrances to burrows (Plate 4.5-2).



Plate 4.5-2. Example of a colony location surveyed from the ground, with a burrow entrance under the boulder.

Table 4.5-2. Additional Habitat Features Recorded During Ground Surveys

Characteristic	Description	Value/Descriptor
Elevation	-	Metres above sea level
Soil Nutrient Regime*	Soil's ability to supply major nutrient for plant growth	Low (very poor) to High (very rich)
Soil Drainage*	Speed and extent to which water is removed from soil in relation to additions	Slow (very poorly drained) to Fast (very rapidly drained)
Presence of Talus/Boulder	Identification of landform cover for groundhogs and its relation to the colony	Distance from Colony (m)

*Source: (BC MELP and BC MOF 1998)

4.5.3.3 Data Analysis

Colony Density

Colony density was determined in two ways: density per total area of SUs and density per area of habitat above 1,110 m elevation within SUs (i.e., habitat generally above the treeline).

Habitat Features of Colony Locations

Spatial survey data were analyzed to identify the broad scale topographic and vegetation features associated with colony locations. Topographical features at each colony observation, including elevation, aspect, and slope, were derived from a DEM with 1:20,000 TRIM data. Aspect is reported as the observed aspect or aspect bearing, separated into the cardinal directions (e.g., N, NE, E). Vegetative features at each colony were derived from the results of PEM conducted within the RSA (refer to Section 3.2.3 of Rescan 2010c for further details). Colony observations were overlaid on the

PEM and the habitat information, including BEC zone, general ecosystem type, site series, and structural stage, and this information was exported at each colony location.

For consistency, the results of the broad scale analysis of habitat features were compared to the results of aerial and ground investigations in 2009, where applicable. The results of aerial and ground investigations were also compared between features collected on both surveys. To facilitate a comparison between field and digital data from PEM, the vegetation species and soil moisture regime were analyzed and grouped *post hoc* into four general vegetation types: dry herb, mesic herb, moist herb, and heather heath. These vegetation types were then compared to site series from the PEM.

The aim of these analyses was to develop a comprehensive set of habitat features that define the habitat selected by marmots and/or ground squirrels for denning. The results will define suitable habitat for groundhogs to be used in ecosystem mapping and habitat suitability modelling (refer to Rescan 2010d).

4.5.4 Results

4.5.4.1 Field Surveys and Colony Density

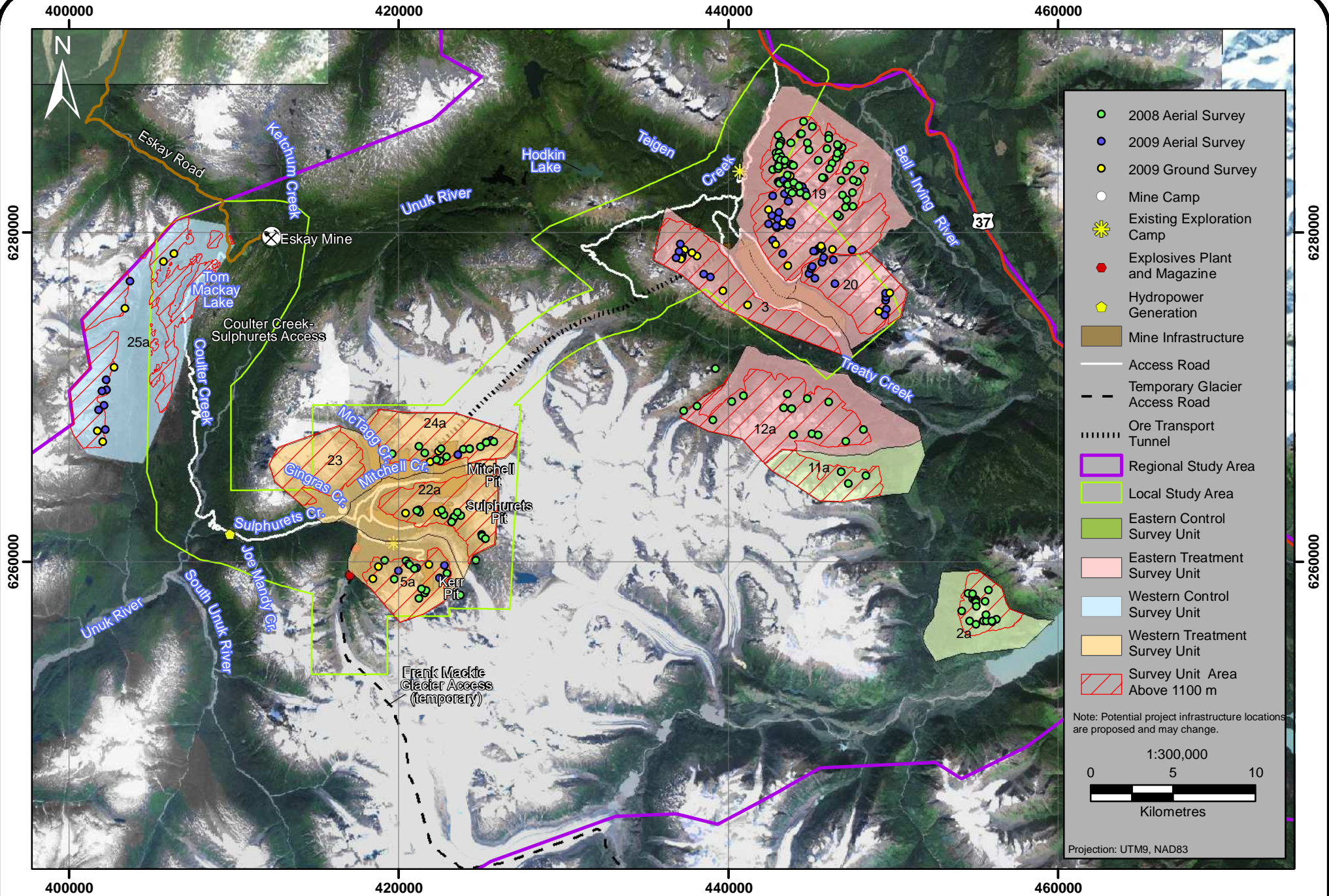
A total of 148 colonies were observed across 7 SUs in 2008 and 92 were observed in 7 SUs in 2009 (Figure 4.5-2; Table 4.5-3; Appendices 4.5-1 and 4.5-2). During ground surveys, 31 colonies identified during the aerial survey were visited on the ground in 7 SUs (Figure 4.5-2; Appendix 4.5-3). Hoary marmots were more abundant than Arctic ground squirrel. There was little evidence of occupation by ground squirrels during both aerial and ground surveys in 2009 (Appendices 4.5-1 and 4.5-2). Of the 31 colonies surveyed from the ground, 28 appeared to be actively occupied by hoary marmot, while the remaining 3 had no recent evidence of occupation by either species (Appendix 4.5-3).

Table 4.5-3. Results of Aerial Surveys for Groundhog Colonies, 2008 and 2009

Survey Unit	Number of Colonies Identified	
	2008	2009
<u>Eastern Treatment¹</u>		
3	-	13
12a	16*	-
19	73	33
20	-	14
<u>Western Treatment¹</u>		
5a	12*	7
22a	13*	6
23	-	0
24a	12	6
<u>Eastern Control¹</u>		
2a	19	-
11a	3	-
<u>Western Control¹</u>		
25a	-	13
Total	148	92

¹ Treatment survey units refer to those that are located near or on the proposed Project footprint, control survey units are those that are located away from the proposed development.

* totals includes several colonies located just outside survey unit boundaries



Nearly half of all colonies identified during field surveys in 2008 and 2009 were in SU 19 (106), on the northern Snowslide Range just east of the proposed TMF (Figure 4.5-2; Table 4.5-4). As such, SU 19 had the highest density of not only the SUs in the eastern treatment area, but of all units across the study area based on total SU area and area of habitat above 1,100 m (Table 4.5-4). High densities were also observed in the eastern control area SU 2a (0.73/km²) and western treatment area SU 5a (0.72/km²). SU 2a is on Mount Anderson to the south of Treaty Creek and SU 5a is within the proposed mine area around the proposed Kerr Pit (Figure 4.5-2). On average, the SUs in the eastern area (both treatment and control) had a higher average density than those in the western area (Table 4.5-4).

Table 4.5-4. Density of Colonies within Survey Units

Survey Unit	No. of Colonies	Density (colonies/km ²)	
		Total SU Area	SU area above 1,100m
<i>Eastern Treatment</i>			
3	13	0.37	0.53
12a	14	0.24	0.41
19	106	1.29	2.04
20	14	0.57	0.73
Average ± Standard Error (SE)		0.62 ± 0.23	0.93 ± 0.38
<i>Western Treatment</i>			
5a	18	0.72	1.17
22a	18	0.48	0.81
23	0	0	0
24a	18	0.66	0.80
Average ± SE		0.46 ± 0.16	0.69 ± 0.25
<i>Eastern Control</i>			
2a	19	0.73	2.02
11a	3	0.13	0.24
Average ± SE		0.43 ± 0.30	1.13 ± 0.89
<i>Western Control</i>			
25a	13	0.17	0.39

4.5.4.2 Topographic Features at Colony Locations

Elevation, aspect, and slope were calculated for each of the 240 colonies observed in 2008 and 2009 based on a DEM with 1:20,000 TRIM data (i.e., digital data). Colonies were generally above the treeline (> 1,100 m). The average elevation of all colonies was 1,423 ± 9 m (± SE), with 90% of all colony locations falling between 1,176 and 1,629 m (Figure 4.5-3a). Overall, 66% of all colonies were on warmer southeast to west facing slopes than cooler northern slopes (Figure 4.5-3b; BC MELP and BC MOF 1998). Colony locations were observed over a wide range of slopes, with 90% of colonies on slopes between 31 and 97% (mean 63 ± 1%) (Figure 4.5-3c).

4.5.4.3 Comparison of Topographic Ground and Digital Data

Colonies were at comparable elevations between digital and field data sets; 22 of 31 colonies (71%) were within an elevational range of 100 m of one another (i.e., digital elevation from a DEM with TRIM were within 50 m above and below the elevation recorded on the ground) and 94% were within 200 m. The aspect of colony locations classified with a DEM and TRIM data were also similar to that recorded

by observers in the field. Thirty-seven of the 92 colonies (40%) were classified with the same aspect between the digital and aerial survey data sets and 46% were within 45° of one another (e.g., S vs. SW). Furthermore, 18 of the 31 colonies (58%) were classified with the same aspect and 32% were within 45° of one another between digital and ground survey data sets. However, the slope of colonies was consistently over rated using digital data; 84% (77 of 92 colonies) were on steeper slopes according to the digital data set as compared to the aerial survey data. The average slope of colonies according to aerial survey data was $43 \pm 1\%$, with 90% of colonies falling on slopes from 18 and 60% (Appendix 4.5-2). Similarly, 71% of colonies (22 of 31 colonies) were on steeper slopes when digital data were compared to ground survey data. The average slope of colonies according to ground survey data was $42 \pm 3\%$ and 90% of colonies were on slopes from 19 to 64% (Appendix 4.5-3).

The comparisons indicate that digital data predicted some topographic features well (elevation and aspect) but may be too coarse to accurately predict slope. There can be some localized variability in the slope of the face that cannot be predicted at the resolution of the digital data.

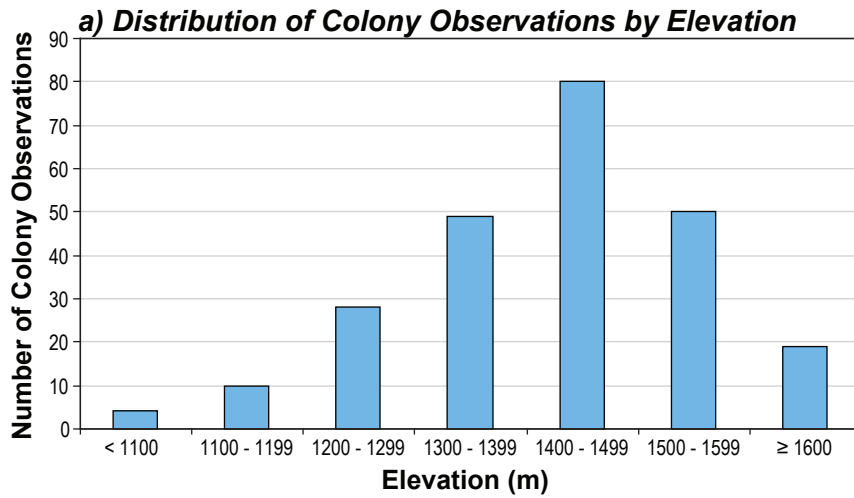
4.5.4.4 *Vegetation and Soil Characteristics at Colony Locations*

Most colonies were within higher elevation BEC zones (Appendices 4.5-1 and 4.5-2). Most of the colonies were within the undifferentiated parkland variants of the Boreal Altai Fescue Alpine (BAFAunp; 55%) and Coastal Mountain-heather Alpine (CMAunp; 20%). The remaining colonies were just below the alpine parkland within the ESSFwv (16%) and the MHmm2 (9%).

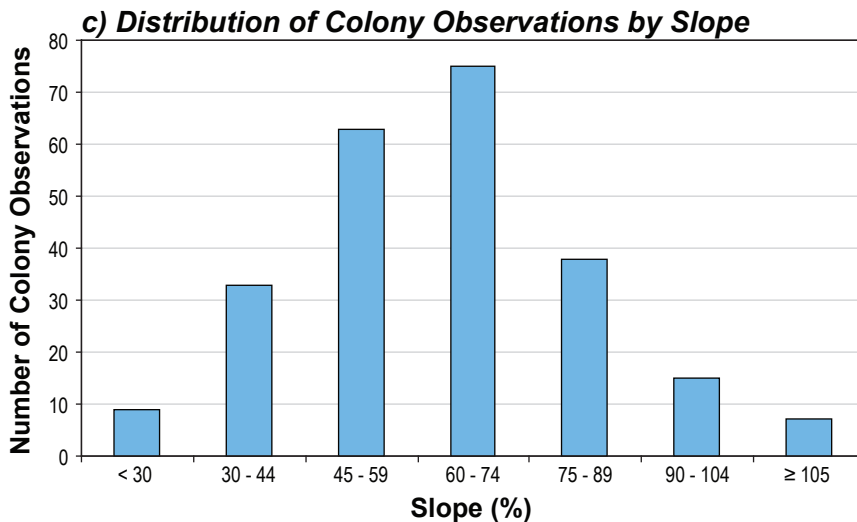
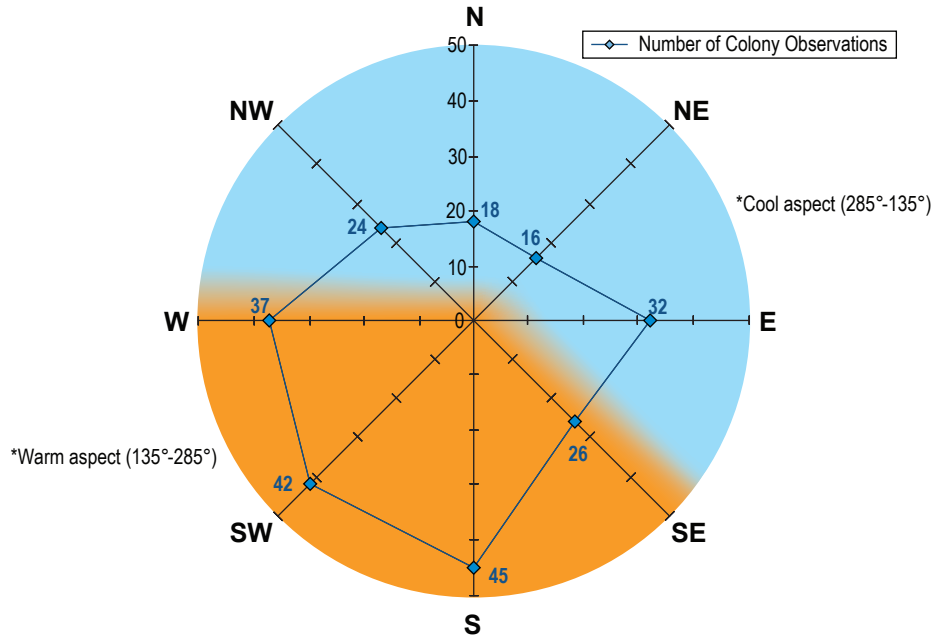
Colonies were present in 10 different general ecosystem types as identified by PEM, within which there were 18 different site series present (Figure 4.5-4; Appendices 4.5-1 and 4.5-2). The majority of colonies were within the sparsely vegetated general ecosystem type, and divided between two site series: barren (25% of colonies) and escape terrain (14%). The escape terrain site series is defined as steep slopes (greater than 70%) that are typically devoid of vegetation. Many colonies were also on the Mesic Shrub/Herb (18%) and Heather Heath Site Series (11%) within the Mesic Shrub/Herb and Mesic Herb General Ecosystem Types, respectively (Figure 4.5-4). Overall, PEM indicated that most colonies were present in areas that were very sparsely vegetated or dominated by short ground cover.

During the aerial survey in 2009, observers recorded several vegetation and soil characteristics around colony locations (Figure 4.5-5; Appendix 4.5-2). Areas around colonies were dominated by herbs (82%), followed by a mixed herbs and subalpine fir krummholz (13%), mixed herbs and willow spp. (3%), and mixed herbs and barren (non-vegetated) areas (2%). Colonies were most frequently found on mesic soils (74%) with underlying soil textures ranging from fine (sandy loam) to coarse (gravel/cobble). Across all soil moisture regimes, colonies were mainly associated with finer textured soils such as sandy loam and slightly coarser soils with gravel components.

When colonies were grouped into general vegetation classes, the majority were within the Heather Heath class (39%), followed by Mesic Herb (35%), Dry Herb (24%), and Moist Herb (2%) (Figure 4.5-5; Plate 4.5-3). Colonies observed from the air were also given a field rating of habitat suitability (WHR). Overall, colonies were rated as WHR 2 (51% of colonies) or WHR 3 (43%) (Appendix 4.5-2). Five colonies were assigned a rating of 1, representing the most suitable habitat according to provincial standards (RIC 1999a; Appendix 4.5-2).

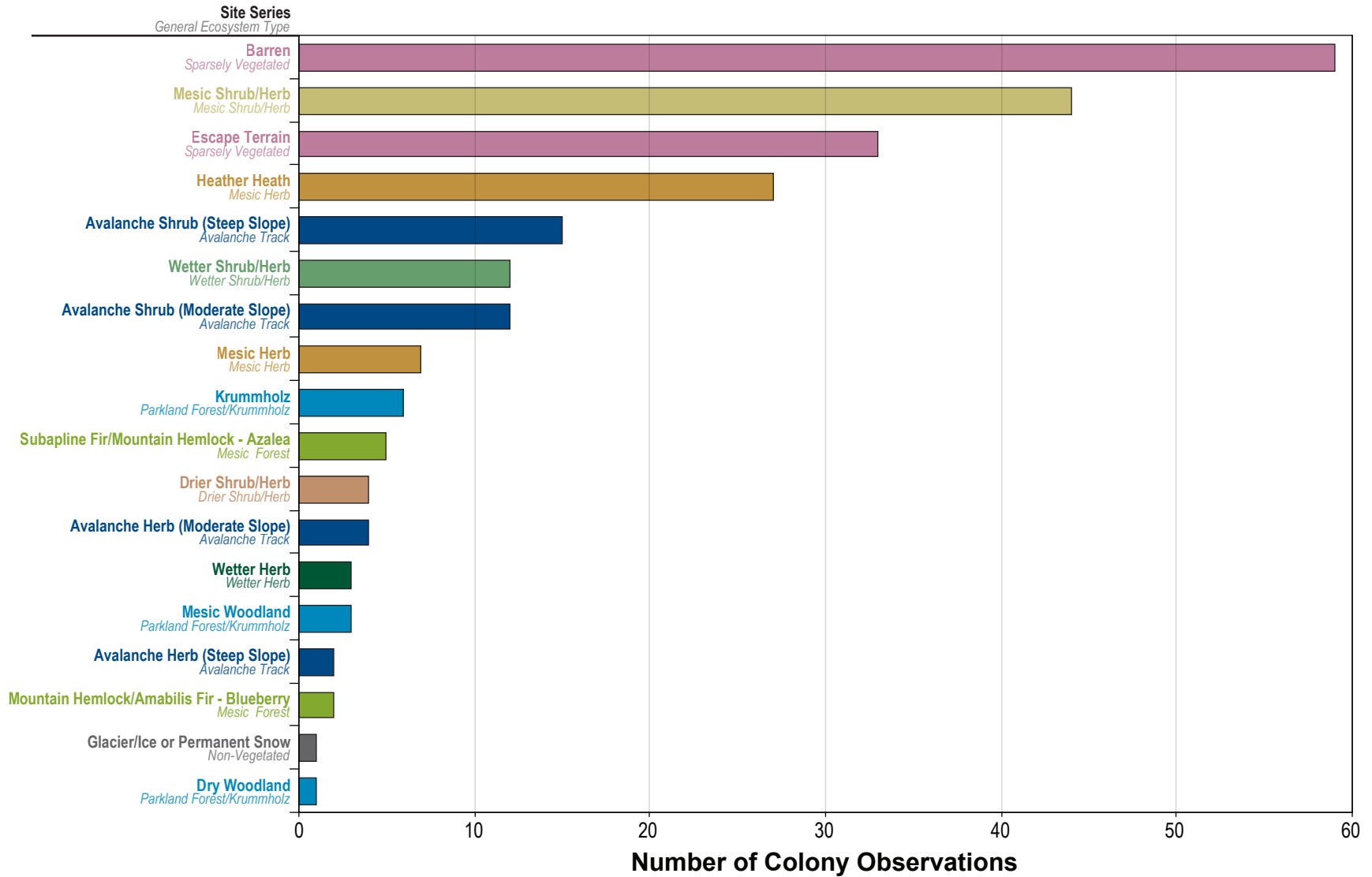


b) Distribution of Colony Observations by Aspect



Spatial Distribution of Colony Locations, 2008 and 2009

FIGURE 4.5-3

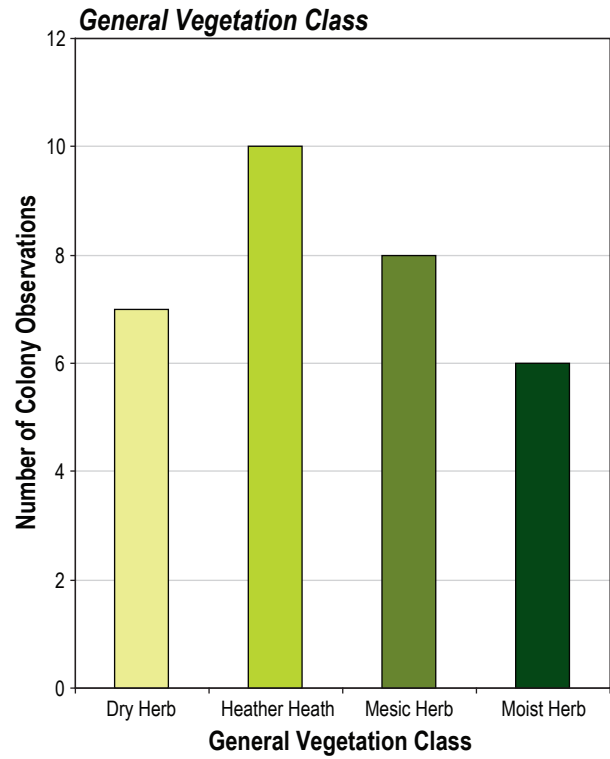
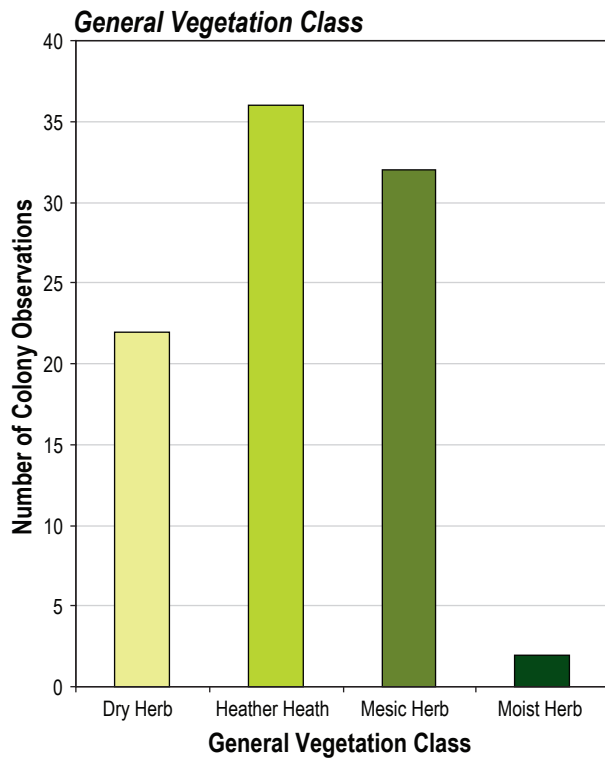
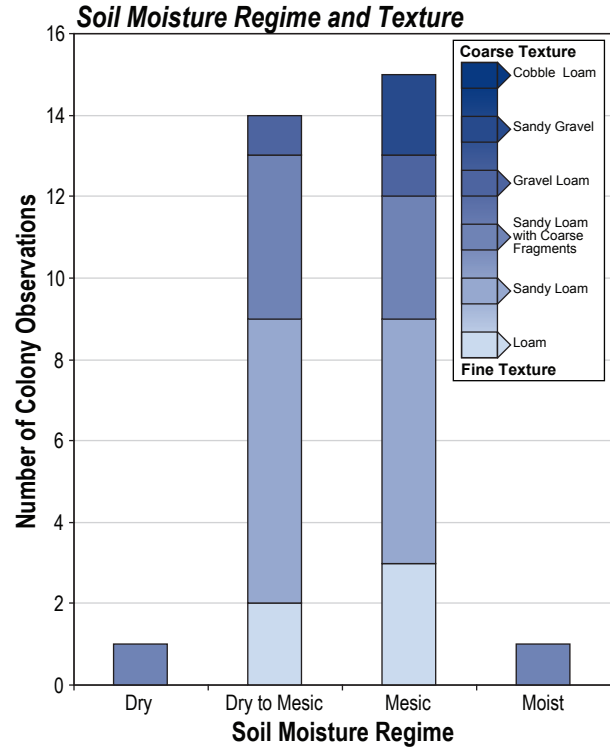
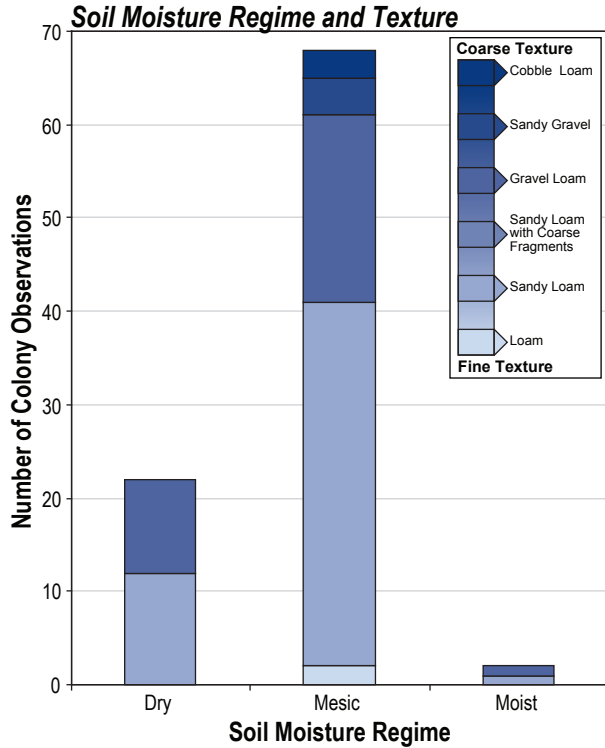


General Ecosystem Type and Site Series Identified at Colony Locations

FIGURE 4.5-4

Aerial Survey

Ground Survey



Soil Characteristics and General Vegetation Class Identified at Colony Locations during Aerial and Ground Surveys, 2009

FIGURE 4.5-5



(a) Heather Heath



(b) Mesic Herb



(c) Dry Herb (with well defined travel corridor/packed trail leading from burrow entrance)



(d) Moist Herb

Plate 4.5-3. Examples of general vegetation classes recorded during the aerial survey.

Ground investigations at 31 colonies supported the data collected from the air. Most colonies were associated with finer textured soils (e.g., sandy loam) with moisture regimes of mesic (54% of colonies) and dry to mesic (50%) (Figure 4.5-5; Appendix 4.5-3). Observers recorded similar soil texture between the aerial and ground survey; 63% of colonies were rated within the same soil texture between surveys and 30% were rated finer. Soil moisture was also similar, with 45% rated with the same moisture regime between surveys; however, observers found that mesic soils categorized from the air were often slightly drier on the ground (i.e., dry to mesic). Soil nutrients regime at colonies ranged from poor to rich, with the majority on rich (42%) and medium (29%) soils (Appendix 4.5-3). Water moved quickly through soils around colonies; 90% of colonies were classed as rapidly drained and the remaining 10% were classed as moderately well drained (Appendix 4.5-3).

Consistent with the results of the aerial survey, most colonies fell within the heather heath (36%) and mesic herb (24%) general vegetation classes, followed by dry herb (7%) and moist herb (6%) (Figure 4.5-5; Appendix 4.5-3; Plate 4.5-4). Between surveys, 50% of colonies were rated within the same vegetation class (Appendices 4.5-2 and 4.5-3). Observers recorded a variety of plant species surrounding colony locations, including Indian hellebore; common red paintbrush; sitka valerian (*Valeriana sitchensis*); partridgefoot (*Luetkea pectinata*); fireweed (*Epilobium augustifolium*); and

several species of moss, lichen, grass, and sedge (Appendix 4.5-3). On occasion, areas immediately around the burrows of hoary marmots appeared to be fertilized from the animals' waste, resulting in zones of denser vegetation surrounding dens (Plate 4.5-5). Boulder and/or talus were present at 28 of the 31 colonies and were most frequently within colonies as shown in Plate 4.5-2 (20 colonies; Appendix 4.5-3). At the 8 remaining colonies, these landforms were no more than 50 m away. Most of the colonies were rated as WHR 2 (19 colonies) and WHR 3 (eight colonies); four colonies were rated as WHR 1 (Appendix 4.5-3). Observers assigned the same WHR on 15 occasions; however, 11 colonies were given higher habitat ratings on the ground as opposed to the air (Appendices 4.5-2 and 4.5-3).



(a) Dry herb, mix of barren and vegetated (partridge foot, lichen, and grass spp.) areas



(b) Heather heath, dominated by heather spp. with some Arctic lupine and Indian hellebore.



(c) Mesic herb, supporting fireweed, Sitka valerian, partridge foot, Arctic lupine, and groundsel spp.



(d) Moist herb, mix of Indian Hellebore, Sitka valerian, partridge foot, and sedge and grass spp.

Plate 4.5-4. Examples of general vegetation classes recorded during the ground survey.



Plate 4.5-5. Example of fertilization surrounding burrow entrances.

4.5.5 Discussion

Hoary marmots are much more common in the study area than Arctic ground squirrels. Marmots were observed on a number of occasions during field studies in 2009, confirming their presence within the LSA and RSA. However, Arctic ground squirrel were not observed during the ground survey nor any evidence of their presence documented (e.g., tracks, scat). Several colonies observed from the air had burrow entrances that were smaller than those typically found in marmot colonies, suggesting that those colonies could have been occupied by ground squirrel. One ground squirrel colony was recorded during TEM field studies in 2009 (Rescan 2010d). This species appears to be more sparsely distributed in the study area than hoary marmot. This may be because of the location of the Project area, which occurs near the southern range limit for Arctic ground squirrel (Reid 2006).

Marmot colonies were distributed throughout the alpine in both eastern and western areas, with the highest densities observed in the eastern areas surrounding the proposed TMF (e.g., SU 19). Relatively low densities were recorded in the western area, where some units had no colonies (e.g., SU 23). The western area is characterized by steep and rugged coastal mountainous terrain as compared to the eastern area that has larger areas of alpine meadow and gentler mountain topography. The more expansive alpine in the east may provide marmots with a greater area of habitat that is appropriate for denning.

There are relatively few studies that have focused on specific habitat selection of hoary marmots within the province. Armitage (2000) documented that alpine dwelling marmots occupy habitats with the following characteristics: (1) elevation above or near timberline or lower elevation forest openings; (2) a southern or eastern exposure where snow melts early; (3) a steep or moderate slope with good drainage; (4) a soil structure that both permits burrowing and supports burrows, and (5) meadow or grassland for foraging. These characteristics are generally consistent with the habitat information collected during KSM Project field studies in 2008 and 2009.

Colonies were located across an elevational gradient ranging from treeline to the transition zone of shallow, nutrient poor soils and exposed bedrock in the higher alpine. Colonies were observed on all aspects but were more common on warmer aspects than cooler ones (Figure 4.5-3b). Hoary marmots hibernate for up to eight months and are generally active through the months of April to late August, depending on latitude (RIC 1998c). Selection of productive habitats is important for marmots to acquire sufficient food resources during the short growing season. Warm southern aspects become snow free earlier in the spring than northern slopes, causing vegetation phenology to progress quicker in these areas. Evidence that selection of warmer aspects has reproductive implications was documented in yellow-bellied marmots (*M. flaviventris*); female marmots had greater annual reproductive success in areas where snow melted earlier in the season (Van Vuren and Armitage 1991).

The slope associated with colony locations varied considerably across the areas studied in 2008 and 2009, ranging from very gentle (13%) to fairly steep (120%). These results are similar to those of Barash (1989) who found that hoary marmot colonies were commonly found on slopes between 15 to 50° (27 to 120%) and that marmots did not exhibit a specific preference for gentler or steeper slopes. Use of gentler topography has been noted elsewhere. Hoary marmots studied in south-central Alaska were found on relatively flat meadows above the timberline (Holmes 1984). Occupation of particular gradients across the landscape may be a function of selection for soil types that are conducive for burrowing (Merriam 1971).

Colonies identified in 2009 were associated with well-drained soils of loamy texture (i.e., equal mix of clay, sand, and silt), often with coarse fragments such as gravel or cobbles. Marmots in the RSA appear to be selecting suitable areas for burrowing. Soils with finer texture are more favourable for burrowing, and selection of well-drained soils for burrowing has been observed in a number of species, including yellow-bellied marmots (Svendsen 1976; Floyd 2004) and woodchucks (*M. monax*; Merriam 1971; Barash 1989; Armitage 2003). Large boulders or talus were also present at nearly all colonies sampled on the ground. Svendsen (1974, 1976) concluded that coarser fragments, such as boulders, provided some stability to yellow-bellied marmot burrows in Colorado. Boulders and coarse fragments at burrow entrances may also serve to as protection from grizzly bears.

Marmot colonies were generally on mesic soils, and ground investigations concluded that the majority had medium and rich nutrient regimes. These two soil characteristics, among others, influence the species of vegetation present within an area (BC MELP and BC MOF 1998). A number of plant species that were frequently recorded near colonies, such as lupine, Indian hellebore, and common red paintbrush, are species commonly consumed by hoary marmots (Appendix 4.5-3; Gray 1967 in Hansen 1975; Banfield 1981).

4.6 SMALL MAMMAL

4.6.1 Introduction

Small mammals are useful indicators of the concentration of metals in the environment and can be used to determine baseline concentrations (Hunter, Johnson, and Thompson 1987; Pascoe, Blanchet, and Linder 1994). Their small body size and high metabolic rate facilitate greater bio-accumulation relative to larger mammals and render them an ideal candidate for monitoring both natural and anthropogenic heavy metal accumulation in the environment (Pascoe, Blanchet, and Linder 1994). Furthermore, small mammals are a major item in the diet of predatory birds and some mammals (Cross 1988), and thus, species that feed on small mammals may be at risk of bio-magnification of any heavy metals that accumulate in their prey.

Several species of small mammals are known to occur in areas near to the proposed Project, including Keen's mouse (*Peromyscus keeni*; also known as northwestern deer mouse), meadow vole (*Microtus pennsylvanicus*), long-tailed vole (*Microtus longicaudus*), northern red-backed vole (*Myodes rutilus*), meadow jumping mouse (*Zapus hudsonius*), common shrew (*Sorex cinereus*), dusky shrew (*Sorex monticolus*), and American water shrew (*Sorex palustris*) (RTEC 2006d). Other species of lemming, vole, and mouse may also occur, but at lower densities in this region (RTEC 2006d).

4.6.2 Objectives

The purpose of small mammal trapping was to assess the metals content of species near proposed Project components, including the mining area and TMF, and in respective control areas away from proposed Project infrastructure, to establish a baseline for future monitoring purposes. Specifically, the objectives of small mammal baseline work were to:

- establish baseline information on the small mammal community in the area (which species are present);
- determine a common small mammal species in the LSA to be used as the focal species for metals analysis (conducted in 2008); and
- collect a sample of this focal species to determine the baseline levels of metals present in the environment before development (2009).

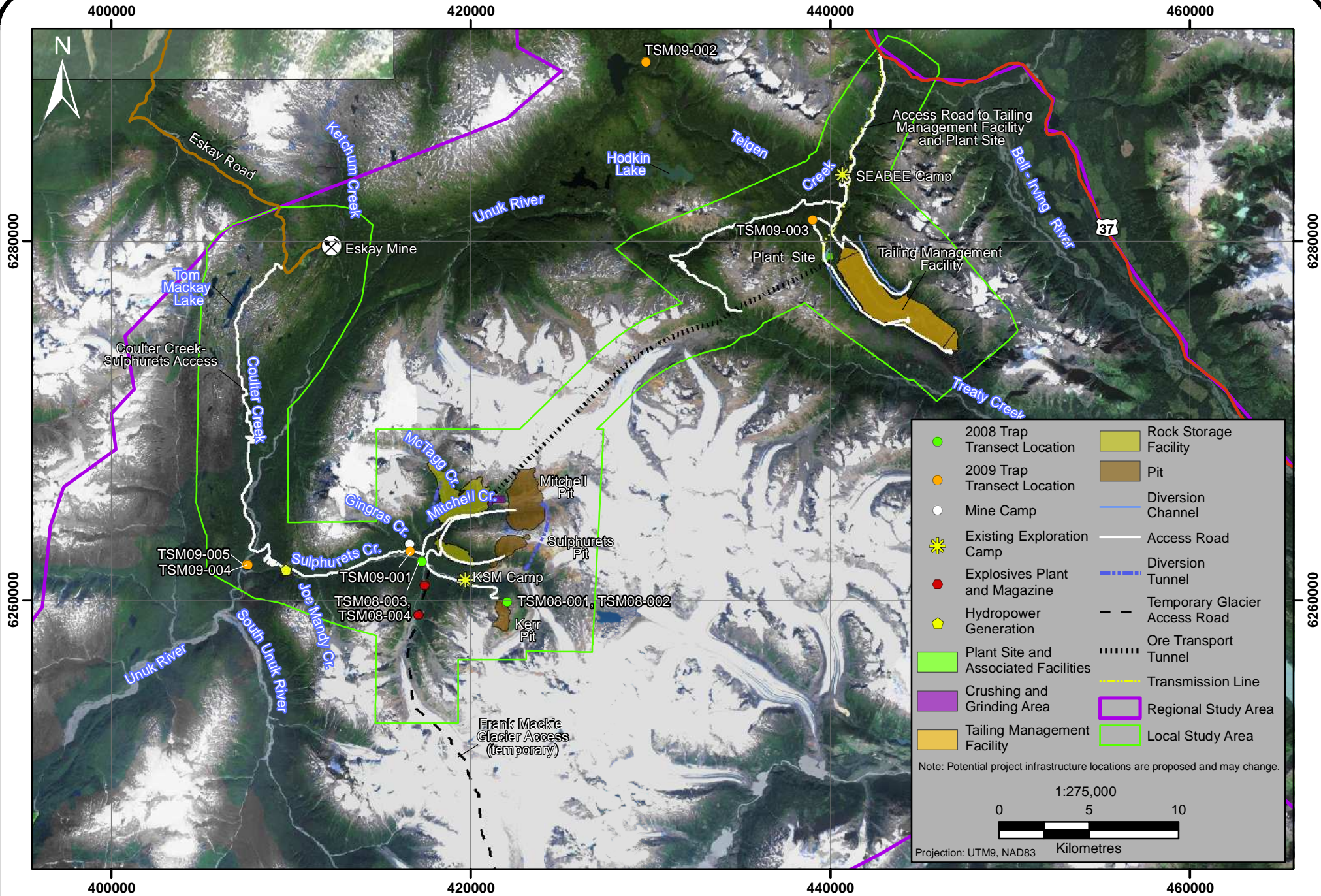
4.6.3 Methods

4.6.3.1 Small Mammal Trapping

Two small mammal trapping sessions were conducted. During 2008, trapping was conducted to identify common species in the area that would be appropriate for collection. During 2009, trapping and collection of small mammal samples was conducted. Small mammal trapping was conducted during late summer when small mammal populations are at their yearly maximum. Small mammal capture and handling procedure adhered to live capture guidelines described in the RISC standards (RIC 1998e) in accordance with Provincial *Wildlife Act* General Permits SM08-44679 and SM09-52968. Small mammal field euthanasia (2009 only) was performed following RISC standards (RIC 1998e) and acceptable measures outlined in *The Guidelines On: The Care and Use of Wildlife* (CACC 2003) and *AVMA Guidelines on Euthanasia* (AVMA 2007) under Permit SM09-52968.

During 2008, small mammal trapping was conducted by two field personnel from August 16 to 19 along four 150 m-long transects in the LSA (TSM08-001 through 004; Figure 4.6-1; Rescan 2009). The objective of trapping in 2008 was to characterize the small mammal community to identify a focal species for collection in 2009. Hence, transects were placed in areas where there was potential to capture a variety of small mammal species. Two transects were placed in a high elevation alpine meadow above the KSM Camp in the CMAunp BEC zone (Plate 4.6-1) (TSM08-001 and TSM08-002). Two transects (TSM08-003 and TSM08-004) were placed in a riparian corridor along Sulphurets Creek within the MHun BEC (Plate 4.6-1).

Each trap transect in 2008 consisted of 10 trapping stations placed 15 m apart from one another with one live trap per trapping station (Havahart® Two Door Mouse Trap) (Plate 4.6-1). Trapping was conducted over four trap-nights beginning on August 16. Traps were set in the evening with cotton bedding and bait (peanut butter and oatmeal) and checked in the early morning, and closed for the day.





(a) High elevation trapping location



(b) Low elevation trapping location

Plate 4.6-1. Examples of small mammal trapping locations in 2008: (a) alpine transect characterized by mountain-heather and krummoltz (Stunted Subalpine Fir), and (b) riparian transect characterized by alder, black cottonwood, and willow.

Captured small mammals were identified to species level, where possible, and standard morphometrics were measured, including: body length, tail length, ear length, right hind foot length, and weight. Animals were released in a timely manner to prevent stress and exhaustion. Small mammals were marked with a permanent marker on their right ear once captured, which was done to facilitate an estimate of the population size and to account for re-captures.

In 2009, small mammal trapping was conducted by three field personnel from August 14 and 18. The survey crew established five trapping transects near the mine site and TMF and at control sites at a greater distance (TSM09-001 to 005; Figure 4.6-1). The objective of small mammal trapping in 2009 was to collect a sample of a focal species (Keen's mouse) to derive a baseline estimate of metal concentrations in that species before potential development of the proposed Project. Transect locations were selected so that they would be in habitats favoured by Keen's mouse along proposed access road corridors (termed "treatment" transects) and in areas outside of the expected zone of influence from the development (termed "control" transects). Treatment transects were placed near proposed road corridors as these areas have the potential for fugitive dust accumulation as a result of the proposed development. Transect TSM09-001, the treatment transect for the proposed mining site, was in mixed riparian/coniferous forest habitat along Sulphurets Creek in the MHun BEC. Transects TSM09-004 and TSM09-005 were the controls for the proposed mining area (Figure 4.6-1). These two transects were in a mature coniferous forest adjacent to riparian habitat near the confluence of Sulphurets Creek and the Unuk River within the CWHwv BEC (Plate 4.6-2). Transect TSM09-003 was the treatment transect for the TMF, while TSM09-002 was the control for the TMF (Figure 4.6-1), both in the ESSFwv BEC within open mature coniferous forests (Plate 4.6-c).

Each trap transect in 2009 was 285 m long with 19 trapping stations spaced at 15 m. Two Havahart® live traps were placed at each trapping station, for a total of 38 traps per transect. Trapping occurred over four nights starting on August 14, following the same methodology as in 2008. Non-focal species that were captured were identified to species level, measured for standard body size morphometrics, and released in a timely manner. Keen's mouse were field euthanized using the cervical dislocation method outlined in AMVA (2007). Effort was placed on equal numbers of mice from control transects and treatment transects. Euthanized Keen's mouse were labelled, double bagged, and stored frozen.

This sample size was selected to ensure specimens were submitted to ALS Laboratory in Burnaby for metals analysis (Section 4.6.3.3).



(a) riparian/coniferous forest area, TSM09-001



(b) conifer forest adjacent to riparian area, TSM09-004



(c) upland conifer forest, TSM09-002.

Plate 4.6-2. Examples of small mammal trapping locations in 2009.

Tail length was used to differentiate between Keen's mouse and sympatric deer mouse (*Peromyscus maniculatus*; also known as North American deer mouse) following the methods of Nagorsen (2002). Keen's mouse typically have a longer tail (>98mm in length) than deer mouse, but there is some overlap between species (D. W. Nagorsen 2002). Fur colour is a less reliable indicator of species; Keen's mouse is known to have more variable colouring than the deer mouse (D. W. Nagorsen 2002). For this inventory, tail length was used and all individuals identified to the *Peromyscus* genus that had a tail near 98 cm in length were determined to be Keen' mouse, and were collected for metals analysis. An analysis of the frequency of distributions in adult tail length was conducted *post-hoc* to confirm that the species collected were Keen's mouse. It was important to collect only one species for metals analysis, because different species can uptake and sequester metals differently, which would introduce additional variation into the results.

Incidental observations of small mammals were recorded and geo-referenced during other wildlife field inventories in 2008 and 2009. Incidental small mammal observations were also documented by field staff in other disciplines.

4.6.3.2 Data Analysis

Catch per unit effort (CPUE), a measure of the relative abundance of species along a transect, was calculated. CPUE was calculated by dividing the total number of individuals within a species caught along a transect by the number of trap nights (traps X set nights). The number of species and individuals captured on transects in 2008 and 2009 were also totalled as an index of species diversity and abundance within BEC zones and general habitat types.

Standard morphometrics, specifically tail length, were compared between adult individuals identified to the *Peromyscus* genus to assess whether both species, Keen's mouse and deer mouse, occur in the study area. Immature *Peromyscus* can only be identified to species through genetic analysis (D. W. Nagorsen 2002) and were excluded from this analysis.

4.6.3.3 Metal Concentrations in Keen's Mouse

Whole body Keen's mouse were submitted to ALS Laboratory in Burnaby for metals analysis on August 12 and were stored frozen until tissue preparation. The target tissue for sampling metals was the liver, which has been used in other studies (Wren 1986; Levenson, Heske, and Caldwell 2003; USFWS 2005). Liver tissue preparation involved extracting the liver from partially frozen mice followed by mechanical homogenization, extraction of 0.3 g of tissue, which was block digested under heat and nitric acid, followed by repeated additions of hydrogen peroxide. Several digestions were repeated for quality control purposes, using the remainder of tissue samples (~0.2-0.5 grams).

Metals analysis was carried out using procedures adapted from *Recommended Guidelines for Measuring Metals in Puget Sound Marine Water, Sediment, and Tissue Samples* (PSEP 1995). Instrumental analysis for metals was by inductively coupled plasma-mass spectrometry (EPA Method 6020A). Instrumental analysis for mercury was by atomic fluorescence spectrophotometry (EPA Method 245.7). Metal concentrations with values below the detection limit were replaced with half the value of the detection limit for calculations.

4.6.4 Results

4.6.4.1 Species Identified and Relative Abundance

Six species were caught during 2008 and 2009 (Table 4.6-1; Plate 4.6-3; Appendix 4.6-1). The majority of animals caught in 2008 were identified as Keen's mouse (Table 4.6-1). As such, Keen's mouse was selected as the focal species for baseline metals analysis in 2009 (Section 4.6.4.2). Transect CPUE for Keen's mouse in 2008 was used to direct sampling effort in 2009 and the transect with the highest CPUE in 2008 (TSM08-004) was resurveyed in 2009 (TSM09-001 was within a kilometre of TSM08-004) (Appendix 4.6-2). Similar results were recorded between years, where TSM09-001 also had the highest CPUE of Keen's mouse (Appendix 4.6-2). While Keen's mouse was the most frequently caught species in 2009, northern red-backed voles were also frequently caught and had relatively high CPUE, particularly on TSM09-001 (Table 4.6-1; Appendix 4.6-2). The rest of the species trapped in either 2008 or 2009 were trapped in very low numbers and had low CPUE (Table 4.6-1; Appendix 4.6-2). One other species, Nearctic brown lemming, was detected incidentally in an alpine area near the Kerr Pit in 2009 (Plate 4.6-4). None of the species identified were of conservation concern in BC (BC CDC 2010).

Table 4.6-1. Species Observed During 2008 and 2009

Common Name	Scientific Name	Number Caught		Range in Transect CPUE ¹	
		2008	2009	2008	2009
Keen's mouse	<i>Peromyscus keeni</i>	12	48	0 - 0.33	0 - 0.23
Northern red-backed vole	<i>Myodes rutilus</i>	0	33	-	0.05 - 0.12
Meadow vole	<i>Microtus pennsylvanicus</i>	3	0	0 - 0.07	-
Meadow jumping mouse	<i>Zapus hudsonius</i>	0	5	-	0 - 0.01
Common/Cinereus shrew	<i>Sorex cinereus</i>	0	2	-	0 - 0.02
Dusky shrew	<i>Sorex monticolus</i>	0	3	-	0 - 0.06
Nearctic brown lemming ²	<i>Lemmus trimucronatus</i>	0	1	-	-

¹ Number of individuals caught per Trap Night along one transect.

² Caught incidentally.



(a) Keen's mouse: TSM08-001



(b) Meadow vole: TSM08-003



(c) Keen's mouse: TSM09-004



(d) Common shrew: TSM09-002

Plate 4.6-3. Photos of species caught in 2008 and 2009.



Plate 4.6-4. Nearctic brown lemming detected incidentally on August 31, 2009.

Species diversity and abundance was analyzed by BEC zone and general habitat type (Section 4.6.3.2). Transects were within four BEC zones, MHun, CWHwv, ESSFwv, and CMAunp (Table 4.6-2). Transect locations could be generalized by three habitat types: mixed riparian/coniferous forest (TSM08-003, TSM08-004, TSM09-001, TSM09-004, TSM09-005), open mature coniferous forest (TSM09-002, TSM09-003), and high elevation alpine meadow (TSM08-001, TSM08-002) (Appendix 4.6-1). Transects with the highest number of species and abundance were in the MHun and CWHwv BEC Zones. Specifically, TSM09-001 and TSM09-004 had the highest species diversity and abundance (Figure 4.6-1). The lowest species diversity and abundance was observed in the CMAunp BEC, specifically along TSM08-001 and TSM08-002 (Figure 4.6-1; Table 4.6-2). Some small mammal species were concentrated within certain ecosystems. Meadow jumping mouse was only found within the CWH BEC in lower elevation coniferous forests composed of western red cedar and western hemlock adjacent to riparian areas (i.e., mixed riparian/coniferous forest habitat type). Meadow voles were the only species found in alpine areas in the CMAunp BEC during the trapping sessions. Shrew species were found in either mixed riparian/coniferous forests (MHun) or mature forested habitats (ESSFwv) while other species, such as the northern red-backed vole, were found in almost every BEC zone and habitat type that was sampled (Table 4.6-2).

Table 4.6-2. Number of Species and Individuals Caught on Transects, 2008 and 2009

Transect	BEC Zone	Species Caught						Total
		Dusky Shrew	Common Shrew	Keen’s Mouse	Meadow Jumping Mouse	Meadow Vole	Northern Red-backed Vole	
<i>2008</i>								
TSM08-001	CMAunp					1		1
TSM08-002	CMAunp							0
TSM08-003	MHun			2		2		4
TSM08-004	MHun			10				10

(continued)

Table 4.6-2. Number of Species and Individuals Caught on Transects, 2008 and 2009 (completed)

Transect	BEC Zone	Species Caught					Total	
		Dusky Shrew	Common Shrew	Keen's Mouse	Meadow Jumping Mouse	Meadow Vole		Northern Red-backed Vole
<i>2009</i>								
TSM09-001	MHun	1	1	25			13	40
TSM09-002	ESSFwv		1				4	5
TSM09-003	ESSFwv	2					7	9
TSM09-004	CWHwv			17	1		6	24
TSM09-005	CWHwv			6	4		3	13

4.6.4.2 Distribution of *Peromyscus* Species in the RSA

A total of 24 adult mice identified to the *Peromyscus* genus were caught in 2009 and were included for analysis of tail length. The 12 individuals caught in 2008 could not be used in this analysis because adults and juveniles were not differentiated from one another. The distribution in adult tail lengths exhibited a single mode distribution, with a peak between 98 to 102 mm (Figure 4.6-2) and an average tail length was 99.8 ± 1.5 mm (\pm SE). This distribution indicates that only Keen's mouse was caught during trapping in 2009. A bimodal distribution of tail lengths is expected where both Keen's and deer mice occur, while a single mode suggests that a single species occurs in the area.

4.6.4.3 Baseline Metal Concentrations in Keen's Mouse

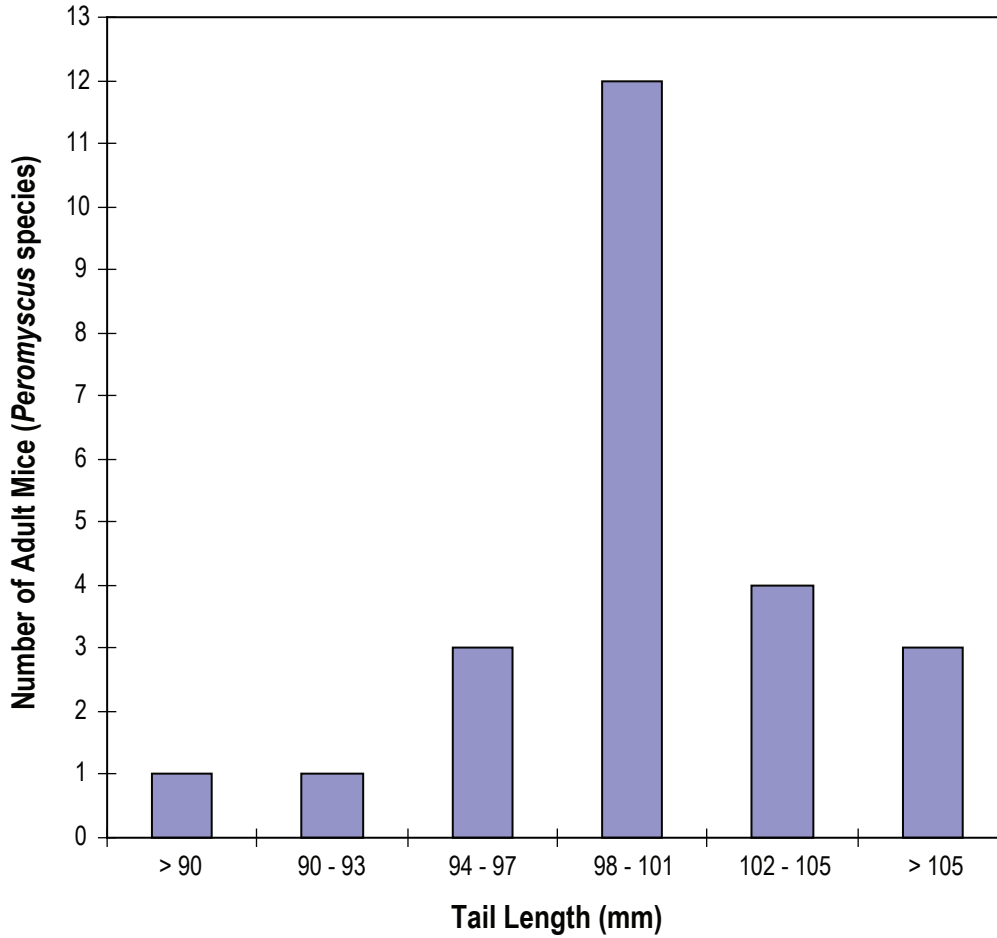
A total of 28 Keen's mouse were collected for metals analysis: 14 from treatment transect TSM09-001 and 14 from control transects TSM09-004 (10 individuals) and TSM09-005 (4 individuals) (Appendix 4.6-3). Twenty-one were adults, 17 were male and 4 females (Appendix 4.6-4). The remaining seven specimens were juveniles, all of which were male.

The results of the analysis, conducted for 25 different metals, are summarized in Table 4.6-3. The raw results of the laboratory analysis are presented in Appendix 4.6-4. A number of metals; including aluminum, antimony, beryllium, bismuth, lithium, nickel, thallium, tin, uranium, and vanadium, were below detection limits in control and/or treatment groups (Table 4.6-3). Other metals, such as arsenic, chromium, lead, and mercury had a large portion of samples falling below detection limits in either group. 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 (Table 4.6-3).

4.6.5 Discussion

Over the two year baseline study, seven small mammal species were identified in the study area, none of which are of conservation concern in BC (BC CDC 2010c). Overall, species diversity is similar to nearby areas, where eight species were positively identified (RTEC 2006d). Productive habitats for small mammals were found, especially within low elevation riparian areas and adjacent coniferous forests in the western part of the study area (i.e., TSM09-001, TSM09-004). These transects had the highest numbers caught and greatest species richness, including species such as meadow jumping mice that were not found elsewhere in the study area.

There are currently no provincial or federal environmental guidelines for acceptable metal levels in wildlife. The metals analysis conducted in 2009 serve as a baseline estimate of metals present in Keen's mouse prior to potential development of the propose Project, and can be used as a reference point should future sampling be undertaken for monitoring purposes.



Frequency of Distributions in Adult Tail Length for Individuals Identified to the *Peromyscus* Genus

FIGURE 4.6-2

Table 4.6-3. Baseline Metals Concentrations in Liver Tissue Samples from Keen's Mouse

Metals	Control Group				Treatment Group			
	N (Total)	N (BDL) ¹	Mean	± SE	N (Total)	N (BDL) ¹	Mean	± SE
Aluminum (Al)	14	14	1.143	0.097	14	13	1.264	0.147
Antimony (Sb)	14	14	0.006	0.0005	14	14	0.006	0.0005
Arsenic (As)	14	11	0.012	0.006	14	12	0.009	0.002
Barium (Ba)	14	0	0.066	0.009	14	0	0.047	0.010
Beryllium (Be)	14	14	0.057	0.005	14	14	0.057	0.005
Bismuth (Bi)	14	14	0.017	0.001	14	14	0.017	0.001
Cadmium (Cd)	14	0	0.347	0.083	14	0	0.311	0.097
Calcium (Ca)	14	0	81.33	3.908	14	0	74.48	5.106
Chromium (Cr)	14	11	0.084	0.016	14	12	0.066	0.007
Cobalt (Co)	14	1	0.052	0.007	14	0	0.041	0.004
Copper (Cu)	14	0	4.691	0.259	14	0	5.079	0.231
Lead (Pb)	14	11	0.014	0.002	14	11	0.017	0.003
Lithium (Li)	14	14	0.057	0.005	14	14	0.057	0.005
Magnesium (Mg)	14	0	231.4	4.937	14	0	230.1	4.631
Manganese (Mn)	14	0	1.932	0.082	14	0	2.066	0.087
Mercury (Hg)	14	11	0.001	0.001	14	8	0.004	0.001
Molybdenum (Mo)	14	0	1.316	0.063	14	0	1.295	0.065
Nickel (Ni)	14	14	0.057	0.005	14	14	0.057	0.005
Selenium (Se)	14	0	1.914	0.125	14	0	1.621	0.110
Strontium (Sr)	14	0	0.065	0.007	14	0	0.052	0.005
Thallium (Tl)	14	13	0.006	0.001	14	14	0.006	0.0005
Tin (Sn)	14	14	0.029	0.002	14	13	0.035	0.007
Uranium (U)	14	14	0.001	0.0001	14	14	0.001	0.0001
Vanadium (V)	14	14	0.057	0.005	14	14	0.057	0.005
Zinc (Zn)	14	0	39.18	3.468	14	0	39.54	2.525

¹ Below Detection Limit. Indicates the number of samples where the metal concentration was below the detection limit.

4.7 BATS

4.7.1 Introduction

Bats are considered a main predator of night-flying insects, and are important in areas where the abundance of insect pest species is high (Whitaker 1996). In addition, there are many bat species of conservation concern in BC, many with indeterminate distributions. Research suggests that bats exploit areas previously thought to be unsuitable, such as northern latitudes and cooler mid to high elevation habitats (Lauson 2006; RTEC 2006d, 2008a).

Based on the distribution of bat species in BC provided in Nagorson and Brigham (1995), two species of provincial and federal conservation concern could occur in the area associated with the KSM Project: northern long-eared myotis (*Myotis septentrionalis*) and Keen's long-eared myotis (*M. keenii*). The northern long-eared myotis is blue-listed in British Columbia and Keen's long-eared myotis is provincially red-listed (BC CDC 2010c) and federally listed as special concern under SARA, Schedule 3

(2002b). In addition, the silver-haired bat (*Lasionycteris noctivagans*) has been identified by BC MOE as regionally important in the Skeena Region because of concerns with maintaining maternal roosts in tree cavities (S. Freeman, pers. comm.). Determining the presence of these bat species in the proposed development area is required to meet the obligations of provincial regulations under the BC *Wildlife Act* (1996a) for species protection.

4.7.2 Objectives

An inventory directed at identifying the presence or absence of bats within the study area was undertaken in 2009. The principal objective of this bat baseline study was to determine if, and to what extent, bats (with consideration for species of conservation concern) exist in the LSA. The objectives of the inventory were to determine the presence, diversity, and distribution of bats and attempt to characterize species or groups present in the area surrounding the proposed Project.

4.7.3 Methods

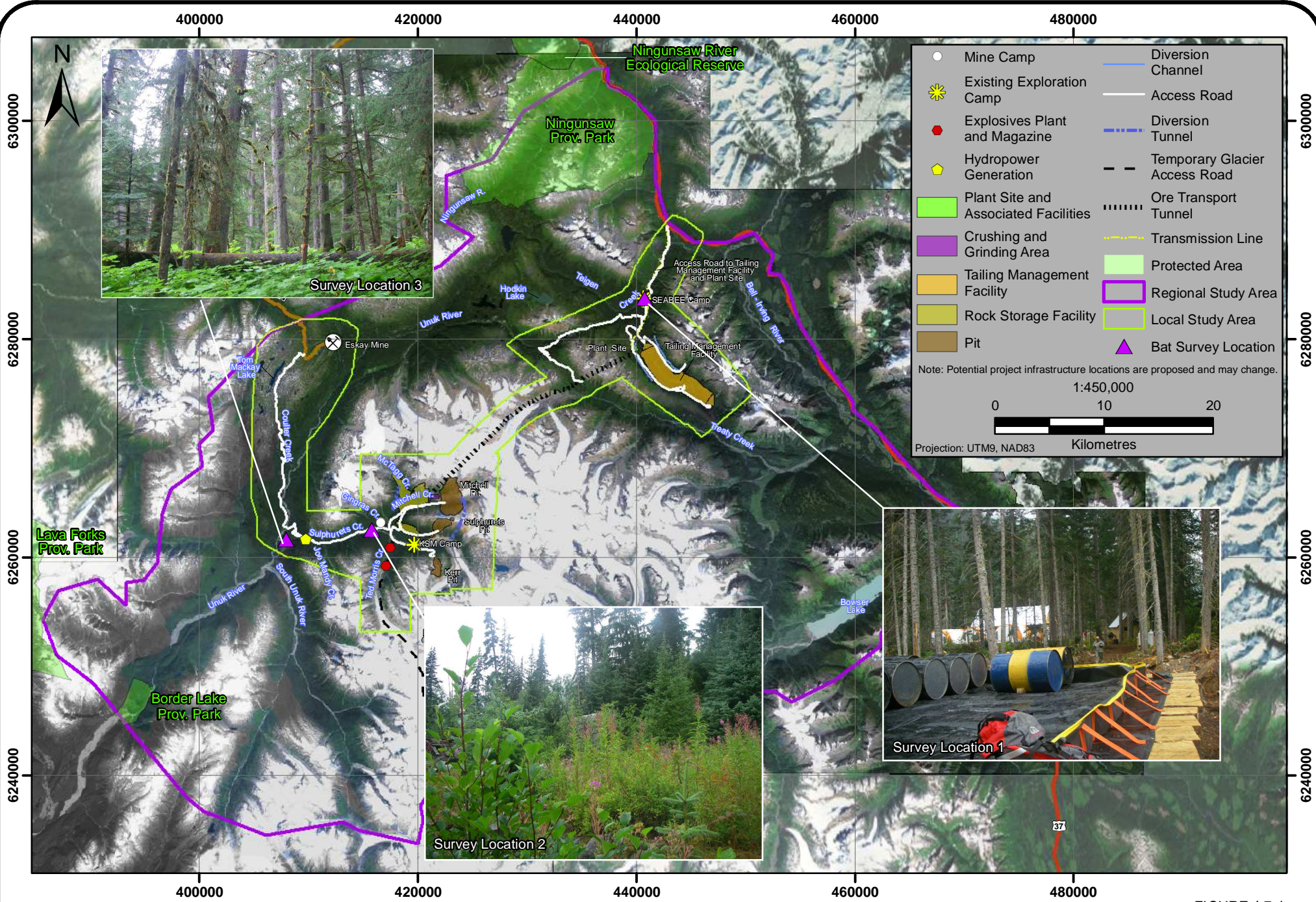
4.7.3.1 Evaluation of Species Presence

A list of potentially occurring bat species was compiled before field surveys based on range maps and species habitat requirements (D.W. Nagorsen and Brigham 1995; BC CDC 2010c). Bats use a combination of habitat types during the year, primarily old growth conifer forests with snags for roosting and riparian areas for foraging (D.W. Nagorsen and Brigham 1995; Ormsbee 1996; Sasse and Pekins 1996; Grindal, Morissette, and Brigham 1999; Vonhof and Wilkinson 1999). The likelihood that species occur within the study area was placed into two categories: likely and possible. Species that were considered likely to occur have overlapping seasonal ranges with the RSA, suitable habitat is available within the RSA, and they have been detected in nearby areas. Species in the possibly occurring category may or may not have overlapping seasonal ranges but their seasonal habitat requirements are met within the RSA. The call characteristics that were available for likely and possibly occurring species were compiled to assist in species identification during sonogram analysis.

4.7.3.2 Echolocation Call Survey, 2009

Echolocation call surveys were conducted at three survey locations within the LSA on August 14 to 16, 2009 (Figure 4.7-1). Survey locations were selected based on their potential as foraging habitat, including the presence of open areas or wetlands, which attract flying insects. All survey sites were also located next to mature or intermediate forest that may provide snags suitable for day roosts or night roosts during cooler weather.

Inventory methods adhered to RISC standards (1998b) and used a broad band bat detector, (specifically an Anabat II detector), which records the frequencies of bat vocalizations and allows species identification using sonograms. An external zero-crossings analysis interface module or ZCAIM was used to transfer data (sequence files) to a computer for analysis. Surveys were timed between dusk and dawn, when species are most active (RIC 1998b). Location, weather conditions, and time of operation were recorded at each survey site. On August 14, two observers were present at the survey site to ensure the Anabat II detector was operating correctly. Observers also recorded and analyzed individual vocalizations from the Anabat II detector and flight patterns of individuals (if observed). On the following two nights of survey, the Anabat II detector was set remotely at dusk and was recovered the following morning.



4.7.3.3 Sonogram Analysis

Sonograms of bat echolocation calls were produced from downloaded Anabat sequence files using AnaLookW v. 3.3q. While foraging, bats emit calls with different frequency (kHz) and duration (ms), which are separated by researchers into three phases: search, approach, and terminal (Simmons, Fenton, and O'Farrell 1979; Fenton and Bell 1981). Search phase calls tend to be spaced apart from one another, as the animal actively searches the vicinity for prey. During the approach and terminal phases, calls are emitted progressively closer to one another, as the bat identifies and targets the prey item (Simmons, Fenton, and O'Farrell 1979; Fenton and Bell 1981).

To differentiate between species and genus, the characteristics of the recorded calls (frequency and duration) were compared with available published accounts and voucher sonograms for several species (Fenton and Bell 1981; RIC 1998b; Madison et al. 2003; McCaffrey, Rodhouse, and Garrett 2003). Search and approach phase calls are most diagnostic for species identification. In particular, the lowest or "fundamental" frequency of search and approach phase calls has been used to distinguish between species (Fenton and Bell 1981; O'Farrell, Miller, and Gannon 1999). For example, silver-haired bat search phase calls have exhibited a fundamental frequency of around 25 kHz in several studies (Madison et al. 2003; McCaffrey, Rodhouse, and Garrett 2003). However, reliable differentiation between species in the genus *Myotis* is challenging (RIC 1998b). A number of *Myotis* spp. are classified as "40 kHz *Myotis*," because various species in this genus have overlapping characteristics of echolocation calls. These species share a search phase call that descends to a fundamental frequency of 40 kHz over a duration of 1 to 2 ms (e.g., Plate 4.7-1) (Madison et al. 2003; McCaffrey, Rodhouse, and Garrett 2003; Lauson 2006; RTEC 2006d, 2008a).

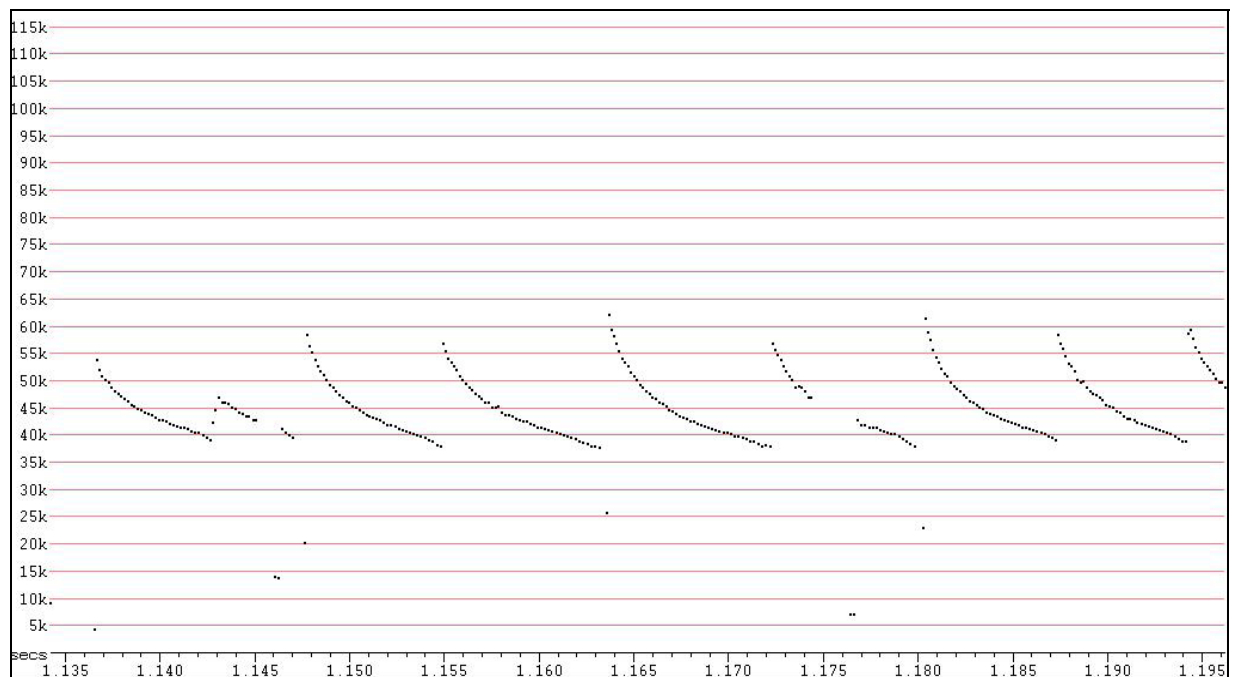


Plate 4.7-1. Sonogram of a search phase call of a "40 kHz *Myotis*" foraging, frequency (kHz) is recorded on the y-axis, duration along the x-axis (sec) (RTEC 2006d).

In situations where the call could belong to more than one species, the list of potentially occurring species was also used to refine the selection, i.e., species that were categorized as likely to occur were given greater consideration over those that were categorized as possibly occurring.

4.7.4 Results

4.7.4.1 Evaluation of Species Presence

Based on information from various sources (Section 4.7.3.1), nine species of bat were identified as species that potentially occur within the RSA, two of which were categorized as likely to occur and seven as possibly occurring (Table 4.7-1). This list provided the basis for directing analysis of sonograms for species identification.

Table 4.7-1. Bat Species Potentially Occurring within the RSA

Common Name	Scientific Name	Likelihood of Occurrence ¹	Call Characteristics ²		
			High Freq. (kHz)	Low Freq. (kHz)	Max. Duration (ms)
California myotis	<i>Myotis californicus</i>	Possible	67-80	37-40	2-6
Western long-eared myotis	<i>M. evotis</i>	Likely	>97	54-40	1-3
Keen's long-eared myotis	<i>M. keenii</i>	Possible	~78	38-40	5
Northern long-eared myotis	<i>M. septentrionalis</i>	Possible	110-80	38-40	1-3
Little brown myotis	<i>M. lucifugus</i>	Likely	>60	38-40	2-5
Long-legged myotis	<i>M. volans</i>	Possible	89	35-40	5-10
Yuma myotis	<i>M. yumanensis</i>	Possible	>60	40-46	3-5
Silver-haired bat	<i>Lasiorycteris noctivagans</i>	Possible	37-30	25-26	3-6
Big brown bat	<i>Eptesicus fuscus</i>	Possible	33	28	10

¹ Nagorsen and Brigham (1995), RTEC (2006d, 2008a), Rescan (unpublished data)

² Fenton and Bell (1981), RIC (1998b), O'Farrell, Miller, and Gannon (1999), Rescan (unpublished data)

4.7.4.2 Echolocation Call Survey, 2009

Surveys were conducted over a period of three nights in mid-August, 2009: one survey location was surveyed per night. On August 16, 2009, observers recorded 55 detections from the Anabat II detector at Survey Location 1, within the eastern area of the LSA near the Seabee Camp (Figure 4.7-1; Appendix 4.7-1). Observers classified these bats as belonging to the *Myotis* genus, based on preliminary analysis of call pattern (Appendix 4.7-2). The following two nights of survey were conducted remotely at Survey Locations 2 and 3. Survey Location 2 was at the confluence of Mitchell and Sulphurets creeks and Survey Location 3 was at the confluence of Sulphurets Creek and the Unuk River (Figure 4.7-1; Appendix 4.7-1). All three sites were in low elevation riparian areas; full habitat descriptions at survey locations are provided in Appendix 4.7-1.

4.7.4.3 Sonogram Analysis and Species Detected

A total of 45 full sonograms were developed from Anabat sequence files: 40 files from Survey Location 1 and 5 files from Survey Location 3 (Figure 4.7-1; Appendix 4.7-1). Several sequence files were incomplete, i.e., did not contain sufficient information for identification of species.

The majority of echolocation calls that were recorded at Survey Location 1 had a high frequency of less than 90 kHz and a fundamental (low) frequency of about 40 kHz: call duration was on average less than 2 ms. These call characteristics are within the range exhibited by most species in the genus *Myotis* (Fenton and Bell 1981; RIC 1998b; Madison et al. 2003; McCaffrey, Rodhouse, and Garrett 2003). On a few occasions, sonograms with high frequencies of up to 100 kHz with a fundamental frequency between 35 and 40 kHz were recorded (Plate 4.7-2a). This particular individual was suspected to be a western long-eared myotis, as this species is known to have a high frequency of 100 kHz or more (RIC

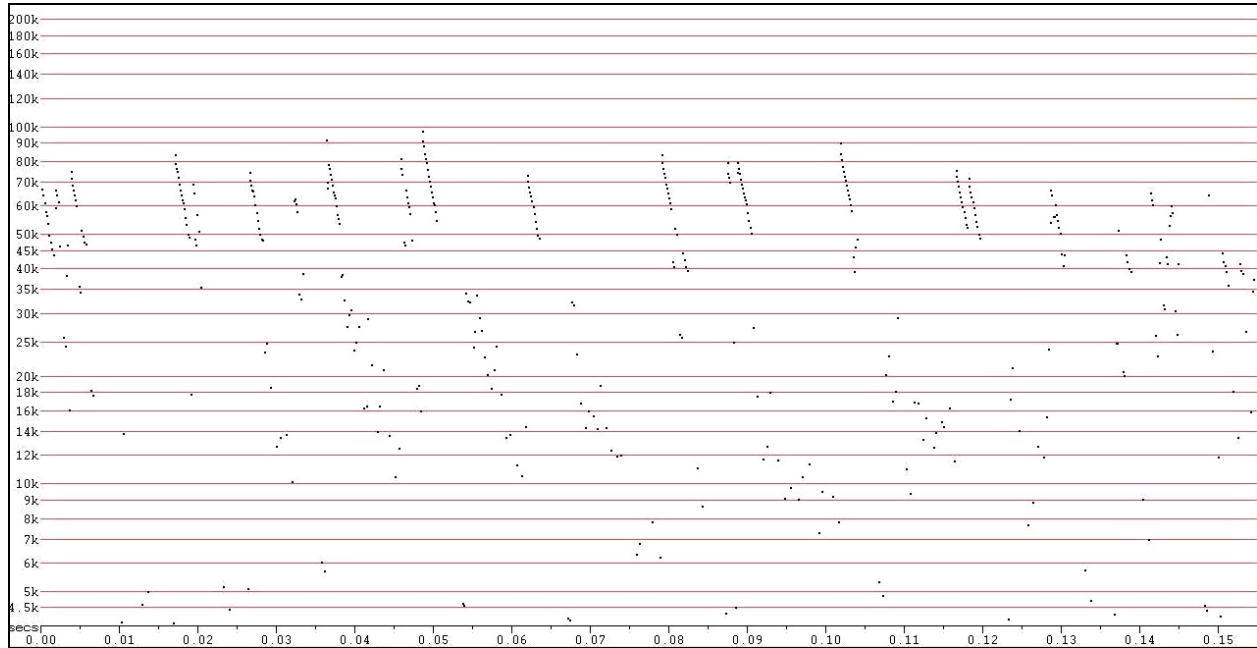
1998b). This species was detected in watersheds 130 kilometres to the north in 2005 (RTEC 2006d). A sonogram was obtained from a partial sequence file recorded at Survey Location 1 that had characteristics of a silver-haired bat, namely a longer call duration (5 ms) with a lower overall frequency range of the entire call (~35 kHz; Plate 4.7-2b). However, as the sequence file was incomplete, this identification could not be confirmed. The frequency range and call duration of many of the calls overlap with little brown myotis (Plate 4.7-2c), a species previously documented in the region (RTEC 2006d, 2008a).

All of the developed sonograms obtained from Survey Location 3 exhibited characteristics of bats in the *Myotis* genus, and potentially long-legged myotis as the fundamental frequency descended to around 35-40 kHz. Species identification was complicated as sequence files were not entirely clear, potentially due to interference factors such as trees.

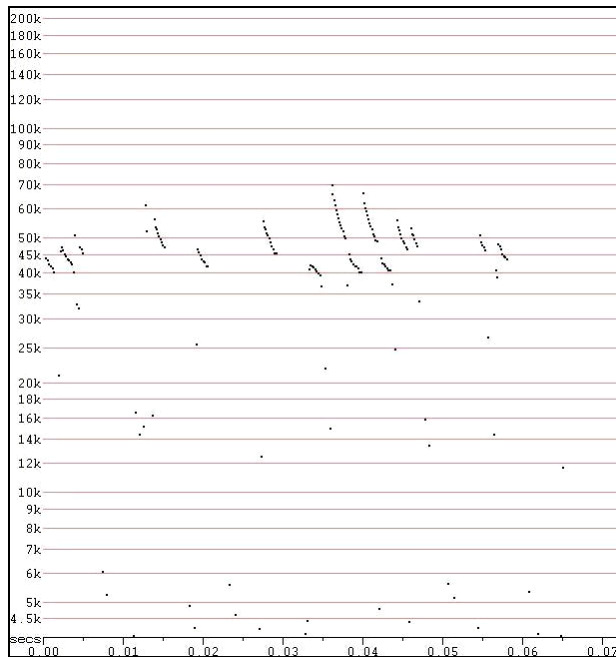
4.7.5 Discussion

Bats exist within the LSA, including at least two species of 40 kHz myotis: little brown myotis and western long-eared myotis. Both of these species have been identified through capture and/or echolocation call surveys along watersheds 130 km to the north (RTEC 2006d, 2008a). Two other species, long-legged myotis and silver haired bat, could also be present in the LSA; however, sonograms could not provide definitive species identification. None of these species are of conservation concern in BC (BC CDC 2010c).

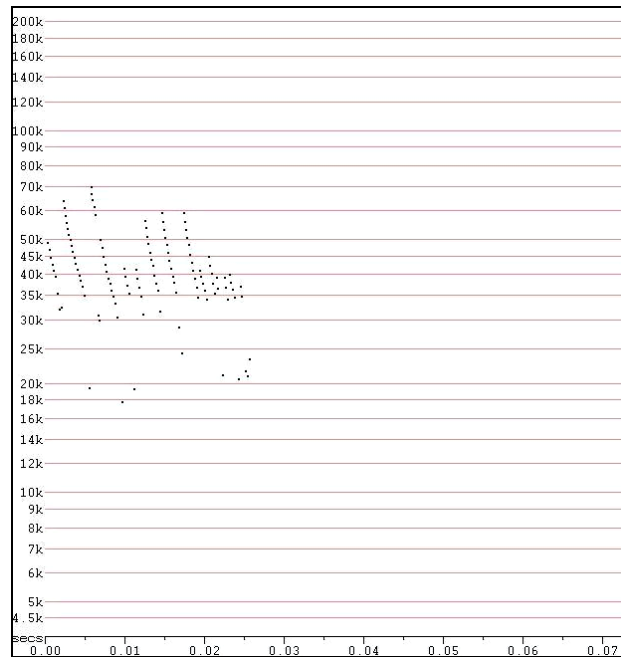
In general, large diameter trees and snags where cavities and areas underneath rugged bark provide roosting areas are important for a number of bat species. Areas that provide a combination of roosting and open foraging spots (i.e., abundant insect prey) may also be important bat habitat. Riparian areas are an example of edge habitat that provides elements both for foraging and roosting. Similar habitat preferences were observed during the bat inventory; a large amount of bat activity was observed in riparian areas in 2009.



(a) Potential western long-eared myotis (*M. evotis*).



(b) Potential silver-haired bat (*Lasionycteris noctivagans*)



(c) Potential little brown myotis (*M. lucifugus*).

Plate 4.7-2. Examples of Sonograms attained from Anabat Sequence Files at Survey Location 1. Frequency (kHz) is recorded on the y-axis, duration along the x-axis (sec).

5. Avian Community

5.1 OVERVIEW

The following sections summarize avian studies conducted in 2008 and 2009 for the proposed Project. Surveys focused on terrestrial and riparian dwelling raptors, terrestrial breeding birds, and water dependent birds (e.g., waterfowl, shorebirds), and were designed to collect baseline information on species presence and abundance, reproductive timing, diversity and avian community structure, and community habitat associations within the wildlife study areas (LSA and RSA; Figure 1.5-1). Avian monitoring is important throughout the planning, implementation, and development phases of a project, as identification of avian species is a necessary step in meeting the obligations of federal and provincial regulations for species protection. Avian species that migrate between countries receive protection under the federal *Migratory Birds Convention Act* (1994b). Bird species, especially raptors, are also afforded protection under the provincial *Wildlife Act* (1996a), while species at risk are protected under the federal *Species at Risk Act* (2002b).

5.2 TERRESTRIAL AND RIPARIAN RAPTORS

5.2.1 Introduction

Raptors (i.e., falcons, hawks, eagles, and owls) are considered appropriate indicator species of ecosystem health because they are top-level predators, have large home range sizes, and utilize a variety of habitats throughout the year, which renders them more sensitive to environmental alterations and disturbances. Additionally, all active raptor nests (and some inactive raptor nests) are protected under the BC *Wildlife Act*, with particular emphasis on bald eagle, osprey, peregrine falcon, and gyrfalcon nest sites. Raptors are also highlighted by the Cassiar Iskut-Stikine LRMP and regulating agencies (BC ILMB 2000) as a group requiring consideration in the region. Within the Cassiar Iskut-Stikine LRMP General Management Direction, provisions are outlined to maintain nesting and foraging habitat for nest sites of raptors, particularly rare or at risk species including northern goshawk, short-eared owl, gyrfalcon, and peregrine falcon (BC ILMB 2000).

The northern goshawk is a forest raptor that is presently yellow-listed in British Columbia. Yellow-listed species are secure and not considered at risk of extinction. Northern goshawk generally warrant special attention by wildlife and resource managers because of the loss of nesting/post fledging areas and alteration of habitat as a result of clear-cut timber harvesting. Northern goshawk nest areas are typically characterized by a relatively homogeneous stand of mature to old growth coniferous forest with high canopy closure (Doyle and Mahon 2001). Nest areas are the centre of all breeding activity from courtship through fledging. This, coupled with re-occupation of a nest area from year to year, makes northern goshawk a good focal species for baseline inventory.

5.2.2 Objectives

Surveys were conducted in 2008 and 2009 to assess the presence and distribution of raptor species in the study area, with focus on the LSA. Specifically, the objectives were to:

- conduct call-playback surveys for northern goshawks;
- characterize raptor biodiversity and identify nests of cliff and tree nesting raptor species that may be directly affected by the development; and
- identify species of conservation concern in the area, such that appropriate conservation steps may be taken to meet statutory requirements of relevant wildlife legislation and guidelines.

5.2.3 Methods

5.2.3.1 Call Playback Survey

During the breeding season, many birds use species-specific calls and songs to establish and defend territories, attract mates, and communicate with young. Using pre-recorded calls or call playbacks to simulate the presence of an “intruder” in an already-claimed territory elicits a defensive response in the target species. The response of the bird, whether it is a close approach, accompanied by an aggressive behaviour, or a distant vocalization, allows the observer to record the presence of the species. Call playbacks are used for inconspicuous, scarce, or nocturnal species known to respond to calls during the breeding season (e.g., northern goshawk).

Call playback surveys (CPS) were conducted by two separate field crews in 2008; each field crew consisted of two observers. Surveys were conducted in conjunction with variable radius point counts (VRPC) for terrestrial breeding birds (Section 5.3). From June 12 to 18, 2008, 28 CPS were completed within the study area (Figure 5.2-1). Many species of songbirds will mob² a perceived predator, and other species of raptors may behave aggressively to other raptorial species within their breeding territories. Broadcasting northern goshawk calls at prescribed distances could therefore alter normal terrestrial breeding bird activity. For this reason, one CPS was conducted at the end of each VRPC transect. In cases where two observers were walking in opposite directions along a transect, one CPS was conducted at each end of the transect.

In 2009, surveys were conducted by one field crew consisting of two observers. From June 22 to 29, 2009, 32 CPS were completed in study area with specific focus on areas of potential Project disturbance (Figure 5.2-1). Northern goshawk surveys were conducted independently of VRPC surveys in 2009, using a minimum inter-station distance (distance between consecutive CPS broadcasts) of 200 m to a maximum of no more than 400 m based on standardized RISC methods (2001). Survey effort was directed toward mature forests wherever possible, as these areas are more likely to support adequate nesting habitat for goshawks (Squires and Reynolds 1997).

Field teams used a modified Animal Observation Form-Raptor Call Playback (B) during CPS surveys (RIC 1998a). The CPS methodology adhered to RISC standards for call broadcast and equipment (RIC 2001). Broadcast equipment used included a megaphone (RadioShack®) linked to a digital voice recorder via a mono cable and a digital game caller (FOXPRO Inc. NX3). Each piece of equipment was tested and had a broadcast range of at least 200 m (a power output of greater than 1.2 W at 1 kHz and a known volume output of 100 to 110 dB at 1 m from the broadcast equipment (RIC 2001)). When batteries were fully charged, the equipment was loud enough to elicit responses from goshawks in the desired vicinity of the playback.

Recordings of adult alarm calls were used for surveys (RIC 2001). An audio track was engineered that had three rounds of 20-second calls broadcast followed by 30 seconds of silence (total 2.5 minutes per audio track). During surveys, one observer would play the goshawk broadcast while the other observer would listen for a response during the interval of silence between each broadcast. As each round of calls was played, the direction of the speaker was rotated such that the entire range around the focal playback location was included (120° after each call). Additionally, observers waited five and a half minutes after the broadcast period had concluded to record any potential response before moving on (for a total of eight minutes per CPS).

² “Mobbing” responses are when smaller bird species congregate in groups at the location of perceived predator. If the threat is real, such as a potentially dangerous predator, these groups of birds will mob (i.e., attack) the predator to drive it away.

If a response from a northern goshawk was elicited, field crews recorded the time, species, sex, age, and type of response (visual/aural). As well, the crews estimated the initial distance and compass bearing to the bird from the CPS station, and direction of departure (if a bird was observed), as these provide clues to the proximity and direction of a nest. Field crews also recorded any responses to a broadcast including those from other hawks and mimics (e.g., jays).

5.2.3.2 *Stand Watch Survey*

In 2008 and 2009, stand watch surveys were conducted to document the presence of tree and cliff nesting raptors specifically within and around the LSA. A total of 14 stand watch surveys were completed: 10 in 2008 and 4 in 2009 (Figure 5.2-1). Stand watches were conducted concurrently with terrestrial breeding bird surveys in both years: stand watches were performed in the afternoon after terrestrial breeding bird surveys had concluded. Survey sites were selected based on their potential to support suitable nesting habitat. Site selection was restricted by safe helicopter access and limited vantage points. Clear vantage points are necessary so that available habitat (e.g., tree-tops, cliffs) can be monitored for activity. Once sites with suitable habitat were located and deemed accessible, surveyors approached by helicopter and landed at a suitable location such that they could position themselves with binoculars and high-powered spotting scopes at vantage points. All sites were geo-referenced with a handheld Garmin GPS 60 (advertised accuracy 3 to 15 m). For cliff-nesting raptors, surveyors scanned cliffs for white-wash and/or the presence of *Xanthoria* spp., an orange lichen that is often abundant near nest or roost sites where bird droppings accumulate. For tree nesting raptors, treetops were monitored for perching activity and dense spots in the canopy, which could indicate a nest. Habitats were scanned from 30 minutes to 1 hour, depending on visibility (influenced by weather conditions) and observed bird activity. If no bird activity was detected in an area within 30 minutes, the stand watch was curtailed shortly thereafter.

5.2.3.3 *Incidental Observations*

Observations of raptors or raptor nests were noted and geo-referenced (wherever possible) when they were detected incidentally during other wildlife field inventories. Incidental raptor observations were also documented by field staff in other disciplines.

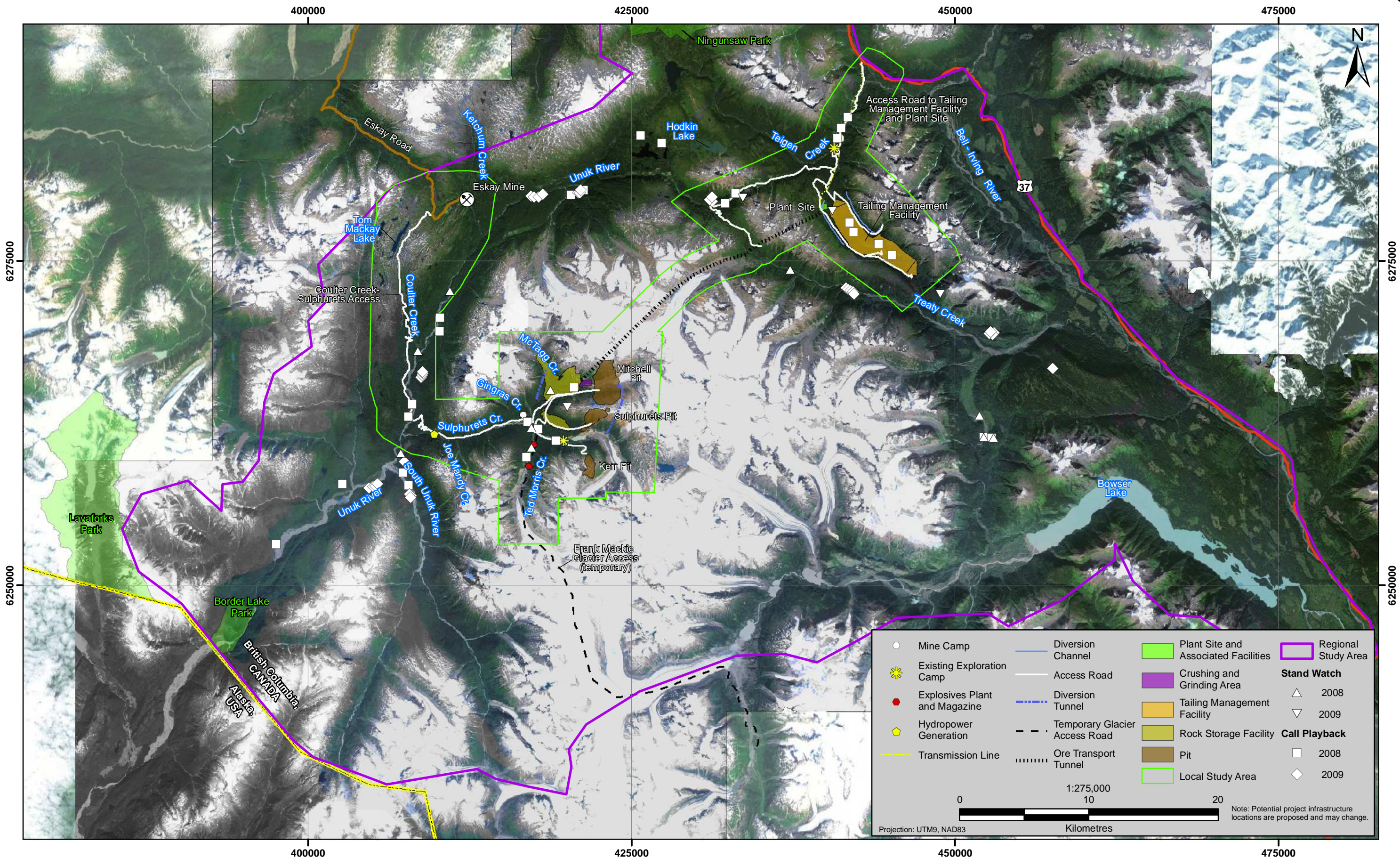
5.2.4 **Results**

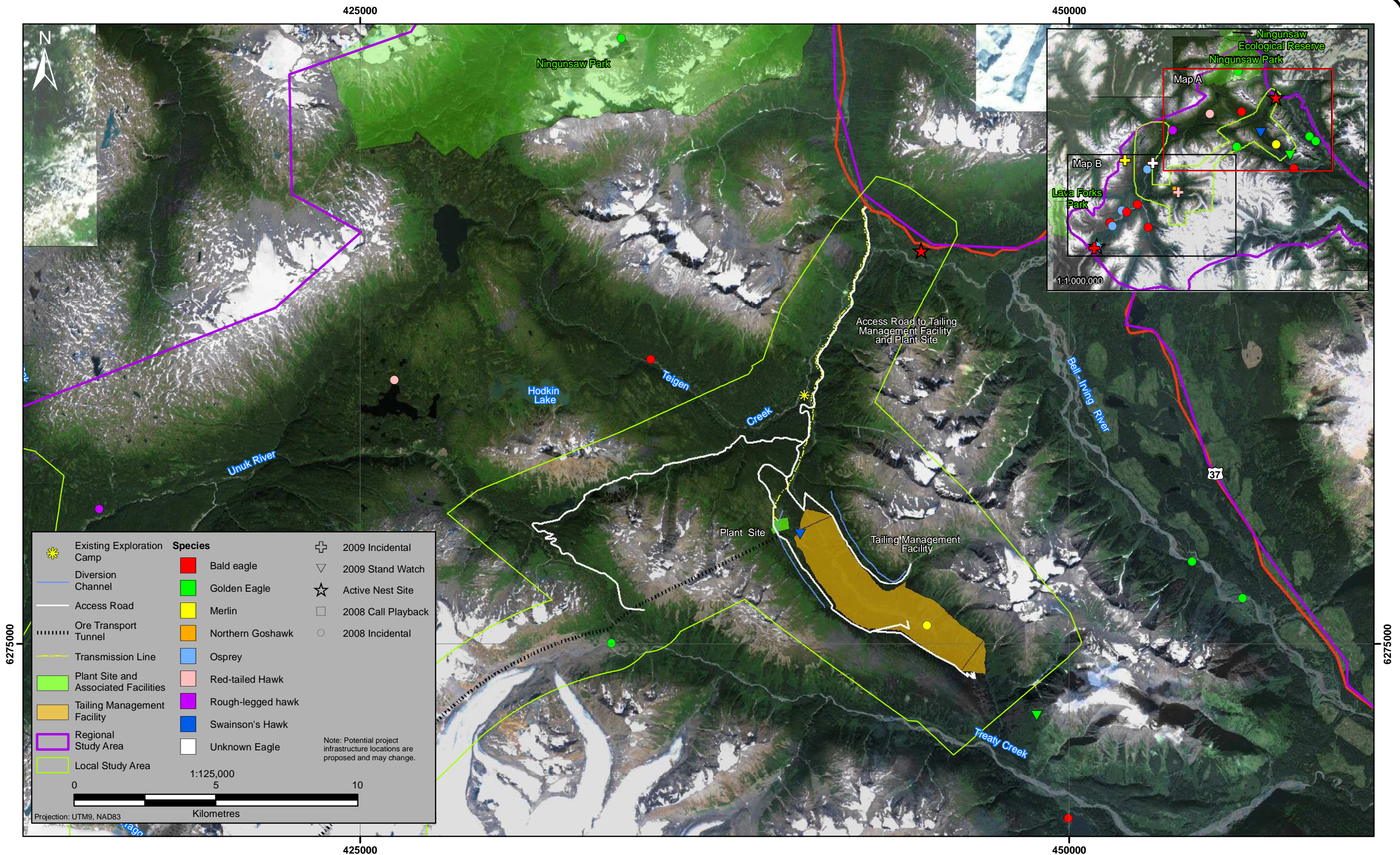
5.2.4.1 *Summary*

Eight species of raptors were detected in the study area in 2008 and 2009, the majority of which were recorded incidentally (Figures 5.2-2a and 5.2-2b; Table 5.2-1). The most commonly seen species were bald eagles, ospreys, and golden eagles.

5.2.4.2 *Call Playback Survey*

In 2008, one northern goshawk was identified along Sulphurets Creek (Figure 5.2-2b; Appendix 5.2-1). The goshawk flew in from the northwest immediately after the last broadcast and perched at the top of a tree directly above the CPS station. This bird called consistently for two minutes before flying off in a northwesterly direction. The dominant tree species in the area where the goshawk was detected were mountain hemlock (*Tsuga mertensiana*) and sitka spruce (*Picea sitchensis*); the area also supported a relatively open understorey with minor components of coarse woody debris (Plate 5.2-1). No northern goshawks were detected during CPS in 2009. In both years, several instances of northern goshawk call mimicry were recorded; gray jays (*Perisoreus canadensis*) most frequently mimicked the broadcasted goshawk call.





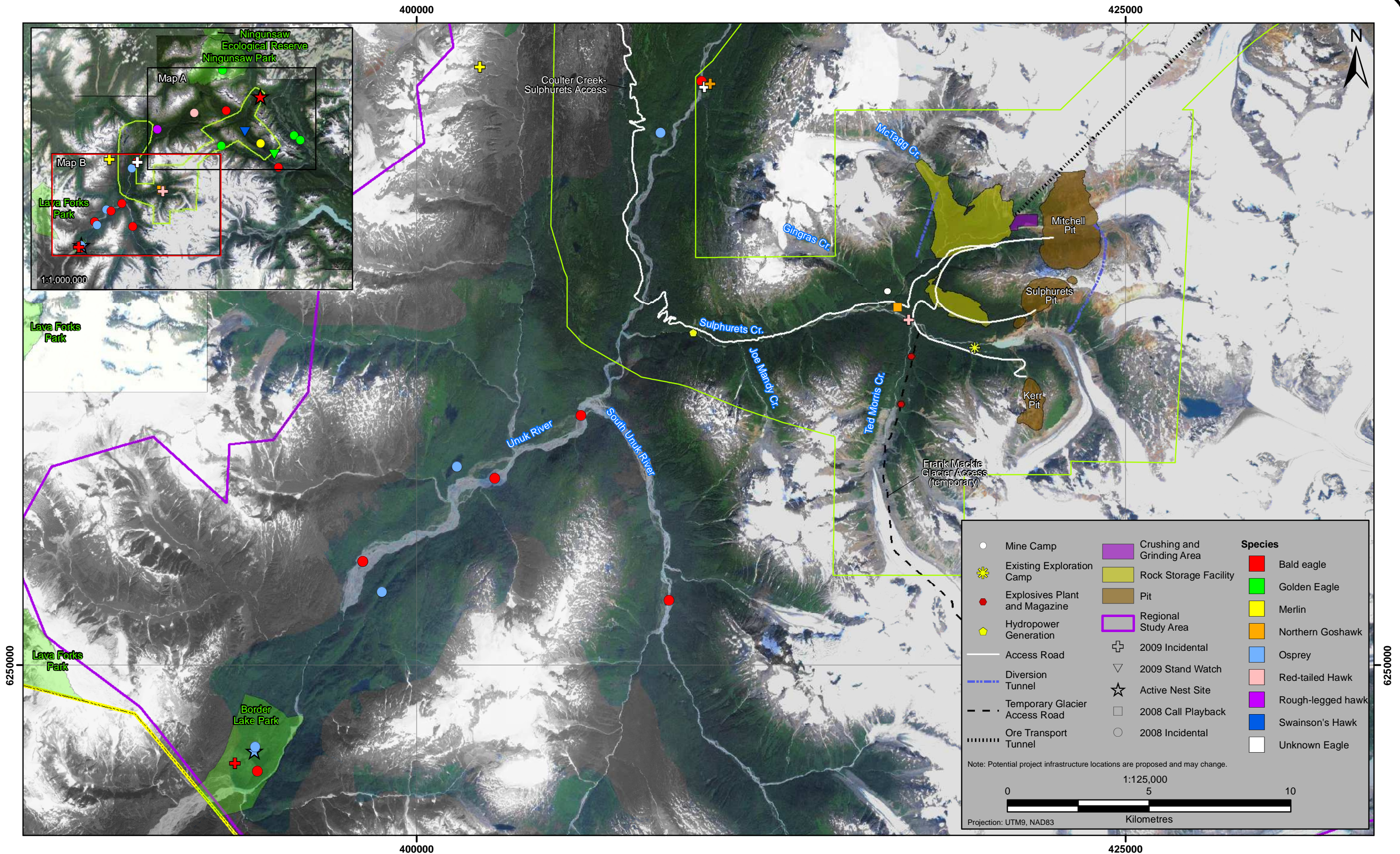


Table 5.2-1. Raptors Species Observed in the Study Area during 2008 and 2009

Species	Scientific Name	No. Raptors Observed during Surveys		No. Raptors Observed Incidentally		Total
		2008	2009	2008	2009	
Bald eagle	<i>Haliaeetus leucocephalus</i>	-	-	9	2	11
Golden eagle	<i>Aquila chrysaetos</i>	-	1	4	-	5
Merlin	<i>Falco columbarius</i>	-	-	1	-	1
Northern goshawk	<i>Accipiter gentilis</i>	1	-	-	1	2
Osprey	<i>Pandion haliaetus</i>	-	-	7	-	7
Red-tailed hawk	<i>Buteo jamaicensis</i>	-	-	1	1	2
Rough-legged hawk	<i>Buteo lagopus</i>	-	-	1	-	1
Swainson's hawk	<i>Buteo swainsoni</i>	-	1	-	-	1

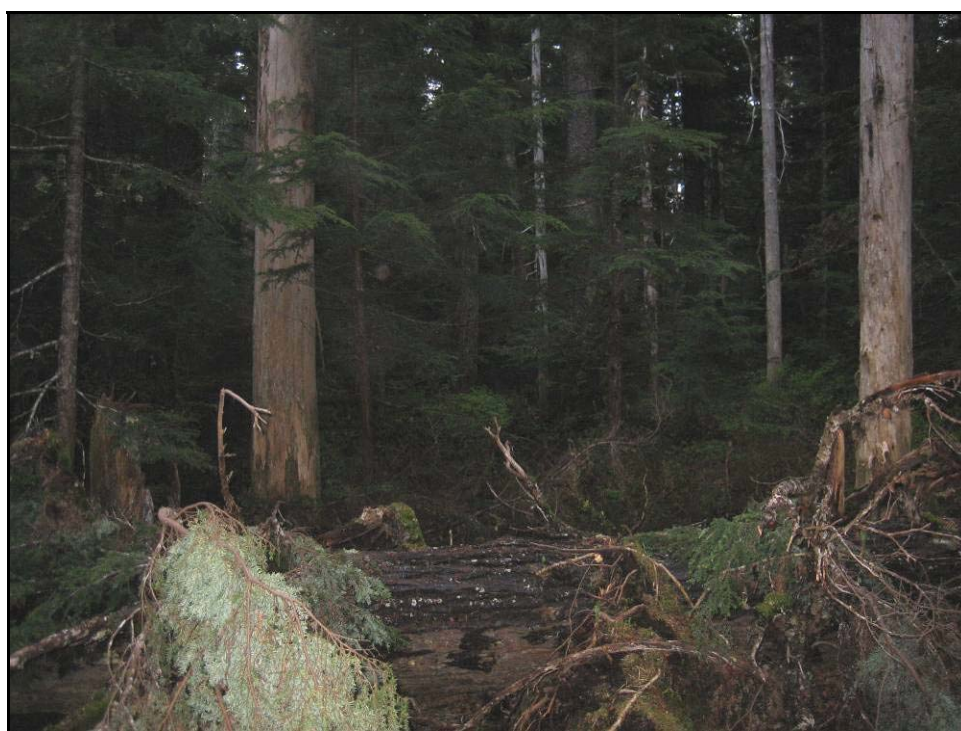


Plate 5.2-1. Example of habitat where the northern goshawk was detected in 2008.

5.2.4.3 Stand Watch Survey

No raptor activity was recorded at any of the 10 stand watch stations in 2008 (Appendix 5.2-2). In 2009, two raptor species were observed (Appendix 5.2-2). A Swainson's hawk (*Buteo swainsoni*) was observed above the north end of the proposed TMF location within the eastern LSA (Figure 5.2-2a). This individual flew in and perched on a snag approximately 50 m from the observers for two minutes, after which it flew off in a predatory manner. A golden eagle (*Aquila chrysaetos*) adult was seen soaring on air thermals above Treaty Creek just south of the proposed TMF location (Figure 5.2-2a). Both stand watches were above mixed intermediate successional forests dominated by subalpine fir (*Abies lasiocarpa*) and Engelmann spruce (*Picea engelmannii*) (Plate 5.2-2).



(a) Standwatch at north end of Tailing Management Facility (Swainson's hawk)



(b) Standwatch above Treaty Creek (golden eagle)

Plate 5.2-2. Stand watch locations with raptor detections in 2009.

5.2.4.4 Incidental Raptor Observations

Seven species of raptors were observed incidentally during various wildlife surveys in the RSA in 2008 and 2009 (Figures 5.2-2a and 5.2-2b; Appendix 5.2-3). Bald eagles were the most frequently observed, with nine sightings in 2008 and two in 2009 (Table 5.2-1). Osprey and golden eagle were also frequently detected, with seven and four observations in 2008, respectively. One northern goshawk was incidentally observed along the Unuk River during terrestrial breeding bird surveys (Figure 5.2-2b; Appendix 5.2-1 and 5.2-3). Breeding was confirmed for two of the observed species: bald eagle and osprey. In 2008, a pair of osprey was observed at a nest on Border Lake outside of the LSA in June: no young were present in the nest at the time of the survey (Figure 5.2-2b). In 2009, a female bald eagle was observed on a nest in a black cottonwood (*Populus trichocarpa*) tree near the confluence of Teigen and Snowbank creeks within the eastern area of the LSA (Figure 5.2-2a).

5.2.4.5 Species of Conservation Concern

Two raptor species of conservation concern were observed in the RSA: rough-legged hawk (2008) and Swainson's hawk (2009). Rough-legged hawk are blue-listed and are provincially ranked as imperilled to vulnerable during the non-breeding season. Swainson's hawk are red-listed and are provincially ranked as imperilled during the breeding season. All other raptor species observed are listed as secure or apparently secure in BC.

5.2.5 Discussion

Eight raptor species were identified in the RSA over the two year baseline study. Raptor diversity in the RSA is typical for the region, based on the results of other raptor surveys in areas of similar ecology (RTEC 2006a, 2007a). However, other species have been detected within 100 km of the RSA, including peregrine falcon, northern harrier, American kestrel (*Falco sparverius*), and gyrfalcon (RTEC 2006a, 2007a).

Northern goshawk CPS in 2008 were successful in recording the presence of one adult goshawk. No goshawks were detected on call-playback surveys in 2009; however, one individual was incidentally observed during terrestrial breeding bird surveys. The individual detected in 2008 was observed in an older growth forest dominated by hemlock and spruce along Sulphurets Creek and the individual detected in 2009 was observed in older cedar and hemlock forest along the Unuk River (Figure 5.2-2b). Northern goshawks typically nest in mature and old growth forests with an open understorey and closed

canopy, and use an area of roughly 30 ha around the nest site for foraging (Doyle and Mahon 2001; RIC 2001; BC ILMB 2009). Open understorey is a requirement for accipiters as these species actively hunt within the forest and need to be able to maneuver and see their prey. Goshawks also exhibit fidelity to nesting areas within their home range. Studies in the Kispiox Forest District showed that some nesting goshawks reused the same nesting areas over multiple years, and that alternate nests with the nesting area were on average 200 m from one another (Doyle and Mahon 2001). The spacing between nests of adjacent goshawk pairs was 5 km in Oregon (Reynolds and Wight 1978) and up to 20 km in the Kispiox Forest District (Doyle and Mahon 2001). The estimated minimum density of nesting pairs of goshawks within the Kispiox valley to the south of the Project was 1.5 pairs per 100 km² (Mahon and Doyle 2000).

Evidence of reproduction was observed for riparian nesting raptors in 2008 and 2009. One osprey nest site, occupied by two adults, was observed at Border Lake outside of the LSA in June 2008 (Figure 5.2-2b, Appendix 5.2-3). 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 within the eastern area of the LSA. Both of these species' nests are protected under the BC *Wildlife Act* (1996a). Ospreys and bald eagles have been shown to exhibit breeding territory and also nest site fidelity (i.e., occupation of the same breeding territory and nest site on an annual basis) (BC MOE 2005).

Two raptor species of conservation concern were observed in the RSA: a rough-legged hawk in 2008 and a Swainson's hawk in 2009 (Figures 5.2-2a and 5.2-2b). Rough-legged hawks breed in the tundra and taiga of North America and their winter range extends from southern Canada to Mexico (Bechard and Swem 2002). Their presence in the RSA confirms that migrating individuals pass through the study area, but they do not breed in the area. Swainson's hawk have a limited breeding range in the province, which spans across southern interior valleys, such as the Okanagan and Thompson River valleys and within the Bulkley basin between Hazelton and Smithers (R. W. Campbell, Dawe, McTaggart-Cowan, Cooper, Kaiser, Stewart, et al. 1997; BC MOE 2005). This species prefers open habitat, such as grasslands or wetlands, and typically nest in solitary trees near these open habitats (England, Sidney, and Houston 1997; BC MOE 2005). Northern goshawk are on the yellow list in BC (BC CDC 2010c) There is no current evidence that the *laingi* subspecies of the northern goshawk, or Queen Charlotte goshawk, which is red-listed and ranked as imperilled by the provincial government and listed as threatened by COSEWIC (COSEWIC 2000; BC CDC 2010c) occurs in the RSA (USFWS 2007; Northern Goshawk Accipiter gentilis laingi Recovery Team 2008).

5.3 TERRESTRIAL BREEDING BIRDS

5.3.1 Introduction

Baseline studies were conducted on terrestrial breeding birds (i.e., passerines, hummingbirds, swifts, woodpeckers, grouse, and ptarmigan) because, in addition to migratory bird and species at risk protection, active terrestrial breeding bird nests are protected under the BC *Wildlife Act* (1996a). They also represent an abundant and diverse vertebrate group that is potentially vulnerable to landscape alteration and development. The abundance of terrestrial breeding birds enables the statistical detection of changes in diversity and abundance over time.

5.3.2 Objectives

Surveys were designed to collect baseline information on species presence, abundance, and diversity. The objectives of collecting these data were to:

- establish baseline information on terrestrial breeding bird species present in the area;

- compare species abundance, diversity, and equitability (evenness) to determine habitat of high value for the maintenance of species diversity; and
- identify terrestrial breeding bird species of conservation concern in the area, such that appropriate conservation steps may be taken to meet statutory requirements of relevant wildlife acts and guidelines.

5.3.3 Methods

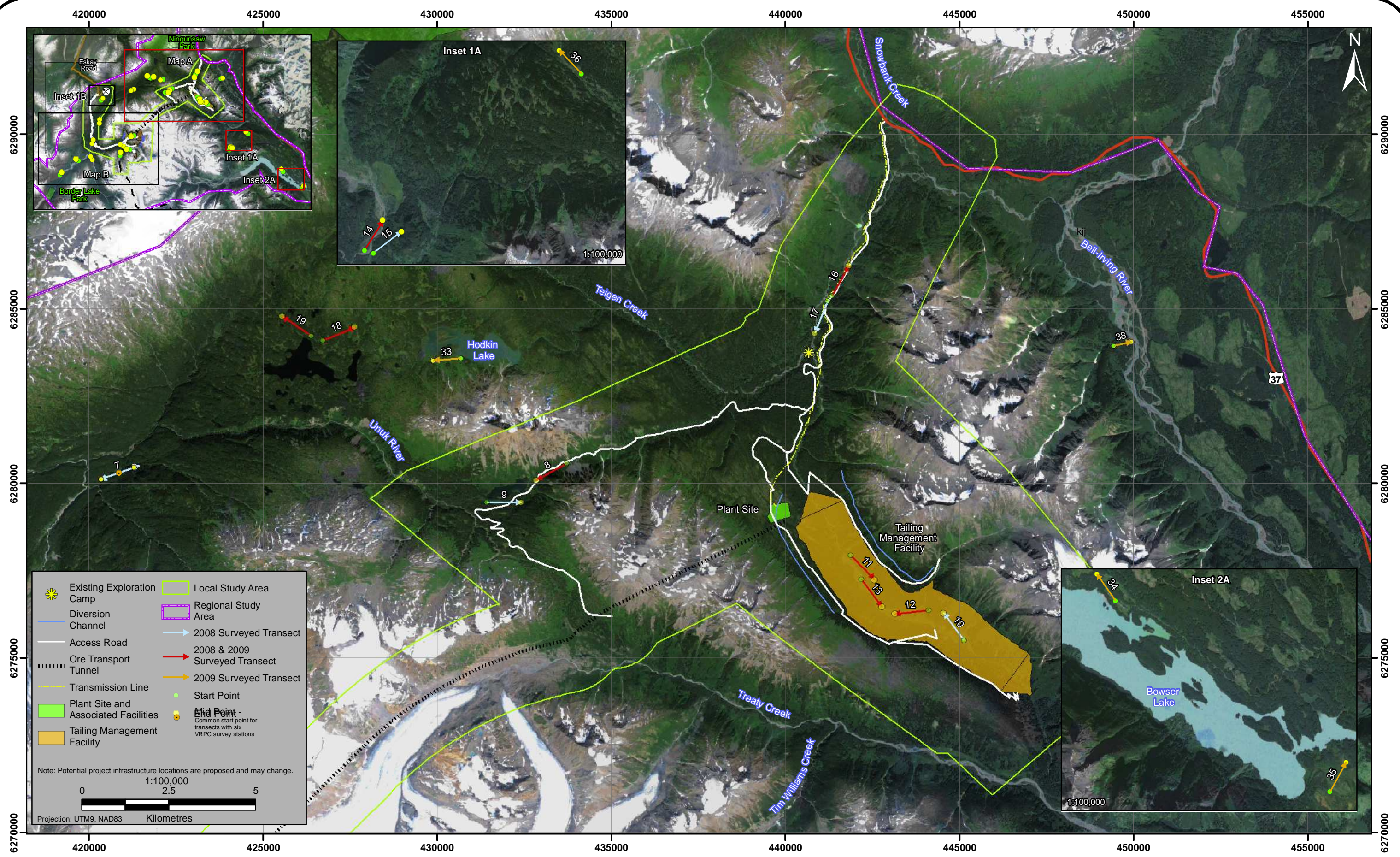
5.3.3.1 Terrestrial Bird Surveys

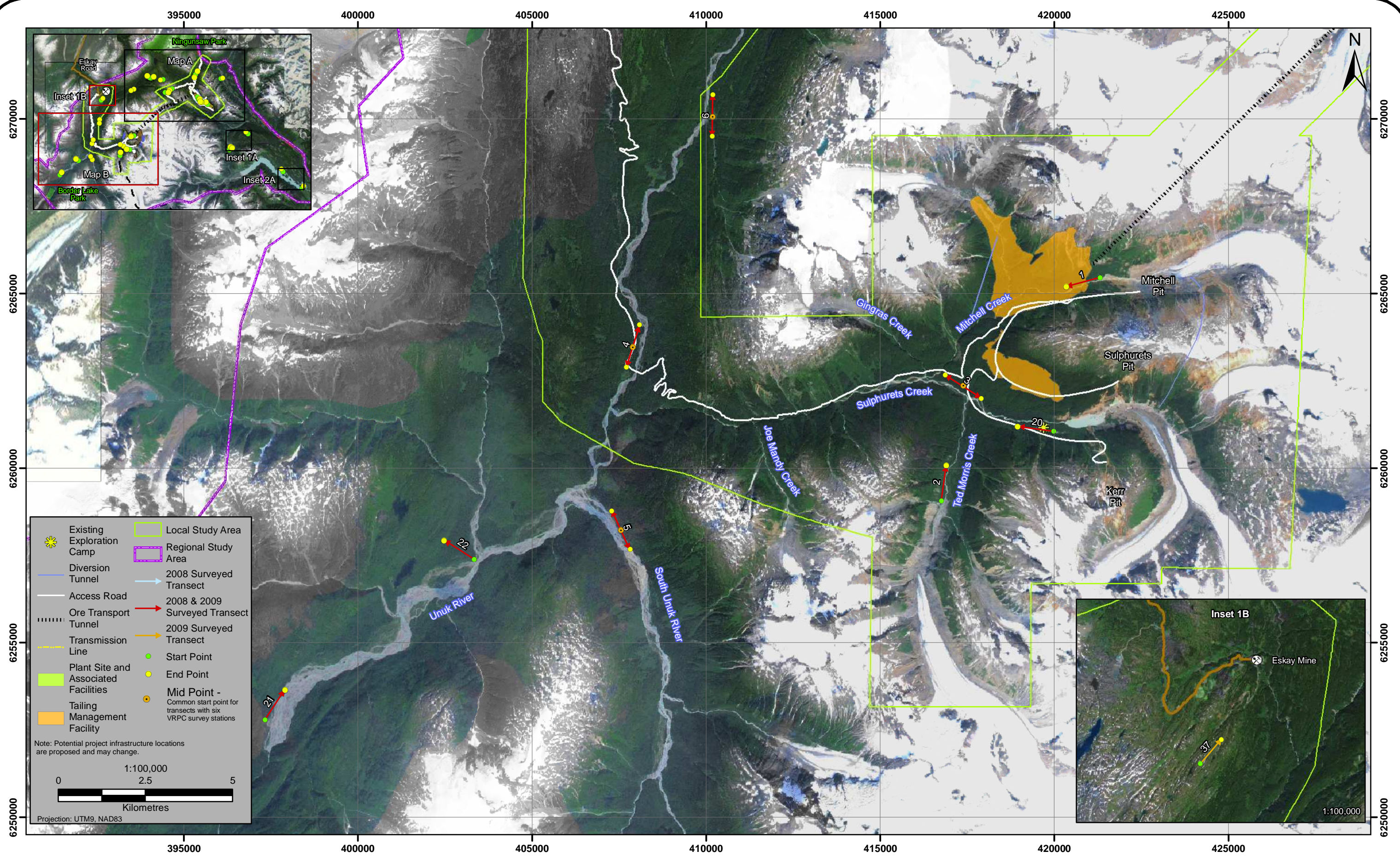
Two terrestrial bird surveys were conducted, one in 2008 and one in 2009, following standard VRPC inventory methods for songbirds (Ralph, Droege, and Sauer 1995). VRPC methods enable the identification of a wide range of bird species along transects (Ralph, Droege, and Sauer 1995). A well-designed VRPC allows for using maximum point radii along transects (100 m in open habitat), while also enabling the observer to see birds that flush or that are detectable at different distances. VRPC surveys are useful for identifying species and for determining relative abundances of species.

In 2008, surveys were conducted along 22 one kilometre-long transects by four field personnel from June 12 to 18 (Figures 5.3-1a and 5.3-1b). In 2009, transects were resurveyed by two field personnel from June 22 to 29, with the exception of Transects 7, 9, 10, 15, and 17. Six additional transect locations were surveyed in 2009 (Transects 33 to 38) (Figures 5.3-1a and 5.3-1b). Surveys were timed within the breeding season window for local birds (R. W. Campbell, Dawe, McTaggart-Cowan, Cooper, Kaiser, McNall, et al. 1997; R. W. Campbell et al. 2001; BC MOE 2006a). Survey effort focused on a diverse number of habitat types within the study area. Survey locations represented two types of disturbance: disturbed (treatment) and undisturbed (control). Treatment sites were selected within the area associated with the proposed development footprint (LSA) and control sites were selected in habitats outside the expected zone of influence of the proposed Project but within the regional area (RSA).

Data collected at each point count location included: number of birds, species, breeding behaviour, habitat descriptions, and weather. Breeding behaviour included observations of: copulations, nest material carries, food carries, faecal sac carries, nests, distraction displays, and pair bonding. Each observer was competent at identifying species in the region by sight and sound. VRPC surveys began at sunrise (~4:30 a.m.) each morning when birds were most active and sang most frequently and continued until 12 pm when bird activity decreases. Surveys were not carried out when wind speed exceeded approximately 30 km/h (5 on the Beaufort scale), or during rain or snow storms.

Observers were transported to transect locations by helicopter and were dropped at a distance that minimized flushing birds. In 2008, the first two transects were conducted with all four field personnel to calibrate distance estimation. Observers established a starting point of the transect using a handheld Garmin GPS 60 (advertised accuracy 3 to 15 m), and then proceeded for one kilometre along a compass bearing for that transect. Where obstructions (ridges, rivers, etc.) prevented travel along the bearing, a new bearing was taken from that point on and the new direction of travel was recorded. Observers stopped five times to perform point count surveys along each transect: the first point count station was 100 m from the starting point, and each subsequent point count station was located at distances of 200 m thereafter. Proceeding the initial calibration period in 2008, five transects were conducted where field personnel split into two teams of two observers after establishing a common starting point at the centre of the transect. Each team then proceeded 100 m along opposite compass bearings, whereupon they would stop and conduct a point count. Teams completed three stops along each transect: each transect had six point count stations spaced 200 m apart. The rest of the transects in 2008 were conducted with a team of two observers following the methodology of the initial calibration. All surveys were performed in this manner in 2009: no distance calibration was required as surveys were only performed by one field team of two field personnel.





At each point count location, bird observations were recorded for 5 minutes within 0 to 50 m and 50 to 100 m radii. Incidental observations were also made of birds flying overhead and those >100 m away from the observer during point counts. Incidental observations of terrestrial birds detected during other wildlife field inventories were also noted. All species observations are reported regardless of whether they were within the 100 m radius or recorded incidentally. However, comparisons of abundance, richness, diversity, and equitability only used the standardized data collected within 100 m of the observer and within the 5 minute survey period. For the purposes of consistent data analysis, data from one point count station were randomly omitted from transects with six survey stations in 2008 (Transects 3 to 7).

5.3.3.2 Analysis

There are four common metrics of bird community diversity: abundance, species richness, diversity, and equitability. Abundance of individual species is simply the number of individual birds observed, while species richness is the number of species observed.

A diversity index such as “Shannon’s H” is a mathematical measure of species diversity in a community. This diversity index provides information about bird community composition because it takes the relative abundance of different species into account, along with the number of species observed (Magurran 1988; Rosenzweig 1995). As such, diversity indices provide important information about rarity and commonness of species in a community. The Shannon-Weiner index of diversity (H) was calculated for each transect to facilitate diversity comparisons between transects in the LSA and RSA. Shannon’s H index of diversity was calculated using the equation:

$$H = - \sum_{i=1}^S p_i \ln p_i$$

Where S is the total number of species in a community and p_i is the proportion of S made up by the i^{th} species.

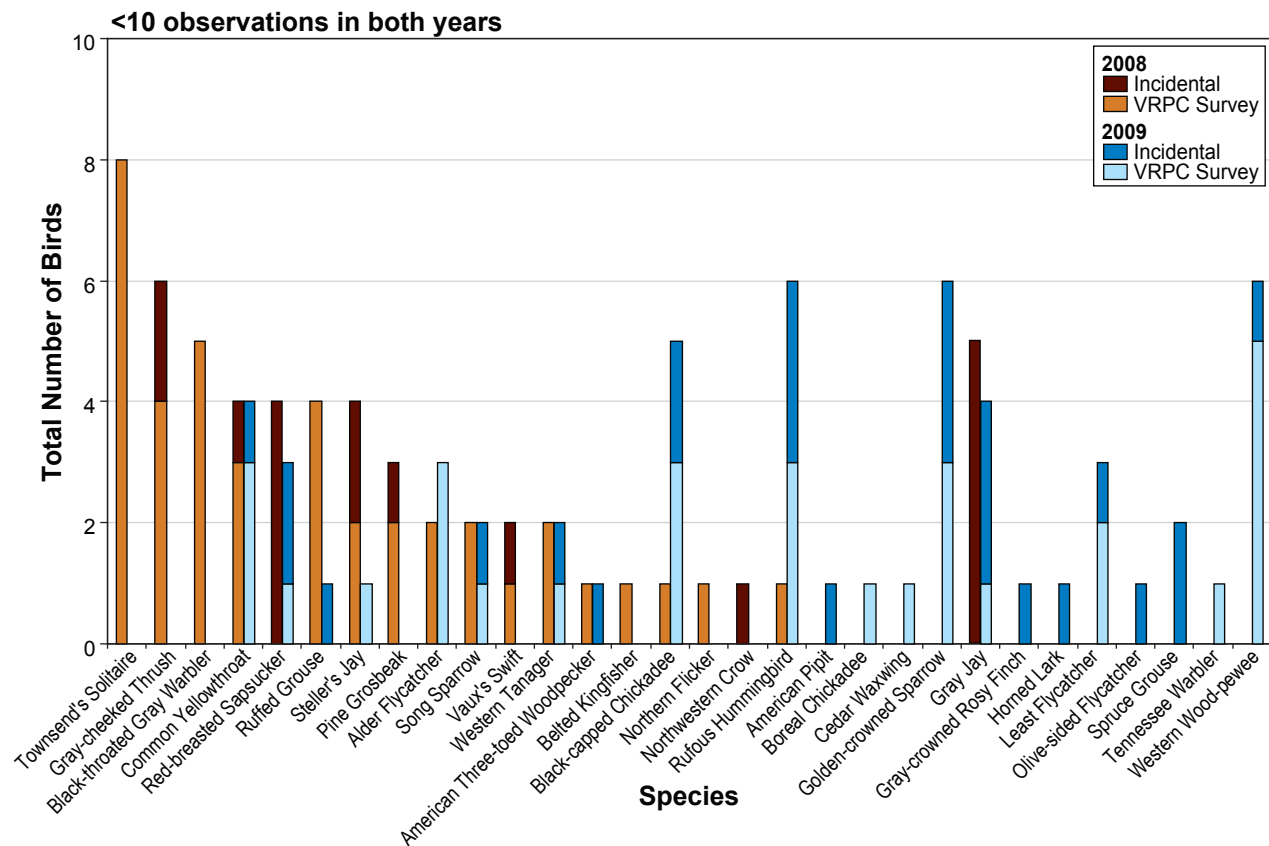
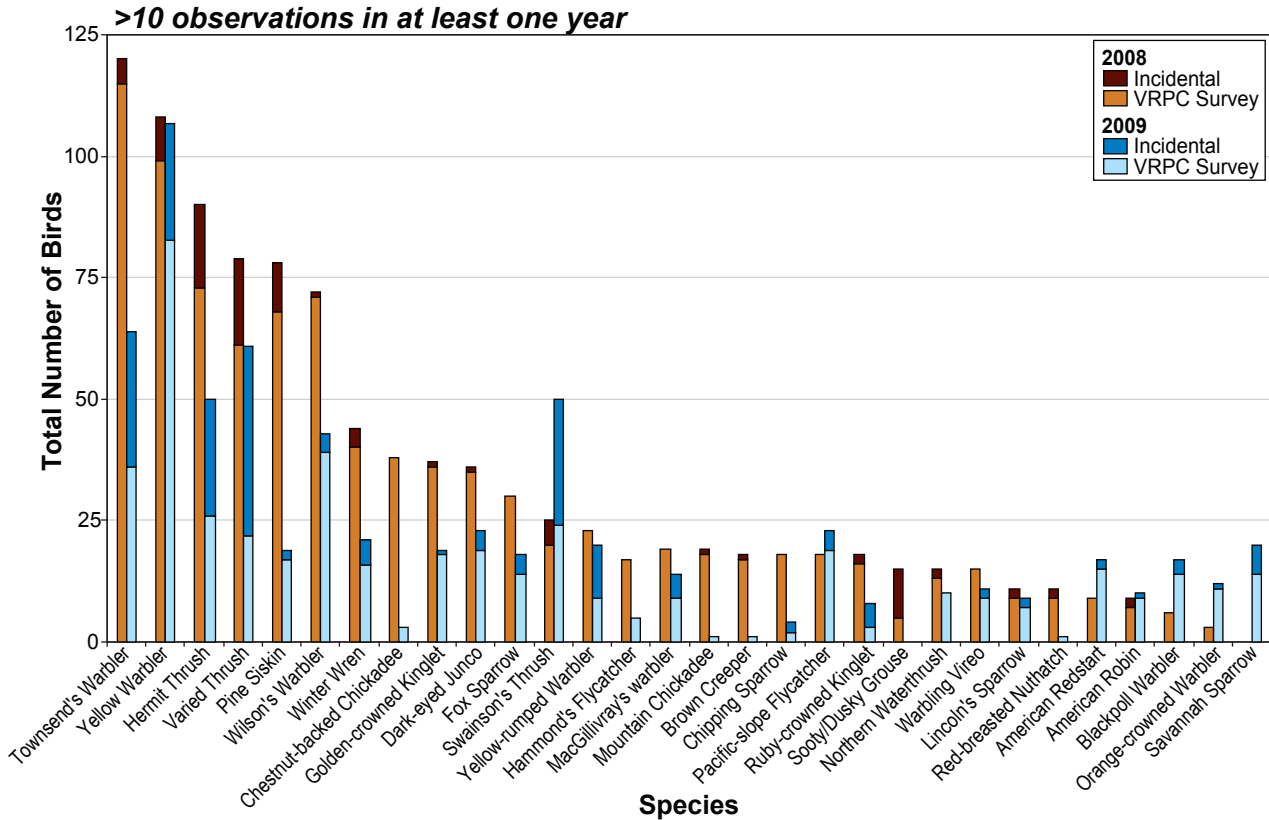
Following the calculation of H , Shannon’s equitability (E_H) was calculated by dividing H by H_{max} ($H_{max} = \ln S$). Equitability assumes a value between 0 and 1 with 1 being complete evenness (i.e., roughly equivalent numbers of birds belonging to each species recorded). The formula for Shannon’s equitability is presented below.

$$E_H = \frac{H}{H_{max}} = \frac{H}{\ln S}$$

5.3.4 Results

5.3.4.1 Species Observed

In 2008, 22 transects were surveyed and 48 species of terrestrial breeding birds were identified (Appendix 5.3-1). In 2009, a total of 23 transects were surveyed (of which 17 were re-sampled from 2008), and 51 terrestrial breeding bird species were identified (Appendix 5.3-2). Including all incidental observations during the two year baseline study, a total of 60 terrestrial breeding bird species were positively identified in the study area (Figure 5.3-2; Appendices 5.3-1 to 5.3-3). Four species were detected during surveys that could not be identified to the species level including an unknown chickadee, ptarmigan, flycatcher, and woodpecker.



Species Observed During the Breeding Season in 2008 and 2009

FIGURE 5.3-2

Overall, the four most abundant species in both years were Townsend's warbler, yellow warbler, hermit thrush, and varied thrush; however, fewer birds were observed in general in 2009 (Figure 5.3-2). Thirty species had fewer than 10 observations in both 2008 and 2009 (Figure 5.3-2).

5.3.4.2 *Species Abundance, Richness, Diversity, and Evenness*

Among Transects

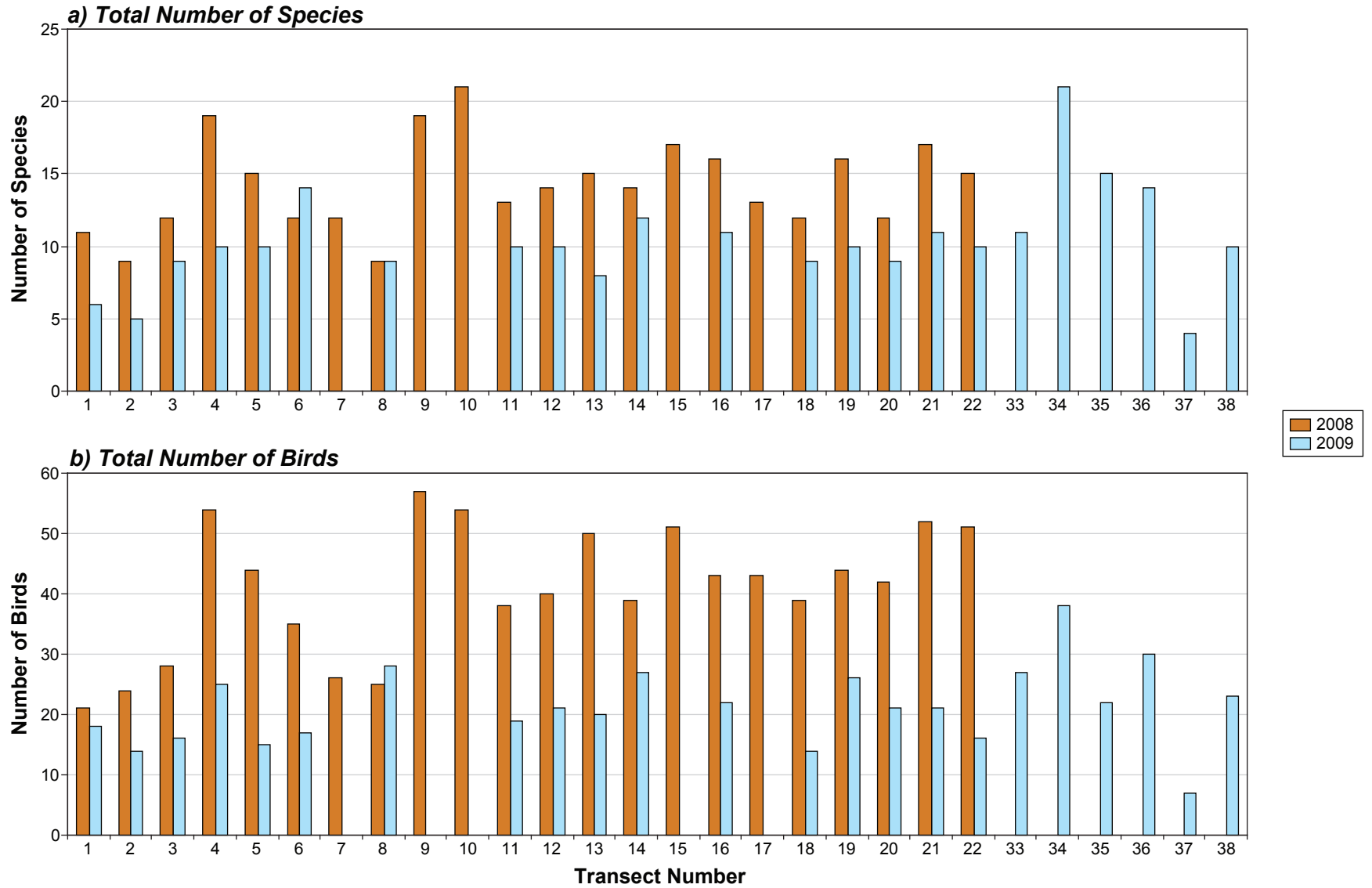
In 2008, the highest species richness, as well as avian abundance, was observed along Transects 4, 9, and 10, all of which are treatment transects within the LSA (Figures 5.3-1a and b, 5.3-3). Transect 4 is along the Unuk River within the Coulter Creek Access Corridor, and Transects 9 and 10 are associated with the proposed TMF within the eastern area of the LSA. Conversely, transects that hosted the highest species richness in 2009 were control transects outside the LSA (Transects 34 through 36; Figures 5.3-1a and b, 5.3-3). These three transects were in the southern RSA along the northern slopes of Mount Anderson (Transect 36) and on the shores of Bowser Lake (Transects 34 and 35). Among transects that were surveyed twice, 88% had lower abundance and species richness in 2009 as compared to 2008 (Figure 5.3-3).

A similar trend was observed among transects when considering diversity and equitability. Transects 4, 9, and 10 had the highest diversity values in 2008, while Transects 34 and 35 had the highest diversity values in 2009 (Figure 5.3-4). Equitability values sometimes covaried with diversity values (i.e., transects with high diversity values also had high equitability values and vice versa). Transects 10 (2008) and 35 (2009) had the highest equitability values, meaning that these transects had the most equal representation of numbers of individuals among species observed (i.e., one or two species did not make up most of the birds seen; rather there were many species that were equally represented in numbers).

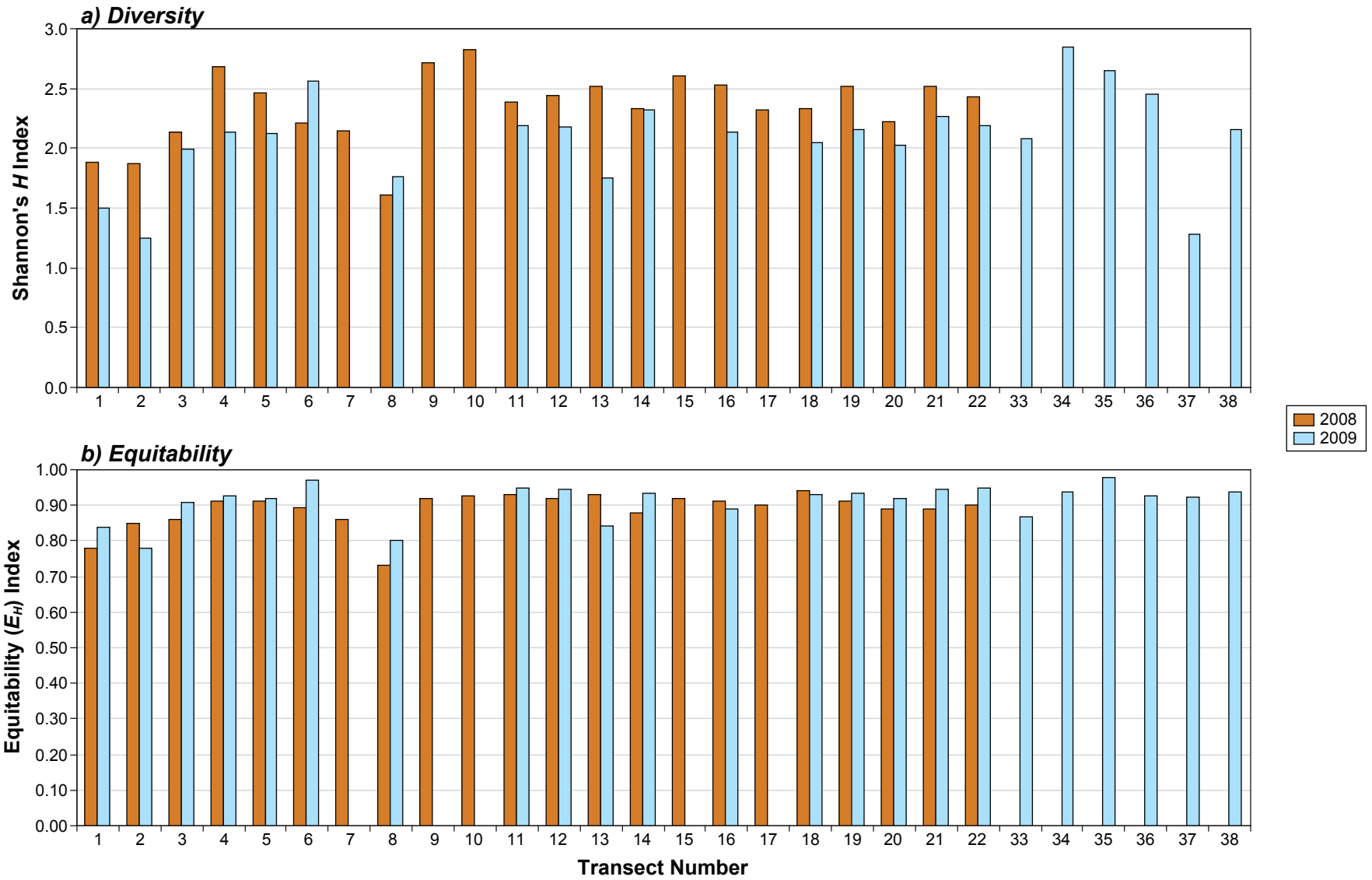
Transects 8 (in 2008) and 37 (in 2009) had the lowest species richness and diversity; Transect 2 also had one of the lowest calculated species richness and diversity values in both 2008 and 2009 (Figures 5.3-3 and 5.3-4). Transect 2 and 8 are treatment transects within the LSA: Transect 2 is adjacent to the temporary glacier access road along Ted Morris Creek and Transect 8 is associated with the access road to the Mitchell - Teigen Tunnel (Figures 5.3-1a and b). Transect 37 is also a treatment transect just south of Eskay Creek Mine (Figure 5.3-1b).

Among BEC Subzones

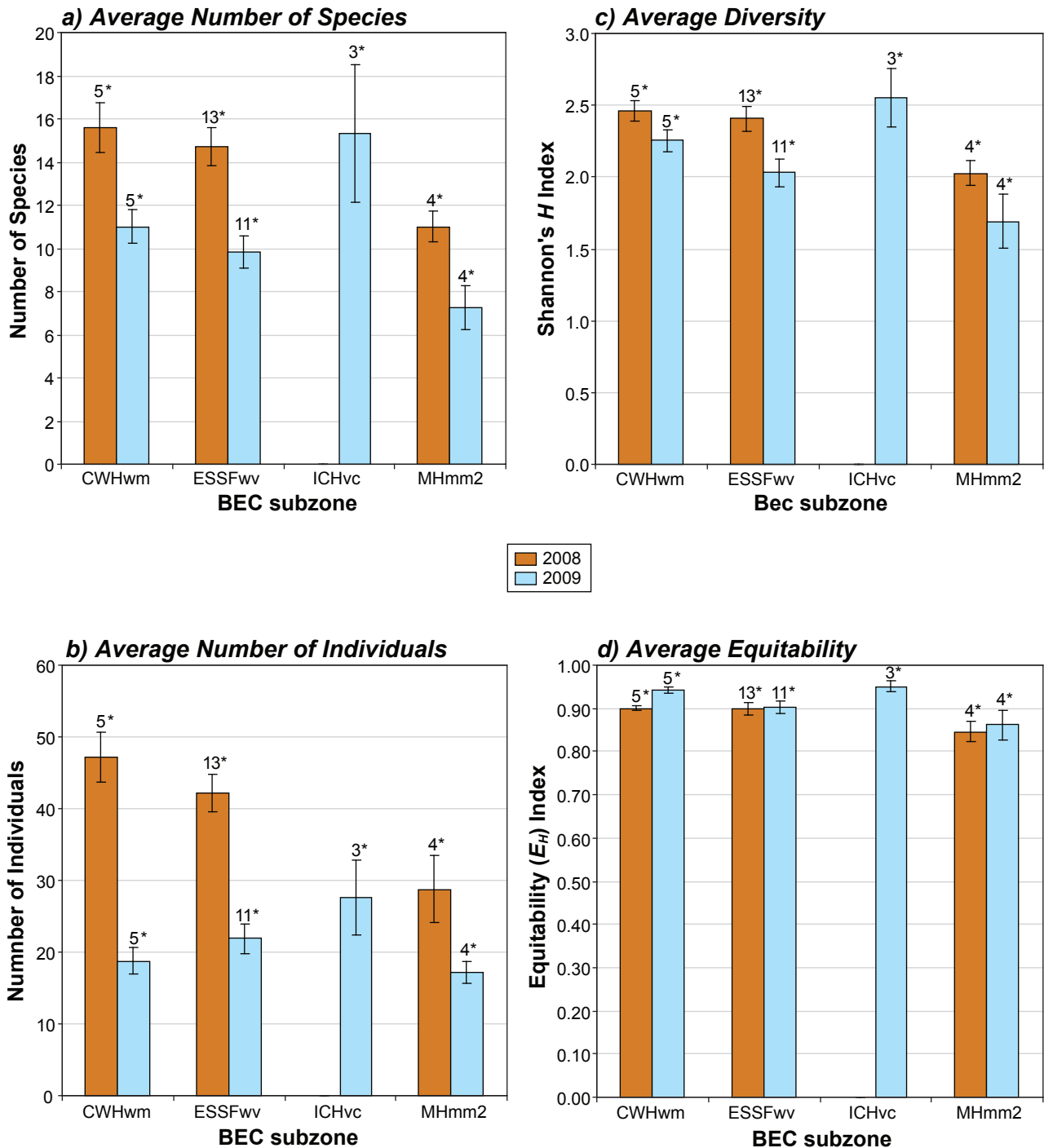
To gain a broader perspective of avian community composition and distribution in the RSA, species richness, abundance, diversity, and equitability was analyzed by BEC zone. Over two years, surveys were conducted in four BEC subzones; ESSFwv (24 transects), CWHwm (10 transects), MHmm2 (8 transects), and ICHvc (3 transects) (Plate 5.3-1). Average values for species richness, abundance, diversity, and equitability were calculated across transects in the same BEC subzone (Figure 5.3-5). The highest species richness was observed in the CWHwm in 2008 and in the ICHvc in 2009. Because fewer birds were seen in 2009 as compared to 2008, ICHvc had a lower species abundance than would be expected based on the relatively high species richness. However, ICHvc had the highest diversity and equitability values across the RSA (Figure 5.3-5). Transects within the MHmm2 had a relatively low species richness, abundance, diversity, and equitability in both 2008 and 2009 (Figure 5.3-5).



Number of Species and Number of Individuals Observed Per Transect, 2008 and 2009



Species Diversity and Evenness Indices among Transects, 2008 and 2009



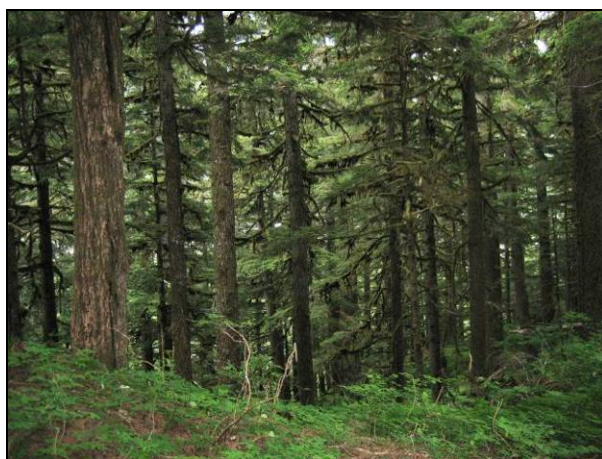
Note: * sample size (the number of transects within each subzone)

Avian Abundance, Species Richness, Shannon's Diversity, and Equitability among Transects, averaged by

FIGURE 5.3-5



(a) ESSFmv: low elevation forest in the proposed tailing management facility area (Transect 12)



(b) CWHvm: low elevation forest adjacent to the Unuk River (Transect 22)



(c) MHmm2: low elevation older growth forest adjacent to Sulphurets Creek (Transect 3)



(d) ICHvc: low elevation forest adjacent to the Bell-Irving River (Transect 38)

Plate 5.3-1. Examples of habitat in BEC zones in the study area.

The relative density of all bird species detected on survey point counts within representative BEC subzones is shown in Table 5.3-1. This was achieved by dividing the number of birds observed within BEC subzones by the number of individual point counts conducted within that same BEC subzone. Townsend's warbler, hermit thrush, winter wren, and yellow warbler all had consistently high relative densities per point in 2008 and 2009, especially within the CWHwm and ESSFwv. A total of eight species were only observed within one particular BEC subzone during only one year; these species had very low relative densities (Table 5.3-1).

5.3.4.3 Evidence of Reproduction

Behavioural and physical evidence of reproduction was observed for eight species in 2008 and 2009 (Table 5.3-2; Plate 5.3-2). Yellow warbler had the most observations of reproductive behaviour over the two years, with three nests observed within the LSA. Yellow warbler nest sites were commonly found in alder trees in low elevation riparian habitat (Plate 5.3-2a and 5.3-2c); two nests were observed along the Mitchell (Transect 1) and Sulphurets Creek (Transect 3) drainages in the western area of the LSA and one was seen along Teigen Creek in the eastern LSA (Transect 16). Dark-eyed junco nests were observed on the ground adjacent to riparian habitat within the western LSA (Transects 1)

and outside the LSA (Transect 14). Woodpecker nest holes (red-breasted sapsucker and American three-toed woodpecker) were associated with mature forests (Transects 4 and 7), generally at lower elevation (Plate 5.3-2d). Swainson's thrush nests were found in similar habitats as yellow warbler nest sites; all thrush nests were found in alder trees within the LSA. One was observed along Ted Morris Creek in the western area of the LSA (Transect 2) and one was found along the access road to the proposed TMF and plant site adjacent to Teigen Creek (Transect 16).

5.3.4.4 *Species of Conservation Concern*

Of the species that were observed in 2008 and 2009, two are of conservation concern. Olive-sided flycatcher is on the BC blue list, is provincially ranked as vulnerable to apparently secure during the breeding season, and is also listed as Threatened by COSEWIC (COSEWIC 2007; BC CDC 2010c). One individual was observed incidentally within the RSA along Transect 19 adjacent to Unuk Lake (Figure 5.3-1a). There were 15 observations of sooty/dusky grouse in 2008 (Appendix 5.3-1). Sooty and dusky grouse were formerly known as blue grouse until 2006, when they were designated as separate species based on DNA, morphological, and behavioural differences (AOU 2006). Observers in 2008 identified these birds based on sound only; none were physically observed. Thus, the two species could not be differentiated based on morphology or behaviour. Sooty grouse, which inhabits the coastal areas of BC, is on the BC blue list and is ranked as vulnerable to apparently secure during the breeding season, while dusky grouse, which ranges within interior BC, is yellow-listed and is not of conservation concern (BC CDC 2010c). The proposed Project overlaps both of these species' ranges; thus, the several individuals recorded in 2008 could belong to either species. All the remaining species are on the BC yellow list, have a provincial and global rank of secure to apparently secure, and are not listed by either COSEWIC or SARA.

5.3.5 Discussion

Sixty terrestrial bird species were identified in the study area over the two year baseline study. The most commonly observed species were Townsend's warbler, yellow warbler, hermit thrush, Wilson's warbler, varied thrush, and pine siskin. In 2008, the most diverse species communities were associated with transects within the eastern area of LSA near the proposed TMF and the Coulter Creek Access Corridor along the Unuk River (Transects 4, 9, and 10; Figures 5.3-1a and b). These transects also had the highest species richness as well as the greatest number of individuals detected per transect in 2008. In 2009, the highest diversity, species richness, and abundance was associated with transects outside of the LSA (Transects 34 and 35; Figures 5.3-1a and b). Species richness recorded in 2008 (48 species), and 2009 (51 species) is comparable to areas of similar ecology in northern BC (55, RTEC 2006a; 51, RTEC 2007a).

Songbird diversity and abundance in other studies tend to correlate positively with increased vegetative diversity and structural heterogeneity (e.g., vertical stratification of vegetation; Whelan 2001), wide forested buffer areas along water or where two habitat types transition (Peak and Thompson 2006), and/or the availability of diverse food resources (Whelan 2001). To test whether certain habitats had higher or lower species richness and diversity in the RSA, the four metrics of avian community diversity (species richness, abundance, diversity, and equitability) were grouped and averaged by BEC subzone. In 2008, the CWHwm had the highest species richness and diversity, followed closely by ESSFwv. In 2009, the highest species richness and diversity were observed in the ICHvc and CWHwm. Sample sizes between BEC subzones are uneven and are not directly comparable, although trends are apparent. Transects in the ESSFwv and CWHwm were often close to transitory habitats, such as forest adjacent to riparian corridors, wetlands, or lakes. Transects in CWHwm also had high structural heterogeneity, with tall canopies, high amounts of mossy coarse woody debris, and diverse communities of plants in the understorey, including oval-leaf blueberry (*Vaccinium ovalifolium*), devil's club (*Oplopanax horridus*), and ferns species.

Table 5.3-1. Relative Density of Bird Species per Point Count by BEC Subzone, 2008 and 2009

Common Name	MH mm2				CWHwm				ESSFmv				ICH vc	
	2008		2009		2008		2009		2008		2009		2009	
	No. Observed	Per Point Count (n = 20)	No. Observed	Per Point Count (n = 20)	No. Observed	Per Point Count (n = 25)	No. Observed	Per Point Count (n = 25)	No. Observed	Per Point Count (n = 65)	No. Observed	Per Point Count (n = 55)	No. Observed	Per Point Count (n = 15)
Alder flycatcher	-	-	-	-	1	0.04	-	-	1	0.02	-	-	3	0.15
American redstart	1	0.05	6	0.3	3	0.12	2	0.1	4	0.06	2	0.1	5	0.25
American robin	-	-	-	-	3	0.12	5	0.25	4	0.06	3	0.15	1	0.05
Belted kingfisher	-	-	-	-	1	0.04	-	-	-	-	-	-	-	-
Black-capped chickadee	1	0.05	-	-	-	-	1	0.05	-	-	-	-	-	-
Blackpoll warbler	-	-	-	-	-	-	-	-	6	0.09	13	0.65	1	0.05
Black-throated gray warbler	-	-	-	-	1	0.04	-	-	4	0.06	-	-	-	-
Dusky/Sooty grouse	1	0.05	-	-	-	-	-	-	2	0.03	-	-	-	-
Boreal chickadee	-	-	-	-	-	-	-	-	-	-	-	-	1	0.05
Brown creeper	3	0.15	1	0.05	7	0.28	-	-	3	0.05	-	-	-	-
Cedar waxwing	-	-	-	-	-	-	1	0.05	-	-	-	-	-	-
Chestnut-backed chickadee	10	0.5	-	-	22	0.88	1	0.05	3	0.05	1	0.05	1	0.05
Chipping sparrow	-	-	-	-	-	-	-	-	18	0.28	1	0.05	1	0.05
Common yellowthroat	-	-	-	-	-	-	1	0.05	2	0.03	-	-	2	0.1
Dark-eyed junco	1	0.05	-	-	7	0.28	4	0.3	27	0.42	9	0.45	6	0.3
Fox sparrow	3	0.15	-	-	-	-	-	-	27	0.42	13	0.65	-	-
Golden-crowned kinglet	2	0.1	4	0.2	15	0.6	11	0.55	15	0.23	2	0.1	1	0.05
Golden-crowned sparrow	-	-	-	-	-	-	-	-	-	-	1	0.05	-	-
Gray-cheeked thrush	-	-	-	-	-	-	-	-	4	0.06	-	-	-	-
Gray Jay	-	-	-	-	-	-	-	-	-	-	1	0.05	-	-
Hammond's flycatcher	-	-	-	-	7	0.28	-	-	8	0.12	2	0.1	3	0.15
Hermit thrush	11	0.55	2	0.1	13	0.52	1	0.05	48	0.74	22	1.1	-	-
Least Flycatcher	-	-	-	-	-	-	-	-	-	-	1	0.05	1	0.05
Lincoln's sparrow	-	-	1	0.05	-	-	-	-	9	0.14	6	0.3	-	-
MacGillivray's warbler	5	0.25	-	-	3	0.12	2	0.1	10	0.15	1	0.05	6	0.3
Mountain chickadee	-	-	-	-	-	-	-	-	18	0.28	1	0.05	-	-

(continued)

Table 5.3-1. Relative Density of Bird Species per Point Count by BEC Subzone, 2008 and 2009 (completed)

Common Name	MH mm2				CWHwm				ESSFmv				ICH vc	
	2008		2009		2008		2009		2008		2009		2009	
	No. Observed	Per Point Count (n = 20)	No. Observed	Per Point Count (n = 20)	No. Observed	Per Point Count (n = 25)	No. Observed	Per Point Count (n = 25)	No. Observed	Per Point Count (n = 65)	No. Observed	Per Point Count (n = 55)	No. Observed	Per Point Count (n = 15)
Northern flicker	-	-	-	-	-	-	-	-	1	0.02	-	-	-	-
Northern waterthrush	3	0.15	4	0.2	-	-	2	0.1	10	0.15	2	0.1	-	-
Orange-crowned warbler	3	0.15	2	0.1	-	-	-	-	-	-	5	0.25	2	0.1
Pacific-slope flycatcher	1	0.05	3	0.15	13	0.52	15	0.75	2	0.03	1	0.05	3	0.15
Pine grosbeak	-	-	-	-	-	-	-	-	2	0.03	10	0.5	-	-
Pine siskin	3	0.15	4	0.2	13	0.52	2	0.1	49	0.75	-	-	1	0.05
Red-breasted nuthatch	-	-	-	-	2	0.08	1	0.05	6	0.09	-	-	-	-
Ruby-crowned kinglet	-	-	1	0.05	1	0.04	-	-	15	0.23	1	0.05	1	0.05
Ruffed grouse	-	-	-	-	1	0.04	-	-	3	0.05	-	-	-	-
Rufous hummingbird	-	-	-	-	-	-	1	0.04	-	-	-	-	2	0.1
Song sparrow	-	-	-	-	-	-	-	-	1	0.02	-	-	1	0.05
Steller's jay	1	0.05	-	-	1	0.04	1	0.05	-	-	-	-	-	-
Swainson's thrush	4	0.2	2	0.1	4	0.16	6	0.3	9	0.14	8	0.4	8	0.4
American Three-toed woodpecker	-	-	-	-	-	-	-	-	1	0.02	-	-	-	-
Townsend's solitaire	1	0.05	-	-	4	0.16	-	-	3	0.05	-	-	-	-
Townsend's warbler	11	0.55	6	0.3	33	1.32	11	0.55	64	0.98	13	0.65	5	0.25
Varied thrush	7	0.35	1	0.05	20	0.8	6	0.3	32	0.49	12	0.6	2	0.1
Vaux's swift	1	0.05	-	-	-	-	-	-	-	-	-	-	-	-
Warbling vireo	-	-	1	0.05	9	0.36	4	0.2	6	0.09	2	0.1	2	0.1
Western tanager	-	-	-	-	2	0.08	-	-	-	-	-	-	-	-
Western wood-pewee	-	-	-	-	-	-	-	-	-	-	1	0.05	4	0.2
Wilson's warbler	5	0.25	1	0.05	6	0.24	1	0.05	57	0.88	34	1.7	3	0.15
Winter wren	2	0.1	-	-	31	1.24	4	0.2	7	0.11	5	0.25	7	0.35
Yellow warbler	30	1.5	24	1.2	11	0.44	8	0.4	55	0.85	44	2.2	6	0.3
Yellow-rumped warbler	5	0.25	4	0.2	2	0.08	1	0.05	13	0.2	3	0.15	1	0.05

¹ Data from one VRPC station was randomly omitted from transects where six VRPC surveys were conducted for the purposes of consistent analysis.

² Includes only species identified to species level within 100 m from point count survey station.

Table 5.3-2. Evidence of Reproduction recorded during the 2008 and 2009 Surveys

Species	Copulation	Fecal Sac Carry	Fledgling	Food Carry	Material Carry	Nest	Total
<i>2008</i>							
American three-toed woodpecker						1	1
Dark-eyed junco						2	2
Swainson's thrush						2	2
Yellow warbler						1	1
<i>2009</i>							
Red-breasted sapsucker						1	1
Varied thrush				2			2
Yellow warbler						2	2
Yellow-rumped warbler				1			1
Total	0	0	0	3	0	9	12



(a) Yellow warbler nest with eggs



(b) Swainson's thrush nest with eggs



(c) Yellow warbler nest site



(b) American three-toed woodpecker nest site

Plate 5.3-2. Examples of nest sites found during surveys in 2008 and 2009.

The evidence of reproduction recorded in the RSA in 2008 and 2009 indicates that surveys were well timed within the breeding season. The majority of species breeding in northern BC would arrive on their breeding grounds around the end of May each year, regardless of climatic conditions ((R. W. Campbell, Dawe, McTaggart-Cowan, Cooper, Kaiser, McNall, et al. 1997; R. W. Campbell et al. 2001). After their arrival males readily sing, defend territories, and perform courtship displays during the morning. As the seasons progress, females can be seen carrying nesting materials and building nests in June and rearing young through to July. In 2008, there were several observations of nests containing eggs; however, there were no observations of nestlings or adult food carries for young. In 2009, surveys were performed one week later. During the survey period, there were observations of nests containing eggs and adults carrying food (varied thrushes and a yellow-rumped warbler), indicating that some species had live young at the end of June.

The onset of reproduction may have been delayed by a late spring in 2008 and 2009. A late snowpack was observed in both years where snow was still present in many areas in the RSA, including some low elevation habitats within the proposed TMF. Variable weather conditions, such as a late snowpack, can affect reproductive timing in songbirds, especially those that nest on the ground (Hendricks 2003; Bears 2007). Later snowpacks delay the onset of vegetation and insect emergence, which is known to affect the egg-laying date in several songbird species (Svensson and Nilsson 1995; Inouye et al. 2000; Hegelbach 2001; Thomas et al. 2001). Terrestrial breeding birds arrive on their breeding grounds at the same time each year (with some inter-annual variation) (R. W. Campbell, Dawe, McTaggart-Cowan, Cooper, Kaiser, McNall, et al. 1997; R. W. Campbell et al. 2001). However, the onset of reproduction will be delayed for many species in years of unfavourable weather conditions until there are sufficient nutritional resources for females to raise a successful brood. Thus, birds species could be expected to nest and raise young earlier in June than was documented in either 2008 or 2009.

One species of conservation concern was confirmed within the RSA in 2009: olive-sided flycatcher. In Canada, the olive-sided flycatcher has undergone a population decline of approximately 3 to 4% per year since 1968 (COSEWIC 2007). Olive-sided flycatchers are found in open coniferous forests and often near wetlands with dead trees (snags), which are used as foraging perches. Nests are often placed in conifers, such as Douglas fir (*Pseudotsuga menziesii*) and Engelmann spruce (*Picea engelmannii*) (R. W. Campbell, Dawe, McTaggart-Cowan, Cooper, Kaiser, McNall, et al. 1997; COSEWIC 2007). Both the blue-listed sooty grouse and yellow-listed dusky grouse can occur in the study area (BC CDC 2010c); these two species select similar habitats across their range, namely relatively open habitat such as shrubby areas, meadows from the lower treeline to the subalpine, and open canopied forests (Zwickel and Bendell 2005). A well defined ground vegetation layer (e.g., herbs, grass, and shrubs) is known to be important for sooty and dusky grouse (Zwickel and Bendell 2005). The habitat characteristics associated with nest sites are variable; however, most nests are placed on the ground with some overhead cover for protection from predators (Zwickel and Bendell 2005).

5.4 WATER DEPENDENT BIRDS

5.4.1 Introduction

Water dependent birds include groups such as diving and dabbling ducks, loons, geese, swans, gulls, and shorebirds. The term waterfowl has generally been used interchangeably with water dependent bird. However, waterfowl specifically refers only to species of dabbling and diving ducks, geese, and swans in the family *Anatidae*. For the purposes of this report, the term "water dependent bird" is used as an umbrella term to encompass all birds that exclusively use water as habitat for foraging, breeding, or staging during the year.

The presence of water dependent birds, such as ducks, is an indicator of the availability of functional wetland habitat. Waterfowl can be an important game species for local hunters and Aboriginal peoples. Furthermore, water dependent birds hold intrinsic value regionally. For example, the Cassiar Iskut-Stikine LRMP identified trumpeter swan winter habitat as important areas to maintain, and identified inventories of trumpeter swan nesting and overwintering areas, including late fall and early spring migration areas, as high priority areas for research (BC ILMB 2000). Harlequin duck is of particular interest to federal regulators as it occupies a unique habitat niche and has received widespread concern following declines in Pacific populations (Robertson and Goudie 1999). While harlequin ducks are currently yellow-listed in BC, the BC MOE identified harlequin ducks as requiring conservation consideration under the BC Conservation Framework to prevent the species from becoming at risk in the future (BC MOE 2009; BC CDC 2010c). This species nests near fast flowing rivers and mountain streams (R.W. Campbell et al. 1990).

Migratory water dependent species receive protection under the federal *Migratory Birds Convention Act* (1994b), and identifying species of conservation concern is imperative to meet the obligations of the *Species At Risk Act* (2002b) and the BC *Wildlife Act* (1996a) during the breeding season.

5.4.2 Objectives

Baseline surveys were designed to investigate the water dependent bird community within the RSA, including the LSA. Water dependent birds were anticipated to use the area for spring and fall staging as well as localized breeding by some species. Specifically, the objectives were to:

- characterize biodiversity, distribution, and seasonal extent of use within the study area;
- determine presence and distribution of riverine birds, with particular emphasis on harlequin ducks;
- identify habitats and locations of greatest importance to breeding water dependent birds; and
- identify species of conservation concern in the area, such that appropriate conservation steps may be taken to meet statutory requirements of relevant wildlife legislation and guidelines.

5.4.3 Methods

5.4.3.1 Aerial Surveys

Four aerial surveys for water dependent birds were conducted in the RSA during 2008 and 2009. Surveys were flown according to approved provincial inventory standards (RIC 1998d, 1999c) and included the use of an A-Star helicopter with a navigator, a pilot, and an observer. The helicopter flew at speeds of 40 to 100 km/hour depending on weather conditions, and at height of approximately 30 to 50 m above the water. Water dependent birds were identified from the air using binoculars. A handheld Garmin GPS 76 (advertised accuracy 3 to 15 m) equipped with a remote antenna was used to record survey routes and bird observation waypoints. Waypoint, group number, species, numbers of individuals, and sex (wherever possible) was recorded for each observation.

Aerial surveys were timed during the general breeding and migration periods for water dependent birds in northern BC, which spans from April through October (R.W. Campbell et al. 1990). Specific survey dates were selected to (a) collect evidence of breeding and reproduction by documenting the presence of breeding pairs (spring pair survey) and young birds (summer brood survey), and (b) assess the extent of habitat use by migrating birds (spring and fall staging surveys). Particular emphasis was placed on identifying the harlequin duck presence and distribution given their provincial conservation concern (BC MOE 2009; BC CDC 2010c).

The first of the breeding surveys, the spring pair survey, was conducted on June 2 and 3, 2008, using 9.2 hours of helicopter time. The survey was restricted to the unfrozen wetland and riverine areas of the RSA (mostly within the Unuk River drainage and the Teigen Creek and Treaty Creek watersheds). Observers noted whether male and females were paired as behavioural evidence of breeding. The summer brood survey was conducted on July 15 and 16, 2008, using a total of 12.3 hours of helicopter time. When broods were observed, the number of young as well as brood class was recorded (Table 5.4-1). The approximate age of young waterfowl can be determined through brood class identification. Although brood classes were developed specifically for ducks, geese, and swans they can also be applied to some non-waterfowl species, such as loons, as plumage development is similar in these species. The eclipse plumage of drakes of many duck species and the cryptic nature of hens with broods limited the success of species and sex identification from helicopters in some cases. However, information collected was sufficiently robust to allow for an estimate of productivity and to identify important breeding locations.

Table 5.4-1. Plumage Development in Young Waterfowl

Brood Class	Description
IA	Young are covered in bright down, neck and tail not prominent; 1 to 7 days of age
IB	Young are covered in fading down, neck and tail not prominent; 8 to 13 days of age
IC	Young are down-covered, but colour faded, body elongated; 14 to 18 days of age
IIA	First feathers appear, replacing down on sides and tail; 19 to 27 days of age
IIB	Over half of body covered with feathers; 28 to 42 days of age
IIC	Small amount of down remains, among feathers of back; 28 to 42 days of age
III	Fully feathered but incapable of flight; 43 to 55 days of age, flying at 56 to 60 days of age

References: Bellrose (1980) and Gollop & Marshall (1954).

Staging surveys were conducted during the late fall of 2008 and early spring of 2009. The fall staging survey was conducted on September 27, 2008, using 4.5 hours of helicopter time. Differentiation between species and between male and female becomes difficult during the post breeding season. Many water dependent species undergo a post breeding season moult to winter plumage. For water dependent species, adult winter plumages can be alike between the sexes: first year offspring (i.e., born that year) also have plumages very similar to winter adults. As such, aerial identification is complicated for water dependent birds during this time. The spring staging survey was conducted on April 26, 2009, using 2.4 hours of helicopter time and covering all the open water areas (i.e., unfrozen) within the RSA.

5.4.3.2 *Incidental Observations*

Observations of water dependent bird species were noted and geo-referenced when they were detected incidentally during other wildlife field inventories in 2008 and 2009. Incidental water dependent bird species observations were also documented by field staff in other disciplines.

5.4.3.3 *Data Analysis*

Habitat associated with each bird observation was classified into general categories of small, medium, or large sized river (RI), creek (CR), pond (PO), lake (LK), swamp (SW), and marsh (MA) to identify important areas for water dependent birds. Rivers were defined as streams greater than 4 m wet width, while creeks were defined as streams less than 4 m wet width. Ponds were defined as shallow waterbodies with organic substrate and substantial emergent vegetation, while lakes were deeper with predominantly mineral soil substrata. Marshes were areas of shallow water, dominated by rush (*Scirpus*

spp.) and sedge (*Carex* spp.) vegetation. Swamps were defined as areas where shrubby or woody vegetation persisted in areas with high water tables (i.e., a wetland area with woody vegetation).

For general analysis, water dependent birds were grouped as dabbling ducks, diving ducks (including sea ducks), geese, swans, waterbirds (loons and grebes), shorebirds, and other (e.g., gulls, terns). For reporting purposes, waterfowl refers to all species of ducks, geese, and swans excluding harlequin duck. Harlequin duck is classified as a riverine bird for this report and is given a separate analysis (RIC 1998d). American dipper (*Cinclus mexicanus*) is also classified as a riverine bird and is analyzed separately with harlequin duck.

5.4.4 Results

5.4.4.1 Summary

A total of 25 water dependent bird species were positively identified in the RSA in 2008 and 2009 (Table 5.4-2; Appendices 5.4-1 to 5.4-5). Six additional species were detected that could not be identified to the species level including an unidentified scoter, merganser, loon, sandpiper, scaup, and goldeneye. Of these species observed, two are listed as species of conservation concern: harlequin duck and surf scoter (*Melanitta perspicillata*) (BC CDC 2010c). Harlequin ducks are provincially ranked as vulnerable during the non-breeding season and surf scoter is blue-listed and provincially ranked as vulnerable during the breeding season. A species of regional concern, trumpeter swan, was also observed (BC ILMB 2000).

5.4.4.2 Breeding Surveys

Species Observed

There were 312 individual birds identified representing a minimum of 14 species during the spring survey on June 2 and 3, 2008. Several individuals of an unidentified sandpiper species were also detected (Figures 5.4-1a and 5.4-1b; Table 5.4-3; Appendix 5.4-1). The majority (33%) of birds observed during the pair survey were diving ducks, which were predominately Barrow's goldeneye (*Bucephala islandica*) (Table 5.4-3). Dabbling ducks (mostly mallard (*Anas platyrhynchos*)) and Canada geese were also frequently observed, accounting for 23% and 20% of all bird recorded, respectively.

Both riverine birds were observed during spring pair surveys (Table 5.4-3). Three harlequin ducks and 15 American dippers were seen (Figure 5.4-1a or b; Appendix 5.4-1).

During the summer brood survey on July 15 and 16, 2008, 298 individual birds representing a minimum of nine species were identified. Multiple individuals belonging to unidentified loon, merganser, goldeneye, and sandpiper species were also detected (Figures 5.4-2a and 5.4-2b; Table 5.4-3; Appendix 5.4-2). The majority (40%) of birds observed during the brood survey were Canada geese, followed by diving ducks (23% of total) and dabbling ducks (19%) (Table 5.4-3). Harlequin ducks were not observed during the summer brood surveys; however, one observation of American dippers was recorded from a marsh complex near Todedada Creek (Figures 5.4-2a or b).

Table 5.4-2. Water Dependent Bird Species Observed in the RSA, 2008 and 2009

Group	Species	Scientific Name	Spring Pair	Summer Brood	Fall Staging	Spring Staging	Incidental Observation
Dabbling Duck	American wigeon	<i>Anas americana</i>			X		
	Blue-winged teal	<i>Anas discors</i>	X	X			
	Green-winged teal	<i>Anas crecca</i>	X		X		X
	Mallard	<i>Anas platyrhynchos</i>	X	X	X	X	
Diving Duck	Barrow's goldeneye	<i>Bucephala islandica</i>	X		X	X	
	Bufflehead	<i>Bucephala albeola</i>		X			X
	Common merganser	<i>Mergus merganser</i>	X		X	X	
	Lesser scaup	<i>Aythya affinis</i>	X	X	X	X	
	Hooded merganser	<i>Lophodytes cucullatus</i>				X	
	Ring-necked duck	<i>Aythya collaris</i>	X				
	Surf scoter	<i>Melanitta perspicillata</i>			X		
	White-winged scoter	<i>Melanitta fusca</i>		X			
	Unidentified goldeneye	<i>Bucephala spp.</i>		X	X		
	Unidentified merganser	-		X	X		
	Unidentified scaup	<i>Aythya spp.</i>			X		
	Unidentified scoter	<i>Melanitta spp.</i>			X		
Goose	Canada goose	<i>Branta canadensis</i>	X	X	X	X	X
Riverine Bird	Harlequin duck	<i>Histrionicus histrionicus</i>	X				X
	American dipper	<i>Cinclus mexicanus</i>	X	X			
Shorebird	Greater yellowlegs	<i>Tringa melanoleuca</i>			X		
	Solitary sandpiper	<i>Tringa solitaria</i>					X
	Spotted sandpiper	<i>Actitis macularia</i>					X
	Wilson's snipe	<i>Gallinago delicata</i>					X
	Unidentified sandpiper	-	X	X			
Swan	Trumpeter swan	<i>Cygnus buccinator</i>	X		X	X	
Waterbird	Common loon	<i>Gavia immer</i>	X		X		X
	Pacific loon	<i>Gavia pacifica</i>	X	X			
	Unidentified loon	<i>Gavia spp.</i>		X	X		X
Other	Arctic tern	<i>Sterna paradisaea</i>	X				
	Bonaparte's gull	<i>Larus philadelphia</i>		X			X
	Ring-billed gull	<i>Larus delawarensis</i>	X				

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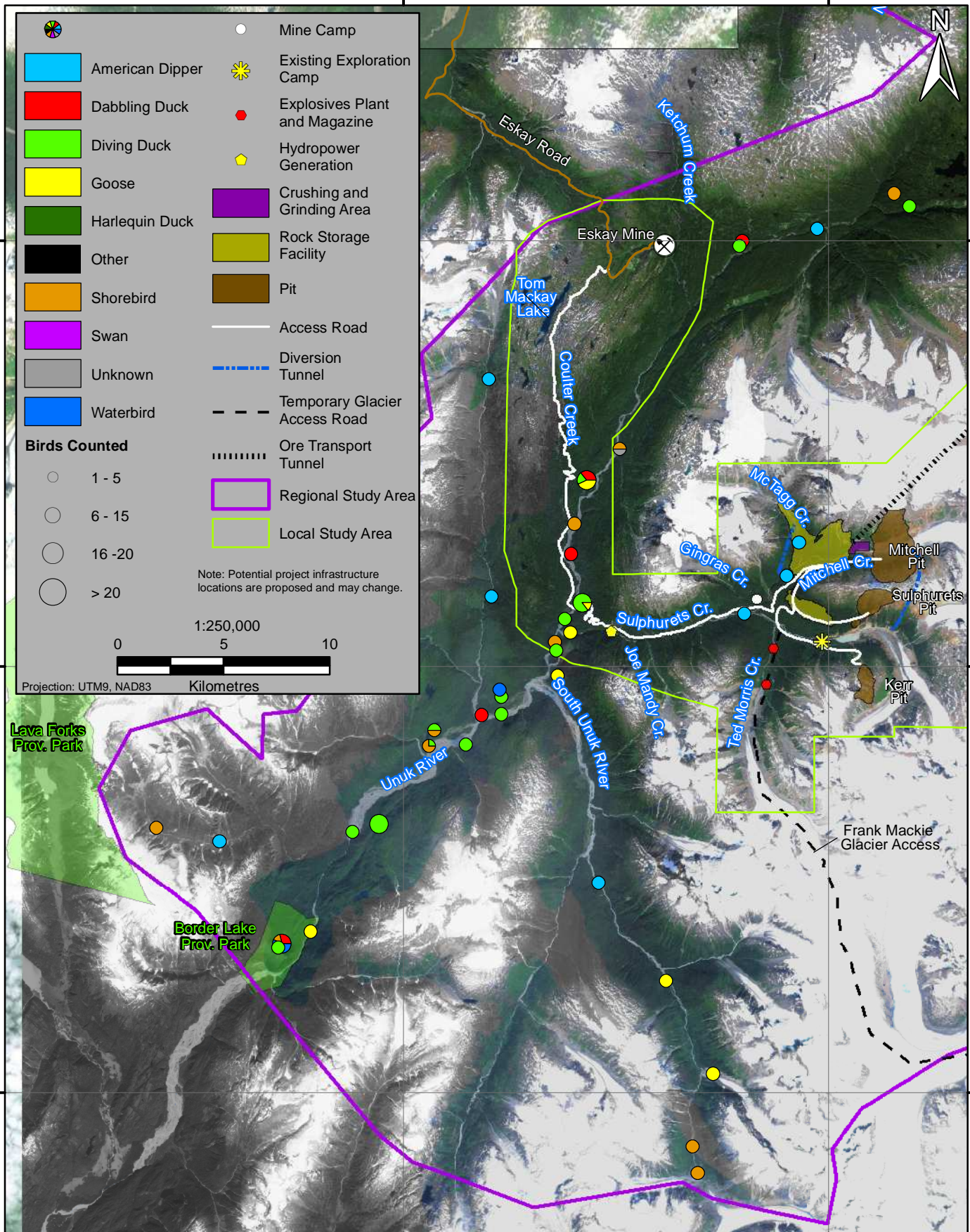
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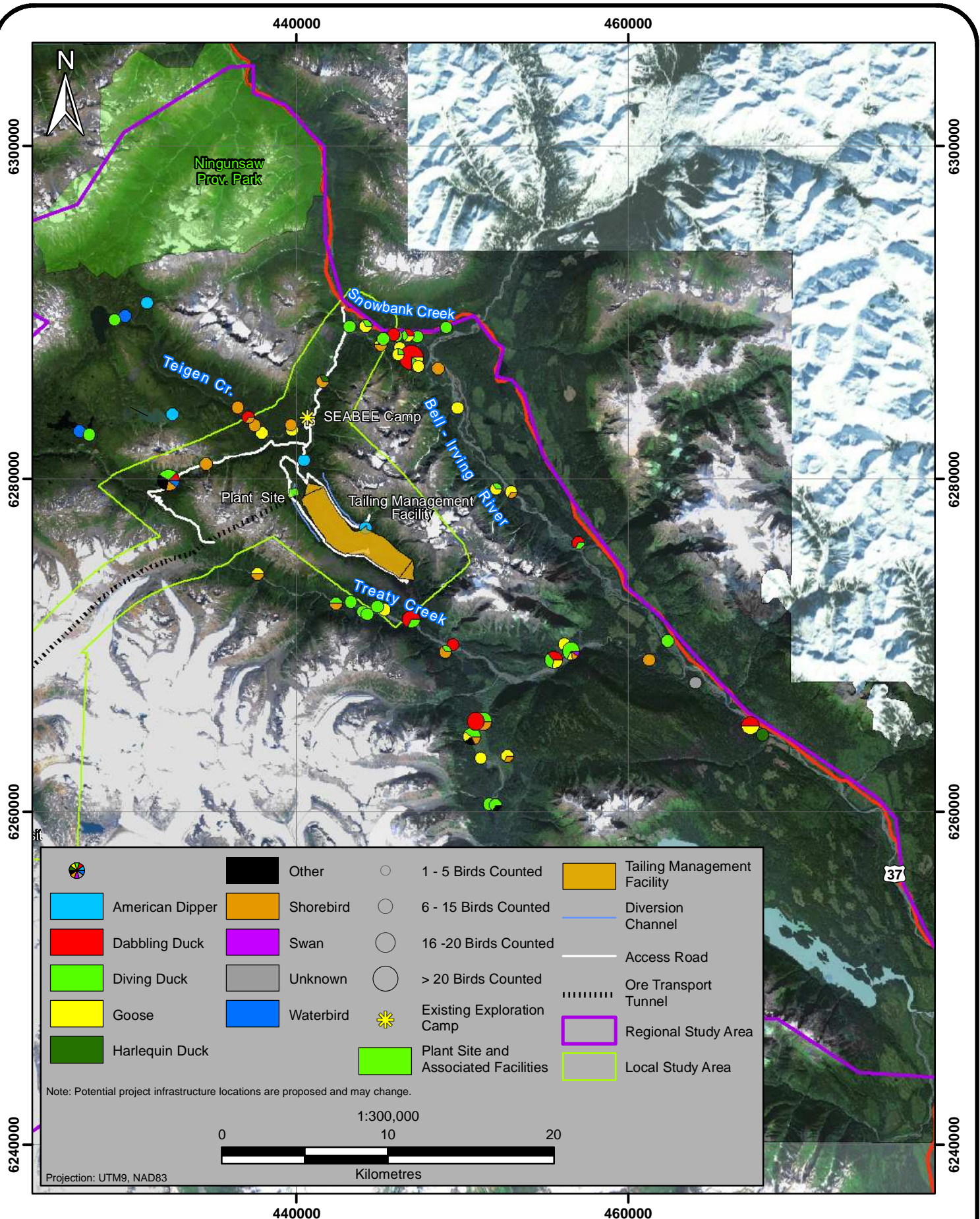


Table 5.4-3. Water Dependent Birds Observed on Breeding Surveys, 2008

Group	Species	Number of Individuals Observed	
		Pair Survey	Brood Survey ¹
Dabbling Duck	Blue-winged teal	8	1
	Green-winged teal	7	-
	Mallard	53	55
	Total Dabbler	68	56
Diving Duck	Barrow's goldeneye	85	-
	Bufflehead	-	1
	Common merganser	8	-
	Lesser scaup	4	1
	Ring-necked duck	1	-
	unknown goldeneye	-	27
	unknown merganser	-	38
	White-winged scoter	-	1
	Total Diver	98	68
Goose	Canada goose	60	118
	Total Goose	60	118
Riverine Bird	American dipper	15	2
	Harlequin duck	3	-
	Total Riverine	18	2
Shorebird	unknown sandpiper	48	36
	Total Shorebird	48	36
Swan	Trumpeter swan	1	-
	Total Swan	1	0
Waterbird	Common loon	9	-
	Pacific loon	2	2
	unknown loon	-	13
	Total Waterbird	11	15
Other	Arctic tern	5	-
	Bonaparte's gull	-	3
	Ring-billed gull	3	-
	Total Other	8	3
Grand Total		312	298

¹ Count includes young.

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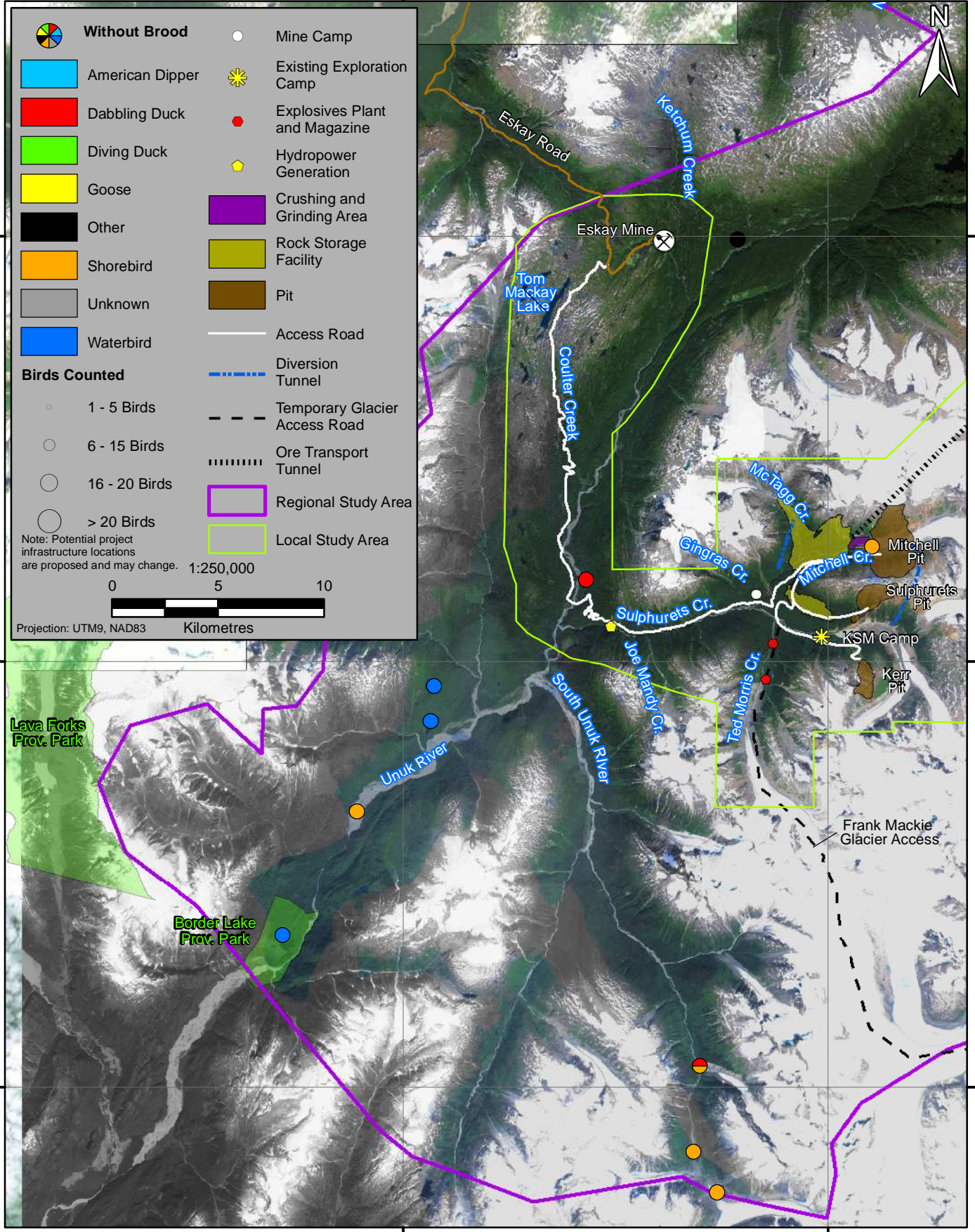
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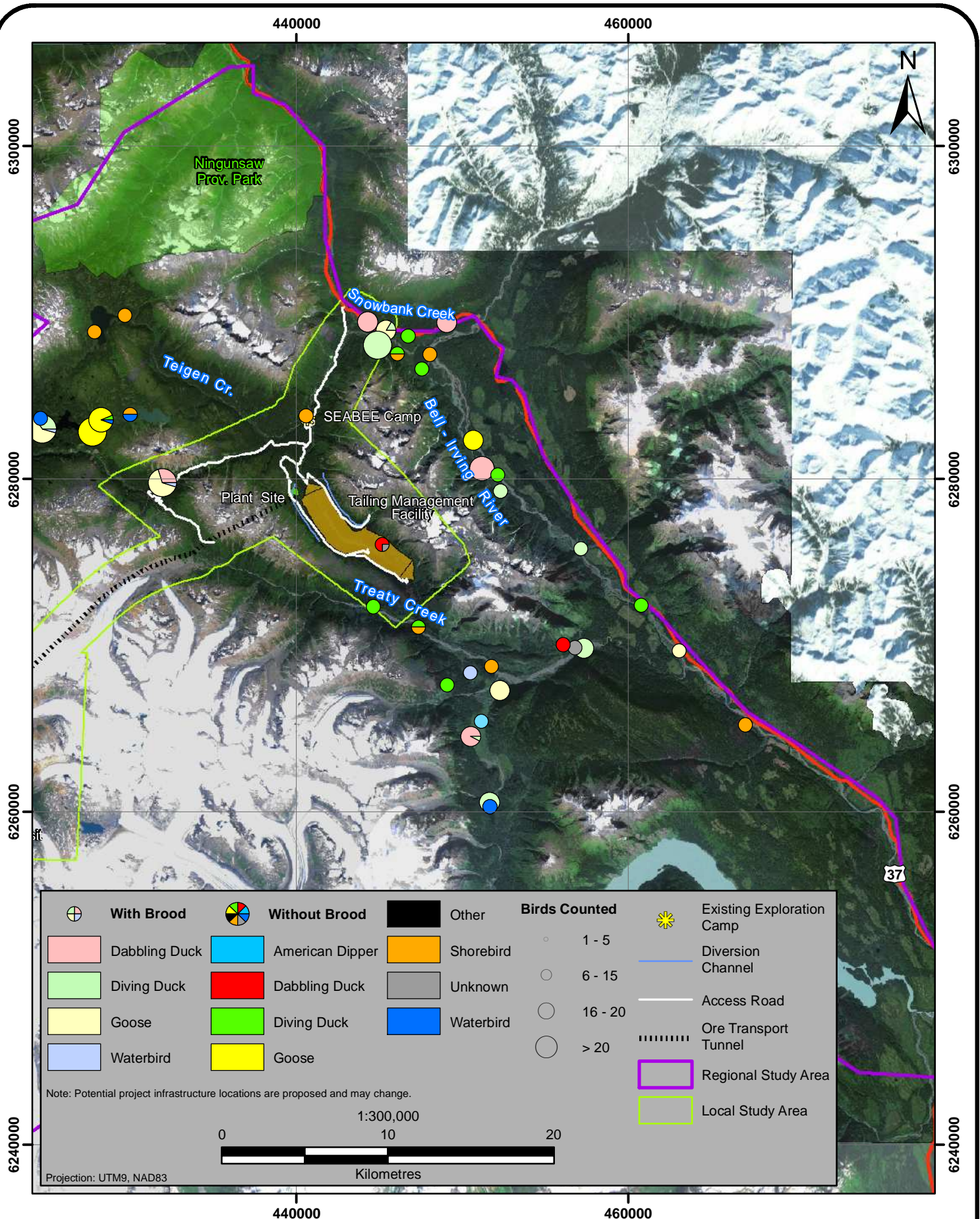
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Evidence of Breeding and Reproduction

Behavioural evidence of breeding, e.g., pair bonding activities, was recorded for seven species during the spring pair survey. Of the seven species, pair bonding was most frequently recorded for Barrow's goldeneye (18 pairs) and mallard (10 pairs) (Table 5.4-4). Although Canada geese were frequently seen during the spring survey, only three breeding pairs were positively identified (Table 5.4-4). However, activities, such as courtship displays, nest building, or copulation, are required to positively identify a breeding pair for goose species because male and female colouration are identical.

Several species for which behavioural evidence of breeding was recorded in June also had evidence of reproductive success in July (Table 5.4-4). Five mallard broods and a total of 37 ducklings were observed: brood class ranged from IA to III (Figure 5.4-3a or b; Appendix 5.4-2). Thirty-three goslings ranging from class IIA to IIC were observed across three Canada goose broods (Figure 5.4-3a or b). Eight broods were documented where the species could not be positively identified, including an unidentified merganser species (four broods), goldeneye species (three broods) and loon species (one brood). Brood class ranged from IIA to IIB for these unknown species. The distribution of waterfowl brood observations was relatively restricted to the eastern area of the RSA (and LSA), particularly along the Bell-Irving River. The reaches of lower Teigen Creek near the Bell-Irving River (area within and just outside the eastern LSA), supported nine broods. Outside the eastern LSA, Treaty Creek supported five broods and two broods were observed on Unuk Lake (Figure 5.4-2a or b).

Table 5.4-4. Evidence of Breeding Recorded During Pair and Brood Surveys, 2008

Group	Species	Pair Bonding	Reproductive Success	
		(No. Pairs)	(No. Broods)	(No. Young ¹)
Dabbler	Blue-winged teal	2	-	-
	Green-winged teal	2	-	-
	Mallard	10	5	37
Diver	Barrow's goldeneye	18	-	-
	Lesser scaup	2	1	1
	unknown goldeneye	-	3	9
	unknown merganser	-	4	33
Goose	Canada goose	3	3	12
Riverine	Harlequin duck	1	-	-
Waterbird	unknown loon	-	1	2

¹ Number of young included in total individual count in Table 5.4-3.

Habitat Associations of Breeding Water Dependent Birds

Some groups of water dependent birds selected habitat differently in June and July, whereas other were seen in the same habitat type between the two surveys. For example, waterbirds exhibited a strong habitat selection for large calm waterbodies and were only seen in lakes and ponds during both surveys (Tables 5.4-5 and 5.4-6). With the exception of a large group of dabbling ducks observed on the Bell-Irving River in June, the majority of dabblers were associated with calm, low flowing waterbodies such as marshes, ponds, and meandering river glides in both June and July. Conversely, diving waterfowl exploited a wide range of habitats in spring and a much narrower range later in the summer (Tables 5.4-5 and 5.4-6). Habitat selection recorded during the spring survey appeared to be species-specific in some cases; some diving species such as Barrow's goldeneye and lesser scaup (*Aythya affinis*) were present in deep still water while merganser presence was associated with faster flowing riverine habitats (Table 5.4-5; Appendix 5.4-1). However, in the summer the majority of diving waterfowl were seen in shallow water (ponds) and creek habitat (Table 5.4-6; Appendix 5.4-2).

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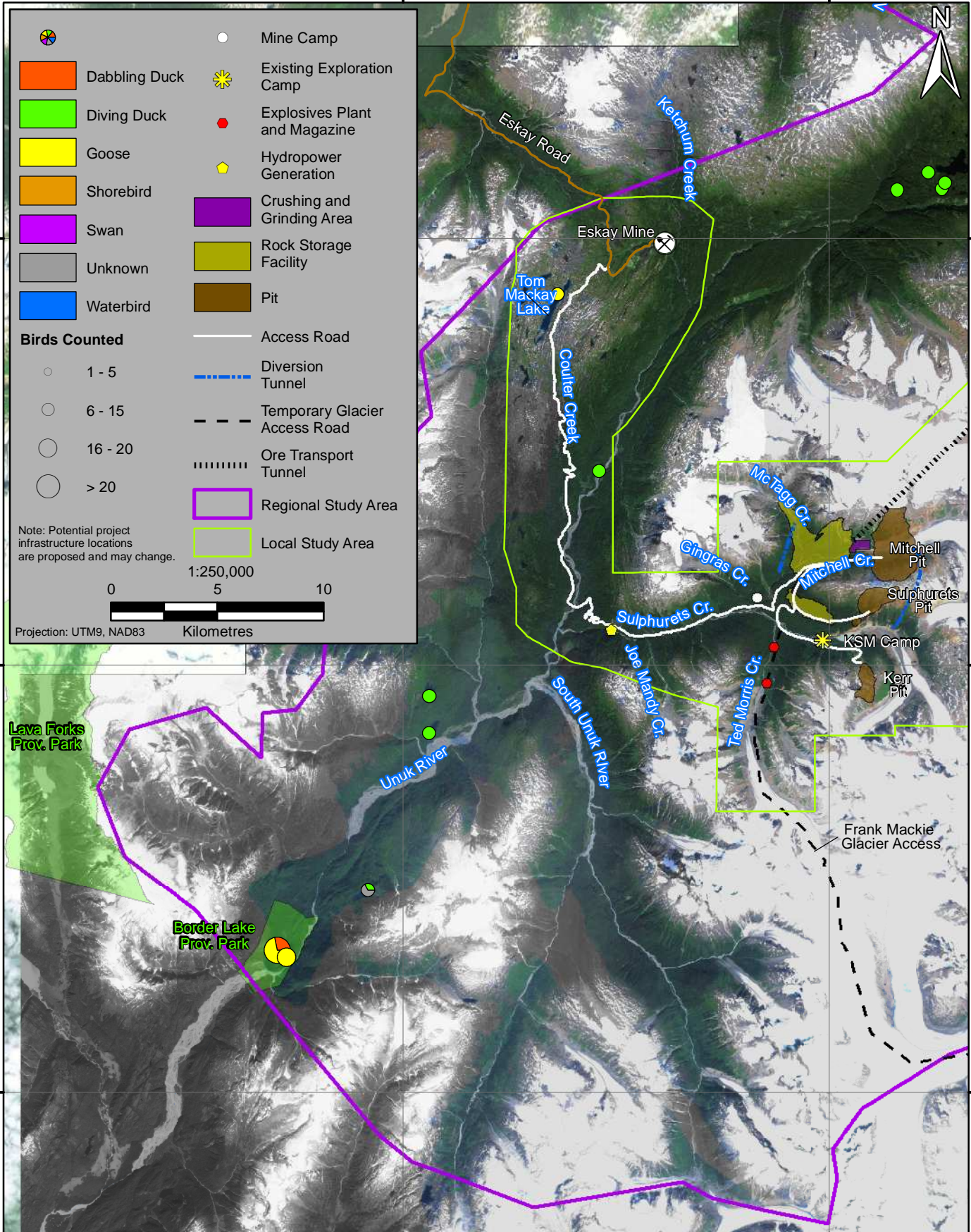
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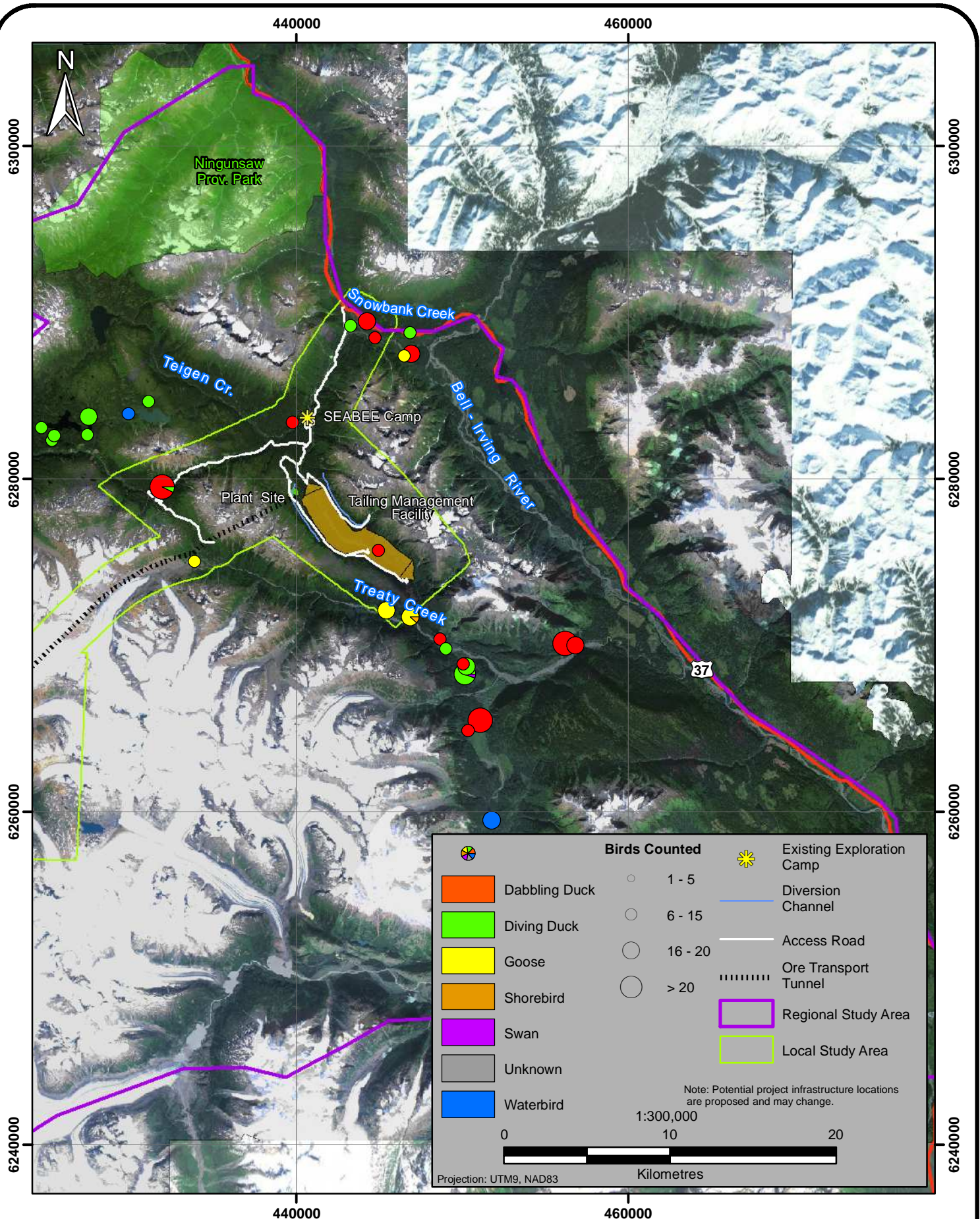


Table 5.4-5. Habitat Associations of Water Dependent Birds during the Spring and Summer

Habitat Type	Dabbler	Diver	Goose	Swan	Shorebird	Waterbird	Other	Total*
<i>Spring Pair Survey</i>								
Creek					6			6
River	28	19	23		19			89
Lake	9	38	7		9	11	6	80
Pond	6	16	13		6		2	43
Marsh	16	15	14	1	4			50
Swamp	9	10	3		4			26
Total	68	98	60	1	48	11	8	294
<i>Summer Brood Survey</i>								
Creek		27			3			30
River	1	7	15		9			32
Lake	7	8	62		24	12	3	116
Pond	23	26	36			3		88
Marsh								0
Swamp	25		5					30
Total	56	68	118	0	36	15	3	296

The observations of riverine birds during the spring and summer were associated with river and creek habitat (Appendices 5.4-1 and 5.4-2). Harlequin ducks were associated with larger stretches of the Bell-Irving River in the southeastern RSA and Teigen Creek within the eastern area of the LSA, while American dipper observations were associated with fast-flowing creeks and rivers, such as Mitchell and Sulphurets Creeks within the eastern area of the LSA (Figure 5.4-1a or b). Because of the small sample size, no further analysis regarding habitat use of riverine birds during the breeding season was conducted. Suitable habitat for harlequin ducks was noted within some the fast flowing reaches of streams and rivers on the west side of the Unuk River.

5.4.4.3 Staging Surveys

Species Observed

There were 301 individual birds identified, representing a minimum of 11 species during the fall staging survey on September 27, 2008. Individuals belonging to unidentified loon, merganser, goldeneye, scaup, and scoter species were also detected (Table 5.4-6; Appendix 5.4-3). The majority of birds observed (50%) were classified as dabbling ducks, followed by diving ducks (23%), and geese (22%). Winter/moult plumage complicated the identification of several diving duck species. Thirty-one juvenile birds were observed: 7 class III mallards, 3 unclassified common mergansers (*Mergus merganser*), 8 unidentified goldeneyes (unclassified), 2 unidentified mergansers (unclassified), and 11 unclassified loons representing either Arctic loon (*Gavia arctica*) or red-throated loon (*Gavia stellata*).

There were 126 individual birds identified, representing eight species, during the early spring staging surveys on April 26, 2009. The majority of birds observed (66%) were Canada geese, followed by diving ducks (19% of total) and dabbling ducks (9%) (Table 5.4-6; Appendix 5.4-4).

Table 5.4-6. Water Dependent Birds Observed on Staging Surveys, 2008 and 2009

Group	Species	Number of Individuals	
		Fall Staging	Spring Staging
Dabbling Duck	American wigeon	4	-
	Green-winged teal	18	-
	Mallard	128	12
	Total Dabbling	150	12
Diving Duck	Barrow's goldeneye	10	2
	Bufflehead	-	1
	Common merganser	3	8
	Lesser scaup	15	12
	Hooded merganser	-	1
	Surf scoter	7	-
	unidentified goldeneye	16	-
	unidentified merganser	7	-
	unidentified scaup	11	-
	unidentified scoter	1	-
Total Diver	70	24	
Goose	Canada Goose	67	85
	Total Goose	67	85
Swan	Trumpeter swan	1	5
	Total Swan	1	5
Shorebird	Greater yellowlegs	1	-
	Total Shorebird	1	0
Waterbird	Common loon	1	-
	unidentified loon	11	-
	Total Waterbird	12	0
Grand Total		301	126

Extent of Habitat Use by Migrating Water Dependent Birds

During the fall, the highest concentrations of avifauna were observed in calm, low flowing waterbodies within and surrounding the eastern area of the LSA near the Teigen Creek/Bell-Irving River confluence, along the Treaty Creek drainage, and surrounding Unuk Lake (Figures 5.4-3a and 5.4-3b; Table 5.4-7). However, in general, relatively fewer numbers of water dependent birds were seen in habitats within the LSA as compared to those outside the LSA (Figures 5.4-3a and 5.4-3b). The majority of birds observed in the early spring were near the Teigen Creek/Bell-Irving River confluence just outside the eastern portion of the LSA: a large congregation of birds was also observed in the southwestern RSA at Border Lake near the Alaskan border (Figure 5.4-4).

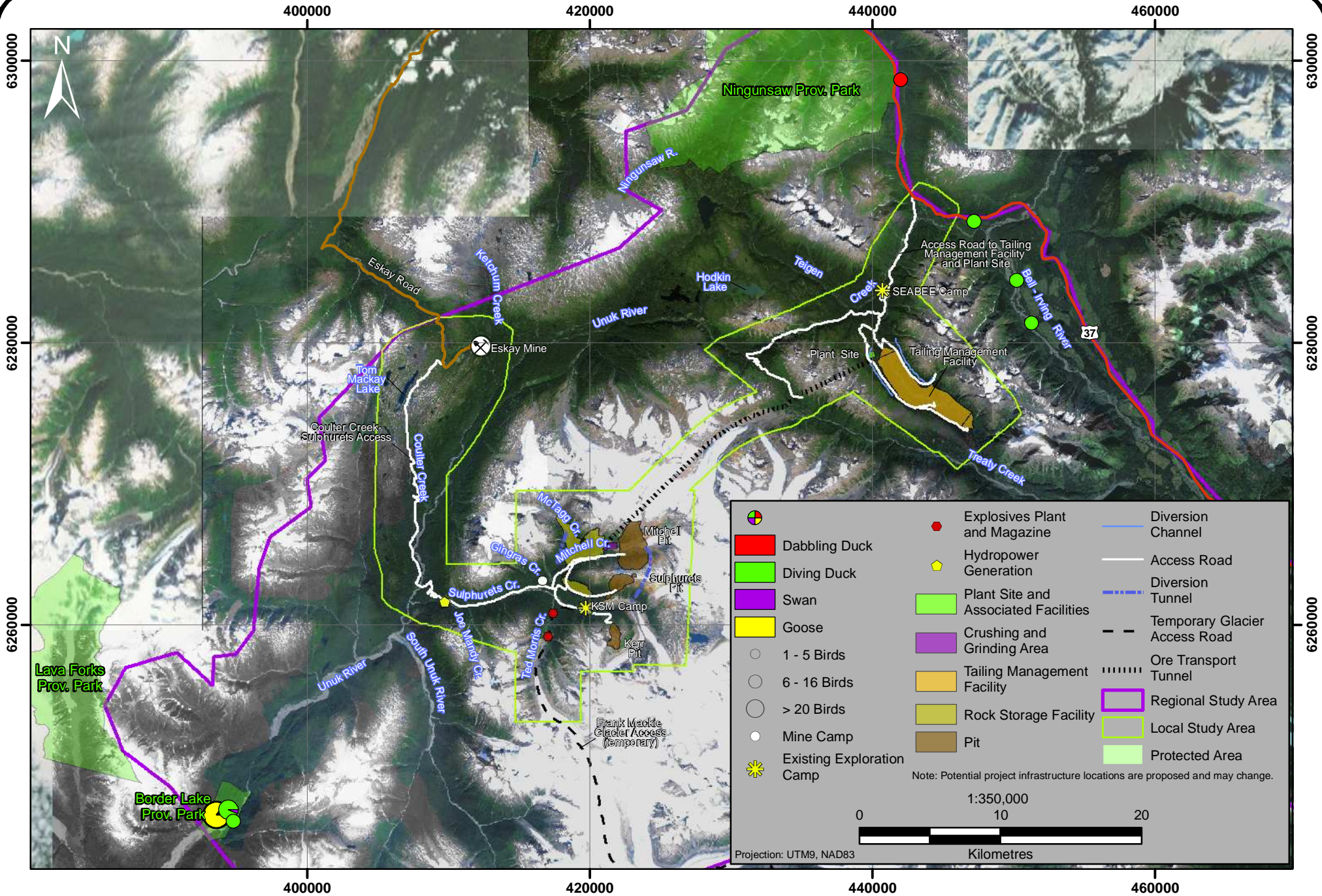
The strongest habitat affinity of migrating water dependent birds was observed in lakes: 56% of all birds were seen on lakes on the fall staging survey and 78% during the spring staging survey (Table 5.4-7). The extent of habitat use by staging birds in the spring was highly influenced by the availability of open water. At the time of the survey, only large waterbodies such as lakes and rivers were unfrozen (Plate 5.4-1).

Table 5.4-7. Habitat Associations of Migrating Water Dependent Birds

Habitat Type	Dabblers	Divers	Geese	Swans	Shorebirds	Waterbirds	Total
<i>Fall Staging Survey</i>							
Creek							0
River		3					3
Lake	64	53	41			12	170
Pond	12	6	4				22
Marsh	64	8	18	1	1		92
Swamp	10		4				14
Total	150	70	67	1	1	12	301
<i>Spring Staging Survey</i>							
Creek	2						17
River		8					8
Lake	10	15	85	5			100
Pond		1					1
Marsh							0
Swamp							0
Total	12	24	85	5	0	0	126



Plate 5.4-1. Open Water Observed on Border Lake.



5.4.4.4 Incidental Observations

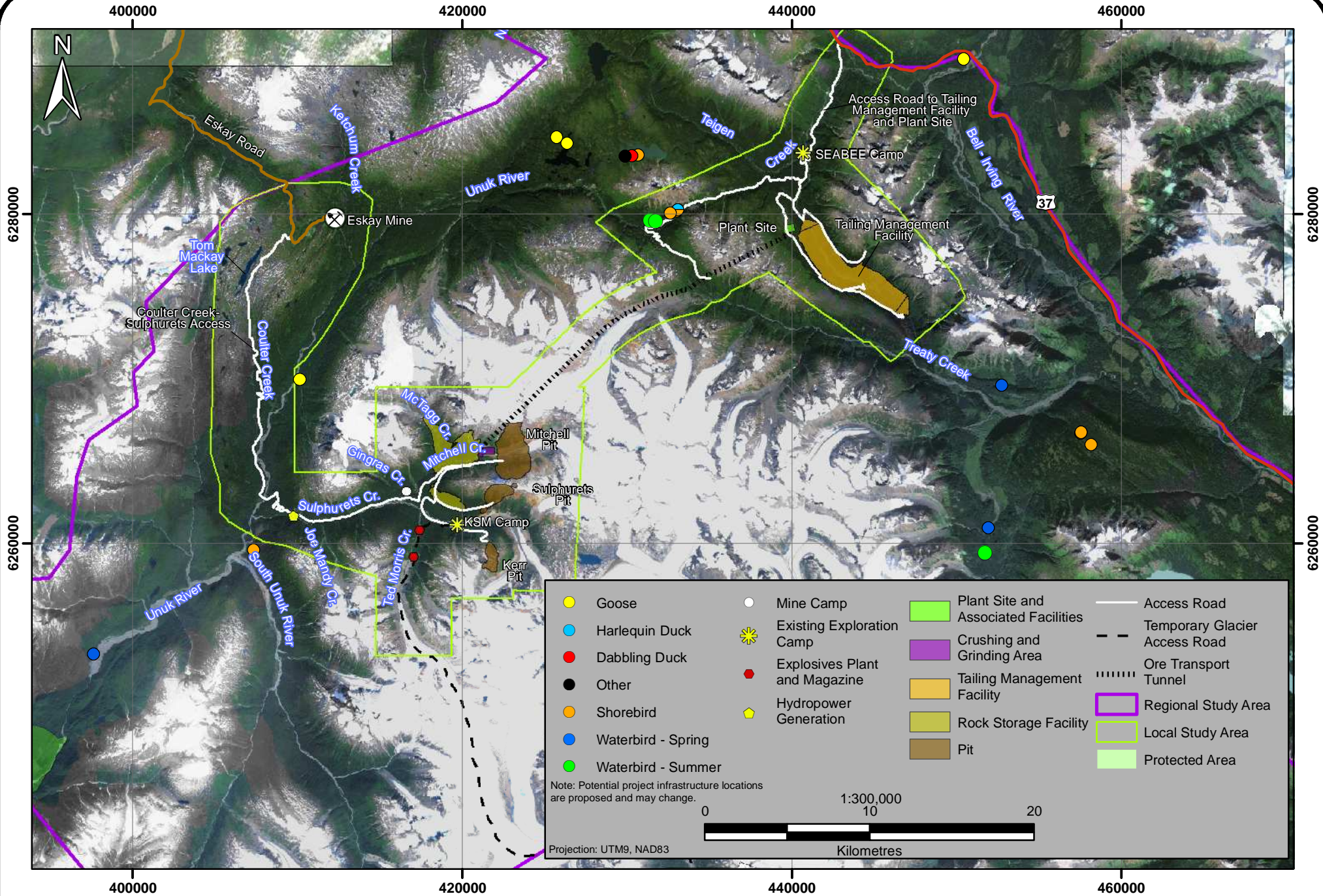
Incidental observations of water dependent birds were collected during 2008 and 2009 field studies in the RSA (Appendix 5.4-5). Ten different species were identified; one unidentified loon species was also observed (Figure 5.4-5; Table 5.4-8). Three of these species—spotted sandpiper, solitary sandpiper, and Wilson’s snipe—were not documented during aerial surveys (Sections 5.4.4.2 and 5.4.4.3).

Table 5.4-8. Incidental Observations of Water Dependent Birds, 2008 and 2009

Date	Species	Group	No. Observed
15-Jun-08	Spotted Sandpiper	Shorebird	2
15-Jun-08	Canada Goose	Goose	2
18-Jun-08	Canada Goose	Goose	10
26-Apr-09	Canada Goose	Goose	150
22-Jun-09	Unknown loon	Waterbird	1
23-Jun-09	Common Loon	Waterbird	1
23-Jun-09	Spotted Sandpiper	Shorebird	1
23-Jun-09	Green-winged teal	Dabbling Duck	1
23-Jun-09	Bonaparte's gull	Other	1
23-Jun-09	Solitary Sandpiper	Shorebird	1
25-Jun-09	Solitary Sandpiper	Shorebird	1
25-Jun-09	Solitary Sandpiper	Shorebird	1
25-Jun-09	Wilson's Snipe	Shorebird	1
25-Jun-09	Wilson's Snipe	Shorebird	1
25-Jun-09	Solitary Sandpiper	Shorebird	1
27-Jun-09	Harlequin Duck	Riverine Bird	1
27-Jun-09	Spotted Sandpiper	Shorebird	1
27-Jun-09	Spotted Sandpiper	Shorebird	1
28-Jun-09	Common Loon	Waterbird	3
29-Jun-09	Canada Goose	Goose	1
07-Jul-09	Common Loon	Waterbird	2
09-Jul-09	Common Loon	Waterbird	2
30-Aug-09	Common Loon	Waterbird	3
Total			189

The majority of observations in either year were recorded in June, corresponding to the spring breeding period for water dependent birds and the timing of the pair survey in 2008 (Figure 5.4-5; Campbell et al. 1990). A notable observation during this period was a harlequin duck female on West Teigen Creek within the eastern area of the LSA.

There were a few observations during July and August of 2009, corresponding to the summer breeding period and the timing of the brood survey in 2008 (Figure 5.4-5; Campbell et al. 1990). There was also one observation of migrating Canada geese recorded incidentally during the early spring staging survey on April 26, 2009 (Section 5.4.4.3); large groups of high flying geese were noted near Bell II (Figure 5.4-5).



Evidence of breeding was observed for two shorebird species during the spring of 2008 and 2009. On June 15, 2008, a pair of spotted sandpiper was observed on West Teigen Lake in the eastern area of the LSA (Figure 5.4-5; Table 5.4-8). In June 27, 2009, one individual and a nest with four eggs was observed in the same area (Figure 5.4-5; Table 5.4-8; Plate 5.4-2a). On June 23, 2009, an adult solitary sandpiper and a nest with four eggs was observed near a small wetland adjacent to the Unuk River just outside the western LSA (Figure 5.4-5; Table 5.4-8; Plate 5.4-2b).



(a) Spotted Sandpiper Nest recorded at West Teigen Lake.



(b) Solitary Sandpiper Nest recorded near the Unuk River.

Plate 5.4-2. Shorebirds Nest Sites Observed in June, 2009.

5.4.5 Discussion

5.4.5.1 Species Observed

The RSA supports a diversity of waterfowl species similar to what has been observed elsewhere in the region (RTEC 2006a, 2007a). Common species that migrate through northern BC, such as northern pintail (*Anas acuta*), gadwall (*Anas strepera*), and greater white-fronted goose (*Anser albifrons*) (RTEC 2006a, 2007a), were not observed during this study. Three species identified in the RSA are of regional or provincial conservation concern: harlequin duck, surf scoter, and trumpeter swan (BC ILMB 2000; BC CDC 2010c). Harlequin ducks were observed on the Bell-Irving River (one pair), Teigen Creek (one drake), and West Teigen Creek (one female) during the spring (Figures 5.4-1b and 5.4-5). A group of seven surf scoters were seen on Treaty Creek during the fall (Figure 5.4-3b). Trumpeter swans were detected on three of the four aerial surveys conducted in 2008 and 2009, including both of the staging surveys and the spring pair survey; all observations of swans were recorded outside of the LSA. One individual swan was observed during the spring pair survey, and another individual was observed during the fall staging survey in 2008, both on Treaty Creek. Five swans were observed on Border Lake during the spring staging survey in 2009 (Figure 5.4-1b, 5.4-3b, and 5.4-4).

Emphasis was placed on identifying the presence and distribution of harlequin ducks during aerial surveys as this species was identified as requiring conservation consideration within the BC Conservation Framework (BC MOE 2009; BC CDC 2010c). The number of individuals and amount of breeding evidence observed were less than predicted, given the results of other studies in the region (RTEC 2006a, 2007a). Aerial surveys, particularly helicopter surveys, are the recommended method for inventorying harlequin ducks in BC (RIC 1998d). However, the method has acknowledged drawbacks. On breeding streams, aerial surveys can be hampered by tree cover, terrain, vegetation, observer bias, and water hydraulics, which all can reduce visibility of harlequin ducks (RIC 1998d). Additionally, noise disturbance from aerial surveys

is known to cause avoidance behaviour in harlequin ducks (Goudie 2006), and these effects can be exacerbated when adults have young to protect, or if young react more strongly to overhead noise. Coordinated ground-based studies on breeding streams indicate that between 30% and 50% of birds can be missed during aerial surveys (Freeman and Goudie 1996; RIC 1998d). Therefore, the apparent lack of harlequin duck presence and productivity observed during baseline studies in 2008 and 2009 does not result from a lack of suitable harlequin duck breeding habitat. Suitable habitat was noted in several areas, including the Bell-Irving River and King Creek (S. Freeman, pers. obs). RISC (1998d) states that all harlequin pairs detected on surveys should be considered to be potential breeding pairs. Studies have shown that harlequin ducks nest within the same watersheds occupied by pairs and females exhibit some fidelity to nesting areas over the years (Freeman and Goudie 1996; Freeman and Goudie 2001). Thus, local breeding populations may occur in the RSA.

5.4.5.2 *Habitat Use in the RSA*

Breeding Habitat

Water dependent birds were fairly evenly distributed across habitat types in the study area in the spring, whereas the distribution of birds became confined to certain areas later in the summer. However, there were several areas identified as having a prevalence to host breeding water dependent birds in the spring and summer. Concentrations of a diversity of species were identified in wetland complexes (marshes, swamps, and ponds) associated with the confluence of the Teigen Creek and Bell-Irving River within and surrounding the eastern area of the LSA, particularly during the spring (Figure 5.4-1b and 5.4-2b). Outside the LSA, Treaty Creek and associated drainages (e.g., Todedada Creek) were also areas where a number of water dependent birds were observed on both surveys (Figure 5.4-1b and 5.4-2b). Overall, there appears to be a limited amount of breeding habitat within the LSA that was used consistently by water dependent birds during and between surveys. Wetlands and marshes of the eastern area of the LSA did provide habitat for waterfowl and shorebirds, and a number of waterfowl broods were observed in the area surrounding Bell II. However, the habitat associated with the western area of the LSA, e.g., Mitchell and Sulphurets drainages around the proposed mine site, does not provide good breeding habitat for the majority of water dependent species; only American dippers were observed within this area.

In general, a wider range of habitats were used in the spring than in the summer (Table 5.4-3). This is to be expected as pairs, and females in particular, require substantial nutrients during the breeding season. While many species build up fat reserves in the winter before breeding, some studies have found that foods consumed just before nesting and egg laying may help to support breeding waterfowl through incubation (Krapu and Reinecke 1992). As such, most water dependent birds during the time of the pair survey would be using habitats to gain resources. This is generally supported by the results. Most dabbling ducks were associated with slow moving waters (e.g., swamps, marshes) where there is a proliferation of macroinvertebrates and aquatic vegetation. Loons were associated with large, still waterbodies (lakes), likely those that contained fish, as loons are piscivores (fish-eating) (Mcintyre and Barr 1997). Other piscivorous species, such as mergansers, were observed more frequently in fast flowing rivers, which likely also provide excellent fish habitat. For example, the Unuk River is known to support a variety of fish species (Rescan 2010e).

Lakes, ponds, and marshes were identified as the areas of greatest importance to water dependent birds with young. Many water dependent birds, waterfowl in particular, select the margins of slow moving or still waterbodies as nesting habitat (R.W. Campbell et al. 1990). Some species, such as goldeneye species and buffleheads, nest in tree cavities that are naturally formed or excavated by woodpeckers. Cavity-nesting waterfowl species may therefore breed in treed areas near the water, but may also breed up to 800 m from the water in forested habitat (Pierre, Bears, and Paszkowski 2001).

Cavity-nesting waterfowl require habitat with sufficiently old forest with trees of a large diameter (usually softened by fungal degradation), and woodpecker activity within 1 km of waterbodies. The location of suitable nesting habitat may be extrapolated from the presence of young. Families will usually be seen in aquatic habitat in the general vicinity of nest sites until the young are capable of flight (50 to 60 days after hatching). Wetlands associated with the lower 5 km of Teigen Creek near the Bell-Irving River confluence supported the densest accumulation of broods within any area of the RSA; this area encompasses and surrounds the eastern area of the LSA. Off channels and wetlands along the Bell-Irving drainage also supported several waterfowl broods. Thus, these areas support suitable nesting habitat for water dependent bird species.

Staging Habitat

The results of staging surveys indicate that the larger RSA contains more usable habitat for staging birds on their winter migration as opposed to those migrating northwards; fewer species and less than half of the total number of birds were recorded during the spring staging survey than on the fall survey. The LSA does not appear to support a large amount of habitat that may be used by migrating waterfowl; relatively fewer birds were observed within the LSA during both spring and fall staging surveys. The timing of the spring survey was appropriate to capture species moving north, as several high flying flocks of Canada geese (~150 individuals) were detected incidentally near Bell II during the survey.

For the majority of waterfowl and waterbirds that breed in the region, habitats used in preparation for winter migration occur relatively near breeding habitat. A range of freshwater habitats are used to gather the nutrient requirements to begin a southward migration. Species that breed farther north (e.g., greater white-fronted goose) may temporarily stop over in inland habitats as well. Areas that were occupied during the fall staging survey included both habitat within the RSA (Unuk Lake and Treaty Creek) and within the LSA (near the Teigen Creek/Bell-Irving River confluence). In the southwestern RSA, Border Lake and wetlands surrounding the lower Unuk River near the Alaskan border also supported a number of individuals (47) during the survey period. While waterfowl and waterbirds generally exploit inland habitats for staging, shorebirds and some species of diving ducks (scoter spp.) move to coastal and estuarine habitats during the post-breeding season. Shorebirds stage on tidal flats and estuaries, where they forage for aquatic invertebrates to build up sufficient fat stores for migration.

Spring staging areas are important for a number of reasons. Some water dependent species, such as shorebirds, cannot build up sufficient resources during the winter to complete migration and use stopover points (i.e., staging areas) to forage and acquire additional fat reserves along the way (Scott, Mitchell, and Evans 1994). Other species, including geese, are less constrained to stop during migration as they built up fat reserves during the overwintering period to sustain themselves during migration (Krapu and Reinecke 1992). However, most species do stop at some point during the northward migration to rest and build up depleted nutrient reserves.

The extent of habitat use by staging water dependent birds in the spring was very limited. Border Lake and nearby wetlands supported over 90% of the species observed during the spring staging survey, of which all were waterfowl. Considering its proximity to the coast and low elevation, Border Lake becomes ice free before most areas in the RSA. Evidence recorded in migrating Canada geese showed that the timing of migration corresponded to the northward expansion of the 16° isotherm (Lincoln, Peterson, and Zimmerman 1998). By following the progression of warmer spring temperatures northwards, the birds could ensure that there are open water areas available for foraging. Thus, areas that become ice free early in the spring are important for migrating water dependent birds. Border Lake and nearby areas could be used as a staging area on an annual basis, depending on climatic conditions.

6. Amphibian Community

6.1 OVERVIEW

Four amphibian species have been identified in the section of the coast range where the KSM Project is proposed: the relatively common Columbia spotted frog (*Rana luteiventris*), the long-toed salamander (*Ambystoma macrodactylum*), the wood frog (*Lithobates sylvaticus*), and the western toad (*Anaxyrus boreas*). Columbia spotted frog, long-toed salamanders, and wood frogs are yellow listed ('secure but with conservation concern') in BC and considered Not at Risk by COSEWIC, with the wood frog not being assessed to date by COSEWIC. Western toads are yellow listed in BC, but are a species of Special Concern under COSEWIC. Hence, the wildlife characterization baseline for amphibians focuses on western toad.

6.2 WESTERN TOAD

6.2.1 Introduction

Historically, western toads occurred throughout much of western North America (Lannoo 2005). Their distribution has always been patchy and currently populations are widespread at low densities from southern Alaska and the Yukon south across British Columbia, west-central Alberta, and the western United States. Western toad was known as *Bufo boreas* before 2006, when it was reclassified into the *Anaxyrus* genus (Frost et al. 2006). For the purposes of this report, *Bufo* and *Anaxyrus* are equivalent.

Western toad population declines have been documented in southern BC. The extent of their current distribution in BC is unknown, but the central and northern part of the province represents a stronghold for the species (Davis 2002). The western toad is protected under the British Columbia *Wildlife Act* (1996a), which states that western toads cannot be killed, collected, or held in captivity without a permit. It is also listed as a species of special concern according to COSEWIC and is present on Schedule 1 of SARA, on the basis of rapid population declines in southern parts of the species' range and the species' vulnerability to habitat deterioration (COSEWIC 2002). It requires monitoring under section 79(2) of SARA. It is also present on the red list published by the International Union for Conservation of Nature (IUCN; Hammerson, Santos-Barrera, and Muths 2004). The particular set of ecological characteristics of western toads makes them more vulnerable to threats than other amphibians. These characteristics include seasonal aggregations, metapopulation dynamics, fluctuations in breeding success, high turnover rates, migratory behaviour, physiological specialization, dependence on ephemeral pond habitats, and toxicological sensitivity (Pyare 2005).

Western toads are one of the few amphibian species to occupy alpine areas, occurring from sea level up to 3,660 m elevation (Wind and Dupuis 2002). Western toads require a variety of terrestrial and aquatic habitats to complete different stages of their life cycle: spring breeding, summer foraging, and winter hibernation. Toads migrate over relatively long distances each spring from their winter terrestrial hibernation sites to aquatic breeding sites, and then to forested feeding sites during the summer. The onset of breeding is thought to be linked to the timing of snowpack melt (Pyare 2005) and the average daily minimum and maximum temperatures (Gyug 1996). Within the northern regions of the province, the initiation of breeding most likely occurs in June. Toads are capable of travelling over five kilometres to breeding sites and occasional long distance excursions of up to 7.2 km have been noted (Davis 2002). Adult toads dispersing from breeding sites to summer foraging and hibernation areas may travel several kilometres; however, toadlets do not appear to move more than 200 m to 300 m from their natal site within the first year (Pyare 2006). Migrations are typically

conducted over several days and a significant proportion of a local population can cross roads near breeding sites within a few hours of each other.

6.2.2 Objectives

Considering the conservation status of western toads and its potential sensitivity to development, a study was required to assess the distribution and breeding status of toads within the wildlife study area. Specifically, the objectives of the western toad survey were to:

- conduct an aerial reconnaissance for ponds with a high probability of toad breeding; and
- survey ponds on the ground along proposed road routes, mine site, and TMF to document evidence of western toad breeding.

In BC, one of the greatest concerns for western toads is habitat fragmentation, specifically potential barriers to migration routes to and from breeding ponds. Roads create a significant barrier to movement (Carr and Fahrig 2001). Thus, barriers to movement occur on a localized scale around roads or infrastructure. Surveys to identify current and potential toad breeding sites were primarily focused within one kilometre of all proposed infrastructure and road routes (i.e., within the LSA).

6.2.3 Methods

6.2.3.1 Aerial Survey

An aerial reconnaissance survey was conducted on August 14, 2008 to identify potential breeding sites along the Project access roads and within the proposed plant site and TMF. Breeding habitat requires open water deep enough to prevent drying out before tadpole metamorphosis, but with sufficient shallow areas (<0.5 m) to support egg-laying. Wetland areas that have limited tree canopy, relatively shallow water, and a low level of water flow through the site have the site characteristics to support breeding (Pyare 2005). Breeding can take place in temporary ponds, including large puddles, roadside ditches, and irrigation ponds. However, ephemeral waterbodies usually lack thermal and predatory cover for developing larvae and these habitats often function as “ecological sinks” in that they may dry up before tadpoles metamorphose and cause tadpole mortality (C. E. Stevens, Paszkowski, and Stringer 2006).

Wetlands (i.e., survey sites) were geo-referenced with a Garmin GPSMAP 60Cx (advertised accuracy ± 10 m) and assigned to wetland classes based on the Canadian Wetland Classification System (National Wetlands Working Group 1997) (Table 6.2-1) and other hydrodynamic and vegetative characteristics (MacKenzie and Moran 2004) (Table 6.2-2). In addition, photographs were taken for each site. Each pond was also rated for overall habitat quality on a scale between one to four; one being unlikely and four being a good quality toad site. Good quality breeding sites were those ponds with open canopy, areas of muddy banks, shallow ponds, and ponds with a low rate of water flow (rated Sluggish (2); Table 6.2-2).

6.2.3.2 Ground Surveys

Wetland Habitat Assessment

A subset of wetlands and ponds identified during the 2008 aerial reconnaissance survey were surveyed from the ground on August 14 and 17, 2008 and from August 3 to 6, 2009. Survey locations were selected based on the habitat quality rating assigned during the aerial survey. Like the aerial survey, wetlands were classified according to provincial wetland indices for hydroperiod and vegetation associations (Tables 6.2-1 and 6.2-2). Observers also measured 16 biotic and abiotic environmental and

habitat characteristics at each site, which are listed in Table 6.2-3. Sites were described, photographed, geo-referenced, and subsequently searched for western toad breeding and adult occupancy (see following section).

Table 6.2-1. Canadian Wetland Classification System

Wetland Type	Characteristics
Bog	Dense layer of peat, acidic, low nutrient content, water table at or near the surface, usually covered with mosses, shrubs and sedges, trees possibly present.
Fen	Covered with peat, water table at or near the surface, higher nutrient content than bogs, trees and shrubs may be present, similar to bog but supports marshy vegetation (sedges, grasses, rushes).
Swamp	Stagnant or slow-flowing pool, high nutrient content, similar to marsh but characterized by dominance of trees or shrubbery (usually >30% cover).
Marsh	Periodically or permanently flooded, mosaic of emergent vegetation, usually high nutrient content, similar to swamp but <30% cover.
Shallow open water	Transitional between saturated/seasonally wet and aquatic ecosystems (i.e., lakes); include basins, pools and ponds, as well as wetlands found beside rivers, coastlines and shorelines, submerged vegetation, floating leaved plants.

Table 6.2-2. Hydrodynamic and Vegetative Wetland Characteristics

Hydrodynamic Category	Organic Matter Accumulation	Bryophytes	Water Regime
Stagnant (1)	Abundant	High	Surface saturation, minimal to no surface flooding
Sluggish (2)	Abundant	Abundant	Semi-permanent soil saturation
Mobile (3)	Abundant (deep)	Patchy cover	Adjacent to open water tracks, ponds, rivulets, or potholes with stable water regimes
Dynamic (4)	Low	Few	Wave-exposed shores or flood-plain back channels
Very dynamic (5)	None	None	Wave-exposed shores, or directly adjacent to river flow

Table 6.2-3. Abiotic and Biotic Site Characteristics

Characteristic	Description
<i>Abiotic</i>	
Location	UTM coordinates of site
Elevation	M above sea level
Observers	Person(s) who collected the data
Clouds	Clear and sunny, partially cloudy, or overcast
Rain	No rain, drizzle, or raining
Air Temperature	Measure air temperature
Water Temperature	Measure water temperature at a depth of 0.2 m, 0.5 m from shore
Size (m X m)	Length x width (as estimated with a rangefinder)
Water Flow	1=stagnant, 2=sluggish, 3=mobile, 4=dynamic, 5=very dynamic
Water depth (cm)	Measure water depth 0.50 m from edge
Substrate depth (cm)	Measure substrate depth 0.50 m from edge
Tannin	0=clear, 1=slightly stained brown, like weak tea (common in peatlands)

(continued)

Table 6.2-3. Abiotic and Biotic Site Characteristics (completed)

Characteristic	Description
<i>Biotic</i>	
Wetland type	Assigned to one of the five major wetland types: bog, fen, marsh, or shallow open water (MacKenzie and Moran 2004)
Muddy substrate	Presence of a muddy bank or bottom
% Canopy	Estimate of the % of waterbody edge with canopy cover >10 m high
Canopy type	Forest, shrubs, open, etc.
Canopy open?	Wetland without surrounding canopy
Canopy set back?	Wetland with canopy, but canopy set back from pond at least the height of the canopy trees
Canopy dense, dark?	Canopy close to the wetland and casting a shadow on the water
Fish Present?	Yes, no, or unknown
Water Level Variable?	Whether or not the site has a variable water level (i.e., evidence of flooding)
Edge Type	Proportion of waterbody shoreline belonging to each type, which is characterized as the amount that is visible during ground or aerial surveys.
% mud	% muddy or silty materials (i.e., no vegetation)
% shrubs	% small shrubby vegetation (e.g., <i>Salix</i> spp.)
% gravel	% gravel/rocky materials (i.e., no vegetation)
% sphagnum/bog	% sphagnum or peat vegetation (i.e., loose shoreline)
% dense sedges/ aquatic vegetation	% in water aquatic vegetation (e.g., <i>Carex</i> spp., rushes, pond lilies)
% other	
Bank Slope	Proportion of waterbody edge with edge gradient, ranked on scale of 1 to 5
1 - mudflats	gradient < 10°
2 - gentle slope	gradient 10 to 30°
3 - moderate slope	gradient 30 to 50°
4 - steep slope	gradient 50 to 70°
5 - drop off	Drop off from aquatic vegetation or hard bank, gradient >70°
6 - other	
Vegetation type	Proportion of area (waterbody edge, aquatic survey area) with vegetation in each type
Emergent	Proportion of edge with emergent vegetation
Floating	Proportion of aquatic survey area with floating vegetation (i.e., lily pads, duckweed)
Submerged	Proportion of aquatic survey area with submerged vegetation

Amphibian Presence/Absence

Field methods for detecting amphibian species were adapted from standard amphibian sampling techniques and western toad monitoring programs (Crump and Scott 1994; Leonard, Bury, and Olson 1997; Pyare 2005). Survey timing reflected the period when western toad breeding is easiest to observe, as toadlets often aggregate along margins of waterbodies during the late summer (Plate 6.2-1). Observers searched shorelines, waterbodies, and terrestrial habitat adjacent to the pond margin using the Visual Encounter Survey (VES) technique and net sweeps to locate evidence of breeding (i.e., tadpoles and emerging toadlets). Observers did not communicate with each other for the duration of the timed survey, and they independently recorded presence/not detected data.

Amphibians were identified and classified into two broad life stages: breeding (tadpole, metamorph/toadlet and yearling) or adult (>2 years of age). Photographs were taken whenever possible. Amphibians were handled using powder-free latex gloves, and standard protocols were followed to sterilize field gear to minimize the transference of pathogens (i.e., chytrid fungus) and toxins (i.e., insect repellent, hand moisturizers).



Plate 6.2-1. Western toad tadpole aggregation.

Disease Screening

The western toad, like many amphibians, is subject to the introduced pathogen chytrid fungus (*Batrachochytrium dendrobatidis*). This study investigated whether chytrid fungus is present in the study. All captured amphibians were screened for evidence of malformations and signs of disease, including:

- abnormal posture;
- abnormal behaviour (i.e., lethargy, lack of flee response); and
- abnormal appearance (i.e., thickened epidermis, sloughing of skin surface, abnormal mouth parts).

Disease screening techniques followed the methodology developed by the Amphibian Research and Monitoring Initiative (Galvan 2006; Pyare 2006)

6.2.4 Results

6.2.4.1 Overview

The aerial reconnaissance survey was completed successfully along all of the potential road routes and in each of the proposed infrastructure locations. The ground survey did not find any evidence of toad breeding during 2008. These results, in combination with lower-than-expected toad breeding observations conducted by the surveyor elsewhere in northern BC, led to the early termination of the 2008 ground surveys. Surveys during 2009 re-sampled several high-quality ponds that were surveyed during 2008 and several new ponds, and recorded three sites with toad breeding in the LSA.

6.2.4.2 Aerial Survey

During an aerial reconnaissance of road corridors and infrastructure locations on August 14, 136 ponds were examined for characteristics that would indicate their ability to support toad breeding (Figure 6.2-1; Appendix 6.2-1). Most wetlands in the study area were at high elevation (~970 m) and were classified as either lakes, fens, or bogs with deep water (>2 m). These characteristics result in cold water temperature and thus received low habitat ratings for toads (Figure 6.2-1; Appendix 6.2-1).

6.2.4.3 Ground Surveys

Wetland Habitat Assessment

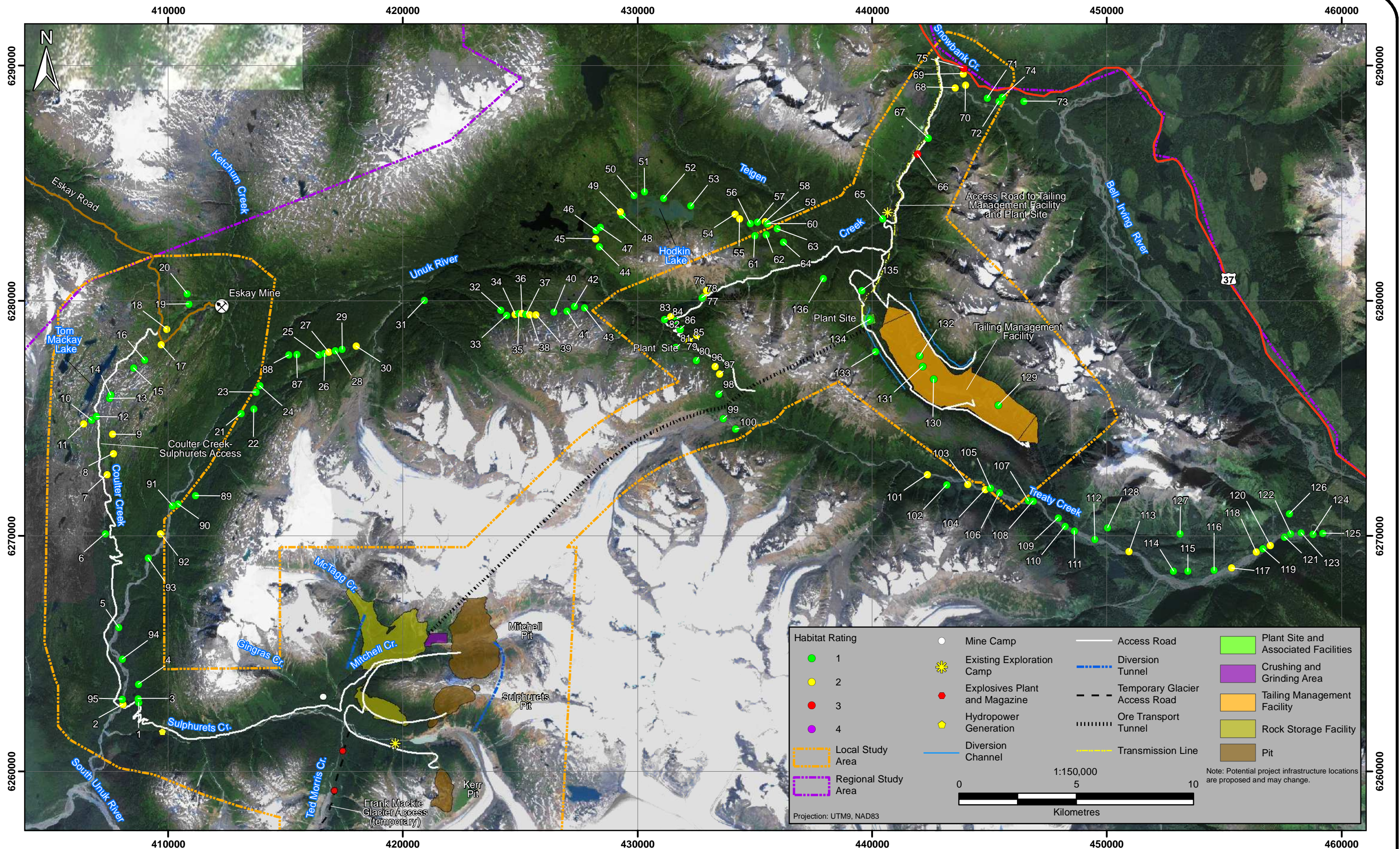
Surveyors visited 21 wetlands on August 14 and 17, 2008 (Figure 6.2-2; Appendices 6.2-2 and 6.2-3). Six of these sites and 44 new sites were visited from August 3 to 6, 2009 (Figure 6.2-2; Appendices 6.2-2 and 6.2-3). Of the 21 wetlands surveyed in 2008, the majority (67%) were classified as fens (Table 6.2-4; Appendix 6.2-3). Similar results were achieved in 2009, where 27 of the 44 new sites sampled (61% of total) were in fens (Table 6.2-4; Appendix 6.2-3). A few wetlands visited in 2008 and 2009 did not fit the Canadian Wetland Classification; these were mostly larger waterbodies such as lakes or ponds or side channels of larger watercourses (e.g., streams or rivers) (Table 6.2-4). Several sites visited in 2009 were due to recent beaver activity and were assigned a "beaver pond" class.

Table 6.2-4. Wetland Classification at Ground Survey Sites, 2008 and 2009

Wetland Classification	No. Sites Visited	
	2008	2009
Alpine Pond/Lake	3	0
Beaver Pond	0	8
Bog	2	0
Fen	14	27
Lake	2	3
Marsh	0	1
Watercourse (stream/river)	0	3
Swamp	0	2
Total	21	44

Amphibian Presence/Absence

One amphibian species, Columbia spotted frog, was observed during the 2008 ground surveys (Table 6.2-5; Appendix 6.2-4); 11 individuals were detected across 4 locations, all of which were classified as fens (Appendix 6.2-4). While no other amphibians were recorded during ground surveys in 2008, two western toads and one wood frog (*Lithobates sylvaticus*) were recorded incidentally during TEM fieldwork later in August 2008 (Figure 6.2-3). A toad was also observed at the existing KSM camp location near Sulphurets Creek by the TEM crew and camp personnel (Figure 6.2-3). These observations confirmed the presence of western toad in the LSA.



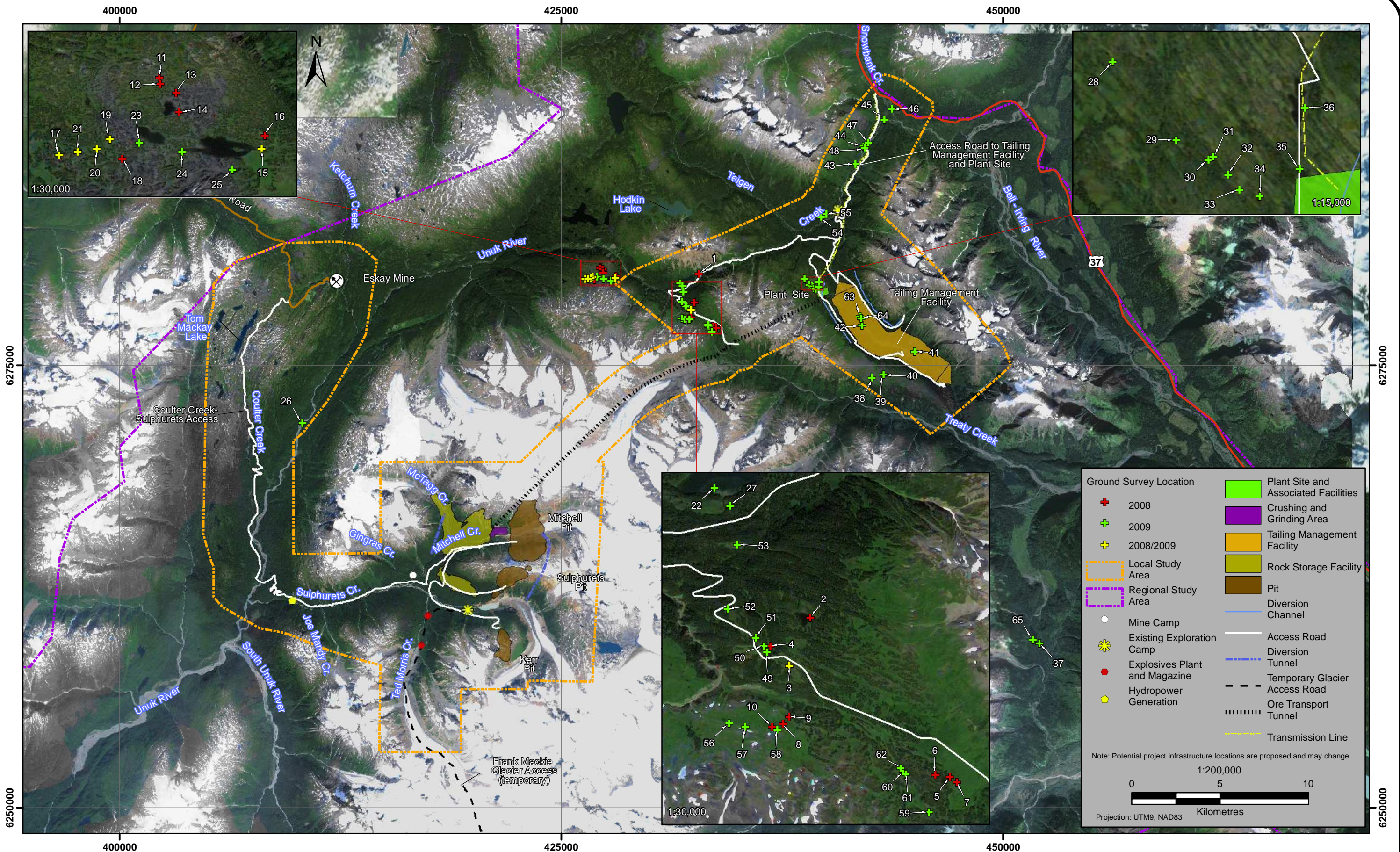


Table 6.2-5. Summary of Amphibian Observations, 2008 and 2009

Species	Year	Sites Sampled	Number of Breeding Sites	Number of Sites with Adults
Western toad	2008	21	0	0
	2009	50	3*	5*
Columbia spotted frog	2008	21	0	4
	2009	50	1	3
Long-toed salamander	2008	21	0	0
	2009	50	0	0

* Rescan fisheries biologists incidentally recorded one toad breeding site (Site 22) and one adult observation (Site 65), which were later confirmed by the herptile surveyors.

During 2009 ground surveys, a total of three western toad breeding sites were observed (Table 6.2-5). Two of the three western toad breeding sites, Sites 27 and 47, were classified as beaver ponds (Appendices 6.2-3 and 6.2-4). Site 27, near West Teigen Lake, contained a large amount of shallow water with the exposed roots and sticks of the failed beaver dam along the shoreline (Figure 6.2-2; Plate 6.2-2). Site 47 was created as a result of another failed beaver dam on a minor tributary within the flood plain of Teigen Creek near its confluence with the Bell-Irving River (Plate 6.2-3). The third western toad breeding site, Site 22, was approximately 200 m downstream from Site 27 on the muddy delta of West Teigen Lake (Figure 6.2-2). In addition, adult toads were observed at one of the breeding sites and at four other locations (Table 6.2-5; Appendix 6.2-4). Of the four locations where only adults were observed, three were classified as beaver ponds and one was classified as a fen (Appendices 6.2-3 and 6.2-4).

Columbia spotted frog adults were detected at three locations in 2009; adults were observed in two fens and one beaver pond (Appendix 6.2-4). In addition, one Columbia spotted frog breeding site was documented where a single tadpole was observed in a bog. No long-toed salamanders were found during either sampling year.

Disease Screening

Chytrid samples from three toads (Sites 21, 41, 45) were sent to the Abbotsford Animal Health Centre for analysis for Chytrid fungus infections. All samples were found to be negative for Chytrid fungus.

6.2.5 Discussion

The aerial survey for toad breeding sites found few sites that were appropriate for western toad (Figure 6-2-1). In northern BC, toad breeding ponds are typically found at low elevations. Studies of western toads in northern BC have identified that breeding ponds occur from 450 to 750 m elevation (G. Sharam, pers. obs.). Western toads are known to breed at higher elevations up to 3,660 m (Wind and Dupuis 2002), but these sites were in the United States at a much lower latitude. Elevation influences the climatic conditions within an area. Higher elevations are snow-free later in the season, and may not be available for toads when breeding occurs during May. Lower elevations tend to become snow free sooner and have a longer growing season. All these factors influence the water temperature. The use of breeding ponds by western toads in northern BC appears to be controlled by water temperature. Toads breed more frequently in shallow open water wetlands that have a series of characteristics that correlate with higher water temperatures, such as: earlier snowmelt, shallow, muddy margins, low water flow, and open forest canopy. Water temperature affects larval growth and differentiation rates and strongly determines developmental time to metamorphosis, as well as metamorph (toadlet) body size (Smith-Gill and Berven 1979; Ultsch, Bradford, and Freda 1999).

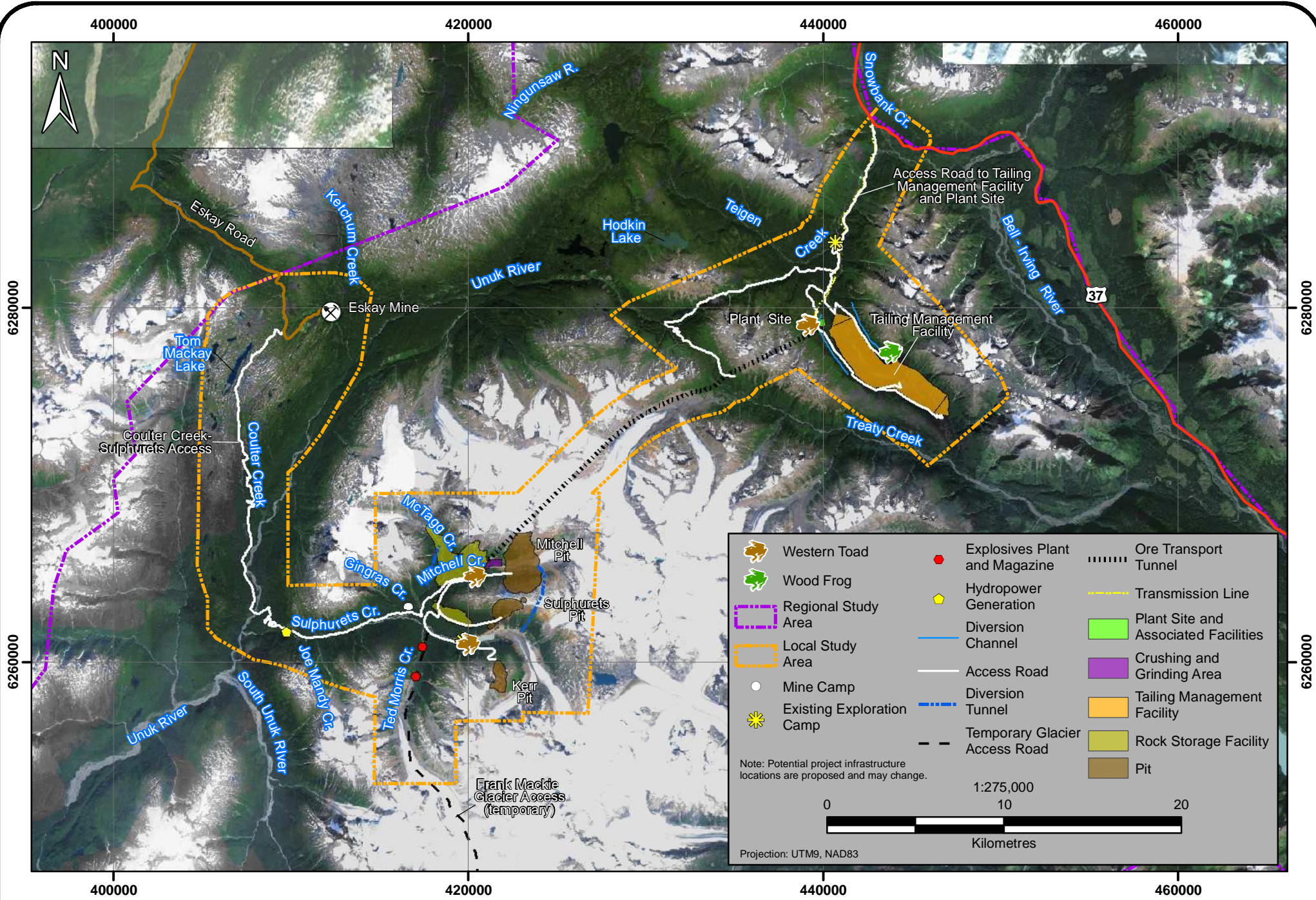




Plate 6.2-2. Site 27, a partially failed beaver dam with adult and tadpole toads observed upstream from West Teigen Lake (behind the tree line).



Plate 6.2-3. Site 47, a failed beaver dam with toad breeding observations on Teigen Creek.

The results of the aerial survey in 2008 indicated that the majority of ponds in the study area were inappropriate for toad breeding. Most of the ponds in the study area were too high for toad breeding (average of 946 m), based on the results observed from nearby areas. In addition, many do not have the open canopy, muddy banks, and low water flow characteristics that toads prefer. Instead, the majority of ponds that were surveyed were high elevation ponds, deep ponds in fens, or had high water flow features associated with rivers. During the ground based surveys in 2008, no western toad tadpoles were observed. There are several potential reasons why toad breeding was not observed in the study area. First, the area may not support appropriate breeding habitat (discussed previously). Second, breeding sites are notoriously rare and difficult to find. Similar studies in northern BC have found very low numbers of toad breeding sites. RTEC (2008b) surveyed ponds that had site characteristics that maximized the chance of finding breeding toads. These encounter rates are also similar for studies conducted nearby in the Alaskan Panhandle (Pyare 2006). Another reason is that, in some areas, toads may breed in alternate years. This cyclic nature of breeding is not well understood; however, there were indications that 2006 represented a low breeding year and 2007 was a higher breeding year (G. Sharam, pers. obs.). Surveys in other locations in northern BC resulted in very few breeding sites being located and low toad numbers being recorded in 2008. These results suggest that 2008 may be a lower than average year for toad breeding. The toad surveys were curtailed in 2008 after two days of surveying given the potential for toads to be cyclically breeding in this area.

During 2009, three toad breeding sites were observed, all at low elevation in shallow open water with an open canopy and warm water temperatures. Two of the sites may be a single breeding site. Site 27 is in a partially failed beaver dam on West Teigen Lake, with shallow, muddy water at the banks, an open canopy and warm water temperatures. Site 22 is approximately 200 m downstream from site 27 on the muddy delta of West Teigen Lake. Toad tadpoles can be washed downstream from pond to pond. Hence, site 27, where both toads and tadpoles were found, may be considered the actual breeding site. The second breeding site was at Site 47 at low elevation on the lower reaches of Teigen Creek near the confluence with the Bell-Irving River. This site was also in a former beaver dam, with shallow, muddy water and an open canopy. Failed beaver dams provide the necessary conditions for western toad breeding, particularly at intermediate elevations, where ponds with the preferred characteristics for toads breeding are uncommon. In the mountainous terrain of northern BC, ponds with slow moving water, with muddy banks, open canopies and warm water are typically a limiting resource.

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Appendix 3-1

Potentially Occurring Vertebrate Species in the Wildlife Study Area

Appendix 3-1. Potentially Occurring Vertebrate Species in the Wildlife Study Area

Common Name	Scientific Name	Likelihood of Occurrence	Detected During Baseline Studies	Presence Relative to Wildlife Study Area	Presence Detected in BEC Zones Associated with Wildlife Study Area					Conservation Status								
					BAFA/CMA	CWH	ESSF	ICH	MH	Prov. Rank	BC List	Identified Wildlife	COSEWIC	SARA	Global Rank			
Herpetiles																		
Columbia Spotted frog	<i>Rana luteiventris</i>	L	Y	resident_hibernator		X	X	X	X		S4	Yellow		NAR		G4		
Long-toed salamander	<i>Ambystoma macrodactylum</i>	L	N	resident_hibernator	X	X	X	X			S5	Yellow		NAR		G5		
Northwestern salamander	<i>Ambystoma gracile</i>	U	N	resident_hibernator		X			X		S4S5	Yellow		NAR		G5		
Rough-skinned newt	<i>Taricha granulosa</i>	P	N	resident_hibernator		X					S4S5	Yellow				G5		
Western toad	<i>Bufo boreas</i>	L	Y	resident_hibernator		X	X	X	X		S4	Yellow		SC	1	G4		
Wood frog	<i>Rana sylvatica</i>	P	Y	resident_hibernator				X			S4	Yellow				G5		
Common garter snake	<i>Thamnophis sirtalis</i>	U	N	resident_hibernator		X					S5	Yellow				G5		
Birds																		
Red-throated loon	<i>Gavia stellata</i>	L	N	breeder		X					S5B	Yellow				G5		
Common loon	<i>Gavia immer</i>	L	Y	breeder	X	X	X	X	X		S5B	Yellow		NAR		G5		
Canada goose	<i>Branta canadensis</i>	L	Y	breeder	X	X	X	X	X		S5	Yellow				G5		
Green-winged teal	<i>Anas crecca</i>	L	Y	breeder		X		X			S5B,S5N	Yellow				G5		
Mallard	<i>Anas platyrhynchos</i>	L	Y	breeder		X	X	X	X		S5B,S5N	Yellow				G5		
Northern pintail	<i>Anas acuta</i>	L	N	breeder		X		X			S4B,S5N	Yellow				G5		
Blue-winged teal	<i>Anas discors</i>	L	Y	breeder	X	X	X	X	X		S4S5B	Yellow				G5		
Northern shoveler	<i>Anas clypeata</i>	L	N	breeder		X		X	X		S5B,S5N	Yellow				G5		
Gadwall	<i>Anas strepera</i>	L	N	breeder		X		X			S5B	Yellow				G5		
American wigeon	<i>Anas americana</i>	L	Y	breeder		X		X			S5B,S5N	Yellow				G5		
Ring-necked duck	<i>Aythya collaris</i>	L	Y	breeder	X	X	X	X	X		S5B,S5N	Yellow				G5		
Lesser scaup	<i>Aythya affinis</i>	L	Y	breeder	X	X	X	X	X		S4S5B,S5N	Yellow				G5		
Harlequin duck	<i>Histrionicus histrionicus</i>	L	Y	breeder, offshore winter	X	X	X	X	X		S4B,S3N	Yellow				G4		
Barrow's goldeneye	<i>Bucephala islandica</i>	L	Y	breeder	X	X	X	X	X		S4B	Yellow				G5		
Bufflehead	<i>Bucephala albeola</i>	L	Y	breeder	X	X	X	X	X		S5B	Yellow				G5		
Common merganser	<i>Mergus merganser</i>	L	Y	breeder	X	X	X	X	X		S5B	Yellow				G5		
Red-breasted merganser	<i>Mergus serrator</i>	L	N	breeder		X		X			S4B	Yellow				G5		
Osprey	<i>Pandion haliaetus</i>	L	Y	breeder		X		X			S5B	Yellow				G5		
Bald eagle	<i>Haliaeetus leucocephalus</i>	L	Y	resident		X	X	X	X		S5B,S5N	Yellow		NAR		G5		
Northern harrier	<i>Circus cyaneus</i>	L	N	breeder		X	X	X			S4B	Yellow		NAR		G5		
Sharp-shinned hawk	<i>Accipiter striatus</i>	L	N	breeder	X	X	X	X	X		S5B,S5N	Yellow		NAR		G5		
Northern goshawk	<i>Accipiter gentilis</i>	L	Y	resident	X	X	X	X	X		S4B,S4N	Yellow				G5		
Red-tailed hawk	<i>Buteo jamaicensis</i>	L	Y	breeder	X	X	X	X	X		S5B	Yellow		NAR		G5		
Golden eagle	<i>Aquila chrysaetos</i>	L	Y	breeder	X	X	X	X	X		S4S5B	Yellow		NAR		G5		
American kestrel	<i>Falco sparverius</i>	L	N	breeder	X	X	X	X	X		S4B	Yellow				G5		
Merlin	<i>Falco columbarius</i>	L	Y	breeder	X	X	X	X	X		S5B	Yellow		NAR		G5		
Spruce grouse	<i>Falciptennis canadensis</i>	L	Y	resident			X	X			S5	Yellow				G5		
Sooty Grouse	<i>Dendragapus fuliginosus</i>	L	?	resident	X	X	X	X	X		S3S4	Blue				G5		
Ruffed grouse	<i>Bonasa umbellus</i>	L	Y	resident		X		X			S4	Yellow				G5		
Willow ptarmigan	<i>Lagopus lagopus</i>	L	Y	resident	X						S5	Yellow				G5		
Rock ptarmigan	<i>Lagopus muta</i>	L	Y	resident	X				X		S5	Yellow				G5		
White-tailed ptarmigan	<i>Lagopus leucura</i>	L	N	resident	X				X		S5	Yellow				G5		
Semipalmated plover	<i>Charadrius semipalmatus</i>	L	N	migrant		X	X				S4S5B	Yellow				G5		
Killdeer	<i>Charadrius vociferus</i>	L	N	breeder	X	X		X	X		S4B	Yellow				G5		
Greater yellowlegs	<i>Tringa melanoleuca</i>	L	Y	breeder	X	X	X	X	X		S5B	Yellow				G5		
Solitary sandpiper	<i>Tringa solitaria</i>	L	Y	migrant	X	X	X	X	X		S5B	Yellow				G5		
Spotted sandpiper	<i>Actitis macularius</i>	L	Y	breeder	X	X	X	X	X		S5B	Yellow				G5		
Wilson's snipe	<i>Gallinago delicata</i>	L	Y	breeder	X	X	X	X	X		S4S5B	Yellow				G5		
Mew gull	<i>Larus canus</i>	L	N	breeder	X	X	X	X	X		S5B	Yellow				G5		
Great horned owl	<i>Bubo virginianus</i>	L	N	resident		X	X	X			S5	Yellow				G5		
Barred owl	<i>Strix varia</i>	L	Y	resident		X			X		S5B	Yellow				G5		
Boreal owl	<i>Aegolius funereus</i>	L	N	resident			X	X	X		S4	Yellow		NAR		G5		
Common nighthawk	<i>Chordeiles minor</i>	L	N	breeder		X		X			S4B	Yellow		T	1	G5		
Black swift	<i>Cypseloides niger</i>	L	N	breeder	X	X		X			S4B	Yellow				G4		
Vaux's swift	<i>Chaetura vauxi</i>	L	Y	breeder		X		X			S4B	Yellow				G5		
Rufous hummingbird	<i>Selasphorus rufus</i>	L	Y	breeder	X	X	X	X	X		S4B	Yellow				G5		
Belted kingfisher	<i>Megasceryle alcyon</i>	L	Y	breeder		X	X	X			S4S5B	Yellow				G5		
Red-breasted sapsucker	<i>Sphyrapicus ruber</i>	L	Y	breeder		X		X	X		S5B	Yellow				G5		
Downy woodpecker	<i>Picoides pubescens</i>	L	N	resident		X	X	X			S5B	Yellow				G5		

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Common Name	Scientific Name	Likelihood of Occurrence	Detected During Baseline Studies	Presence Relative to Wildlife Study Area	Presence Detected in BEC Zones Associated with Wildlife Study Area ¹					Conservation Status					
					BAFA/CMA	CWH	ESSF	ICH	MH	Prov. Rank	BC List	Identified Wildlife	COSEWIC	SARA	Global Rank
Hairy woodpecker	<i>Picoides villosus</i>	L	N	resident		X	X	X	X	S5B	Yellow				G5
American three-toed woodpecker	<i>Picoides dorsalis</i>	L	Y	resident		X	X	X	X	S5B	Yellow				G5
Black-backed woodpecker	<i>Picoides arcticus</i>	L	N	resident			X	X		S5B	Yellow				G5
Northern flicker	<i>Colaptes auratus</i>	L	Y	breeder		X		X	X	S5B	Yellow				G5
Olive-sided flycatcher	<i>Contopus cooperi</i>	L	Y	breeder		X	X	X	X	S3S4B	Blue	T	1		G4
Western wood-pewee	<i>Contopus sordidulus</i>	L	Y	breeder		X		X		S4B	Yellow				G5
Alder flycatcher	<i>Empidonax aliorum</i>	L	Y	breeder		X		X		S5B	Yellow				G5
Hammond's flycatcher	<i>Empidonax hammondi</i>	L	Y	breeder		X	X	X	X	S5B	Yellow				G5
Pacific-slope flycatcher	<i>Empidonax difficilis</i>	L	Y	breeder		X		X	X	S4S5B	Yellow				G5
Horned lark	<i>Eremophila alpestris</i>	L	Y	breeder	X	X	X			S4S5B	Yellow				G5
Tree swallow	<i>Tachycineta bicolor</i>	L	N	breeder	X	X	X	X	X	S4S5B	Yellow				G5
Northern rough-winged swallow	<i>Stelgidopteryx serripennis</i>	L	N	breeder		X	X	X	X	S4B	Yellow				G5
Cliff swallow	<i>Petrochelidon pyrrhonota</i>	L	N	breeder	X	X	X	X	X	S4B	Yellow				G5
Barn swallow	<i>Hirundo rustica</i>	L	N	breeder	X	X	X	X	X	S3S4B	Blue				G5
Gray jay	<i>Perisoreus canadensis</i>	L	Y	resident		X	X	X	X	S5B	Yellow				G5
Steller's jay	<i>Cyanocitta stelleri</i>	L	Y	resident		X	X	X	X	S5	Yellow				G5
American crow	<i>Corvus brachyrhynchos</i>	L	N	breeder			X	X	X	S5B	Yellow				G5
Northwestern crow	<i>Corvus caurinus</i>	L	Y	resident		X	X	X	X	S5B	Yellow				G5
Common raven	<i>Corvus corax</i>	L	N	resident		X	X	X	X	S5B	Yellow				G5
Black-capped chickadee	<i>Poecile atricapillus</i>	L	Y	resident		X		X		S5B	Yellow				G5
Mountain chickadee	<i>Poecile gambeli</i>	L	Y	resident			X	X	X	S5B	Yellow				G5
Boreal chickadee	<i>Poecile hudsonica</i>	L	Y	resident			X	X	X	S5B	Yellow				G5
Chestnut-backed chickadee	<i>Poecile rufescens</i>	L	Y	resident		X		X	X	S4S5B	Yellow				G5
Red-breasted nuthatch	<i>Sitta canadensis</i>	L	Y	resident		X	X	X	X	S5B	Yellow				G5
Brown creeper	<i>Certhia americana</i>	L	Y	resident		X	X	X	X	S4S5B	Yellow				G5
Winter wren	<i>Troglodytes troglodytes</i>	L	Y	breeder		X	X	X	X	S5B	Yellow				G5
American dipper	<i>Cinclus mexicanus</i>	L	Y	resident		X	X	X	X	S5B,S4N	Yellow				G5
Golden-crowned kinglet	<i>Regulus satrapa</i>	L	Y	breeder		X	X	X	X	S5B	Yellow				G5
Ruby-crowned kinglet	<i>Regulus calendula</i>	L	Y	breeder		X	X	X	X	S5B	Yellow				G5
Townsend's solitaire	<i>Myadestes townsendi</i>	L	Y	breeder	X	X	X	X	X	S4S5B	Yellow				G5
Gray-cheeked thrush	<i>Catharus minimus</i>	L	Y	migrant		X	X			S4S5B	Yellow				G5
Swainson's thrush	<i>Catharus ustulatus</i>	L	Y	breeder		X		X		S4S5B	Yellow				G5
Hermit thrush	<i>Catharus guttatus</i>	L	Y	breeder		X	X	X	X	S5B	Yellow				G5
American robin	<i>Turdus migratorius</i>	L	Y	breeder	X	X	X	X	X	S5B	Yellow				G5
Varied thrush	<i>Ixoreus naevius</i>	L	Y	breeder		X	X	X	X	S5B	Yellow				G5
American pipit	<i>Anthus rubescens</i>	L	Y	breeder	X	X	X	X	X	S5B	Yellow				G5
Bohemian waxwing	<i>Bombycilla garrulus</i>	L	N	resident		X	X	X	X	S5B	Yellow				G5
Cedar waxwing	<i>Bombycilla cedrorum</i>	L	Y	breeder		X		X	X	S5B	Yellow				G5
Warbling vireo	<i>Vireo gilvus</i>	L	Y	breeder		X		X		S5B	Yellow				G5
Tennessee warbler	<i>Vermivora peregrina</i>	L	Y	breeder		X		X		S5B	Yellow				G5
Orange-crowned warbler	<i>Vermivora celata</i>	L	Y	breeder		X	X	X	X	S5B	Yellow				G5
Yellow warbler	<i>Dendroica petechia</i>	L	Y	breeder		X		X	X	S4S5B	Yellow				G5
Yellow-rumped warbler	<i>Dendroica coronata</i>	L	Y	breeder		X	X	X	X	S5B	Yellow				G5
Townsend's warbler	<i>Dendroica townsendi</i>	L	Y	breeder		X	X	X	X	S5B	Yellow				G5
Blackpoll warbler	<i>Dendroica striata</i>	L	Y	breeder			X	X		S5B	Yellow				G5
American redstart	<i>Setophaga ruticilla</i>	L	Y	breeder		X	X	X		S5B	Yellow				G5
Northern waterthrush	<i>Seiurus noveboracensis</i>	L	Y	breeder			X	X		S5B	Yellow				G5
MacGillivray's warbler	<i>Oporornis tolmiei</i>	L	Y	breeder		X	X	X	X	S5B	Yellow				G5
Common yellowthroat	<i>Geothlypis trichas</i>	L	Y	breeder		X	X	X	X	S5B	Yellow				G5
Wilson's warbler	<i>Wilsonia pusilla</i>	L	Y	breeder		X	X	X	X	S4B	Yellow				G5
Western tanager	<i>Piranga ludoviciana</i>	L	Y	breeder		X	X	X		S5B	Yellow				G5
Chipping sparrow	<i>Spizella passerina</i>	L	Y	breeder		X	X	X		S5B	Yellow				G5
Savannah sparrow	<i>Passerculus sandwichensis</i>	L	Y	breeder	X	X		X	X	S5B	Yellow				G5
Fox sparrow	<i>Passerella iliaca</i>	L	Y	breeder		X	X	X	X	S5B	Yellow				G5
Song sparrow	<i>Melospiza melodia</i>	L	Y	breeder		X	X	X		S5B	Yellow				G5
Lincoln's sparrow	<i>Melospiza lincolni</i>	L	Y	breeder		X		X	X	S5B	Yellow				G5
Golden-crowned sparrow	<i>Zonotrichia atricapilla</i>	L	Y	breeder	X	X		X	X	S5B	Yellow				G5
White-crowned sparrow	<i>Zonotrichia leucophrys</i>	L	N	breeder	X	X	X	X	X	S5B	Yellow				G5
Dark-eyed junco	<i>Junco hyemalis</i>	L	Y	breeder		X	X	X	X	S5B	Yellow				G5
Rusty blackbird	<i>Euphagus carolinus</i>	L	N	breeder			X	X		S3S4B	Blue	SC	1		G4
Brown-headed cowbird	<i>Molothrus ater</i>	L	N	breeder		X		X	X	S5B	Yellow				G5

Appendix 3-1. Potentially Occurring Vertebrate Species in the Wildlife Study Area

Common Name	Scientific Name	Likelihood of Occurrence	Detected During Baseline Studies	Presence Relative to Wildlife Study Area	Presence Detected in BEC Zones Associated with Wildlife Study Area					Conservation Status						
					BAFA/CMA	CWH	ESSF	ICH	MH	Prov. Rank	BC List	Identified Wildlife	COSEWIC	SARA	Global Rank	
Gray-crowned rosy finch	<i>Leucosticte tephrocotis</i>	L	Y	breeder	X	X	X	X	X	S5B	Yellow					G5
Pine grosbeak	<i>Pinicola enucleator</i>	L	Y	resident		X	X	X	X	S5B	Yellow					G5
Red crossbill	<i>Loxia curvirostra</i>	L	N	resident		X	X	X	X	S4S5B	Yellow					G5
White-winged crossbill	<i>Loxia leucoptera</i>	L	N	resident		X	X	X	X	S5B	Yellow					G5
Pine siskin	<i>Carduelis pinus</i>	L	Y	breeder		X	X	X	X	S5B	Yellow					G5
Pacific loon	<i>Gavia pacifica</i>	P	Y	offshore winter	X	X	X	X	X	S4S5B, S4N	Yellow					G5
Yellow-billed loon	<i>Gavia adamsii</i>	P	N	offshore winter		X		X		S2S3N	Blue		NAR			G4
Horned grebe	<i>Podiceps auritus</i>	P	N	offshore winter		X		X		S4B	Yellow		SC			G5
Red-necked grebe	<i>Podiceps grisegena</i>	P	N	breeder		X	X	X	X	S4S5B	Yellow		NAR			G5
Western grebe	<i>Aechmophorus occidentalis</i>	P	N	offshore winter		X				S1B, S2N	Red					G5
Fork-tailed storm petrel	<i>Oceanodroma furcata</i>	P	N	offshore migrant		X				S4B	Yellow					G5
Double-crested cormorant	<i>Phalacrocorax auritus</i>	P	N	offshore breeder		X				S3B	Blue		NAR			G5
Pelagic cormorant	<i>Phalacrocorax pelagicus</i>	P	N	offshore resident		X				S4B	Yellow					G5
American bittern	<i>Botaurus lentiginosus</i>	P	N	breeder		X				S3B	Blue					G4
Great blue heron	<i>Ardea herodias</i>	P	N	resident		X			X	S3B	No Status					G5
Tundra swan	<i>Cygnus columbianus</i>	P	N	migrant		X		X		S3N	Blue					G5
Trumpeter swan	<i>Cygnus buccinator</i>	P	Y	migrant		X		X		S4B, S5N	Yellow		NAR			G4
Greater white-fronted goose	<i>Anser albifrons</i>	P	N	migrant		X				S4M	Yellow					G5
Snow goose	<i>Chen caerulescens</i>	P	N	migrant		X		X		S4M	Yellow					G5
Brant	<i>Branta bernicla</i>	P	N	migrant		X				S3M	Blue					G5
Canvasback	<i>Aythya valisineria</i>	P	N	migrant		X		X		S4B	Yellow					G5
Redhead	<i>Aythya americana</i>	P	N	migrant		X				S4S5B, S5N	Yellow					G5
Greater scaup	<i>Aythya marila</i>	P	N	migrant		X		X		S4N	Yellow					G5
Long-tailed duck	<i>Clangula hyemalis</i>	P	N	migrant	X	X	X	X		SUB, S4N	Unknown					G5
Black scoter	<i>Melanitta nigra</i>	P	N	offshore winter		X				S4N	Yellow					G5
Surf scoter	<i>Melanitta perspicillata</i>	P	Y	offshore winter	X	X	X	X		S3B, S4N	Blue					G5
White-winged scoter	<i>Melanitta fusca</i>	P	Y	breeder, offshore winter	X	X	X	X	X	S5B	Yellow					G5
Common goldeneye	<i>Bucephala clangula</i>	P	N	breeder	X	X	X	X	X	S4S5B	Yellow					G5
Hooded merganser	<i>Lophodytes cucullatus</i>	P	Y	resident		X	X	X		S5B	Yellow					G5
Northern goshawk, <i>laingi</i> ssp	<i>Accipiter gentilis laingi</i>	P	N	resident		X			X	S2B	Red	Y	T	1		G5T2
Rough-legged hawk	<i>Buteo lagopus</i>	P	Y	migrant	X	X	X	X	X	S2S3N	Blue		NAR			G5
Peregrine Falcon, <i>pealei</i> ssp	<i>Falco peregrinus pealei</i>	P	N	resident		X				S3B	Blue		SC	1		G4T3
Peregrine Falcon, <i>anatum</i> ssp	<i>Falco peregrinus anatum</i>	P	N	resident		X				S2B	Red		SC	1		G4T4
Swainson's Hawk	<i>Buteo swainsoni</i>	P	Y	migrant		X	X	X	X	S2B	Red					G5
Gyr Falcon	<i>Falco rusticolus</i>	P	N	migrant		X		X		S3S4B	Blue		NAR			G5
Dusky grouse	<i>Dendragapus obscurus</i>	P	?	resident	X	X	X	X	X	S4	Yellow					G5
Sora	<i>Porzana carolina</i>	P	N	breeder		X		X		S5	Yellow					G5
American coot	<i>Fulica americana</i>	P	N	offshore winter		X		X		S4B	Yellow		NAR			G5
Sandhill crane	<i>Grus canadensis</i>	P	N	migrant		X		X		S4B	Yellow	Y	NAR			G5
Black-bellied plover	<i>Pluvialis squatarola</i>	P	N	offshore migrant		X				S5N	Yellow					G5
American golden-plover	<i>Pluvialis dominica</i>	P	N	migrant		X				S3S4B	Blue					G5
Black oystercatcher	<i>Haematopus bachmani</i>	P	N	offshore resident		X				S4	Yellow					G5
Lesser yellowlegs	<i>Tringa flavipes</i>	P	N	migrant	X	X	X	X	X	S5B	Yellow					G5
Wandering tattler	<i>Tringa incana</i>	P	N	migrant		X				S3S4B	Blue					G5
Upland sandpiper	<i>Bartramia longicauda</i>	P	N	migrant		X		X		S1S2B	Red					G5
Whimbrel	<i>Numenius phaeopus</i>	P	N	offshore migrant		X				S4S5M	Yellow					G5
Ruddy turnstone	<i>Arenaria interpres</i>	P	N	offshore migrant		X				S4M	Yellow					G5
Black turnstone	<i>Arenaria melanocephala</i>	P	N	offshore migrant		X				S4N, S5M	Yellow					G5
Surfbird	<i>Aphriza virgata</i>	P	N	offshore migrant		X				S4M	Yellow					G5
Sanderling	<i>Calidris alba</i>	P	N	offshore migrant				X		S4S5M	Yellow					G5
Semipalmated sandpiper	<i>Calidris pusilla</i>	P	N	offshore migrant		X		X		SNA	Yellow					G5
Western sandpiper	<i>Calidris mauri</i>	P	N	offshore migrant		X		X		S4S5M	Yellow					G5
Least sandpiper	<i>Calidris minutilla</i>	P	N	migrant	X		X		X	S47B	Yellow					G5
Baird's sandpiper	<i>Calidris bairdii</i>	P	N	offshore migrant		X	X	X		SU	Unknown					G5
Rock sandpiper	<i>Calidris ptilocnemis</i>	P	N	offshore migrant		X				S4N	Yellow					G5
Dunlin	<i>Calidris alpina</i>	P	N	offshore winter		X				S4N	Yellow					G5
Stilt sandpiper	<i>Calidris himantopus</i>	P	N	offshore migrant		X				SNA	Yellow					G5
Short-billed dowitcher	<i>Limnodromus griseus</i>	P	N	offshore migrant		X				S2S4B	Blue					G5
Long-billed dowitcher	<i>Limnodromus scolopaceus</i>	P	N	offshore migrant		X				S5M	Yellow					G5
Red-necked phalarope	<i>Phalaropus lobatus</i>	P	N	offshore migrant	X	X	X	X	X	S3S4B	Blue					G4G5
Parasitic jaeger	<i>Stercorarius parasiticus</i>	P	N	offshore migrant		X		X		SNA	Yellow					G5

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Long-tailed jaeger	<i>Stercorarius longicaudus</i>	P	N	offshore migrant		X				SNA	Yellow				G5
Bonaparte's gull	<i>Chroicocephalus philadelphia</i>	P	Y	migrant	X	X	X	X	X	S5B	Yellow				G5
Ring-billed gull	<i>Larus delawarensis</i>	P	Y	breeder		X				S4B	Yellow				G5
Herring gull	<i>Larus argentatus</i>	P	N	offshore migrant	X	X	X	X	X	S4S5B	Yellow				G5
Thayer's gull	<i>Larus thayeri</i>	P	N	offshore migrant		X				S5M	Yellow				G5
Glaucous-winged gull	<i>Larus glaucescens</i>	P	N	offshore resident		X				S5B	Yellow				G5
Glaucous gull	<i>Larus hyperboreus</i>	P	N	offshore migrant		X				SNA	Yellow				G5
Black-legged kittiwake	<i>Rissa tridactyla</i>	P	N	offshore resident		X				SNA	Yellow				G5
Caspian tern	<i>Hydroprogne caspia</i>	P	N	offshore migrant		X				S3B	Blue		NAR		G5
Arctic tern	<i>Sterna paradisaea</i>	P	Y	offshore migrant		X				S47B	Yellow				G5
Western screech-owl	<i>Megascops kennicottii</i>	P	N	resident		X		X		S4	No Status			1	G5
Snowy owl	<i>Bubo scandiacus</i>	P	N	migrant		X				S3N	Blue		NAR		G5
Northern hawk owl	<i>Surnia ulula</i>	P	N	migrant		X			X	S4S5B	Yellow		NAR		G5
Northern pygmy-owl	<i>Glaucidium gnoma</i>	P	N	resident		X		X	X	S4S5B	Yellow				G4G5
Great gray owl	<i>Strix nebulosa</i>	P	N	resident		X				S4B	Yellow		NAR		G5
Short-eared owl	<i>Asio flammeus</i>	P	N	breeder		X		X		S3B, S2N	Blue	Y	SC	3	G5
Northern saw-whet owl	<i>Aegolius acadicus</i>	P	N	resident		X			X	S5B, S5N	Yellow				G5
Say's phoebe	<i>Sayornis saya</i>	P	N	migrant	X	X		X		S5B	Yellow				G5
Violet-green swallow	<i>Tachycineta thalassina</i>	P	N	breeder	X	X	X	X	X	S4S5B	Yellow				G5
Bank swallow	<i>Riparia riparia</i>	P	N	breeder				X		S5B	Yellow				G5
Mountain bluebird	<i>Sialia currucoides</i>	P	N	breeder	X	X	X	X		S4S5B	Yellow				G5
Northern shrike	<i>Lanius excubitor</i>	P	N	winter		X	X	X		S4S5B, S4N	Yellow				G5
Red-eyed vireo	<i>Vireo olivaceus</i>	P	N	breeder		X		X		S4B	Yellow				G5
Black-throated gray warbler	<i>Dendroica nigrescens</i>	P	Y	breeder		X				S4S5B	Yellow				G5
American tree sparrow	<i>Spizella arborea</i>	P	N	breeder		X		X		S5B	Yellow				G5
Harris's sparrow	<i>Zonotrichia querula</i>	P	N	migrant		X		X		SNA	Yellow				G5
Lapland longspur	<i>Calcarius lapponicus</i>	P	N	migrant		X				SNA	Yellow				G5
Snow bunting	<i>Plectrophenax nivalis</i>	P	N	winter	X	X	X			S4S5B, S4N	Yellow				G5
Red-winged blackbird	<i>Agelaius phoeniceus</i>	P	N	breeder		X		X		S5B, S5N	Yellow				G5
Purple finch	<i>Carpodacus purpureus</i>	P	N	breeder		X			X	S4S5B	Yellow				G5
Common redpoll	<i>Carduelis flammea</i>	P	N	migrant			X	X		S47B	Yellow				G5
Hoary redpoll	<i>Carduelis hornemanni</i>	P	N	migrant			X	X		SNA	Yellow				G5
Evening grosbeak	<i>Coccothraustes vespertinus</i>	P	N	breeder		X	X	X	X	S4B	Yellow				G5
Brandt's cormorant	<i>Phalacrocorax penicillatus</i>	U	N	offshore winter		X				S1B, S4N	Red				G5
Emperor goose	<i>Chen canagica</i>	U	N	offshore migrant		X				SNA	Accidental				G3G4
Tufted duck	<i>Aythya fuligula</i>	U	N	offshore winter		X				SNA	Accidental				G5
Hudsonian godwit	<i>Limosa haemastica</i>	U	N	migrant		X				S2B	Red				G4
Red knot	<i>Calidris canutus</i>	U	N	offshore migrant		X				S1S2M	Red		E/T	1	G4
Pectoral sandpiper	<i>Calidris melanotos</i>	U	N	offshore migrant	X	X	X	X	X	S5M	Yellow				G5
Sharp-tailed sandpiper	<i>Calidris acuminata</i>	U	N	offshore migrant		X				SNA	Yellow				G5
Black-headed gull	<i>Chroicocephalus ridibundus</i>	U	N	offshore migrant		X				SNA	Accidental				G5
Common murre	<i>Uria aalge</i>	U	N	offshore resident		X				S2B, S4N	Red				G5
Pigeon guillemot	<i>Cephus columba</i>	U	N	offshore resident		X				S4B	Yellow				G5
Marbled murrelet	<i>Brachyramphus marmoratus</i>	U	N	offshore resident		X				S2B, S4N	Red	Y	T	1	G3G4
Ancient murrelet	<i>Synthliboramphus antiquus</i>	U	N	offshore resident		X				S2S3B, S4N	Blue	Y	SC	1	G4
Cassin's auklet	<i>Ptychoramphus aleuticus</i>	U	N	offshore resident		X				S2S3B, S4N	Blue	Y			G4
Rhinoceros auklet	<i>Cerorhinca monocerata</i>	U	N	offshore breeder		X				S4B	Yellow				G5
Tufted puffin	<i>Fratercula cirrhata</i>	U	N	offshore resident		X				S3B, S4N	Blue				G5
Anna's hummingbird	<i>Calypte anna</i>	U	N	migrant		X		X		S4S5B	Yellow				G5
Black-billed magpie	<i>Pica hudsonia</i>	U	N	resident		X				S5B	Yellow				G5
Smith's longspur	<i>Calcarius pictus</i>	U	N	breeder	X					S3S4B	Blue				G5
Mammals															
American beaver	<i>Castor canadensis</i>	L	Y	resident		X	X	X	X	S5	Yellow				G5
American black bear	<i>Ursus americanus</i>	L	Y	resident_hibernator	X	X	X	X	X	S5	Yellow		NAR		G5
American marten	<i>Martes americana</i>	L	Y	resident		X	X	X	X	S4S5	Yellow				G5
American mink	<i>Neovison vison</i>	L	Y	resident		X	X	X	X	S5	Yellow				G5
Arctic ground squirrel	<i>Spermophilus parryii</i>	L	Y	resident_hibernator						S5	Yellow				G5
Bushy-tailed woodrat	<i>Neotoma cinerea</i>	L	N	resident	X	X	X	X	X	S5	Yellow				G5
Canada lynx	<i>Lynx canadensis</i>	L	N	resident			X	X		S4	Yellow		NAR		G5
Cinereus shrew	<i>Sorex cinereus</i>	L	Y	resident		X	X	X	X	S5	Yellow				G5
Coloured fox (red fox)	<i>Vulpes vulpes</i>	L	Y	resident	X	X	X	X	X	S5	Yellow				G5

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Common Name	Scientific Name	Likelihood of Occurrence	Detected During Baseline Studies	Presence Relative to Wildlife Study Area	Presence Detected in BEC Zones Associated with Wildlife Study Area					Conservation Status					
					BAFA/CMA	CWH	ESSF	ICH	MH	Prov. Rank	BC List	Identified Wildlife	COSEWIC	SARA	Global Rank
Common muskrat	<i>Ondatra zibethicus</i>	L	N	resident	X	X	X	X	X	S5	Yellow				G5
Cougar	<i>Puma concolor</i>	L	N	resident	X	X	X	X	X	S4	Yellow				G5
Coyote	<i>Canis latrans</i>	L	N	resident		X	X	X	X	S5	Yellow				G5
Dusky shrew	<i>Sorex monticolus</i>	L	Y	resident		X	X	X	X	S5	Yellow				G5
Ermine	<i>Mustela erminea</i>	L	N	resident		X		X	X	S5	Yellow				G5
Fisher	<i>Martes pennanti</i>	L	Y	resident			X	X	X	S2S3	Blue	Y			G5
Gray wolf	<i>Canis lupus</i>	L	Y	resident	X	X	X	X	X	S4	Yellow		NAR		G4
Grizzly bear	<i>Ursus arctos</i>	L	Y	resident_hibernator	X	X	X	X	X	S3	Blue	Y	SC		G4
Hoary marmot	<i>Marmota caligata</i>	L	Y	resident_hibernator	X			X	X	S5	Yellow				G5
Least chipmunk	<i>Neotamias minimus</i>	L	N	resident			X			S5	Yellow				G5
Least weasel	<i>Mustela nivalis</i>	L	N	resident				X		S3S5	Blue				G5
Little brown myotis	<i>Myotis lucifugus</i>	L	Y	resident_hibernator		X	X	X	X	S5	Yellow				G5
Long-tailed vole	<i>Microtus longicaudus</i>	L	N	resident		X	X	X	X	S5	Yellow				G5
Meadow jumping mouse	<i>Zapus hudsonius</i>	L	Y	resident		X	X	X		S5	Yellow				G5
Meadow vole	<i>Microtus pennsylvanicus</i>	L	Y	resident			X	X		S5	Yellow				G5
Moose	<i>Alces americanus</i>	L	Y	resident		X	X	X	X	S5	Yellow				G5
Mountain goat	<i>Oreamnos americanus</i>	L	Y	resident	X	X	X		X	S4	Yellow				G5
Nearctic brown Lemming	<i>Lemmus trimucronatus</i>	L	Y	resident	X			X	X	S5	Yellow				G5
North American deer mouse	<i>Peromyscus maniculatus</i>	L	N	resident	X	X	X	X	X	S5	Yellow				G5
North American porcupine	<i>Erethizon dorsatum</i>	L	N	resident		X	X	X	X	S4	Yellow				G5
Northern bog lemming	<i>Synaptomys borealis</i>	L	N	resident	X	X	X	X	X	S5	Yellow				G4
Northern red-backed vole	<i>Myodes rutilus</i>	L	Y	resident			X		X	S5	Yellow				G5
Northern river otter	<i>Lontra canadensis</i>	L	N	resident		X	X	X	X	S4S5	Yellow				G5
Keen's mouse	<i>Peromyscus keeni</i>	L	Y	resident						S5	Yellow				G5
Red squirrel	<i>Tamiasciurus hudsonicus</i>	L	Y	resident		X	X	X	X	S5	Yellow				G5
Snowshoe hare	<i>Lepus americanus</i>	L	Y	resident		X	X	X	X	S5	Yellow				G5
Thinhorn Sheep, <i>stonei</i> ssp	<i>Ovis dalli stonei</i>	L	N	resident			X			S4	Yellow				G5
Western heather vole	<i>Phenacomys intermedius</i>	L	N	resident		X	X		X	S5	Yellow				G5
Western jumping mouse	<i>Zapus princeps</i>	L	N	resident		X	X	X	X	S5	Yellow				G5
Western long-eared myotis	<i>Myotis evotis</i>	L	Y	resident_hibernator		X	X	X	X	S4S5	Yellow				G5
Wolverine, <i>luscus</i> spp	<i>Gulo gulo luscus</i>	L	Y	resident	X	X	X	X		S3	Blue	Y	SC		G4T4
American water shrew	<i>Sorex palustris</i>	P	N	resident		X	X	X	X	S5	Yellow				G5
American Pygmy Shrew	<i>Sorex hoyi</i>	P	N	resident			X	X	X	S5	Yellow				G5
Californian myotis	<i>Myotis californicus</i>	P	N	resident_hibernator		X	X			S4S5	Yellow				G5
Northern Caribou (population 15)	<i>Rangifer tarandus</i> pop. 15	P	N	resident			X	X		S3S4	No Status	Y			G5
Keen's myotis	<i>Myotis keenii</i>	P	N	resident_hibernator		X				S1S3	Red	Y	DD	3	G2G3
Long-legged myotis	<i>Myotis volans</i>	P	?	resident_hibernator		X	X	X	X	S4S5	Yellow				G5
Mule Deer, <i>sitkensis</i> ssp	<i>Odocoileus hemionus sitkensis</i>	P	N	resident		X	X		X	S5	Yellow				G5
Northern flying squirrel	<i>Glaucomys sabrinus</i>	P	N	resident		X		X	X	S5	Yellow				G5
Northern myotis	<i>Myotis septentrionalis</i>	P	N	resident_hibernator						S2S3	Blue				G4
Silver-haired bat	<i>Lasiurus noctivagans</i>	P	?	resident_migrant		X	X	X	X	S4S5	Yellow				G5
Southern red-backed vole	<i>Myodes gapperi</i>	P	N	resident	X	X	X	X	X	S5	Yellow				G5
Big brown bat	<i>Eptesicus fuscus</i>	U	N	resident_hibernator			X			S5	Yellow				G5
Brown rat	<i>Rattus norvegicus</i>	U	N	resident		X				SNA	Exotic				G5
House mouse	<i>Mus musculus</i>	U	N	resident						SNA	Exotic				G5

1 species that have been detected in BEC zones associated with the Project area, according to Stevens (1995).

Appendix 4.2-1

Moose Aerial Survey Effort, Winter 2009

Appendix 4.2-1. Moose Aerial Survey Effort, Winter 2009


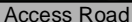

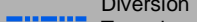






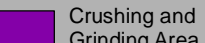
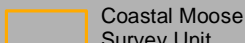
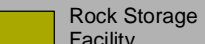
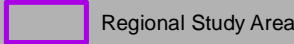

Date	Survey Unit (SU)	Total Time (min)	Total Area (km ²)	Total Area Effort (min/km ²)	Census Area (km ²)	Census Area Effort (min/km ²)	Capable Habitat (km ²)	Capable Habitat Effort (min/km ²)	Temp. (°c)	Cloud Cover (%)	Wind	Lighting
<i>Coastal Survey Area</i>												
27-Feb-09	4	50	45	1.11	18	2.72	25	1.98	-10	overcast	light	flat
27-Feb-09	5	23	53	0.44	14	1.64	27	0.84	-8	overcast	calm	flat
27-Feb-09	6	65	78	0.84	31	2.08	46	1.42	-10			flat
27-Feb-09	1	49	61	0.80	21	2.33	27	1.80	-8	overcast	calm	flat
27-Feb-09	3	21	39	0.54	10	2.15	16	1.28	-8	100	10km	flat
27-Feb-09	7	9	48	0.19	4	2.19	21	0.44	-4	80	light	flat
27-Feb-09	8	40	61	0.65	18	2.18	33	1.21	-8	overcast	10-30km	flat
27-Feb-09	2	7	42	0.17	4	1.81	8	0.90				
<i>All</i>		264	426		121		203					
<i>Average</i>				0.59		2.14		1.24				
<i>± SE</i>				0.12		0.12		0.18				
<i>Interior Survey Area</i>												
1-Mar-09	20	23	25	0.94	15	1.53	1	22.73	-10	100	light	flat
1-Mar-09	21	12	19	0.63	1	14.27	3	4.19	-10	100	light	flat
1-Mar-09	12	50	33	1.51	22	2.30	20	2.51	-10	100	light	flat
1-Mar-09	19	38	74	0.52	16	2.33	20	1.86	-10	100	light	flat
1-Mar-09	13	108	39	2.75	32	3.40	35	3.12	-10	100	light	flat
1-Mar-09	11	64	27	2.33	23	2.81	26	2.49	-10	100	light	flat
01-Mar-09/02-Mar-09	10	76	34	2.23	33	2.30	31	2.46	-8 / -7	100	light	flat / moderate
2-Mar-09	9	62	31	1.98	21	2.89	23	2.72	-7	overcast	light	moderate
2-Mar-09	18	35	41	0.86	17	2.03	21	1.66	-7	overcast	light	high
3-Mar-09	14	36	107	0.34	44	0.81	78	0.46	-4	80	light	high
3-Mar-09	17	100	101	0.99	47	2.12	83	1.21	-2	80	light	high
3-Mar-09	16	95	73	1.30	53	1.78	66	1.45	-2	100	light	high
4-Mar-09	15	64	39	1.63	32	1.99	38	1.69	-6	10	15-20km	high
<i>All</i>		763	644		357		443					
<i>Average</i>				1.38		3.12		3.73				
<i>± SE</i>				0.21		0.95		1.60				

Appendix 4.2-2

Moose Aerial Survey Flightline Maps

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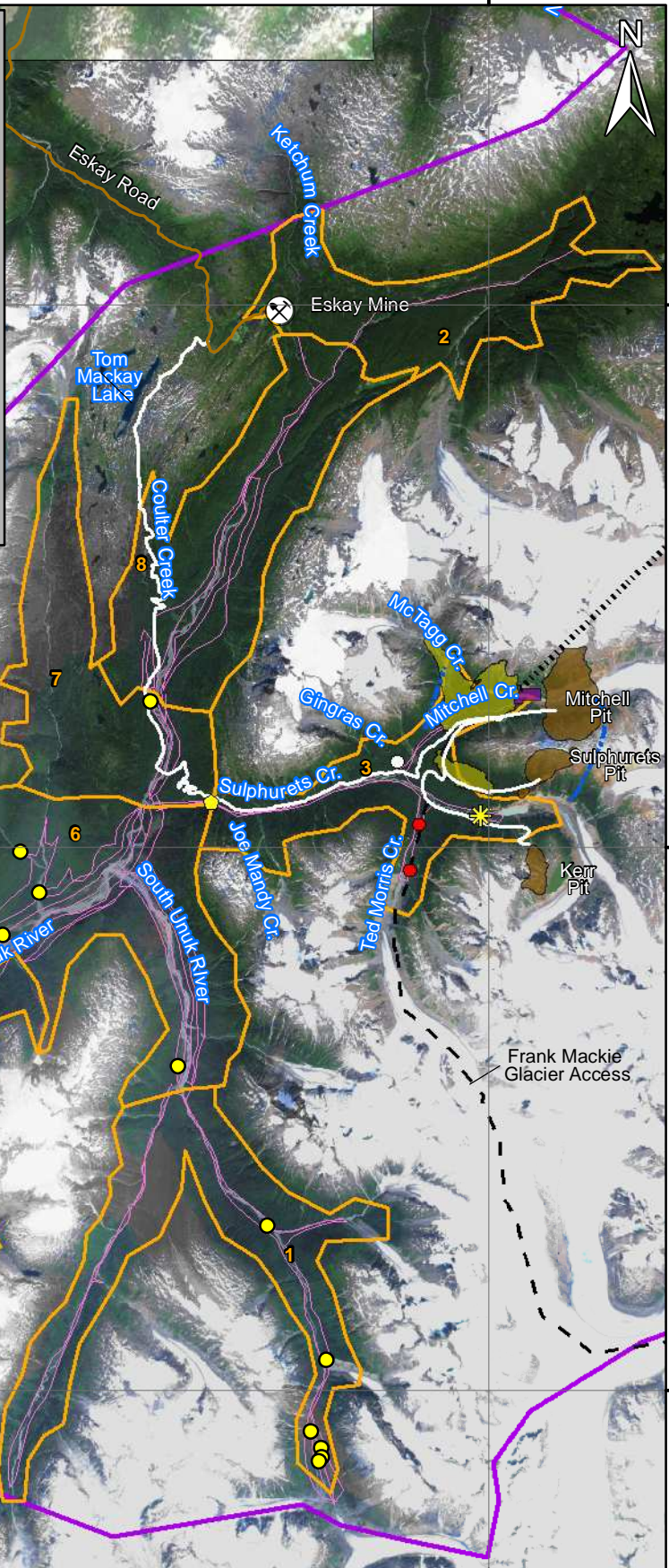
	Moose Observation		Access Road
	Mine Camp		Diversion Tunnel
	Existing Exploration Camp		Temporary Glacier Access Road
	Explosives Plant and Magazine		Ore Transport Tunnel
	Hydropower Generation		Flight Line
	Crushing and Grinding Area		Coastal Moose Survey Unit
	Rock Storage Facility		Regional Study Area
	Pit		

Note: Potential project infrastructure locations are proposed and may change.

0 1:250,000 10

0 5 10

Projection: UTM9, NAD83 Kilometres



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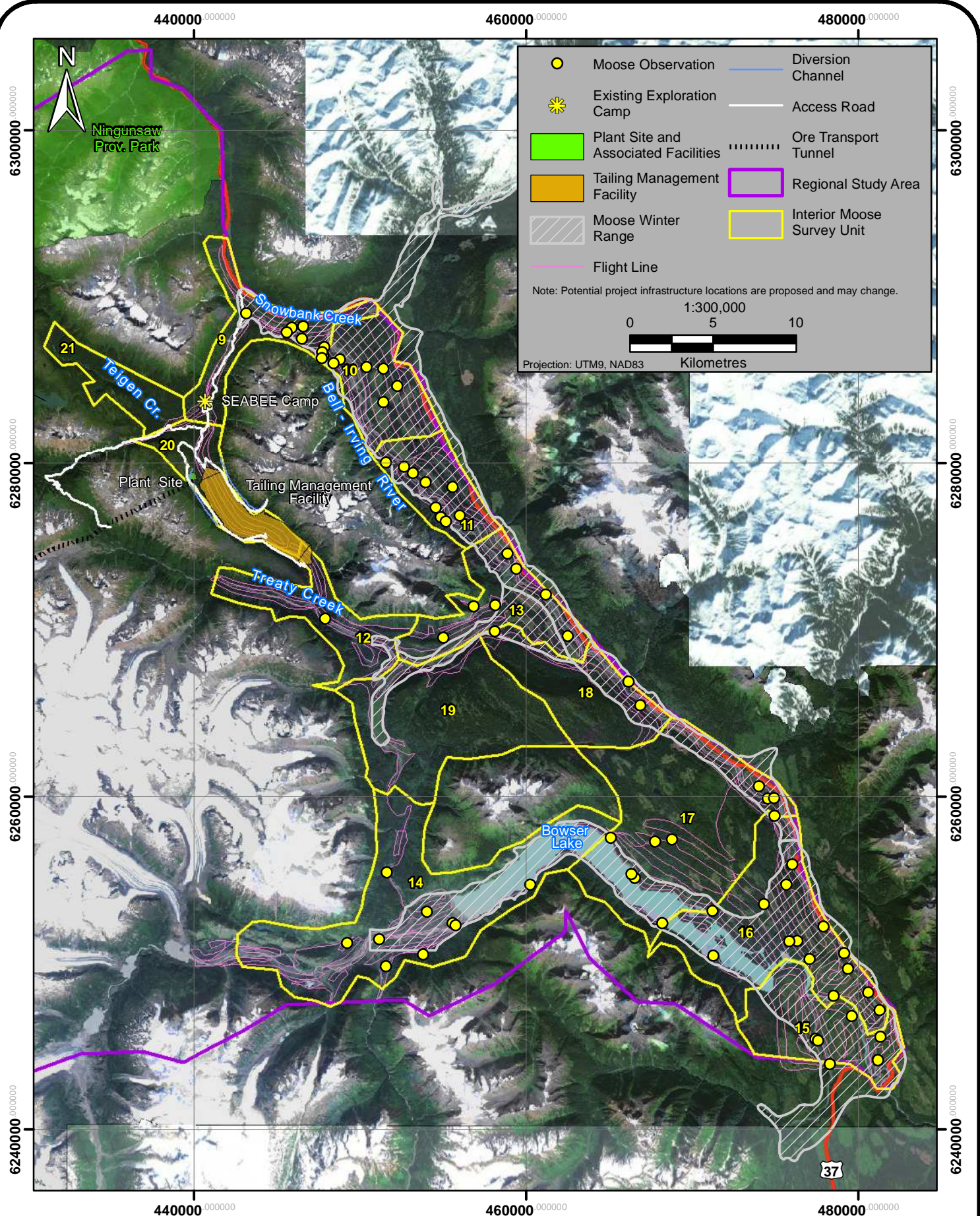
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Appendix 4.2-3

Moose Raw Observation Data, Winter 2009

Appendix 4.2-3. Moose Raw Observation Data, Winter 2009

Date	Time	Survey Area	Survey Unit	Easting	Northing	Observation No.	Survey Location	No. Moose					Topographic Characteristics		BEC Zone	Comment(s)				
								Bulls	Cows	Calves	Unknown	Total	HSR	% Cover			Elevation (m)	Aspect (o)	Slope (o)	
27-Feb-09	9:56	Coastal	4	392751	6245832	1	Unuk River	2				2	2	20	96	222	1	CWH wm		
27-Feb-09	10:21	Coastal	5	398129	6253134	2	Unuk River	2				2	3	10	141	172	2	CWH wm		
27-Feb-09	10:23	Coastal	5	400623	6254873	3	Unuk River		1			1	2	10	158	208	6	CWH wm		
27-Feb-09	10:42	Coastal	6	402041	6256757	4	South Unuk/Unuk River	3	5			8	2	10	173	16	3	CWH wm		
27-Feb-09	11:00	Coastal	6	403403	6258338	5	South Unuk/Unuk River		1	1		2	3	5	194	319	1	CWH wm		
27-Feb-09	11:06	Coastal	6	402702	6259827	6	South Unuk/Unuk River	1				1	4	5	229	178	38	CWH wm		
27-Feb-09	12:33	Coastal	6	408518	6251933	7	South Unuk/Unuk River		1	1		2	2	30	302	282	4	CWH wm		
27-Feb-09	12:57	Coastal	1	411834	6246052	8	South Unuk River	1				1	3	30	432	202	2	MH un		
27-Feb-09	13:04	Coastal	1	414003	6241099	9	South Unuk River		2			2	2	0	593	328	3	MH un		
27-Feb-09	13:06	Coastal	1	413442	6238476	10	South Unuk River	2				2	1	30	726	72	20	MH un		
27-Feb-09	13:07	Coastal	1	413814	6237857	11	South Unuk River	3				3	1	30	747	279	21	MH un		
27-Feb-09	13:08	Coastal	1	413836	6237517	12	South Unuk River	1				1	1	15	740	269	23	MH un		
27-Feb-09	13:08	Coastal	1	413736	6237360	13	South Unuk River	1				1	1	15	743	290	1	MH un		
27-Feb-09		Coastal	3				Unuk River			none observed										
27-Feb-09	14:13	Coastal	7	407512	6265375	14	Unuk River		1			1	3	20	239	196	2	CWH wm		
27-Feb-09		Coastal	8				Unuk River			none observed										
27-Feb-09		Coastal	2				Unuk River			none observed										
1-Mar-09		Interior	20				North and South Cells			none observed										
1-Mar-09		Interior	21				Teigen Creek			none observed										
1-Mar-09	10:16	Interior	12	447906	6270646	15	Treaty Creek	1				1	2	5	604	146	0	ICH vc		
1-Mar-09	11:11	Interior	19	458111	6269892	16	Todedada Creek		1			1	2	25	527	23	3	ICH vc		
1-Mar-09	11:32	Interior	13	455009	6269511	17	Bell-Irving River		1	1		2	3	10	577	123	11	ICH vc		
1-Mar-09	11:35	Interior	13	458134	6271461	18	Bell-Irving River		4			4	3	35	600	142	18	ICH vc		
1-Mar-09	12:16	Interior	13	456855	6271392	19	Bell-Irving River	2				2	2	20	677	193	51	ICH vc	a little steep for capable habitat	
1-Mar-09	12:31	Interior	13	461186	6272110	20	Bell-Irving River		2		1	3	2	5	475	237	1	ICH vc		
1-Mar-09	12:35	Interior	13	459403	6273642	21	Bell-Irving River	1				1	2	60	482	117	1	ICH vc		
1-Mar-09	12:38	Interior	13	458878	6274560	22	Bell-Irving River				1	1	2	70	488	216	2	ICH vc		
1-Mar-09	12:44	Interior	13	462516	6269613	23	Bell-Irving River	3	3			6	2	0	466	44	11	ICH vc		
1-Mar-09	13:12	Interior	11	456020	6276843	24	Bell-Irving River		1	1		2	2	0	490	104	3	ICH vc		
1-Mar-09	13:17	Interior	11	453188	6279383	25	Bell-Irving River		1	1		2	2	20	505	108	2	ICH vc		
1-Mar-09	13:18	Interior	11	452647	6279763	26	Bell-Irving River		2			2	2	20	505	215	4	ICH vc		
1-Mar-09	13:23	Interior	11	454554	6277326	27	Bell-Irving River		1	1		2	3	50	547	36	15	ICH vc		
1-Mar-09	13:24	Interior	11	454870	6276758	28	Bell-Irving River					2	2	10	551	94	13	ICH vc		
1-Mar-09	13:25	Interior	11	455173	6276490	29	Bell-Irving River	4				4	2	20	523	49	34	ICH vc		
1-Mar-09	13:40	Interior	11	453950	6278826	30	Bell-Irving River	1				1	3	20	501	60	1	ICH vc		
1-Mar-09	13:57	Interior	11	455570	6278546	31	Bell-Irving River		1			1	3	20	551	35	32	ICH vc		
1-Mar-09	14:21	Interior	10	448794	6286226	32	Bell-Irving River		1			1	2	20	529	82	1	ICH vc		
1-Mar-09	14:27	Interior	10	451576	6280033	33	Bell-Irving River		3			3	2	15	513	343	13	ICH vc		
1-Mar-09	14:35	Interior	10	447809	6286474	34	Bell-Irving River		2			2	3	20	535	63	19	ICH vc		
1-Mar-09	14:37	Interior	10	448423	6285989	35	Bell-Irving River	2				2	3	10	526	236	13	ICH vc		
1-Mar-09	14:49	Interior	10	450393	6285776	36	Bell-Irving River	2				2	3	5	603	249	33	ICH vc		
1-Mar-09	14:55	Interior	10	451417	6283656	37	Bell-Irving River	2	1			3	4	0	-	-	-	ICH vc		
1-Mar-09	15:01	Interior	10	451405	6285665	38	Bell-Irving River		1	1		2	3	5	718	184	9	ICH vc		
2-Mar-09	9:12	Interior	10	452243	6284628	39	Bell-Irving River		1	1		2	2	20	620	15	10	ICH vc		
2-Mar-09	9:48	Interior	9	446596	6288199	40	Bell-Irving River	3				3	1	50	537	20	8	ICH vc		
2-Mar-09	9:57	Interior	9	445911	6288140	41	Bell-Irving River		1			1	1	35	540	256	3	ICH vc		
2-Mar-09	10:00	Interior	9	443162	6288986	42	Bell-Irving River	1	1			2	2	20	560	176	12	ICH vc		
2-Mar-09	10:08	Interior	9	446511	6287467	43	Bell-Irving River	1				1	1	50	-	-	-	ICH vc		
2-Mar-09	10:17	Interior	9	447847	6286957	44	Bell-Irving River		1	1		2	2	20	536	110	12	ICH vc		
2-Mar-09	10:17	Interior	9	447725	6286662	45	Bell-Irving River		1			1	2	20	532	236	1	ICH vc		
2-Mar-09	10:20	Interior	9	447703	6286293	46	Bell-Irving River		1			1	2	35	554	47	21	ESSFwv		
2-Mar-09	10:22	Interior	9	445583	6287849	47	Bell-Irving River		1	1		2	2	40	561	71	4	ICH vc		
2-Mar-09	10:49	Interior	18	466885	6265445	48	Treaty Creek		1			1	2	20	457	78	2	ICH vc		
2-Mar-09	11:12	Interior	18	466164	6266875	49	Treaty Creek		1	1		2	3	0	466	220	2	ICH vc		

Appendix 4.2-3. Moose Raw Observation Data, Winter 2009

Date	Time	Survey Area	Survey Unit	Easting	Northing	Observation No.	Survey Location	No. Moose					HSR % Cover		Topographic Characteristics			BEC Zone	Comment(s)
								Bulls	Cows	Calves	Unknown	Total			Elevation (m)	Aspect (o)	Slope (o)		
3-Mar-09	10:33	Interior	14	451620	6255399	50	Scott Creek		2			2	25	467	77	35	ESSFwv		
3-Mar-09	10:38	Interior	14	454024	6253035	51	Scott Creek		2			2	0	377	340	3	ICH vc		
3-Mar-09	11:07	Interior	14	449235	6251170	52	Scott Creek		1	1		2	25	399	123	3	ICH vc		
3-Mar-09	11:39	Interior	14	451150	6251402	53	Scott Creek		3	2		5	10	391	127	3	ICH vc		
3-Mar-09	11:42	Interior	14	455581	6252363	54	Scott Creek		3	4		7	30	373	117	4	ICH vc		
3-Mar-09	11:43	Interior	14	455762	6252225	55	Scott Creek		1	2		3	30	373	353	2	ICH vc		
3-Mar-09	11:52	Interior	14	451561	6249782	56	Scott Creek	1				1	20	407	271	2	ICH vc		
3-Mar-09	11:56	Interior	14	453810	6250480	57	Scott Creek	2				2	5	494	343	43	ICH vc		
3-Mar-09	12:00	Interior	14	460256	6254685	58	Scott Creek	1				1	3	371	323	31	ICH vc		
3-Mar-09	12:07	Interior	17	468194	6252369	59	Bowser Lake/ Bell-Irving River	1				3	35	387	10	10	ICH vc		
3-Mar-09	12:14	Interior	17	466550	6255090	60	Bowser Lake/ Bell-Irving River		1			1	0	368	82	0	ICH vc		
3-Mar-09	12:14	Interior	17	466360	6255307	61	Bowser Lake/ Bell-Irving River		2			2	0	368	63	0	ICH vc		
3-Mar-09	12:16	Interior	17	465093	6257493	62	Bowser Lake/ Bell-Irving River	1				2	20	487	214	27	ICH vc		
3-Mar-09	13:34	Interior	17	467771	6257254	63	Bowser Lake/ Bell-Irving River		2			2	10	601	159	5	ICH vc		
3-Mar-09	13:37	Interior	17	468784	6257397	64	Bowser Lake/ Bell-Irving River		2			2	15	616	219	18	ICH vc		
3-Mar-09	13:51	Interior	17	474544	6259846	65	Bowser Lake/ Bell-Irving River		1	1		2	10		-		ICH vc		
3-Mar-09	13:52	Interior	17	474945	6259882	66	Bowser Lake/ Bell-Irving River		1	1		2	10		-		ICH vc		
3-Mar-09	13:55	Interior	17	474960	6258818	67	Bowser Lake/ Bell-Irving River		2	2		4	35	420	59	17	ICH vc		
3-Mar-09	14:22	Interior	17	474029	6260583	68	Bowser Lake/ Bell-Irving River		2	2		4	35	427	91	7	ICH vc		
3-Mar-09	14:27	Interior	16	476022	6255895	69	Bowser Lake/ Bell-Irving River		1			1	10	402	89	3	ICH vc		
3-Mar-09	14:30	Interior	16	477909	6252148	70	Bowser Lake/ Bell-Irving River		1	1		2	5	387	58	1	ICH vc		
3-Mar-09	14:32	Interior	16	479147	6250567	71	Bowser Lake/ Bell-Irving River	1				2	5	379	105	3	ICH vc		
3-Mar-09	14:34	Interior	16	480597	6248200	72	Bowser Lake/ Bell-Irving River		1	1		2	0	377	250	15	ICH vc		
3-Mar-09	14:36	Interior	16	481289	6247132	73	Bowser Lake/ Bell-Irving River		1			1	0	367	29	0	ICH vc		
3-Mar-09	14:47	Interior	16	478510	6247991	74	Bowser Lake/ Bell-Irving River		4			4	40	373	27	4	ICH vc		
3-Mar-09	14:54	Interior	16	479370	6249616	75	Bowser Lake/ Bell-Irving River	1				1	30	408	218	1	ICH vc		
3-Mar-09	15:10	Interior	16	475678	6254673	76	Bowser Lake/ Bell-Irving River		1			1	10	560	241	12	ICH vc		
3-Mar-09	15:26	Interior	16	476344	6251285	77	Bowser Lake/ Bell-Irving River	2				2	35	437	245	34	ICH vc		
3-Mar-09	15:28	Interior	16	477077	6250212	78	Bowser Lake/ Bell-Irving River	1				1	10	436	238	18	ICH vc		
3-Mar-09	15:30	Interior	16	475841	6251271	79	Bowser Lake/ Bell-Irving River		1	1		2	10	387	98	4	ICH vc		
3-Mar-09	15:35	Interior	16	474337	6253496	80	Bowser Lake/ Bell-Irving River		1	1		2	10	545	191	24	ICH vc		
3-Mar-09	15:50	Interior	16	471230	6253086	81	Bowser Lake/ Bell-Irving River		1	1		2	20	411	212	21	ICH vc		
3-Mar-09	15:57	Interior	16	471270	6250415	82	Bowser Lake/ Bell-Irving River				1	2	80	388	39	18	ICH vc		
4-Mar-09	9:23	Interior	15	479602	6246764	83	Bell Irving River		1	1		2	20	368	19	6	ICH vc		
4-Mar-09	9:25	Interior	15	481346	6245523	84	Bell Irving River		1	1		2	5	371	270	4	ICH vc		
4-Mar-09	9:38	Interior	15	481186	6244121	85	Bell Irving River		1	1		2	30	369	344	2	ICH vc		
4-Mar-09	9:43	Interior	15	478280	6243906	86	Bell Irving River		2			2	0	415	222	1	ICH vc		
4-Mar-09	9:50	Interior	15	477436	6245396	87	Bell Irving River		1			1	30	401	66	1	ICH vc	wolf killed calf	
4-Mar-09	9:53	Interior	15	477565	6245287	88	Bell Irving River		1	1		2	30	400	38	3	ICH vc	wolf here	

Appendix 4.2-4

Incidental Moose Observations, 2008 and 2009

Appendix 4.2-4. Incidental Moose Observations, 2008 and 2009

Date	Discipline	Easting	Northing	No. Moose					Comments
				Bulls	Cows	Calves	Unknown	Total	
14-Jun-08	Wildlife	407858	6260935				1	1	in wetland at the confluence of the Sulphurets and Unuk
15-Jun-08	Wildlife	450274	6269142				1	1	in wetland south of proposed tailings impoundment
16-Jun-08	Wildlife	443342	6276314				1	1	
15-Jul-08	Wildlife	456788	6269853		1	1		2	
15-Jul-08	Wildlife	424703	6282997				1	1	swimming
16-Jul-08	Wildlife	441081	6273258		1	1		2	
16-Jul-08	Wildlife	439363	6273368		2			2	
16-Jul-08	Wildlife	438588	6273628	1				1	
16-Jul-08	Wildlife	437656	6274292	4				4	
27-Sep-08	Wildlife	450152	6268266	1	3			4	near lake
5-Jun-09	Hydrology	441456	6278464				1	1	
2-Jul-09	Aquatics	456592	6269436				2	2	foraging in pond
2-Jul-09	Aquatics	452709	6269686				1	1	foraging in pond
5-Jul-09	Aquatics	445956	6288275				1	1	in a pond next to the Bell-Irving River
7-Jul-09	Fisheries	431719	6279637				1	1	

Appendix 4.2-5

Moose Density Calculations by Survey Unit, Winter 2009

Appendix 4.2-5. Moose Density Calculations by Survey Unit, Winter 2009

Survey Unit	No. Of Moose			Total Area Density (moose/km ²)			Census Area Density (moose/km ²)			Capable Habitat Density (moose/km ²)					
	Observed	Corrected	90% CI ¹	Area (km ²)	Observed	Corrected	90% CI ¹	Area (km ²)	Observed	Corrected	90% CI ¹	Area (km ²)	Observed	Corrected	90% CI ¹
<i>Coastal Survey Area</i>															
1	10	12	4	61	0.16	0.20	0.07	21	0.47	0.57	0.19	27	0.37	0.44	0.15
2	0	0	0	42	0	0	0	4	0	0	0	8	0	0	0
3	0	0	0	39	0	0	0	10	0	0	0	16	0	0	0
4	2	2	1	45	0.04	0.04	0.02	18	0.11	0.11	0.05	25	0.08	0.08	0.04
5	3	3	1	53	0.06	0.06	0.02	14	0.21	0.21	0.07	27	0.11	0.11	0.04
6	13	14	4	78	0.17	0.18	0.05	31	0.42	0.45	0.13	46	0.28	0.31	0.09
7	1	1	0	48	0.02	0.02	0.00	4	0.24	0.24	0.00	21	0.05	0.05	0.00
8	0	0	0	61	0	0	0	18	0	0	0	33	0	0	0
Total	29	32	6	426	0.07	0.08	0.01	121	0.24	0.26	0.05	203	0.14	0.16	0.03
<i>Interior Survey Area</i>															
9	13	21	12	31	0.42	0.67	0.38	21	0.61	0.98	0.56	23	0.57	0.92	0.53
10	17	18	3	34	0.50	0.53	0.09	33	0.51	0.54	0.09	31	0.55	0.58	0.10
11	16	20	7	27	0.58	0.73	0.26	23	0.70	0.88	0.31	26	0.62	0.78	0.27
12	1	1	0	33	0.03	0.03	0.00	22	0.05	0.05	0.00	20	0.05	0.05	0.00
13	19	30	15	39	0.48	0.76	0.38	32	0.60	0.95	0.47	35	0.55	0.87	0.43
14	25	30	9	107	0.23	0.28	0.08	44	0.57	0.68	0.20	78	0.32	0.39	0.12
15	11	13	4	39	0.28	0.33	0.10	32	0.34	0.40	0.12	38	0.29	0.34	0.11
16	24	34	15	73	0.33	0.47	0.21	53	0.45	0.64	0.28	66	0.37	0.52	0.23
17	21	25	7	101	0.21	0.25	0.07	47	0.45	0.53	0.15	83	0.25	0.30	0.08
18	3	3	1	41	0.07	0.07	0.02	17	0.17	0.17	0.06	21	0.14	0.14	0.05
19	1	1	1	74	0.01	0.01	0.01	16	0.06	0.06	0.06	20	0.05	0.05	0.05
20	0	0	0	25	0	0	0	15	0	0	0	1	0	0	0
21	0	0	0	19	0	0	0	1	0	0	0	3	0	0	0
Total	151	196	28	644	0.23	0.30	0.04	357	0.42	0.55	0.08	443	0.34	0.44	0.06

¹ Confidence limit around moose numbers and densities corrected for sightability

Appendix 4.3-1

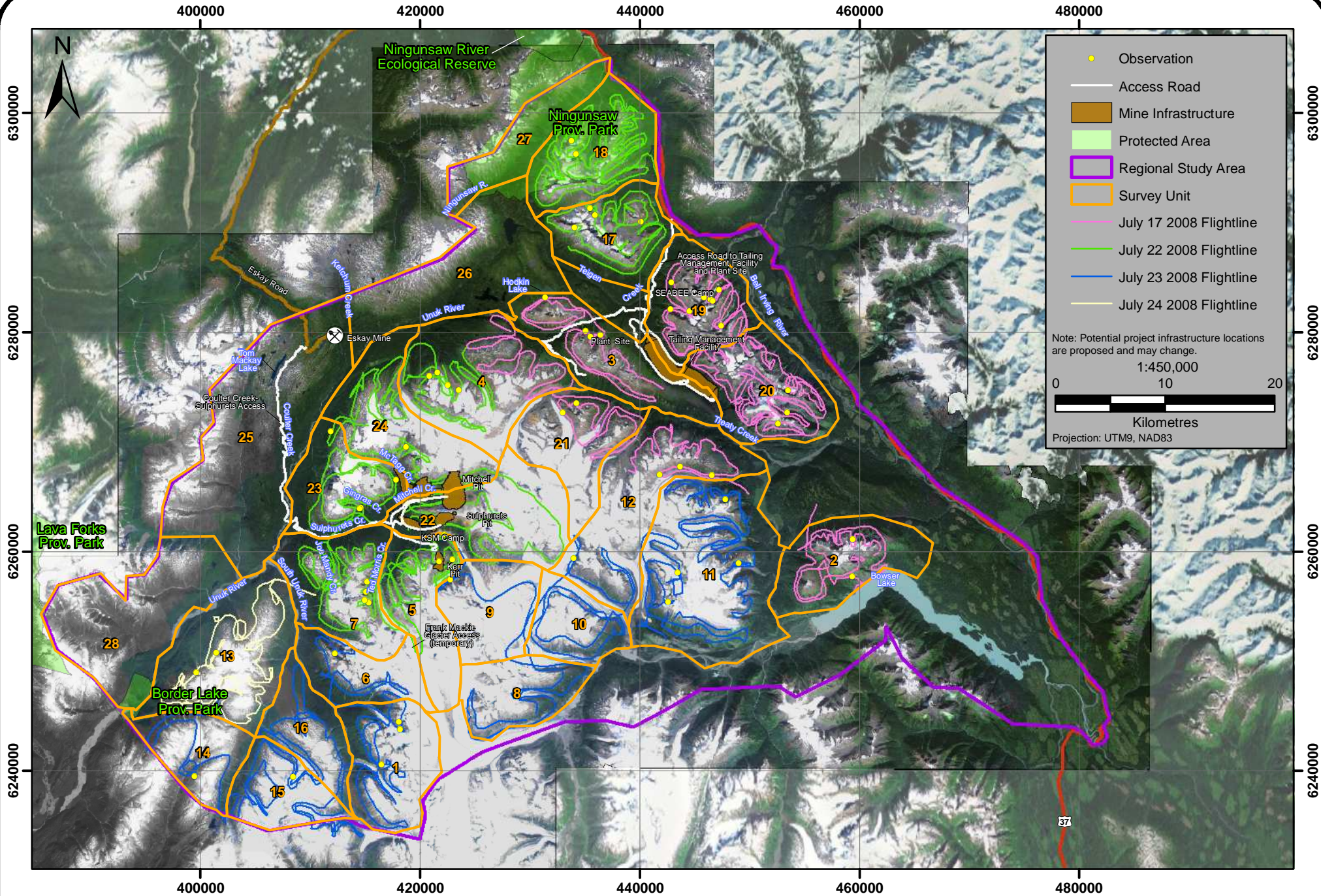
Mountain Goat Aerial Survey Effort, Summer 2008 and Winter 2009

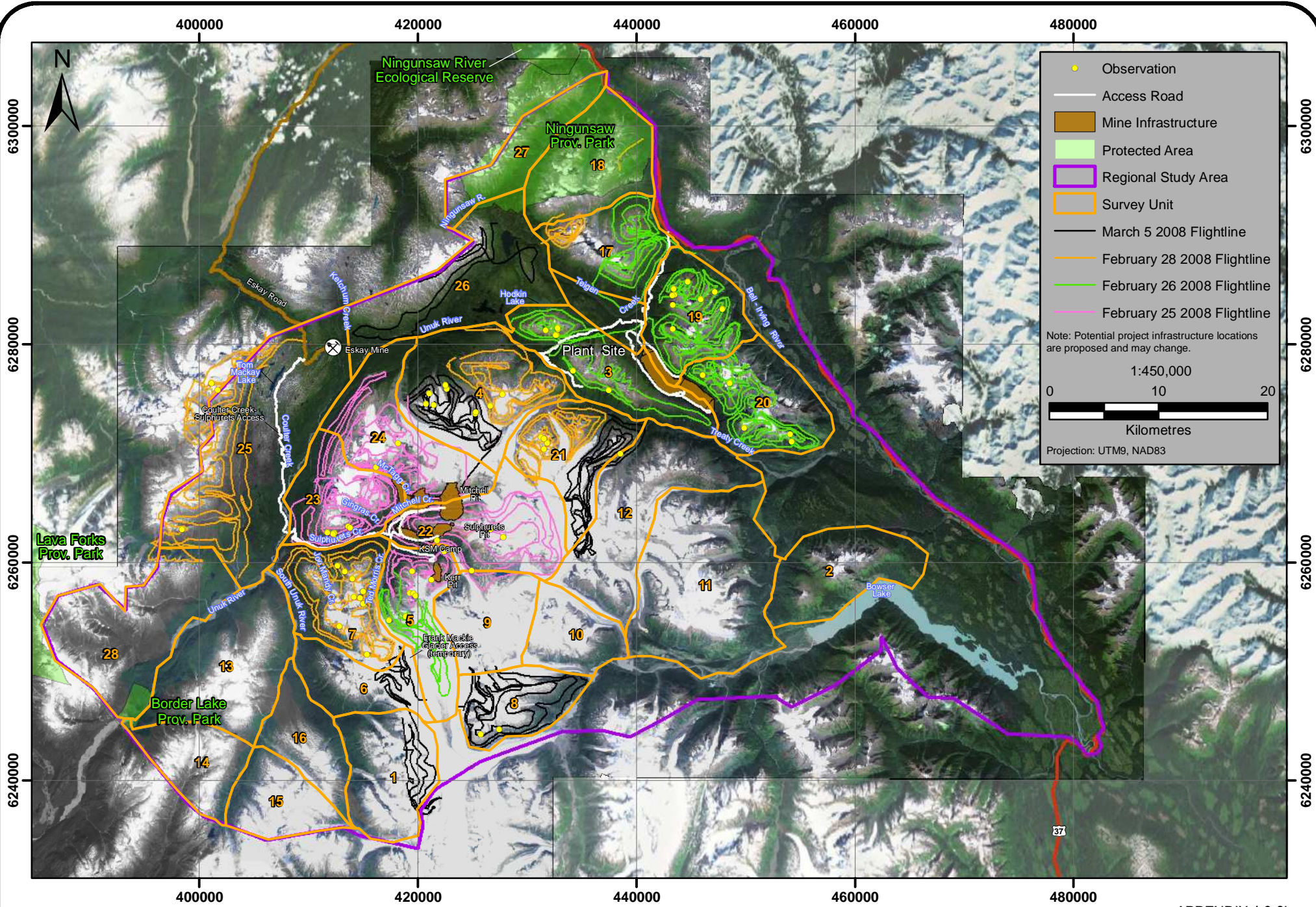
Appendix 4.3-1. Mountain Goat Aerial Survey Effort, Summer 2008 and Winter 2009

Date	Survey Unit (SU)	Total Time (min)	Total Area (km2)	Total Area Effort (min/km2)	Capable Habitat (km2)	Capable Habitat Effort (min/km2)	Temp. (° c)	Cloud Cover (%)	Wind	Lighting	Survey Area
<i>Summer 2008</i>											
23-Jul-08	1	30	82	0.37	66	0.46	9	85	na	variable	S. Unuk
17-Jul-08	2	30	81	0.37	40	0.76	9	85	na	variable	Mt. Anderson
17-Jul-08	3	25	83	0.30	39	0.65	9	100	na	variable	Treaty Cr
17-Jul-08 & 22-Jul-08	4	51	134	0.38	63	0.81	6	95	W 15 kn	variable	Treaty Cr
22-Jul-08	5	35	75	0.47	52	0.67	4	75	na	bright	Sulphurets Cr
23-Jul-08	6	15	55	0.27	40	0.37	9	85	na	variable	S. Unuk
22-Jul-08	7	45	85	0.53	55	0.81	2	60	na	bright	Nandy Cr
23-Jul-08	8	30	63	0.23	55	0.31	2	60	W 9 kn	variable/flat	Frank Mackie Glacier/Bowser R
23-Jul-08	9	30	68	0.23	41	0.31	8	90	W 9 kn	variable/flat	Frank Mackie Glacier
23-Jul-08	10	15	53	0.28	37	0.40	8	85	light	variable	Bowser Lk
23-Jul-08	11	75	191	0.39	135	0.56	8	25	na	sunny/variable	Bowser Lk
17-Jul-08 & 23-Jul-08	12	35	130	0.27	96	0.37	10	95	na	flat/variable	Treaty Cr
24-Jul-08	13	50	128	0.39	65	0.77	4	50	na	variable	S.Unuk/Unuk
23-Jul-08	14	20	58	0.35	49	0.41	8	80	moderate	variable	Boulder Cr
23-Jul-08	15	20	59	0.35	43	0.41	8	80	moderate	variable	Boulder Cr
23-Jul-08	16	70	60	0.59	30	0.95	9	60	na	variable/bright	S. Unuk
22-Jul-08	17	35	76	0.46	37	0.95	4	50	light	bright	Teigen Cr
22-Jul-08	18	64	96	0.66	53	1.21	10	50	light/moderate	variable	Teigen Cr
17-Jul-08	19	45	80	0.57	49	0.92	9	90	SE 9 kn	variable	Snow slide range
17-Jul-08	20	75	94	0.80	68	1.11	8	98	SE 6 kn	variable	Snow slide range
17-Jul-08	21	20	84	0.24	60	0.33	8	85	W 15 kn	variable	Treaty Cr
22-Jul-08	22	25	98	0.26	65	0.38	8	na	light	variable	Mitchell Cr
22-Jul-08	23	30	76	0.40	42	0.72	2	90	na	variable	John Peaks
22-Jul-08	24	27	105	0.26	59	0.46	8	n/a	light	bright	McTagg/Storie Cr
All		847	2,113		1,338						
Average				0.40		0.65					
± SE				0.03		0.06					
<i>Winter 2009</i>											
5-Mar-09	1	26	82	0.32	66	0.40	-10	5	light	high	S. Unuk
26-Feb-09	3	66	83	0.79	39	1.70	-16	0	light	bright	Treaty Cr
28-Feb-09/05-Mar-09	4	104	134	0.78	63	1.65	-10 / -16	overcast	minimal	bright	Treaty Cr
25-Feb-09/26-Feb-09	5	79	75	1.06	52	1.52	-15	0	5- 10 kn	bright/flat	Sulphurets Cr
5-Mar-09	6	20	55	0.36	40	0.50	-10	0	light	high	S. Unuk
28-Feb-09	7	126	85	1.48	55	2.27	-6	0	5- 10 kn	bright	Nandy Cr.
5-Mar-09	8	64	63	1.01	55	1.17	-12	100	light	high	Frank Mackie Glacier/Bowser R
26-Feb-09/28-Feb-09	17	66	76	0.87	37	1.78	-15	5	5- 10 kn	bright/flat	Teigen Cr
26-Feb-09	19	103	80	1.29	49	2.11	-16	high cloud	light	flat	Snow slide range
26-Feb-09	20	88	94	0.94	68	1.30	-16	0	light	birght	Snow slide range
28-Feb-09/05-Mar-09	21	132	84	1.57	60	2.19	-10 / -18	overcast /clear	minimal	bright	Treaty Cr
25-Feb-09	22	86	98	0.88	65	1.32	-19	0	5 kn	bright	Mitchell Cr
25-Feb-09	23	94	76	1.24	42	2.26	-15	0	5- 10 kn	bright	John Peaks
25-Feb-09	24	102	105	0.97	59	1.72	-15	0	5- 10 kn	bright	McTagg/Storie Cr
28-Feb-09	25	114	223	0.51	69	1.64	-15	5	5- 10 kn	bright	Boulder Cr
5-Mar-09	26	28	140	0.20	13	2.09	-12	5	light	high	Unuk River
All		1,298	1,553		832						
Average				0.89		1.60					
± SE				0.10		0.14					

Appendix 4.3-2

Mountain Goat Aerial Survey Flightline Maps





Appendix 4.3-3

Mountain Goat Raw Observation Data, Summer 2008 and
Winter 2009

Appendix 4.3-3. Mountain Goat Raw Observation Data, Summer 2008 and Winter 2009

Survey	Date	Time	Survey Unit	Easting	Northing	Sighting No.	No. Mountain Goats			HSR	% Cover	Topographic Characteristics				Comment(s)
							Adult	Kid	Total			Elevation (m)	Aspect (o)	Slope (o)	Dist. Escape Terrain (m)	
Summer 2008	17-Jul-08	11:55	19	442895	6284598	1	1	0	1	3	0	1,474	337	52	548	
Summer 2008	17-Jul-08	12:00	19	446415	6283043	2	1	1	2	2	75	1,282	5	28	478	
Summer 2008	17-Jul-08	12:00	19	447223	6283926	3	5	2	7	2	75	1,210	353	48	546	
Summer 2008	17-Jul-08	12:00	19	447223	6283926	4	5	3	8	2	75	1,210	353	48	546	
Summer 2008	17-Jul-08	12:03	19	446658	6282881	5	1	0	1	2	75	1,428	356	49	631	
Summer 2008	17-Jul-08	12:03	19	445856	6283221	6	2	0	2	2	75	1,375	99	32	158	
Summer 2008	17-Jul-08	12:08	19	447400	6280656	7	1	0	1	3	75	1,306	316	30	759	
Summer 2008	17-Jul-08	12:25	19	444506	6281963	8	2	0	2	3	35	1,444	332	11	269	
Summer 2008	17-Jul-08	12:26	19	442811	6282151	9	1	1	2	3	1	1,403	342	42	750	
Summer 2008	17-Jul-08	13:39	20	453508	6274754	10	1	0	1	4	25	1,426	55	37	42	
Summer 2008	17-Jul-08	13:51	20	453416	6272701	11	1	0	1	3	75	1,167	8	28	329	
Summer 2008	17-Jul-08	13:51	20	453416	6272701	12	5	3	8	3	75	1,167	8	28	329	
Summer 2008	17-Jul-08	14:01	20	452606	6271722	13	2	2	4	3	35	1,502	141	37	134	
Summer 2008	17-Jul-08	14:41	3	436441	6279817	14	3	0	3	1	100	1,454	104	23	1,001	
Summer 2008	17-Jul-08	14:43	3	435519	6279662	15	6	0	6	3	40	1,352	67	36	514	
Summer 2008	17-Jul-08	14:43	3	435109	6280155	16	1	0	1	3	40	1,406	345	35	742	
Summer 2008	17-Jul-08	14:58	3	431411	6283252	17	3	2	5	2	65	1,122	12	39	284	1 yearling
Summer 2008	17-Jul-08	14:58	3	431411	6283252	18	6	2	8	2	65	1,122	12	39	284	
Summer 2008	17-Jul-08	15:37	21	434263	6273593	19	3	0	3	4	20	1,372	55	27	468	
Summer 2008	17-Jul-08	15:39	21	432997	6272736	20	4	0	4	4	5	1,334	231	26	18	
Summer 2008	17-Jul-08	16:43	2	459363	6257742	21	2	0	2	3	0	1,218	90	37	171	
Summer 2008	17-Jul-08	17:04	2	459429	6261140	22	8	3	11	2	10	1,445	307	26	279	
Summer 2008	17-Jul-08	17:04	2	459429	6261140	23	2	2	4	2	0	1,445	307	26	279	
Summer 2008	17-Jul-08	17:17	12	441793	6267093	24	3	0	3	4	0	1,448	118	33	331	
Summer 2008	17-Jul-08	17:18	12	443688	6267809	25	1	0	1	3	80	1,403	169	34	101	
Summer 2008	17-Jul-08	17:19	12	446582	6267021	26	1	0	1	3	65	1,121	167	35	39	
Summer 2008	22-Jul-08	10:10	5	422247	6261540	27	2	0	2	0	5	717	212	13	351	sulphurets mineral lick
Summer 2008	22-Jul-08	10:16	5	422934	6259312	28	1	0	1	2	80	1,287	112	29	209	
Summer 2008	22-Jul-08	10:18	5	421738	6259128	29	1	0	1	3	75	1,571	347	37	289	
Summer 2008	22-Jul-08	10:57	7	415371	6255337	30	7	0	7	2	75	1,455	47	33	148	
Summer 2008	22-Jul-08	10:58	7	414989	6255627	31	2	0	2	2	50	1,547	63	17	106	
Summer 2008	22-Jul-08	10:59	7	415113	6256343	32	4	0	4	4	10	1,422	61	37	82	2 yearlings
Summer 2008	22-Jul-08	11:01	7	415235	6257246	33	2	0	2	3	35	1,359	143	43	0	
Summer 2008	22-Jul-08	11:36	23	414629	6264032	34	6	3	9	1	100	1,161	51	60	210	
Summer 2008	22-Jul-08	11:41	23	411916	6271002	35	7	2	9	2	90	909	283	30	2,106	
Summer 2008	22-Jul-08	11:41	23	417796	6266597	36	9	4	13	4	10	1,102	84	33	515	
Summer 2008	22-Jul-08	14:09	24	418721	6269603	37	1	0	1	2	50	1,210	211	32	230	
Summer 2008	22-Jul-08	14:54	4	420874	6276063	38	1	0	1	2	100	1,633	326	38	502	
Summer 2008	22-Jul-08	14:59	4	421598	6276370	39	1	0	1	3	0	1,263	74	44	363	
Summer 2008	22-Jul-08	15:02	4	422533	6275237	40	1	0	1	3	50	1,440	274	11	592	
Summer 2008	22-Jul-08	15:04	4	423528	6274777	41	4	3	7	3	50	1,433	94	30	242	
Summer 2008	22-Jul-08	15:35	17	435950	6290753	42	1	1	2	3	25	1,209	45	25	85	
Summer 2008	22-Jul-08	15:36	17	435498	6291360	43	1	1	2	3	0	1,322	345	10	370	
Summer 2008	22-Jul-08	15:42	17	434085	6289604	44	22	6	28	3	10	1,664	157	34	173	3 yearlings included in adult count
Summer 2008	22-Jul-08	15:52	17	440123	6290150	45	1	0	1	4	10	1,457	134	43	97	
Summer 2008	22-Jul-08	16:54	18	434216	6296316	46	1	0	1	4	60	1,406	74	42	0	
Summer 2008	22-Jul-08	16:54	18	434216	6296316	47	1	0	1	4	25	1,406	74	42	0	
Summer 2008	22-Jul-08	16:59	18	433799	6297514	48	3	0	3	4	0	1,577	13	16	331	
Summer 2008	23-Jul-08	08:16	11	443447	6258080	49	1	0	1	4	2	1,575	9	5	523	

Appendix 4.3-3. Mountain Goat Raw Observation Data, Summer 2008 and Winter 2009

Survey	Date	Time	Survey Unit	Easting	Northing	Sighting No.	No. Mountain Goats			HSR	% Cover	Topographic Characteristics				Comment(s)
							Adult	Kid	Total			Elevation (m)	Aspect (o)	Slope (o)	Dist. Escape Terrain (m)	
Summer 2008	23-Jul-08	08:28	11	442582	6255434	50	5	2	7	4	2	1,844	232	19	218	
Summer 2008	23-Jul-08	08:52	11	449021	6258950	51	1	0	1	2	100	1,116	156	40	33	
Summer 2008	23-Jul-08	09:18	11	447809	6264795	52	2	0	2	3	40	1,350	305	31	363	
Summer 2008	23-Jul-08	10:32	12	433996	6259415	53	2	1	3	4	5	1,469	260	9	786	
Summer 2008	23-Jul-08	10:05	10				0	0	0							no goats observed
Summer 2008	23-Jul-08	10:40	8				0	0	0							no goats observed
Summer 2008	23-Jul-08	11:10	9	422775	6257468	54	1	0	1	3	50	1,142	43	3	315	
Summer 2008	23-Jul-08	13:03	6	412297	6250749	55	4	0	4	4	5	1,435	14	33	231	
Summer 2008	23-Jul-08	13:19	1	418174	6243816	56	1	0	1	4	5	1,716	246	42	16	
Summer 2008	23-Jul-08	13:20	1	418058	6244497	57	1	0	1	4	5	1,875	287	39	66	
Summer 2008	23-Jul-08	13:28	1	416462	6240597	58	1	0	1	3	25	1,258	198	25	37	
Summer 2008	23-Jul-08	13:50	16				0	0	0							no goats observed
Summer 2008	23-Jul-08	15:09	15	408467	6239509	59	6	5	11	2	75	1,426	128	6	214	yearling
Summer 2008	23-Jul-08	15:37	14	399493	6239525	60	1	1	2	2	75	1,146	15	35	67	
Summer 2008	24-Jul-08	08:37	13	401458	6250817	61	1	1	2	3	5	1,265	300	18	189	
Summer 2008	24-Jul-08	08:40	13	399636	6248989	62	1	1	2	3	5	1,145	352	38	98	
Winter 2009	25-Feb-09	09:35	22	421753	6262008	63	3	1	4	1	0	894	162	47	0	
Winter 2009	25-Feb-09	10:05	22	424924	6259276	64	1	1	2	1		1,211	343	25	606	
Winter 2009	25-Feb-09	10:50	22	426656	6263053	65	3	0	3	3		1,887	160	37	9	
Winter 2009	25-Feb-09	10:52	22	427838	6262313	66	1	0	1	5		2,162	307	17	261	
Winter 2009	25-Feb-09	12:27	24	418177	6270976	67	1	0	1	3		1,896	237	26	151	
Winter 2009	25-Feb-09	12:30	24	416153	6268740	68	1	1	2	2		1,445	207	46	6	
Winter 2009	25-Feb-09	15:35	23	413670	6263293	69	5	0	5	1		1,273	138	49	3	
Winter 2009	25-Feb-09	15:37	23	412406	6262709	70	1	0	1	2		1,321	182	39	144	
Winter 2009	25-Feb-09	15:38	23	412272	6262607	71	5	1	6	2		1,222	183	47	25	
Winter 2009	25-Feb-09	15:39	23	411768	6262722	72	2	0	2	1		1,314	153	39	61	
Winter 2009	25-Feb-09	15:45	23	413864	6263192	73	1	0	1	1		1,131	153	38	220	
Winter 2009	25-Feb-09	15:52	23	412749	6262143	74	3	0	3	1		866	155	44	243	
Winter 2009	25-Feb-09	16:24	5	422408	6261038	75	5	2	7	1		944	25	54	222	aspect could be warmer
Winter 2009	25-Feb-09	16:45	5	421254	6258434	76	5	2	7	3		1,786	124	50	0	
Winter 2009	25-Feb-09	16:53	5	419254	6257218	77	3	1	4	3		1,851	229	44	7	
Winter 2009	25-Feb-09	16:55	5	419592	6257183	78	1	1	2	3		2,101	199	46	48	
Winter 2009	25-Feb-09	16:55	5	419793	6256975	79	1	1	2	3		2,084	298	34	102	
Winter 2009	25-Feb-09	16:58	5	419469	6259197	80	2	0	2	4		1,501	57	37	76	
Winter 2009	26-Feb-09	09:19	5	419469	6259197	81	1	0	1	3		1,501	57	37	76	
Winter 2009	26-Feb-09	09:33	5	418869	6255065	82	1	0	1	2/3		1,664	343	40	96	
Winter 2009	26-Feb-09	10:17	5	417354	6254711	83	3	1	4	2		1,373	256	43	0	
Winter 2009	26-Feb-09	10:17	3	432735	6280887	84	2	1	3	2		1,328	155	41	64	
Winter 2009	26-Feb-09	10:23	3	432613	6280888	85	2	1	3	2		1,320	160	40	3	
Winter 2009	26-Feb-09	10:25	3	432853	6281403	86	4	1	5	2		1,715	158	44	0	
Winter 2009	26-Feb-09	10:29	3	431708	6281326	87	1	0	1	1		1,719	187	43	55	
Winter 2009	26-Feb-09	10:51	3	432810	6281512	88	1	0	1	1		1,821	176	31	27	
Winter 2009	26-Feb-09	10:54	3	437524	6275813	89	2	0	2	3		1,368	160	43	0	
Winter 2009	26-Feb-09	12:05	3	434243	6277591	90	1	0	1	2		1,395	190	29	1,659	
Winter 2009	26-Feb-09	12:14	19	443353	6281443	91	2	0	2	2/3		1,907	226	33	195	
Winter 2009	26-Feb-09	12:17	19	443339	6283660	92	2	1	3	2		1,710	240	33	796	
Winter 2009	26-Feb-09	12:17	19	443492	6284559	93	5	1	6	2		1,774	205	32	98	
Winter 2009	26-Feb-09	12:27	19	443312	6284504	94	1	1	2	2		1,673	201	27	120	
Winter 2009	26-Feb-09	12:34	19	444725	6285735	95	1	0	1	2		1,783	119	17	161	

Appendix 4.3-3. Mountain Goat Raw Observation Data, Summer 2008 and Winter 2009

Survey	Date	Time	Survey Unit	Easting	Northing	Sighting No.	No. Mountain Goats			HSR	% Cover	Topographic Characteristics				Comment(s)
							Adult	Kid	Total			Elevation (m)	Aspect (o)	Slope (o)	Dist. Escape Terrain (m)	
Winter 2009	26-Feb-09	12:45	19	443424	6285094	96	1	1	2	1		1,731	255	39	349	
Winter 2009	26-Feb-09	13:01	19	447176	6284850	97	1	1	2	2		1,043	166	52	110	
Winter 2009	26-Feb-09	13:06	19	447877	6283263	98	2	1	3	2/3		1,379	120	43	12	
Winter 2009	26-Feb-09	13:44	19	445892	6284166	99	2	0	2	1		1,674	109	38	55	
Winter 2009	26-Feb-09	14:28	20	454243	6271111	100	1	0	1	3		1,084	202	49	126	
Winter 2009	26-Feb-09	14:40	20	446060	6277229	101	1	0	1	2/3		1,681	223	36	437	
Winter 2009	26-Feb-09	14:45	20	449887	6272391	102	2	0	2	3		1,627	227	34	73	
Winter 2009	26-Feb-09	14:53	20	454073	6271815	103	4	2	6	2		1,566	196	26	66	
Winter 2009	26-Feb-09	15:42	17				0	0	0							no goats observed
Winter 2009	28-Feb-09	9:13	17				0	0	0							no goats observed
Winter 2009	28-Feb-09	10:38	25	401689	6275840	104	1	0	1	3		1,809	208	40	2	
Winter 2009	28-Feb-09	10:56	25	398403	6263033	105	1	1	2	3		1,371	195	52	5	
Winter 2009	28-Feb-09	12:34	7	415356	6251563	106	2	0	2	3		1,767	254	49	59	
Winter 2009	28-Feb-09	12:56	7	415832	6258173	107	1	0	1	2		1,193	89	42	67	
Winter 2009	28-Feb-09	13:21	7	412684	6259673	108	1	0	1	2		1,289	236	47	212	
Winter 2009	28-Feb-09	13:23	7	413339	6259144	109	1	0	1	3		1,455	320	16	649	
Winter 2009	28-Feb-09	13:30	7	415018	6257365	110	1	1	2	3		1,570	153	45	0	
Winter 2009	28-Feb-09	13:32	7	414756	6256737	111	11	5	16	3		1,684	166	52	0	
Winter 2009	28-Feb-09	13:33	7	414195	6256836	112	7	1	8	3		1,863	263	22	229	
Winter 2009	28-Feb-09	13:36	7	415026	6256223	113	1	0	1	3		1,547	18	46	153	
Winter 2009	28-Feb-09	13:46	7	412854	6254179	114	3	1	4	3		1,973	252	39	80	
Winter 2009	28-Feb-09	13:58	7	414022	6258495	115	1	0	1	3		1,751	149	10	66	
Winter 2009	28-Feb-09	14:20	4	426654	6274411	116	1	0	1	2		1,697	268	38	162	
Winter 2009	28-Feb-09	15:33	4	427748	6275466	117	1	0	1	3		1,791	106	35	139	
Winter 2009	28-Feb-09	16:17	21	431877	6271008	118	1	1	2	3		1,905	143	53	3	close to ski tracks
Winter 2009	28-Feb-09	16:20	21	431295	6271539	119	1	1	2	3		1,891	216	34	87	close to ski tracks
Winter 2009	28-Feb-09	16:21	21	431567	6271402	120	2	0	2	3		2,024	254	39	122	close to ski tracks
Winter 2009	28-Feb-09	16:23	21	431559	6270448	121	1	1	2	3		2,194	16	25	37	close to ski tracks
Winter 2009	5-Mar-09	09:39	21	438577	6270006	122	1	0	1	3	0	1,343	131	46	142	
Winter 2009	5-Mar-09	10:53	4	422653	6275910	123	2	1	3	2	0	1,563	254	48	179	
Winter 2009	5-Mar-09	10:53	4	422549	6276282	124	1	0	1	2	0	1,527	258	44	426	
Winter 2009	5-Mar-09	11:00	4	425269	6273681	125	1	0	1	3	0	1,793	133	42	0	
Winter 2009	5-Mar-09	11:00	4	425304	6273808	126	2	0	2	3	0	1,799	75	42	5	
Winter 2009	5-Mar-09	11:14	4	421044	6275523	127	2	0	2	3	0	1,813	92	24	40	
Winter 2009	5-Mar-09	11:16	4	421473	6274461	128	2	0	2	3	0	1,913	57	22	160	
Winter 2009	5-Mar-09	11:30	4	420752	6274576	129	1	0	1	3	0	2,032	235	51	25	
Winter 2009	5-Mar-09	13:01	8	427443	6244701	130	1	0	1	2	0	1,463	212	43	0	
Winter 2009	5-Mar-09	13:15	8	425779	6244255	131	3	1	4	3	0	1,874	118	42	9	
Winter 2009	5-Mar-09	13:42	6				0	0	0							no goats observed
Winter 2009	5-Mar-09	14:02	1				0	0	0							no goats observed
Winter 2009	5-Mar-09	15:19	26				0	0	0							no goats observed

Appendix 4.3-4

Incidental Mountain Goat Observations, 2009

Appendix 4.3-4. Incidental Mountain Goat Observations, 2009

Date	Discipline	Easting	Northing	No. Mountain Goat			Comments
				Adults	Kids	Total	
27-Jun-09	Wildlife	450152	6268266	8	2	10	
5-Jul-09	Aquatics	441456	6278464	5	1	6	
11-Jul-09	Fisheries	456592	6269436	1	0	1	at Sulphurets waterfall
31-Aug-09	Archeology	431719	6279637	4	1	5	south portion of Kerr Pit, north facing slope, ~ 1750m

Appendix 4.4-1

Incidental Observations of Furbearers, 2008 and 2009.

Appendix 4.4-1. Incidental Observations of Furbearers, 2008 and 2009

Date	Wildlife Survey	Easting	Northing	Species	Animal/Sign	No. Observed	Comment(s)
14-Jun-08	Terrestrial Breeding Bird	-	-	Grey Wolf	Sign	1	old tracks observed along the South Unuk River
15-Jun-08	Terrestrial Breeding Bird	-	-	Grey Wolf	Sign	2	fresh tracks along lake shore of West Teigen Lake
15-Jun-08	Terrestrial Breeding Bird	-	-	American Black Bear	Animal	1	travelling east along Sulphurets Creek
16-Jun-08	Terrestrial Breeding Bird	-	-	Red Fox	Sign	1	fresh scat observed near Todedada Creek
15-Jul-08	Water Dependent Bird	427635	6290137	Grey Wolf	Animal	1	on shore of Teigen Lake
22-Jul-08	Mountain Ungulate	414513	6263910	American Black Bear	Animal	1	observed near Survey Unit 23
22-Jul-08	Mountain Ungulate	-	-	American Black Bear	Animal	1	observed within Survey Unit 18
22-Jul-08	Mountain Ungulate	-	-	Grey Wolf	Animal	1	observed within Survey Unit 18
22-Jul-08	Terrestrial Ecosystem Mapping - Wildlife	419647	6262132	American Black Bear	Sign	2	
22-Jul-08	Terrestrial Ecosystem Mapping - Wildlife	-	-	American Black Bear	Sign	2	Black bear sow and possible cub (approximate location: 419647 6262132)
22-Jul-08	Terrestrial Ecosystem Mapping - Wildlife	-	-	American Black Bear	Sign	2	approximate location: 419436 6262226
22-Jul-08	Terrestrial Ecosystem Mapping - Wildlife	-	-	American Black Bear	Sign	2	approximate location: 419190 6262325
22-Jul-08	Terrestrial Ecosystem Mapping - Wildlife	-	-	American Marten	Sign	1	approximate location: 419190 6262325
23-Jul-08	Terrestrial Ecosystem Mapping - Wildlife	418837	6262315	Red Squirrel	Sign	1	
23-Jul-08	Terrestrial Ecosystem Mapping - Wildlife	417941	6261892	Red Squirrel	Sign	1	Squirrel feeding stations (cones)
23-Jul-08	Terrestrial Ecosystem Mapping - Wildlife	-	-	Red Squirrel	Sign	1	approximate location: 418336 6262336
23-Jul-08	Terrestrial Ecosystem Mapping - Wildlife	-	-	Red Squirrel	Sign	1	approximate location: 418143 6262056
23-Jul-08	Terrestrial Ecosystem Mapping - Wildlife	-	-	Red Squirrel	Sign	1	approximate location: 417941 6261892
24-Jul-08	Terrestrial Ecosystem Mapping - Wildlife	-	-	American Marten	Sign	1	Old winter scat (approximate location: 432029 6279043)
24-Jul-08	Terrestrial Ecosystem Mapping - Wildlife	-	-	Snowshoe Hare	Sign	1	approximate location: 431641 6279306
24-Jul-08	Terrestrial Ecosystem Mapping - Wildlife	-	-	Grey Wolf	Sign	2	approximate location: 431751 6279560
25-Jul-08	Terrestrial Ecosystem Mapping - Wildlife	442145	6276633	American Marten	Sign	1	
25-Jul-08	Terrestrial Ecosystem Mapping - Wildlife	442145	6276633	Red Squirrel	Sign	1	Squirrel feeding stations (cones)
25-Jul-08	Terrestrial Ecosystem Mapping - Wildlife	-	-	American Marten	Sign	1	approximate location: 441934 6276313
25-Jul-08	Terrestrial Ecosystem Mapping - Wildlife	-	-	Red Squirrel	Sign	1	approximate location: 442145 6276633
25-Jul-08	Terrestrial Ecosystem Mapping - Wildlife	-	-	American Marten	Sign	1	approximate location: 442209 6277006
25-Jul-08	Terrestrial Ecosystem Mapping - Wildlife	-	-	American Marten	Sign	1	Multiple scat piles on stumps & logs. (approximate location: 443882 6277508)
26-Jul-08	Terrestrial Ecosystem Mapping - Wildlife	443982	6277147	American Marten	Sign	1	
26-Jul-08	Terrestrial Ecosystem Mapping - Wildlife	443939	6276864	American Marten	Sign	1	
26-Jul-08	Terrestrial Ecosystem Mapping - Wildlife	443939	6276864	Red Squirrel	Sign	1	
26-Jul-08	Terrestrial Ecosystem Mapping - Wildlife	-	-	Fisher	Sign	1	Scat 4-6" found along creek (approximate location: 421193 6265204)
26-Jul-08	Terrestrial Ecosystem Mapping - Wildlife	-	-	American Marten	Sign	2	Multiple scats on multiple logs. (approximate location: 443982 6277147)
26-Jul-08	Terrestrial Ecosystem Mapping - Wildlife	-	-	Red Squirrel	Sign	2	Numerous squirrel feeding stations and numerous mouse holes. (approximate location: 443982 6277147)
26-Jul-08	Terrestrial Ecosystem Mapping - Wildlife	-	-	American Marten	Sign	1	Multiple marten scat on multiple logs, multiple squirrel feeding stations. (approximate location: 443939 6276864)
26-Jul-08	Terrestrial Ecosystem Mapping - Wildlife	443939	6276864	Red Squirrel	Sign	1	approximate location: 443939 6276864
27-Jul-08	Terrestrial Ecosystem Mapping - Wildlife	430202	6280265	Red Squirrel	Sign	1	
27-Jul-08	Terrestrial Ecosystem Mapping - Wildlife	419676	6261048	American Black Bear	Sign	1	
27-Jul-08	Terrestrial Ecosystem Mapping - Wildlife	407594	6266333	Red Squirrel	Sign	1	
27-Jul-08	Terrestrial Ecosystem Mapping - Wildlife	-	-	Red Squirrel	Sign	1	approximate location: 430372 6279926
27-Jul-08	Terrestrial Ecosystem Mapping - Wildlife	-	-	American Marten	Sign	2	Single scats and several in one small area 1m x 1/2m. (approximate location: 430503 6279397)

Appendix 4.4-1. Incidental Observations of Furbearers, 2008 and 2009

Date	Wildlife Survey	Easting	Northing	Species	Animal/Sign	No. Observed	Comment(s)
27-Jul-08	Terrestrial Ecosystem Mapping - Wildlife	-	-	American Black Bear	Sign	1	approximate location: 419676 6261048
27-Jul-08	Terrestrial Ecosystem Mapping - Wildlife	-	-	American Marten	Sign	2	approximate location: 407594 6266333
27-Jul-08	Terrestrial Ecosystem Mapping - Wildlife	-	-	Red Squirrel	Animal	1	approximate location: 407594 6266333
27-Jul-08	Terrestrial Ecosystem Mapping - Wildlife	-	-	Red Squirrel	Sign	1	approximate location: 407594 6266333
28-Jul-08	Terrestrial Ecosystem Mapping - Wildlife	407336	6266332	American Marten	Sign	1	
28-Jul-08	Terrestrial Ecosystem Mapping - Wildlife	407336	6266332	Red Squirrel	Animal	1	
28-Jul-08	Terrestrial Ecosystem Mapping - Wildlife	410086	6270007	American Black Bear	Sign	1	Black bear sow/cub in area.
28-Jul-08	Terrestrial Ecosystem Mapping - Wildlife	410086	6270007	Mink	Sign	1	
28-Jul-08	Terrestrial Ecosystem Mapping - Wildlife	-	-	American Marten	Both	2	Numerous trees with cavity nests, many scat piles. (approximate location: 407336 6266332)
28-Jul-08	Terrestrial Ecosystem Mapping - Wildlife	-	-	Red Squirrel	Both	2	feeding stations (approximate location: 407336 6266332)
28-Jul-08	Terrestrial Ecosystem Mapping - Wildlife	-	-	Red Squirrel	Sign	1	approximate location: 407378 6266351
28-Jul-08	Terrestrial Ecosystem Mapping - Wildlife	-	-	American Black Bear	Sign	3	approximate location: 410333 6269888
28-Jul-08	Terrestrial Ecosystem Mapping - Wildlife	-	-	American Marten	Sign	1	approximate location: 410333 6269888
28-Jul-08	Terrestrial Ecosystem Mapping - Wildlife	-	-	Red Squirrel	Animal	1	approximate location: 410333 6269888
28-Jul-08	Terrestrial Ecosystem Mapping - Wildlife	-	-	American Marten	Sign	1	approximate location: 410216 6269873
28-Jul-08	Terrestrial Ecosystem Mapping - Wildlife	-	-	Red Squirrel	Animal	1	approximate location: 410216 6269873
28-Jul-08	Terrestrial Ecosystem Mapping - Wildlife	-	-	American Beaver	Sign	1	Active beaver pond/dam. (approximate location: 410086 6270007)
28-Jul-08	Terrestrial Ecosystem Mapping - Wildlife	-	-	American Black Bear	Sign	2	approximate location: 410086 6270007
28-Jul-08	Terrestrial Ecosystem Mapping - Wildlife	-	-	Red Squirrel	Sign	1	approximate location: 411878 6274645
29-Jul-08	Terrestrial Ecosystem Mapping - Wildlife	439754	6280113	Red Squirrel	Sign	1	Squirrel feeding stations (cones)
29-Jul-08	Terrestrial Ecosystem Mapping - Wildlife	-	-	American Marten	Sign	2	approximate location: 459551 6280045
29-Jul-08	Terrestrial Ecosystem Mapping - Wildlife	-	-	Red Squirrel	Sign	1	approximate location: 439754 6280113
29-Jul-08	Terrestrial Ecosystem Mapping - Wildlife	439819	6279044	Red Squirrel	Sign	1	approximate location: 439819 6279044
26-Apr-09	Water Dependent Bird	392390	6245403	Wolverine	Animal	1	observed on lower Unuk River near the US border
26-Apr-09	Water Dependent Bird	-	-	Grey Wolf	Animal	1	observed on the lower Unuk River near Border Lake
18-Aug-09	Terrestrial Ecosystem Mapping - Wildlife	435946	6281456	American Black Bear	Sign	1	Scat in forest and tracks in creek.
18-Aug-09	Terrestrial Ecosystem Mapping - Wildlife	435007	6280955	American Black Bear	Sign	1	
18-Aug-09	Terrestrial Ecosystem Mapping - Wildlife	-	-	American Black Bear	Sign	1	approximate location: 435946 6281456
18-Aug-09	Terrestrial Ecosystem Mapping - Wildlife	-	-	American Black Bear	Sign	1	approximate location: 435007 6280955
23-Aug-09	Terrestrial Ecosystem Mapping - Wildlife	-	-	American Black Bear	Sign	1	approximate location: 436135 6276993
23-Aug-09	Terrestrial Ecosystem Mapping - Wildlife	-	-	American Black Bear	Sign	1	Tracks in small upslope wetland. (approximate location: 434407 6276102)
25-Aug-09	Terrestrial Ecosystem Mapping - Wildlife	-	-	American Marten	Sign	1	Sporadic marten scat in area. Increased denning potential in area. (approximate location: 417909 6260307)
27-Aug-09	Terrestrial Ecosystem Mapping - Wildlife	407797	6261768	American Marten	Sign	1	
28-Aug-09	Terrestrial Ecosystem Mapping - Wildlife	-	-	American Marten	Sign	1	approximate location: 407978 6269749
30-Aug-09	Terrestrial Ecosystem Mapping - Wildlife	437432	6283326	American Black Bear	Sign	1	

Appendix 4.5-1

Summary of Hoary Marmot and Arctic Ground Squirrel Aerial
Survey Results, 2008

Appendix 4.5-1. Summary of Hoary Marmot and Arctic Ground Squirrel Aerial Survey Results, 2008

Survey						Digital Topographic Characteristics			Digital Habitat Characteristics				Structural Stage
						Elevation ^a (m)	Aspect ^a (o)	Slope ^a (%)	BEC Zone	PEM Value	General Ecosystem Type	Site Series	
15-Aug-08	2a	Eastern Control	456014	6256345	93	1,476	159	60	BAFAunp	1009	Mesic Herb	Heather heath	2
15-Aug-08	2a	Eastern Control	456269	6256487	94	1,459	124	38	ESSFwv	9044	Avalanche Track	Avalanche Herb mod slope	2
15-Aug-08	2a	Eastern Control	455789	6258268	95	1,372	34	16	BAFAunp	1006	Wetter Herb	Wetter Herb	2
15-Aug-08	2a	Eastern Control	454530	6258073	96	1,262	291	64	ESSFwv	4011	Mesic Forest	BIHm - Azalea	6/7
15-Aug-08	2a	Eastern Control	454815	6257746	97	1,442	224	73	BAFAunp	1009	Mesic Herb	Heather heath	2
15-Aug-08	2a	Eastern Control	454944	6257715	98	1,491	211	75	BAFAunp	1001	Drier Shrub/Herb	Drier Shrub/Herb	3
15-Aug-08	2a	Eastern Control	455024	6257691	99	1,519	260	95	BAFAunp	1012	sparsely vegetated	Escape Terrain	1
15-Aug-08	2a	Eastern Control	455017	6257638	100	1,507	248	96	BAFAunp	1004	Mesic Herb	Mesic Herb	2
15-Aug-08	2a	Eastern Control	455028	6257548	101	1,478	249	61	BAFAunp	1009	Mesic Herb	Heather heath	2
15-Aug-08	2a	Eastern Control	455053	6257281	102	1,522	335	76	BAFAunp	1007	sparsely vegetated	Barren	1
15-Aug-08	2a	Eastern Control	454163	6256997	103	1,250	288	98	ESSFwv	4011	Mesic Forest	BIHm - Azalea	6/7
15-Aug-08	2a	Eastern Control	454651	6256384	104	1,542	252	82	BAFAunp	1003	Mesic Shrub/Herb	Mesic Shrub/Herb	3
15-Aug-08	2a	Eastern Control	455033	6256204	105	1,530	160	51	BAFAunp	1007	sparsely vegetated	Barren	1
15-Aug-08	2a	Eastern Control	455475	6256400	106	1,536	167	54	BAFAunp	1007	sparsely vegetated	Barren	1
15-Aug-08	2a	Eastern Control	455664	6256404	107	1,535	187	81	BAFAunp	1004	Mesic Herb	Mesic Herb	2
15-Aug-08	2a	Eastern Control	456000	6256403	108	1,513	149	67	BAFAunp	1003	Mesic Shrub/Herb	Mesic Shrub/Herb	3
15-Aug-08	2a	Eastern Control	455637	6256786	109	1,629	115	34	BAFAunp	1007	sparsely vegetated	Barren	1
15-Aug-08	2a	Eastern Control	455575	6257583	110	1,500	51	26	BAFAunp	1007	sparsely vegetated	Barren	1
15-Aug-08	2a	Eastern Control	454809	6258041	111	1,435	300	70	BAFAunp	1003	Mesic Shrub/Herb	Mesic Shrub/Herb	3
15-Aug-08	11a	Eastern Control	448335	6265229	112	1,311	56	72	ESSFwv	9027	Parkland Forest/Krummholz	Dry Woodland	3
15-Aug-08	11a	Eastern Control	447279	6264753	113	1,443	105	64	BAFAunp	1007	sparsely vegetated	Barren	1
15-Aug-08	11a	Eastern Control	446841	6265468	114	1,318	9	86	ESSFwv	9028	Parkland Forest/Krummholz	Mesic Woodland	3
15-Aug-08	12a	Eastern Treatment	443941	6267725	115	1,354	129	64	BAFAunp	1003	Mesic Shrub/Herb	Mesic Shrub/Herb	3
15-Aug-08	12a	Eastern Treatment	445070	6267776	116	1,374	233	91	BAFAunp	1002	Wetter Shrub/Herb	Wetter Shrub/Herb	3
15-Aug-08	12a	Eastern Treatment	445446	6267687	117	1,443	208	76	BAFAunp	1007	sparsely vegetated	Barren	1
15-Aug-08	12a	Eastern Treatment	447137	6267327	118	1,282	159	107	ESSFwv	9040	Avalanche Track	Avalanche Shrub steep slope	3
15-Aug-08	12a	Eastern Treatment	448192	6268030	119	1,131	22	30	ESSFwv	4011	Mesic Forest	BIHm - Azalea	6/7
15-Aug-08	12a	Eastern Treatment	446092	6269709	120	1,325	57	20	ESSFwv	9034	sparsely vegetated	Barren	1
15-Aug-08	12a	Eastern Treatment	444784	6269897	121	1,286	344	64	BAFAunp	1003	Mesic Shrub/Herb	Mesic Shrub/Herb	3
15-Aug-08	12a	Eastern Treatment	443855	6269293	122	1,461	306	88	BAFAunp	1012	sparsely vegetated	Escape Terrain	1
15-Aug-08	12a	Eastern Treatment	443375	6269357	123	1,545	87	94	BAFAunp	1012	sparsely vegetated	Escape Terrain	1
15-Aug-08	12a	Eastern Treatment	443591	6270190	124	1,508	160	32	BAFAunp	1007	sparsely vegetated	Barren	1
15-Aug-08	12a	Eastern Treatment	440928	6270098	125	1,229	63	74	ESSFwv	9040	Avalanche Track	Avalanche Shrub steep slope	3
15-Aug-08	12a	Eastern Treatment	440206	6269727	126	1,251	290	85	ESSFwv	4011	Mesic Forest	BIHm - Azalea	6/7
15-Aug-08	12a	Eastern Treatment	439071	6268621	127	1,306	285	51	BAFAunp	1003	Mesic Shrub/Herb	Mesic Shrub/Herb	3
15-Aug-08	12a	Eastern Treatment	437306	6269175	128	1,316	167	72	BAFAunp	1007	sparsely vegetated	Barren	1
15-Aug-08	12a*	Eastern Treatment	438117	6269453	129	1,314	132	47	BAFAunp	1003	Mesic Shrub/Herb	Mesic Shrub/Herb	3
15-Aug-08	12a*	Eastern Treatment	439214	6271747	130	1,525	26	68	ESSFwv	9034	sparsely vegetated	Barren	1
15-Aug-08	22a	Western Treatment	423212	6262404	131	1,263	169	41	MHm2	9066	Avalanche Track	Avalanche Track - shrub dominated - moderate slope	3
15-Aug-08	22a	Western Treatment	423305	6262540	132	1,359	193	56	CMAunp	2003	Mesic Shrub/Herb	Mesic Shrub/Herb	3
15-Aug-08	22a	Western Treatment	423490	6262830	133	1,522	248	67	CMAunp	2007	sparsely vegetated	Barren	1
15-Aug-08	22a	Western Treatment	423794	6262807	134	1,634	213	71	CMAunp	2012	sparsely vegetated	Escape Terrain	1
15-Aug-08	22a	Western Treatment	425076	6261562	135	1,455	219	47	CMAunp	2009	Mesic Herb	Heather heath	2
15-Aug-08	22a	Western Treatment	425288	6261412	136	1,486	235	45	CMAunp	2003	Mesic Shrub/Herb	Mesic Shrub/Herb	3
15-Aug-08	5a*	Western Treatment	423765	6257981	137	1,205	16	88	CMAunp	2002	Wetter Shrub/Herb	Wetter Shrub/Herb	3
15-Aug-08	5a	Western Treatment	421248	6257775	138	1,401	122	68	CMAunp	2012	sparsely vegetated	Escape Terrain	1
15-Aug-08	5a	Western Treatment	421604	6258093	139	1,374	184	60	CMAunp	2007	sparsely vegetated	Barren	1
15-Aug-08	5a	Western Treatment	421666	6258254	140	1,464	199	78	CMAunp	2012	sparsely vegetated	Escape Terrain	1
15-Aug-08	5a	Western Treatment	422932	6259288	141	1,282	117	55	CMAunp	2003	Mesic Shrub/Herb	Mesic Shrub/Herb	3
15-Aug-08	22a	Western Treatment	421299	6263003	142	1,437	202	44	MHm2	9067	Avalanche Track	Avalanche Track - herb dominated - moderate slope	2

Appendix 4.5-1. Summary of Hoary Marmot and Arctic Ground Squirrel Aerial Survey Results, 2008

Survey						Digital Topographic Characteristics			Digital Habitat Characteristics				Structural Stage
						Date	Unit	Area	Easting	Northing	Colony ID	Elevation ^a (m)	
15-Aug-08	22a	Western Treatment	423391	6262746	143	1,462	163	75	CMAunp	2007	sparsely vegetated	Barren	1
15-Aug-08	5a	Western Treatment	419154	6260081	144	1,186	343	81	MHmm2	7011	Mesic Forest	HmBa - Blueberry	6/7
15-Aug-08	5a	Western Treatment	420461	6260041	145	1,247	4	59	MHmm2	9080	Parkland Forest/Krummholz	Mesic Woodland	3
15-Aug-08	5a	Western Treatment	420599	6259879	146	1,344	354	45	MHmm2	9066	Avalanche Track	Avalanche Track - shrub dominated - moderate slope	3
15-Aug-08	5a	Western Treatment	420692	6259792	147	1,382	59	74	MHmm2	9069	sparsely vegetated	Escape Terrain	1
16-Aug-08	19	Eastern Treatment	443043	6285923	148	1,172	278	46	ESSFwv	9039	Avalanche Track	Avalanche Shrub mod slope	3
16-Aug-08	19	Eastern Treatment	443669	6282596	149	1,314	231	71	BAFAunp	1009	Mesic Herb	Heather heath	2
16-Aug-08	19	Eastern Treatment	443863	6282401	150	1,305	212	86	BAFAunp	1012	sparsely vegetated	Escape Terrain	1
16-Aug-08	19	Eastern Treatment	446736	6280993	151	1,476	172	33	BAFAunp	1009	Mesic Herb	Heather heath	2
16-Aug-08	19	Eastern Treatment	447550	6281600	152	1,227	99	61	ESSFwv	9045	Avalanche Track	Avalanche Herb steep slope	2
16-Aug-08	19	Eastern Treatment	447842	6283090	153	1,338	53	104	ESSFwv	9028	Parkland Forest/Krummholz	Mesic Woodland	3
16-Aug-08	19	Eastern Treatment	448245	6283814	154	1,200	41	115	ESSFwv	4011	Mesic Forest	BIHm - Azalea	6/7
16-Aug-08	19	Eastern Treatment	447144	6283752	155	1,249	283	77	BAFAunp	1003	Mesic Shrub/Herb	Mesic Shrub/Herb	3
16-Aug-08	19	Eastern Treatment	446841	6283180	156	1,326	295	82	BAFAunp	1012	sparsely vegetated	Escape Terrain	1
16-Aug-08	19	Eastern Treatment	446724	6284668	157	1,257	132	86	ESSFwv	9040	Avalanche Track	Avalanche Shrub steep slope	3
16-Aug-08	19	Eastern Treatment	446788	6284966	158	1,318	81	78	ESSFwv	9040	Avalanche Track	Avalanche Shrub steep slope	3
16-Aug-08	19	Eastern Treatment	446906	6285173	159	1,313	184	107	ESSFwv	9038	Mesic Herb	Heather Heath	2
16-Aug-08	19	Eastern Treatment	446082	6285923	160	1,279	277	120	BAFAunp	1001	Drier Shrub/Herb	Drier Shrub/Herb	3
16-Aug-08	19	Eastern Treatment	446083	6285716	161	1,330	304	72	BAFAunp	1003	Mesic Shrub/Herb	Mesic Shrub/Herb	3
16-Aug-08	19	Eastern Treatment	445086	6286438	162	1,293	106	66	ESSFwv	9040	Avalanche Track	Avalanche Shrub steep slope	3
16-Aug-08	19	Eastern Treatment	444560	6286749	163	1,275	352	65	ESSFwv	9040	Avalanche Track	Avalanche Shrub steep slope	3
16-Aug-08	19	Eastern Treatment	443214	6285556	164	1,429	322	95	ESSFwv	9040	Avalanche Track	Avalanche Shrub steep slope	3
16-Aug-08	19	Eastern Treatment	443154	6285433	165	1,463	309	82	ESSFwv	9040	Avalanche Track	Avalanche Shrub steep slope	3
16-Aug-08	19	Eastern Treatment	442909	6284856	166	1,351	261	78	BAFAunp	1010	Parkland Forest/Krummholz	Krummholz	3
16-Aug-08	19	Eastern Treatment	443090	6284246	167	1,472	227	42	BAFAunp	1009	Mesic Herb	Heather heath	2
16-Aug-08	19	Eastern Treatment	443223	6284217	168	1,495	209	48	BAFAunp	1009	Mesic Herb	Heather heath	2
16-Aug-08	19	Eastern Treatment	443417	6284125	169	1,515	252	27	BAFAunp	1007	sparsely vegetated	Barren	1
16-Aug-08	19	Eastern Treatment	442716	6283816	170	1,363	309	58	ESSFwv	9039	Avalanche Track	Avalanche Shrub mod slope	3
16-Aug-08	19	Eastern Treatment	443048	6283088	171	1,322	252	62	ESSFwv	9040	Avalanche Track	Avalanche Shrub steep slope	3
16-Aug-08	19	Eastern Treatment	443076	6283081	172	1,342	227	63	ESSFwv	9045	Avalanche Track	Avalanche Herb steep slope	2
16-Aug-08	19	Eastern Treatment	443099	6283001	173	1,313	217	59	ESSFwv	9039	Avalanche Track	Avalanche Shrub mod slope	3
16-Aug-08	19	Eastern Treatment	443536	6282941	174	1,411	174	57	BAFAunp	1006	Wetter Herb	Wetter Herb	2
16-Aug-08	19	Eastern Treatment	443621	6282906	175	1,425	231	71	BAFAunp	1003	Mesic Shrub/Herb	Mesic Shrub/Herb	3
16-Aug-08	19	Eastern Treatment	444324	6282433	176	1,472	213	64	BAFAunp	1003	Mesic Shrub/Herb	Mesic Shrub/Herb	3
16-Aug-08	19	Eastern Treatment	444365	6282427	177	1,487	226	66	BAFAunp	1007	sparsely vegetated	Barren	1
16-Aug-08	19	Eastern Treatment	446613	6281088	178	1,514	173	36	BAFAunp	1009	Mesic Herb	Heather heath	2
16-Aug-08	19	Eastern Treatment	447524	6282419	179	1,406	120	75	BAFAunp	1009	Mesic Herb	Heather heath	2
16-Aug-08	19	Eastern Treatment	445804	6283316	180	1,440	94	72	BAFAunp	1012	sparsely vegetated	Escape Terrain	1
16-Aug-08	19	Eastern Treatment	446295	6284214	181	1,378	176	74	BAFAunp	1009	Mesic Herb	Heather heath	2
16-Aug-08	19	Eastern Treatment	446547	6284535	182	1,389	133	76	ESSFwv	9040	Avalanche Track	Avalanche Shrub steep slope	3
16-Aug-08	19	Eastern Treatment	446627	6284810	183	1,354	67	73	ESSFwv	9034	sparsely vegetated	Barren	1
16-Aug-08	19	Eastern Treatment	446673	6285286	184	1,468	136	103	BAFAunp	1012	sparsely vegetated	Escape Terrain	1
16-Aug-08	19	Eastern Treatment	443804	6285453	185	1,587	315	70	BAFAunp	1007	sparsely vegetated	Barren	1
16-Aug-08	19	Eastern Treatment	443115	6285289	186	1,491	297	76	ESSFwv	9042	sparsely vegetated	Escape Terrain	1
16-Aug-08	19	Eastern Treatment	443077	6284843	187	1,478	263	97	BAFAunp	1009	Mesic Herb	Heather heath	2
16-Aug-08	19	Eastern Treatment	443207	6284612	188	1,592	319	108	BAFAunp	1012	sparsely vegetated	Escape Terrain	1
16-Aug-08	19	Eastern Treatment	442967	6284552	189	1,521	263	50	BAFAunp	1001	Drier Shrub/Herb	Drier Shrub/Herb	3
16-Aug-08	19	Eastern Treatment	443188	6284341	190	1,547	216	70	BAFAunp	1003	Mesic Shrub/Herb	Mesic Shrub/Herb	3
16-Aug-08	19	Eastern Treatment	443285	6284342	191	1,584	201	73	BAFAunp	1007	sparsely vegetated	Barren	1
16-Aug-08	19	Eastern Treatment	443197	6284410	192	1,593	217	74	BAFAunp	1012	sparsely vegetated	Escape Terrain	1

Appendix 4.5-1. Summary of Hoary Marmot and Arctic Ground Squirrel Aerial Survey Results, 2008

Survey						Digital Topographic Characteristics			Digital Habitat Characteristics				Structural Stage
						Date	Unit	Area	Easting	Northing	Colony ID	Elevation ^a (m)	
16-Aug-08	19	Eastern Treatment	443451	6284377	193	1,630	209	65	BAFAunp	1012	sparsely vegetated	Escape Terrain	1
16-Aug-08	19	Eastern Treatment	443791	6284152	194	1,646	216	61	BAFAunp	1003	Mesic Shrub/Herb	Mesic Shrub/Herb	3
16-Aug-08	19	Eastern Treatment	443906	6284076	195	1,663	275	33	BAFAunp	1008	non-vegetated	Glacier/ice or permanent snow	n/a
16-Aug-08	19	Eastern Treatment	443956	6284093	196	1,698	249	39	BAFAunp	1007	sparsely vegetated	Barren	1
16-Aug-08	19	Eastern Treatment	443020	6283978	197	1,489	355	85	BAFAunp	1010	Parkland Forest/Krummholz	Krummholz	3
16-Aug-08	19	Eastern Treatment	443001	6283912	198	1,500	278	40	BAFAunp	1003	Mesic Shrub/Herb	Mesic Shrub/Herb	3
16-Aug-08	19	Eastern Treatment	443084	6283944	199	1,539	301	71	BAFAunp	1010	Parkland Forest/Krummholz	Krummholz	3
16-Aug-08	19	Eastern Treatment	443039	6283882	200	1,522	285	56	BAFAunp	1003	Mesic Shrub/Herb	Mesic Shrub/Herb	3
16-Aug-08	19	Eastern Treatment	443976	6283030	201	1,603	234	52	BAFAunp	1007	sparsely vegetated	Barren	1
16-Aug-08	19	Eastern Treatment	444279	6282819	202	1,578	183	47	BAFAunp	1007	sparsely vegetated	Barren	1
16-Aug-08	19	Eastern Treatment	444719	6282220	203	1,574	252	63	BAFAunp	1012	sparsely vegetated	Escape Terrain	1
16-Aug-08	19	Eastern Treatment	444736	6282259	204	1,598	256	76	BAFAunp	1012	sparsely vegetated	Escape Terrain	1
16-Aug-08	19	Eastern Treatment	447090	6281543	205	1,455	109	106	ESSFww	9040	Avalanche Track	Avalanche Shrub steep slope	3
16-Aug-08	19	Eastern Treatment	447177	6282007	206	1,501	95	76	BAFAunp	1012	sparsely vegetated	Escape Terrain	1
16-Aug-08	19	Eastern Treatment	447392	6284059	207	1,254	289	97	ESSFww	9040	Avalanche Track	Avalanche Shrub steep slope	3
16-Aug-08	19	Eastern Treatment	445694	6283349	208	1,516	144	101	BAFAunp	1012	sparsely vegetated	Escape Terrain	1
16-Aug-08	19	Eastern Treatment	446145	6283888	209	1,486	99	68	BAFAunp	1001	Drier Shrub/Herb	Drier Shrub/Herb	3
16-Aug-08	19	Eastern Treatment	446626	6285347	210	1,526	39	54	BAFAunp	1012	sparsely vegetated	Escape Terrain	1
16-Aug-08	19	Eastern Treatment	445972	6285103	211	1,501	281	53	BAFAunp	1012	sparsely vegetated	Escape Terrain	1
16-Aug-08	19	Eastern Treatment	444898	6285020	212	1,629	140	69	BAFAunp	1007	sparsely vegetated	Barren	1
16-Aug-08	19	Eastern Treatment	444790	6285452	213	1,609	105	84	BAFAunp	1012	sparsely vegetated	Escape Terrain	1
16-Aug-08	19	Eastern Treatment	444346	6285981	214	1,523	326	34	BAFAunp	1007	sparsely vegetated	Barren	1
16-Aug-08	19	Eastern Treatment	444443	6286024	215	1,541	283	50	BAFAunp	1009	Mesic Herb	Heather heath	2
16-Aug-08	19	Eastern Treatment	443058	6284031	216	1,460	349	68	BAFAunp	1003	Mesic Shrub/Herb	Mesic Shrub/Herb	3
16-Aug-08	19	Eastern Treatment	443594	6283502	217	1,676	235	78	BAFAunp	1007	sparsely vegetated	Barren	1
16-Aug-08	19	Eastern Treatment	446925	6282269	218	1,702	123	61	BAFAunp	1007	sparsely vegetated	Barren	1
16-Aug-08	19	Eastern Treatment	447585	6283203	219	1,563	94	76	BAFAunp	1009	Mesic Herb	Heather heath	2
16-Aug-08	19	Eastern Treatment	445438	6284397	220	1,477	326	53	BAFAunp	1007	sparsely vegetated	Barren	1
16-Aug-08	22a*	Western Treatment	424698	6260074	221	1,252	336	30	CMAunp	2010	Parkland Forest/Krummholz	Krummholz	3
16-Aug-08	5a	Western Treatment	421397	6258342	222	1,588	123	106	CMAunp	2012	sparsely vegetated	Escape Terrain	1
16-Aug-08	5a	Western Treatment	420962	6259572	223	1,493	23	98	MHmm2	9065	Avalanche Track	Avalanche Track - shrub dominated - steep slope	3
16-Aug-08	5a	Western Treatment	419741	6258947	224	1,430	10	36	CMAunp	2007	sparsely vegetated	Barren	1
16-Aug-08	22a	Western Treatment	421124	6263112	225	1,444	191	31	MHmm2	9067	Avalanche Track	Avalanche Track - herb dominated - moderate slope	2
16-Aug-08	22a	Western Treatment	422761	6262851	226	1,453	188	61	MHmm2	9069	sparsely vegetated	Escape Terrain	1
16-Aug-08	22a	Western Treatment	423571	6262989	227	1,621	250	74	CMAunp	2007	sparsely vegetated	Barren	1
16-Aug-08	22a	Western Treatment	422610	6263139	228	1,585	217	59	MHmm2	9069	sparsely vegetated	Escape Terrain	1
16-Aug-08	24a	Western Treatment	422528	6266131	229	1,289	188	48	CMAunp	2004	Mesic Herb	Mesic Herb	2
16-Aug-08	24a	Western Treatment	424964	6266995	230	1,308	168	64	CMAunp	2007	sparsely vegetated	Barren	1
16-Aug-08	24a	Western Treatment	425342	6267238	231	1,384	157	61	CMAunp	2003	Mesic Shrub/Herb	Mesic Shrub/Herb	3
16-Aug-08	24a	Western Treatment	425789	6267301	232	1,448	209	51	CMAunp	2002	Wetter Shrub/Herb	Wetter Shrub/Herb	3
16-Aug-08	24a	Western Treatment	419615	6266566	233	1,345	165	75	MHmm2	9069	sparsely vegetated	Escape Terrain	1
16-Aug-08	24a	Western Treatment	421589	6266611	234	1,448	187	91	MHmm2	9069	sparsely vegetated	Escape Terrain	1
16-Aug-08	24a	Western Treatment	422310	6266198	235	1,293	248	40	MHmm2	9067	Avalanche Track	Avalanche Track - herb dominated - moderate slope	2
16-Aug-08	24a	Western Treatment	422931	6266368	236	1,366	140	58	CMAunp	2007	sparsely vegetated	Barren	1
16-Aug-08	24a	Western Treatment	423934	6266826	237	1,481	155	40	CMAunp	2007	sparsely vegetated	Barren	1
16-Aug-08	24a	Western Treatment	424328	6266867	238	1,362	119	63	CMAunp	2007	sparsely vegetated	Barren	1
16-Aug-08	24a	Western Treatment	421253	6267009	239	1,596	173	19	CMAunp	2007	sparsely vegetated	Barren	1
16-Aug-08	24a	Western Treatment	422585	6266868	240	1,609	209	64	CMAunp	2007	sparsely vegetated	Barren	1

Appendix 4.5-2

Summary of Hoary Marmot and Arctic Ground Squirrel Aerial
Survey Results, 2009

Appendix 4.5-2. Summary of Hoary Marmot and Arctic Ground Squirrel Aerial Survey Results, 2009

						Field Topographic Features		Digital Topographic Features			Field Habitat Characteristics					Digital Habitat Characteristics				
						Aspect (Cardinal)	Slope (%)	Elevation (m)	Aspect (o)	Slope (%)	Soil Moisture Regime	Soil Texture	Vegetation Cover (H/S/T/B)	Vegetation Species	General Vegetation Class	WHR	BEC Zone	General Ecosystem Type	Site Series	Structural Stage
14-Aug-09	3a	Eastern Treatment	441188	6275604	1	E	10	1359	33	13	Mesic	sandy loam	h	grass, heather, herbs	heather heath	2	ESSFvw	Mesic Shrub/Herb	Mesic Shrub/Herb	3
14-Aug-09	3a	Eastern Treatment	438109	6278561	2	E	10	1425	38	42	Mesic	gravel loam	h	heather, dry grass	heather heath	2	ESSFvw	Avalanche Track	Avalanche Shrub mod slope	3
14-Aug-09	3a	Eastern Treatment	437798	6278774	3	SE	20	1414	69	32	Mesic	gravel loam	h/t	krummholz, heather, herbs	heather heath	3	ESSFvw	Avalanche Track	Avalanche Shrub mod slope	3
14-Aug-09	3a	Eastern Treatment	437353	6278949	4	N	25	1410	310	53	Mesic	gravel loam	h	heather, grass, lichen	heather heath	2	BAFAunp	sparsely vegetated	Barren	1
14-Aug-09	3a	Eastern Treatment	437222	6278617	5	N	25	1435	283	36	Mesic	sandy loam	h	grass, heather	heather heath	2	BAFAunp	Wetter Shrub/Herb	Wetter Shrub/Herb	3
14-Aug-09	3a	Eastern Treatment	437181	6278466	6	N	25	1446	293	30	Dry	sandy loam	h	grass, herbs	dry herb	2	BAFAunp	Wetter Shrub/Herb	Wetter Shrub/Herb	3
14-Aug-09	3a	Eastern Treatment	437133	6278384	7	N	25	1444	297	32	Mesic	cobble loam	h	lichen, heather	heather heath	2	BAFAunp	sparsely vegetated	Barren	1
14-Aug-09	3a	Eastern Treatment	436836	6278458	8	S	32.5	1471	99	65	Mesic	gravel loam	h	heather	heather heath	2	BAFAunp	sparsely vegetated	Barren	1
14-Aug-09	3a	Eastern Treatment	437004	6278850	9	S	32.5	1415	86	33	Mesic	gravel loam	h	heather	heather heath	2	BAFAunp	Wetter Shrub/Herb	Wetter Shrub/Herb	3
14-Aug-09	3a	Eastern Treatment	437097	6279318	10	S	32.5	1347	79	48	Mesic	sandy loam	h	heather, hellebore, fireweed	mesic herb	2	BAFAunp	Mesic Shrub/Herb	Mesic Shrub/Herb	3
14-Aug-09	3a	Eastern Treatment	438525	6277482	11	NE	27.5	1465	314	31	Mesic	cobble loam	h	heather, barren	heather heath	2	BAFAunp	sparsely vegetated	Barren	1
14-Aug-09	3a	Eastern Treatment	438916	6277306	12	SE	37.5	1462	112	57	Mesic	gravel loam	h	heather, herbs	heather heath	2	BAFAunp	Mesic Shrub/Herb	Mesic Shrub/Herb	3
14-Aug-09	3a	Eastern Treatment	439673	6276458	13	SE	42.5	1498	112	54	Mesic	cobble loam	h	heather, grass	heather heath	2	BAFAunp	Mesic Shrub/Herb	Mesic Shrub/Herb	3
15-Aug-09	19	Eastern Treatment	442454	6280514	14	N	47.5	1304	350	73	Mesic	sandy loam	h	grass, fireweed	mesic herb	3	BAFAunp	Mesic Shrub/Herb	Mesic Shrub/Herb	3
15-Aug-09	19	Eastern Treatment	442970	6280301	15	N	47.5	1428	4	61	Mesic	sandy loam	h	grass, fireweed	mesic herb	3	BAFAunp	Wetter Shrub/Herb	Wetter Shrub/Herb	3
15-Aug-09	19	Eastern Treatment	443224	6280423	16	W	7.5	1430	287	32	Mesic	gravel loam	h	heather	heather heath	2	BAFAunp	Parkland Forest/Krummholz	Krummholz	3
15-Aug-09	19	Eastern Treatment	445678	6278998	17	S	42.5	1454	181	47	Mesic	gravel loam	t/h	krummholz, herb meadow	mesic herb	3	BAFAunp	Wetter Shrub/Herb	Wetter Shrub/Herb	3
15-Aug-09	19	Eastern Treatment	446321	6278969	18	S	52.5	1397	174	74	Mesic	sandy loam	h	grass, heather	heather heath	3	BAFAunp	Mesic Shrub/Herb	Mesic Shrub/Herb	3
15-Aug-09	19	Eastern Treatment	447506	6278949	19	S	52.5	1477	238	65	Dry	gravel loam	h	herbs, barren	dry herb	3	BAFAunp	sparsely vegetated	Barren	1
15-Aug-09	19	Eastern Treatment	445477	6279029	20	S	42.5	1513	168	54	Mesic	gravel loam	h/t	heather, krummholz, barren	heather heath	3	BAFAunp	Mesic Herb	Heather heath	2
15-Aug-09	19	Eastern Treatment	445271	6278863	21	S	52.5	1469	163	79	Mesic	sandy loam	h/t	herbs, krummholz	mesic herb	3	BAFAunp	Mesic Shrub/Herb	Mesic Shrub/Herb	3
15-Aug-09	19	Eastern Treatment	443631	6277984	22	SW	42.5	1440	212	50	Moist	gravel loam	h/t	krummholz, herbs, hellebore	moist herb	3	ESSFvw	Avalanche Track	Avalanche Shrub mod slope	3
15-Aug-09	19	Eastern Treatment	442888	6279277	23	W	42.5	1493	220	43	Mesic	gravel loam	h/t	heather, lichen, krummholz	heather heath	3	BAFAunp	sparsely vegetated	Barren	1
15-Aug-09	19	Eastern Treatment	443318	6278715	24	W	27.5	1530	233	50	Mesic	gravel loam	h/t	lichen, heather, krummholz	heather heath	2	BAFAunp	sparsely vegetated	Barren	1
15-Aug-09	19	Eastern Treatment	445160	6278881	25	SW	47.5	1508	165	69	Mesic	gravel loam	h/t	krummholz, herbs	mesic herb	3	BAFAunp	Mesic Herb	Heather heath	2
15-Aug-09	19	Eastern Treatment	445632	6279185	26	SW	37.5	1537	195	59	Mesic	gravel loam	h	heather, barren	heather heath	3	BAFAunp	sparsely vegetated	Barren	1
16-Aug-09	24a	Western Treatment	422444	6266700	27	SW	30	1494	261	55	Mesic	sandy loam	h	herbs, lupine, fireweed	mesic herb	2	CMAunp	sparsely vegetated	Barren	1
16-Aug-09	24a	Western Treatment	425621	6267375	28	S	47.5	1453	221	55	Mesic	sandy loam	h	herbs, heather	heather heath	3	CMAunp	Mesic Shrub/Herb	Mesic Shrub/Herb	3
16-Aug-09	24a	Western Treatment	424316	6266859	29	S	42.5	1362	119	63	Mesic	sandy loam	h	grass, lupine	mesic herb	2	CMAunp	Mesic Shrub/Herb	Mesic Shrub/Herb	3
16-Aug-09	24a	Western Treatment	423614	6266498	30	S	55	1339	169	65	Mesic	sandy loam	h	lupine, grass	mesic herb	3	CMAunp	sparsely vegetated	Barren	1
16-Aug-09	24a	Western Treatment	425329	6267270	31	S	40	1400	160	56	Mesic	sandy loam	h	lupine, herbs, grass	mesic herb	2	CMAunp	Mesic Shrub/Herb	Mesic Shrub/Herb	3
16-Aug-09	24a	Western Treatment	421935	6266082	32	SW	30	1153	223	56	Mesic	loam	h	herbs, lupine, fireweed	mesic herb	1	MHmm2	Mesic Forest	HmBa, Blueberry	6/7
16-Aug-09	22a	Western Treatment	422376	6263008	33	W	10	1526	184	33	Mesic	gravel loam	h	heather, grass	heather heath	2	MHmm2	Avalanche Track	Avalanche Track, shrub dominated, moderate slope	3
16-Aug-09	22a	Western Treatment	423353	6262704	34	W	40	1456	149	89	Mesic	sandy gravel	h	herbs, fireweed, heather	mesic herb	3	CMAunp	Mesic Herb	Mesic Herb	2
16-Aug-09	22a	Western Treatment	425063	6261649	35	W	20	1479	225	57	Mesic	sandy gravel	h	herbs, fireweed, heather	mesic herb	2	CMAunp	Mesic Herb	Heather heath	2
16-Aug-09	22a	Western Treatment	425266	6261400	36	W	35	1479	240	49	Mesic	sandy gravel	h	herbs, fireweed, heather	mesic herb	3	CMAunp	Mesic Herb	Heather heath	2
16-Aug-09	22a	Western Treatment	421235	6263159	37	W	15	1478	221	54	Mesic	loam	h	heather, herbs, fireweed	mesic herb	1	MHmm2	Mesic Herb	Heather Heath	2

Appendix 4.5-2. Summary of Hoary Marmot and Arctic Ground Squirrel Aerial Survey Results, 2009

						Field Topographic Features		Digital Topographic Features			Field Habitat Characteristics					Digital Habitat Characteristics				
						Aspect (Cardinal)	Slope (%)	Elevation (m)	Aspect (°)	Slope (%)	Soil Moisture Regime	Soil Texture	Vegetation Cover (H/S/T/B)	Vegetation Species	General Vegetation Class	WHR	BEC Zone	General Ecosystem Type	Site Series	Structural Stage
16-Aug-09	22a	Western Treatment	420421	6262961	38	W	45	1405	192	45	Mesic	gravel loam	h	krummholz, heather	heather heath	3	MHmm2	Avalanche Track	Avalanche Track , shrub dominated , moderate slope	3
16-Aug-09	5a	Western Treatment	421854	6259837	39	E	40	1243	310	63	Mesic	sandy loam	h	mixed herbs	mesic herb	3	MHmm2	Mesic Herb	Heather Heath	2
16-Aug-09	5a	Western Treatment	422796	6259770	40	E	30	1320	41	66	Mesic	sandy loam	h	thick lupine, heather	mesic herb	2	CMAunp	Wetter Herb	Wetter Herb	2
16-Aug-09	5a	Western Treatment	422488	6259017	41	E	40	1433	137	73	Mesic	sandy loam	h	herb meadow, grass	mesic herb	2	CMAunp	Mesic Herb	Mesic Herb	2
16-Aug-09	5a	Western Treatment	421105	6259617	42	E	55	1394	79	88	Mesic	gravel loam	h	heather, herbs	heather heath	3	MHmm2	sparsely vegetated	Escape Terrain	1
16-Aug-09	5a	Western Treatment	419995	6259435	43	W	37.5	1410	275	35	Mesic	gravel loam	h	heather, herbs	heather heath	2	CMAunp	Mesic Shrub/Herb	Mesic Shrub/Herb	3
16-Aug-09	5a	Western Treatment	418767	6259688	44	NW	20	1341	347	30	Mesic	gravel loam	h	heather, herbs	heather heath	2	MHmm2	Avalanche Track	Avalanche Track , shrub dominated , moderate slope	3
16-Aug-09	5a	Western Treatment	418437	6258961	45	NW	20	1383	275	42	Mesic	sandy loam	h	heather, herbs	heather heath	1	MHmm2	Avalanche Track	Avalanche Track , shrub dominated , moderate slope	3
18-Aug-09	25a	Western Control	403715	6277052	46	E	55	1058	87	59	Mesic	sandy loam	h/s	fireweed, lupine, heather, willow	mesic herb	3	CMAunp	Mesic Herb	Heather heath	2
18-Aug-09	25a	Western Control	403404	6275395	47	E	60	1094	95	77	Mesic	sandy gravel	h/s	herb meadow, willow	mesic herb	3	CMAunp	Mesic Shrub/Herb	Mesic Shrub/Herb	3
18-Aug-09	25a	Western Control	402743	6271802	48	E	50	1067	86	63	Mesic	sandy loam	h/s	herb meadow, willow	mesic herb	2	MHmm2	sparsely vegetated	Escape Terrain	1
18-Aug-09	25a	Western Control	402294	6270441	49	E	45	1134	102	54	Mesic	sandy loam	h	heather	heather heath	2	CMAunp	Mesic Shrub/Herb	Mesic Shrub/Herb	3
18-Aug-09	25a	Western Control	402143	6269490	50	E	55	1105	82	71	Mesic	sandy loam	h	heather, mesic herbs	mesic herb	2	CMAunp	Mesic Shrub/Herb	Mesic Shrub/Herb	3
18-Aug-09	25a	Western Control	402216	6268032	51	E	45	1058	84	60	Mesic	sandy loam	h	heather, herb meadow	heather heath	2	CMAunp	sparsely vegetated	Barren	1
18-Aug-09	25a	Western Control	402062	6267284	52	E	40	1117	102	53	Mesic	sandy loam	h/t	thick herbs, willow, krummholz,	mesic herb	2	CMAunp	Mesic Shrub/Herb	Mesic Shrub/Herb	3
18-Aug-09	25a	Western Control	401744	6267945	53	E	30	1318	101	71	Mesic	sandy loam	h	herb meadow, heather	mesic herb	2	CMAunp	sparsely vegetated	Escape Terrain	1
18-Aug-09	25a	Western Control	401822	6269223	54	E	45	1253	104	54	Mesic	sandy loam	h	heather	heather heath	2	CMAunp	sparsely vegetated	Barren	1
18-Aug-09	25a	Western Control	402022	6270364	55	E	45	1279	112	70	Mesic	sandy loam	h	heather, barren	heather heath	2	CMAunp	Mesic Shrub/Herb	Mesic Shrub/Herb	3
18-Aug-09	25a	Western Control	402270	6271064	56	E	57.5	1216	77	62	Mesic	sandy loam	h	heather	heather heath	3	CMAunp	sparsely vegetated	Barren	1
18-Aug-09	25a	Western Control	405752	6278242	57	SE	50	1128	158	67	Dry	sandy loam	h	herb meadow	dry herb	3	CMAunp	Mesic Herb	Heather heath	2
18-Aug-09	25a	Western Control	406376	6278713	58	SE	30	1114	106	55	Mesic	sandy loam	h	heather	heather heath	3	CMAunp	Wetter Shrub/Herb	Wetter Shrub/Herb	3
19-Aug-09	19	Eastern Treatment	442664	6281042	59	SW	55	1510	209	58	Dry	gravel loam	h/t	herbs, krummholz	dry herb	2	BAFAunp	sparsely vegetated	Barren	1
19-Aug-09	19	Eastern Treatment	443008	6280822	60	SW	40	1471	169	52	Dry	gravel loam	h	herbs	dry herb	2	BAFAunp	Wetter Shrub/Herb	Wetter Shrub/Herb	3
19-Aug-09	19	Eastern Treatment	443342	6280606	61	SW	30	1500	216	52	Mesic	sandy loam	h	herbs	mesic herb	1	BAFAunp	Mesic Herb	Heather heath	2
19-Aug-09	19	Eastern Treatment	443744	6280448	62	SW	55	1539	236	50	Mesic	sandy loam	h	herbs	mesic herb	2	BAFAunp	sparsely vegetated	Barren	1
19-Aug-09	19	Eastern Treatment	442913	6280409	63	NE	55	1374	349	44	Mesic	gravel loam	h/t	herbs, krummholz, willow	mesic herb	3	BAFAunp	Wetter Shrub/Herb	Wetter Shrub/Herb	3
19-Aug-09	19	Eastern Treatment	442710	6279548	64	W	50	1505	263	38	Dry	gravel loam	h/b	herbs, barren	dry herb	2	ESSFwv	sparsely vegetated	Barren	1
19-Aug-09	19	Eastern Treatment	443831	6280648	65	SW	55	1678	190	70	Dry	gravel loam	h/b	heather, herbs, barren	dry herb	3	BAFAunp	Mesic Herb	Heather heath	2
19-Aug-09	19	Eastern Treatment	443075	6281225	66	SW	37.5	1682	192	66	Dry	sandy loam	h	herb meadow	dry herb	2	BAFAunp	sparsely vegetated	Barren	1
19-Aug-09	19	Eastern Treatment	442451	6281397	67	W	55	1566	251	50	Dry	gravel loam	h	herbs	dry herb	2	BAFAunp	sparsely vegetated	Barren	1
19-Aug-09	19	Eastern Treatment	442714	6282226	68	N	55	1324	335	77	Mesic	sandy loam	h	herbs	mesic herb	3	ESSFwv	Avalanche Track	Avalanche Shrub steep slope	3
19-Aug-09	19	Eastern Treatment	443639	6281905	69	N	55	1488	37	65	Dry	sandy loam	h	herbs	dry herb	3	BAFAunp	Wetter Shrub/Herb	Wetter Shrub/Herb	3
19-Aug-09	19	Eastern Treatment	443372	6283184	70	SW	55	1470	185	54	Mesic	sandy loam	h	rich herbs	mesic herb	2	BAFAunp	Mesic Shrub/Herb	Mesic Shrub/Herb	3
19-Aug-09	19	Eastern Treatment	443963	6282924	71	SW	55	1561	215	47	Dry	sandy loam	h	herbs	dry herb	2	BAFAunp	sparsely vegetated	Barren	1
19-Aug-09	19	Eastern Treatment	444278	6282851	72	SW	50	1587	185	49	Dry	sandy loam	h	herbs	dry herb	2	BAFAunp	sparsely vegetated	Barren	1
19-Aug-09	19	Eastern Treatment	444480	6282780	73	SW	55	1647	240	77	Dry	sandy loam	h	herbs, barren	dry herb	3	BAFAunp	sparsely vegetated	Escape Terrain	1
19-Aug-09	19	Eastern Treatment	444666	6282488	74	SW	55	1644	213	30	Dry	sandy loam	h	herbs, barren	dry herb	3	BAFAunp	sparsely vegetated	Barren	1
19-Aug-09	19	Eastern Treatment	443759	6283442	75	SW	50	1716	209	54	Dry	sandy loam	h	herbs	dry herb	3	BAFAunp	sparsely vegetated	Barren	1
19-Aug-09	19	Eastern Treatment	442975	6283939	76	SW	40	1495	272	31	Mesic	sandy loam	h	herbs	mesic herb	2	BAFAunp	Mesic Herb	Heather heath	2
19-Aug-09	19	Eastern Treatment	443418	6282353	77	SW	45	1267	359	50	Mesic	sandy loam	h	herbs	mesic herb	2	BAFAunp	Mesic Herb	Mesic Herb	2

Appendix 4.5-2. Summary of Hoary Marmot and Arctic Ground Squirrel Aerial Survey Results, 2009

						Field Topographic Features		Digital Topographic Features			Field Habitat Characteristics					Digital Habitat Characteristics				
						Aspect (Cardinal)	Slope (%)	Elevation (m)	Aspect (o)	Slope (%)	Soil Moisture Regime	Soil Texture	Vegetation Cover (H/S/T/B)	Vegetation Species	General Vegetation Class	WHR	BEC Zone	General Ecosystem Type	Site Series	Structural Stage
19-Aug-09	20	Eastern Treatment	444892	6277510	78	NW	60	1382	304	70	Mesic	sandy loam	h	herb meadow, heather	heather heath	2	ESSFwv	Avalanche Track	Avalanche Shrub steep slope	3
19-Aug-09	20	Eastern Treatment	445015	6277809	79	NW	60	1422	290	77	Mesic	sandy loam	h	herb meadow, heather	heather heath	2	BAFAunp	Mesic Shrub/Herb	Mesic Shrub/Herb	3
19-Aug-09	20	Eastern Treatment	445105	6277928	80	N	60	1397	336	93	Dry	sandy loam	h	herbs, heather	dry herb	3	BAFAunp	Parkland Forest/Krummholz	Krummholz	3
19-Aug-09	20	Eastern Treatment	445681	6278190	81	N	50	1419	19	95	Mesic	sandy loam	h	heather, herbs	heather heath	2	BAFAunp	Mesic Shrub/Herb	Mesic Shrub/Herb	3
19-Aug-09	20	Eastern Treatment	446368	6278346	82	N	60	1441	311	52	Dry	sandy loam	h	herbs	dry herb	2	BAFAunp	Mesic Shrub/Herb	Mesic Shrub/Herb	3
19-Aug-09	20	Eastern Treatment	445766	6278484	83	N	50	1243	349	38	Moist	sandy loam	h	herbs	moist herb	2	BAFAunp	sparsely vegetated	Barren	1
19-Aug-09	20	Eastern Treatment	446474	6276903	84	N	60	1629	161	70	Mesic	sandy loam	h	barren, herbs, heather	heather heath	3	BAFAunp	sparsely vegetated	Escape Terrain	1
19-Aug-09	20	Eastern Treatment	449129	6275219	85	S	60	1506	122	58	Mesic	sandy loam	h	heather	heather heath	3	BAFAunp	Mesic Herb	Heather heath	2
19-Aug-09	20	Eastern Treatment	449527	6275880	86	S	60	1473	152	72	Dry	sandy loam	h	herbs	dry herb	3	BAFAunp	sparsely vegetated	Escape Terrain	1
19-Aug-09	20	Eastern Treatment	449553	6276070	87	W	60	1466	73	54	Dry	gravel loam	h	herbs, barren	dry herb	3	BAFAunp	sparsely vegetated	Barren	1
19-Aug-09	20	Eastern Treatment	449529	6276317	88	S	60	1500	151	67	Dry	gravel loam	h	herbs, barren	dry herb	3	BAFAunp	Mesic Shrub/Herb	Mesic Shrub/Herb	3
19-Aug-09	20	Eastern Treatment	449798	6276333	89	S	60	1512	181	89	Dry	gravel loam	h	herbs, barren	dry herb	3	BAFAunp	Mesic Shrub/Herb	Mesic Shrub/Herb	3
19-Aug-09	20	Eastern Treatment	449595	6275339	90	S	25	1208	118	65	Mesic	gravel loam	h	herbs	mesic herb	1	BAFAunp	Mesic Herb	Mesic Herb	2
19-Aug-09	20	Eastern Treatment	449487	6274999	91	S	47.5	1176	106	64	Dry	gravel loam	h/t	krummholz, herb	dry herb	3	BAFAunp	Mesic Shrub/Herb	Mesic Shrub/Herb	3
19-Aug-09	20	Eastern Treatment	445241	6277214	92	W	60	1379	213	76	Mesic	sandy loam	h	heather, herb meadow	heather heath	3	BAFAunp	Mesic Shrub/Herb	Mesic Shrub/Herb	3

Appendix 4.5-3

Summary of Hoary Marmot and Arctic Ground Squirrel Ground
Survey Results, 2009

Appendix 4.5-3. Summary of Hoary Marmot and Arctic Ground Squirrel Ground Survey Results, 2009

Date	Survey Unit	Area	Easting	Northing	Colony ID	Species Identified	Field Topographic Features			Digital Topographic Features		
							Elevation ^o (m)	Aspect ^o (o)	Slope ^o (%)	Elevation ^o (m)	Aspect ^o (o)	Slope ^o (%)
<i>Unactive Colony</i>												
15-Aug-09	19	Eastern Treatment	442888	6279277	23	None	1,500	250	25	1,493	220	43
16-Aug-09	24a	Western Treatment	421935	6266082	32	None	1,227	210	40	1,153	223	56
18-Aug-09	25a	Western Control	403404	6275395	47	None	1,239	120	43	1,094	95	77
<i>Active Colony</i>												
14-Aug-09	3a	Eastern Treatment	441188	6275604	1	Hoary Marmot	1,357	48	15	1,359	33	13
14-Aug-09	3a	Eastern Treatment	438109	6278561	2	Hoary Marmot	1,432	40	40	1,425	38	42
14-Aug-09	3a	Eastern Treatment	437798	6278774	3	Hoary Marmot	1,413	82	45	1,414	69	32
14-Aug-09	3a	Eastern Treatment	437353	6278949	4	Hoary Marmot	1,420	310	25	1,410	310	53
14-Aug-09	3a	Eastern Treatment	437133	6278384	7	Hoary Marmot	1,456	300	18	1,444	297	32
14-Aug-09	3a	Eastern Treatment	439673	6276458	13	Hoary Marmot	1,527	122	60	1,498	112	54
15-Aug-09	19	Eastern Treatment	446321	6278969	18	Hoary Marmot	1,513	210	45	1,397	174	74
15-Aug-09	19	Eastern Treatment	443631	6277984	22	Hoary Marmot	1,460	192	75	1,440	212	50
15-Aug-09	19	Eastern Treatment	445632	6279185	26	Hoary Marmot	1,499	160	38	1,537	195	59
16-Aug-09	24a	Western Treatment	422444	6266700	27	Hoary Marmot	1,499	200	45	1,494	261	55
16-Aug-09	22a	Western Treatment	422376	6263008	33	Hoary Marmot	1,540	260	35	1,526	184	33
16-Aug-09	22a	Western Treatment	425266	6261400	36	Hoary Marmot	1,553	245	45	1,479	240	49
16-Aug-09	22a	Western Treatment	421235	6263159	37	Hoary Marmot	1,480	200	30	1,478	221	54
16-Aug-09	22a	Western Treatment	420421	6262961	38	Hoary Marmot	1,353	250	40	1,405	192	45
16-Aug-09	5a	Western Treatment	421854	6259837	39	Hoary Marmot	1,243	320	45	1,243	310	63
16-Aug-09	5a	Western Treatment	418767	6259688	44	Hoary Marmot	1,370	340	25	1,341	347	30
16-Aug-09	5a	Western Treatment	418437	6258961	45	Hoary Marmot	1,420	280	35	1,383	275	42
18-Aug-09	25a	Western Control	402743	6271802	48	Hoary Marmot	1,163	92	50	1,067	86	63
18-Aug-09	25a	Western Control	402062	6267284	52	Hoary Marmot	1,132	90	58	1,117	102	53
18-Aug-09	25a	Western Control	401744	6267945	53	Hoary Marmot	1,348	100	68	1,318	101	71
18-Aug-09	25a	Western Control	405752	6278242	57	Hoary Marmot	1,103	160	55	1,128	158	67
18-Aug-09	25a	Western Control	406376	6278713	58	Hoary Marmot	1,096	120	20	1,114	106	55
19-Aug-09	19	Eastern Treatment	443342	6280606	61	Hoary Marmot	1,493	215	25	1,500	216	52
19-Aug-09	19	Eastern Treatment	442451	6281397	67	Hoary Marmot	1,590	208	45	1,566	251	50
19-Aug-09	19	Eastern Treatment	443963	6282924	71	Hoary Marmot	1,576	206	50	1,561	215	47
19-Aug-09	19	Eastern Treatment	443759	6283442	75	Hoary Marmot	1,665	200	55	1,716	209	54
19-Aug-09	20	Eastern Treatment	449129	6275219	85	Hoary Marmot	1,562	130	60	1,506	122	58
19-Aug-09	20	Eastern Treatment	449798	6276333	89	Hoary Marmot	1,416	150	50	1,512	181	89

Appendix 4.5-3. Summary of Hoary Marmot and Arctic Ground Squirrel Ground Survey Results, 2009

Date	Survey Unit	Field Habitat Characteristics		Soil Texture	Soil Drainage	General Vegetation Class	WHR	Digital Habitat Characteristics		
		Soil Nutrient Regime	Soil Moisture Regime					Dist. Talus/ Boulder (m)	BEC Zone	General Ecosystem Type
<i>Unactive Colony</i>										
15-Aug-09	19	medium	dry to mesic	sandy loam	rapid	dry herb	2	50	BAFAunp	sparsely vegetated
16-Aug-09	24a	medium to rich	mesic	sandy loam	moderate	moist herb	1	none present	MHmm2	Mesic Forest
18-Aug-09	25a	poor to medium	dry to mesic	sandy loam w/coarse fragments	rapid	heather heath	2	50	CMAunp	Mesic Shrub/Herb
<i>Active Colony</i>										
14-Aug-09	3a	rich	mesic	sandy loam	moderate	mesic herb	2	0	ESSFwv	Mesic Shrub/Herb
14-Aug-09	3a	rich	mesic	sandy loam	rapid	moist herb	3	0	ESSFwv	Avalanche Track
14-Aug-09	3a	rich	mesic	sandy loam	rapid	mesic herb	3	35	ESSFwv	Avalanche Track
14-Aug-09	3a	medium	mesic	gravel loam	moderate	mesic herb	1	0	BAFAunp	sparsely vegetated
14-Aug-09	3a	poor to medium	dry to mesic	gravel loam	rapid	heather heath	2	0	BAFAunp	sparsely vegetated
14-Aug-09	3a	medium to rich	dry to mesic	sandy loam	rapid	dry herb	2	40	BAFAunp	Mesic Shrub/Herb
15-Aug-09	19	medium	mesic	sandy loam w/coarse fragments	rapid	mesic herb	3	0	BAFAunp	Mesic Shrub/Herb
15-Aug-09	19	rich	dry to mesic	loam	rapid	dry herb	2	15	ESSFwv	Avalanche Track
15-Aug-09	19	medium	dry to mesic	sandy loam w/coarse fragments	rapid	heather heath	2	0	BAFAunp	sparsely vegetated
16-Aug-09	24a	rich	mesic	loamy	rapid	mesic herb	2	20	CMAunp	sparsely vegetated
16-Aug-09	22a	medium	mesic	sandy gravel	moderate	heather heath	2	0	MHmm2	Avalanche Track
16-Aug-09	22a	medium to rich	mesic	sandy gravel	rapid	mesic herb	2	0	CMAunp	Mesic Herb
16-Aug-09	22a	medium to rich	mesic	sandy loam	moderate	moist herb	1	0	MHmm2	Mesic Herb
16-Aug-09	22a	rich	dry to mesic	sandy loam	rapid	dry herb	2	0	MHmm2	Avalanche Track
16-Aug-09	5a	rich	moist	sandy loam w/coarse fragments	rapid	moist herb	3	20	MHmm2	Mesic Herb
16-Aug-09	5a	medium	dry to mesic	sandy loam w/coarse fragments	rapid	heather heath		0	MHmm2	Avalanche Track
16-Aug-09	5a	medium	mesic	sandy loam w/coarse fragments	rapid	moist herb	2	none present	MHmm2	Avalanche Track
18-Aug-09	25a	rich	dry to mesic	sandy loam	rapid	heather heath	2	0	MHmm2	sparsely vegetated
18-Aug-09	25a	medium	dry to mesic	sandy loam w/coarse fragments	rapid	heather heath	3	0	CMAunp	Mesic Shrub/Herb
18-Aug-09	25a	rich	mesic	loam	rapid	heather heath	2	0	CMAunp	sparsely vegetated
18-Aug-09	25a	rich	mesic	loam	rapid	mesic herb	2	0	CMAunp	Mesic Herb
18-Aug-09	25a	medium to rich	dry to mesic	sandy loam	moderate	heather heath	2	0	CMAunp	Wetter Shrub/Herb
19-Aug-09	19	rich	mesic	sandy loam w/coarse fragments	moderate	moist herb	1	0	BAFAunp	Mesic Herb
19-Aug-09	19	rich	mesic	sandy loam	moderate	mesic herb	2	0	BAFAunp	sparsely vegetated
19-Aug-09	19	poor	dry to mesic	sandy loam	rapid	dry herb	3	10	BAFAunp	sparsely vegetated
19-Aug-09	19	poor to medium	dry	sandy loam w/coarse fragments	rapid	dry herb	2	0	BAFAunp	sparsely vegetated
19-Aug-09	20	medium	dry to mesic	sandy loam	rapid	heather heath	3	none present	BAFAunp	Mesic Herb
19-Aug-09	20	rich	dry to mesic	loamy	rapid	dry herb	2	0	BAFAunp	Mesic Shrub/Herb

Appendix 4.5-3. Summary of Hoary Marmot and Arctic Ground Squirrel Ground Survey Results, 2009

Date	Survey Unit	Site Series	Structural Stage	Vegetation Species
<i>Unactive Colony</i>				
15-Aug-09	19	Barren	1	herbs, lichen, sedge, cranberry, lupine, heather, patches of subalpine fir - shrublike (20%)
16-Aug-09	24a	HmBa - Blueberry	6/7	grass, sedge, groundsel, hellebore, valerian, heather, partridge foot, mostly herb.
18-Aug-09	25a	Mesic Shrub/Herb	3	dominated by heather & partridge foot <5% grass & herbs, some patches of barren.
<i>Active Colony</i>				
14-Aug-09	3a	Mesic Shrub/Herb	3	Some subalpine fir in area. deer cabbage, heather, partridge foot, valerian, groundsel, mossy patches on ground, lichen, sedges, saxifrage.
14-Aug-09	3a	Avalanche Shrub mod slope	3	Sedges mixed in. heather, some partridge foot, moss covering ground, rocky areas (20%), some groundsel & valerian present (10%).
14-Aug-09	3a	Avalanche Shrub mod slope	3	Lots of heather (30%), partridge foot (20%), sm subalpine fir, valerian sm patch <5m tall (10%)
14-Aug-09	3a	Barren	1	herb, alpine willow, grass, sedge, fireweed, bluebell, partridge foot, heather, cranberry, narcissis, elephants head, shrub willow 25%, colts foot.
14-Aug-09	3a	Barren	1	lichen, heather, crowberry, alpine willow, some fireweed & grass, narcissis.
14-Aug-09	3a	Mesic Shrub/Herb	3	heather, partridge foot, misc herbs
15-Aug-09	19	Mesic Shrub/Herb	3	heather & partridge foot 80%, herbs, lichen, lupine, groundsel, hellebore, valerian
15-Aug-09	19	Avalanche Shrub mod slope	3	partridge foot, hellebore, lupine, different type of heather (95%), rock (5%). Trees all small in surrounding area.
15-Aug-09	19	Barren	1	heather, partridge foot, herbs, hellebore, valerian, groundsel, lupine, some patches of subalpine fir <5%)
16-Aug-09	24a	Barren	1	partridge foot, mountain sagewort, heather, groundsel, valerian, lupine, subaldia (80%), bare rock (20%). White lichen/moss present
16-Aug-09	22a	Avalanche Track - shrub dominated - moderate slope	3	Rich herb meadow - hellebore, fireweed, groundsel, Indian paintbrush, colombine, grass, monkshood, valerian.
16-Aug-09	22a	Heather heath	2	mostly heather, some partridge foot, some patchy subalpine fir - shrub size. Herb (10%) sedge, fireweed, hellebore, and mesic herbs.
16-Aug-09	22a	Heather Heath	2	Extensive moist/mesic herb meadow 80% (10% lichen/dry), 10% barren, sedge, grass, lupin, groundsel, valerian, fireweed, heather-heath, partridge foot
16-Aug-09	22a	Avalanche Track - shrub dominated - moderate slope	3	Subalpine fir surrounding. heather, subalpine fir (ground cover), grass, partridge foot (75%), exposed rock (25%).
16-Aug-09	5a	Heather Heath	2	Herbs with patches of lupine, fir and willow, heather-heath and barren areas. Partridge foot & heather, some grass, herbs, fireweed, groundsel, valerian
16-Aug-09	5a	Avalanche Track - shrub dominated - moderate slope	3	Mountain heather, partridge foot, herb (15%), grass, sedges, lichen, other herbs.
16-Aug-09	5a	Avalanche Track - shrub dominated - moderate slope	3	Steep, rich, herb-covered site with deep soils.
18-Aug-09	25a	Escape Terrain	1	herb - heather heath with mesic herb meadow
18-Aug-09	25a	Mesic Shrub/Herb	3	heather, partridge foot, herbs, lupine, hellebore, groundsel, valerian, narcissis, Indian paintbrush, shrubs, vaccinium, black huckleberry, saxifrage, aster, monkshood, subalpine fir
18-Aug-09	25a	Escape Terrain	1	Subalpine fir present, heather (lots), exposed rock (20%), valerian, pod plant.
18-Aug-09	25a	Heather heath	2	herb - mesic herb meadow with heather-heath
18-Aug-09	25a	Wetter Shrub/Herb	3	heather & partridge foot. Herb - moist with sedges, cotton grass, saxifrage, colts foot, hellebore. Subalpine fir & shrub patches with willow
19-Aug-09	19	Heather heath	2	herb meadow, grass 70%, fireweed, bluebells, crowberry, some lichen.
19-Aug-09	19	Barren	1	Lots of lichen, grass heather, fireweed, partridge foot (90%), exposed rocky area (10%).
19-Aug-09	19	Barren	1	heather, partridge foot, whitish lichen, grass, fireweed. All = 70%, rocky exposed areas 30%.
19-Aug-09	19	Barren	1	sedge & grass, lichen, heather, partridge foot, buttercup, small (<1%) of fireweed & hellebore.
19-Aug-09	20	Heather heath	2	heather moist 60%, lupine 30%, hellebore, groundsel, valerian.
19-Aug-09	20	Mesic Shrub/Herb	3	Lots of partridge foot, misc herbs, some heather patches, valerian, groundsel, fireweed, hellebore. Lots of rocks (talus) mixed in with veg ground around it.

Appendix 4.6-1

Raw Small Mammal Capture Data, 2008 and 2009

Appendix 4.6-1. Raw Small Mammal Capture Data, 2008 and 2009

Year	Transect	BEC Zone	Habitat Description	Location	Transect Group	Transect Start Point		Visit No.	Capture Date	Capture Station (m from Start)	Species Caught
						Easting	Northing				
2008	TSM08-001	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	1	17-Aug-08	15	-
2008	TSM08-001	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	1	17-Aug-08	30	-
2008	TSM08-001	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	1	17-Aug-08	45	-
2008	TSM08-001	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	1	17-Aug-08	60	-
2008	TSM08-001	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	1	17-Aug-08	75	-
2008	TSM08-001	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	1	17-Aug-08	90	-
2008	TSM08-001	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	1	17-Aug-08	105	-
2008	TSM08-001	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	1	17-Aug-08	120	-
2008	TSM08-001	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	1	17-Aug-08	135	-
2008	TSM08-001	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	1	17-Aug-08	150	-
2008	TSM08-002	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	1	17-Aug-08	15	-
2008	TSM08-002	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	1	17-Aug-08	30	-
2008	TSM08-002	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	1	17-Aug-08	45	-
2008	TSM08-002	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	1	17-Aug-08	60	-
2008	TSM08-002	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	1	17-Aug-08	75	-
2008	TSM08-002	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	1	17-Aug-08	90	-
2008	TSM08-002	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	1	17-Aug-08	105	-
2008	TSM08-002	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	1	17-Aug-08	120	-
2008	TSM08-002	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	1	17-Aug-08	135	-
2008	TSM08-002	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	1	17-Aug-08	150	-
2008	TSM08-003	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	1	17-Aug-08	15	-
2008	TSM08-003	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	1	17-Aug-08	30	-
2008	TSM08-003	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	1	17-Aug-08	45	-
2008	TSM08-003	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	1	17-Aug-08	60	-
2008	TSM08-003	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	1	17-Aug-08	75	-
2008	TSM08-003	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	1	17-Aug-08	90	-
2008	TSM08-003	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	1	17-Aug-08	105	-
2008	TSM08-003	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	1	17-Aug-08	120	-
2008	TSM08-003	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	1	17-Aug-08	135	-
2008	TSM08-003	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	1	17-Aug-08	150	Meadow vole
2008	TSM08-004	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	1	17-Aug-08	15	-
2008	TSM08-004	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	1	17-Aug-08	30	-
2008	TSM08-004	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	1	17-Aug-08	45	-
2008	TSM08-004	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	1	17-Aug-08	60	-
2008	TSM08-004	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	1	17-Aug-08	75	-
2008	TSM08-004	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	1	17-Aug-08	90	Keen's mouse
2008	TSM08-004	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	1	17-Aug-08	105	-
2008	TSM08-004	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	1	17-Aug-08	120	-
2008	TSM08-004	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	1	17-Aug-08	135	Keen's mouse
2008	TSM08-004	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	1	17-Aug-08	150	-
2008	TSM08-001	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	2	18-Aug-08	15	-

Appendix 4.6-1. Raw Small Mammal Capture Data, 2008 and 2009

Year	Transect	BEC Zone	Habitat Description	Location	Transect Group	Transect Start Point		Visit No.	Capture Date	Capture Station (m from Start)	Species Caught
						Easting	Northing				
2008	TSM08-001	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	2	18-Aug-08	30	Meadow vole
2008	TSM08-001	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	2	18-Aug-08	45	-
2008	TSM08-001	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	2	18-Aug-08	60	Meadow vole
2008	TSM08-001	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	2	18-Aug-08	75	-
2008	TSM08-001	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	2	18-Aug-08	90	-
2008	TSM08-001	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	2	18-Aug-08	105	-
2008	TSM08-001	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	2	18-Aug-08	120	-
2008	TSM08-001	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	2	18-Aug-08	135	-
2008	TSM08-001	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	2	18-Aug-08	150	-
2008	TSM08-002	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	2	18-Aug-08	15	-
2008	TSM08-002	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	2	18-Aug-08	30	-
2008	TSM08-002	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	2	18-Aug-08	45	-
2008	TSM08-002	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	2	18-Aug-08	60	-
2008	TSM08-002	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	2	18-Aug-08	75	-
2008	TSM08-002	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	2	18-Aug-08	90	-
2008	TSM08-002	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	2	18-Aug-08	105	-
2008	TSM08-002	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	2	18-Aug-08	120	-
2008	TSM08-002	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	2	18-Aug-08	135	-
2008	TSM08-002	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	2	18-Aug-08	150	-
2008	TSM08-003	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	2	18-Aug-08	150	-
2008	TSM08-003	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	2	18-Aug-08	135	-
2008	TSM08-003	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	2	18-Aug-08	120	-
2008	TSM08-003	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	2	18-Aug-08	105	-
2008	TSM08-003	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	2	18-Aug-08	90	-
2008	TSM08-003	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	2	18-Aug-08	75	-
2008	TSM08-003	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	2	18-Aug-08	60	-
2008	TSM08-003	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	2	18-Aug-08	45	-
2008	TSM08-003	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	2	18-Aug-08	30	-
2008	TSM08-003	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	2	18-Aug-08	15	-
2008	TSM08-004	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	2	18-Aug-08	15	Keen's mouse
2008	TSM08-004	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	2	18-Aug-08	30	-
2008	TSM08-004	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	2	18-Aug-08	45	Keen's mouse
2008	TSM08-004	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	2	18-Aug-08	60	-
2008	TSM08-004	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	2	18-Aug-08	75	Keen's mouse
2008	TSM08-004	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	2	18-Aug-08	90	-
2008	TSM08-004	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	2	18-Aug-08	105	Keen's mouse
2008	TSM08-004	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	2	18-Aug-08	135	Keen's mouse
2008	TSM08-004	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	2	18-Aug-08	150	-
2008	TSM08-001	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	3	19-Aug-08	15	-
2008	TSM08-001	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	3	19-Aug-08	30	-
2008	TSM08-001	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	3	19-Aug-08	45	-

Appendix 4.6-1. Raw Small Mammal Capture Data, 2008 and 2009

Year	Transect	BEC Zone	Habitat Description	Location	Transect Group	Transect Start Point		Visit No.	Capture Date	Capture Station (m from Start)	Species Caught
						Easting	Northing				
2008	TSM08-001	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	3	19-Aug-08	60	-
2008	TSM08-001	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	3	19-Aug-08	75	-
2008	TSM08-001	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	3	19-Aug-08	90	-
2008	TSM08-001	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	3	19-Aug-08	105	-
2008	TSM08-001	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	3	19-Aug-08	120	-
2008	TSM08-001	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	3	19-Aug-08	135	-
2008	TSM08-001	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	3	19-Aug-08	150	-
2008	TSM08-002	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	3	19-Aug-08	15	-
2008	TSM08-002	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	3	19-Aug-08	30	-
2008	TSM08-002	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	3	19-Aug-08	45	-
2008	TSM08-002	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	3	19-Aug-08	60	-
2008	TSM08-002	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	3	19-Aug-08	75	-
2008	TSM08-002	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	3	19-Aug-08	90	-
2008	TSM08-002	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	3	19-Aug-08	105	-
2008	TSM08-002	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	3	19-Aug-08	120	-
2008	TSM08-002	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	3	19-Aug-08	135	-
2008	TSM08-002	CMAunp	Alpine Meadow	Above KSM Camp	n/a	422363	6260236	3	19-Aug-08	150	-
2008	TSM08-003	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	3	19-Aug-08	150	-
2008	TSM08-003	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	3	19-Aug-08	135	-
2008	TSM08-003	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	3	19-Aug-08	120	Keen's mouse
2008	TSM08-003	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	3	19-Aug-08	105	-
2008	TSM08-003	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	3	19-Aug-08	90	-
2008	TSM08-003	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	3	19-Aug-08	75	-
2008	TSM08-003	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	3	19-Aug-08	60	-
2008	TSM08-003	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	3	19-Aug-08	45	Keen's mouse
2008	TSM08-003	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	3	19-Aug-08	30	-
2008	TSM08-003	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	3	19-Aug-08	15	-
2008	TSM08-004	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	3	19-Aug-08	15	Keen's mouse
2008	TSM08-004	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	3	19-Aug-08	30	-
2008	TSM08-004	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	3	19-Aug-08	45	-
2008	TSM08-004	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	3	19-Aug-08	60	-
2008	TSM08-004	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	3	19-Aug-08	75	-
2008	TSM08-004	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	3	19-Aug-08	90	Keen's mouse
2008	TSM08-004	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	3	19-Aug-08	105	-
2008	TSM08-004	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	3	19-Aug-08	120	-
2008	TSM08-004	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	3	19-Aug-08	135	-
2008	TSM08-004	MHun	Riparian	Sulphurets Cr.	n/a	417283	6262153	3	19-Aug-08	150	Keen's mouse
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	1	15-Aug-09	45	Northern red-backed vole
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	1	15-Aug-09	60	Northern red-backed vole
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	1	15-Aug-09	105	Northern red-backed vole
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	1	15-Aug-09	15	Keen's mouse

Appendix 4.6-1. Raw Small Mammal Capture Data, 2008 and 2009

Year	Transect	BEC Zone	Habitat Description	Location	Transect Group	Transect Start Point		Visit No.	Capture Date	Capture Station (m from Start)	Species Caught
						Easting	Northing				
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	1	15-Aug-09	30	Keen's mouse
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	1	15-Aug-09	90	Keen's mouse
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	1	15-Aug-09	135	Keen's mouse
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	1	15-Aug-09	150	Keen's mouse
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	1	15-Aug-09	180	Keen's mouse
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	1	15-Aug-09	240	Keen's mouse
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	1	15-Aug-09	255	Keen's mouse
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	1	15-Aug-09	270	Keen's mouse
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	1	15-Aug-09	75	-
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	1	15-Aug-09	120	-
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	1	15-Aug-09	165	-
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	1	15-Aug-09	195	-
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	1	15-Aug-09	210	-
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	1	15-Aug-09	225	-
2009	TSM09-002	ESSFvw	Conifer Forest	Teigen Lake	Control - TSF	416638	6262738	1	15-Aug-09	15	Northern red-backed vole
2009	TSM09-002	ESSFvw	Conifer Forest	Teigen Lake	Control - TSF	416638	6262738	1	15-Aug-09	30	-
2009	TSM09-002	ESSFvw	Conifer Forest	Teigen Lake	Control - TSF	416638	6262738	1	15-Aug-09	45	-
2009	TSM09-002	ESSFvw	Conifer Forest	Teigen Lake	Control - TSF	416638	6262738	1	15-Aug-09	60	-
2009	TSM09-002	ESSFvw	Conifer Forest	Teigen Lake	Control - TSF	416638	6262738	1	15-Aug-09	75	-
2009	TSM09-002	ESSFvw	Conifer Forest	Teigen Lake	Control - TSF	416638	6262738	1	15-Aug-09	90	-
2009	TSM09-002	ESSFvw	Conifer Forest	Teigen Lake	Control - TSF	416638	6262738	1	15-Aug-09	105	-
2009	TSM09-002	ESSFvw	Conifer Forest	Teigen Lake	Control - TSF	416638	6262738	1	15-Aug-09	120	-
2009	TSM09-002	ESSFvw	Conifer Forest	Teigen Lake	Control - TSF	416638	6262738	1	15-Aug-09	135	-
2009	TSM09-002	ESSFvw	Conifer Forest	Teigen Lake	Control - TSF	416638	6262738	1	15-Aug-09	150	-
2009	TSM09-002	ESSFvw	Conifer Forest	Teigen Lake	Control - TSF	416638	6262738	1	15-Aug-09	165	-
2009	TSM09-002	ESSFvw	Conifer Forest	Teigen Lake	Control - TSF	416638	6262738	1	15-Aug-09	180	-
2009	TSM09-002	ESSFvw	Conifer Forest	Teigen Lake	Control - TSF	416638	6262738	1	15-Aug-09	195	-
2009	TSM09-003	ESSFvw	Conifer Forest	TSF/Teigen Creek	Treatment - TSF	439044	6281213	1	15-Aug-09	15	-
2009	TSM09-003	ESSFvw	Conifer Forest	TSF/Teigen Creek	Treatment - TSF	439044	6281213	1	15-Aug-09	30	-
2009	TSM09-003	ESSFvw	Conifer Forest	TSF/Teigen Creek	Treatment - TSF	439044	6281213	1	15-Aug-09	45	-
2009	TSM09-003	ESSFvw	Conifer Forest	TSF/Teigen Creek	Treatment - TSF	439044	6281213	1	15-Aug-09	60	-
2009	TSM09-003	ESSFvw	Conifer Forest	TSF/Teigen Creek	Treatment - TSF	439044	6281213	1	15-Aug-09	75	-
2009	TSM09-003	ESSFvw	Conifer Forest	TSF/Teigen Creek	Treatment - TSF	439044	6281213	1	15-Aug-09	90	-
2009	TSM09-003	ESSFvw	Conifer Forest	TSF/Teigen Creek	Treatment - TSF	439044	6281213	1	15-Aug-09	105	-
2009	TSM09-003	ESSFvw	Conifer Forest	TSF/Teigen Creek	Treatment - TSF	439044	6281213	1	15-Aug-09	120	-
2009	TSM09-003	ESSFvw	Conifer Forest	TSF/Teigen Creek	Treatment - TSF	439044	6281213	1	15-Aug-09	135	-
2009	TSM09-003	ESSFvw	Conifer Forest	TSF/Teigen Creek	Treatment - TSF	439044	6281213	1	15-Aug-09	150	-
2009	TSM09-003	ESSFvw	Conifer Forest	TSF/Teigen Creek	Treatment - TSF	439044	6281213	1	15-Aug-09	165	-
2009	TSM09-003	ESSFvw	Conifer Forest	TSF/Teigen Creek	Treatment - TSF	439044	6281213	1	15-Aug-09	180	-
2009	TSM09-003	ESSFvw	Conifer Forest	TSF/Teigen Creek	Treatment - TSF	439044	6281213	1	15-Aug-09	195	-
2009	TSM09-003	ESSFvw	Conifer Forest	TSF/Teigen Creek	Treatment - TSF	439044	6281213	1	15-Aug-09	210	-

Appendix 4.6-1. Raw Small Mammal Capture Data, 2008 and 2009

Year	Transect	BEC Zone	Habitat Description	Location	Transect Group	Transect Start Point		Visit No.	Capture Date	Capture Station (m from Start)	Species Caught
						Easting	Northing				
2009	TSM09-003	ESSFwv	Conifer Forest	TSF/Teigen Creek	Treatment - TSF	439044	6281213	1	15-Aug-09	225	-
2009	TSM09-003	ESSFwv	Conifer Forest	TSF/Teigen Creek	Treatment - TSF	439044	6281213	1	15-Aug-09	240	-
2009	TSM09-002	ESSFwv	Conifer Forest	Teigen Lake	Control - TSF	416638	6262738	2	16-Aug-09	15	Northern red-backed vole
2009	TSM09-002	ESSFwv	Conifer Forest	Teigen Lake	Control - TSF	416638	6262738	2	16-Aug-09	30	-
2009	TSM09-002	ESSFwv	Conifer Forest	Teigen Lake	Control - TSF	416638	6262738	2	16-Aug-09	45	-
2009	TSM09-002	ESSFwv	Conifer Forest	Teigen Lake	Control - TSF	416638	6262738	2	16-Aug-09	60	Northern red-backed vole
2009	TSM09-002	ESSFwv	Conifer Forest	Teigen Lake	Control - TSF	416638	6262738	2	16-Aug-09	75	-
2009	TSM09-002	ESSFwv	Conifer Forest	Teigen Lake	Control - TSF	416638	6262738	2	16-Aug-09	90	-
2009	TSM09-002	ESSFwv	Conifer Forest	Teigen Lake	Control - TSF	416638	6262738	2	16-Aug-09	105	-
2009	TSM09-002	ESSFwv	Conifer Forest	Teigen Lake	Control - TSF	416638	6262738	2	16-Aug-09	120	-
2009	TSM09-002	ESSFwv	Conifer Forest	Teigen Lake	Control - TSF	416638	6262738	2	16-Aug-09	135	-
2009	TSM09-002	ESSFwv	Conifer Forest	Teigen Lake	Control - TSF	416638	6262738	2	16-Aug-09	150	-
2009	TSM09-002	ESSFwv	Conifer Forest	Teigen Lake	Control - TSF	416638	6262738	2	16-Aug-09	165	Northern red-backed vole
2009	TSM09-002	ESSFwv	Conifer Forest	Teigen Lake	Control - TSF	416638	6262738	2	16-Aug-09	180	-
2009	TSM09-002	ESSFwv	Conifer Forest	Teigen Lake	Control - TSF	416638	6262738	2	16-Aug-09	195	-
2009	TSM09-002	ESSFwv	Conifer Forest	Teigen Lake	Control - TSF	416638	6262738	2	16-Aug-09	210	-
2009	TSM09-002	ESSFwv	Conifer Forest	Teigen Lake	Control - TSF	416638	6262738	2	16-Aug-09	225	-
2009	TSM09-002	ESSFwv	Conifer Forest	Teigen Lake	Control - TSF	416638	6262738	2	16-Aug-09	240	-
2009	TSM09-002	ESSFwv	Conifer Forest	Teigen Lake	Control - TSF	416638	6262738	2	16-Aug-09	255	Common shrew
2009	TSM09-002	ESSFwv	Conifer Forest	Teigen Lake	Control - TSF	416638	6262738	2	16-Aug-09	270	-
2009	TSM09-002	ESSFwv	Conifer Forest	Teigen Lake	Control - TSF	416638	6262738	2	16-Aug-09	285	-
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	2	16-Aug-09	105	Northern red-backed vole
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	2	16-Aug-09	135	Northern red-backed vole
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	2	16-Aug-09	15	Keen's mouse
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	2	16-Aug-09	30	Keen's mouse
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	2	16-Aug-09	45	Northern red-backed vole
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	2	16-Aug-09	135	Keen's mouse
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	2	16-Aug-09	165	Keen's mouse
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	2	16-Aug-09	180	Keen's mouse
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	2	16-Aug-09	240	Keen's mouse
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	2	16-Aug-09	255	Keen's mouse
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	2	16-Aug-09	270	Keen's mouse
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	2	16-Aug-09	270	Keen's mouse
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	2	16-Aug-09	45	Common shrew
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	2	16-Aug-09	30	-
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	2	16-Aug-09	60	-
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	2	16-Aug-09	75	-
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	2	16-Aug-09	90	-
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	2	16-Aug-09	120	-
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	2	16-Aug-09	150	-
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	2	16-Aug-09	195	-

Appendix 4.6-1. Raw Small Mammal Capture Data, 2008 and 2009

Year	Transect	BEC Zone	Habitat Description	Location	Transect Group	Transect Start Point		Visit No.	Capture Date	Capture Station (m from Start)	Species Caught
						Easting	Northing				
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	2	16-Aug-09	210	-
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	2	16-Aug-09	225	-
2009	TSM09-003	ESSFvw	Conifer Forest	TSF/Teigen Creek	Treatment - TSF	439044	6281213	2	16-Aug-09	15	Duisky shrew
2009	TSM09-003	ESSFvw	Conifer Forest	TSF/Teigen Creek	Treatment - TSF	439044	6281213	2	16-Aug-09	15	Duisky shrew
2009	TSM09-003	ESSFvw	Conifer Forest	TSF/Teigen Creek	Treatment - TSF	439044	6281213	2	16-Aug-09	165	Northern red-backed vole
2009	TSM09-003	ESSFvw	Conifer Forest	TSF/Teigen Creek	Treatment - TSF	439044	6281213	2	16-Aug-09	240	Northern red-backed vole
2009	TSM09-003	ESSFvw	Conifer Forest	TSF/Teigen Creek	Treatment - TSF	439044	6281213	2	16-Aug-09	30	-
2009	TSM09-003	ESSFvw	Conifer Forest	TSF/Teigen Creek	Treatment - TSF	439044	6281213	2	16-Aug-09	45	-
2009	TSM09-003	ESSFvw	Conifer Forest	TSF/Teigen Creek	Treatment - TSF	439044	6281213	2	16-Aug-09	60	-
2009	TSM09-003	ESSFvw	Conifer Forest	TSF/Teigen Creek	Treatment - TSF	439044	6281213	2	16-Aug-09	75	-
2009	TSM09-003	ESSFvw	Conifer Forest	TSF/Teigen Creek	Treatment - TSF	439044	6281213	2	16-Aug-09	90	-
2009	TSM09-003	ESSFvw	Conifer Forest	TSF/Teigen Creek	Treatment - TSF	439044	6281213	2	16-Aug-09	105	-
2009	TSM09-003	ESSFvw	Conifer Forest	TSF/Teigen Creek	Treatment - TSF	439044	6281213	2	16-Aug-09	120	-
2009	TSM09-003	ESSFvw	Conifer Forest	TSF/Teigen Creek	Treatment - TSF	439044	6281213	2	16-Aug-09	135	-
2009	TSM09-003	ESSFvw	Conifer Forest	TSF/Teigen Creek	Treatment - TSF	439044	6281213	2	16-Aug-09	150	-
2009	TSM09-003	ESSFvw	Conifer Forest	TSF/Teigen Creek	Treatment - TSF	439044	6281213	2	16-Aug-09	180	-
2009	TSM09-003	ESSFvw	Conifer Forest	TSF/Teigen Creek	Treatment - TSF	439044	6281213	2	16-Aug-09	195	-
2009	TSM09-003	ESSFvw	Conifer Forest	TSF/Teigen Creek	Treatment - TSF	439044	6281213	2	16-Aug-09	210	-
2009	TSM09-003	ESSFvw	Conifer Forest	TSF/Teigen Creek	Treatment - TSF	439044	6281213	2	16-Aug-09	225	-
2009	TSM09-003	ESSFvw	Conifer Forest	TSF/Teigen Creek	Treatment - TSF	439044	6281213	2	16-Aug-09	255	-
2009	TSM09-003	ESSFvw	Conifer Forest	TSF/Teigen Creek	Treatment - TSF	439044	6281213	2	16-Aug-09	270	-
2009	TSM09-003	ESSFvw	Conifer Forest	TSF/Teigen Creek	Treatment - TSF	439044	6281213	2	16-Aug-09	285	-
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	3	17-Aug-09	75	Northern red-backed vole
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	3	17-Aug-09	90	Northern red-backed vole
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	3	17-Aug-09	130	Northern red-backed vole
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	3	17-Aug-09	130	Northern red-backed vole
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	3	17-Aug-09	180	Northern red-backed vole
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	3	17-Aug-09	180	Northern red-backed vole
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	3	17-Aug-09	195	Northern red-backed vole
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	3	17-Aug-09	15	Keen's mouse
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	3	17-Aug-09	30	Keen's mouse
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	3	17-Aug-09	120	Keen's mouse
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	3	17-Aug-09	120	Keen's mouse
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	3	17-Aug-09	150	Keen's mouse
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	3	17-Aug-09	270	Keen's mouse
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	3	17-Aug-09	270	Keen's mouse
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	3	17-Aug-09	15	Duisky shrew
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	3	17-Aug-09	45	-
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	3	17-Aug-09	60	-
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	3	17-Aug-09	105	-
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	3	17-Aug-09	165	-

Appendix 4.6-1. Raw Small Mammal Capture Data, 2008 and 2009

Year	Transect	BEC Zone	Habitat Description	Location	Transect Group	Transect Start Point		Visit No.	Capture Date	Capture Station (m from Start)	Species Caught
						Easting	Northing				
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	3	17-Aug-09	210	-
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	3	17-Aug-09	225	-
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	3	17-Aug-09	240	-
2009	TSM09-001	MHun	Riparian	Sulphurets Cr.	Treatment - Mine Site	416638	6262738	3	17-Aug-09	255	-
2009	TSM09-003	ESSFwv	Conifer Forest	TSF/Teigen Creek	Treatment - TSF	439044	6281213	3	17-Aug-09	105	Northern red-backed vole
2009	TSM09-003	ESSFwv	Conifer Forest	TSF/Teigen Creek	Treatment - TSF	439044	6281213	3	17-Aug-09	120	Northern red-backed vole
2009	TSM09-003	ESSFwv	Conifer Forest	TSF/Teigen Creek	Treatment - TSF	439044	6281213	3	17-Aug-09	165	Northern red-backed vole
2009	TSM09-003	ESSFwv	Conifer Forest	TSF/Teigen Creek	Treatment - TSF	439044	6281213	3	17-Aug-09	165	Northern red-backed vole
2009	TSM09-003	ESSFwv	Conifer Forest	TSF/Teigen Creek	Treatment - TSF	439044	6281213	3	17-Aug-09	240	Northern red-backed vole
2009	TSM09-003	ESSFwv	Conifer Forest	TSF/Teigen Creek	Treatment - TSF	439044	6281213	3	17-Aug-09	15	-
2009	TSM09-003	ESSFwv	Conifer Forest	TSF/Teigen Creek	Treatment - TSF	439044	6281213	3	17-Aug-09	30	-
2009	TSM09-003	ESSFwv	Conifer Forest	TSF/Teigen Creek	Treatment - TSF	439044	6281213	3	17-Aug-09	45	-
2009	TSM09-003	ESSFwv	Conifer Forest	TSF/Teigen Creek	Treatment - TSF	439044	6281213	3	17-Aug-09	60	-
2009	TSM09-003	ESSFwv	Conifer Forest	TSF/Teigen Creek	Treatment - TSF	439044	6281213	3	17-Aug-09	75	-
2009	TSM09-003	ESSFwv	Conifer Forest	TSF/Teigen Creek	Treatment - TSF	439044	6281213	3	17-Aug-09	90	-
2009	TSM09-003	ESSFwv	Conifer Forest	TSF/Teigen Creek	Treatment - TSF	439044	6281213	3	17-Aug-09	135	-
2009	TSM09-003	ESSFwv	Conifer Forest	TSF/Teigen Creek	Treatment - TSF	439044	6281213	3	17-Aug-09	150	-
2009	TSM09-003	ESSFwv	Conifer Forest	TSF/Teigen Creek	Treatment - TSF	439044	6281213	3	17-Aug-09	180	-
2009	TSM09-003	ESSFwv	Conifer Forest	TSF/Teigen Creek	Treatment - TSF	439044	6281213	3	17-Aug-09	195	-
2009	TSM09-003	ESSFwv	Conifer Forest	TSF/Teigen Creek	Treatment - TSF	439044	6281213	3	17-Aug-09	210	-
2009	TSM09-003	ESSFwv	Conifer Forest	TSF/Teigen Creek	Treatment - TSF	439044	6281213	3	17-Aug-09	225	-
2009	TSM09-003	ESSFwv	Conifer Forest	TSF/Teigen Creek	Treatment - TSF	439044	6281213	3	17-Aug-09	255	-
2009	TSM09-003	ESSFwv	Conifer Forest	TSF/Teigen Creek	Treatment - TSF	439044	6281213	3	17-Aug-09	270	-
2009	TSM09-003	ESSFwv	Conifer Forest	TSF/Teigen Creek	Treatment - TSF	439044	6281213	3	17-Aug-09	285	-
2009	TSM09-004	CWHwv	Mature Conifer Forest	Sulphurets/Unuk	Control - Mine Site	407522	6261953	1	17-Aug-09	75	Keen's mouse
2009	TSM09-004	CWHwv	Mature Conifer Forest	Sulphurets/Unuk	Control - Mine Site	407522	6261953	1	17-Aug-09	165	Keen's mouse
2009	TSM09-004	CWHwv	Mature Conifer Forest	Sulphurets/Unuk	Control - Mine Site	407522	6261953	1	17-Aug-09	165	Keen's mouse
2009	TSM09-004	CWHwv	Mature Conifer Forest	Sulphurets/Unuk	Control - Mine Site	407522	6261953	1	17-Aug-09	180	Keen's mouse
2009	TSM09-004	CWHwv	Mature Conifer Forest	Sulphurets/Unuk	Control - Mine Site	407522	6261953	1	17-Aug-09	210	Keen's mouse
2009	TSM09-004	CWHwv	Mature Conifer Forest	Sulphurets/Unuk	Control - Mine Site	407522	6261953	1	17-Aug-09	225	Keen's mouse
2009	TSM09-004	CWHwv	Mature Conifer Forest	Sulphurets/Unuk	Control - Mine Site	407522	6261953	1	17-Aug-09	240	Keen's mouse
2009	TSM09-004	CWHwv	Mature Conifer Forest	Sulphurets/Unuk	Control - Mine Site	407522	6261953	1	17-Aug-09	270	Keen's mouse
2009	TSM09-004	CWHwv	Mature Conifer Forest	Sulphurets/Unuk	Control - Mine Site	407522	6261953	1	17-Aug-09	285	Keen's mouse
2009	TSM09-004	CWHwv	Mature Conifer Forest	Sulphurets/Unuk	Control - Mine Site	407522	6261953	1	17-Aug-09	15	-
2009	TSM09-004	CWHwv	Mature Conifer Forest	Sulphurets/Unuk	Control - Mine Site	407522	6261953	1	17-Aug-09	30	-
2009	TSM09-004	CWHwv	Mature Conifer Forest	Sulphurets/Unuk	Control - Mine Site	407522	6261953	1	17-Aug-09	45	-
2009	TSM09-004	CWHwv	Mature Conifer Forest	Sulphurets/Unuk	Control - Mine Site	407522	6261953	1	17-Aug-09	60	-
2009	TSM09-004	CWHwv	Mature Conifer Forest	Sulphurets/Unuk	Control - Mine Site	407522	6261953	1	17-Aug-09	90	-
2009	TSM09-004	CWHwv	Mature Conifer Forest	Sulphurets/Unuk	Control - Mine Site	407522	6261953	1	17-Aug-09	105	-
2009	TSM09-004	CWHwv	Mature Conifer Forest	Sulphurets/Unuk	Control - Mine Site	407522	6261953	1	17-Aug-09	120	-
2009	TSM09-004	CWHwv	Mature Conifer Forest	Sulphurets/Unuk	Control - Mine Site	407522	6261953	1	17-Aug-09	135	-

Appendix 4.6-1. Raw Small Mammal Capture Data, 2008 and 2009

Year	Transect	Scientific Name	Code	Sex	Age	Standard Morphometrics				Keen's Mouse ID	Comment(s)
						Tail (mm)	Total (mm)	Ear (mm)	Rear Right Foot (mm)		
2008	TSM08-001										
2008	TSM08-001										
2008	TSM08-001										
2008	TSM08-001										
2008	TSM08-001										
2008	TSM08-001										
2008	TSM08-001										
2008	TSM08-001										
2008	TSM08-001										
2008	TSM08-002										
2008	TSM08-002										
2008	TSM08-002										
2008	TSM08-002										
2008	TSM08-002										
2008	TSM08-002										
2008	TSM08-002										
2008	TSM08-002										
2008	TSM08-002										
2008	TSM08-002										
2008	TSM08-002										
2008	TSM08-002										
2008	TSM08-003										
2008	TSM08-003										
2008	TSM08-003										
2008	TSM08-003										
2008	TSM08-003										
2008	TSM08-003										
2008	TSM08-003										
2008	TSM08-003										
2008	TSM08-003										
2008	TSM08-003										
2008	TSM08-003										
2008	TSM08-003	<i>Microtus pennsylvanicus</i>	M-MIPE	U	U	46	160	8	12	44	
2008	TSM08-004										
2008	TSM08-004										
2008	TSM08-004										
2008	TSM08-004										
2008	TSM08-004	<i>Peromyscus keeni</i>	M-PEKI								mouse escaped
2008	TSM08-004										
2008	TSM08-004	<i>Peromyscus keeni</i>	M-PEKI								mouse escaped
2008	TSM08-004										
2008	TSM08-001										

Appendix 4.6-1. Raw Small Mammal Capture Data, 2008 and 2009

Year	Transect	Scientific Name	Code	Sex	Age	Standard Morphometrics				Keen's Mouse ID	Comment(s)
						Tail (mm)	Total (mm)	Ear (mm)	Rear Right Foot (mm)		
2008	TSM08-001	<i>Microtus pennsylvanicus</i>	M-MIPE	U	U	35	132	12	19	23	
2008	TSM08-001										
2008	TSM08-001	<i>Microtus pennsylvanicus</i>	M-MIPE	U	U	38	120	13	17	24	
2008	TSM08-001										
2008	TSM08-001										
2008	TSM08-001										
2008	TSM08-001										
2008	TSM08-001										
2008	TSM08-002										
2008	TSM08-002										
2008	TSM08-002										
2008	TSM08-002										
2008	TSM08-002										
2008	TSM08-002										
2008	TSM08-002										
2008	TSM08-002										
2008	TSM08-002										
2008	TSM08-002										
2008	TSM08-002										
2008	TSM08-002										
2008	TSM08-002										
2008	TSM08-003										
2008	TSM08-003										
2008	TSM08-003										
2008	TSM08-003										
2008	TSM08-003										
2008	TSM08-003										
2008	TSM08-003										
2008	TSM08-003										
2008	TSM08-003										
2008	TSM08-003										
2008	TSM08-003										
2008	TSM08-003										
2008	TSM08-003										
2008	TSM08-004	<i>Peromyscus keeni</i>	M-PEKI	U	U	92	144	14	19		
2008	TSM08-004										
2008	TSM08-004	<i>Peromyscus keeni</i>	M-PEKI	F	U	86	140	13	19	16.5	
2008	TSM08-004										
2008	TSM08-004	<i>Peromyscus keeni</i>	M-PEKI	U	U	92	167	11	21	19.5	
2008	TSM08-004										
2008	TSM08-004	<i>Peromyscus keeni</i>	M-PEKI								
2008	TSM08-004	<i>Peromyscus keeni</i>	M-PEKI	U	U	91	157	15	22	18.5	
2008	TSM08-004										
2008	TSM08-001										
2008	TSM08-001										
2008	TSM08-001										

Appendix 4.6-1. Raw Small Mammal Capture Data, 2008 and 2009

Year	Transect	Scientific Name	Code	Sex	Age	Standard Morphometrics				Keen's Mouse ID	Comment(s)
						Tail (mm)	Total (mm)	Ear (mm)	Rear Right Foot (mm)		
2008	TSM08-001										
2008	TSM08-001										
2008	TSM08-001										
2008	TSM08-001										
2008	TSM08-001										
2008	TSM08-001										
2008	TSM08-001										
2008	TSM08-002										
2008	TSM08-002										
2008	TSM08-002										
2008	TSM08-002										
2008	TSM08-002										
2008	TSM08-002										
2008	TSM08-002										
2008	TSM08-002										
2008	TSM08-002										
2008	TSM08-003										
2008	TSM08-003										
2008	TSM08-003	<i>Peromyscus keeni</i>	M-PEKI	U	U	97	166	11	18	26	
2008	TSM08-003										
2008	TSM08-003										
2008	TSM08-003										
2008	TSM08-003	<i>Peromyscus keeni</i>	M-PEKI								mouse escaped
2008	TSM08-003										
2008	TSM08-003										
2008	TSM08-004	<i>Peromyscus keeni</i>	M-PEKI	U	U	97	168	9	16		
2008	TSM08-004										
2008	TSM08-004										
2008	TSM08-004										
2008	TSM08-004	<i>Peromyscus keeni</i>	M-PEKI	U	U	71	150	10	16	18	
2008	TSM08-004										
2008	TSM08-004										
2008	TSM08-004	<i>Peromyscus keeni</i>	M-PEKI	U		82	155	8	17	21	
2009	TSM09-001	<i>Myodes rutilus</i>	M-CLRU	F	A	35	135			22	
2009	TSM09-001	<i>Myodes rutilus</i>	M-CLRU	F	A	40	135			25	animal deceased
2009	TSM09-001	<i>Myodes rutilus</i>	M-CLRU	F	A	37	145			24	
2009	TSM09-001	<i>Peromyscus keeni</i>	M-PEKE	F	A	102	X			23	SM001-01

Appendix 4.6-1. Raw Small Mammal Capture Data, 2008 and 2009

Year	Transect	Scientific Name	Code	Sex	Age	Standard Morphometrics				Keen's Mouse ID	Comment(s)	
						Tail (mm)	Total (mm)	Ear (mm)	Rear Right Foot (mm)			Weight (g)
2009	TSM09-001	<i>Peromyscus keeni</i>	M-PEKE	M	J	82	165			15	SM001-02	
2009	TSM09-001	<i>Peromyscus keeni</i>	M-PEKE	M	J	87	172			16	SM001-3	
2009	TSM09-001	<i>Peromyscus keeni</i>	M-PEKE	F	A	103	201			34	SM001-4	
2009	TSM09-001	<i>Peromyscus keeni</i>	M-PEKE	F	A	99	197			21	SM001-5	
2009	TSM09-001	<i>Peromyscus keeni</i>	M-PEKE	M	A	75	161			19	SM001-6	tail damaged
2009	TSM09-001	<i>Peromyscus keeni</i>	M-PEKE	M	J	89	171			16	SM001-7	
2009	TSM09-001	<i>Peromyscus keeni</i>	M-PEKE	X	X	X	X			X		mouse escaped
2009	TSM09-001	<i>Peromyscus keeni</i>	M-PEKE	F	A	100	196			22	SM001-8	
2009	TSM09-001											
2009	TSM09-001											
2009	TSM09-001											
2009	TSM09-001											
2009	TSM09-001											
2009	TSM09-002	<i>Myodes rutilus</i>	M-CLRU	M	J	X	X			X		
2009	TSM09-002											
2009	TSM09-002											
2009	TSM09-002											
2009	TSM09-002											
2009	TSM09-002											
2009	TSM09-002											
2009	TSM09-002											
2009	TSM09-002											
2009	TSM09-002											
2009	TSM09-002											
2009	TSM09-002											
2009	TSM09-002											
2009	TSM09-002											
2009	TSM09-003											
2009	TSM09-003											
2009	TSM09-003											
2009	TSM09-003											
2009	TSM09-003											
2009	TSM09-003											
2009	TSM09-003											
2009	TSM09-003											
2009	TSM09-003											
2009	TSM09-003											
2009	TSM09-003											
2009	TSM09-003											
2009	TSM09-003											
2009	TSM09-003											
2009	TSM09-003											
2009	TSM09-003											
2009	TSM09-003											
2009	TSM09-003											
2009	TSM09-003											
2009	TSM09-003											
2009	TSM09-003											
2009	TSM09-003											

Appendix 4.6-1. Raw Small Mammal Capture Data, 2008 and 2009

Year	Transect	Scientific Name	Code	Sex	Age	Standard Morphometrics				Keen's Mouse ID	Comment(s)
						Tail (mm)	Total (mm)	Ear (mm)	Rear Right Foot (mm)		
2009	TSM09-003										
2009	TSM09-003										
2009	TSM09-002	<i>Myodes rutilus</i>	M-CLRU	X	J	X	X			X	
2009	TSM09-002										
2009	TSM09-002										
2009	TSM09-002	<i>Myodes rutilus</i>	M-CLRU	F	J	X	X			X	
2009	TSM09-002										
2009	TSM09-002										
2009	TSM09-002										
2009	TSM09-002										
2009	TSM09-002	<i>Myodes rutilus</i>	M-CLRU	F	A	X	X			X	
2009	TSM09-002										
2009	TSM09-002										
2009	TSM09-002										
2009	TSM09-002	<i>Sorex cinereus</i>	M-SOCI	F	A	X	X			X	
2009	TSM09-002										
2009	TSM09-002										
2009	TSM09-001	<i>Myodes rutilus</i>	M-CLRU	F	A	X	X			X	
2009	TSM09-001	<i>Myodes rutilus</i>	M-CLRU	M	A	X	X			X	
2009	TSM09-001	<i>Peromyscus keeni</i>	M-PEKE	X	X	X	X			X	mouse escaped
2009	TSM09-001	<i>Peromyscus keeni</i>	M-PEKE	M	J	89	168			18	SM001-16
2009	TSM09-001	<i>Myodes rutilus</i>	M-CLRU	M	A	X	X			X	
2009	TSM09-001	<i>Peromyscus keeni</i>	M-PEKE	M	A	111	210			25	SM001-9
2009	TSM09-001	<i>Peromyscus keeni</i>	M-PEKE	M	J	92	177			18	SM001-10
2009	TSM09-001	<i>Peromyscus keeni</i>	M-PEKE	M	J	92	174			18	SM001-11
2009	TSM09-001	<i>Peromyscus keeni</i>	M-PEKE	M	A	115	217			30	SM001-12
2009	TSM09-001	<i>Peromyscus keeni</i>	M-PEKE	M	J	81	156			13	SM001-13
2009	TSM09-001	<i>Peromyscus keeni</i>	M-PEKE	M	J	81	155			14	SM001-14
2009	TSM09-001	<i>Peromyscus keeni</i>	M-PEKE	M	J	72	142			14	SM001-15
2009	TSM09-001	<i>Sorex cinereus</i>	M-SOCI	M	A	X	X			X	
2009	TSM09-001										
2009	TSM09-001										
2009	TSM09-001										
2009	TSM09-001										
2009	TSM09-001										
2009	TSM09-001										
2009	TSM09-001										
2009	TSM09-001										
2009	TSM09-001										

Appendix 4.6-1. Raw Small Mammal Capture Data, 2008 and 2009

Year	Transect	Scientific Name	Code	Sex	Age	Standard Morphometrics				Keen's Mouse ID	Comment(s)
						Tail (mm)	Total (mm)	Ear (mm)	Rear Right Foot (mm)		
2009	TSM09-001										
2009	TSM09-001										
2009	TSM09-003	<i>Sorex monticolus</i>	M-SOMO	unk	unk	X	X			X	
2009	TSM09-003	<i>Sorex monticolus</i>	M-SOMO	X	X	X	X			X	
2009	TSM09-003	<i>Myodes rutilus</i>	M-CLRU	M	A	X	X			X	
2009	TSM09-003	<i>Myodes rutilus</i>	M-CLRU	M	A	X	X			X	
2009	TSM09-003										
2009	TSM09-003										
2009	TSM09-003										
2009	TSM09-003										
2009	TSM09-003										
2009	TSM09-003										
2009	TSM09-003										
2009	TSM09-003										
2009	TSM09-003										
2009	TSM09-003										
2009	TSM09-003										
2009	TSM09-003										
2009	TSM09-003										
2009	TSM09-003										
2009	TSM09-003										
2009	TSM09-003										
2009	TSM09-003										
2009	TSM09-001	<i>Myodes rutilus</i>	M-CLRU	M	A	X	X			X	
2009	TSM09-001	<i>Myodes rutilus</i>	M-CLRU	F	A	X	X			X	
2009	TSM09-001	<i>Myodes rutilus</i>	M-CLRU	M	J	X	X			X	
2009	TSM09-001	<i>Myodes rutilus</i>	M-CLRU	M	J	X	X			X	
2009	TSM09-001	<i>Myodes rutilus</i>	M-CLRU	M	A	X	X			X	
2009	TSM09-001	<i>Myodes rutilus</i>	M-CLRU	M	J	X	X			X	
2009	TSM09-001	<i>Myodes rutilus</i>	M-CLRU	F	A	X	X			X	
2009	TSM09-001	<i>Peromyscus keeni</i>	M-PEKE	M	J	93	171			15	SM001-16
2009	TSM09-001	<i>Peromyscus keeni</i>	M-PEKE	M	A	101	187			21	SM001-17
2009	TSM09-001	<i>Peromyscus keeni</i>	M-PEKE	M	A	95	188			24	SM001-18
2009	TSM09-001	<i>Peromyscus keeni</i>	M-PEKE	M	A	100	197			23	SM001-19
2009	TSM09-001	<i>Peromyscus keeni</i>	M-PEKE	M	A	99	194			26	SM001-20
2009	TSM09-001	<i>Peromyscus keeni</i>	M-PEKE	M	A	107	201			30	SM001-21
2009	TSM09-001	<i>Peromyscus keeni</i>	M-PEKE	M	J	80	155			25	SM001-22
2009	TSM09-001	<i>Sorex monticolus</i>	M-SOMO	X	X	X	X			X	
2009	TSM09-001										
2009	TSM09-001										
2009	TSM09-001										
2009	TSM09-001										

Appendix 4.6-1. Raw Small Mammal Capture Data, 2008 and 2009

Year	Transect	Scientific Name	Code	Sex	Age	Standard Morphometrics					Keen's Mouse ID	Comment(s)
						Tail (mm)	Total (mm)	Ear (mm)	Rear Right Foot (mm)	Weight (g)		
2009	TSM09-001											
2009	TSM09-001											
2009	TSM09-001											
2009	TSM09-001											
2009	TSM09-003	<i>Myodes rutilus</i>	M-CLRU	M	J	X	X			X		
2009	TSM09-003	<i>Myodes rutilus</i>	M-CLRU	M	A	X	X			X		
2009	TSM09-003	<i>Myodes rutilus</i>	M-CLRU	M	A	X	X			X		
2009	TSM09-003	<i>Myodes rutilus</i>	M-CLRU	F	A	X	X			X		
2009	TSM09-003	<i>Myodes rutilus</i>	M-CLRU	M	A	X	X			X		
2009	TSM09-003											
2009	TSM09-003											
2009	TSM09-003											
2009	TSM09-003											
2009	TSM09-003											
2009	TSM09-003											
2009	TSM09-003											
2009	TSM09-003											
2009	TSM09-003											
2009	TSM09-003											
2009	TSM09-003											
2009	TSM09-003											
2009	TSM09-003											
2009	TSM09-003											
2009	TSM09-003											
2009	TSM09-003											
2009	TSM09-004	<i>Peromyscus keeni</i>	M-PEKE	M	A	103	192			17	SM004-01	
2009	TSM09-004	<i>Peromyscus keeni</i>	M-PEKE	M	A	99	198			25	SM004-02	
2009	TSM09-004	<i>Peromyscus keeni</i>	M-PEKE	F	J	82	167			21	SM004-03	Could be PEOR?
2009	TSM09-004	<i>Peromyscus keeni</i>	M-PEKE	M	J	91	180			19	SM004-04	
2009	TSM09-004	<i>Peromyscus keeni</i>	M-PEKE	M	A	102	205			25	SM004-05	
2009	TSM09-004	<i>Peromyscus keeni</i>	M-PEKE	M	J	88	173			18	SM004-06	
2009	TSM09-004	<i>Peromyscus keeni</i>	M-PEKE	M	A	95	190			25	SM004-07	
2009	TSM09-004	<i>Peromyscus keeni</i>	M-PEKE	M	A	101	198			29	SM004-08	
2009	TSM09-004	<i>Peromyscus keeni</i>	M-PEKE	M	A	100	181			25	SM004-09	
2009	TSM09-004											
2009	TSM09-004											
2009	TSM09-004											
2009	TSM09-004											
2009	TSM09-004											
2009	TSM09-004											
2009	TSM09-004											
2009	TSM09-004											
2009	TSM09-004											
2009	TSM09-004											

Appendix 4.6-1. Raw Small Mammal Capture Data, 2008 and 2009

Year	Transect	Scientific Name	Code	Sex	Age	Standard Morphometrics				Weight (g)	Keen's Mouse ID	Comment(s)
						Tail (mm)	Total (mm)	Ear (mm)	Rear Right Foot (mm)			
2009	TSM09-004											
2009	TSM09-004											
2009	TSM09-004											
2009	TSM09-004	<i>Myodes rutilus</i>	M-CLRU	unk	X	X	X			X		
2009	TSM09-004	<i>Myodes rutilus</i>	M-CLRU	F	A	X	X			X		
2009	TSM09-004	<i>Myodes rutilus</i>	M-CLRU	M	J	X	X			X		
2009	TSM09-004	<i>Myodes rutilus</i>	M-CLRU	M	J	X	X			X		
2009	TSM09-004	<i>Myodes rutilus</i>	M-CLRU	M	J	X	X			X		
2009	TSM09-004	<i>Peromyscus keeni</i>	M-PEKE	M	J	82	161			13	SM004-10	Could be PEOR?
2009	TSM09-004	<i>Peromyscus keeni</i>	M-PEKE	M	J	79	148			10	SM004-11	
2009	TSM09-004	<i>Peromyscus keeni</i>	M-PEKE	M	J	86	158			11	SM004-12	
2009	TSM09-004	<i>Peromyscus keeni</i>	M-PEKE	X	X	X	X			X		mouse escaped
2009	TSM09-004	<i>Peromyscus keeni</i>	M-PEKE	M	J	87	177			18	SM004-13	
2009	TSM09-004	<i>Peromyscus keeni</i>	M-PEKE	M	A	97	190			20	SM004-14	
2009	TSM09-004	<i>Peromyscus keeni</i>	M-PEKE	M	J	89	170			X		released
2009	TSM09-004	<i>Peromyscus keeni</i>	M-PEKE	M	J	X	X			X		released
2009	TSM09-004	<i>Zapus hudsonius</i>	M-ZAHU	unk	A	X	X			X		
2009	TSM09-004											
2009	TSM09-004											
2009	TSM09-004											
2009	TSM09-004											
2009	TSM09-004											
2009	TSM09-005	<i>Myodes rutilus</i>	M-CLRU	F	A	X	X			X		released
2009	TSM09-005	<i>Myodes rutilus</i>	M-CLRU	F	A	X	X			X		
2009	TSM09-005	<i>Myodes rutilus</i>	M-CLRU	M	J	X	X			X		
2009	TSM09-005	<i>Peromyscus keeni</i>	M-PEKE	M	A	101	188			25	SM005-01	
2009	TSM09-005	<i>Peromyscus keeni</i>	M-PEKE	M	A	93	165			18	SM005-02	
2009	TSM09-005	<i>Peromyscus keeni</i>	M-PEKE	M	A	100	186			26	SM005-03	
2009	TSM09-005	<i>Peromyscus keeni</i>	M-PEKE	M	J	X	X			X		released - too small
2009	TSM09-005	<i>Peromyscus keeni</i>	M-PEKE	M	A	99	183			21	SM005-04	
2009	TSM09-005	<i>Peromyscus keeni</i>	M-PEKE	M	A	98	189			23	SM005-05	
2009	TSM09-005	<i>Zapus hudsonius</i>	M-ZAHU	F	A	X	X			X		
2009	TSM09-005	<i>Zapus hudsonius</i>	M-ZAHU	F	A	X	X			X		
2009	TSM09-005	<i>Zapus hudsonius</i>	M-ZAHU	M	J	X	X			X		
2009	TSM09-005	<i>Zapus hudsonius</i>	M-ZAHU	unk	A	X	X			X		escaped
2009	TSM09-005											
2009	TSM09-005											
2009	TSM09-005											
2009	TSM09-005											

Appendix 4.6-2

Small Mammal Catch Per Unit Effort (CPUE) among Transects,
2008 and 2009

Appendix 4.6-2. Small Mammal Catch Per Unit Effort (CPUE) among Transects, 2008 and 2009

Transect	BEC Zone	Date Set	Date Removed	No. Nights Set	Length (m)	No. Stations	No. Traps	Trap Nights	Meadow vole		Keen's mouse	
									No.	CPUE	No.	CPUE
<i>2008</i>												
TSM08-001	CMAump	16-Aug-08	19-Aug-08	3	150	10	10	30	1	0.03		
TSM08-002	CMAump	16-Aug-08	19-Aug-08	3	150	10	10	30				
TSM08-003	MHun	16-Aug-08	19-Aug-08	3	150	10	10	30	2	0.07	2	0.07
TSM08-004	MHun	16-Aug-08	19-Aug-08	3	150	10	10	30			10	0.33
<i>2009</i>												
TSM09-001	MHun	14-Aug-09	17-Aug-09	3	270	18	36	108			25	0.23
TSM09-002	ESSFwv	14-Aug-09	16-Aug-09	2	285	19	38	76				0
TSM09-003	ESSFwv	14-Aug-09	17-Aug-09	3	285	19	38	114				0
TSM09-004	CWHwm	16-Aug-09	18-Aug-09	2	285	19	38	76			17	0.22
TSM09-005	CWHwm	17-Aug-09	18-Aug-09	2	265	16	32	64			6	0.09

Appendix 4.6-2. Small Mammal Catch Per Unit Effort (CPUE) among Transects, 2008 and 2009

Transect	Northern red-backed vole		Common shrew		Dusky shrew		Meadow jumping mouse		Total Traps Snapped	CPUE Snapped
	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE		
<i>2008</i>										
TSM08-001										
TSM08-002										
TSM08-003										
TSM08-004										
<i>2009</i>										
TSM09-001	13	0.12	1	0.01	1	0.01		0	31	0.29
TSM09-002	4	0.05	1	0.01		0		0	15	0.20
TSM09-003	7	0.06		0	2	0.02		0	20	0.18
TSM09-004	6	0.08		0		0	1	0.01	46	0.61
TSM09-005	3	0.05		0		0	4	0.06	16	0.25

Appendix 4.6-3

Keen's Mouse Sent to ALS Laboratory for Metals Analysis

Appendix 4.6-3. Keen's Mouse Sent to ALS Laboratory for Metals Analysis

Year	Transect	Transect Group	Capture Date	Species	Sex	Age	Sample ID
2009	TSM09-001	Treatment - Mine Site	15-Aug-09	Keen's mouse	F	A	SM1-01
2009	TSM09-001	Treatment - Mine Site	15-Aug-09	Keen's mouse	M	J	SM001-02
2009	TSM09-001	Treatment - Mine Site	15-Aug-09	Keen's mouse	M	J	SM01-03
2009	TSM09-001	Treatment - Mine Site	15-Aug-09	Keen's mouse	F	A	SM001-04
2009	TSM09-001	Treatment - Mine Site	15-Aug-09	Keen's mouse	F	A	SM001-05
2009	TSM09-001	Treatment - Mine Site	15-Aug-09	Keen's mouse	M	A	SM001-06
2009	TSM09-001	Treatment - Mine Site	15-Aug-09	Keen's mouse	M	J	SM01-07
2009	TSM09-001	Treatment - Mine Site	15-Aug-09	Keen's mouse	F	A	SM001-08
2009	TSM09-001	Treatment - Mine Site	16-Aug-09	Keen's mouse	M	A	SM001-12
2009	TSM09-001	Treatment - Mine Site	16-Aug-09	Keen's mouse	M	J	SM001-16
2009	TSM09-001	Treatment - Mine Site	17-Aug-09	Keen's mouse	M	A	SM001-17
2009	TSM09-001	Treatment - Mine Site	17-Aug-09	Keen's mouse	M	A	SM001-19
2009	TSM09-001	Treatment - Mine Site	17-Aug-09	Keen's mouse	M	A	SM001-20
2009	TSM09-001	Treatment - Mine Site	17-Aug-09	Keen's mouse	M	A	SM001-21
2009	TSM09-004	Control - Mine Site	17-Aug-09	Keen's mouse	M	A	SM004-01
2009	TSM09-004	Control - Mine Site	17-Aug-09	Keen's mouse	M	A	SM004-02
2009	TSM09-004	Control - Mine Site	17-Aug-09	Keen's mouse	M	A	SM004-05
2009	TSM09-004	Control - Mine Site	17-Aug-09	Keen's mouse	M	J	SM004-06
2009	TSM09-004	Control - Mine Site	17-Aug-09	Keen's mouse	M	A	SM004-07
2009	TSM09-004	Control - Mine Site	17-Aug-09	Keen's mouse	M	A	SM004-08
2009	TSM09-004	Control - Mine Site	17-Aug-09	Keen's mouse	M	A	SM004-09
2009	TSM09-004	Control - Mine Site	18-Aug-09	Keen's mouse	M	J	SM004-12
2009	TSM09-004	Control - Mine Site	18-Aug-09	Keen's mouse	M	J	SM004-13
2009	TSM09-004	Control - Mine Site	18-Aug-09	Keen's mouse	M	A	SM004-14
2009	TSM09-005	Control - Mine Site	18-Aug-09	Keen's mouse	M	A	SM05-01
2009	TSM09-005	Control - Mine Site	18-Aug-09	Keen's mouse	M	A	SM05-02
2009	TSM09-005	Control - Mine Site	18-Aug-09	Keen's mouse	M	A	SM05-03

Appendix 4.6-4

Raw Laboratory Results From Keen's Mouse Metals Analysis

Appendix 4.6-4. Raw Laboratory Results From Keen's Mouse Metals Analysis

Project	KEEN'S MOUSE									
Report To	Greg Sharam, RESCAN ENVIRONMENTAL SERVICES									
ALS File No.	L811481									
RESULTS OF ANALYSIS										
Sample ID	SM1-1	SM001-02	SM01-03	SM001-04	SM001-05	SM001-06	SM01-07	SM001-08	SM001-12	
Date Sampled	15-AUG-09	15-AUG-09	15-AUG-09	15-AUG-09	15-AUG-09	15-AUG-09	15-AUG-09	15-AUG-09	16-AUG-09	
Time Sampled	08:50	09:05	09:23	09:44	09:55	10:07	10:14	10:29	12:35	
ALS Sample ID	L811481-1	L811481-2	L811481-3	L811481-4	L811481-5	L811481-6	L811481-7	L811481-8	L811481-9	
Matrix	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	
METALS										
Aluminum (Al)-Total	<2.0	<2.0	<2.0	<2.0	<2.0	<4.0	<4.0	<2.0	<2.0	
Antimony (Sb)-Total	<0.010	<0.010	<0.010	<0.010	<0.010	<0.020	<0.020	<0.010	<0.010	
Arsenic (As)-Total	<0.010	<0.010	<0.010	0.027	0.024	<0.020	<0.020	<0.010	<0.010	
Barium (Ba)-Total	0.024	0.036	0.048	0.067	0.020	0.164	0.050	0.065	0.042	
Beryllium (Be)-Total	<0.10	<0.10	<0.10	<0.10	<0.10	<0.20	<0.20	<0.10	<0.10	
Bismuth (Bi)-Total	<0.030	<0.030	<0.030	<0.030	<0.030	<0.060	<0.060	<0.030	<0.030	
Cadmium (Cd)-Total	0.867	0.0597	0.0582	0.404	1.24	0.340	0.078	0.612	0.217	
Calcium (Ca)-Total	66.5	76.3	89.4	47.6	45.3	59.5	111	87.6	91.2	
Chromium (Cr)-Total	<0.10	<0.10	<0.10	0.10	<0.10	<0.20	<0.20	0.13	<0.10	
Cobalt (Co)-Total	0.062	0.026	0.034	0.050	0.068	0.055	0.043	0.046	0.033	
Copper (Cu)-Total	5.52	4.86	5.26	4.69	6.10	6.69	6.42	3.77	3.86	
Lead (Pb)-Total	0.050	<0.020	<0.020	0.036	0.025	<0.040	<0.040	<0.020	<0.020	
Lithium (Li)-Total	<0.10	<0.10	<0.10	<0.10	<0.10	<0.20	<0.20	<0.10	<0.10	
Magnesium (Mg)-Total	230	230	250	236	242	228	229	196	229	
Manganese (Mn)-Total	1.90	2.00	2.47	1.82	2.59	2.07	2.14	1.49	1.97	
Mercury (Hg)-Total	<0.0010	0.0033	<0.0010	0.0062	0.0123	<0.0010	<0.0010	0.0074	<0.0010	
Molybdenum (Mo)-Total	1.73	1.12	1.26	1.49	1.50	1.59	1.35	1.21	0.895	
Nickel (Ni)-Total	<0.10	<0.10	<0.10	<0.10	<0.10	<0.20	<0.20	<0.10	<0.10	
Selenium (Se)-Total	1.89	1.31	1.61	1.86	2.26	2.46	1.96	1.62	1.45	
Strontium (Sr)-Total	0.048	0.048	0.077	0.061	0.042	0.026	0.068	0.073	0.067	
Thallium (Tl)-Total	<0.010	<0.010	<0.010	<0.010	<0.010	<0.020	<0.020	<0.010	<0.010	
Tin (Sn)-Total	<0.050	<0.050	<0.050	<0.050	<0.050	<0.10	<0.10	<0.050	0.120	
Uranium (U)-Total	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0040	<0.0040	<0.0020	<0.0020	
Vanadium (V)-Total	<0.10	<0.10	<0.10	<0.10	<0.10	<0.20	<0.20	<0.10	<0.10	
Zinc (Zn)-Total	41.7	41.2	35.3	59.5	31.2	48.2	41.7	34.6	28.1	

Appendix 4.6-4. Raw Laboratory Results From Keen's Mouse Metals Analysis

Project	KEEN'S MOUSE								
Report To	Greg Sharam, RESCAN ENVIRONMENTAL SERVICES								
ALS File No.	L811481								
RESULTS OF ANALYSIS									
Sample ID	SM001-17	SM001-19	SM001-20	SM001-21	SM001-16	SM004-01	SM004-02	SM004-05	SM004-06
Date Sampled	17-AUG-09	17-AUG-09	17-AUG-09	17-AUG-09	16-AUG-09	17-AUG-09	17-AUG-09	17-AUG-09	17-AUG-09
Time Sampled	09:53	10:10	10:17	10:30	13:25	12:13	12:46	13:13	13:21
ALS Sample ID	L811481-10	L811481-11	L811481-12	L811481-13	L811481-14	L811481-15	L811481-16	L811481-17	L811481-18
Matrix	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue
METALS									
Aluminum (Al)-Total	2.7	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<4.0
Antimony (Sb)-Total	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.020
Arsenic (As)-Total	<0.010	<0.010	<0.010	<0.010	<0.010	0.011	<0.010	<0.010	0.090
Barium (Ba)-Total	0.034	0.014	0.016	0.011	0.063	0.050	0.029	0.047	0.085
Beryllium (Be)-Total	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.20
Bismuth (Bi)-Total	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.060
Cadmium (Cd)-Total	0.0786	0.0802	0.0561	0.119	0.148	0.0928	0.548	0.586	0.107
Calcium (Ca)-Total	89.4	80.5	59.8	56.2	82.4	63.7	72.3	71.9	92.8
Chromium (Cr)-Total	<0.10	<0.10	<0.10	<0.10	<0.10	0.16	0.25	<0.10	<0.20
Cobalt (Co)-Total	0.035	0.026	0.035	0.032	0.031	0.040	0.078	0.041	0.048
Copper (Cu)-Total	5.18	4.62	4.73	4.70	4.71	4.00	4.82	4.81	7.08
Lead (Pb)-Total	<0.020	<0.020	<0.020	<0.020	<0.020	0.023	0.025	<0.020	<0.040
Lithium (Li)-Total	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.20
Magnesium (Mg)-Total	245	230	216	201	260	200	222	237	272
Manganese (Mn)-Total	2.10	1.66	2.49	1.83	2.39	1.59	1.75	2.03	2.85
Mercury (Hg)-Total	<0.0010	0.0152	<0.0010	0.0013	<0.0010	<0.0010	0.0031	<0.0010	<0.0010
Molybdenum (Mo)-Total	1.51	1.17	1.02	1.27	1.02	1.27	1.51	1.35	1.58
Nickel (Ni)-Total	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.20
Selenium (Se)-Total	1.33	1.15	1.26	1.39	1.14	1.59	2.39	1.87	2.54
Strontium (Sr)-Total	0.069	0.043	0.019	0.022	0.063	0.056	0.047	0.036	0.111
Thallium (Tl)-Total	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.020
Tin (Sn)-Total	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.10
Uranium (U)-Total	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0040
Vanadium (V)-Total	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.20
Zinc (Zn)-Total	43.6	29.2	29.9	35.6	53.7	34.4	56.7	32.8	75.1

Appendix 4.6-4. Raw Laboratory Results From Keen's Mouse Metals Analysis

Project	KEEN'S MOUSE									
Report To	Greg Sharam, RESCAN ENVIRONMENTAL SERVICES									
ALS File No.	L811481									
RESULTS OF ANALYSIS										
Sample ID	SM004-07	SM004-08	SM004-09	SM004-13	SM004-14	SM05-01	SM05-02	SM05-03	SM05-04	SM004-12
Date Sampled	17-AUG-09	17-AUG-09	17-AUG-09	18-AUG-09	18-AUG-09	18-AUG-09	18-AUG-09	18-AUG-09	18-AUG-09	18-AUG-09
Time Sampled	13:27	13:37	13:40	09:19	09:28	09:00	09:07	09:24	09:27	09:09
ALS Sample ID	L811481-19	L811481-20	L811481-21	L811481-22	L811481-23	L811481-24	L811481-25	L811481-26	L811481-27	L811481-28
Matrix	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue
METALS										
Aluminum (Al)-Total	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<4.0
Antimony (Sb)-Total	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.020
Arsenic (As)-Total	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	<0.020
Barium (Ba)-Total	0.027	0.025	0.065	0.089	0.062	0.075	0.144	0.048	0.060	0.115
Beryllium (Be)-Total	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.20
Bismuth (Bi)-Total	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.060
Cadmium (Cd)-Total	0.824	1.03	0.0469	0.149	0.0748	0.355	0.127	0.476	0.385	0.057
Calcium (Ca)-Total	80.0	59.7	74.0	91.8	94.5	75.9	90.9	75.5	79.6	116
Chromium (Cr)-Total	<0.10	0.11	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.20
Cobalt (Co)-Total	0.066	0.061	0.033	0.050	0.032	0.125	0.021	0.063	0.052	<0.040
Copper (Cu)-Total	5.58	4.21	4.16	3.73	4.42	4.10	3.67	5.67	3.89	5.53
Lead (Pb)-Total	<0.020	<0.020	<0.020	<0.020	0.020	<0.020	<0.020	<0.020	<0.020	<0.040
Lithium (Li)-Total	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.20
Magnesium (Mg)-Total	242	222	248	239	236	209	212	246	226	229
Manganese (Mn)-Total	2.06	1.90	1.86	1.70	2.05	1.62	1.80	1.96	2.04	1.84
Mercury (Hg)-Total	0.0034	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0076	<0.0010
Molybdenum (Mo)-Total	1.33	1.03	1.04	0.945	1.34	1.29	1.21	1.86	1.37	1.30
Nickel (Ni)-Total	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.20
Selenium (Se)-Total	2.49	2.01	1.98	1.16	1.55	1.75	2.05	2.57	1.68	1.17
Strontium (Sr)-Total	0.033	0.038	0.069	0.084	0.064	0.092	0.074	0.039	0.061	0.106
Thallium (Tl)-Total	0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.020
Tin (Sn)-Total	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.10
Uranium (U)-Total	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0040
Vanadium (V)-Total	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.20
Zinc (Zn)-Total	37.2	30.3	50.3	34.0	28.7	31.8	29.2	36.7	35.9	35.4

Appendix 4.7-1

Echolocation Call Survey Data and Survey Site Habitat
Descriptions

Appendix 4.7-1. Echolocation Call Survey Data and Survey Site Habitat Descriptions

				Echolocation Call Survey Results			Survey Site Habitat Description					
Survey Site	Eastings	Northing	Survey Date	On-site Detections	Anabat II Sequence files/Sonograms	Species Detected	BEC Zone	Site Description	Dominant Tree/ Shrub Species	Structural Stage	Canopy Closure	Understorey Species (Shrub/Herb Layer)
1	440745	6283801	16-Aug-09	55	40	<i>Myotis lucifugus</i> , <i>M. evotis</i> , and <i>Lasionycterus noctivagans</i> (potential)	ESSFwv	Riparian Shrub	Red Osier Dogwood and Red Alder	3	45%	oak fern, lady fern, sitka valerian, foamflower, horsetail, twisted stalk, and various leafy mosse
2	415793	6262585	17-Aug-09	n/a	0		CWHwm	Riparian Forest	Coastal Western Hemlock, Black Cottonwood, Sitka Spruce	6/7	50%	devils club, vaccinium spp., salmonberry, equisetum, lady fern, oak fern, bunchberry, five-leaved bramble, twisted stalk, fireweed, and moss
3	407940	6261657	18-Aug-09	n/a	5	<i>M. lucifugus</i> or <i>M. volans</i> (potential)	CWHwm	Mixed Riparian Shrub/Forest	Willow spp., Red Alder, Coastal Western Hemlock, Black Cottonwood, Sitka Spruce	3/7	65%	devils club, elderberry, raspberry, lady fern, oak fern, foam flower, twisted stalk, and trailing raspberry.

Appendix 4.7-2

Bat Survey Raw Data, August 14, 2009

Appendix 4.7-2. Bat Survey Raw Data, August 14, 2009

Survey Site	Date	Survey Start	Survey End	Lunar Phase	Sunset	Survey Weather Conditions								Detection Details							
						Cloud Cover (%)		Wind (km/hr)		Precipitation		Temperature (°c)		Detector	Band	Obs No.	Obs. Time	Pass	Buzz	Species	Quality
						Start	End	Start	End	Start	End	Start	End								
1	14-Aug-09	21:30	23:15	1/4	21:24	100	100	5	10-15	light	none	16	11	Anabat II	broad/handheld	1	21:45	√		<i>Myotis</i> spp.	good
																2	22:06	√		<i>Myotis</i> spp.	small/short
																3	22:14	√		<i>Myotis</i> spp.	small/short
																4	22:16	√		<i>Myotis</i> spp.	good
																5	22:17	√		<i>Myotis</i> spp.	good
																6	22:20	√		<i>Myotis</i> spp.	good
																7	22:22	√		<i>Myotis</i> spp.	good
																8	22:22	√		<i>Myotis</i> spp.	good
																9	22:23	√		<i>Myotis</i> spp.	short
																10	22:24	√		<i>Myotis</i> spp.	good
																11	22:25	√		<i>Myotis</i> spp.	good
																12	22:30	√		<i>Myotis</i> spp.	good
																13	22:35	√		<i>Myotis</i> spp.	good/long
																14	22:36	√	√	<i>Myotis</i> spp.	excellent
																15	22:43	√		<i>Myotis</i> spp.	good
																16	22:45	√		<i>Myotis</i> spp.	good
																17	22:46	√		<i>Myotis</i> spp.	good
																18	22:47	√		<i>Myotis</i> spp.	good
																19	22:48	√		<i>Myotis</i> spp.	good
																20	22:48	√		<i>Myotis</i> spp.	good
																21	22:48	√		<i>Myotis</i> spp.	excellent
																22	22:48	√		<i>Myotis</i> spp.	good
																23	22:49	√		<i>Myotis</i> spp.	good/long
																24	22:51	√		<i>Myotis</i> spp.	good
																25	22:52	√		<i>Myotis</i> spp.	moderate
																26	22:56	√		<i>Myotis</i> spp.	moderate
																27	22:58	√	√	<i>Myotis</i> spp.	good/long
																28	22:59	√		<i>Myotis</i> spp.	good
																29	22:50	√		<i>Myotis</i> spp.	excellent
																30	23:00	√		<i>Myotis</i> spp.	good
																31	23:01	√		<i>Myotis</i> spp.	good
																32	23:02	√		<i>Myotis</i> spp.	good
																33	23:02	√		<i>Myotis</i> spp.	moderate
																34	23:03	√		<i>Myotis</i> spp.	moderate
																35	23:05	√		<i>Myotis</i> spp.	moderate
																36	23:05	√		<i>Myotis</i> spp.	good
																37	23:05	√	√	<i>Myotis</i> spp.	excellent
																38	23:05	√		<i>Myotis</i> spp.	moderate
																39	23:06	√		<i>Myotis</i> spp.	good
																40	23:06	√		<i>Myotis</i> spp.	moderate
																41	23:07	√		<i>Myotis</i> spp.	excellent
																42	23:07	√		<i>Myotis</i> spp.	good
																43	23:08	√	√	<i>Myotis</i> spp.	excellent
																44	23:09	√		<i>Myotis</i> spp.	excellent
																45	23:09	√		<i>Myotis</i> spp.	moderate
																46	23:10	√		<i>Myotis</i> spp.	excellent
																47	23:11	√		<i>Myotis</i> spp.	good
																48	23:12	√	√	<i>Myotis</i> spp.	excellent
																49	23:12	√		<i>Myotis</i> spp.	good
																50	23:13	√		<i>Myotis</i> spp.	moderate
																51	23:15	√		<i>Myotis</i> spp.	good
																52	23:15	√	√	<i>Myotis</i> spp.	excellent
																53	23:16	√		<i>Myotis</i> spp.	good
																54	23:17	√		<i>Myotis</i> spp.	moderate
																55	23:18	√		<i>Myotis</i> spp.	good

Appendix 5.2-1

Summary of Call Playback Survey (CPS) Data, 2008 and 2009

Appendix 5.2-1. Summary of Call Playback Survey (CPS) Data, 2008 and 2009

Date	Transect ID	Easting	Northing	Call Type	Start Time	End Time	Detection	Distance (m)	Bearing (°)	Visual/Call	Activity	Sex	Age	Comment(s)
13-Jun-08	1	420552	6265260	NOGO Alarm	7:40	7:48	-							
13-Jun-08	2	416869	6259910	NOGO Alarm	11:18	11:26	-							
14-Jun-08	3	417782	6262084	NOGO Alarm	6:10	6:18	-							
14-Jun-08	3	416962	6262607	NOGO Alarm	6:07	6:09	NOGO	12	300	V and C	territorial calling	UC	A	Called after CPS, at tree top 10-15m away, stopped calling after 2 min. Flew off in NW direction
14-Jun-08	4	407746	6263016	NOGO Alarm	8:06	8:14	-							
14-Jun-08	4	408046	6263965	NOGO Alarm	7:55	8:03	-							
14-Jun-08	5	407771	6257739	NOGO Alarm	10:00	10:08	-							
14-Jun-08	5	407323	6258707	NOGO Alarm	10:06	10:13	-							
15-Jun-08	6	410194	6270645	NOGO Alarm	6:09	6:17	-							
15-Jun-08	6	410180	6269580	NOGO Alarm	6:18	6:26	-							
15-Jun-08	7	421298	6280477	NOGO Alarm	8:18	8:26	-							
15-Jun-08	7	420337	6280134	NOGO Alarm	8:05	8:13	-							
15-Jun-08	8	433029	6280218	NOGO Alarm	11:18	11:26	-							
15-Jun-08	9	432245	6279473	NOGO Alarm	10:43	10:51	-							
16-Jun-08	10	445116	6275503	NOGO Alarm	5:49	5:57	-							
16-Jun-08	11	441857	6277968	NOGO Alarm	5:51	5:59	-							
16-Jun-08	12	444103	6276375	NOGO Alarm	8:12	8:20	-							
16-Jun-08	13	442169	6277262	NOGO Alarm	7:25	7:33	-							
16-Jun-08	14	452219	6261405	NOGO Alarm	11:50	11:58	-							
17-Jun-08	15	452841	6261376	NOGO Alarm	11:35	11:43	-							
17-Jun-08	16	441718	6286107	NOGO Alarm	7:14	7:22	-							
17-Jun-08	17	440906	6284513	NOGO Alarm	6:43	6:51	-							
17-Jun-08	INC	441218	6285285	NOGO Alarm	7:20	7:28	-							
17-Jun-08	18	427334	6284136	NOGO Alarm	9:18	9:26	-							
17-Jun-08	19	425715	6284687	NOGO Alarm	9:08	9:16	-							
18-Jun-08	20	419168	6261170	NOGO Alarm	5:19	5:27	-							
18-Jun-08	21	397515	6253157	NOGO Alarm	7:20	7:28	-							
18-Jun-08	22	402652	6257826	NOGO Alarm	7:41	7:49	-							
22-Jun-09	NOGO1-A	407912	6256929	NOGO Alarm	11:37	11:45	-							
22-Jun-09	NOGO1-B	407792	6257051	NOGO Alarm	11:58	12:06	-							
22-Jun-09	NOGO1-C	407873	6256820	NOGO Alarm	12:19	12:27	-							
23-Jun-09	NOGO2-A	404662	6257537	NOGO Alarm	10:39	10:47	-							
23-Jun-09	NOGO2-B	404969	6257661	NOGO Alarm	10:58	11:07	-							
23-Jun-09	NOGO2-C	405166	6257687	NOGO Alarm	11:22	11:30	-							
23-Jun-09	NOGO2-D	405331	6257865	NOGO Alarm	11:43	11:51	-							
23-Jun-09	NOGO3-A	407390	6259551	NOGO Alarm	12:14	12:12	-							
24-Jun-09	NOGO4-A	408695	6266079	NOGO Alarm	12:32	12:40	-							
24-Jun-09	NOGO4-B	408796	6266242	NOGO Alarm	12:48	12:56	-							
24-Jun-09	NOGO4-C	408842	6266400	NOGO Alarm	1:03	1:11	-							
24-Jun-09	NOGO4-D	408818	6266517	NOGO Alarm	1:17	1:25	-							
25-Jun-09	NOGO5-A	457533	6266754	NOGO Alarm	9:35	9:43	-							
25-Jun-09	NOGO6-A	441554	6272984	NOGO Alarm	10:48	10:56	-							
25-Jun-09	NOGO6-B	441723	6272866	NOGO Alarm	11:04	11:12	-							
25-Jun-09	NOGO6-C	441908	6272783	NOGO Alarm	11:19	11:27	-							
25-Jun-09	NOGO6-D	442110	6272712	NOGO Alarm	11:39	11:47	-							
25-Jun-09	NOGO6-E	442158	6272497	NOGO Alarm	11:54	12:02	-							
26-Jun-09	NOGO7-A	417195	6280039	NOGO Alarm	10:13	10:21	-							
26-Jun-09	NOGO7-B	417446	6279986	NOGO Alarm	10:35	10:43	-							
26-Jun-09	NOGO7-C	417784	6279967	NOGO Alarm	11:00	11:08	-							
26-Jun-09	NOGO7-D	418102	6280178	NOGO Alarm	11:27	11:35	-							
27-Jun-09	NOGO8-A	431232	6279666	NOGO Alarm	12:32	12:40	-							
27-Jun-09	NOGO8-B	431013	6279749	NOGO Alarm	12:47	12:45	-							
27-Jun-09	NOGO8-C	431199	6279960	NOGO Alarm	1:00	1:08	-							
28-Jun-09	NOGO9-A	453004	6269529	NOGO Alarm	10:06	10:14	-							
28-Jun-09	NOGO9-B	452873	6269384	NOGO Alarm	10:34	10:42	-							
28-Jun-09	NOGO9-C	452624	6269459	NOGO Alarm	10:50	10:58	-							
28-Jun-09	NOGO9-D	452746	6269618	NOGO Alarm	11:04	11:12	-							
29-Jun-09	NOGO10-A	420863	6280322	NOGO Alarm	8:25	8:33	-							
29-Jun-09	NOGO10-B	420983	6280315	NOGO Alarm	8:48	8:56	-							
29-Jun-09	NOGO10-C	421042	6280529	NOGO Alarm	9:13	9:21	-							

Appendix 5.2-1. Summary of Call Playback Survey (CPS) Data, 2008 and 2009

CPS Label	Site Description
1	In very thick alder scrub ~ 200 m transition to fir forest further downstream of Mitchell Cr.
2	very thick alder riparian on slope in the valley that heads south from the Mitchell and Sulphurets confluence
3	old growth MH/sitka spruce - lots of snags
3	in old stand of sitka spruce and MH
4	multilayered canopy/CWH/devils club
4	on steep slope (coniferous hemlock/fir) looking down to slightly mixed deciduous/coniferous stand of forest adjacent to the Unuk
5	forest on the edge of the Unuk, mostly western hemlock, lots of downed trees, ridges, devil's club
5	fairly high alder stand directly adjacent to the the south Unuk river
6	swamp/riparian/CWH/willow scrub - old growth
6	hemlock forest and devils club
7	coastal western hemlock forest
7	hemlock/pine forest with little understory
8	snow, willow, alpine valley scrub
9	in subalpine fir fores w/ some douglas fir and engelmann spruce
10	swamp/riparian/willow
11	spruce/fir forest on hillside in tailings area
12	Engelmann spruce/subalpine fir - lots of snow still on ground
13	edge of forest on river pan/willow thicket
14	stunted subalpine fir trees, lots of snow, next to river
15	alder thicket (open) looking N of valley on Treaty Cr, good open vantage point
16	riparian floodplain/cottonwood
17	edge of Teigen Cr, bordered by some spruce/fir forest, some devil's club and alder
INC	gravel bar on Teigen Cr
18	high elevation engelmann spruce/open forest surrounding lake interspersed with boogy area
19	higher elevation ESSF forest, lots of snow, trees likely too stunted to support raptors
20	closed canopy forest on edge of slope adjacent to Sulphurets
21	old growth sitka spruce w/ hemlock
22	sitka/ hemlock forest, medium age stand, lots of fallen logs, CWD
NOGO1-A	East facing slope of mature old growth hemlock forest. Little to no understory. Closed canopy.
NOGO1-B	East facing slope of mature old growth hemlock forest. Little to no understory. Closed canopy.
NOGO1-C	East facing slope of mature old growth hemlock forest. Little to no understory. Closed canopy.
NOGO2-A	Douglas fir and hemlock old growth
NOGO2-B	Douglas fir and hemlock old growth
NOGO2-C	Douglas fir and hemlock old growth. Mature log. Steep cliff
NOGO2-D	Douglas fir and hemlock mature
NOGO3-A	Hemlock
NOGO4-A	Hemlock and Douglas fir.
NOGO4-B	Hemlock and Douglas fir.
NOGO4-C	Hemlock and Douglas fir.
NOGO4-D	Hemlock and Douglas fir.
NOGO5-A	ESSF, open willow seep.
NOGO6-A	ESSF; Mature forest on North slope; Canopy is medium coverage; Snow still on ground.
NOGO6-B	Mature forest on North slope.
NOGO6-C	ESSF, sub alpine fir. On steep slope near clearing.
NOGO6-D	On river edge ESSF.
NOGO6-E	ESSF beside avalanche pack.
NOGO7-A	Douglas fir and hemlock old growth. Closed canopy. Very little understory.
NOGO7-B	Mix of hemlock and Douglas fir. 200m from Unuk River on steep slope. Very little understory.
NOGO7-C	Mix of hemlock and Douglas fir. 200m from Unuk River on steep slope. Very little understory.
NOGO7-D	ESSF, hemlock and Douglas fir. Very little understory.
NOGO8-A	ESSF near small wetland.
NOGO8-B	ESSF, still snow on ground, open understory.
NOGO8-C	ESSF near small clearing and creek.
NOGO9-A	Hemlock and some ESSF.
NOGO9-B	Mature hemlock. Ridge top with moderate slope.
NOGO9-C	On ridge near steep slope with hemlock habitat.
NOGO9-D	On lakeside.
NOGO10-A	Small pond surrounded by bog pond and mixed conifer.
NOGO10-B	Small pond surrounded by bog pond and mixed conifer.
NOGO10-C	Hemlock mature forest with some dead spruce; flat above ravine.

Appendix 5.2-2

Summary of Raptor Stand Watch (SW) Data, 2008 and 2009

Appendix 5.2-2. Summary of Raptor Stand Watch (SW) Data, 2008 and 2009

Date	SW Label	Easting	Northing	Start Time	End Time	Cloud %	Wind	Temp. °C	Species	No. Observed	Comment(s)
13-Jun-08	SW1	417281	6262159	14:13	15:20	100	1	12	-		
14-Jun-08	SW2	417264	6260635	13:45	14:30	100	1	13	-		
14-Jun-08	SW3	418731	6265060	13:35	14:30	100	2	15	-		
14-Jun-08	SW4	408490	6268068	15:00	15:45	100	2	14	-		
14-Jun-08	SW4	408490	6268068	15:00	15:45	100	2	14	-		
14-Jun-08	SW5	410968	6272712	15:05	15:40	90	3	15	-		
15-Jun-08	SW6	451901	6263097	14:15	14:55	70	1	15	-		
15-Jun-08	SW7	437272	6274357	14:15	15:00	65	1	14	-		
16-Jun-08	SW8	453003	6261392	12:15	13:00	100	2	12	-		
16-Jun-08	SW9	452219	6261405	12:05	12:50	100	0	12	-		
17-Jun-08	SW10	407157	6260204	10:20	10:50	100	2	12	-		
24-Jun-09	1-1	420017	6263746	9:48	10:28	80	3	2	-		
24-Jun-09	1-2	420017	6263746	10:40	11:10	80	3	2	-		
24-Jun-09	1-3	420017	6263746	11:28	11:58	80	3	2	-		
24-Jun-09	1-4	420017	6263746	12:11		80	3	2	-		
25-Jun-09	2	440527	6278871	12:48	13:48	100	2	8	Swainson's hawk	1	Flew <50m and perched on tall dead spruce for 2 minutes; flew off and continued hunting at centre of valley.
27-Jun-09	3	433627	6279875	10:25	12:00	100	2	0			
29-Jun-09	4	448864	6272483	10:23	11:45	90-100	2	0	Golden Eagle	1	Soaring in upward direction using thermals from sunny breaks directly over Treaty Creek.

SW Label	Site Description
SW1	Alongside Sulphurets Cr. (on S side) bordered by Fir/Spruce forest.
SW2	alongside Unnamed Cr in valley that extends south from Sulphurets. Immediate area is willow/alder riparian bordered w/ cottonwood and subalpine fir
SW3	Mitchell/McTagg confluence
SW4	edge of marsh wetland next to the Unuk. Band of cottonwoods seperates river from marsh, mostly hemlock. Beaver activity.
SW4	
SW5	on river pan (accidentally right by bear hair trap)
SW6	flat meadow (~2km wide), mostly cottonwood with bordering mountains
SW7	wide river bar ~ 60m decidous trees (cottonwood) mixed w/ spruce (Engelmann and mountain hemlock). Only valley bottom has fully grown trees, higher is subalpine parkland, stunted trees spread out, lots of willow/alder scrub.
SW8	On hillside ~ 300-500 m up looking N towards Treaty Cr.
SW9	
SW10	On Unuk downstream from Sulpherets - Riparian/coniferous mix/large gravel bars
1-1	
1-2	North facing alpine on slope of Mitchell Creek Valley
1-3	South-facing alpine facing into Ted Morris Creek
1-4	West facing apline downstream on Sulphurets Creek
2	alpine, 1027m elevation
3	
4	SE view of drainage proposed to accommodate tailings pond as it converges with Treaty Creek; 252 degrees

Appendix 5.2-3

Incidental Raptor Observations, 2008 and 2009

Appendix 5.2-3. Incidental Raptor Observations, 2008 and 2009

Date	Discipline	Easting	Northing	Species	No. Observed	Comment(s)
2-Jun-08	Wildlife	394387	6246277	Bald eagle	1	
3-Jun-08	Wildlife	435248	6285022	Bald eagle	1	
3-Jun-08	Wildlife	449978	6268869	Bald eagle	1	
2-Jun-08	Wildlife	394270	6246980	Osprey	2	pair at nest (no young in nest)
2-Jun-08	Wildlife	401438	6256997	Osprey	1	
2-Jun-08	Wildlife	408608	6268745	Osprey	1	
2-Jun-08	Wildlife	415791	6279753	Rough-legged hawk	1	flying/hunting
15-Jul-08	Wildlife	394314	6247136	Osprey	2	
16-Jul-08	Wildlife	454347	6277908	Golden eagle	1	
16-Jul-08	Wildlife	456122	6276622	Golden eagle	1	
27-Sep-08	Wildlife	405806	6258784	Bald eagle	1	
27-Sep-08	Wildlife	398116	6253649	Bald eagle	1	
27-Sep-08	Wildlife	398116	6253649	Bald eagle	1	
27-Sep-08	Wildlife	408905	6252282	Bald eagle	1	
27-Sep-08	Wildlife	410060	6270555	Bald eagle	1	
27-Sep-08	Wildlife	433870	6275046	Golden eagle	1	
27-Sep-08	Wildlife	398788	6252585	Osprey	1	
16-Jun-08	Wildlife	444987	6275657	Merlin	1	
17-Jun-08	Wildlife	426207	6284296	Red-tailed Hawk	1	
18-Jun-08	Wildlife	402768	6256589	Bald eagle	1	
22-Jul-08	Wildlife	434216	6296316	Golden eagle	1	
26-Apr-09	Wildlife	444773	6288848	Bald eagle	1	female on nest
26-Apr-09	Wildlife	393595	6246537	Bald eagle	1	
24-Jun-09	Wildlife	417350	6262151	Red-tailed Hawk	1	
26-Jun-09	Wildlife	410154	6270340	Northern Goshawk	1	
26-Jun-09	Wildlife	410154	6270340	Unknown Eagle	1	
20-Aug-09	Wildlife	402236	6271062	Merlin	1	

Appendix 5.3-1

Summary of Variable Range Point Count (VRPC) Data, 2008

Appendix 5.3-1. Summary of Variable Range Point Count (VRPC) Data, 2008

Date	Transect ID	Transect Start Coordinates		Transect End Coordinates		Temp (°C)	Cloud Cover (%)	Wind Scale	Point No.	Time	Species	Scientific Name	Total Birds <100 m	Total Birds >100 m	Breeding Obs.	Comment(s)
		Eastings	Northing	Eastings	Northing											
13-Jun-08	1	421318	6265470	420552	6265260	11	100	0	1	5:59	Yellow Warbler	<i>Dendroica petechia</i>	4	0		
13-Jun-08	1	421318	6265470	420552	6265260	11	100	0	1	5:59	Dusky/Sooty Grouse	<i>Dendragapus spp.</i>	0	1		
13-Jun-08	1	421318	6265470	420552	6265260	11	100	0	1	5:59	Fox Sparrow	<i>Passerella iliaca</i>	1	0		
13-Jun-08	1	421318	6265470	420552	6265260	11	100	0	1	5:59	Hermit Thrush	<i>Catharus guttatus</i>	1	0		
13-Jun-08	1	421318	6265470	420552	6265260	11	100	0	2	6:19	Yellow Warbler	<i>Dendroica petechia</i>	3	0		
13-Jun-08	1	421318	6265470	420552	6265260	11	100	0	2	6:19	Dusky/Sooty Grouse	<i>Dendragapus spp.</i>	0	1		
13-Jun-08	1	421318	6265470	420552	6265260	11	100	0	2	6:19	Townsend's Solitaire	<i>Myadestes townsendi</i>	1	0		
13-Jun-08	1	421318	6265470	420552	6265260	11	100	0	2	6:19	Steller's Jay	<i>Cyanocitta stelleri</i>	1	0		
13-Jun-08	1	421318	6265470	420552	6265260	11	100	0	3	6:40	Yellow Warbler	<i>Dendroica petechia</i>	1	0		
13-Jun-08	1	421318	6265470	420552	6265260	11	100	0	3	6:40	Northern Waterthrush	<i>Seiurus noveboracensis</i>	1	0		
13-Jun-08	1	421318	6265470	420552	6265260	11	100	0	3	6:40	American Redstart	<i>Setophaga ruticilla</i>	1	0		
13-Jun-08	1	421318	6265470	420552	6265260	11	100	0	3	6:40	Fox Sparrow	<i>Passerella iliaca</i>	1	0		
13-Jun-08	1	421318	6265470	420552	6265260	11	100	0	4	7:01	Yellow Warbler	<i>Dendroica petechia</i>	1	1		dark-eyed junco nest (incidental)
13-Jun-08	1	421318	6265470	420552	6265260	11	100	0	4	7:01	Dusky/Sooty Grouse	<i>Dendragapus spp.</i>	1	0		
13-Jun-08	1	421318	6265470	420552	6265260	11	100	0	4	7:01	MacGillivray's warbler	<i>Oporornis tolmiei</i>	1	0		
13-Jun-08	1	421318	6265470	420552	6265260	11	100	0	4	7:01	Varied Thrush	<i>Ixoreus naevius</i>	1	0		
13-Jun-08	1	421318	6265470	420552	6265260	11	100	0	5	7:51	Townsend's Warbler	<i>Dendroica townsendi</i>	1	0		
13-Jun-08	1	421318	6265470	420552	6265260	11	100	0	5	7:51	Yellow Warbler	<i>Dendroica petechia</i>	1	0		
13-Jun-08	2	416753	6259074	416869	6259910	12	100	1	1	9:17	MacGillivray's warbler	<i>Oporornis tolmiei</i>	1	0		
13-Jun-08	2	416753	6259074	416869	6259910	12	100	1	1	9:17	Yellow Warbler	<i>Dendroica petechia</i>	3	0		
13-Jun-08	2	416753	6259074	416869	6259910	12	100	1	1	9:17	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
13-Jun-08	2	416753	6259074	416869	6259910	12	100	1	2	9:45	Vaux's Swift	<i>Chaetura vauxi</i>	1	0		
13-Jun-08	2	416753	6259074	416869	6259910	12	100	1	2	9:45	Fox Sparrow	<i>Passerella iliaca</i>	1	0		
13-Jun-08	2	416753	6259074	416869	6259910	12	100	1	2	9:45	Dusky/Sooty Grouse	<i>Dendragapus spp.</i>	0	1		
13-Jun-08	2	416753	6259074	416869	6259910	12	100	1	2	9:45	MacGillivray's warbler	<i>Oporornis tolmiei</i>	1	0		
13-Jun-08	2	416753	6259074	416869	6259910	12	100	1	2	9:45	Yellow Warbler	<i>Dendroica petechia</i>	3	0		
13-Jun-08	2	416753	6259074	416869	6259910	12	100	1	2	9:45	Hermit Thrush	<i>Catharus guttatus</i>	0	1		
13-Jun-08	2	416753	6259074	416869	6259910	12	100	1	2	9:45	Pine Siskin	<i>Carduelis pinus</i>	1	0		
13-Jun-08	2	416753	6259074	416869	6259910	12	100	1	3	10:09	Yellow-rumped Warbler	<i>Dendroica coronata</i>	1	0		
13-Jun-08	2	416753	6259074	416869	6259910	12	100	1	3	10:09	Orange-crowned Warbler	<i>Vermivora celata</i>	2	0		
13-Jun-08	2	416753	6259074	416869	6259910	12	100	1	3	10:09	Yellow Warbler	<i>Dendroica petechia</i>	1	0		
13-Jun-08	2	416753	6259074	416869	6259910	12	100	1	3	10:09	Hermit Thrush	<i>Catharus guttatus</i>	0	1		
13-Jun-08	2	416753	6259074	416869	6259910	12	100	1	3	10:09	MacGillivray's warbler	<i>Oporornis tolmiei</i>	1	0		
13-Jun-08	2	416753	6259074	416869	6259910	12	100	1	3	10:09	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		swainson's thrush nest (incidental)
13-Jun-08	2	416753	6259074	416869	6259910	12	100	1	4	10:44	MacGillivray's warbler	<i>Oporornis tolmiei</i>	1	0		
13-Jun-08	2	416753	6259074	416869	6259910	12	100	1	4	10:44	Yellow Warbler	<i>Dendroica petechia</i>	2	0		
13-Jun-08	2	416753	6259074	416869	6259910	12	100	1	4	10:44	Hermit Thrush	<i>Catharus guttatus</i>	2	0		
13-Jun-08	2	416753	6259074	416869	6259910	12	100	1	5	11:13	Hermit Thrush	<i>Catharus guttatus</i>	1	0		
14-Jun-08	3	417416	6262246	417782	6262084	13	100	0	1	5:21	Hermit Thrush	<i>Catharus guttatus</i>	1	0		
14-Jun-08	3	417416	6262246	417782	6262084	13	100	0	1	5:21	Chestnut-backed Chickadee	<i>Poecile rufescens</i>	1	0		
14-Jun-08	3	417416	6262246	417782	6262084	13	100	0	1	5:21	Yellow-rumped Warbler	<i>Dendroica coronata</i>	1	0		
14-Jun-08	3	417416	6262246	417782	6262084	13	100	0	1	5:21	Black-capped Chickadee	<i>Poecile atricapillus</i>	1	0		
14-Jun-08	3	417416	6262246	417782	6262084	13	100	0	2	5:38	Winter Wren	<i>Troglodytes troglodytes</i>	1	0		
14-Jun-08	3	417416	6262246	417782	6262084	13	100	0	2	5:38	Hermit Thrush	<i>Catharus guttatus</i>	0	1		
14-Jun-08	3	417416	6262246	417782	6262084	13	100	0	2	5:38	Varied Thrush	<i>Ixoreus naevius</i>	1	0		
14-Jun-08	3	417416	6262246	417782	6262084	13	100	0	2	5:38	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
14-Jun-08	3	417416	6262246	417782	6262084	13	100	0	2	5:38	Brown Creeper	<i>Certhia americana</i>	1	0		
14-Jun-08	3	417416	6262246	417782	6262084	13	100	0	2	5:38	Townsend's Warbler	<i>Dendroica townsendi</i>	1	0		
14-Jun-08	3	417416	6262246	417782	6262084	13	100	0	3	5:54	Pacific-slope Flycatcher	<i>Empidonax difficilis</i>	1	0		
14-Jun-08	3	417416	6262246	417782	6262084	13	100	0	3	5:54	Chestnut-backed Chickadee	<i>Poecile rufescens</i>	1	0		
14-Jun-08	3	417416	6262246	417782	6262084	13	100	0	3	5:54	Brown Creeper	<i>Certhia americana</i>	1	0		
14-Jun-08	3	417416	6262246	417782	6262084	13	100	0	3	5:54	Townsend's Warbler	<i>Dendroica townsendi</i>	1	0		
14-Jun-08	3	417313	6262377	416962	6262607	13	100	0	1	5:23	Townsend's Warbler	<i>Dendroica townsendi</i>	3	0		
14-Jun-08	3	417313	6262377	416962	6262607	13	100	0	1	5:23	Chestnut-backed Chickadee	<i>Poecile rufescens</i>	3	0		
14-Jun-08	3	417313	6262377	416962	6262607	13	100	0	1	5:23	Varied Thrush	<i>Ixoreus naevius</i>	0	1		
14-Jun-08	3	417313	6262377	416962	6262607	13	100	0	1	5:23	Pine Siskin	<i>Carduelis pinus</i>	2	0		

Appendix 5.3-1. Summary of Variable Range Point Count (VRPC) Data, 2008

Date	Transect ID	Transect Start Coordinates		Transect End Coordinates		Temp (°C)	Cloud Cover (%)	Wind Scale	Point No.	Time	Species	Scientific Name	Total Birds <100 m	Total Birds >100 m	Breeding Obs.	Comment(s)
		Easting	Northing	Easting	Northing											
14-Jun-08	3	417313	6262377	416962	6262607	13	100	0	2	5:40	Townsend's Warbler	<i>Dendroica townsendi</i>	3	0		
14-Jun-08	3	417313	6262377	416962	6262607	13	100	0	2	5:40	Hermit Thrush	<i>Catharus guttatus</i>	0	1		
14-Jun-08	3	417313	6262377	416962	6262607	13	100	0	2	5:40	Chestnut-backed Chickadee	<i>Poecile rufescens</i>	1	0		
14-Jun-08	3	417313	6262377	416962	6262607	13	100	0	2	5:40	Brown Creeper	<i>Certhia americana</i>	1	0		
14-Jun-08	3	417313	6262377	416962	6262607	13	100	0	2	5:40	Golden-crowned Kinglet	<i>Regulus satrapa</i>	2	0		
14-Jun-08	3	417313	6262377	416962	6262607	13	100	0	3	5:57	Pine Siskin	<i>Carduelis pinus</i>	3	0		
14-Jun-08	3	417313	6262377	416962	6262607	13	100	0	3	5:57	Brown Creeper	<i>Certhia americana</i>	2	0		
14-Jun-08	3	417313	6262377	416962	6262607	13	100	0	3	5:57	Red-breasted Nuthatch	<i>Sitta canadensis</i>	1	0		
14-Jun-08	3	417313	6262377	416962	6262607	13	100	0	3	5:57	MacGillivray's warbler	<i>Oporornis tolmiei</i>	1	0		
14-Jun-08	3	417313	6262377	416962	6262607	13	100	0	3	5:57	Townsend's Warbler	<i>Dendroica townsendi</i>	2	0		
14-Jun-08	4	407985	6263350	407746	6263016	13	100	1	1	7:13	Townsend's Warbler	<i>Dendroica townsendi</i>	2	0		
14-Jun-08	4	407985	6263350	407746	6263016	13	100	1	1	7:13	Hammond's Flycatcher	<i>Empidonax hammondi</i>	2	0		
14-Jun-08	4	407985	6263350	407746	6263016	13	100	1	1	7:13	Yellow Warbler	<i>Dendroica petechia</i>	2	0		
14-Jun-08	4	407985	6263350	407746	6263016	13	100	1	1	7:13	Pacific-slope Flycatcher	<i>Empidonax difficilis</i>	1	0		
14-Jun-08	4	407985	6263350	407746	6263016	13	100	1	1	7:13	Winter Wren	<i>Troglodytes troglodytes</i>	2	0		
14-Jun-08	4	407985	6263350	407746	6263016	13	100	1	1	7:13	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
14-Jun-08	4	407985	6263350	407746	6263016	13	100	1	1	7:13	Ruby-crowned Kinglet	<i>Regulus calendula</i>	1	0		
14-Jun-08	4	407985	6263350	407746	6263016	13	100	1	1	7:13	Swainson's Thrush	<i>Catharus ustulatus</i>	0	1		
14-Jun-08	4	407985	6263350	407746	6263016	13	100	1	2	7:35	Hammond's Flycatcher	<i>Empidonax hammondi</i>	2	0		
14-Jun-08	4	407985	6263350	407746	6263016	13	100	1	2	7:35	Swainson's Thrush	<i>Catharus ustulatus</i>	2	0		
14-Jun-08	4	407985	6263350	407746	6263016	13	100	1	2	7:35	Varied Thrush	<i>Ixoreus naevius</i>	2	1		
14-Jun-08	4	407985	6263350	407746	6263016	13	100	1	2	7:35	Golden-crowned Kinglet	<i>Regulus satrapa</i>	1	0		
14-Jun-08	4	407985	6263350	407746	6263016	13	100	1	2	7:35	Townsend's Warbler	<i>Dendroica townsendi</i>	2	0		
14-Jun-08	4	407985	6263350	407746	6263016	13	100	1	2	7:35	Wilson's Warbler	<i>Wilsonia pusilla</i>	2	0		
14-Jun-08	4	407985	6263350	407746	6263016	13	100	1	3	8:02	Yellow-rumped Warbler	<i>Dendroica coronata</i>	1	0		
14-Jun-08	4	407985	6263350	407746	6263016	13	100	1	3	8:02	Red-breasted Nuthatch	<i>Sitta canadensis</i>	1	0		
14-Jun-08	4	407985	6263350	407746	6263016	13	100	1	3	8:02	Townsend's Warbler	<i>Dendroica townsendi</i>	2	0		
14-Jun-08	4	407985	6263350	407746	6263016	13	100	1	3	8:02	Varied Thrush	<i>Ixoreus naevius</i>	3	0		
14-Jun-08	4	407985	6263350	407746	6263016	13	100	1	3	8:02	Golden-crowned Kinglet	<i>Regulus satrapa</i>	2	0		
14-Jun-08	4	407985	6263350	407746	6263016	13	100	1	3	8:02	Winter Wren	<i>Troglodytes troglodytes</i>	2	0		
14-Jun-08	4	407985	6263350	407746	6263016	13	100	1	3	8:02	Pacific-slope Flycatcher	<i>Empidonax difficilis</i>	1	0		
14-Jun-08	4	407985	6263350	407746	6263016	13	100	1	3	8:02	Alder Flycatcher	<i>Empidonax alnorum</i>	1	0		
14-Jun-08	4	408091	6263548	408046	6263965	13	100	1	1	7:13	Swainson's Thrush	<i>Catharus ustulatus</i>	1	0		
14-Jun-08	4	408091	6263548	408046	6263965	13	100	1	1	7:13	Yellow Warbler	<i>Dendroica petechia</i>	1	0		
14-Jun-08	4	408091	6263548	408046	6263965	13	100	1	1	7:13	Golden-crowned Kinglet	<i>Regulus satrapa</i>	2	0		
14-Jun-08	4	408091	6263548	408046	6263965	13	100	1	1	7:13	Townsend's Solitaire	<i>Myadestes townsendi</i>	1	0		
14-Jun-08	4	408091	6263548	408046	6263965	13	100	1	1	7:13	Townsend's Warbler	<i>Dendroica townsendi</i>	1	0		
14-Jun-08	4	408091	6263548	408046	6263965	13	100	1	1	7:13	Winter Wren	<i>Troglodytes troglodytes</i>	1	0		
14-Jun-08	4	408091	6263548	408046	6263965	13	100	1	1	7:13	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
14-Jun-08	4	408091	6263548	408046	6263965	13	100	1	2	7:30	Winter Wren	<i>Troglodytes troglodytes</i>	1	0		
14-Jun-08	4	408091	6263548	408046	6263965	13	100	1	2	7:30	Townsend's Warbler	<i>Dendroica townsendi</i>	2	0		
14-Jun-08	4	408091	6263548	408046	6263965	13	100	1	2	7:30	Brown Creeper	<i>Certhia americana</i>	2	0		
14-Jun-08	4	408091	6263548	408046	6263965	13	100	1	2	7:30	Hermit Thrush	<i>Catharus guttatus</i>	2	0		
14-Jun-08	4	408091	6263548	408046	6263965	13	100	1	2	7:30	Golden-crowned Kinglet	<i>Regulus satrapa</i>	1	0		
14-Jun-08	4	408091	6263548	408046	6263965	13	100	1	2	7:30	Wilson's Warbler	<i>Wilsonia pusilla</i>	2	0		
14-Jun-08	4	408091	6263548	408046	6263965	13	100	1	2	7:30	Townsend's Solitaire	<i>Myadestes townsendi</i>	1	0		
14-Jun-08	4	408091	6263548	408046	6263965	13	100	1	3	7:48	Winter Wren	<i>Troglodytes troglodytes</i>	2	0		
14-Jun-08	4	408091	6263548	408046	6263965	13	100	1	3	7:48	Varied Thrush	<i>Ixoreus naevius</i>	1	0		
14-Jun-08	4	408091	6263548	408046	6263965	13	100	1	3	7:48	Pine Siskin	<i>Carduelis pinus</i>	3	0		
14-Jun-08	4	408091	6263548	408046	6263965	13	100	1	3	7:48	Golden-crowned Kinglet	<i>Regulus satrapa</i>	1	0		
14-Jun-08	4	408091	6263548	408046	6263965	13	100	1	3	7:48	Warbling Vireo	<i>Vireo gilvus</i>	1	0		
14-Jun-08	4	408091	6263548	408046	6263965	13	100	1	3	7:48	Townsend's Warbler	<i>Dendroica townsendi</i>	1	0		
14-Jun-08	4	408091	6263548	408046	6263965	13	100	1	3	7:48	Black-throated Gray Warbler	<i>Dendroica nigrescens</i>	1	0		
14-Jun-08	4	408091	6263548	408046	6263965	13	100	1	3	7:48	Townsend's Solitaire	<i>Myadestes townsendi</i>	1	0		
14-Jun-08	5	407517	6258099	407771	6257739	14	95	1	1	9:12	Yellow Warbler	<i>Dendroica petechia</i>	3	0		
14-Jun-08	5	407517	6258099	407771	6257739	14	95	1	1	9:12	Warbling Vireo	<i>Vireo gilvus</i>	1	0		

Appendix 5.3-1. Summary of Variable Range Point Count (VRPC) Data, 2008

Date	Transect ID	Transect Start Coordinates		Transect End Coordinates		Temp (°C)	Cloud Cover (%)	Wind Scale	Point No.	Time	Species	Scientific Name	Total Birds <100 m	Total Birds >100 m	Breeding Obs.	Comment(s)
		Easting	Northing	Easting	Northing											
14-Jun-08	5	407517	6258099	407771	6257739	14	95	1	1	9:12	Hermit Thrush	<i>Catharus guttatus</i>	1	1		
14-Jun-08	5	407517	6258099	407771	6257739	14	95	1	2	9:33	Winter Wren	<i>Troglodytes troglodytes</i>	1	0		
14-Jun-08	5	407517	6258099	407771	6257739	14	95	1	2	9:33	Chestnut-backed Chickadee	<i>Poecile rufescens</i>	2	0		
14-Jun-08	5	407517	6258099	407771	6257739	14	95	1	2	9:33	Hermit Thrush	<i>Catharus guttatus</i>	1	0		
14-Jun-08	5	407517	6258099	407771	6257739	14	95	1	2	9:33	Townsend's Warbler	<i>Dendroica townsendi</i>	1	0		
14-Jun-08	5	407517	6258099	407771	6257739	14	95	1	2	9:33	Ruffed Grouse	<i>Bonasa umbellus</i>	1	0		
14-Jun-08	5	407517	6258099	407771	6257739	14	95	1	2	9:33	Yellow Warbler	<i>Dendroica petechia</i>	1	0		
14-Jun-08	5	407517	6258099	407771	6257739	14	95	1	2	9:33	Pine Siskin	<i>Carduelis pinus</i>	6	0		
14-Jun-08	5	407517	6258099	407771	6257739	14	95	1	2	9:33	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
14-Jun-08	5	407517	6258099	407771	6257739	14	95	1	2	9:33	American Redstart	<i>Setophaga ruticilla</i>	1	0		
14-Jun-08	5	407517	6258099	407771	6257739	14	95	1	3	9:59	American Robin	<i>Turdus migratorius</i>	2	0		
14-Jun-08	5	407517	6258099	407771	6257739	14	95	1	3	9:59	Dark-eyed Junco	<i>Junco hyemalis</i>	1	0		
14-Jun-08	5	407517	6258099	407771	6257739	14	95	1	3	9:59	Vaux's Swift	<i>Chaetura vauxi</i>	0	1		
14-Jun-08	5	407517	6258099	407771	6257739	14	95	1	3	9:59	Pine Siskin	<i>Carduelis pinus</i>	1	0		
14-Jun-08	5	407587	6258369	407323	6258707	14	95	1	1	9:15	Chestnut-backed Chickadee	<i>Poecile rufescens</i>	3	0		
14-Jun-08	5	407587	6258369	407323	6258707	14	95	1	1	9:15	Golden-crowned Kinglet	<i>Regulus satrapa</i>	2	0		
14-Jun-08	5	407587	6258369	407323	6258707	14	95	1	1	9:15	Dusky/Sooty Grouse	<i>Dendragapus spp.</i>	0	1		
14-Jun-08	5	407587	6258369	407323	6258707	14	95	1	1	9:15	Townsend's Warbler	<i>Dendroica townsendi</i>	1	0		
14-Jun-08	5	407587	6258369	407323	6258707	14	95	1	1	9:15	Pacific-slope Flycatcher	<i>Empidonax difficilis</i>	2	0		
14-Jun-08	5	407587	6258369	407323	6258707	14	95	1	1	9:15	Yellow-rumped Warbler	<i>Dendroica coronata</i>	1	0		
14-Jun-08	5	407587	6258369	407323	6258707	14	95	1	1	9:15	Swainson's Thrush	<i>Catharus ustulatus</i>	1	0		
14-Jun-08	5	407587	6258369	407323	6258707	14	95	1	1	9:15	Brown Creeper	<i>Certhia americana</i>	1	0		
14-Jun-08	5	407587	6258369	407323	6258707	14	95	1	1	9:15	Townsend's Warbler	<i>Dendroica townsendi</i>	2	0		
14-Jun-08	5	407587	6258369	407323	6258707	14	95	1	1	9:15	American Redstart	<i>Setophaga ruticilla</i>	1	0		
14-Jun-08	5	407587	6258369	407323	6258707	14	95	1	2	9:42	Swainson's Thrush	<i>Catharus ustulatus</i>	2	0		
14-Jun-08	5	407587	6258369	407323	6258707	14	95	1	2	9:42	Varied Thrush	<i>Ixoreus naevius</i>	1	1		
14-Jun-08	5	407587	6258369	407323	6258707	14	95	1	2	9:42	Chestnut-backed Chickadee	<i>Poecile rufescens</i>	2	0		
14-Jun-08	5	407587	6258369	407323	6258707	14	95	1	2	9:42	Dusky/Sooty Grouse	<i>Dendragapus spp.</i>	0	1		
14-Jun-08	5	407587	6258369	407323	6258707	14	95	1	2	9:42	Hammond's Flycatcher	<i>Empidonax hammondii</i>	1	0		
14-Jun-08	5	407587	6258369	407323	6258707	14	95	1	2	9:42	Townsend's Warbler	<i>Dendroica townsendi</i>	2	0		
14-Jun-08	5	407587	6258369	407323	6258707	14	95	1	2	9:42	Pine Siskin	<i>Carduelis pinus</i>	2	0		
14-Jun-08	5	407587	6258369	407323	6258707	14	95	1	2	9:42	Warbling Vireo	<i>Vireo gilvus</i>	1	0		
14-Jun-08	5	407587	6258369	407323	6258707	14	95	1	3	10:00	Warbling Vireo	<i>Vireo gilvus</i>	2	0		
14-Jun-08	5	407587	6258369	407323	6258707	14	95	1	3	10:00	Varied Thrush	<i>Ixoreus naevius</i>	1	0		
14-Jun-08	5	407587	6258369	407323	6258707	14	95	1	3	10:00	Hermit Thrush	<i>Catharus guttatus</i>	2	0		
14-Jun-08	5	407587	6258369	407323	6258707	14	95	1	3	10:00	Townsend's Warbler	<i>Dendroica townsendi</i>	2	0		
14-Jun-08	5	407587	6258369	407323	6258707	14	95	1	3	10:00	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
14-Jun-08	5	407587	6258369	407323	6258707	14	95	1	3	10:00	Chestnut-backed Chickadee	<i>Poecile rufescens</i>	1	0		
14-Jun-08	5	407587	6258369	407323	6258707	14	95	1	3	10:00	Dusky/Sooty Grouse	<i>Dendragapus spp.</i>	0	1		
15-Jun-08	6	410123	6270267	410194	6270645	10	100	0	1	5:26	Warbling Vireo	<i>Vireo gilvus</i>	1	0		
15-Jun-08	6	410122	6270267	410194	6270645	10	100	0	1	5:26	Townsend's Warbler	<i>Dendroica townsendi</i>	2	0		
15-Jun-08	6	410122	6270267	410194	6270645	10	100	0	1	5:26	Yellow Warbler	<i>Dendroica petechia</i>	1	0		
15-Jun-08	6	410122	6270267	410194	6270645	10	100	0	1	5:26	Chestnut-backed Chickadee	<i>Poecile rufescens</i>	1	0		
15-Jun-08	6	410122	6270267	410194	6270645	10	100	0	1	5:26	Hermit Thrush	<i>Catharus guttatus</i>	0	1		
15-Jun-08	6	410122	6270267	410194	6270645	10	100	0	1	5:26	MacGillivray's warbler	<i>Oporornis tolmiei</i>	2	0		
15-Jun-08	6	410122	6270267	410194	6270645	10	100	0	1	5:26	Belted Kingfisher	<i>Ceryle alcyon</i>	1	0		
15-Jun-08	6	410122	6270267	410194	6270645	10	100	0	2	5:44	Winter Wren	<i>Troglodytes troglodytes</i>	3	0		
15-Jun-08	6	410122	6270267	410194	6270645	10	100	0	2	5:44	Townsend's Warbler	<i>Dendroica townsendi</i>	2	0		
15-Jun-08	6	410122	6270267	410194	6270645	10	100	0	2	5:44	Golden-crowned Kinglet	<i>Regulus satrapa</i>	1	0		
15-Jun-08	6	410122	6270267	410194	6270645	10	100	0	2	5:44	Warbling Vireo	<i>Vireo gilvus</i>	1	0		
15-Jun-08	6	410122	6270267	410194	6270645	10	100	0	2	5:44	Chestnut-backed Chickadee	<i>Poecile rufescens</i>	1	0		
15-Jun-08	6	410122	6270267	410194	6270645	10	100	0	2	5:44	Hammond's Flycatcher	<i>Empidonax hammondii</i>	1	0		
15-Jun-08	6	410122	6270267	410194	6270645	10	100	0	2	5:44	Dusky/Sooty Grouse	<i>Dendragapus spp.</i>	0	1		
15-Jun-08	6	410122	6270267	410194	6270645	10	100	0	3	6:03	Townsend's Warbler	<i>Dendroica townsendi</i>	2	0		
15-Jun-08	6	410122	6270267	410194	6270645	10	100	0	3	6:03	Golden-crowned Kinglet	<i>Regulus satrapa</i>	1	0		
15-Jun-08	6	410122	6270267	410194	6270645	10	100	0	3	6:03	Winter Wren	<i>Troglodytes troglodytes</i>	1	1		
15-Jun-08	6	410122	6270267	410194	6270645	10	100	0	3	6:03	Unknown flycatcher		1	0		
15-Jun-08	6	410122	6270267	410194	6270645	10	100	0	3	6:03	Varied Thrush	<i>Ixoreus naevius</i>	1	0		

Appendix 5.3-1. Summary of Variable Range Point Count (VRPC) Data, 2008

Date	Transect ID	Transect Start Coordinates		Transect End Coordinates		Temp (°C)	Cloud Cover (%)	Wind Scale	Point No.	Time	Species	Scientific Name	Total Birds <100 m	Total Birds >100 m	Breeding Obs.	Comment(s)
		Easting	Northing	Easting	Northing											
15-Jun-08	6	410132	6269970	410180	6269580	13	100	1	1	5:23	Yellow Warbler	<i>Dendroica petechia</i>	1	0		
15-Jun-08	6	410132	6269970	410180	6269580	13	100	1	1	5:23	Common Yellowthroat	<i>Geothlypis trichas</i>	1	0		
15-Jun-08	6	410132	6269970	410180	6269580	13	100	1	1	5:23	Yellow-rumped Warbler	<i>Dendroica coronata</i>	2	0		
15-Jun-08	6	410132	6269970	410180	6269580	13	100	1	1	5:23	Hermit Thrush	<i>Catharus guttatus</i>	1	0		
15-Jun-08	6	410132	6269970	410180	6269580	13	100	1	1	5:23	Dusky/Sooty Grouse	<i>Dendragapus spp.</i>	1	0		
15-Jun-08	6	410132	6269970	410180	6269580	13	100	1	1	5:23	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
15-Jun-08	6	410132	6269970	410180	6269580	13	100	1	1	5:23	Brown Creeper	<i>Certhia americana</i>	1	0		
15-Jun-08	6	410132	6269970	410180	6269580	13	100	1	1	5:23	Rufous Hummingbird	<i>Selasphorus rufus</i>	1	0		
15-Jun-08	6	410132	6269970	410180	6269580	13	100	1	1	5:23	Song Sparrow	<i>Melospiza melodia</i>	1	0		
15-Jun-08	6	410132	6269970	410180	6269580	13	100	1	2	5:45	Brown Creeper	<i>Certhia americana</i>	1	0		
15-Jun-08	6	410132	6269970	410180	6269580	13	100	1	2	5:45	Hermit Thrush	<i>Catharus guttatus</i>	1	0		
15-Jun-08	6	410132	6269970	410180	6269580	13	100	1	2	5:45	Winter Wren	<i>Troglodytes troglodytes</i>	2	0		
15-Jun-08	6	410132	6269970	410180	6269580	13	100	1	3	6:11	Golden-crowned Kinglet	<i>Regulus satrapa</i>	2	0		
15-Jun-08	6	410132	6269970	410180	6269580	13	100	1	3	6:11	Chestnut-backed Chickadee	<i>Poecile rufescens</i>	2	0		
15-Jun-08	6	410132	6269970	410180	6269580	13	100	1	3	6:11	Townsend's Warbler	<i>Dendroica townsendi</i>	1	0		
15-Jun-08	6	410132	6269970	410180	6269580	13	100	1	3	6:11	Winter Wren	<i>Troglodytes troglodytes</i>	2	0		
15-Jun-08	6	410132	6269970	410180	6269580	13	100	1	3	6:11	Brown Creeper	<i>Certhia americana</i>	1	0		
15-Jun-08	6	410132	6269970	410180	6269580	13	100	1	3	6:11	Hammond's Flycatcher	<i>Empidonax hammondi</i>	1	0		
15-Jun-08	7	420913	6280408	421298	6280477	9	100	0	1	7:33	Dusky/Sooty Grouse	<i>Dendragapus spp.</i>	1	0		
15-Jun-08	7	420913	6280408	421298	6280477	9	100	0	1	7:33	Golden-crowned Kinglet	<i>Regulus satrapa</i>	1	0		
15-Jun-08	7	420913	6280408	421298	6280477	9	100	0	1	7:33	Yellow Warbler	<i>Dendroica petechia</i>	2	1		
15-Jun-08	7	420913	6280408	421298	6280477	9	100	0	2	7:54	Dusky/Sooty Grouse	<i>Dendragapus spp.</i>	0	1		
15-Jun-08	7	420913	6280408	421298	6280477	9	100	0	2	7:54	Golden-crowned Kinglet	<i>Regulus satrapa</i>	1	0		
15-Jun-08	7	420913	6280408	421298	6280477	9	100	0	2	7:54	Townsend's Warbler	<i>Dendroica townsendi</i>	2	0		
15-Jun-08	7	420913	6280408	421298	6280477	9	100	0	3	8:11	Townsend's Warbler	<i>Dendroica townsendi</i>	1	0		
15-Jun-08	7	420701	6280303	420337	6280134	11	100	0	1	7:27	Townsend's Warbler	<i>Dendroica townsendi</i>	1	0		
15-Jun-08	7	420701	6280303	420337	6280134	11	100	0	1	7:27	Dusky/Sooty Grouse	<i>Dendragapus spp.</i>	1	0		
15-Jun-08	7	420701	6280303	420337	6280134	11	100	0	1	7:27	Golden-crowned Kinglet	<i>Regulus satrapa</i>	1	0		
15-Jun-08	7	420701	6280303	420337	6280134	11	100	0	1	7:27	Pine Siskin	<i>Carduelis pinus</i>	0	1		
15-Jun-08	7	420701	6280303	420337	6280134	11	100	0	1	7:27	Hermit Thrush	<i>Catharus guttatus</i>	0	1		
15-Jun-08	7	420701	6280303	420337	6280134	11	100	0	1	7:27	American Three-toed Woodpecker	<i>Picoides dorsalis</i>	1	0	NF	
15-Jun-08	7	420701	6280303	420337	6280134	11	100	0	1	7:27	Red-breasted Nuthatch	<i>Sitta canadensis</i>	1	0		
15-Jun-08	7	420701	6280303	420337	6280134	11	100	0	2	7:41	Chestnut-backed Chickadee	<i>Poecile rufescens</i>	2	0		
15-Jun-08	7	420701	6280303	420337	6280134	11	100	0	2	7:41	Townsend's Warbler	<i>Dendroica townsendi</i>	2	0		
15-Jun-08	7	420701	6280303	420337	6280134	11	100	0	2	7:41	Dusky/Sooty Grouse	<i>Dendragapus spp.</i>	1	0		
15-Jun-08	7	420701	6280303	420337	6280134	11	100	0	2	7:41	Brown Creeper	<i>Certhia americana</i>	1	0		
15-Jun-08	7	420701	6280303	420337	6280134	11	100	0	2	7:41	Dark-eyed Junco	<i>Junco hyemalis</i>	1	0		
15-Jun-08	7	420701	6280303	420337	6280134	11	100	0	2	7:41	Pine Siskin	<i>Carduelis pinus</i>	2	0		
15-Jun-08	7	420701	6280303	420337	6280134	11	100	0	2	7:41	Golden-crowned Kinglet	<i>Regulus satrapa</i>	1	0		
15-Jun-08	7	420701	6280303	420337	6280134	11	100	0	3	7:59	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
15-Jun-08	7	420701	6280303	420337	6280134	11	100	0	3	7:59	Townsend's Warbler	<i>Dendroica townsendi</i>	2	0		
15-Jun-08	7	420701	6280303	420337	6280134	11	100	0	3	7:59	Golden-crowned Kinglet	<i>Regulus satrapa</i>	2	0		
15-Jun-08	7	420701	6280303	420337	6280134	11	100	0	3	7:59	Winter Wren	<i>Troglodytes troglodytes</i>	1	0		
15-Jun-08	7	420701	6280303	420337	6280134	11	100	0	3	7:59	Hermit Thrush	<i>Catharus guttatus</i>	1	0		
15-Jun-08	8	433698	6280597	433029	6280218	8	100	3	1	9:32	Yellow Warbler	<i>Dendroica petechia</i>	5	0		
15-Jun-08	8	433698	6280597	433029	6280218	8	100	3	1	9:32	Golden-crowned Kinglet	<i>Regulus satrapa</i>	1	0		
15-Jun-08	8	433698	6280597	433029	6280218	8	100	3	1	9:32	MacGillivray's warbler	<i>Oporornis tolmiei</i>	2	0		
15-Jun-08	8	433698	6280597	433029	6280218	8	100	3	2	10:03	Townsend's Solitaire	<i>Myadestes townsendi</i>	1	0		
15-Jun-08	8	433698	6280597	433029	6280218	8	100	3	2	10:03	Pine Siskin	<i>Carduelis pinus</i>	2	1		
15-Jun-08	8	433698	6280597	433029	6280218	8	100	3	2	10:03	Yellow Warbler	<i>Dendroica petechia</i>	2	1		
15-Jun-08	8	433698	6280597	433029	6280218	8	100	3	3	10:25	Pine Siskin	<i>Carduelis pinus</i>	2	0		
15-Jun-08	8	433698	6280597	433029	6280218	8	100	3	3	10:25	Yellow Warbler	<i>Dendroica petechia</i>	2	0		
15-Jun-08	8	433698	6280597	433029	6280218	8	100	3	3	10:25	Fox Sparrow	<i>Passerella iliaca</i>	1	0		
15-Jun-08	8	433698	6280597	433029	6280218	8	100	3	4	10:51	Yellow Warbler	<i>Dendroica petechia</i>	1	0		
15-Jun-08	8	433698	6280597	433029	6280218	8	100	3	5	11:15	Yellow Warbler	<i>Dendroica petechia</i>	3	0		
15-Jun-08	8	433698	6280597	433029	6280218	8	100	3	5	11:15	American Redstart	<i>Setophaga ruticilla</i>	1	0		
15-Jun-08	8	433698	6280597	433029	6280218	8	100	3	5	11:15	Hermit Thrush	<i>Catharus guttatus</i>	1	0		
15-Jun-08	8	433698	6280597	433029	6280218	8	100	3	5	11:15	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		

Appendix 5.3-1. Summary of Variable Range Point Count (VRPC) Data, 2008

Date	Transect ID	Transect Start Coordinates		Transect End Coordinates		Temp (°C)	Cloud Cover (%)	Wind Scale	Point No.	Time	Species	Scientific Name	Total Birds <100 m	Total Birds >100 m	Breeding Obs.	Comment(s)
		Easting	Northing	Easting	Northing											
15-Jun-08	9	431416	6279470	432245	6279473	8	100	1	1	9:29	Hermit Thrush	<i>Catharus guttatus</i>	2	0		
15-Jun-08	9	431416	6279470	432245	6279473	8	100	1	1	9:29	Ruby-crowned Kinglet	<i>Regulus calendula</i>	1	0		
15-Jun-08	9	431416	6279470	432245	6279473	8	100	1	1	9:29	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
15-Jun-08	9	431416	6279470	432245	6279473	8	100	1	1	9:29	Chipping Sparrow	<i>Spizella passerina</i>	1	0		
15-Jun-08	9	431416	6279470	432245	6279473	8	100	1	1	9:29	Townsend's Warbler	<i>Dendroica townsendi</i>	3	0		
15-Jun-08	9	431416	6279470	432245	6279473	8	100	1	1	9:29	Dark-eyed Junco	<i>Junco hyemalis</i>	2	0		
15-Jun-08	9	431416	6279470	432245	6279473	8	100	1	1	9:29	Pine Grosbeak	<i>Pinicola enucleator</i>	2	0		
15-Jun-08	9	431416	6279470	432245	6279473	8	100	1	1	9:29	Mountain Chickadee	<i>Poecile gambeli</i>	1	0		
15-Jun-08	9	431416	6279470	432245	6279473	8	100	1	1	9:29	American Robin	<i>Turdus migratorius</i>	1	0		
15-Jun-08	9	431416	6279470	432245	6279473	8	100	1	1	9:45	Hermit Thrush	<i>Catharus guttatus</i>	1	0		
15-Jun-08	9	431416	6279470	432245	6279473	8	100	1	1	9:45	American Robin	<i>Turdus migratorius</i>	1	0		
15-Jun-08	9	431416	6279470	432245	6279473	8	100	1	1	9:45	Wilson's Warbler	<i>Wilsonia pusilla</i>	2	0		
15-Jun-08	9	431416	6279470	432245	6279473	8	100	1	1	9:45	Ruby-crowned Kinglet	<i>Regulus calendula</i>	3	0		
15-Jun-08	9	431416	6279470	432245	6279473	8	100	1	1	9:45	Gray-cheeked Thrush	<i>Catharus minimus</i>	1	0		
15-Jun-08	9	431416	6279470	432245	6279473	8	100	1	1	9:45	Dark-eyed Junco	<i>Junco hyemalis</i>	1	0		
15-Jun-08	9	431416	6279470	432245	6279473	8	100	1	1	9:45	Townsend's Warbler	<i>Dendroica townsendi</i>	1	0		
15-Jun-08	9	431416	6279470	432245	6279473	8	100	1	1	9:45	Northern Flicker	<i>Colaptes auratus</i>	1	0		
15-Jun-08	9	431416	6279470	432245	6279473	8	100	1	1	9:45	Chipping Sparrow	<i>Spizella passerina</i>	1	0		
15-Jun-08	9	431416	6279470	432245	6279473	8	100	1	1	9:45	Fox Sparrow	<i>Passerella iliaca</i>	1	0		
15-Jun-08	9	431416	6279470	432245	6279473	8	100	1	1	9:45	Lincoln's Sparrow	<i>Melospiza lincolnii</i>	2	0		
15-Jun-08	9	431416	6279470	432245	6279473	8	100	1	1	10:03	Swainson's Thrush	<i>Catharus ustulatus</i>	2	0		
15-Jun-08	9	431416	6279470	432245	6279473	8	100	1	1	10:03	Mountain Chickadee	<i>Poecile gambeli</i>	2	0		
15-Jun-08	9	431416	6279470	432245	6279473	8	100	1	1	10:03	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
15-Jun-08	9	431416	6279470	432245	6279473	8	100	1	1	10:03	Yellow Warbler	<i>Dendroica petechia</i>	1	0		
15-Jun-08	9	431416	6279470	432245	6279473	8	100	1	1	10:03	Townsend's Warbler	<i>Dendroica townsendi</i>	1	0		
15-Jun-08	9	431416	6279470	432245	6279473	8	100	1	1	10:03	Varied Thrush	<i>Ixoreus naevius</i>	0	1		
15-Jun-08	9	431416	6279470	432245	6279473	8	100	1	1	10:03	Chipping Sparrow	<i>Spizella passerina</i>	1	0		
15-Jun-08	9	431416	6279470	432245	6279473	8	100	1	1	10:03	Ruby-crowned Kinglet	<i>Regulus calendula</i>	0	1		
15-Jun-08	9	431416	6279470	432245	6279473	8	100	1	1	10:03	American Robin	<i>Turdus migratorius</i>	1	0		
15-Jun-08	9	431416	6279470	432245	6279473	8	100	1	1	10:03	Lincoln's Sparrow	<i>Melospiza lincolnii</i>	0	1		
15-Jun-08	9	431416	6279470	432245	6279473	8	100	1	1	10:20	Wilson's Warbler	<i>Wilsonia pusilla</i>	2	0		
15-Jun-08	9	431416	6279470	432245	6279473	8	100	1	1	10:20	Pine Siskin	<i>Carduelis pinus</i>	2	0		
15-Jun-08	9	431416	6279470	432245	6279473	8	100	1	1	10:20	Varied Thrush	<i>Ixoreus naevius</i>	2	0		
15-Jun-08	9	431416	6279470	432245	6279473	8	100	1	1	10:20	Dark-eyed Junco	<i>Junco hyemalis</i>	2	0		
15-Jun-08	9	431416	6279470	432245	6279473	8	100	1	1	10:20	Townsend's Warbler	<i>Dendroica townsendi</i>	2	0		
15-Jun-08	9	431416	6279470	432245	6279473	8	100	1	1	10:20	Hermit Thrush	<i>Catharus guttatus</i>	0	1		
15-Jun-08	9	431416	6279470	432245	6279473	8	100	1	1	10:36	Townsend's Warbler	<i>Dendroica townsendi</i>	2	0		
15-Jun-08	9	431416	6279470	432245	6279473	8	100	1	1	10:36	Varied Thrush	<i>Ixoreus naevius</i>	1	1		
15-Jun-08	9	431416	6279470	432245	6279473	8	100	1	1	10:36	Pine Siskin	<i>Carduelis pinus</i>	1	1		
15-Jun-08	9	431416	6279470	432245	6279473	8	100	1	1	10:36	Wilson's Warbler	<i>Wilsonia pusilla</i>	2	0		
15-Jun-08	9	431416	6279470	432245	6279473	8	100	1	1	10:36	Black-throated Gray Warbler	<i>Dendroica nigrescens</i>	1	0		
15-Jun-08	9	431416	6279470	432245	6279473	8	100	1	1	10:36	Yellow-rumped Warbler	<i>Dendroica coronata</i>	1	0		
15-Jun-08	9	431416	6279470	432245	6279473	8	100	1	1	10:36	Mountain Chickadee	<i>Poecile gambeli</i>	1	0		
16-Jun-08	10	445116	6275503	444623	6276163	9	80	0	1	5:43	Yellow Warbler	<i>Dendroica petechia</i>	1	0		
16-Jun-08	10	445116	6275503	444623	6276163	9	80	0	1	5:43	Northern Waterthrush	<i>Seiurus noveboracensis</i>	2	0		
16-Jun-08	10	445116	6275503	444623	6276163	9	80	0	1	5:43	Hammond's Flycatcher	<i>Empidonax hammondi</i>	1	0		
16-Jun-08	10	445116	6275503	444623	6276163	9	80	0	1	5:43	Dark-eyed Junco	<i>Junco hyemalis</i>	1	0		
16-Jun-08	10	445116	6275503	444623	6276163	9	80	0	1	5:43	Chipping Sparrow	<i>Spizella passerina</i>	1	0		
16-Jun-08	10	445116	6275503	444623	6276163	9	80	0	1	5:43	Fox Sparrow	<i>Passerella iliaca</i>	2	0		
16-Jun-08	10	445116	6275503	444623	6276163	9	80	0	1	5:43	Hermit Thrush	<i>Catharus guttatus</i>	1	0		
16-Jun-08	10	445116	6275503	444623	6276163	9	80	0	1	5:43	Wilson's Warbler	<i>Wilsonia pusilla</i>	2	0		
16-Jun-08	10	445116	6275503	444623	6276163	9	80	0	1	5:43	MacGillivray's warbler	<i>Oporornis tolmiei</i>	1	0		
16-Jun-08	10	445116	6275503	444623	6276163	9	80	0	1	5:43	Song Sparrow	<i>Melospiza melodia</i>	1	0		
16-Jun-08	10	445116	6275503	444623	6276163	9	80	0	2	6:18	Hermit Thrush	<i>Catharus guttatus</i>	1	0		
16-Jun-08	10	445116	6275503	444623	6276163	9	80	0	2	6:18	Northern Waterthrush	<i>Seiurus noveboracensis</i>	3	0		
16-Jun-08	10	445116	6275503	444623	6276163	9	80	0	2	6:18	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
16-Jun-08	10	445116	6275503	444623	6276163	9	80	0	2	6:18	Chipping Sparrow	<i>Spizella passerina</i>	1	0		
16-Jun-08	10	445116	6275503	444623	6276163	9	80	0	2	6:18	MacGillivray's warbler	<i>Oporornis tolmiei</i>	2	0		

Appendix 5.3-1. Summary of Variable Range Point Count (VRPC) Data, 2008

Date	Transect ID	Transect Start Coordinates		Transect End Coordinates		Temp (°C)	Cloud Cover (%)	Wind Scale	Point No.	Time	Species	Scientific Name	Total Birds <100 m	Total Birds >100 m	Breeding Obs.	Comment(s)
		Easting	Northing	Easting	Northing											
16-Jun-08	10	445116	6275503	444623	6276163	9	80	0	2	6:18	Yellow-rumped Warbler	<i>Dendroica coronata</i>	2	0		
16-Jun-08	10	445116	6275503	444623	6276163	9	80	0	2	6:18	Townsend's Warbler	<i>Dendroica townsendi</i>	1	0		
16-Jun-08	10	445116	6275503	444623	6276163	9	80	0	2	6:18	Fox Sparrow	<i>Passerella iliaca</i>	1	0		
16-Jun-08	10	445116	6275503	444623	6276163	9	80	0	3	6:44	Ruby-crowned Kinglet	<i>Regulus calendula</i>	2	0		
16-Jun-08	10	445116	6275503	444623	6276163	9	80	0	3	6:44	MacGillivray's warbler	<i>Oporornis tolmiei</i>	1	0		
16-Jun-08	10	445116	6275503	444623	6276163	9	80	0	3	6:44	Lincoln's Sparrow	<i>Melospiza lincolni</i>	1	0		
16-Jun-08	10	445116	6275503	444623	6276163	9	80	0	3	6:44	Wilson's Warbler	<i>Wilsonia pusilla</i>	2	0		
16-Jun-08	10	445116	6275503	444623	6276163	9	80	0	3	6:44	Chestnut-backed Chickadee	<i>Poecile rufescens</i>	1	0		
16-Jun-08	10	445116	6275503	444623	6276163	9	80	0	3	6:44	Yellow Warbler	<i>Dendroica petechia</i>	2	0		
16-Jun-08	10	445116	6275503	444623	6276163	9	80	0	3	6:44	Fox Sparrow	<i>Passerella iliaca</i>	1	0		
16-Jun-08	10	445116	6275503	444623	6276163	9	80	0	4	7:03	Townsend's Warbler	<i>Dendroica townsendi</i>	2	0		
16-Jun-08	10	445116	6275503	444623	6276163	9	80	0	4	7:03	Pine Siskin	<i>Carduelis pinus</i>	2	0		
16-Jun-08	10	445116	6275503	444623	6276163	9	80	0	4	7:03	Brown Creeper	<i>Certhia americana</i>	1	0		
16-Jun-08	10	445116	6275503	444623	6276163	9	80	0	4	7:03	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
16-Jun-08	10	445116	6275503	444623	6276163	9	80	0	4	7:03	Golden-crowned Kinglet	<i>Regulus satrapa</i>	1	0		
16-Jun-08	10	445116	6275503	444623	6276163	9	80	0	4	7:03	Mountain Chickadee	<i>Poecile gambeli</i>	1	0		
16-Jun-08	10	445116	6275503	444623	6276163	9	80	0	4	7:03	Unknown Woodpecker		1	0		
16-Jun-08	10	445116	6275503	444623	6276163	9	80	0	5	7:22	Golden-crowned Kinglet	<i>Regulus satrapa</i>	1	0		
16-Jun-08	10	445116	6275503	444623	6276163	9	80	0	5	7:22	Northern Waterthrush	<i>Seiurus noveboracensis</i>	1	0		
16-Jun-08	10	445116	6275503	444623	6276163	9	80	0	5	7:22	Pine Siskin	<i>Carduelis pinus</i>	1	0		
16-Jun-08	10	445116	6275503	444623	6276163	9	80	0	5	7:22	Red-breasted Nuthatch	<i>Sitta canadensis</i>	1	0		
16-Jun-08	10	445116	6275503	444623	6276163	9	80	0	5	7:22	Mountain Chickadee	<i>Poecile gambeli</i>	1	0		
16-Jun-08	10	445116	6275503	444623	6276163	9	80	0	5	7:22	Wilson's Warbler	<i>Wilsonia pusilla</i>	2	0		
16-Jun-08	10	445116	6275503	444623	6276163	9	80	0	5	7:22	Fox Sparrow	<i>Passerella iliaca</i>	1	0		
16-Jun-08	10	445116	6275503	444623	6276163	9	80	0	5	7:22	Townsend's Warbler	<i>Dendroica townsendi</i>	1	0		
16-Jun-08	10	445116	6275503	444623	6276163	9	80	0	5	7:22	Lincoln's Sparrow	<i>Melospiza lincolni</i>	1	0		
16-Jun-08	10	445116	6275503	444623	6276163	9	80	0	5	7:22	Swainson's Thrush	<i>Catharus ustulatus</i>	1	0		
16-Jun-08	11	441857	6277968	442407	6277386	10	100	1	1	5:40	Wilson's Warbler	<i>Wilsonia pusilla</i>	2	0		
16-Jun-08	11	441857	6277968	442407	6277386	10	100	1	1	5:40	Fox Sparrow	<i>Passerella iliaca</i>	1	0		
16-Jun-08	11	441857	6277968	442407	6277386	10	100	1	1	5:40	Mountain Chickadee	<i>Poecile gambeli</i>	1	0		
16-Jun-08	11	441857	6277968	442407	6277386	10	100	1	1	5:40	Yellow Warbler	<i>Dendroica petechia</i>	1	0		
16-Jun-08	11	441857	6277968	442407	6277386	10	100	1	1	5:40	Ruby-crowned Kinglet	<i>Regulus calendula</i>	1	0		
16-Jun-08	11	441857	6277968	442407	6277386	10	100	1	1	5:40	Dark-eyed Junco	<i>Junco hyemalis</i>	1	0		
16-Jun-08	11	441857	6277968	442407	6277386	10	100	1	1	5:40	Chipping Sparrow	<i>Spizella passerina</i>	1	0		
16-Jun-08	11	441857	6277968	442407	6277386	10	100	1	1	5:40	Pine Siskin	<i>Carduelis pinus</i>	2	0		
16-Jun-08	11	441857	6277968	442407	6277386	10	100	1	1	5:40	Hermit Thrush	<i>Catharus guttatus</i>	1	0		
16-Jun-08	11	441857	6277968	442407	6277386	10	100	1	2	6:10	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
16-Jun-08	11	441857	6277968	442407	6277386	10	100	1	2	6:10	Hermit Thrush	<i>Catharus guttatus</i>	2	0		
16-Jun-08	11	441857	6277968	442407	6277386	10	100	1	2	6:10	Townsend's Warbler	<i>Dendroica townsendi</i>	1	0		
16-Jun-08	11	441857	6277968	442407	6277386	10	100	1	2	6:10	Chipping Sparrow	<i>Spizella passerina</i>	1	0		
16-Jun-08	11	441857	6277968	442407	6277386	10	100	1	2	6:10	Mountain Chickadee	<i>Poecile gambeli</i>	0	1		
16-Jun-08	11	441857	6277968	442407	6277386	10	100	1	2	6:10	Dark-eyed Junco	<i>Junco hyemalis</i>	0	1		
16-Jun-08	11	441857	6277968	442407	6277386	10	100	1	2	6:10	Pine Siskin	<i>Carduelis pinus</i>	1	0		
16-Jun-08	11	441857	6277968	442407	6277386	10	100	1	3	6:26	Dark-eyed Junco	<i>Junco hyemalis</i>	1	0		
16-Jun-08	11	441857	6277968	442407	6277386	10	100	1	3	6:26	Townsend's Warbler	<i>Dendroica townsendi</i>	2	0		
16-Jun-08	11	441857	6277968	442407	6277386	10	100	1	3	6:26	Hermit Thrush	<i>Catharus guttatus</i>	1	1		
16-Jun-08	11	441857	6277968	442407	6277386	10	100	1	3	6:26	Pine Siskin	<i>Carduelis pinus</i>	0	1		
16-Jun-08	11	441857	6277968	442407	6277386	10	100	1	3	6:26	Mountain Chickadee	<i>Poecile gambeli</i>	1	0		
16-Jun-08	11	441857	6277968	442407	6277386	10	100	1	3	6:26	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
16-Jun-08	11	441857	6277968	442407	6277386	10	100	1	3	6:26	Golden-crowned Kinglet	<i>Regulus satrapa</i>	1	0		
16-Jun-08	11	441857	6277968	442407	6277386	10	100	1	4	6:40	Golden-crowned Kinglet	<i>Regulus satrapa</i>	1	0		
16-Jun-08	11	441857	6277968	442407	6277386	10	100	1	4	6:40	Dark-eyed Junco	<i>Junco hyemalis</i>	1	0		
16-Jun-08	11	441857	6277968	442407	6277386	10	100	1	4	6:40	Townsend's Warbler	<i>Dendroica townsendi</i>	1	0		
16-Jun-08	11	441857	6277968	442407	6277386	10	100	1	4	6:40	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
16-Jun-08	11	441857	6277968	442407	6277386	10	100	1	4	6:40	Hermit Thrush	<i>Catharus guttatus</i>	1	0		
16-Jun-08	11	441857	6277968	442407	6277386	10	100	1	5	6:59	Dark-eyed Junco	<i>Junco hyemalis</i>	2	0		
16-Jun-08	11	441857	6277968	442407	6277386	10	100	1	5	6:59	Winter Wren	<i>Troglodytes troglodytes</i>	1	0		
16-Jun-08	11	441857	6277968	442407	6277386	10	100	1	5	6:59	Varied Thrush	<i>Ixoreus naevius</i>	2	0		

Appendix 5.3-1. Summary of Variable Range Point Count (VRPC) Data, 2008

Date	Transect ID	Transect Start Coordinates		Transect End Coordinates		Temp (°C)	Cloud Cover (%)	Wind Scale	Point No.	Time	Species	Scientific Name	Total Birds <100 m	Total Birds >100 m	Breeding Obs.	Comment(s)
		Easting	Northing	Easting	Northing											
16-Jun-08	11	441857	6277968	442407	6277386	10	100	1	5	6:59	Hermit Thrush	<i>Catharus guttatus</i>	1	0		
16-Jun-08	11	441857	6277968	442407	6277386	10	100	1	5	6:59	American Robin	<i>Turdus migratorius</i>	0	1		
16-Jun-08	11	441857	6277968	442407	6277386	10	100	1	5	6:59	Wilson's Warbler	<i>Wilsonia pusilla</i>	0	1		
16-Jun-08	11	441857	6277968	442407	6277386	10	100	1	5	6:59	Pine Grosbeak	<i>Pinicola enucleator</i>	0	1		
16-Jun-08	11	441857	6277968	442407	6277386	10	100	1	5	6:59	Mountain Chickadee	<i>Poecile gambeli</i>	1	0		
16-Jun-08	11	441857	6277968	442407	6277386	10	100	1	5	6:59	Townsend's Warbler	<i>Dendroica townsendi</i>	1	0		
16-Jun-08	11	441857	6277968	442407	6277386	10	100	1	5	6:59	Golden-crowned Kinglet	<i>Regulus satrapa</i>	1	0		
16-Jun-08	12	444103	6276375	443195	6276270	100	100	0	1	8:04	Varied Thrush	<i>Ixoreus naevius</i>	2	0		
16-Jun-08	12	444103	6276375	443195	6276270	100	100	0	1	8:04	Townsend's Warbler	<i>Dendroica townsendi</i>	2	0		
16-Jun-08	12	444103	6276375	443195	6276270	100	100	0	1	8:04	Pine Siskin	<i>Carduelis pinus</i>	2	0		
16-Jun-08	12	444103	6276375	443195	6276270	100	100	0	1	8:04	Red-breasted Nuthatch	<i>Sitta canadensis</i>	1	0		
16-Jun-08	12	444103	6276375	443195	6276270	100	100	0	2	8:51	Wilson's Warbler	<i>Wilsonia pusilla</i>	2	0		
16-Jun-08	12	444103	6276375	443195	6276270	100	100	0	2	8:51	Varied Thrush	<i>Ixoreus naevius</i>	2	0		
16-Jun-08	12	444103	6276375	443195	6276270	100	100	0	2	8:51	Hammond's Flycatcher	<i>Empidonax hammondi</i>	1	0		
16-Jun-08	12	444103	6276375	443195	6276270	100	100	0	2	8:51	American Redstart	<i>Setophaga ruticilla</i>	1	0		
16-Jun-08	12	444103	6276375	443195	6276270	100	100	0	2	8:51	Yellow Warbler	<i>Dendroica petechia</i>	1	0		
16-Jun-08	12	444103	6276375	443195	6276270	100	100	0	3	9:08	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
16-Jun-08	12	444103	6276375	443195	6276270	100	100	0	3	9:08	Varied Thrush	<i>Ixoreus naevius</i>	2	0		
16-Jun-08	12	444103	6276375	443195	6276270	100	100	0	3	9:08	Fox Sparrow	<i>Passerella iliaca</i>	1	0		
16-Jun-08	12	444103	6276375	443195	6276270	100	100	0	3	9:08	Pine Siskin	<i>Carduelis pinus</i>	1	0		
16-Jun-08	12	444103	6276375	443195	6276270	100	100	0	4	9:13	Blackpoll Warbler	<i>Dendroica striata</i>	1	0		
16-Jun-08	12	444103	6276375	443195	6276270	100	100	0	4	9:13	Fox Sparrow	<i>Passerella iliaca</i>	1	0		
16-Jun-08	12	444103	6276375	443195	6276270	100	100	0	4	9:13	Lincoln's Sparrow	<i>Melospiza lincolnii</i>	1	0		
16-Jun-08	12	444103	6276375	443195	6276270	100	100	0	4	9:13	Townsend's Warbler	<i>Dendroica townsendi</i>	1	0		
16-Jun-08	12	444103	6276375	443195	6276270	100	100	0	4	9:13	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
16-Jun-08	12	444103	6276375	443195	6276270	100	100	0	4	9:13	Yellow Warbler	<i>Dendroica petechia</i>	1	0		
16-Jun-08	12	444103	6276375	443195	6276270	100	100	0	4	9:13	Dark-eyed Junco	<i>Junco hyemalis</i>	1	0		
16-Jun-08	12	444103	6276375	443195	6276270	100	100	0	4	9:13	Hermit Thrush	<i>Catharus guttatus</i>	1	0		
16-Jun-08	12	444103	6276375	443195	6276270	100	100	0	4	9:13	Ruby-crowned Kinglet	<i>Regulus calendula</i>	1	0		
16-Jun-08	12	444103	6276375	443195	6276270	100	100	0	5	8:49	Yellow Warbler	<i>Dendroica petechia</i>	1	0		
16-Jun-08	12	444103	6276375	443195	6276270	100	100	0	5	8:49	Red-breasted Nuthatch	<i>Sitta canadensis</i>	1	0		
16-Jun-08	12	444103	6276375	443195	6276270	100	100	0	5	8:49	Townsend's Warbler	<i>Dendroica townsendi</i>	3	0		
16-Jun-08	12	444103	6276375	443195	6276270	100	100	0	5	8:49	Dark-eyed Junco	<i>Junco hyemalis</i>	1	0		
16-Jun-08	12	444103	6276375	443195	6276270	100	100	0	5	8:49	Hammond's Flycatcher	<i>Empidonax hammondi</i>	1	0		
16-Jun-08	12	444103	6276375	443195	6276270	100	100	0	5	8:49	Yellow Warbler	<i>Dendroica petechia</i>	0	1		
16-Jun-08	12	444103	6276375	443195	6276270	100	100	0	5	8:49	Hermit Thrush	<i>Catharus guttatus</i>	0	1		
16-Jun-08	12	444103	6276375	443195	6276270	100	100	0	5	8:49	Varied Thrush	<i>Ixoreus naevius</i>	1	0		
16-Jun-08	12	444103	6276375	443195	6276270	100	100	0	5	8:49	Ruby-crowned Kinglet	<i>Regulus calendula</i>	1	0		
16-Jun-08	12	444103	6276375	443195	6276270	100	100	0	5	8:49	Pine Siskin	<i>Carduelis pinus</i>	2	0		
16-Jun-08	12	444103	6276375	443195	6276270	100	100	0	5	8:49	Fox Sparrow	<i>Passerella iliaca</i>	1	0		
16-Jun-08	13	442169	6277262	442649	6276614	12	100	1	1	7:16	Lincoln's Sparrow	<i>Melospiza lincolnii</i>	1	0		
16-Jun-08	13	442169	6277262	442649	6276614	12	100	1	1	7:16	Yellow Warbler	<i>Dendroica petechia</i>	2	0		
16-Jun-08	13	442169	6277262	442649	6276614	12	100	1	1	7:16	Chipping Sparrow	<i>Spizella passerina</i>	1	0		
16-Jun-08	13	442169	6277262	442649	6276614	12	100	1	1	7:16	Wilson's Warbler	<i>Wilsonia pusilla</i>	2	0		
16-Jun-08	13	442169	6277262	442649	6276614	12	100	1	1	7:16	Hermit Thrush	<i>Catharus guttatus</i>	2	0		
16-Jun-08	13	442169	6277262	442649	6276614	12	100	1	1	7:16	Gray-cheeked Thrush	<i>Catharus minimus</i>	2	0		
16-Jun-08	13	442169	6277262	442649	6276614	12	100	1	1	7:16	unknown Woodpecker		1	0		drumming
16-Jun-08	13	442169	6277262	442649	6276614	12	100	1	1	7:16	Fox Sparrow	<i>Passerella iliaca</i>	1	0		
16-Jun-08	13	442169	6277262	442649	6276614	12	100	1	1	7:16	Townsend's Warbler	<i>Dendroica townsendi</i>	1	0		
16-Jun-08	13	442169	6277262	442649	6276614	12	100	1	2	7:41	Dark-eyed Junco	<i>Junco hyemalis</i>	1	0		
16-Jun-08	13	442169	6277262	442649	6276614	12	100	1	2	7:41	Lincoln's Sparrow	<i>Melospiza lincolnii</i>	2	0		
16-Jun-08	13	442169	6277262	442649	6276614	12	100	1	2	7:41	unknown Woodpecker		1	0		drumming
16-Jun-08	13	442169	6277262	442649	6276614	12	100	1	2	7:41	Yellow Warbler	<i>Dendroica petechia</i>	2	0		
16-Jun-08	13	442169	6277262	442649	6276614	12	100	1	2	7:41	Common Yellowthroat	<i>Geothlypis trichas</i>	2	0		
16-Jun-08	13	442169	6277262	442649	6276614	12	100	1	2	7:41	Chipping Sparrow	<i>Spizella passerina</i>	1	0		
16-Jun-08	13	442169	6277262	442649	6276614	12	100	1	2	7:41	Fox Sparrow	<i>Passerella iliaca</i>	1	0		
16-Jun-08	13	442169	6277262	442649	6276614	12	100	1	2	7:41	Townsend's Warbler	<i>Dendroica townsendi</i>	1	0		

Appendix 5.3-1. Summary of Variable Range Point Count (VRPC) Data, 2008

Date	Transect ID	Transect Start Coordinates		Transect End Coordinates		Temp (°C)	Cloud Cover (%)	Wind Scale	Point No.	Time	Species	Scientific Name	Total Birds <100 m	Total Birds >100 m	Breeding Obs.	Comment(s)
		Easting	Northing	Easting	Northing											
16-Jun-08	13	442169	6277262	442649	6276614	12	100	1	3	7:52	Lincoln's Sparrow	<i>Melospiza lincolni</i>	1	0		
16-Jun-08	13	442169	6277262	442649	6276614	12	100	1	3	7:52	Dark-eyed Junco	<i>Junco hyemalis</i>	3	0		
16-Jun-08	13	442169	6277262	442649	6276614	12	100	1	3	7:52	Chipping Sparrow	<i>Spizella passerina</i>	1	0		
16-Jun-08	13	442169	6277262	442649	6276614	12	100	1	3	7:52	Black-throated Gray Warbler	<i>Dendroica nigrescens</i>	1	0		
16-Jun-08	13	442169	6277262	442649	6276614	12	100	1	3	7:52	Yellow Warbler	<i>Dendroica petechia</i>	1	1		
16-Jun-08	13	442169	6277262	442649	6276614	12	100	1	3	7:52	Common Yellowthroat	<i>Geothlypis trichas</i>	0	1		
16-Jun-08	13	442169	6277262	442649	6276614	12	100	1	3	7:52	Hermit Thrush	<i>Catharus guttatus</i>	1	1		
16-Jun-08	13	442169	6277262	442649	6276614	12	100	1	3	7:52	Varied Thrush	<i>Ixoreus naevius</i>	0	1		
16-Jun-08	13	442169	6277262	442649	6276614	12	100	1	4	8:05	Chipping Sparrow	<i>Spizella passerina</i>	1	0		
16-Jun-08	13	442169	6277262	442649	6276614	12	100	1	4	8:05	Dark-eyed Junco	<i>Junco hyemalis</i>	1	0		
16-Jun-08	13	442169	6277262	442649	6276614	12	100	1	4	8:05	Hermit Thrush	<i>Catharus guttatus</i>	2	0		
16-Jun-08	13	442169	6277262	442649	6276614	12	100	1	4	8:05	Townsend's Warbler	<i>Dendroica townsendi</i>	1	0		
16-Jun-08	13	442169	6277262	442649	6276614	12	100	1	4	8:05	American Redstart	<i>Setophaga ruticilla</i>	1	0		
16-Jun-08	13	442169	6277262	442649	6276614	12	100	1	4	8:05	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
16-Jun-08	13	442169	6277262	442649	6276614	12	100	1	4	8:05	Swainson's Thrush	<i>Catharus ustulatus</i>	1	0		
16-Jun-08	13	442169	6277262	442649	6276614	12	100	1	4	8:05	Yellow Warbler	<i>Dendroica petechia</i>	1	0		
16-Jun-08	13	442169	6277262	442649	6276614	12	100	1	4	8:05	Mountain Chickadee	<i>Poecile gambeli</i>	1	0		
16-Jun-08	13	442169	6277262	442649	6276614	12	100	1	5	8:18	Chipping Sparrow	<i>Spizella passerina</i>	1	0		
16-Jun-08	13	442169	6277262	442649	6276614	12	100	1	5	8:18	Hermit Thrush	<i>Catharus guttatus</i>	2	1		
16-Jun-08	13	442169	6277262	442649	6276614	12	100	1	5	8:18	Swainson's Thrush	<i>Catharus ustulatus</i>	1	0		
16-Jun-08	13	442169	6277262	442649	6276614	12	100	1	5	8:18	Wilson's Warbler	<i>Wilsonia pusilla</i>	2	0		
16-Jun-08	13	442169	6277262	442649	6276614	12	100	1	5	8:18	Fox Sparrow	<i>Passerella iliaca</i>	1	0		
16-Jun-08	13	442169	6277262	442649	6276614	12	100	1	5	8:18	Ruby-crowned Kinglet	<i>Regulus calendula</i>	1	0		
16-Jun-08	13	442169	6277262	442649	6276614	12	100	1	5	8:18	Dark-eyed Junco	<i>Junco hyemalis</i>	1	0		
16-Jun-08	13	442169	6277262	442649	6276614	12	100	1	5	8:18	Varied Thrush	<i>Ixoreus naevius</i>	0	1		
16-Jun-08	13	442169	6277262	442649	6276614	12	100	1	5	8:18	Gray-cheeked Thrush	<i>Catharus minimus</i>	1	0		
16-Jun-08	13	442169	6277262	442649	6276614	12	100	1	5	8:18	Lincoln's Sparrow	<i>Melospiza lincolni</i>	0	1		
16-Jun-08	14	451936	6260951	452219	6261405	10	100	0	1	10:16	Hermit Thrush	<i>Catharus guttatus</i>	2	0		
16-Jun-08	14	451936	6260951	452219	6261405	10	100	0	1	10:16	Pine Siskin	<i>Carduelis pinus</i>	4	0		
16-Jun-08	14	451936	6260951	452219	6261405	10	100	0	1	10:16	Yellow Warbler	<i>Dendroica petechia</i>	2	0		
16-Jun-08	14	451936	6260951	452219	6261405	10	100	0	1	10:16	Varied Thrush	<i>Ixoreus naevius</i>	1	0		
16-Jun-08	14	451936	6260951	452219	6261405	10	100	0	1	10:16	Hammond's Flycatcher	<i>Empidonax hammondii</i>	1	0		
16-Jun-08	14	451936	6260951	452219	6261405	10	100	0	2	10:34	Blackpoll Warbler	<i>Dendroica striata</i>	1	0		
16-Jun-08	14	451936	6260951	452219	6261405	10	100	0	2	10:34	Hermit Thrush	<i>Catharus guttatus</i>	1	0		
16-Jun-08	14	451936	6260951	452219	6261405	10	100	0	2	10:34	Alder Flycatcher	<i>Empidonax alnorum</i>	1	0		
16-Jun-08	14	451936	6260951	452219	6261405	10	100	0	2	10:34	Pine Siskin	<i>Carduelis pinus</i>	1	0		
16-Jun-08	14	451936	6260951	452219	6261405	10	100	0	2	10:34	Varied Thrush	<i>Ixoreus naevius</i>	0	1		
16-Jun-08	14	451936	6260951	452219	6261405	10	100	0	2	10:34	Yellow Warbler	<i>Dendroica petechia</i>	1	0		
16-Jun-08	14	451936	6260951	452219	6261405	10	100	0	2	10:34	Townsend's Warbler	<i>Dendroica townsendi</i>	2	0		
16-Jun-08	14	451936	6260951	452219	6261405	10	100	0	3	11:01	Townsend's Solitaire	<i>Myadestes townsendi</i>	1	0		
16-Jun-08	14	451936	6260951	452219	6261405	10	100	0	3	11:01	Yellow Warbler	<i>Dendroica petechia</i>	1	0		
16-Jun-08	14	451936	6260951	452219	6261405	10	100	0	3	11:01	Varied Thrush	<i>Ixoreus naevius</i>	2	0		
16-Jun-08	14	451936	6260951	452219	6261405	10	100	0	3	11:01	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
16-Jun-08	14	451936	6260951	452219	6261405	10	100	0	3	11:01	Pine Siskin	<i>Carduelis pinus</i>	1	0		
16-Jun-08	14	451936	6260951	452219	6261405	10	100	0	3	11:01	Red-breasted Nuthatch	<i>Sitta canadensis</i>	1	0		
16-Jun-08	14	451936	6260951	452219	6261405	10	100	0	3	11:01	Pacific-slope Flycatcher	<i>Empidonax difficilis</i>	1	0		
16-Jun-08	14	451936	6260951	452219	6261405	10	100	0	3	11:01	Ruby-crowned Kinglet	<i>Regulus calendula</i>	1	0		
16-Jun-08	14	451936	6260951	452219	6261405	10	100	0	4	11:23	Blackpoll Warbler	<i>Dendroica striata</i>	1	0		
16-Jun-08	14	451936	6260951	452219	6261405	10	100	0	4	11:23	Townsend's Warbler	<i>Dendroica townsendi</i>	2	0		
16-Jun-08	14	451936	6260951	452219	6261405	10	100	0	4	11:23	Yellow Warbler	<i>Dendroica petechia</i>	1	0		
16-Jun-08	14	451936	6260951	452219	6261405	10	100	0	4	11:23	Hermit Thrush	<i>Catharus guttatus</i>	1	0		
16-Jun-08	14	451936	6260951	452219	6261405	10	100	0	4	11:23	Hammond's Flycatcher	<i>Empidonax hammondii</i>	1	0		
16-Jun-08	14	451936	6260951	452219	6261405	10	100	0	5	11:48	Hermit Thrush	<i>Catharus guttatus</i>	0	1		
16-Jun-08	14	451936	6260951	452219	6261405	10	100	0	5	11:48	Yellow Warbler	<i>Dendroica petechia</i>	3	0		
16-Jun-08	14	451936	6260951	452219	6261405	10	100	0	5	11:48	Varied Thrush	<i>Ixoreus naevius</i>	1	0		
16-Jun-08	14	451936	6260951	452219	6261405	10	100	0	5	11:48	Pine Siskin	<i>Carduelis pinus</i>	1	0		

Appendix 5.3-1. Summary of Variable Range Point Count (VRPC) Data, 2008

Date	Transect ID	Transect Start Coordinates		Transect End Coordinates		Temp (°C)	Cloud Cover (%)	Wind Scale	Point No.	Time	Species	Scientific Name	Total Birds <100 m	Total Birds >100 m	Breeding Obs.	Comment(s)
		Easting	Northing	Easting	Northing											
16-Jun-08	14	451936	6260951	452219	6261405	10	100	0	5	11:48	Townsend's Warbler	<i>Dendroica townsendi</i>	1	0		
16-Jun-08	14	451936	6260951	452219	6261405	10	100	0	5	11:48	MacGillivray's warbler	<i>Oporornis tolmiei</i>	1	0		
16-Jun-08	15	452189	6260875	452841	6261376	12	100	1	1	10:18	Golden-crowned Kinglet	<i>Regulus satrapa</i>	1	0		
16-Jun-08	15	452189	6260875	452841	6261376	12	100	1	1	10:18	Hermit Thrush	<i>Catharus guttatus</i>	1	0		
16-Jun-08	15	452189	6260875	452841	6261376	12	100	1	1	10:18	Townsend's Warbler	<i>Dendroica townsendi</i>	1	0		
16-Jun-08	15	452189	6260875	452841	6261376	12	100	1	1	10:18	Yellow-rumped Warbler	<i>Dendroica coronata</i>	2	0		
16-Jun-08	15	452189	6260875	452841	6261376	12	100	1	1	10:18	Hammond's Flycatcher	<i>Empidonax hammondii</i>	2	0		
16-Jun-08	15	452189	6260875	452841	6261376	12	100	1	1	10:18	Wilson's Warbler	<i>Wilsonia pusilla</i>	2	0		
16-Jun-08	15	452189	6260875	452841	6261376	12	100	1	1	10:18	Dark-eyed Junco	<i>Junco hyemalis</i>	2	0		
16-Jun-08	15	452189	6260875	452841	6261376	12	100	1	1	10:18	Pine Siskin	<i>Carduelis pinus</i>	1	0		
16-Jun-08	15	452189	6260875	452841	6261376	12	100	1	1	10:18	Brown Creeper	<i>Certhia americana</i>	1	0		
16-Jun-08	15	452189	6260875	452841	6261376	12	100	1	2	10:35	Ruby-crowned Kinglet	<i>Regulus calendula</i>	2	0		
16-Jun-08	15	452189	6260875	452841	6261376	12	100	1	2	10:35	Townsend's Warbler	<i>Dendroica townsendi</i>	2	0		
16-Jun-08	15	452189	6260875	452841	6261376	12	100	1	2	10:35	Red-breasted Nuthatch	<i>Sitta canadensis</i>	0	1		
16-Jun-08	15	452189	6260875	452841	6261376	12	100	1	2	10:35	Varied Thrush	<i>Ixoreus naevius</i>	0	1		
16-Jun-08	15	452189	6260875	452841	6261376	12	100	1	2	10:35	Pine Siskin	<i>Carduelis pinus</i>	1	0		
16-Jun-08	15	452189	6260875	452841	6261376	12	100	1	2	10:35	Hermit Thrush	<i>Catharus guttatus</i>	1	0		
16-Jun-08	15	452189	6260875	452841	6261376	12	100	1	2	10:35	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
16-Jun-08	15	452189	6260875	452841	6261376	12	100	1	2	10:35	Yellow Warbler	<i>Dendroica petechia</i>	1	0		
16-Jun-08	15	452189	6260875	452841	6261376	12	100	1	2	10:35	Black-throated Gray Warbler	<i>Dendroica nigrescens</i>	1	0		
16-Jun-08	15	452189	6260875	452841	6261376	12	100	1	2	10:35	Dark-eyed Junco	<i>Junco hyemalis</i>	1	0		
16-Jun-08	15	452189	6260875	452841	6261376	12	100	1	3	10:49	Chipping Sparrow	<i>Spizella passerina</i>	1	0		
16-Jun-08	15	452189	6260875	452841	6261376	12	100	1	3	10:49	Yellow Warbler	<i>Dendroica petechia</i>	1	0		
16-Jun-08	15	452189	6260875	452841	6261376	12	100	1	3	10:49	Pine Siskin	<i>Carduelis pinus</i>	2	0		
16-Jun-08	15	452189	6260875	452841	6261376	12	100	1	3	10:49	Dark-eyed Junco	<i>Junco hyemalis</i>	1	0		
16-Jun-08	15	452189	6260875	452841	6261376	12	100	1	3	10:49	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
16-Jun-08	15	452189	6260875	452841	6261376	12	100	1	4	11:06	Townsend's Warbler	<i>Dendroica townsendi</i>	2	0		
16-Jun-08	15	452189	6260875	452841	6261376	12	100	1	4	11:06	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
16-Jun-08	15	452189	6260875	452841	6261376	12	100	1	4	11:06	Hermit Thrush	<i>Catharus guttatus</i>	2	0		
16-Jun-08	15	452189	6260875	452841	6261376	12	100	1	4	11:06	Golden-crowned Kinglet	<i>Regulus satrapa</i>	1	0		
16-Jun-08	15	452189	6260875	452841	6261376	12	100	1	4	11:06	Black-throated Gray Warbler	<i>Dendroica nigrescens</i>	1	0		
16-Jun-08	15	452189	6260875	452841	6261376	12	100	1	4	11:06	Mountain Chickadee	<i>Poecile gambeli</i>	2	0		
16-Jun-08	15	452189	6260875	452841	6261376	12	100	1	4	11:06	Pine Siskin	<i>Carduelis pinus</i>	1	0		
16-Jun-08	15	452189	6260875	452841	6261376	12	100	1	4	11:06	Townsend's Solitaire	<i>Myadestes townsendi</i>	1	0		
16-Jun-08	15	452189	6260875	452841	6261376	12	100	1	4	11:06	Varied Thrush	<i>Ixoreus naevius</i>	1	0		
16-Jun-08	15	452189	6260875	452841	6261376	12	100	1	4	11:06	Northwestern Crow	<i>Corvus caurinus</i>	0	1		
16-Jun-08	15	452189	6260875	452841	6261376	12	100	1	5	11:27	Yellow-rumped Warbler	<i>Dendroica coronata</i>	1	0		
16-Jun-08	15	452189	6260875	452841	6261376	12	100	1	5	11:27	Townsend's Warbler	<i>Dendroica townsendi</i>	2	1		
16-Jun-08	15	452189	6260875	452841	6261376	12	100	1	5	11:27	Pine Siskin	<i>Carduelis pinus</i>	2	0		
16-Jun-08	15	452189	6260875	452841	6261376	12	100	1	5	11:27	Hermit Thrush	<i>Catharus guttatus</i>	1	0		
16-Jun-08	15	452189	6260875	452841	6261376	12	100	1	5	11:27	Dark-eyed Junco	<i>Junco hyemalis</i>	1	0		
16-Jun-08	15	452189	6260875	452841	6261376	12	100	1	5	11:27	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
16-Jun-08	15	452189	6260875	452841	6261376	12	100	1	5	11:27	unknown Woodpecker		1	0		
16-Jun-08	15	452189	6260875	452841	6261376	12	100	1	5	11:27	MacGillivray's warbler	<i>Oporornis tolmiei</i>	1	0		
16-Jun-08	15	452189	6260875	452841	6261376	12	100	1	5	11:27	Golden-crowned Kinglet	<i>Regulus satrapa</i>	1	0		
17-Jun-08	16	441316	6285399	441718	6286107	12	0	1	1	5:34	Winter Wren	<i>Troglodytes troglodytes</i>	2	0		
17-Jun-08	16	441316	6285399	441718	6286107	12	0	1	1	5:34	Townsend's Warbler	<i>Dendroica townsendi</i>	1	0		
17-Jun-08	16	441316	6285399	441718	6286107	12	0	1	1	5:34	Yellow Warbler	<i>Dendroica petechia</i>	3	0		
17-Jun-08	16	441316	6285399	441718	6286107	12	0	1	1	5:34	MacGillivray's warbler	<i>Oporornis tolmiei</i>	2	0		
17-Jun-08	16	441316	6285399	441718	6286107	12	0	1	1	5:34	Hermit Thrush	<i>Catharus guttatus</i>	1	0		
17-Jun-08	16	441316	6285399	441718	6286107	12	0	1	1	5:34	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
17-Jun-08	16	441316	6285399	441718	6286107	12	0	1	1	5:34	Northern Waterthrush	<i>Seiurus noveboracensis</i>	1	0		
17-Jun-08	16	441316	6285399	441718	6286107	12	0	1	1	5:34	Warbling Vireo	<i>Vireo gilvus</i>	1	0		
17-Jun-08	16	441316	6285399	441718	6286107	12	0	1	2	6:02	Ruffed Grouse	<i>Bonasa umbellus</i>	1	0		swainson's thrush nest (incidental)
17-Jun-08	16	441316	6285399	441718	6286107	12	0	1	2	6:02	Warbling Vireo	<i>Vireo gilvus</i>	1	0		
17-Jun-08	16	441316	6285399	441718	6286107	12	0	1	2	6:02	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		

Appendix 5.3-1. Summary of Variable Range Point Count (VRPC) Data, 2008

Date	Transect ID	Transect Start Coordinates		Transect End Coordinates		Temp (°C)	Cloud Cover (%)	Wind Scale	Point No.	Time	Species	Scientific Name	Total Birds <100 m	Total Birds >100 m	Breeding Obs.	Comment(s)
		Easting	Northing	Easting	Northing											
17-Jun-08	16	441316	6285399	441718	6286107	12	0	1	2	6:02	Winter Wren	<i>Troglodytes troglodytes</i>	0	1		
17-Jun-08	16	441316	6285399	441718	6286107	12	0	1	2	6:02	Fox Sparrow	<i>Passerella iliaca</i>	1	0		
17-Jun-08	16	441316	6285399	441718	6286107	12	0	1	2	6:02	Northern Waterthrush	<i>Seiurus noveboracensis</i>	1	0		
17-Jun-08	16	441316	6285399	441718	6286107	12	0	1	2	6:02	Townsend's Warbler	<i>Dendroica townsendi</i>	3	0		
17-Jun-08	16	441316	6285399	441718	6286107	12	0	1	2	6:02	Varied Thrush	<i>Ixoreus naevius</i>	0	1		
17-Jun-08	16	441316	6285399	441718	6286107	12	0	1	2	6:02	Yellow Warbler	<i>Dendroica petechia</i>	2	0		
17-Jun-08	16	441316	6285399	441718	6286107	12	0	1	3	6:26	Varied Thrush	<i>Ixoreus naevius</i>	1	0		
17-Jun-08	16	441316	6285399	441718	6286107	12	0	1	3	6:26	Fox Sparrow	<i>Passerella iliaca</i>	2	0		
17-Jun-08	16	441316	6285399	441718	6286107	12	0	1	3	6:26	Warbling Vireo	<i>Vireo gilvus</i>	1	0		
17-Jun-08	16	441316	6285399	441718	6286107	12	0	1	3	6:26	Wilson's Warbler	<i>Troglodytes troglodytes</i>	1	0		
17-Jun-08	16	441316	6285399	441718	6286107	12	0	1	3	6:26	Hermit Thrush	<i>Catharus guttatus</i>	1	0		
17-Jun-08	16	441316	6285399	441718	6286107	12	0	1	3	6:26	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
17-Jun-08	16	441316	6285399	441718	6286107	12	0	1	4	6:47	Mountain Chickadee	<i>Poecile gambeli</i>	2	0		
17-Jun-08	16	441316	6285399	441718	6286107	12	0	1	4	6:47	Townsend's Warbler	<i>Dendroica townsendi</i>	2	0		
17-Jun-08	16	441316	6285399	441718	6286107	12	0	1	4	6:47	Winter Wren	<i>Troglodytes troglodytes</i>	1	0		
17-Jun-08	16	441316	6285399	441718	6286107	12	0	1	4	6:47	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
17-Jun-08	16	441316	6285399	441718	6286107	12	0	1	4	6:47	Red-breasted Nuthatch	<i>Sitta canadensis</i>	0	1		
17-Jun-08	16	441316	6285399	441718	6286107	12	0	1	4	6:47	American Robin	<i>Turdus migratorius</i>	0	1		
17-Jun-08	16	441316	6285399	441718	6286107	12	0	1	4	6:47	Golden-crowned Kinglet	<i>Regulus satrapa</i>	1	0		
17-Jun-08	16	441316	6285399	441718	6286107	12	0	1	5	7:09	Yellow-rumped Warbler	<i>Dendroica coronata</i>	1	0		
17-Jun-08	16	441316	6285399	441718	6286107	12	0	1	5	7:09	Wilson's Warbler	<i>Wilsonia pusilla</i>	2	0		
17-Jun-08	16	441316	6285399	441718	6286107	12	0	1	5	7:09	Pine Siskin	<i>Carduelis pinus</i>	1	0		
17-Jun-08	16	441316	6285399	441718	6286107	12	0	1	5	7:09	Pacific-slope Flycatcher	<i>Empidonax difficilis</i>	1	0		
17-Jun-08	16	441316	6285399	441718	6286107	12	0	1	5	7:09	Yellow Warbler	<i>Dendroica petechia</i>	2	0		
17-Jun-08	16	441316	6285399	441718	6286107	12	0	1	5	7:09	Townsend's Warbler	<i>Dendroica townsendi</i>	0	1		
17-Jun-08	17	441207	6285253	440906	6284513	12	15	2	1	5:27	Wilson's Warbler	<i>Wilsonia pusilla</i>	2	0		
17-Jun-08	17	441207	6285253	440906	6284513	12	15	2	1	5:27	Yellow Warbler	<i>Dendroica petechia</i>	3	0		
17-Jun-08	17	441207	6285253	440906	6284513	12	15	2	1	5:27	Warbling Vireo	<i>Vireo gilvus</i>	1	0		
17-Jun-08	17	441207	6285253	440906	6284513	12	15	2	1	5:27	Swainson's Thrush	<i>Catharus ustulatus</i>	1	0		
17-Jun-08	17	441207	6285253	440906	6284513	12	15	2	1	5:27	Pine Siskin	<i>Carduelis pinus</i>	1	0		
17-Jun-08	17	441207	6285253	440906	6284513	12	15	2	2	5:43	Fox Sparrow	<i>Passerella iliaca</i>	1	0		
17-Jun-08	17	441207	6285253	440906	6284513	12	15	2	2	5:43	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
17-Jun-08	17	441207	6285253	440906	6284513	12	15	2	2	5:43	Yellow Warbler	<i>Dendroica petechia</i>	2	0		
17-Jun-08	17	441207	6285253	440906	6284513	12	15	2	2	5:43	Northern Waterthrush	<i>Seiurus noveboracensis</i>	1	0		
17-Jun-08	17	441207	6285253	440906	6284513	12	15	2	2	5:43	Swainson's Thrush	<i>Catharus ustulatus</i>	1	0		
17-Jun-08	17	441207	6285253	440906	6284513	12	15	2	2	5:43	Pine Siskin	<i>Carduelis pinus</i>	2	0		
17-Jun-08	17	441207	6285253	440906	6284513	12	15	2	2	5:43	Varied Thrush	<i>Ixoreus naevius</i>	1	0		
17-Jun-08	17	441207	6285253	440906	6284513	12	15	2	3	6:02	Warbling Vireo	<i>Vireo gilvus</i>	2	0		
17-Jun-08	17	441207	6285253	440906	6284513	12	15	2	3	6:02	Varied Thrush	<i>Ixoreus naevius</i>	1	0		
17-Jun-08	17	441207	6285253	440906	6284513	12	15	2	3	6:02	Northern Waterthrush	<i>Seiurus noveboracensis</i>	1	0		
17-Jun-08	17	441207	6285253	440906	6284513	12	15	2	3	6:02	Ruffed Grouse	<i>Bonasa umbellus</i>	1	0		
17-Jun-08	17	441207	6285253	440906	6284513	12	15	2	3	6:02	Pine Siskin	<i>Carduelis pinus</i>	1	0		
17-Jun-08	17	441207	6285253	440906	6284513	12	15	2	3	6:02	Townsend's Warbler	<i>Dendroica townsendi</i>	1	0		
17-Jun-08	17	441207	6285253	440906	6284513	12	15	2	3	6:02	Wilson's Warbler	<i>Wilsonia pusilla</i>	2	0		
17-Jun-08	17	441207	6285253	440906	6284513	12	15	2	3	6:02	Yellow Warbler	<i>Dendroica petechia</i>	2	0		
17-Jun-08	17	441207	6285253	440906	6284513	12	15	2	3	6:02	Yellow-rumped Warbler	<i>Dendroica coronata</i>	1	0		
17-Jun-08	17	441207	6285253	440906	6284513	12	15	2	4	6:20	Hammond's Flycatcher	<i>Empidonax hammondii</i>	1	0		
17-Jun-08	17	441207	6285253	440906	6284513	12	15	2	4	6:20	Yellow-rumped Warbler	<i>Dendroica coronata</i>	1	0		
17-Jun-08	17	441207	6285253	440906	6284513	12	15	2	4	6:20	Townsend's Warbler	<i>Dendroica townsendi</i>	2	0		
17-Jun-08	17	441207	6285253	440906	6284513	12	15	2	4	6:20	Hermit Thrush	<i>Catharus guttatus</i>	1	0		
17-Jun-08	17	441207	6285253	440906	6284513	12	15	2	4	6:20	Pine Siskin	<i>Carduelis pinus</i>	1	0		
17-Jun-08	17	441207	6285253	440906	6284513	12	15	2	4	6:20	Varied Thrush	<i>Ixoreus naevius</i>	1	0		
17-Jun-08	17	441207	6285253	440906	6284513	12	15	2	4	6:20	Yellow Warbler	<i>Dendroica petechia</i>	2	0		
17-Jun-08	17	441207	6285253	440906	6284513	12	15	2	4	6:20	Ruffed Grouse	<i>Bonasa umbellus</i>	1	0		
17-Jun-08	17	441207	6285253	440906	6284513	12	15	2	5	6:36	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
17-Jun-08	17	441207	6285253	440906	6284513	12	15	2	5	6:36	Yellow Warbler	<i>Dendroica petechia</i>	1	0		

Appendix 5.3-1. Summary of Variable Range Point Count (VRPC) Data, 2008

Date	Transect ID	Transect Start Coordinates		Transect End Coordinates		Temp (°C)	Cloud Cover (%)	Wind Scale	Point No.	Time	Species	Scientific Name	Total Birds <100 m	Total Birds >100 m	Breeding Obs.	Comment(s)
		Easting	Northing	Easting	Northing											
17-Jun-08	17	441207	6285253	440906	6284513	12	15	2	5	6:36	Townsend's Warbler	<i>Dendroica townsendi</i>	2	0		
17-Jun-08	18	426715	6284108	427334	6284136	6	100	1	1	8:07	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
17-Jun-08	18	426715	6284108	427334	6284136	6	100	1	1	8:07	Townsend's Warbler	<i>Dendroica townsendi</i>	2	0		
17-Jun-08	18	426715	6284108	427334	6284136	6	100	1	1	8:07	Yellow-rumped Warbler	<i>Dendroica coronata</i>	2	0		
17-Jun-08	18	426715	6284108	427334	6284136	6	100	1	1	8:07	Blackpoll Warbler	<i>Dendroica striata</i>	1	0		
17-Jun-08	18	426715	6284108	427334	6284136	6	100	1	1	8:07	Fox Sparrow	<i>Passerella iliaca</i>	1	0		
17-Jun-08	18	426715	6284108	427334	6284136	6	100	1	1	8:07	Swainson's Thrush	<i>Catharus ustulatus</i>	1	0		
17-Jun-08	18	426715	6284108	427334	6284136	6	100	1	2	8:23	Varied Thrush	<i>Ixoreus naevius</i>	3	1		
17-Jun-08	18	426715	6284108	427334	6284136	6	100	1	2	8:23	Hermit Thrush	<i>Catharus guttatus</i>	2	1		
17-Jun-08	18	426715	6284108	427334	6284136	6	100	1	2	8:23	Swainson's Thrush	<i>Catharus ustulatus</i>	0	1		
17-Jun-08	18	426715	6284108	427334	6284136	6	100	1	3	8:34	Chipping Sparrow	<i>Spizella passerina</i>	2	0		
17-Jun-08	18	426715	6284108	427334	6284136	6	100	1	3	8:34	Varied Thrush	<i>Ixoreus naevius</i>	3	1		
17-Jun-08	18	426715	6284108	427334	6284136	6	100	1	3	8:34	Hermit Thrush	<i>Catharus guttatus</i>	1	1		
17-Jun-08	18	426715	6284108	427334	6284136	6	100	1	3	8:34	Fox Sparrow	<i>Passerella iliaca</i>	2	0		
17-Jun-08	18	426715	6284108	427334	6284136	6	100	1	3	8:34	Townsend's Warbler	<i>Dendroica townsendi</i>	1	0		
17-Jun-08	18	426715	6284108	427334	6284136	6	100	1	3	8:34	American Robin	<i>Turdus migratorius</i>	1	0		
17-Jun-08	18	426715	6284108	427334	6284136	6	100	1	4	8:54	Fox Sparrow	<i>Passerella iliaca</i>	2	0		
17-Jun-08	18	426715	6284108	427334	6284136	6	100	1	4	8:54	Blackpoll Warbler	<i>Dendroica striata</i>	1	0		
17-Jun-08	18	426715	6284108	427334	6284136	6	100	1	4	8:54	Pine Siskin	<i>Carduelis pinus</i>	2	0		
17-Jun-08	18	426715	6284108	427334	6284136	6	100	1	4	8:54	Yellow-rumped Warbler	<i>Dendroica coronata</i>	1	0		
17-Jun-08	18	426715	6284108	427334	6284136	6	100	1	4	8:54	Hermit Thrush	<i>Catharus guttatus</i>	1	0		
17-Jun-08	18	426715	6284108	427334	6284136	6	100	1	5	9:12	Mountain Chickadee	<i>Poecile gambeli</i>	2	0		
17-Jun-08	18	426715	6284108	427334	6284136	6	100	1	5	9:12	Blackpoll Warbler	<i>Dendroica striata</i>	1	0		
17-Jun-08	18	426715	6284108	427334	6284136	6	100	1	5	9:12	Fox Sparrow	<i>Passerella iliaca</i>	1	0		
17-Jun-08	18	426715	6284108	427334	6284136	6	100	1	5	9:12	Hermit Thrush	<i>Catharus guttatus</i>	2	0		
17-Jun-08	18	426715	6284108	427334	6284136	6	100	1	5	9:12	Pine Siskin	<i>Carduelis pinus</i>	2	0		
17-Jun-08	18	426715	6284108	427334	6284136	6	100	1	5	9:12	Varied Thrush	<i>Ixoreus naevius</i>	0	1		
17-Jun-08	18	426715	6284108	427334	6284136	6	100	1	5	9:12	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
17-Jun-08	19	426373	6284243	425715	6284687	10	100	1	1	8:04	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
17-Jun-08	19	426373	6284243	425715	6284687	10	100	1	1	8:04	Swainson's Thrush	<i>Catharus ustulatus</i>	1	0		
17-Jun-08	19	426373	6284243	425715	6284687	10	100	1	1	8:04	Townsend's Warbler	<i>Dendroica townsendi</i>	1	0		
17-Jun-08	19	426373	6284243	425715	6284687	10	100	1	1	8:04	Chipping Sparrow	<i>Spizella passerina</i>	1	0		
17-Jun-08	19	426373	6284243	425715	6284687	10	100	1	1	8:04	Yellow Warbler	<i>Dendroica petechia</i>	1	0		
17-Jun-08	19	426373	6284243	425715	6284687	10	100	1	1	8:04	Hermit Thrush	<i>Catharus guttatus</i>	1	0		
17-Jun-08	19	426373	6284243	425715	6284687	10	100	1	1	8:04	Pine Siskin	<i>Carduelis pinus</i>	1	0		
17-Jun-08	19	426373	6284243	425715	6284687	10	100	1	1	8:04	Varied Thrush	<i>Ixoreus naevius</i>	1	0		
17-Jun-08	19	426373	6284243	425715	6284687	10	100	1	2	8:18	Fox Sparrow	<i>Passerella iliaca</i>	1	0		
17-Jun-08	19	426373	6284243	425715	6284687	10	100	1	2	8:18	Pine Siskin	<i>Carduelis pinus</i>	1	0		
17-Jun-08	19	426373	6284243	425715	6284687	10	100	1	2	8:18	Hermit Thrush	<i>Catharus guttatus</i>	2	0		
17-Jun-08	19	426373	6284243	425715	6284687	10	100	1	2	8:18	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
17-Jun-08	19	426373	6284243	425715	6284687	10	100	1	2	8:18	Townsend's Warbler	<i>Dendroica townsendi</i>	1	0		
17-Jun-08	19	426373	6284243	425715	6284687	10	100	1	2	8:18	Yellow Warbler	<i>Dendroica petechia</i>	0	1		
17-Jun-08	19	426373	6284243	425715	6284687	10	100	1	2	8:18	Varied Thrush	<i>Ixoreus naevius</i>	0	1		
17-Jun-08	19	426373	6284243	425715	6284687	10	100	1	2	8:18	Chipping Sparrow	<i>Spizella passerina</i>	1	0		
17-Jun-08	19	426373	6284243	425715	6284687	10	100	1	2	8:18	unknown Ptarmigan		1	0		
17-Jun-08	19	426373	6284243	425715	6284687	10	100	1	2	8:18	American Redstart	<i>Setophaga ruticilla</i>	1	0		
17-Jun-08	19	426373	6284243	425715	6284687	10	100	1	3	8:31	Varied Thrush	<i>Ixoreus naevius</i>	2	0		
17-Jun-08	19	426373	6284243	425715	6284687	10	100	1	3	8:31	Hermit Thrush	<i>Catharus guttatus</i>	2	0		
17-Jun-08	19	426373	6284243	425715	6284687	10	100	1	3	8:31	Townsend's Warbler	<i>Dendroica townsendi</i>	1	0		
17-Jun-08	19	426373	6284243	425715	6284687	10	100	1	3	8:31	Fox Sparrow	<i>Passerella iliaca</i>	1	0		
17-Jun-08	19	426373	6284243	425715	6284687	10	100	1	3	8:31	Winter Wren	<i>Troglodytes troglodytes</i>	1	0		
17-Jun-08	19	426373	6284243	425715	6284687	10	100	1	3	8:31	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
17-Jun-08	19	426373	6284243	425715	6284687	10	100	1	3	8:31	Pine Siskin	<i>Carduelis pinus</i>	1	0		
17-Jun-08	19	426373	6284243	425715	6284687	10	100	1	3	8:31	Dark-eyed Junco	<i>Junco hyemalis</i>	1	0		
17-Jun-08	19	426373	6284243	425715	6284687	10	100	1	4	8:45	Pine Siskin	<i>Carduelis pinus</i>	1	0		
17-Jun-08	19	426373	6284243	425715	6284687	10	100	1	4	8:45	Mountain Chickadee	<i>Poecile gambeli</i>	2	0		

Appendix 5.3-1. Summary of Variable Range Point Count (VRPC) Data, 2008

Date	Transect ID	Transect Start Coordinates		Transect End Coordinates		Temp (°C)	Cloud Cover (%)	Wind Scale	Point No.	Time	Species	Scientific Name	Total Birds <100 m	Total Birds >100 m	Breeding Obs.	Comment(s)
		Easting	Northing	Easting	Northing											
17-Jun-08	19	426373	6284243	425715	6284687	10	100	1	4	8:45	Ruby-crowned Kinglet	<i>Regulus calendula</i>	2	0		
17-Jun-08	19	426373	6284243	425715	6284687	10	100	1	4	8:45	Varied Thrush	<i>Ixoreus naevius</i>	1	1		
17-Jun-08	19	426373	6284243	425715	6284687	10	100	1	4	8:45	Red-breasted Nuthatch	<i>Sitta canadensis</i>	1	0		
17-Jun-08	19	426373	6284243	425715	6284687	10	100	1	4	8:45	Hermit Thrush	<i>Catharus guttatus</i>	1	1		
17-Jun-08	19	426373	6284243	425715	6284687	10	100	1	4	8:45	Yellow-rumped Warbler	<i>Dendroica coronata</i>	1	0		
17-Jun-08	19	426373	6284243	425715	6284687	10	100	1	4	8:45	Townsend's Warbler	<i>Dendroica townsendi</i>	0	1		
17-Jun-08	19	426373	6284243	425715	6284687	10	100	1	5	8:59	Hermit Thrush	<i>Catharus guttatus</i>	3	0		
17-Jun-08	19	426373	6284243	425715	6284687	10	100	1	5	8:59	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
17-Jun-08	19	426373	6284243	425715	6284687	10	100	1	5	8:59	Dark-eyed Junco	<i>Junco hyemalis</i>	1	0		
17-Jun-08	19	426373	6284243	425715	6284687	10	100	1	5	8:59	Pine Siskin	<i>Carduelis pinus</i>	1	0		
17-Jun-08	19	426373	6284243	425715	6284687	10	100	1	5	8:59	Chipping Sparrow	<i>Spizella passerina</i>	1	0		
17-Jun-08	19	426373	6284243	425715	6284687	10	100	1	5	8:59	Fox Sparrow	<i>Passerella iliaca</i>	1	0		
17-Jun-08	19	426373	6284243	425715	6284687	10	100	1	5	8:59	Varied Thrush	<i>Ixoreus naevius</i>	1	0		
18-Jun-08	20	419976	6261057	419168	6261170	11	100	1	1	4:16	Yellow Warbler	<i>Dendroica petechia</i>	2	0		
18-Jun-08	20	419976	6261057	419168	6261170	11	100	1	1	4:16	Varied Thrush	<i>Ixoreus naevius</i>	1	0		
18-Jun-08	20	419976	6261057	419168	6261170	11	100	1	1	4:16	Swainson's Thrush	<i>Catharus ustulatus</i>	1	0		
18-Jun-08	20	419976	6261057	419168	6261170	11	100	1	1	4:16	Hermit Thrush	<i>Catharus guttatus</i>	2	0		
18-Jun-08	20	419976	6261057	419168	6261170	11	100	1	1	4:16	Yellow-rumped Warbler	<i>Dendroica coronata</i>	1	0		
18-Jun-08	20	419976	6261057	419168	6261170	11	100	1	1	4:16	Wilson's Warbler	<i>Wilsonia pusilla</i>	2	0		
18-Jun-08	20	419976	6261057	419168	6261170	11	100	1	2	4:28	Yellow Warbler	<i>Dendroica petechia</i>	2	0		
18-Jun-08	20	419976	6261057	419168	6261170	11	100	1	2	4:28	Swainson's Thrush	<i>Catharus ustulatus</i>	2	1		
18-Jun-08	20	419976	6261057	419168	6261170	11	100	1	2	4:28	Varied Thrush	<i>Ixoreus naevius</i>	3	0		
18-Jun-08	20	419976	6261057	419168	6261170	11	100	1	2	4:28	Orange-crowned Warbler	<i>Vermivora celata</i>	1	0		
18-Jun-08	20	419976	6261057	419168	6261170	11	100	1	2	4:28	Hermit Thrush	<i>Catharus guttatus</i>	1	0		
18-Jun-08	20	419976	6261057	419168	6261170	11	100	1	3	4:42	Yellow Warbler	<i>Dendroica petechia</i>	4	0		
18-Jun-08	20	419976	6261057	419168	6261170	11	100	1	3	4:42	Northern Waterthrush	<i>Seiurus noveboracensis</i>	2	0		
18-Jun-08	20	419976	6261057	419168	6261170	11	100	1	3	4:42	Dark-eyed Junco	<i>Junco hyemalis</i>	1	0		
18-Jun-08	20	419976	6261057	419168	6261170	11	100	1	3	4:42	Swainson's Thrush	<i>Catharus ustulatus</i>	1	0		
18-Jun-08	20	419976	6261057	419168	6261170	11	100	1	4	4:59	Varied Thrush	<i>Ixoreus naevius</i>	1	0		
18-Jun-08	20	419976	6261057	419168	6261170	11	100	1	4	4:59	Winter Wren	<i>Troglodytes troglodytes</i>	1	0		
18-Jun-08	20	419976	6261057	419168	6261170	11	100	1	4	4:59	Yellow Warbler	<i>Dendroica petechia</i>	2	0		
18-Jun-08	20	419976	6261057	419168	6261170	11	100	1	4	4:59	Townsend's Warbler	<i>Dendroica townsendi</i>	1	0		
18-Jun-08	20	419976	6261057	419168	6261170	11	100	1	4	4:59	Hermit Thrush	<i>Catharus guttatus</i>	1	0		
18-Jun-08	20	419976	6261057	419168	6261170	11	100	1	4	4:59	Swainson's Thrush	<i>Catharus ustulatus</i>	0	1		
18-Jun-08	20	419976	6261057	419168	6261170	11	100	1	5	5:13	Chestnut-backed Chickadee	<i>Poecile rufescens</i>	4	0		
18-Jun-08	20	419976	6261057	419168	6261170	11	100	1	5	5:13	Yellow Warbler	<i>Dendroica petechia</i>	1	0		
18-Jun-08	20	419976	6261057	419168	6261170	11	100	1	5	5:13	Yellow-rumped Warbler	<i>Dendroica coronata</i>	2	0		
18-Jun-08	20	419976	6261057	419168	6261170	11	100	1	5	5:13	Hermit Thrush	<i>Catharus guttatus</i>	2	0		
18-Jun-08	20	419976	6261057	419168	6261170	11	100	1	5	5:13	Townsend's Warbler	<i>Dendroica townsendi</i>	1	0		
18-Jun-08	21	397330	6252793	397762	6253446	10	100	6	3	6:42	Pacific-slope Flycatcher	<i>Empidonax difficilis</i>	2	0		
18-Jun-08	21	397330	6252793	397762	6253446	10	100	6	3	6:42	Townsend's Warbler	<i>Dendroica townsendi</i>	2	0		
18-Jun-08	21	397330	6252793	397762	6253446	10	100	6	3	6:42	Varied Thrush	<i>Ixoreus naevius</i>	2	0		
18-Jun-08	21	397330	6252793	397762	6253446	10	100	6	3	6:42	Western Tanager	<i>Piranga ludoviciana</i>	1	0		
18-Jun-08	21	397330	6252793	397762	6253446	10	100	6	3	6:42	Winter Wren	<i>Troglodytes troglodytes</i>	2	0		
18-Jun-08	21	397330	6252793	397762	6253446	10	100	6	3	6:42	American Redstart	<i>Setophaga ruticilla</i>	1	0		
18-Jun-08	21	397330	6252793	397762	6253446	10	100	6	3	6:42	Dusky/Sooty Grouse	<i>Dendragapus spp.</i>	0	1		
18-Jun-08	21	397330	6252793	397762	6253446	10	100	6	3	6:42	Warbling Vireo	<i>Vireo gilvus</i>	1	0		
18-Jun-08	21	397330	6252793	397762	6253446	10	100	6	2	6:54	Chestnut-backed Chickadee	<i>Poecile rufescens</i>	4	0		
18-Jun-08	21	397330	6252793	397762	6253446	10	100	6	2	6:54	Golden-crowned Kinglet	<i>Regulus satrapa</i>	1	0		
18-Jun-08	21	397330	6252793	397762	6253446	10	100	6	2	6:54	Varied Thrush	<i>Ixoreus naevius</i>	2	0		
18-Jun-08	21	397330	6252793	397762	6253446	10	100	6	2	6:54	Hermit Thrush	<i>Catharus guttatus</i>	2	0		
18-Jun-08	21	397330	6252793	397762	6253446	10	100	6	2	6:54	Winter Wren	<i>Troglodytes troglodytes</i>	1	0		
18-Jun-08	21	397330	6252793	397762	6253446	10	100	6	2	6:54	Steller's Jay	<i>Cyanocitta stelleri</i>	1	0		
18-Jun-08	21	397330	6252793	397762	6253446	10	100	6	2	6:54	Townsend's Warbler	<i>Dendroica townsendi</i>	1	0		
18-Jun-08	21	397330	6252793	397762	6253446	10	100	6	2	6:54	Brown Creeper	<i>Certhia americana</i>	2	0		
18-Jun-08	21	397330	6252793	397762	6253446	10	100	6	2	6:54	Yellow Warbler	<i>Dendroica petechia</i>	1	0		

Appendix 5.3-1. Summary of Variable Range Point Count (VRPC) Data, 2008

Date	Transect ID	Transect Start Coordinates		Transect End Coordinates		Temp (°C)	Cloud Cover (%)	Wind Scale	Point No.	Time	Species	Scientific Name	Total Birds <100 m	Total Birds >100 m	Breeding Obs.	Comment(s)
		Easting	Northing	Easting	Northing											
18-Jun-08	21	397330	6252793	397762	6253446	10	100	6	2	6:54	Pacific-slope Flycatcher	<i>Empidonax difficilis</i>	1	0		
18-Jun-08	21	397330	6252793	397762	6253446	10	100	6	2	6:54	Dusky/Sooty Grouse	<i>Dendragapus</i> spp.	0	1		
18-Jun-08	21	397330	6252793	397762	6253446	10	100	6	2	6:54	Western Tanager	<i>Piranga ludoviciana</i>	1	0		
18-Jun-08	21	397330	6252793	397762	6253446	10	100	6	1	7:14	Varied Thrush	<i>Ixoreus naevius</i>	3	0		
18-Jun-08	21	397330	6252793	397762	6253446	10	100	6	1	7:14	Pacific-slope Flycatcher	<i>Empidonax difficilis</i>	2	0		
18-Jun-08	21	397330	6252793	397762	6253446	10	100	6	1	7:14	Winter Wren	<i>Troglodytes troglodytes</i>	2	0		
18-Jun-08	21	397330	6252793	397762	6253446	10	100	6	1	7:14	Swainson's Thrush	<i>Catharus ustulatus</i>	1	0		
18-Jun-08	21	397330	6252793	397762	6253446	10	100	6	1	7:14	Chestnut-backed Chickadee	<i>Poecile rufescens</i>	1	0		
18-Jun-08	21	397330	6252793	397762	6253446	10	100	6	1	7:14	Townsend's Solitaire	<i>Myadestes townsendi</i>	1	0		
18-Jun-08	21	397330	6252793	397762	6253446	10	100	6	4	7:55	Warbling Vireo	<i>Vireo gilvus</i>	1	0		
18-Jun-08	21	397330	6252793	397762	6253446	10	100	6	4	7:55	Winter Wren	<i>Troglodytes troglodytes</i>	1	0		
18-Jun-08	21	397330	6252793	397762	6253446	10	100	6	4	7:55	Townsend's Warbler	<i>Dendroica townsendi</i>	1	0		
18-Jun-08	21	397330	6252793	397762	6253446	10	100	6	4	7:55	MacGillivray's warbler	<i>Oporornis tolmiei</i>	1	0		
18-Jun-08	21	397330	6252793	397762	6253446	10	100	6	4	7:55	Pacific-slope Flycatcher	<i>Empidonax difficilis</i>	1	0		
18-Jun-08	21	397330	6252793	397762	6253446	10	100	6	4	7:55	Yellow-rumped Warbler	<i>Dendroica coronata</i>	1	0		
18-Jun-08	21	397330	6252793	397762	6253446	10	100	6	4	7:55	Golden-crowned Kinglet	<i>Regulus satrapa</i>	1	0		
18-Jun-08	21	397330	6252793	397762	6253446	10	100	6	4	7:55	Chestnut-backed Chickadee	<i>Poecile rufescens</i>	1	0		
18-Jun-08	21	397330	6252793	397762	6253446	10	100	6	5	8:18	Varied Thrush	<i>Ixoreus naevius</i>	3	0		
18-Jun-08	21	397330	6252793	397762	6253446	10	100	6	5	8:18	Townsend's Warbler	<i>Dendroica townsendi</i>	1	0		
18-Jun-08	21	397330	6252793	397762	6253446	10	100	6	5	8:18	Yellow Warbler	<i>Dendroica petechia</i>	1	0		
18-Jun-08	21	397330	6252793	397762	6253446	10	100	6	5	8:18	Chestnut-backed Chickadee	<i>Poecile rufescens</i>	1	0		
18-Jun-08	22	403341	6257392	402652	6257826	12	100	1	1	6:36	Hermit Thrush	<i>Catharus guttatus</i>	1	0		
18-Jun-08	22	403341	6257392	402652	6257826	12	100	1	1	6:36	Winter Wren	<i>Troglodytes troglodytes</i>	1	0		
18-Jun-08	22	403341	6257392	402652	6257826	12	100	1	1	6:36	Townsend's Warbler	<i>Dendroica townsendi</i>	1	0		
18-Jun-08	22	403341	6257392	402652	6257826	12	100	1	1	6:36	Hammond's Flycatcher	<i>Empidonax hammondi</i>	1	0		
18-Jun-08	22	403341	6257392	402652	6257826	12	100	1	1	6:36	Chestnut-backed Chickadee	<i>Poecile rufescens</i>	2	0		
18-Jun-08	22	403341	6257392	402652	6257826	12	100	1	1	6:36	American Robin	<i>Turdus migratorius</i>	1	0		
18-Jun-08	22	403341	6257392	402652	6257826	12	100	1	1	6:36	Yellow Warbler	<i>Dendroica petechia</i>	1	0		
18-Jun-08	22	403341	6257392	402652	6257826	12	100	1	1	6:36	American Redstart	<i>Setophaga ruticilla</i>	1	0		
18-Jun-08	22	403341	6257392	402652	6257826	12	100	1	2	6:48	Townsend's Warbler	<i>Dendroica townsendi</i>	2	0		
18-Jun-08	22	403341	6257392	402652	6257826	12	100	1	2	6:48	Chestnut-backed Chickadee	<i>Poecile rufescens</i>	1	0		
18-Jun-08	22	403341	6257392	402652	6257826	12	100	1	2	6:48	Hermit Thrush	<i>Catharus guttatus</i>	2	0		
18-Jun-08	22	403341	6257392	402652	6257826	12	100	1	2	6:48	Dark-eyed Junco	<i>Junco hyemalis</i>	4	0		
18-Jun-08	22	403341	6257392	402652	6257826	12	100	1	2	6:48	Golden-crowned Kinglet	<i>Regulus satrapa</i>	2	0		
18-Jun-08	22	403341	6257392	402652	6257826	12	100	1	2	6:48	Winter Wren	<i>Troglodytes troglodytes</i>	2	0		
18-Jun-08	22	403341	6257392	402652	6257826	12	100	1	2	6:48	Varied Thrush	<i>Ixoreus naevius</i>	0	1		
18-Jun-08	22	403341	6257392	402652	6257826	12	100	1	3	7:05	Townsend's Warbler	<i>Dendroica townsendi</i>	2	0		
18-Jun-08	22	403341	6257392	402652	6257826	12	100	1	3	7:05	Winter Wren	<i>Troglodytes troglodytes</i>	2	0		
18-Jun-08	22	403341	6257392	402652	6257826	12	100	1	3	7:05	Brown Creeper	<i>Certhia americana</i>	1	0		
18-Jun-08	22	403341	6257392	402652	6257826	12	100	1	3	7:05	Hammond's Flycatcher	<i>Empidonax hammondi</i>	1	0		
18-Jun-08	22	403341	6257392	402652	6257826	12	100	1	3	7:05	Pacific-slope Flycatcher	<i>Empidonax difficilis</i>	1	0		
18-Jun-08	22	403341	6257392	402652	6257826	12	100	1	3	7:05	Chestnut-backed Chickadee	<i>Poecile rufescens</i>	2	0		
18-Jun-08	22	403341	6257392	402652	6257826	12	100	1	3	7:05	Golden-crowned Kinglet	<i>Regulus satrapa</i>	1	0		
18-Jun-08	22	403341	6257392	402652	6257826	12	100	1	3	7:05	Red-breasted Nuthatch	<i>Sitta canadensis</i>	1	0		
18-Jun-08	22	403341	6257392	402652	6257826	12	100	1	4	7:20	Pacific-slope Flycatcher	<i>Empidonax difficilis</i>	2	0		
18-Jun-08	22	403341	6257392	402652	6257826	12	100	1	4	7:20	Townsend's Warbler	<i>Dendroica townsendi</i>	2	0		
18-Jun-08	22	403341	6257392	402652	6257826	12	100	1	4	7:20	Winter Wren	<i>Troglodytes troglodytes</i>	2	0		
18-Jun-08	22	403341	6257392	402652	6257826	12	100	1	4	7:20	Varied Thrush	<i>Ixoreus naevius</i>	1	0		
18-Jun-08	22	403341	6257392	402652	6257826	12	100	1	4	7:20	Dark-eyed Junco	<i>Junco hyemalis</i>	1	0		
18-Jun-08	22	403341	6257392	402652	6257826	12	100	1	4	7:20	Pine Siskin	<i>Carduelis pinus</i>	1	0		
18-Jun-08	22	403341	6257392	402652	6257826	12	100	1	5	7:35	Winter Wren	<i>Troglodytes troglodytes</i>	1	0		
18-Jun-08	22	403341	6257392	402652	6257826	12	100	1	5	7:35	Varied Thrush	<i>Ixoreus naevius</i>	2	0		
18-Jun-08	22	403341	6257392	402652	6257826	12	100	1	5	7:35	Dark-eyed Junco	<i>Junco hyemalis</i>	1	0		
18-Jun-08	22	403341	6257392	402652	6257826	12	100	1	5	7:35	Pacific-slope Flycatcher	<i>Empidonax difficilis</i>	2	0		
18-Jun-08	22	403341	6257392	402652	6257826	12	100	1	5	7:35	Hermit Thrush	<i>Catharus guttatus</i>	1	1		
18-Jun-08	22	403341	6257392	402652	6257826	12	100	1	5	7:35	Townsend's Warbler	<i>Dendroica townsendi</i>	1	1		
18-Jun-08	22	403341	6257392	402652	6257826	12	100	1	5	7:35	Chestnut-backed Chickadee	<i>Poecile rufescens</i>	1	0		

Appendix 5.3-2

Summary of Variable Range Point Count (VRPC) Data, 2009

Appendix 5.3-2. Summary of Variable Range Point Count (VRPC) Data, 2009

Date	Transect ID	Transect Start		Transect End		Temp (°C)	Cloud Cover (%)	Wind Scale	Point No.	Time	Species	Scientific Name	Total Birds <100 m	Total Birds	Breeding Obs.	Comment(s)
		Easting	Northing	Easting	Northing											
22-Jun-09	2	416978	6259926	416965	6259324	15	60	0	1	9:50	Yellow Warbler	<i>Dendroica petechia</i>	1	0		
22-Jun-09	2	416978	6259926	416965	6259324	15	60	0	2	10:08	Swainson's Thrush	<i>Catharus ustulatus</i>	1	1		
22-Jun-09	2	416978	6259926	416965	6259324	15	60	0	2	10:08	Yellow Warbler	<i>Dendroica petechia</i>	1	1		
22-Jun-09	2	416978	6259926	416965	6259324	15	60	0	2	10:08	American Redstart	<i>Setophaga ruticilla</i>	1	0		
22-Jun-09	2	416978	6259926	416965	6259324	15	60	0	3	10:20	Yellow Warbler	<i>Dendroica petechia</i>	3	2		
22-Jun-09	2	416978	6259926	416965	6259324	15	60	0	3	10:20	Swainson's Thrush	<i>Catharus ustulatus</i>	0	1		
22-Jun-09	2	416978	6259926	416965	6259324	15	60	0	4	10:36	Yellow Warbler	<i>Dendroica petechia</i>	1	0		
22-Jun-09	2	416978	6259926	416965	6259324	15	60	0	4	10:36	Swainson's Thrush	<i>Catharus ustulatus</i>	1	1		
22-Jun-09	2	416978	6259926	416965	6259324	15	60	0	4	10:36	American Redstart	<i>Setophaga ruticilla</i>	1	0		
22-Jun-09	2	416978	6259926	416965	6259324	15	60	0	4	10:36	Northern Waterthrush	<i>Seiurus noveboracensis</i>	1	0		
22-Jun-09	2	416978	6259926	416965	6259324	15	60	0	5	10:53	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
22-Jun-09	2	416965	6259324	416965	6259324	15	60	0	5	10:53	Yellow Warbler	<i>Dendroica petechia</i>	2	0		
22-Jun-09	14	451936	6260951	452171	6261528	6	10	0	1	4:45	Hermit Thrush	<i>Catharus guttatus</i>	2	1		
22-Jun-09	14	451936	6260951	452171	6261528	6	10	0	1	4:45	Ruby-crowned Kinglet	<i>Regulus calendula</i>	0	1		
22-Jun-09	14	451936	6260951	452171	6261528	6	10	0	1	4:45	Dark-eyed Junco	<i>Junco hyemalis</i>	0	1		
22-Jun-09	14	451936	6260951	452171	6261528	6	10	0	1	4:45	unknown chickadee		0	1		unknown chickadee
22-Jun-09	14	451936	6260951	452171	6261528	6	10	0	1	4:45	Townsend's Warbler	<i>Dendroica townsendi</i>	0	1		
22-Jun-09	14	451936	6260951	452171	6261528	6	10	0	2	5:01	Dark-eyed Junco	<i>Junco hyemalis</i>	1	1		
22-Jun-09	14	451936	6260951	452171	6261528	6	10	0	2	5:01	Yellow Warbler	<i>Dendroica petechia</i>	2	0		
22-Jun-09	14	451936	6260951	452171	6261528	6	10	0	2	5:01	Orange-crowned Warbler	<i>Vermivora celata</i>	1	0		
22-Jun-09	14	451936	6260951	452171	6261528	6	10	0	2	5:01	Swainson's Thrush	<i>Catharus ustulatus</i>	1	0		
22-Jun-09	14	451936	6260951	452171	6261528	6	10	0	2	5:01	Hermit Thrush	<i>Catharus guttatus</i>	0	1		
22-Jun-09	14	451936	6260951	452171	6261528	6	10	0	2	5:01	Townsend's Warbler	<i>Dendroica townsendi</i>	0	1		
22-Jun-09	14	451936	6260951	452171	6261528	6	10	0	3	5:25	Hermit Thrush	<i>Catharus guttatus</i>	1	0		
22-Jun-09	14	451936	6260951	452171	6261528	6	10	0	3	5:25	Orange-crowned Warbler	<i>Vermivora celata</i>	2	0		
22-Jun-09	14	451936	6260951	452171	6261528	6	10	0	3	5:25	Yellow Warbler	<i>Dendroica petechia</i>	1	0		
22-Jun-09	14	451936	6260951	452171	6261528	6	10	0	3	5:25	Hammond's Flycatcher	<i>Empidonax hammondii</i>	1	0		
22-Jun-09	14	451936	6260951	452171	6261528	6	10	0	3	5:25	Townsend's Warbler	<i>Dendroica townsendi</i>	1	0		
22-Jun-09	14	451936	6260951	452171	6261528	6	10	0	3	5:25	Blackpoll Warbler	<i>Dendroica striata</i>	1	0		
22-Jun-09	14	451936	6260951	452171	6261528	6	10	0	4	5:44	Fox Sparrow	<i>Passerella iliaca</i>	1	0		
22-Jun-09	14	451936	6260951	452171	6261528	6	10	0	4	5:44	Blackpoll Warbler	<i>Dendroica striata</i>	0	1		
22-Jun-09	14	451936	6260951	452171	6261528	6	10	0	4	5:44	Hammond's Flycatcher	<i>Empidonax hammondii</i>	1	0		
22-Jun-09	14	451936	6260951	452171	6261528	6	10	0	4	5:44	Yellow Warbler	<i>Dendroica petechia</i>	1	0		
22-Jun-09	14	451936	6260951	452171	6261528	6	10	0	4	5:44	Hermit Thrush	<i>Catharus guttatus</i>	0	1		
22-Jun-09	14	451936	6260951	452171	6261528	6	10	0	5	6:02	Yellow Warbler	<i>Dendroica petechia</i>	1	1		
22-Jun-09	14	451936	6260951	452171	6261528	6	10	0	5	6:02	Wilson's Warbler	<i>Wilsonia pusilla</i>	3	0		
22-Jun-09	14	451936	6260951	452171	6261528	6	10	0	5	6:02	Orange-crowned Warbler	<i>Vermivora celata</i>	1	0		
22-Jun-09	14	451936	6260951	452171	6261528	6	10	0	5	6:02	Yellow-rumped Warbler	<i>Dendroica coronata</i>	2	0		
22-Jun-09	14	451936	6260951	452171	6261528	6	10	0	5	6:02	Blackpoll Warbler	<i>Dendroica striata</i>	2	0		
22-Jun-09	14	451936	6260951	452171	6261528	6	10	0	5	6:02	Pine Siskin	<i>Carduelis pinus</i>	1	0		
22-Jun-09	20	419969	6261087	419481	6261137	10	50	0	1	7:39	Yellow Warbler	<i>Dendroica petechia</i>	1	0		
22-Jun-09	20	419969	6261087	419481	6261137	10	50	0	1	7:39	Hermit Thrush	<i>Catharus guttatus</i>	0	1		
22-Jun-09	20	419969	6261087	419481	6261137	10	50	0	1	7:39	Townsend's Warbler	<i>Dendroica townsendi</i>	0	1		
22-Jun-09	20	419969	6261087	419481	6261137	10	50	0	1	7:39	Varied Thrush	<i>Ixoreus naevius</i>	0	1		
22-Jun-09	20	419969	6261087	419481	6261137	10	50	0	1	7:39	American Redstart	<i>Setophaga ruticilla</i>	1	0		
22-Jun-09	20	419969	6261087	419481	6261137	10	50	0	2	7:55	Warbling Vireo	<i>Vireo gilvus</i>	1	0		
22-Jun-09	20	419969	6261087	419481	6261137	10	50	0	2	7:55	Yellow-rumped Warbler	<i>Dendroica coronata</i>	1	1		
22-Jun-09	20	419969	6261087	419481	6261137	10	50	0	2	7:55	Yellow Warbler	<i>Dendroica petechia</i>	0	1		
22-Jun-09	20	419969	6261087	419481	6261137	10	50	0	2	7:55	Northern Waterthrush	<i>Seiurus noveboracensis</i>	1	0		
22-Jun-09	20	419969	6261087	419481	6261137	10	50	0	2	7:55	American Redstart	<i>Setophaga ruticilla</i>	1	0		
22-Jun-09	20	419969	6261087	419481	6261137	10	50	0	2	7:55	Pacific-slope Flycatcher	<i>Empidonax difficilis</i>	1	0		
22-Jun-09	20	419969	6261087	419481	6261137	10	50	0	3	8:13	Orange-crowned Warbler	<i>Vermivora celata</i>	2	0		
22-Jun-09	20	419969	6261087	419481	6261137	10	50	0	3	8:13	Yellow Warbler	<i>Dendroica petechia</i>	3	0		
22-Jun-09	20	419969	6261087	419481	6261137	10	50	0	3	8:13	Pacific-slope Flycatcher	<i>Empidonax difficilis</i>	1	0		
22-Jun-09	20	419969	6261087	419481	6261137	10	50	0	3	8:13	Varied Thrush	<i>Ixoreus naevius</i>	1	0		
22-Jun-09	20	419969	6261087	419481	6261137	10	50	0	3	8:13	Yellow-rumped Warbler	<i>Dendroica coronata</i>	1	0		
22-Jun-09	20	419969	6261087	419481	6261137	10	50	0	3	8:13	Northern Waterthrush	<i>Seiurus noveboracensis</i>	1	0		

Appendix 5.3-2. Summary of Variable Range Point Count (VRPC) Data, 2009

Date	Transect ID	Transect Start		Transect End		Temp (°C)	Cloud Cover (%)	Wind Scale	Point No.	Time	Species	Scientific Name	Total Birds <100 m	Total Birds	Breeding Obs.	Comment(s)
		Easting	Northing	Easting	Northing											
22-Jun-09	20	419969	6261087	419481	6261137	10	50	0	3	8:13	American Redstart	<i>Setophaga ruticilla</i>	1	0		
22-Jun-09	20	419969	6261087	419481	6261137	10	50	0	4	8:27	Varied Thrush	<i>Ixoreus naevius</i>	0	2		
22-Jun-09	20	419969	6261087	419481	6261137	10	50	0	4	8:27	American Redstart	<i>Setophaga ruticilla</i>	0	1		
22-Jun-09	20	419969	6261087	419481	6261137	10	50	0	4	8:27	Chipping Sparrow	<i>Spizella passerina</i>	0	1		
22-Jun-09	20	419969	6261087	419481	6261137	10	50	0	4	8:27	Yellow-rumped Warbler	<i>Dendroica coronata</i>	0	1		
22-Jun-09	20	419969	6261087	419481	6261137	10	50	0	4	8:27	Yellow Warbler	<i>Dendroica petechia</i>	1	1		
22-Jun-09	20	419969	6261087	419481	6261137	10	50	0	5	8:46	Hermit Thrush	<i>Catharus guttatus</i>	1	0		
22-Jun-09	20	419969	6261087	419481	6261137	10	50	0	5	8:46	Yellow Warbler	<i>Dendroica petechia</i>	1	0		
22-Jun-09	20	419969	6261087	419481	6261137	10	50	0	5	8:46	Northern Waterthrush	<i>Seiurus noveboracensis</i>	1	0		
23-Jun-09	21	397475	6252692	397824	6253454	8	100	0	1	6:16	American Redstart	<i>Setophaga ruticilla</i>	2	0		
23-Jun-09	21	397475	6252692	397824	6253454	8	100	0	1	6:16	Yellow Warbler	<i>Dendroica petechia</i>	3	0		
23-Jun-09	21	397475	6252692	397824	6253454	8	100	0	1	6:16	Swainson's Thrush	<i>Catharus ustulatus</i>	1	0		
23-Jun-09	21	397475	6252692	397824	6253454	8	100	0	1	6:16	American Robin	<i>Turdus migratorius</i>	2	0		
23-Jun-09	21	397475	6252692	397824	6253454	8	100	0	1	6:16	Warbling Vireo	<i>Vireo gilvus</i>	1	0		
23-Jun-09	21	397475	6252692	397824	6253454	8	100	0	1	6:16	Dark-eyed Junco	<i>Junco hyemalis</i>	1	0		
23-Jun-09	21	397475	6252692	397824	6253454	8	100	0	2	6:28	Warbling Vireo	<i>Vireo gilvus</i>	1	0		
23-Jun-09	21	397475	6252692	397824	6253454	8	100	0	2	6:28	Yellow Warbler	<i>Dendroica petechia</i>	1	0		
23-Jun-09	21	397475	6252692	397824	6253454	8	100	0	2	6:28	Townsend's Warbler	<i>Dendroica townsendi</i>	0	1		
23-Jun-09	21	397475	6252692	397824	6253454	8	100	0	3	6:41	Pacific-slope Flycatcher	<i>Empidonax difficilis</i>	2	0		
23-Jun-09	21	397475	6252692	397824	6253454	8	100	0	3	6:41	Black-capped Chickadee	<i>Poecile atricapillus</i>	1	0		
23-Jun-09	21	397475	6252692	397824	6253454	8	100	0	4	6:55	Swainson's Thrush	<i>Catharus ustulatus</i>	0	1		
23-Jun-09	21	397475	6252692	397824	6253454	8	100	0	4	6:55	American Robin	<i>Turdus migratorius</i>	1	0		
23-Jun-09	21	397475	6252692	397824	6253454	8	100	0	4	6:55	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
23-Jun-09	21	397475	6252692	397824	6253454	8	100	0	4	6:55	Varied Thrush	<i>Ixoreus naevius</i>	1	0		
23-Jun-09	21	397475	6252692	397824	6253454	8	100	0	5	7:07	Pacific-slope Flycatcher	<i>Empidonax difficilis</i>	1	0		
23-Jun-09	21	397475	6252692	397824	6253454	8	100	0	5	7:07	Golden-crowned Kinglet	<i>Regulus satrapa</i>	2	0		
23-Jun-09	22	403536	6257632	403454	6258406	10	100	0	1	7:38	Yellow Warbler	<i>Dendroica petechia</i>	1	0		
23-Jun-09	22	403536	6257632	403454	6258406	10	100	0	1	7:38	Townsend's Warbler	<i>Dendroica townsendi</i>	0	1		
23-Jun-09	22	403536	6257632	403454	6258406	10	100	0	1	7:38	Warbling Vireo	<i>Vireo gilvus</i>	0	1		
23-Jun-09	22	403536	6257632	403454	6258406	10	100	0	2	7:50	Swainson's Thrush	<i>Catharus ustulatus</i>	0	1		
23-Jun-09	22	403536	6257632	403454	6258406	10	100	0	2	7:50	Yellow Warbler	<i>Dendroica petechia</i>	0	1		
23-Jun-09	22	403536	6257632	403454	6258406	10	100	0	2	7:50	Pine Siskin	<i>Carduelis pinus</i>	1	0		
23-Jun-09	22	403536	6257632	403454	6258406	10	100	0	2	7:50	Yellow-rumped Warbler	<i>Dendroica coronata</i>	0	1		
23-Jun-09	22	403536	6257632	403454	6258406	10	100	0	2	7:50	Golden-crowned Kinglet	<i>Regulus satrapa</i>	1	0		
23-Jun-09	22	403536	6257632	403454	6258406	10	100	0	2	7:50	Pacific-slope Flycatcher	<i>Empidonax difficilis</i>	2	0		
23-Jun-09	22	403536	6257632	403454	6258406	10	100	0	3	8:04	Hermit Thrush	<i>Catharus guttatus</i>	1	0		
23-Jun-09	22	403536	6257632	403454	6258406	10	100	0	4	8:33	Townsend's Warbler	<i>Dendroica townsendi</i>	2	0		
23-Jun-09	22	403536	6257632	403454	6258406	10	100	0	4	8:33	Warbling Vireo	<i>Vireo gilvus</i>	1	0		
23-Jun-09	22	403536	6257632	403454	6258406	10	100	0	4	8:33	Golden-crowned Kinglet	<i>Regulus satrapa</i>	2	0		
23-Jun-09	22	403536	6257632	403454	6258406	10	100	0	4	8:33	Chestnut-backed Chickadee	<i>Poecile rufescens</i>	1	0		
23-Jun-09	22	403536	6257632	403454	6258406	10	100	0	5	8:53	Winter Wren	<i>Troglodytes troglodytes</i>	1	0		
23-Jun-09	22	403536	6257632	403454	6258406	10	100	0	5	8:53	Pacific-slope Flycatcher	<i>Empidonax difficilis</i>	1	1		
23-Jun-09	22	403536	6257632	403454	6258406	10	100	0	5	8:53	Pine Siskin	<i>Carduelis pinus</i>	1	0		
23-Jun-09	22	403536	6257632	403454	6258406	10	100	0	5	8:53	Varied Thrush	<i>Ixoreus naevius</i>	1	0		FC
23-Jun-09	33	430668	6283612	429878	6283539	5	100	0	1	4:46	Yellow Warbler	<i>Dendroica petechia</i>	2	0		
23-Jun-09	33	430668	6283612	429878	6283539	5	100	0	1	4:46	Hermit Thrush	<i>Catharus guttatus</i>	0	1		
23-Jun-09	33	430668	6283612	429878	6283539	5	100	0	1	4:46	Savannah Sparrow	<i>Passerculus sandwichensis</i>	1	0		
23-Jun-09	33	430668	6283612	429878	6283539	5	100	0	1	4:46	Wilson's Warbler	<i>Wilsonia pusilla</i>	0	1		
23-Jun-09	33	430668	6283612	429878	6283539	5	100	0	1	4:46	Fox Sparrow	<i>Passerella iliaca</i>	2	0		
23-Jun-09	33	430668	6283612	429878	6283539	5	100	0	2	5:01	Yellow Warbler	<i>Dendroica petechia</i>	2	1		
23-Jun-09	33	430668	6283612	429878	6283539	5	100	0	2	5:01	Fox Sparrow	<i>Passerella iliaca</i>	1	0		
23-Jun-09	33	430668	6283612	429878	6283539	5	100	0	2	5:01	Varied Thrush	<i>Ixoreus naevius</i>	0	2		
23-Jun-09	33	430668	6283612	429878	6283539	5	100	0	2	5:01	Townsend's Warbler	<i>Dendroica townsendi</i>	0	2		
23-Jun-09	33	430668	6283612	429878	6283539	5	100	0	2	5:01	unknown chickadee		0	1		unknown chickadee
23-Jun-09	33	430668	6283612	429878	6283539	5	100	0	2	5:01	Hermit Thrush	<i>Catharus guttatus</i>	0	1		
23-Jun-09	33	430668	6283612	429878	6283539	5	100	0	3	5:14	Varied Thrush	<i>Ixoreus naevius</i>	1	2		
23-Jun-09	33	430668	6283612	429878	6283539	5	100	0	3	5:14	Hermit Thrush	<i>Catharus guttatus</i>	1	0		

Appendix 5.3-2. Summary of Variable Range Point Count (VRPC) Data, 2009

Date	Transect ID	Transect Start		Transect End		Temp (°C)	Cloud Cover (%)	Wind Scale	Point No.	Time	Species	Scientific Name	Total Birds <100 m	Total Birds	Breeding Obs.	Comment(s)
		Easting	Northing	Easting	Northing											
23-Jun-09	33	430668	6283612	429878	6283539	5	100	0	3	5:14	Yellow Warbler	<i>Dendroica petechia</i>	1	0		
23-Jun-09	33	430668	6283612	429878	6283539	5	100	0	3	5:14	Fox Sparrow	<i>Passerella iliaca</i>	1	0		
23-Jun-09	33	430668	6283612	429878	6283539	5	100	0	3	5:14	Orange-crowned Warbler	<i>Vermivora celata</i>	1	0		
23-Jun-09	33	430668	6283612	429878	6283539	5	100	0	3	5:14	Black-capped Chickadee	<i>Poecile atricapillus</i>	1	0		
23-Jun-09	33	430668	6283612	429878	6283539	5	100	0	3	5:14	American Robin	<i>Turdus migratorius</i>	0	1		
23-Jun-09	33	430668	6283612	429878	6283539	5	100	0	3	5:14	Townsend's Warbler	<i>Dendroica townsendi</i>	1	0		
23-Jun-09	33	430668	6283612	429878	6283539	5	100	0	4	5:24	Golden-crowned Sparrow	<i>Zonotrichia atricapilla</i>	0	1		
23-Jun-09	33	430668	6283612	429878	6283539	5	100	0	4	5:24	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
23-Jun-09	33	430668	6283612	429878	6283539	5	100	0	4	5:24	Varied Thrush	<i>Ixoreus naevius</i>	1	1		
23-Jun-09	33	430668	6283612	429878	6283539	5	100	0	4	5:24	Fox Sparrow	<i>Passerella iliaca</i>	2	0		
23-Jun-09	33	430668	6283612	429878	6283539	5	100	0	4	5:24	Yellow Warbler	<i>Dendroica petechia</i>	1	0		
23-Jun-09	33	430668	6283612	429878	6283539	5	100	0	4	5:24	Dark-eyed Junco	<i>Junco hyemalis</i>	1	0		
23-Jun-09	33	430668	6283612	429878	6283539	5	100	0	4	5:24	Savannah Sparrow	<i>Passerculus sandwichensis</i>	1	0		
23-Jun-09	33	430668	6283612	429878	6283539	5	100	0	4	5:24	Orange-crowned Warbler	<i>Vermivora celata</i>	1	0		
23-Jun-09	33	430668	6283612	429878	6283539	5	100	0	4	5:24	Hermit Thrush	<i>Catharus guttatus</i>	0	1		
23-Jun-09	33	430668	6283612	429878	6283539	5	100	0	5	5:36	Yellow Warbler	<i>Dendroica petechia</i>	2	1		
23-Jun-09	33	430668	6283612	429878	6283539	5	100	0	5	5:36	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
23-Jun-09	33	430668	6283612	429878	6283539	5	100	0	5	5:36	Savannah Sparrow	<i>Passerculus sandwichensis</i>	0	1		
23-Jun-09	33	430668	6283612	429878	6283539	5	100	0	5	5:36	Western Wood-pewee	<i>Contopus sordidulus</i>	1	0		
24-Jun-09	3	417350	6262151	417978	6261967	8	95	0	1	7:51	Hermit Thrush	<i>Catharus guttatus</i>	1	0		
24-Jun-09	3	417350	6262151	417978	6261967	8	95	0	1	7:51	Townsend's Warbler	<i>Dendroica townsendi</i>	1	1		
24-Jun-09	3	417350	6262151	417978	6261967	8	95	0	1	7:51	Yellow Warbler	<i>Dendroica petechia</i>	1	0		
24-Jun-09	3	417350	6262151	417978	6261967	8	95	0	1	7:51	Rufous Hummingbird	<i>Selasphorus rufus</i>	0	1		
24-Jun-09	3	417350	6262151	417978	6261967	8	95	0	2	8:17	Golden-crowned Kinglet	<i>Regulus satrapa</i>	3	0		
24-Jun-09	3	417350	6262151	417978	6261967	8	95	0	2	8:17	Townsend's Warbler	<i>Dendroica townsendi</i>	1	1		
24-Jun-09	3	417350	6262151	417978	6261967	8	95	0	3	8:39	Red-breasted Sapsucker	<i>Sphyrapicus ruber</i>	1	0		
24-Jun-09	3	417350	6262151	417978	6261967	8	95	0	3	8:39	Hermit Thrush	<i>Catharus guttatus</i>	0	1		
24-Jun-09	3	417350	6262151	417978	6261967	8	95	0	3	8:39	Townsend's Warbler	<i>Dendroica townsendi</i>	1	0		
24-Jun-09	3	417350	6262151	417978	6261967	8	95	0	3	8:39	American Redstart	<i>Setophaga ruticilla</i>	1	0		
24-Jun-09	3	417350	6262151	417978	6261967	8	95	0	3	8:39	Yellow Warbler	<i>Dendroica petechia</i>	1	0		
24-Jun-09	3	417350	6262151	417978	6261967	8	95	0	3	8:39	Golden-crowned Kinglet	<i>Regulus satrapa</i>	1	0		
24-Jun-09	3	417350	6262151	417978	6261967	8	95	0	4	9:02	Swainson's Thrush	<i>Catharus ustulatus</i>	0	1		
24-Jun-09	3	417350	6262151	417978	6261967	8	95	0	4	9:02	Brown Creeper	<i>Certhia americana</i>	1	0		
24-Jun-09	3	417350	6262151	417978	6261967	8	0	0	5	9:16	Pacific-slope Flycatcher	<i>Empidonax difficilis</i>	1	0		
24-Jun-09	3	417350	6262151	417978	6261967	8	0	0	5	9:16	Townsend's Warbler	<i>Dendroica townsendi</i>	1	0		
24-Jun-09	3	417350	6262151	417978	6261967	8	0	0	5	9:16	Hermit Thrush	<i>Catharus guttatus</i>	0	1		
24-Jun-09	4	407980	6263379	407675	6262797	8	95	0	1	6:24	Townsend's Warbler	<i>Dendroica townsendi</i>	1	1		
24-Jun-09	4	407980	6263379	407675	6262797	8	95	0	1	6:24	Pacific-slope Flycatcher	<i>Empidonax difficilis</i>	1	0		
24-Jun-09	4	407980	6263379	407675	6262797	8	95	0	1	6:24	Golden-crowned Kinglet	<i>Regulus satrapa</i>	2	0		
24-Jun-09	4	407980	6263379	407675	6262797	8	95	0	1	6:24	Yellow Warbler	<i>Dendroica petechia</i>	0	1		
24-Jun-09	4	449417	6283957	449934	6284083	8	95	0	1	6:24	Varied Thrush	<i>Ixoreus naevius</i>	0	1		
24-Jun-09	4	407980	6263379	407675	6262797	8	95	0	2	6:37	Swainson's Thrush	<i>Catharus ustulatus</i>	1	0		
24-Jun-09	4	407980	6263379	407675	6262797	8	95	0	2	6:37	Varied Thrush	<i>Ixoreus naevius</i>	2	0		
24-Jun-09	4	407980	6263379	407675	6262797	8	95	0	2	6:37	Townsend's Warbler	<i>Dendroica townsendi</i>	2	3		
24-Jun-09	4	407980	6263379	407675	6262797	8	95	0	2	6:37	Pacific-slope Flycatcher	<i>Empidonax difficilis</i>	0	1		
24-Jun-09	4	407980	6263379	407675	6262797	8	95	0	2	6:37	Swainson's Thrush	<i>Catharus ustulatus</i>	1	0		
24-Jun-09	4	407980	6263379	407675	6262797	8	95	0	3	6:52	Pacific-slope Flycatcher	<i>Empidonax difficilis</i>	2	0		
24-Jun-09	4	407980	6263379	407675	6262797	8	95	0	3	6:52	Townsend's Warbler	<i>Dendroica townsendi</i>	0	1		
24-Jun-09	4	407980	6263379	407675	6262797	8	95	0	3	6:52	Winter Wren	<i>Troglodytes troglodytes</i>	1	0		
24-Jun-09	4	407980	6263379	407675	6262797	8	95	0	3	6:52	Western Tanager	<i>Piranga ludoviciana</i>	0	1		
24-Jun-09	4	407980	6263379	407675	6262797	8	95	0	3	6:52	Varied Thrush	<i>Ixoreus naevius</i>	0	1		
24-Jun-09	4	407980	6263379	407675	6262797	8	95	0	3	6:52	unknown chickadee		2	0		unknown chickadees
24-Jun-09	4	407980	6263379	407675	6262797	8	95	0	3	6:52	American Robin	<i>Turdus migratorius</i>	1	0		
24-Jun-09	4	407980	6263379	407675	6262797	8	95	0	4	7:08	Pacific-slope Flycatcher	<i>Empidonax difficilis</i>	1	0		
24-Jun-09	4	407980	6263379	407675	6262797	8	95	0	4	7:08	Varied Thrush	<i>Ixoreus naevius</i>	1	0		
24-Jun-09	4	407980	6263379	407675	6262797	8	95	0	4	7:08	Dark-eyed Junco	<i>Junco hyemalis</i>	1	0		
24-Jun-09	4	407980	6263379	407675	6262797	8	95	0	4	7:08	Golden-crowned Kinglet	<i>Regulus satrapa</i>	1	0		

Appendix 5.3-2. Summary of Variable Range Point Count (VRPC) Data, 2009

Date	Transect ID	Transect Start		Transect End		Temp (°C)	Cloud Cover (%)	Wind Scale	Point No.	Time	Species	Scientific Name	Total Birds <100 m	Total Birds	Breeding Obs.	Comment(s)
		Easting	Northing	Easting	Northing											
24-Jun-09	4	407980	6263379	407675	6262797	8	95	0	4	7:08	MacGillivray's warbler	<i>Oporornis tolmiei</i>	0	1		
24-Jun-09	4	407980	6263379	407675	6262797	8	95	0	4	7:08	Townsend's Warbler	<i>Dendroica townsendi</i>	1	0		
24-Jun-09	4	407980	6263379	407675	6262797	8	95	0	5	7:23	Varied Thrush	<i>Ixoreus naevius</i>	1	0		
24-Jun-09	4	407980	6263379	407675	6262797	8	95	0	5	7:23	Townsend's Warbler	<i>Dendroica townsendi</i>	0	1		
24-Jun-09	4	407980	6263379	407675	6262797	8	95	0	5	7:23	Northern Waterthrush	<i>Seiurus noveboracensis</i>	1	0		
24-Jun-09	4	407980	6263379	407675	6262797	8	95	0	5	7:23	MacGillivray's warbler	<i>Oporornis tolmiei</i>	0	1		
24-Jun-09	4	407980	6263379	407675	6262797	8	95	0	5	7:23	Red-breasted Nuthatch	<i>Sitta canadensis</i>	1	0		
24-Jun-09	4	407980	6263379	407675	6262797	8	95	0	5	7:23	Yellow-rumped Warbler	<i>Dendroica coronata</i>	0	1		
24-Jun-09	4	407980	6263379	407675	6262797	8	95	0	5	7:23	Winter Wren	<i>Troglodytes troglodytes</i>	1	0		
24-Jun-09	4	407980	6263379	407675	6262797	8	95	0	5	7:23	Swainson's Thrush	<i>Catharus ustulatus</i>	1	1		
24-Jun-09	4	407980	6263379	407675	6262797	8	95	0	5	7:23	Pacific-slope Flycatcher	<i>Empidonax difficilis</i>	1	0		
24-Jun-09	4	407980	6263379	407675	6262797	8	95	0	5	7:23	Red-breasted Sapsucker	<i>Sphyrapicus ruber</i>	0	1	NF	
24-Jun-09	5	407638	6257955	407528	6258532	5	100	0	1	4:54	Yellow Warbler	<i>Dendroica petechia</i>	0	1		
24-Jun-09	5	407638	6257955	407528	6258532	5	100	0	1	4:54	Warbling Vireo	<i>Vireo gilvus</i>	1	0		
24-Jun-09	5	407638	6257955	407528	6258532	5	100	0	1	4:54	Dark-eyed Junco	<i>Junco hyemalis</i>	1	0		
24-Jun-09	5	407638	6257955	407528	6258532	5	100	0	1	4:54	Varied Thrush	<i>Ixoreus naevius</i>	0	2		
24-Jun-09	5	407638	6257955	407528	6258532	5	100	0	1	4:54	Pacific-slope Flycatcher	<i>Empidonax difficilis</i>	0	1		
24-Jun-09	5	407638	6257955	407528	6258532	5	100	0	1	4:54	Black-capped Chickadee	<i>Poecile atricapillus</i>	0	1		
24-Jun-09	5	407638	6257955	407528	6258532	5	100	0	1	4:54	Winter Wren	<i>Troglodytes troglodytes</i>	0	1		
24-Jun-09	5	407638	6257955	407528	6258532	5	100	0	2	5:04	Yellow Warbler	<i>Dendroica petechia</i>	1	1		
24-Jun-09	5	407638	6257955	407528	6258532	5	100	0	2	5:04	Swainson's Thrush	<i>Catharus ustulatus</i>	1	0		
24-Jun-09	5	407638	6257955	407528	6258532	5	100	0	3	5:14	Townsend's Warbler	<i>Dendroica townsendi</i>	0	1		
24-Jun-09	5	407638	6257955	407528	6258532	5	100	0	3	5:14	Winter Wren	<i>Troglodytes troglodytes</i>	0	1		
24-Jun-09	5	407638	6257955	407528	6258532	5	100	0	3	5:14	Swainson's Thrush	<i>Catharus ustulatus</i>	0	1		
24-Jun-09	5	407638	6257955	407528	6258532	5	100	0	4	5:26	Western Tanager	<i>Piranga ludoviciana</i>	1	0		
24-Jun-09	5	407638	6257955	407528	6258532	5	100	0	4	5:26	Swainson's Thrush	<i>Catharus ustulatus</i>	0	1		
24-Jun-09	5	407638	6257955	407528	6258532	5	100	0	4	5:26	Townsend's Warbler	<i>Dendroica townsendi</i>	2	0		
24-Jun-09	5	407638	6257955	407528	6258532	5	100	0	4	5:26	Pacific-slope Flycatcher	<i>Empidonax difficilis</i>	1	0		
24-Jun-09	5	407638	6257955	407528	6258532	5	100	0	4	5:26	Varied Thrush	<i>Ixoreus naevius</i>	0	1		
24-Jun-09	5	407638	6257955	407528	6258532	5	100	0	4	5:26	unkown chickadee		1	0		unkown chickadee
24-Jun-09	5	407638	6257955	407528	6258532	5	100	0	4	5:26	Golden-crowned Kinglet	<i>Regulus satrapa</i>	2	0		
24-Jun-09	5	407638	6257955	407528	6258532	5	100	0	5	5:44	Townsend's Warbler	<i>Dendroica townsendi</i>	1	0		
24-Jun-09	5	407638	6257955	407528	6258532	5	100	0	5	5:44	Hermit Thrush	<i>Catharus guttatus</i>	0	1		
24-Jun-09	5	407638	6257955	407528	6258532	5	100	0	5	5:44	MacGillivray's warbler	<i>Oporornis tolmiei</i>	1	0		
24-Jun-09	5	407638	6257955	407528	6258532	5	100	0	5	5:44	Black-capped Chickadee	<i>Poecile atricapillus</i>	1	0		
24-Jun-09	5	407638	6257955	407528	6258532	5	100	0	5	5:44	Pacific-slope Flycatcher	<i>Empidonax difficilis</i>	0	1		
24-Jun-09	5	407638	6257955	407528	6258532	5	100	0	5	5:44	Townsend's Warbler	<i>Dendroica townsendi</i>	1	0		
24-Jun-09	5	407638	6257955	407528	6258532	5	100	0	5	5:44	Golden-crowned Kinglet	<i>Regulus satrapa</i>	1	0		
24-Jun-09	5	407638	6257955	407528	6258532	5	100	0	5	5:44	Swainson's Thrush	<i>Catharus ustulatus</i>	0	1		
25-Jun-09	34	469462	6253918	468922	6254678	10	100	0	1	4:56	MacGillivray's warbler	<i>Oporornis tolmiei</i>	1	0		
25-Jun-09	34	469462	6253918	468922	6254678	10	100	0	1	4:56	Swainson's Thrush	<i>Catharus ustulatus</i>	2	1		
25-Jun-09	34	469462	6253918	468922	6254678	10	100	0	1	4:56	Townsend's Warbler	<i>Dendroica townsendi</i>	0	1		
25-Jun-09	34	469462	6253918	468922	6254678	10	100	0	1	4:56	Western Wood-pewee	<i>Contopus sordidulus</i>	1	0		
25-Jun-09	34	469462	6253918	468922	6254678	10	100	0	1	4:56	Dark-eyed Junco	<i>Junco hyemalis</i>	1	0		
25-Jun-09	34	469462	6253918	468922	6254678	10	100	0	1	4:56	Tennessee Warbler	<i>Vermivora peregrina</i>	1	0		
25-Jun-09	34	469462	6253918	468922	6254678	10	100	0	1	4:56	Winter Wren	<i>Troglodytes troglodytes</i>	1	0		
25-Jun-09	34	469462	6253918	468922	6254678	10	100	0	1	4:56	Song Sparrow	<i>Melospiza melodia</i>	1	0		
25-Jun-09	34	469462	6253918	468922	6254678	10	100	0	2	5:06	Dark-eyed Junco	<i>Junco hyemalis</i>	2	0		
25-Jun-09	34	469462	6253918	468922	6254678	10	100	0	2	5:06	Boreal Chickadee	<i>Poecile hudsonica</i>	1	0		
25-Jun-09	34	469462	6253918	468922	6254678	10	100	0	2	5:06	Swainson's Thrush	<i>Catharus ustulatus</i>	0	1		
25-Jun-09	34	469462	6253918	468922	6254678	10	100	0	2	5:06	Warbling Vireo	<i>Vireo gilvus</i>	0	1		
25-Jun-09	34	469462	6253918	468922	6254678	10	100	0	2	5:06	Yellow-rumped Warbler	<i>Dendroica coronata</i>	0	1		
25-Jun-09	34	469462	6253918	468922	6254678	10	100	0	2	5:06	Townsend's Warbler	<i>Dendroica townsendi</i>	0	1		
25-Jun-09	34	469462	6253918	468922	6254678	10	100	0	2	5:06	Orange-crowned Warbler	<i>Vermivora celata</i>	1	0		
25-Jun-09	34	469462	6253918	468922	6254678	10	100	0	2	5:06	MacGillivray's warbler	<i>Oporornis tolmiei</i>	1	0		
25-Jun-09	34	469462	6253918	468922	6254678	10	100	0	3	5:16	American Redstart	<i>Setophaga ruticilla</i>	1	0		
25-Jun-09	34	469462	6253918	468922	6254678	10	100	0	3	5:16	Warbling Vireo	<i>Vireo gilvus</i>	1	0		

Appendix 5.3-2. Summary of Variable Range Point Count (VRPC) Data, 2009

Date	Transect ID	Transect Start		Transect End		Temp (°C)	Cloud Cover (%)	Wind Scale	Point No.	Time	Species	Scientific Name	Total Birds <100 m	Total Birds	Breeding Obs.	Comment(s)
		Easting	Northing	Easting	Northing											
25-Jun-09	34	469462	6253918	468922	6254678	10	100	0	3	5:16	MacGillivray's warbler	<i>Oporornis tolmiei</i>	1	0		
25-Jun-09	34	469462	6253918	468922	6254678	10	100	0	3	5:16	Alder Flycatcher	<i>Empidonax alnorum</i>	1	0		
25-Jun-09	34	469462	6253918	468922	6254678	10	100	0	3	5:16	Western Wood-pewee	<i>Contopus sordidulus</i>	1	0		
25-Jun-09	34	469462	6253918	468922	6254678	10	100	0	3	5:16	Orange-crowned Warbler	<i>Vermivora celata</i>	0	1		
25-Jun-09	34	469462	6253918	468922	6254678	10	100	0	3	5:16	Yellow Warbler	<i>Dendroica petechia</i>	2	0		
25-Jun-09	34	469462	6253918	468922	6254678	10	100	0	3	5:16	Least Flycatcher	<i>Empidonax minimus</i>	1	0		
25-Jun-09	34	469462	6253918	468922	6254678	10	100	0	3	5:16	unknown woodpecker		0	1		unknown woodpecker
25-Jun-09	34	469462	6253918	468922	6254678	10	100	0	3	5:16	Northern Waterthrush	<i>Seiurus noveboracensis</i>	1	0		
25-Jun-09	34	469462	6253918	468922	6254678	10	100	0	4	5:27	Swainson's Thrush	<i>Catharus ustulatus</i>	2	1		
25-Jun-09	34	469462	6253918	468922	6254678	10	100	0	4	5:27	American Redstart	<i>Setophaga ruticilla</i>	2	1		
25-Jun-09	34	469462	6253918	468922	6254678	10	100	0	4	5:27	Townsend's Warbler	<i>Dendroica townsendi</i>	0	2		
25-Jun-09	34	469462	6253918	468922	6254678	10	100	0	4	5:27	Rufous Hummingbird	<i>Selasphorus rufus</i>	1	0		
25-Jun-09	34	469462	6253918	468922	6254678	10	100	0	4	5:27	Yellow Warbler	<i>Dendroica petechia</i>	1	0		
25-Jun-09	34	469462	6253918	468922	6254678	10	100	0	4	5:27	MacGillivray's warbler	<i>Oporornis tolmiei</i>	1	0		
25-Jun-09	34	469462	6253918	468922	6254678	10	100	0	4	5:27	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
25-Jun-09	34	469462	6253918	468922	6254678	10	100	0	4	5:27	Dark-eyed Junco	<i>Junco hyemalis</i>	1	0		
25-Jun-09	34	469462	6253918	468922	6254678	10	100	0	4	5:27	Western Wood-pewee	<i>Contopus sordidulus</i>	0	1		
25-Jun-09	34	469462	6253918	468922	6254678	10	100	0	5	5:50	Spruce Grouse	<i>Falcipectus canadensis</i>	0	1		
25-Jun-09	34	469462	6253918	468922	6254678	10	100	0	5	5:50	Winter Wren	<i>Troglodytes troglodytes</i>	1	0		
25-Jun-09	34	469462	6253918	468922	6254678	10	100	0	5	5:50	Varied Thrush	<i>Ixoreus naevius</i>	0	1		
25-Jun-09	34	469462	6253918	468922	6254678	10	100	0	5	5:50	Swainson's Thrush	<i>Catharus ustulatus</i>	1	0		
25-Jun-09	34	469462	6253918	468922	6254678	10	100	0	5	5:50	Townsend's Warbler	<i>Dendroica townsendi</i>	1	1		
25-Jun-09	34	469462	6253918	468922	6254678	10	100	0	5	5:50	Chipping Sparrow	<i>Spizella passerina</i>	1	0		
25-Jun-09	34	469462	6253918	468922	6254678	10	100	0	5	5:50	American Robin	<i>Turdus migratorius</i>	1	0		
25-Jun-09	34	469462	6253918	468922	6254678	10	100	0	5	5:50	Rufous Hummingbird	<i>Selasphorus rufus</i>	1	0		
25-Jun-09	34	469462	6253918	468922	6254678	10	100	0	5	5:50	Chestnut-backed Chickadee	<i>Poecile rufescens</i>	1	0		
25-Jun-09	35	475615	6248440	476078	6249282	16	100	0	1	6:15	Ruby-crowned Kinglet	<i>Regulus calendula</i>	0	1		
25-Jun-09	35	475615	6248440	476078	6249282	16	100	0	1	6:15	Common Yellowthroat	<i>Geothlypis trichas</i>	2	1		
25-Jun-09	35	475615	6248440	476078	6249282	16	100	0	1	6:15	Western Wood-pewee	<i>Contopus sordidulus</i>	1	0		
25-Jun-09	35	475615	6248440	476078	6249282	16	100	0	1	6:15	Savannah Sparrow	<i>Passerculus sandwichensis</i>	1	1		
25-Jun-09	35	475615	6248440	476078	6249282	16	100	0	1	6:15	Swainson's Thrush	<i>Catharus ustulatus</i>	0	1		
25-Jun-09	35	475615	6248440	476078	6249282	16	100	0	1	6:15	Townsend's Warbler	<i>Dendroica townsendi</i>	0	1		
25-Jun-09	35	475615	6248440	476078	6249282	16	100	0	1	6:15	Song Sparrow	<i>Melospiza melodia</i>	0	1		
25-Jun-09	35	475615	6248440	476078	6249282	16	100	0	2	6:29	Red-breasted Sapsucker	<i>Sphyrapicus ruber</i>	0	1		
25-Jun-09	35	475615	6248440	476078	6249282	16	100	0	2	6:29	Western Wood-pewee	<i>Contopus sordidulus</i>	1	0		
25-Jun-09	35	475615	6248440	476078	6249282	16	100	0	2	6:29	Warbling Vireo	<i>Vireo gilvus</i>	1	0		
25-Jun-09	35	475615	6248440	476078	6249282	16	100	0	2	6:29	Yellow Warbler	<i>Dendroica petechia</i>	1	0		
25-Jun-09	35	475615	6248440	476078	6249282	16	100	0	2	6:29	Alder Flycatcher	<i>Empidonax alnorum</i>	1	0		
25-Jun-09	35	475615	6248440	476078	6249282	16	100	0	2	6:29	Ruby-crowned Kinglet	<i>Regulus calendula</i>	0	1		
25-Jun-09	35	475615	6248440	476078	6249282	16	100	0	2	6:29	Chipping Sparrow	<i>Spizella passerina</i>	0	1		
25-Jun-09	35	475615	6248440	476078	6249282	16	100	0	2	6:29	Orange-crowned Warbler	<i>Vermivora celata</i>	1	0		
25-Jun-09	35	475615	6248440	476078	6249282	16	100	0	2	6:29	MacGillivray's warbler	<i>Oporornis tolmiei</i>	1	0		
25-Jun-09	35	475615	6248440	476078	6249282	16	100	0	3	6:42	Varied Thrush	<i>Ixoreus naevius</i>	2	0		
25-Jun-09	35	475615	6248440	476078	6249282	16	100	0	3	6:42	Pine Siskin	<i>Carduelis pinus</i>	1	0		
25-Jun-09	35	475615	6248440	476078	6249282	16	100	0	3	6:42	Alder Flycatcher	<i>Empidonax alnorum</i>	1	0		
25-Jun-09	35	475615	6248440	476078	6249282	16	100	0	3	6:42	Ruffed Grouse	<i>Bonasa umbellus</i>	0	1		
25-Jun-09	35	475615	6248440	476078	6249282	16	100	0	4	7:00	Orange-crowned Warbler	<i>Vermivora celata</i>	1	0		
25-Jun-09	35	475615	6248440	476078	6249282	16	100	0	4	7:00	American Redstart	<i>Setophaga ruticilla</i>	1	0		
25-Jun-09	35	475615	6248440	476078	6249282	16	100	0	4	7:00	Ruby-crowned Kinglet	<i>Regulus calendula</i>	1	0		
25-Jun-09	35	475615	6248440	476078	6249282	16	100	0	5	7:17	Yellow-rumped Warbler	<i>Dendroica coronata</i>	1	0		
25-Jun-09	35	475615	6248440	476078	6249282	16	100	0	5	7:17	Blackpoll Warbler	<i>Dendroica striata</i>	1	0		
25-Jun-09	35	475615	6248440	476078	6249282	16	100	0	5	7:17	Savannah Sparrow	<i>Passerculus sandwichensis</i>	1	0		
25-Jun-09	35	475615	6248440	476078	6249282	16	100	0	5	7:17	Swainson's Thrush	<i>Catharus ustulatus</i>	1	2		
25-Jun-09	35	475615	6248440	476078	6249282	16	100	0	5	7:17	MacGillivray's warbler	<i>Oporornis tolmiei</i>	1	0		
25-Jun-09	35	475615	6248440	476078	6249282	16	100	0	5	7:17	Townsend's Warbler	<i>Dendroica townsendi</i>	0	1		
25-Jun-09	36	458158	6266013	457517	6266684	8	100	0	1	8:26	Hermit Thrush	<i>Catharus guttatus</i>	2	1		
25-Jun-09	36	458158	6266013	457517	6266684	8	100	0	1	8:26	Varied Thrush	<i>Ixoreus naevius</i>	0	2		

Appendix 5.3-2. Summary of Variable Range Point Count (VRPC) Data, 2009

Date	Transect ID	Transect Start		Transect End		Temp (°C)	Cloud Cover (%)	Wind Scale	Point No.	Time	Species	Scientific Name	Total Birds <100 m	Total Birds	Breeding Obs.	Comment(s)
		Easting	Northing	Easting	Northing											
25-Jun-09	36	458158	6266013	457517	6266684	8	100	0	1	8:26	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
25-Jun-09	36	458158	6266013	457517	6266684	8	100	0	1	8:26	Dark-eyed Junco	<i>Junco hyemalis</i>	2	0		
25-Jun-09	36	458158	6266013	457517	6266684	8	100	0	1	8:26	Chestnut-backed Chickadee	<i>Poecile rufescens</i>	1	0		
25-Jun-09	36	458158	6266013	457517	6266684	8	100	0	1	8:26	Winter Wren	<i>Troglodytes troglodytes</i>	0	1		
25-Jun-09	36	458158	6266013	457517	6266684	8	100	0	1	8:26	Swainson's Thrush	<i>Catharus ustulatus</i>	0	1		
25-Jun-09	36	458158	6266013	457517	6266684	8	100	0	2	8:46	Mountain Chickadee	<i>Poecile gambeli</i>	1	0		
25-Jun-09	36	458158	6266013	457517	6266684	8	100	0	2	8:46	Savannah Sparrow	<i>Passerculus sandwichensis</i>	2	0		
25-Jun-09	36	458158	6266013	457517	6266684	8	100	0	2	8:46	Hermit Thrush	<i>Catharus guttatus</i>	1	1		
25-Jun-09	36	458158	6266013	457517	6266684	8	100	0	2	8:46	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
25-Jun-09	36	458158	6266013	457517	6266684	8	100	0	2	8:46	Yellow-rumped Warbler	<i>Dendroica coronata</i>	0	1		
25-Jun-09	36	458158	6266013	457517	6266684	8	100	0	2	8:46	Pine Siskin	<i>Carduelis pinus</i>	1	0		
25-Jun-09	36	458158	6266013	457517	6266684	8	100	0	3	8:52	Blackpoll Warbler	<i>Dendroica striata</i>	1	0		
25-Jun-09	36	458158	6266013	457517	6266684	8	100	0	3	8:52	Varied Thrush	<i>Ixoreus naevius</i>	2	0		
25-Jun-09	36	458158	6266013	457517	6266684	8	100	0	3	8:52	Savannah Sparrow	<i>Passerculus sandwichensis</i>	2	0		
25-Jun-09	36	458158	6266013	457517	6266684	8	100	0	3	8:52	Lincoln's Sparrow	<i>Melospiza lincolnii</i>	1	0		
25-Jun-09	36	458158	6266013	457517	6266684	8	100	0	3	8:52	Ruby-crowned Kinglet	<i>Regulus calendula</i>	0	1		
25-Jun-09	36	458158	6266013	457517	6266684	8	100	0	3	8:52	Yellow-rumped Warbler	<i>Dendroica coronata</i>	0	1		
25-Jun-09	36	458158	6266013	457517	6266684	8	100	0	3	8:52	Hermit Thrush	<i>Catharus guttatus</i>	1	0		
25-Jun-09	36	458158	6266013	457517	6266684	8	100	0	3	8:52	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
25-Jun-09	36	458158	6266013	457517	6266684	8	100	0	4	9:02	Swainson's Thrush	<i>Catharus ustulatus</i>	2	1		
25-Jun-09	36	458158	6266013	457517	6266684	8	100	0	4	9:02	Ruby-crowned Kinglet	<i>Regulus calendula</i>	1	1		
25-Jun-09	36	458158	6266013	457517	6266684	8	100	0	4	9:02	Blackpoll Warbler	<i>Dendroica striata</i>	1	0		
25-Jun-09	36	458158	6266013	457517	6266684	8	100	0	4	9:02	Townsend's Warbler	<i>Dendroica townsendi</i>	2	0		
25-Jun-09	36	458158	6266013	457517	6266684	8	100	0	4	9:02	Savannah Sparrow	<i>Passerculus sandwichensis</i>	1	0		
25-Jun-09	36	458158	6266013	457517	6266684	8	100	0	4	9:02	Wilson's Warbler	<i>Wilsonia pusilla</i>	0	1		
25-Jun-09	36	458158	6266013	457517	6266684	8	100	0	5	9:17	Yellow Warbler	<i>Dendroica petechia</i>	1	0		
25-Jun-09	36	458158	6266013	457517	6266684	8	100	0	5	9:17	Wilson's Warbler	<i>Wilsonia pusilla</i>	2	0		
25-Jun-09	36	458158	6266013	457517	6266684	8	100	0	5	9:17	Yellow-rumped Warbler	<i>Dendroica coronata</i>	0	1		
25-Jun-09	36	458158	6266013	457517	6266684	8	100	0	5	9:17	Savannah Sparrow	<i>Passerculus sandwichensis</i>	0	1		
25-Jun-09	36	458158	6266013	457517	6266684	8	100	0	5	9:17	Varied Thrush	<i>Ixoreus naevius</i>	0	2		
25-Jun-09	36	458158	6266013	457517	6266684	8	100	0	5	9:17	Hermit Thrush	<i>Catharus guttatus</i>	0	1		
25-Jun-09	36	458158	6266013	457517	6266684	8	100	0	5	9:17	Townsend's Warbler	<i>Dendroica townsendi</i>	0	1		
25-Jun-09	36	458158	6266013	457517	6266684	8	100	0	5	9:17	American Three-toed Woodpecker	<i>Picoides dorsalis</i>	0	1		
26-Jun-09	1	421403	6265523	420684	6265280	10	100	0	1	6:39	Yellow Warbler	<i>Dendroica petechia</i>	2	1		
26-Jun-09	1	421403	6265523	420684	6265280	10	100	0	1	6:39	Hermit Thrush	<i>Catharus guttatus</i>	0	1		
26-Jun-09	1	421403	6265523	420684	6265280	10	100	0	2	6:58	Lincoln's Sparrow	<i>Melospiza lincolnii</i>	1	1		
26-Jun-09	1	421403	6265523	420684	6265280	10	100	0	2	6:58	Yellow Warbler	<i>Dendroica petechia</i>	2	2		
26-Jun-09	1	421403	6265523	420684	6265280	10	100	0	2	6:58	Varied Thrush	<i>Ixoreus naevius</i>	0	1		
26-Jun-09	1	421403	6265523	420684	6265280	10	100	0	2	6:58	Pine Siskin	<i>Carduelis pinus</i>	1	0		
26-Jun-09	1	421403	6265523	420684	6265280	10	100	0	3	7:15	Yellow Warbler	<i>Dendroica petechia</i>	3	1		
26-Jun-09	1	421403	6265523	420684	6265280	10	100	0	3	7:15	Townsend's Warbler	<i>Dendroica townsendi</i>	1	0		
26-Jun-09	1	421403	6265523	420684	6265280	10	100	0	3	7:15	Pine Siskin	<i>Carduelis pinus</i>	2	0		
26-Jun-09	1	421403	6265523	420684	6265280	10	100	0	4	7:32	Yellow Warbler	<i>Dendroica petechia</i>	1	1		
26-Jun-09	1	421403	6265523	420684	6265280	10	100	0	4	7:32	Yellow-rumped Warbler	<i>Dendroica coronata</i>	2	0		
26-Jun-09	1	421403	6265523	420684	6265280	10	100	0	4	7:32	Townsend's Warbler	<i>Dendroica townsendi</i>	1	0		
26-Jun-09	1	421403	6265523	420684	6265280	10	100	0	5	9:07	Ruby-crowned Kinglet	<i>Regulus calendula</i>	1	0		
26-Jun-09	1	421403	6265523	420684	6265280	10	100	0	5	9:07	Pine Siskin	<i>Carduelis pinus</i>	1	0		
26-Jun-09	6	410196	6270966	410155	6270173	5	90	0	1	5:08	Pacific-slope Flycatcher	<i>Empidonax difficilis</i>	1	0		
26-Jun-09	6	410196	6270966	410155	6270173	5	90	0	1	5:08	unknown woodpecker		1	0		unknown woodpecker
26-Jun-09	6	410196	6270966	410155	6270173	5	90	0	1	5:08	Varied Thrush	<i>Ixoreus naevius</i>	0	1		
26-Jun-09	6	410196	6270966	410155	6270173	5	90	0	1	5:08	Dark-eyed Junco	<i>Junco hyemalis</i>	1	0		
26-Jun-09	6	410196	6270966	410155	6270173	5	90	0	1	5:08	Yellow Warbler	<i>Dendroica petechia</i>	0	1		
26-Jun-09	6	410196	6270966	410155	6270173	5	90	0	2	5:20	Pacific-slope Flycatcher	<i>Empidonax difficilis</i>	1	0		
26-Jun-09	6	410196	6270966	410155	6270173	5	90	0	2	5:20	Winter Wren	<i>Troglodytes troglodytes</i>	0	1		
26-Jun-09	6	410196	6270966	410155	6270173	5	90	0	2	5:20	Townsend's Warbler	<i>Dendroica townsendi</i>	1	0		
26-Jun-09	6	410196	6270966	410155	6270173	5	90	0	3	5:32	Winter Wren	<i>Troglodytes troglodytes</i>	1	0		
26-Jun-09	6	410196	6270966	410155	6270173	5	90	0	3	5:32	Varied Thrush	<i>Ixoreus naevius</i>	0	1		

Appendix 5.3-2. Summary of Variable Range Point Count (VRPC) Data, 2009

Date	Transect ID	Transect Start		Transect End		Temp (°C)	Cloud Cover (%)	Wind Scale	Point No.	Time	Species	Scientific Name	Total Birds <100 m	Total Birds	Breeding Obs.	Comment(s)
		Easting	Northing	Easting	Northing											
26-Jun-09	6	410196	6270966	410155	6270173	5	90	0	3	5:32	Pacific-slope Flycatcher	<i>Empidonax difficilis</i>	1	0		
26-Jun-09	6	410196	6270966	410155	6270173	5	90	0	4	5:47	MacGillivray's warbler	<i>Oporornis tolmiei</i>	1	0		
26-Jun-09	6	410196	6270966	410155	6270173	5	90	0	4	5:47	Steller's Jay	<i>Cyanocitta stelleri</i>	1	0		
26-Jun-09	6	410196	6270966	410155	6270173	5	90	0	4	5:47	Yellow-rumped Warbler	<i>Dendroica coronata</i>	1	0		
26-Jun-09	6	410196	6270966	410155	6270173	5	90	0	5	6:01	American Robin	<i>Turdus migratorius</i>	1	0		
26-Jun-09	6	410196	6270966	410155	6270173	5	90	0	5	6:01	Swainson's Thrush	<i>Catharus ustulatus</i>	1	0		
26-Jun-09	6	410196	6270966	410155	6270173	5	90	0	5	6:01	Cedar Waxwing	<i>Bombycilla cedrorum</i>	1	0		
26-Jun-09	6	410196	6270966	410155	6270173	5	90	0	5	6:01	Yellow Warbler	<i>Dendroica petechia</i>	2	0		
26-Jun-09	6	410196	6270966	410155	6270173	5	90	0	5	6:01	Yellow-rumped Warbler	<i>Dendroica coronata</i>	0	1		
26-Jun-09	6	410196	6270966	410155	6270173	5	90	0	5	6:01	Common Yellowthroat	<i>Geothlypis trichas</i>	1	0		
26-Jun-09	6	410196	6270966	410155	6270173	5	90	0	5	6:01	Rufous Hummingbird	<i>Selasphorus rufus</i>	1	0		
26-Jun-09	6	410196	6270966	410155	6270173	5	90	0	5	6:01	Northern Waterthrush	<i>Seiurus noveboracensis</i>	1	0		
26-Jun-09	37	410673	6276827	411275	6277519	0	90	2	1	8:18	Golden-crowned Sparrow	<i>Zonotrichia atricapilla</i>	1	0		
26-Jun-09	37	410673	6276827	411275	6277519	0	90	2	2	8:31	Golden-crowned Sparrow	<i>Zonotrichia atricapilla</i>	1	0		
26-Jun-09	37	410673	6276827	411275	6277519	0	90	2	2	8:31	Savannah Sparrow	<i>Passerculus sandwichensis</i>	0	1		
26-Jun-09	37	410673	6276827	411275	6277519	0	90	2	2	8:31	Dark-eyed Junco	<i>Junco hyemalis</i>	1	1		
26-Jun-09	37	410673	6276827	411275	6277519	0	90	2	2	8:31	Fox Sparrow	<i>Passerella iliaca</i>	0	1		
26-Jun-09	37	410673	6276827	411275	6277519	0	90	2	3	8:45	Golden-crowned Sparrow	<i>Zonotrichia atricapilla</i>	1	0		
26-Jun-09	37	410673	6276827	411275	6277519	0	90	2	3	8:45	Hermit Thrush	<i>Catharus guttatus</i>	0	1		
26-Jun-09	37	410673	6276827	411275	6277519	0	90	2	3	8:45	Pine Siskin	<i>Carduelis pinus</i>	1	0		
26-Jun-09	37	410673	6276827	411275	6277519	0	90	2	3	8:45	Fox Sparrow	<i>Passerella iliaca</i>	0	1		
26-Jun-09	37	410673	6276827	411275	6277519	0	90	2	4	8:56	Dark-eyed Junco	<i>Junco hyemalis</i>	1	0		
26-Jun-09	37	410673	6276827	411275	6277519	0	90	2	4	8:56	Rufous Hummingbird	<i>Selasphorus rufus</i>	0	1		
26-Jun-09	37	410673	6276827	411275	6277519	0	90	2	5	9:08	Fox Sparrow	<i>Passerella iliaca</i>	1	0		
26-Jun-09	37	410673	6276827	411275	6277519	0	90	2	5	9:08	Dark-eyed Junco	<i>Junco hyemalis</i>	0	1		
27-Jun-09	8	433703	6280551	432825	6280152	4	100	3	1	8:28	Yellow Warbler	<i>Dendroica petechia</i>	2	0		
27-Jun-09	8	433703	6280551	432825	6280152	4	100	3	1	8:28	Pine Siskin	<i>Carduelis pinus</i>	1	0		
27-Jun-09	8	433703	6280551	432825	6280152	4	100	3	2	8:52	Hermit Thrush	<i>Catharus guttatus</i>	2	0		
27-Jun-09	8	433703	6280551	432825	6280152	4	100	3	2	8:52	Varied Thrush	<i>Ixoreus naevius</i>	1	0		
27-Jun-09	8	433703	6280551	432825	6280152	4	100	3	2	8:52	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
27-Jun-09	8	433703	6280551	432825	6280152	4	100	3	2	8:52	Yellow Warbler	<i>Dendroica petechia</i>	3	0		
27-Jun-09	8	433703	6280551	432825	6280152	4	100	3	2	8:52	Fox Sparrow	<i>Passerella iliaca</i>	2	0		
27-Jun-09	8	433703	6280551	432825	6280152	4	100	3	2	8:52	Pine Siskin	<i>Carduelis pinus</i>	0	1		
27-Jun-09	8	433703	6280551	432825	6280152	4	100	3	3	9:06	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
27-Jun-09	8	433703	6280551	432825	6280152	4	100	3	3	9:06	Pacific-slope Flycatcher	<i>Empidonax difficilis</i>	1	0		
27-Jun-09	8	433703	6280551	432825	6280152	4	100	3	3	9:06	Yellow Warbler	<i>Dendroica petechia</i>	1	0		
27-Jun-09	8	433703	6280551	432825	6280152	4	100	3	4	9:23	Yellow Warbler	<i>Dendroica petechia</i>	4	0		
27-Jun-09	8	433703	6280551	432825	6280152	4	100	3	4	9:23	Pine Siskin	<i>Carduelis pinus</i>	2	0		
27-Jun-09	8	433703	6280551	432825	6280152	4	100	3	4	9:23	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
27-Jun-09	8	433703	6280551	432825	6280152	4	100	3	5	9:34	Winter Wren	<i>Troglodytes troglodytes</i>	1	0		
27-Jun-09	8	433703	6280551	432825	6280152	4	100	3	5	9:34	Wilson's Warbler	<i>Wilsonia pusilla</i>	2	1		
27-Jun-09	8	433703	6280551	432825	6280152	4	100	3	5	9:34	Yellow Warbler	<i>Dendroica petechia</i>	2	0		
27-Jun-09	8	433703	6280551	432825	6280152	4	100	3	5	9:34	Swainson's Thrush	<i>Catharus ustulatus</i>	1	0		
27-Jun-09	8	433703	6280551	432825	6280152	4	100	3	5	9:34	Fox Sparrow	<i>Passerella iliaca</i>	0	1		
27-Jun-09	16	441269	6285414	441758	6286155	3	100	0	1	6:43	Swainson's Thrush	<i>Catharus ustulatus</i>	0	1		
27-Jun-09	16	441269	6285414	441758	6286155	3	100	0	1	6:43	Varied Thrush	<i>Ixoreus naevius</i>	0	2		
27-Jun-09	16	441269	6285414	441758	6286155	3	100	0	1	6:43	Yellow Warbler	<i>Dendroica petechia</i>	2	0		
27-Jun-09	16	441269	6285414	441758	6286155	3	100	0	2	7:06	Yellow Warbler	<i>Dendroica petechia</i>	3	1		NF
27-Jun-09	16	441269	6285414	441758	6286155	3	100	0	2	7:06	Yellow-rumped Warbler	<i>Dendroica coronata</i>	1	0		
27-Jun-09	16	441269	6285414	441758	6286155	3	100	0	2	7:06	Warbling Vireo	<i>Vireo gilvus</i>	2	0		
27-Jun-09	16	441269	6285414	441758	6286155	3	100	0	2	7:06	Northern Waterthrush	<i>Seiurus noveboracensis</i>	1	0		
27-Jun-09	16	441269	6285414	441758	6286155	3	100	0	2	7:06	American Redstart	<i>Setophaga ruticilla</i>	1	0		
27-Jun-09	16	441269	6285414	441758	6286155	3	100	0	2	7:06	Varied Thrush	<i>Ixoreus naevius</i>	0	1		
27-Jun-09	16	441269	6285414	441758	6286155	3	100	0	2	7:06	MacGillivray's warbler	<i>Oporornis tolmiei</i>	0	1		
27-Jun-09	16	441269	6285414	441758	6286155	3	100	0	3	7:25	Rufous Hummingbird	<i>Selasphorus rufus</i>	0	1		
27-Jun-09	16	441269	6285414	441758	6286155	3	100	0	3	7:25	Least Flycatcher	<i>Empidonax minimus</i>	0	1		
27-Jun-09	16	441269	6285414	441758	6286155	3	100	0	3	7:25	Swainson's Thrush	<i>Catharus ustulatus</i>	0	1		

Appendix 5.3-2. Summary of Variable Range Point Count (VRPC) Data, 2009

Date	Transect ID	Transect Start		Transect End		Temp (°C)	Cloud Cover (%)	Wind Scale	Point No.	Time	Species	Scientific Name	Total Birds <100 m	Total Birds	Breeding Obs.	Comment(s)
		Easting	Northing	Easting	Northing											
27-Jun-09	16	441269	6285414	441758	6286155	3	100	0	3	7:25	Yellow Warbler	<i>Dendroica petechia</i>	0	1		
27-Jun-09	16	441269	6285414	441758	6286155	3	100	0	3	7:25	Varied Thrush	<i>Ixoreus naevius</i>	0	1		
27-Jun-09	16	441269	6285414	441758	6286155	3	100	0	3	7:25	MacGillivray's warbler	<i>Oporornis tolmiei</i>	1	0		
27-Jun-09	16	441269	6285414	441758	6286155	3	100	0	3	7:25	Pine Siskin	<i>Carduelis pinus</i>	0	1		
27-Jun-09	16	441269	6285414	441758	6286155	3	100	0	4	7:46	Wilson's Warbler	<i>Wilsonia pusilla</i>	2	0		
27-Jun-09	16	441269	6285414	441758	6286155	3	100	0	4	7:46	Yellow Warbler	<i>Dendroica petechia</i>	1	0		
27-Jun-09	16	441269	6285414	441758	6286155	3	100	0	4	7:46	Least Flycatcher	<i>Empidonax minimus</i>	1	0		
27-Jun-09	16	441269	6285414	441758	6286155	3	100	0	4	7:46	Northern Waterthrush	<i>Seiurus noveboracensis</i>	1	0		
27-Jun-09	16	441269	6285414	441758	6286155	3	100	0	4	7:46	American Redstart	<i>Setophaga ruticilla</i>	1	0		
27-Jun-09	16	441269	6285414	441758	6286155	3	100	0	5	8:03	Winter Wren	<i>Troglodytes troglodytes</i>	1	0		
27-Jun-09	16	441269	6285414	441758	6286155	3	100	0	5	8:03	Swainson's Thrush	<i>Catharus ustulatus</i>	1	0		
27-Jun-09	16	441269	6285414	441758	6286155	3	100	0	5	8:03	Varied Thrush	<i>Ixoreus naevius</i>	1	0		
27-Jun-09	16	441269	6285414	441758	6286155	3	100	0	5	8:03	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
27-Jun-09	16	441269	6285414	441758	6286155	3	100	0	5	8:03	Yellow Warbler	<i>Dendroica petechia</i>	1	0		
27-Jun-09	38	449417	6283957	449934	6284083	2	100	1	1	5:09	Townsend's Warbler	<i>Dendroica townsendi</i>	1	1		
27-Jun-09	38	449417	6283957	449934	6284083	2	100	1	1	5:09	Winter Wren	<i>Troglodytes troglodytes</i>	1	0		
27-Jun-09	38	449417	6283957	449934	6284083	2	100	1	1	5:09	Hammond's Flycatcher	<i>Empidonax hammondii</i>	1	0		
27-Jun-09	38	449417	6283957	449934	6284083	3	100	1	2	5:22	Townsend's Warbler	<i>Dendroica townsendi</i>	1	0		
27-Jun-09	38	449417	6283957	449934	6284083	3	100	1	2	5:22	Winter Wren	<i>Troglodytes troglodytes</i>	1	0		
27-Jun-09	38	449417	6283957	449934	6284083	3	100	1	2	5:22	Golden-crowned Kinglet	<i>Regulus satrapa</i>	1	0		
27-Jun-09	38	449417	6283957	449934	6284083	3	100	1	2	5:22	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
27-Jun-09	38	449417	6283957	449934	6284083	3	100	1	2	5:22	Swainson's Thrush	<i>Catharus ustulatus</i>	0	1		
27-Jun-09	38	449417	6283957	449934	6284083	3	100	1	3	5:36	Dark-eyed Junco	<i>Junco hyemalis</i>	2	0		
27-Jun-09	38	449417	6283957	449934	6284083	3	100	1	3	5:36	Winter Wren	<i>Troglodytes troglodytes</i>	2	0		
27-Jun-09	38	449417	6283957	449934	6284083	3	100	1	3	5:36	Varied Thrush	<i>Ixoreus naevius</i>	0	1		
27-Jun-09	38	449417	6283957	449934	6284083	3	100	1	3	5:36	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
27-Jun-09	38	449417	6283957	449934	6284083	3	100	1	3	5:36	Townsend's Warbler	<i>Dendroica townsendi</i>	1	0		
27-Jun-09	38	449417	6283957	449934	6284083	3	100	1	3	5:36	Swainson's Thrush	<i>Catharus ustulatus</i>	0	1		
27-Jun-09	38	449417	6283957	449934	6284083	3	100	1	4	5:49	Winter Wren	<i>Troglodytes troglodytes</i>	1	0		
27-Jun-09	38	449417	6283957	449934	6284083	3	100	1	4	5:49	Golden-crowned Kinglet	<i>Regulus satrapa</i>	0	1		
27-Jun-09	38	449417	6283957	449934	6284083	3	100	1	4	5:49	Hammond's Flycatcher	<i>Empidonax hammondii</i>	1	0		
27-Jun-09	38	449417	6283957	449934	6284083	3	100	1	4	5:49	Yellow Warbler	<i>Dendroica petechia</i>	1	0		
27-Jun-09	38	449417	6283957	449934	6284083	3	100	1	4	5:49	Townsend's Warbler	<i>Dendroica townsendi</i>	1	0		
27-Jun-09	38	449417	6283957	449934	6284083	3	100	1	4	5:49	Varied Thrush	<i>Ixoreus naevius</i>	0	1		
27-Jun-09	38	449417	6283957	449934	6284083	3	100	1	4	5:49	Swainson's Thrush	<i>Catharus ustulatus</i>	0	1		
27-Jun-09	38	449417	6283957	449934	6284083	3	100	1	5	6:03	Swainson's Thrush	<i>Catharus ustulatus</i>	2	0		
27-Jun-09	38	449417	6283957	449934	6284083	3	100	1	5	6:03	American Redstart	<i>Setophaga ruticilla</i>	1	0		
27-Jun-09	38	449417	6283957	449934	6284083	3	100	1	5	6:03	Yellow Warbler	<i>Dendroica petechia</i>	1	0		
27-Jun-09	38	449417	6283957	449934	6284083	3	100	1	5	6:03	Lincoln's Sparrow	<i>Melospiza lincolnii</i>	0	1		
27-Jun-09	38	449417	6283957	449934	6284083	3	100	1	5	6:03	Northern Waterthrush	<i>Seiurus noveboracensis</i>	1	0		
27-Jun-09	38	449417	6283957	449934	6284083	3	100	1	5	6:03	Hammond's Flycatcher	<i>Empidonax hammondii</i>	1	0		
27-Jun-09	38	449417	6283957	449934	6284083	3	100	1	5	6:03	MacGillivray's warbler	<i>Oporornis tolmiei</i>	0	1		
28-Jun-09	11	441856	6277829	442433	6277168	3	100	0	1	5:01	Hermit Thrush	<i>Catharus guttatus</i>	1	2		
28-Jun-09	11	441856	6277829	442433	6277168	3	100	0	1	5:01	Yellow Warbler	<i>Dendroica petechia</i>	2	0		
28-Jun-09	11	441856	6277829	442433	6277168	3	100	0	1	5:01	Lincoln's Sparrow	<i>Melospiza lincolnii</i>	2	0		
28-Jun-09	11	441856	6277829	442433	6277168	3	100	0	1	5:01	Savannah Sparrow	<i>Passerculus sandwichensis</i>	1	0		
28-Jun-09	11	441856	6277829	442433	6277168	3	100	0	1	5:01	Varied Thrush	<i>Ixoreus naevius</i>	0	1		
28-Jun-09	11	441856	6277829	442433	6277168	3	100	0	1	5:01	Swainson's Thrush	<i>Catharus ustulatus</i>	0	1		
28-Jun-09	11	441856	6277829	442433	6277168	3	100	0	1	5:01	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
28-Jun-09	11	441856	6277829	442433	6277168	3	100	0	2	5:11	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
28-Jun-09	11	441856	6277829	442433	6277168	3	100	0	2	5:11	Varied Thrush	<i>Ixoreus naevius</i>	0	1		
28-Jun-09	11	441856	6277829	442433	6277168	3	100	0	2	5:11	Yellow Warbler	<i>Dendroica petechia</i>	1	0		
28-Jun-09	11	441856	6277829	442433	6277168	3	100	0	2	5:11	Blackpoll Warbler	<i>Dendroica striata</i>	0	1		
28-Jun-09	11	441856	6277829	442433	6277168	3	100	0	2	5:11	Winter Wren	<i>Troglodytes troglodytes</i>	0	1		
28-Jun-09	11	441856	6277829	442433	6277168	3	100	0	3	5:28	Swainson's Thrush	<i>Catharus ustulatus</i>	1	0		
28-Jun-09	11	441856	6277829	442433	6277168	3	100	0	3	5:28	Yellow Warbler	<i>Dendroica petechia</i>	1	0		
28-Jun-09	11	441856	6277829	442433	6277168	3	100	0	3	5:28	Lincoln's Sparrow	<i>Melospiza lincolnii</i>	1	0		

Appendix 5.3-2. Summary of Variable Range Point Count (VRPC) Data, 2009

Date	Transect ID	Transect Start		Transect End		Temp (°C)	Cloud Cover (%)	Wind Scale	Point No.	Time	Species	Scientific Name	Total Birds <100 m	Total Birds	Breeding Obs.	Comment(s)
		Easting	Northing	Easting	Northing											
28-Jun-09	11	441856	6277829	442433	6277168	3	100	0	3	5:28	Townsend's Warbler	<i>Dendroica townsendi</i>	0	1		
28-Jun-09	11	441856	6277829	442433	6277168	3	100	0	3	5:28	Blackpoll Warbler	<i>Dendroica striata</i>	1	0		
28-Jun-09	11	441856	6277829	442433	6277168	3	100	0	4	5:41	Townsend's Warbler	<i>Dendroica townsendi</i>	1	1		
28-Jun-09	11	441856	6277829	442433	6277168	3	100	0	4	5:41	Swainson's Thrush	<i>Catharus ustulatus</i>	1	0		
28-Jun-09	11	441856	6277829	442433	6277168	3	100	0	4	5:41	Savannah Sparrow	<i>Passerculus sandwichensis</i>	0	1		
28-Jun-09	11	441856	6277829	442433	6277168	3	100	0	4	5:41	Wilson's Warbler	<i>Wilsonia pusilla</i>	0	1		
28-Jun-09	11	441856	6277829	442433	6277168	3	100	0	4	5:41	Blackpoll Warbler	<i>Dendroica striata</i>	1	0		
28-Jun-09	11	441856	6277829	442433	6277168	3	100	0	5	5:54	Winter Wren	<i>Troglodytes troglodytes</i>	1	0		
28-Jun-09	11	441856	6277829	442433	6277168	3	100	0	5	5:54	Swainson's Thrush	<i>Catharus ustulatus</i>	0	1		
28-Jun-09	11	441856	6277829	442433	6277168	3	100	0	5	5:54	Golden-crowned Kinglet	<i>Regulus satrapa</i>	1	0		
28-Jun-09	11	441856	6277829	442433	6277168	3	100	0	5	5:54	Townsend's Warbler	<i>Dendroica townsendi</i>	1	0		
28-Jun-09	12	443167	6276254	444100	6276239	5	100	0	1	7:34	Savannah Sparrow	<i>Passerculus sandwichensis</i>	2	0		
28-Jun-09	12	443167	6276254	444100	6276239	5	100	0	2	7:56	Swainson's Thrush	<i>Catharus ustulatus</i>	1	1		
28-Jun-09	12	443167	6276254	444100	6276239	5	100	0	2	7:56	Yellow Warbler	<i>Dendroica petechia</i>	2	0		
28-Jun-09	12	443167	6276254	444100	6276239	5	100	0	2	7:56	Pine Siskin	<i>Carduelis pinus</i>	3	0		
28-Jun-09	12	443167	6276254	444100	6276239	5	100	0	2	7:56	Varied Thrush	<i>Ixoreus naevius</i>	1	0		
28-Jun-09	12	443167	6276254	444100	6276239	5	100	0	2	7:56	Chipping Sparrow	<i>Spizella passerina</i>	1	0		
28-Jun-09	12	443167	6276254	444100	6276239	5	100	0	2	7:56	Hermit Thrush	<i>Catharus guttatus</i>	1	0		
28-Jun-09	12	443167	6276254	444100	6276239	5	100	0	2	7:56	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
28-Jun-09	12	443167	6276254	444100	6276239	5	100	0	2	7:56	Savannah Sparrow	<i>Passerculus sandwichensis</i>	1	0		
28-Jun-09	12	443167	6276254	444100	6276239	5	100	0	3	8:17	Hermit Thrush	<i>Catharus guttatus</i>	1	0		
28-Jun-09	12	443167	6276254	444100	6276239	5	100	0	3	8:17	Varied Thrush	<i>Ixoreus naevius</i>	0	1		
28-Jun-09	12	443167	6276254	444100	6276239	5	100	0	3	8:17	Yellow Warbler	<i>Dendroica petechia</i>	0	1		
28-Jun-09	12	443167	6276254	444100	6276239	5	100	0	3	8:17	MacGillivray's warbler	<i>Oporornis tolmiei</i>	0	1		
28-Jun-09	12	443167	6276254	444100	6276239	5	100	0	3	8:17	Pine Siskin	<i>Carduelis pinus</i>	1	0		
28-Jun-09	12	443167	6276254	444100	6276239	5	100	0	4	8:35	Yellow Warbler	<i>Dendroica petechia</i>	1	0		
28-Jun-09	12	443167	6276254	444100	6276239	5	100	0	4	8:35	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
28-Jun-09	12	443167	6276254	444100	6276239	5	100	0	4	8:35	Varied Thrush	<i>Ixoreus naevius</i>	1	0		FC
28-Jun-09	12	443167	6276254	444100	6276239	5	100	0	4	8:35	Fox Sparrow	<i>Passerella iliaca</i>	1	1		
28-Jun-09	12	443167	6276254	444100	6276239	5	100	0	5	8:50	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
28-Jun-09	12	443167	6276254	444100	6276239	5	100	0	5	8:50	Golden-crowned Kinglet	<i>Regulus satrapa</i>	1	0		
28-Jun-09	13	442245	6277110	442719	6276465	4	100	0	1	6:07	Lincoln's Sparrow	<i>Melospiza lincolni</i>	1	0		
28-Jun-09	13	442245	6277110	442719	6276465	4	100	0	1	6:07	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
28-Jun-09	13	442245	6277110	442719	6276465	4	100	0	1	6:07	Black-capped Chickadee	<i>Poecile atricapillus</i>	0	1		
28-Jun-09	13	442245	6277110	442719	6276465	4	100	0	1	6:07	Yellow Warbler	<i>Dendroica petechia</i>	0	1		
28-Jun-09	13	442245	6277110	442719	6276465	4	100	0	1	6:07	Swainson's Thrush	<i>Catharus ustulatus</i>	0	1		
28-Jun-09	13	442245	6277110	442719	6276465	4	100	0	2	6:21	Yellow Warbler	<i>Dendroica petechia</i>	1	0		
28-Jun-09	13	442245	6277110	442719	6276465	4	100	0	2	6:21	Wilson's Warbler	<i>Wilsonia pusilla</i>	2	0		
28-Jun-09	13	442245	6277110	442719	6276465	4	100	0	2	6:21	Blackpoll Warbler	<i>Dendroica striata</i>	1	0		
28-Jun-09	13	442245	6277110	442719	6276465	4	100	0	2	6:21	Lincoln's Sparrow	<i>Melospiza lincolni</i>	1	0		
28-Jun-09	13	442245	6277110	442719	6276465	4	100	0	2	6:21	Varied Thrush	<i>Ixoreus naevius</i>	0	1		
28-Jun-09	13	442245	6277110	442719	6276465	4	100	0	2	6:21	Fox Sparrow	<i>Passerella iliaca</i>	1	0		
28-Jun-09	13	442245	6277110	442719	6276465	4	100	0	2	6:21	Townsend's Warbler	<i>Dendroica townsendi</i>	1	0		
28-Jun-09	13	442245	6277110	442719	6276465	4	100	0	3	6:37	Yellow Warbler	<i>Dendroica petechia</i>	2	0		
28-Jun-09	13	442245	6277110	442719	6276465	4	100	0	3	6:37	Blackpoll Warbler	<i>Dendroica striata</i>	0	1		
28-Jun-09	13	442245	6277110	442719	6276465	4	100	0	3	6:37	Varied Thrush	<i>Ixoreus naevius</i>	0	1		
28-Jun-09	13	442245	6277110	442719	6276465	4	100	0	3	6:37	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
28-Jun-09	13	442245	6277110	442719	6276465	4	100	0	3	6:37	American Robin	<i>Turdus migratorius</i>	1	0		
28-Jun-09	13	442245	6277110	442719	6276465	4	100	0	4	6:51	Townsend's Warbler	<i>Dendroica townsendi</i>	1	0		
28-Jun-09	13	442245	6277110	442719	6276465	4	100	0	4	6:51	Hermit Thrush	<i>Catharus guttatus</i>	1	0		
28-Jun-09	13	442245	6277110	442719	6276465	4	100	0	4	6:51	Yellow Warbler	<i>Dendroica petechia</i>	0	1		
28-Jun-09	13	442245	6277110	442719	6276465	4	100	0	4	6:51	Wilson's Warbler	<i>Wilsonia pusilla</i>	2	0		
28-Jun-09	13	442245	6277110	442719	6276465	4	100	0	5	7:04	Yellow Warbler	<i>Dendroica petechia</i>	1	0		
28-Jun-09	13	442245	6277110	442719	6276465	4	100	0	5	7:04	Wilson's Warbler	<i>Wilsonia pusilla</i>	2	0		
28-Jun-09	13	442245	6277110	442719	6276465	4	100	0	5	7:04	Hermit Thrush	<i>Catharus guttatus</i>	0	1		
29-Jun-09	18	426720	6284099	427515	6284394	1	100	0	1	6:05	American Robin	<i>Turdus migratorius</i>	1	0		
29-Jun-09	18	426720	6284099	427515	6284394	1	100	0	1	6:05	Blackpoll Warbler	<i>Dendroica striata</i>	1	0		

Appendix 5.3-2. Summary of Variable Range Point Count (VRPC) Data, 2009

Date	Transect ID	Transect Start		Transect End		Temp (°C)	Cloud Cover (%)	Wind Scale	Point No.	Time	Species	Scientific Name	Total Birds <100 m	Total Birds	Breeding Obs.	Comment(s)
		Easting	Northing	Easting	Northing											
29-Jun-09	18	426720	6284099	427515	6284394	1	100	0	2	6:30	Hermit Thrush	<i>Catharus guttatus</i>	1	1		
29-Jun-09	18	426720	6284099	427515	6284394	1	100	0	2	6:30	Blackpoll Warbler	<i>Dendroica striata</i>	1	0		
29-Jun-09	18	426720	6284099	427515	6284394	1	100	0	2	6:30	Varied Thrush	<i>Ixoreus naevius</i>	0	1		
29-Jun-09	18	426720	6284099	427515	6284394	1	100	0	2	6:30	Townsend's Warbler	<i>Dendroica townsendi</i>	1	0		
29-Jun-09	18	426720	6284099	427515	6284394	1	100	0	3	6:47	Fox Sparrow	<i>Passerella iliaca</i>	1	0		
29-Jun-09	18	426720	6284099	427515	6284394	1	100	0	3	6:47	Varied Thrush	<i>Ixoreus naevius</i>	1	0		
29-Jun-09	18	426720	6284099	427515	6284394	1	100	0	3	6:47	Hermit Thrush	<i>Catharus guttatus</i>	1	0		
29-Jun-09	18	426720	6284099	427515	6284394	1	100	0	4	7:01	Hermit Thrush	<i>Ixoreus naevius</i>	0	1		
29-Jun-09	18	426720	6284099	427515	6284394	1	100	0	5	7:22	Savannah Sparrow	<i>Passerculus sandwichensis</i>	1	0		
29-Jun-09	18	426720	6284099	427515	6284394	1	100	0	5	7:22	Hermit Thrush	<i>Catharus guttatus</i>	2	0		
29-Jun-09	18	426720	6284099	427515	6284394	1	100	0	5	7:22	Yellow Warbler	<i>Dendroica petechia</i>	1	0		
29-Jun-09	18	426720	6284099	427515	6284394	1	100	0	5	7:22	Varied Thrush	<i>Ixoreus naevius</i>	1	0		
29-Jun-09	18	426720	6284099	427515	6284394	1	100	0	5	7:22	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
29-Jun-09	19	425565	6284781	426340	6284314	0	100	0	1	4:52	Dark-eyed Junco	<i>Junco hyemalis</i>	2	0		
29-Jun-09	19	425565	6284781	426340	6284314	0	100	0	1	4:52	Varied Thrush	<i>Ixoreus naevius</i>	1	1		
29-Jun-09	19	425565	6284781	426340	6284314	0	100	0	1	4:52	Blackpoll Warbler	<i>Dendroica striata</i>	1	0		
29-Jun-09	19	425565	6284781	426340	6284314	0	100	0	1	4:52	Hermit Thrush	<i>Catharus guttatus</i>	2	1		
29-Jun-09	19	425565	6284781	426340	6284314	0	100	0	1	4:52	Fox Sparrow	<i>Passerella iliaca</i>	1	0		
29-Jun-09	19	425565	6284781	426340	6284314	0	100	0	2	5:06	Hermit Thrush	<i>Catharus guttatus</i>	1	0		
29-Jun-09	19	425565	6284781	426340	6284314	0	100	0	2	5:06	Townsend's Warbler	<i>Dendroica townsendi</i>	2	0		
29-Jun-09	19	425565	6284781	426340	6284314	0	100	0	2	5:06	Blackpoll Warbler	<i>Dendroica striata</i>	1	0		
29-Jun-09	19	425565	6284781	426340	6284314	0	100	0	2	5:06	Varied Thrush	<i>Ixoreus naevius</i>	0	1		
29-Jun-09	19	425565	6284781	426340	6284314	0	100	0	2	5:06	Olive-sided Flycatcher	<i>Contopus cooperi</i>	0	1		
29-Jun-09	19	425565	6284781	426340	6284314	0	100	0	2	5:06	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
29-Jun-09	19	425565	6284781	426340	6284314	0	100	0	3	5:31	Wilson's Warbler	<i>Wilsonia pusilla</i>	1	0		
29-Jun-09	19	425565	6284781	426340	6284314	0	100	0	3	5:31	Townsend's Warbler	<i>Dendroica townsendi</i>	0	1		
29-Jun-09	19	425565	6284781	426340	6284314	0	100	0	3	5:31	Varied Thrush	<i>Ixoreus naevius</i>	0	1		
29-Jun-09	19	425565	6284781	426340	6284314	0	100	0	3	5:31	Hermit Thrush	<i>Catharus guttatus</i>	1	0		
29-Jun-09	19	425565	6284781	426340	6284314	0	100	0	3	5:31	Dark-eyed Junco	<i>Junco hyemalis</i>	1	0		
29-Jun-09	19	425565	6284781	426340	6284314	0	100	0	3	5:31	Blackpoll Warbler	<i>Dendroica striata</i>	1	0		
29-Jun-09	19	425565	6284781	426340	6284314	0	100	0	3	5:31	Gray Jay	<i>Perisoreus canadensis</i>	1	0		
29-Jun-09	19	425565	6284781	426340	6284314	0	100	0	4	5:31	Hermit Thrush	<i>Catharus guttatus</i>	1	1		
29-Jun-09	19	425565	6284781	426340	6284314	0	100	0	4	5:31	Varied Thrush	<i>Ixoreus naevius</i>	2	2		
29-Jun-09	19	425565	6284781	426340	6284314	0	100	0	4	5:31	Townsend's Warbler	<i>Dendroica townsendi</i>	1	0		
29-Jun-09	19	425565	6284781	426340	6284314	0	100	0	4	5:31	unknown woodpecker		0	1		unknown woodpecker
29-Jun-09	19	425565	6284781	426340	6284314	0	100	0	5	5:43	Winter Wren	<i>Troglodytes troglodytes</i>	2	0		
29-Jun-09	19	425565	6284781	426340	6284314	0	100	0	5	5:43	Townsend's Warbler	<i>Dendroica townsendi</i>	2	0		
29-Jun-09	19	425565	6284781	426340	6284314	0	100	0	5	5:43	Spruce Grouse	<i>Falcapennis canadensis</i>	0	1		
29-Jun-09	19	425565	6284781	426340	6284314	0	100	0	5	5:43	Hermit Thrush	<i>Catharus guttatus</i>	0	1		
29-Jun-09	19	425565	6284781	426340	6284314	0	100	0	5	5:43	American Robin	<i>Turdus migratorius</i>	1	0		

Appendix 5.3-3

Incidental Observations of Terrestrial Breeding Birds, 2008 and 2009

Appendix 5.3-3. Incidental Observations of Terrestrial Breeding Birds, 2008 and 2009

Date	Easting	Northing	Survey	Species	No. Observed	Comment(s)
13-Jun-08	420552	6265260	Raptor	Yellow Warbler	1	
13-Jun-08	417282	6262154	Raptor	Yellow Warbler	2	
14-Jun-08	408046	6263965	Terrestrial Breeding Bird	Gray-cheeked Thrush	1	
14-Jun-08	417782	6262084	Raptor	Brown Creeper	1	
14-Jun-08	417782	6262084	Raptor	Golden-crowned Kinglet	1	
14-Jun-08	416962	6262607	Raptor	Pine Siskin	2	
14-Jun-08	407746	6263016	Raptor	Winter Wren	2	
14-Jun-08	407746	6263016	Raptor	Townsend's Warbler	1	
14-Jun-08	407746	6263016	Raptor	Red-breasted Sapsucker	1	
14-Jun-08	407746	6263016	Raptor	Varied Thrush	1	
14-Jun-08	407323	6258707	Raptor	Steller's Jay	1	
14-Jun-08	408490	6268068	Raptor	Red-breasted Sapsucker	1	
15-Jun-08	433029	6280218	Terrestrial Breeding Bird	Northern Waterthrush	2	
15-Jun-08	432245	6279473	Terrestrial Breeding Bird	Gray Jay	1	
15-Jun-08	410194	6270645	Raptor	Red-breasted Sapsucker	1	
15-Jun-08	420337	6280134	Raptor	Gray Jay	1	
15-Jun-08	432245	6279473	Raptor	Varied Thrush	1	
15-Jun-08	432245	6279473	Raptor	Gray Jay	2	
15-Jun-08	451901	6263097	Raptor	Gray-cheeked Thrush	1	
16-Jun-08	445116	6275503	Raptor	Ruby-crowned Kinglet	1	
16-Jun-08	445116	6275503	Raptor	Pine Siskin	1	
16-Jun-08	445116	6275503	Raptor	Steller's Jay	1	
16-Jun-08	444103	6276375	Raptor	Pine Siskin	3	
16-Jun-08	453003	6261392	Raptor	Swainson's Thrush	1	
17-Jun-08	427334	6284136	Raptor	Gray Jay	1	
18-Jun-08	402652	6257826	Raptor	Red-breasted Sapsucker	1	
24-Jun-09	420017	6263746	Raptor	American Pipit	1	
24-Jun-09	420017	6263746	Raptor	Golden-crowned Sparrow	2	
24-Jun-09	420017	6263746	Raptor	Gray-crowned Rosy Finch	1	
24-Jun-09	420017	6263746	Raptor	Savannah Sparrow	1	
25-Jun-09	441554	6272984	Raptor	Yellow-rumped Warbler	2	food carry
28-Jun-09	453004	6269529	Raptor	Hermit Thrush	2	
28-Jun-09	452624	6269459	Raptor	unknown chickadee	2	
29-Jun-09	421042	6280529	Raptor	Gray Jay	3	

Appendix 5.4-1

Summary of Water Dependent Bird Spring Pair Survey, 2008

Appendix 5.4-1. Summary of Water Dependent Bird Spring Pair Survey, 2008

Date	Waypoint ID	Easting	Northing	Group No.	Species	Species Code	No.		Paired	Pair No	No.		Habitat Type	Comment(s)
							Hens	Drakes			Unided	Total		
2-Jun-08	001	418012	6264268	1	American dipper	AMDI			N	0	1	1	RI-M	
2-Jun-08	002	418598	6265826	1	American dipper	AMDI			N	0	1	1	RI-M	
2-Jun-08	003	416024	6262491	1	American dipper	AMDI			N	0	3	3	RI-M	
2-Jun-08	004	407845	6261597	1	Canada goose	CAGO			N	0	1	1	RI-M	
2-Jun-08	005	407119	6261153	1	unidentified sandpiper	USAN			N	0	1	1	RI-M	
2-Jun-08	006	407172	6260748	1	Common merganser	COME	1		N	0		1	RI-M	
2-Jun-08	007	407243	6259558	1	Canada goose	CAGO			N	0	2	2	PO-L	
2-Jun-08	008	409161	6249846	1	American dipper	AMDI			N	0	1	1	RI-S	
2-Jun-08	009	412345	6245231	1	Canada goose	CAGO			N	0	1	1	RI-S	
2-Jun-08	010	413588	6237473	1	unidentified sandpiper	USAN			N	0	4	4	RI-S	
2-Jun-08	011	413836	6236223	1	unidentified sandpiper	USAN			N	0	4	4	RI-S	
2-Jun-08	012	414555	6240862	1	Canada goose	CAGO			N	0	3	3	PO-S	
2-Jun-08	014	394270	6246980	3	Blue-winged teal	BWTE	1	1	Y	1		2	LK-S	
2-Jun-08	014	394270	6246980	1	Common loon	COLO			N	0	4	4	LK-S	
2-Jun-08	014	394270	6246980	4	unidentified sandpiper	USAN			N	0	1	1	LK-S	
2-Jun-08	015	394104	6246798	1	Lesser scaup	LESC	2	2	Y	2		4	LK-S	
2-Jun-08	016	395617	6247552	1	Canada goose	CAGO			N	0	2	2	RI-M	
2-Jun-08	017	391334	6251804	1	American dipper	AMDI			N	0	1	1	RI-S	
2-Jun-08	018	388362	6252432	1	unidentified sandpiper	USAN			N	0	1	1	CR-L	
2-Jun-08	019	398843	6252610	1	Barrow's goldeneye	BAGO	1	1	Y	1		2	LK-S	
2-Jun-08	019	398843	6252610	2	Barrow's goldeneye	BAGO	2	2	Y	2		4	LK-S	
2-Jun-08	020	397589	6252250	1	Barrow's goldeneye	BAGO			N	0	1	1	RI-L	
2-Jun-08	021	401438	6256997	1	Barrow's goldeneye	BAGO			N	0	2	2	LK-S	
2-Jun-08	021	401438	6256997	2	unidentified sandpiper	USAN			N	0	2	2	LK-S	
2-Jun-08	022	401186	6256262	2	Common merganser	COME	1		N	0		1	RI-L	King Cr. = good HADU habitat *survey earlier next year
2-Jun-08	022	401186	6256262	1	unidentified sandpiper	USAN			N	0	3	3	RI-L	
2-Jun-08	023	402930	6256326	1	Common merganser	COME		1	N	0		1	RI-L	
2-Jun-08	024	404127	6263286	1	American dipper	AMDI			N	0	2	2	RI-S	
2-Jun-08	025	404007	6273490	1	American dipper	AMDI			N	0	1	1	CR-L	
2-Jun-08	026	403672	6257714	1	Blue-winged teal	BWTE			N	0	2	2	RI-L	
2-Jun-08	027	404590	6258564	1	Barrow's goldeneye	BAGO	1	1	Y	1		2	LK-S	
2-Jun-08	028	404511	6258914	1	Pacific loon	PALO		1	N	0	1	2	LK-S	
2-Jun-08	029	404593	6257758	1	Barrow's goldeneye	BAGO			N	0	1	1	RI-L	
2-Jun-08	030	407584	6262235	1	Common merganser	COME			N	0	1	1	RI-M	
2-Jun-08	031	408406	6262998	3	Barrow's goldeneye	BAGO	1		N	0		1	LK-S	
2-Jun-08	031	408406	6262998	1	Canada goose	CAGO			N	0	1	1	LK-S	
2-Jun-08	031	408406	6262998	2	Barrow's goldeneye	BAGO			N	0	5	5	LK-S	young (class I)
2-Jun-08	032	407883	6265294	1	Mallard	MALL		1	N	0		1	SW-M	
2-Jun-08	033	408036	6266711	1	unidentified sandpiper	USAN			N	0	1	1	CR-L	
2-Jun-08	034	408608	6268745	1	Barrow's goldeneye	BAGO			N	0	1	1	LK-S	

* Habitat descriptor: LK=lake, RI=river, PO=pond, MA=Marsh, SW=Swamp; size descriptor S=small, M=medium, L=large

Appendix 5.4-1. Summary of Water Dependent Bird Spring Pair Survey, 2008

Date	Waypoint ID	Easting	Northing	Group No.	Species	Species Code	No.		Paired	Pair No	No.		Habitat Type [*]	Comment(s)
							Hens	Drakes			Unided	Total		
2-Jun-08	034	408608	6268745	4	Barrow's goldeneye	BAGO			N	0	2	2	LK-S	
2-Jun-08	034	408608	6268745	2	Canada goose	CAGO	3	3	Y	3		6	LK-S	
2-Jun-08	034	408608	6268745	5	Mallard	MALL	3	2	Y	2		5	LK-S	
2-Jun-08	035	410158	6270208	1	unidentified sandpiper	USAN			N	0	1	1	LK-S	
2-Jun-08	035	410158	6270208	2	unidentified duck	UDUC			N	0	1	1	LK-S	ducklings
2-Jun-08	036	415932	6279998	1	Mallard	MALL	1	2	Y	1		3	MA-S	
2-Jun-08	037	415791	6279753	1	Barrow's goldeneye	BAGO	1	1	Y	1		2	LK-S	
2-Jun-08	038	419461	6280575	1	American dipper	AMDI			N	0	1	1	RI-S	
2-Jun-08	039	432287	6279934	4	Arctic tern	ARTE			N	0	2	2	LK-M	
2-Jun-08	039	432287	6279934	1	Barrow's goldeneye	BAGO			N	0	2	2	LK-M	
2-Jun-08	039	432287	6279934	5	Barrow's goldeneye	BAGO			N	0	2	2	LK-M	
2-Jun-08	039	432287	6279934	6	Barrow's goldeneye	BAGO		1	N	0		1	LK-M	
2-Jun-08	039	432287	6279934	8	Common loon	COLO			N	0	2	2	LK-M	
2-Jun-08	039	432287	6279934	7	Mallard	MALL	1	1	Y	1		2	LK-M	
2-Jun-08	039	432287	6279934	3	Ring-billed gull	RGBU			N	0	3	3	LK-M	
2-Jun-08	39	432287	6279934	2	unidentified sandpiper	USAN			N	0	3	3	LK-M	
2-Jun-08	040	423069	6282209	1	unidentified sandpiper	USAN			N	0	2	2	LK-S	
2-Jun-08	041	423795	6281627	1	Barrow's goldeneye	BAGO	1	2	Y	1		3	LK-S	
2-Jun-08	042	426933	6282936	1	Common loon	COLO			N	0	1	1	LK-M	
2-Jun-08	043	427502	6282735	1	Barrow's goldeneye	BAGO			N	0	1	1	LK-S	
3-Jun-08	044	434549	6280918	1	unidentified sandpiper	USAN			N	0	2	2	CR-L	
3-Jun-08	045	437884	6282848	1	Canada goose	CAGO			N	0	1	1	SW-M	
3-Jun-08	046	437454	6283320	1	unidentified sandpiper	USAN			N	0	2	2	RI-S	
3-Jun-08	047	437094	6283792	1	Mallard	MALL	1	1	Y	1		2	SW-M	
3-Jun-08	047	437094	6283792	2	unidentified sandpiper	USAN			N	0	1	1	SW-M	
3-Jun-08	048	436456	6284366	1	unidentified sandpiper	USAN			N	0	2	2	SW-M	
3-Jun-08	050	432497	6283971	1	American dipper	AMDI			N	0	1	1	RI-S	Hodson Lake frozen
3-Jun-08	051	429670	6289869	1	Common loon	COLO			N	0	2	2	LK-M	Teigen Lake frozen
3-Jun-08	052	429036	6289625	1	Barrow's goldeneye	BAGO	1	1	Y	1		2	PO-M	
3-Jun-08	053	430982	6290644	1	American dipper	AMDI			N	0	1	1	CR-M	
3-Jun-08	054	439722	6283033	1	Canada goose	CAGO			N	0	2	2	RI-M	
3-Jun-08	055	439638	6283330	1	unidentified sandpiper	USAN			N	0	1	1	SW-M	
3-Jun-08	056	440438	6281136	1	American dipper	AMDI			N	0	1	1	CR-L	
3-Jun-08	057	444155	6277084	1	American dipper	AMDI			N	0	1	1	CR-M	
3-Jun-08	058	441559	6285934	1	Harlequin duck	HADU		1	N	0		1	RI-M	
3-Jun-08	058	441559	6285934	2	unidentified sandpiper	USAN			N	0	2	2	RI-M	
3-Jun-08	059	445071	6288141	1	Canada goose	CAGO			N	0	2	2	RI-M	
3-Jun-08	059	445071	6288141	2	unidentified sandpiper	USAN			N	0	2	2	CR-S	
3-Jun-08	060	446207	6287940	1	Canada goose	CAGO			N	0	1	1	RI-M	
3-Jun-08	061	446903	6287378	5	Barrow's goldeneye	BAGO			N	0	1	1	RI-M	

* Habitat descriptor: LK=lake, RI=river, PO=pond, MA=Marsh, SW=Swamp; size descriptor S=small, M=medium, L=large

Appendix 5.4-1. Summary of Water Dependent Bird Spring Pair Survey, 2008

Date	Waypoint ID	Easting	Northing	Group No.	Species	Species Code	No.		Paired	Pair No	No.		Habitat Type [*]	Comment(s)
							Hens	Drakes			Unided	Total		
3-Jun-08	061	446903	6287378	7	Barrow's goldeneye	BAGO	1		N	0		1	RI-M	
3-Jun-08	061	446903	6287378	2	Blue-winged teal	BWTE			N	0	2	2	RI-M	
3-Jun-08	061	446903	6287378	6	Canada goose	CAGO			N	0	2	2	RI-M	
3-Jun-08	061	446903	6287378	3	Common merganser	COME			N	0	2	2	RI-M	
3-Jun-08	061	446903	6287378	1	Mallard	MALL	1		N	0	13	14	RI-M	
3-Jun-08	061	446903	6287378	4	Mallard	MALL	1	1	Y	1		2	RI-M	
3-Jun-08	062	446103	6287545	2	Barrow's goldeneye	BAGO		1	N	0		1	RI-M	
3-Jun-08	062	446103	6287545	1	Canada goose	CAGO			N	0	2	2	RI-M	
3-Jun-08	062	446103	6287545	3	Canada goose	CAGO			N	0	1	1	RI-M	
3-Jun-08	063	447261	6288616	1	Barrow's goldeneye	BAGO	1	1	Y	1		2	RI-M	
3-Jun-08	063	447261	6288616	2	Barrow's goldeneye	BAGO	1	1	Y	1		2	RI-M	
3-Jun-08	064	446694	6288688	1	Canada goose	CAGO			N	0	1	1	RI-M	
3-Jun-08	064	446694	6288688	3	Mallard	MALL		1	N	0		1	RI-M	
3-Jun-08	064	446694	6288688	2	Ring-necked duck	RNDU		1	N	0		1	RI-M	
3-Jun-08	065	445961	6288655	1	Barrow's goldeneye	BAGO		1	N	0		1	RI-M	
3-Jun-08	066	445834	6288733	2	Green-winged teal	GWTE	1	1	Y	1	1	3	SW-L	
3-Jun-08	066	445834	6288733	1	Mallard	MALL		1	N	0		1	SW-L	
3-Jun-08	067	445225	6288488	1	Barrow's goldeneye	BAGO		2	N	0		2	SW-L	
3-Jun-08	067	445225	6288488	2	Barrow's goldeneye	BAGO			N	0	1	1	SW-L	
3-Jun-08	068	444146	6289239	1	Barrow's goldeneye	BAGO	1		N	0		1	SW-L	
3-Jun-08	068	444146	6289239	2	Canada goose	CAGO			N	0	2	2	SW-L	
3-Jun-08	069	443185	6289218	1	Barrow's goldeneye	BAGO	2	2	Y	2		4	SW-L	
3-Jun-08	070	449004	6289182	1	Barrow's goldeneye	BAGO		2	N	0		2	SW-M	
3-Jun-08	071	448518	6286700	1	unidentified sandpiper	USAN			N	0	1	1	RI-M	
3-Jun-08	072	449684	6284358	1	Canada goose	CAGO			N	0	1	1	RI-M	
3-Jun-08	073	447325	6286840	1	Canada goose	CAGO			N	0	2	2	PO-M	
3-Jun-08	074	452000	6279409	1	Barrow's goldeneye	BAGO		1	N	0		1	PO-S	
3-Jun-08	074	452000	6279409	2	Canada goose	CAGO			N	0	2	2	PO-S	
3-Jun-08	075	452916	6279229	1	Canada goose	CAGO			N	0	2	2	RI-L	
3-Jun-08	075	452916	6279229	2	unidentified sandpiper	USAN			N	0	1	1	RI-L	
3-Jun-08	076	456952	6276197	2	Common merganser	COME		1	N	0		1	RI-M	
3-Jun-08	076	456952	6276197	1	Mallard	MALL	1	1	Y	1		2	RI-M	
3-Jun-08	077	462340	6270313	1	Common merganser	COME		1	N	0		1	RI-M	
3-Jun-08	078	467324	6265210	2	Canada goose	CAGO			N	0	5	5	RI-M	
3-Jun-08	078	467324	6265210	1	Mallard	MALL	1	4	Y	1		5	RI-M	
3-Jun-08	079	468054	6264674	1	Harlequin duck	HADU	1	1	Y	1		2	RI-L	Riffle
3-Jun-08	080	464016	6267793	1	unidentified duck	UDUC			N	0	1	1	PO-L	diving duck
3-Jun-08	081	461210	6269159	1	unidentified sandpiper	USAN			N	0	1	1	RI-M	
3-Jun-08	082	456106	6270096	2	Canada goose	CAGO			N	0	2	2	MA-L	
3-Jun-08	083	456525	6269677	2	Barrow's goldeneye	BAGO	3	3	Y	3		6	MA-L	

* Habitat descriptor: LK=lake, RI=river, PO=pond, MA=Marsh, SW=Swamp; size descriptor S=small, M=medium, L=large

Appendix 5.4-1. Summary of Water Dependent Bird Spring Pair Survey, 2008

Date	Waypoint ID	Easting	Northing	Group No.	Species	Species Code	No.		Paired	Pair No	No.		Habitat Type	Comment(s)
							Hens	Drakes			Unided	Total		
3-Jun-08	083	456525	6269677	1	Canada goose	CAGO			N	0	1	1	MA-L	
3-Jun-08	083	456525	6269677	1	unidentified sandpiper	USAN			N	0	1	1	MA-L	
3-Jun-08	083	456525	6269677	1	Trumpeter swan	TRSW			N	0	1	1	MA-L	
3-Jun-08	084	455461	6269163	4	Barrow's goldeneye	BAGO	1	3	Y	1		4	MA-M	
3-Jun-08	084	455461	6269163	3	Canada goose	CAGO			N	0	3	3	MA-M	
3-Jun-08	084	455461	6269163	4	Mallard	MALL		1	N	0	3	4	MA-M	
3-Jun-08	085	449401	6270074	2	Mallard	MALL	1	1	Y	1		2	SW-M	
3-Jun-08	087	451230	6265469	2	Barrow's goldeneye	BAGO	2	1	Y	1		3	MA-L	
3-Jun-08	087	451230	6265469	1	Canada goose	CAGO			N	0	1	1	MA-L	
3-Jun-08	087	451230	6265469	2	unidentified sandpiper	USAN			N	0	2	2	MA-L	
3-Jun-08	088	450541	6264549	2	Arctic tern	ARTE			N	0	2	2	PO-L	
3-Jun-08	088	450541	6264549	4	Barrow's goldeneye	BAGO			N	0	4	4	PO-L	
3-Jun-08	088	450541	6264549	2	Canada goose	CAGO			N	0	2	2	PO-L	
3-Jun-08	088	450541	6264549	2	unidentified sandpiper	USAN			N	0	2	2	PO-L	
3-Jun-08	089	450768	6265469	2	Blue-winged teal	BWTE	1	1	Y	1		2	MA-L	
3-Jun-08	089	450768	6265469	2	Green-winged teal	GWTE	1	1	Y	1		2	MA-L	
3-Jun-08	089	450768	6265469	4	Mallard	MALL	1	4	Y	1		5	MA-L	
3-Jun-08	090	451089	6263263	5	Canada goose	CAGO			N	0	5	5	MA-L	
3-Jun-08	091	452676	6263380	2	Canada goose	CAGO			N	0	2	2	MA-L	
3-Jun-08	091	452676	6263380	1	unidentified sandpiper	USAN			N	0	1	1	MA-L	
3-Jun-08	092	451591	6260482	1	Barrow's goldeneye	BAGO		1	N	0		1	PO-M	
3-Jun-08	093	451981	6260437	1	Arctic tern	ARTE			N	0	1	1	LK-M	
3-Jun-08	093	451981	6260437	2	Barrow's goldeneye	BAGO	1	1	Y	1		2	LK-S	
3-Jun-08	094	448941	6269645	1	Barrow's goldeneye	BAGO			N	0	1	1	PO-M	
3-Jun-08	094	448941	6269645	2	unidentified sandpiper	USAN			N	0	2	2	PO-M	
3-Jun-08	095	446902	6271596	1	Barrow's goldeneye	BAGO	1	2	Y	1		3	PO-L	
3-Jun-08	095	446902	6271596	3	Green-winged teal	GWTE		2	N	0		2	PO-L	
3-Jun-08	095	446902	6271596	2	Mallard	MALL		4	N	0		4	PO-L	
3-Jun-08	096	445286	6272179	1	Canada goose	CAGO			N	0	1	1	PO-S	
3-Jun-08	097	444845	6272358	1	Barrow's goldeneye	BAGO			N	0	1	1	PO-S	
3-Jun-08	098	443967	6272061	1	Barrow's goldeneye	BAGO			N	0	2	2	MA/PO-M	
3-Jun-08	099	444232	6271892	1	Barrow's goldeneye	BAGO			N	0	2	2	LK-S	
3-Jun-08	100	443251	6272636	1	Barrow's goldeneye	BAGO			N	0	2	2	PO-S	
3-Jun-08	101	442357	6272543	1	Barrow's goldeneye	BAGO		1	N	0		1	PO-L	
3-Jun-08	101	442357	6272543	2	unidentified sandpiper	USAN			N	0	1	1	PO-L	
3-Jun-08	102	437642	6274325	1	Canada goose	CAGO			N	0	1	1	PO-S	
3-Jun-08	102	437642	6274325	2	unidentified sandpiper	USAN			N	0	1	1	PO-S	

* Habitat descriptor: LK=lake, RI=river, PO=pond, MA=Marsh, SW=Swamp; size descriptor S=small, M=medium, L=large

Appendix 5.4-2

Summary of Water Dependent Bird Summer Brood Survey,
2008

Appendix 5.4-2. Summary of Water Dependent Bird Summer Brood Survey, 2008

Date	Waypoint ID	Easting	Northing	Group No.	Species	Species Code	No. Hens	No. Young	Class	No. Drake or Unided	Total Adult	Total	Habitat Type ^e	Comment(s)
15-Jul-08	002	413959	6240977	1	Blue-winged teal	BWTE				1	1	1	RI-M	start: S UNUK 7:55 am
15-Jul-08	002	413959	6240977	1	unidentified sandpiper	USAN				1	1	1	RI-M	
15-Jul-08	003	413650	6236957	1	unidentified sandpiper	USAN				2	2	2	RI-M	
15-Jul-08	004	414770	6235041	1	unidentified sandpiper	USAN				1	1	1	LK-S	stop: S UNUK 8:40 am
15-Jul-08	005	394314	6247136	1	unidentified loon	ULOO				2	2	2	LK-L	
15-Jul-08	006	397812	6252956	1	unidentified sandpiper	USAN				1	1	1	RI-L	
15-Jul-08	007	401285	6257197	1	unidentified loon	ULOO				1	1	1	LK-M	
15-Jul-08	008	401437	6258840	1	Pacific loon	PALO				2	2	2	LK-M	
15-Jul-08	009	397015	6261374	1	unidentified sandpiper	USAN				1	1	1	CR-L	
15-Jul-08	010	394368	6262009	1	Canada goose	CAGO				9	9	9	LK-S	
15-Jul-08	010	394368	6262009	1	unidentified sandpiper	USAN				1	1	1	LK-S	Stop: Harry Mel Cr. 11:30 am
15-Jul-08	011	408598	6263854	1	Mallard	MALL				1	1	1	LK-S	
15-Jul-08	012	415744	6279856		Bonaparte's gull	BOGU				1	1	1	LK-S	
15-Jul-08	013	424603	6283639	1	unidentified loon	ULOO				1	1	1	PO-S	
15-Jul-08	014	424703	6282997	1	Canada goose	CAGO				14	14	14	LK-M	
15-Jul-08	014	424703	6282997	1	unidentified goldeneye	UGOL	1	1		2	3	4	LK-M	
15-Jul-08	014	424703	6282997	2	unidentified goldeneye	UGOL	1				1	1	LK-M	
15-Jul-08	014	424703	6282997	3	unidentified goldeneye	UGOL				1	1	1	LK-M	
15-Jul-08	014	424703	6282997	4	unidentified goldeneye	UGOL				1	1	1	LK-M	
15-Jul-08	014	424703	6282997	1	unidentified loon	ULOO				1	1	1	LK-M	
15-Jul-08	014	424703	6282997	1	unidentified sandpiper	USAN				1	1	1	LK-M	
15-Jul-08	014	424703	6282997		unidentified waterfowl	UWAT				2	2	2	LK-M	
15-Jul-08	014	424703	6282997	1	White-winged scoter	WWSC				1	1	1	LK-M	
15-Jul-08	015	427719	6282826	1	Canada goose	CAGO				39	39	39	LK-M	
15-Jul-08	016	428235	6283552	1	Canada goose	CAGO				15	15	15	PO-S	
15-Jul-08	016	428235	6283552	1	unidentified goldeneye	UGOL	1				1	1	PO-M	
15-Jul-08	016	428235	6283552	1	unidentified loon	ULOO				1	1	1	PO-S	
15-Jul-08	017	429994	6283869	1	unidentified loon	ULOO				1	1	1	PO-M	
15-Jul-08	017	429994	6283869	1	unidentified sandpiper	USAN				1	1	1	LK-L	
15-Jul-08	018	431935	6279759	1	Bonaparte's gull	BOGU				1	1	1	LK-L	
15-Jul-08	018	431935	6279759	2	Bonaparte's gull	BOGU				1	1	1	LK-L	
15-Jul-08	018	431935	6279759	1	Canada goose	CAGO				13	13	13	PO-L	
15-Jul-08	018	431935	6279759	1	unidentified loon	ULOO				1	1	1	LK-L	
15-Jul-08	018	431935	6279759	1	Mallard	MALL	1	5	IA		1	6	LK-L	
15-Jul-08	018	431935	6279759	1	unidentified sandpiper	USAN				3	3	3	LK-L	
15-Jul-08	018	431935	6279759	2	unidentified sandpiper	USAN				15	15	15	LK-L	
15-Jul-08	019	429670	6289828	1	unidentified sandpiper	USAN				1	1	1	LK-L	
15-Jul-08	021	427845	6288845	1	unidentified sandpiper	USAN				1	1	1	LK-L	
15-Jul-08	022	440585	6283791	1	unidentified sandpiper	USAN				1	1	1	RI-M	
15-Jul-08	023	445180	6276066	1	Mallard	MALL				3	3	3	SW	

^e Habitat descriptor: LK=lake, RI=river, PO=pond, MA=Marsh, SW=Swamp; size descriptor S=small, M=medium, L=large^a

Appendix 5.4-2. Summary of Water Dependent Bird Summer Brood Survey, 2008

Date	Waypoint ID	Easting	Northing	Group No.	Species	Species Code	No. Hens	No. Young	Class	No. Drake or Unided	Total Adult	Total	Habitat Type ^e	Comment(s)
15-Jul-08	023	445180	6276066	1	unidentified waterfowl	UWAT				1	1	1	SW	
15-Jul-08	024	447351	6271093	1	unidentified goldeneye	UGOL				1	1	1	PO-S	
15-Jul-08	024	447351	6271093	1	unidentified sandpiper	USAN				1	1	1	RI-M	
15-Jul-08	025	451761	6268725	1	unidentified sandpiper	USAN				1	1	1	RI-M	
15-Jul-08	026	456788	6269853	1	unidentified waterfowl	UWAT				3	3	3	PO-M	
15-Jul-08	027	457323	6269806	1	unidentified goldeneye	UGOL	1	5	IIB		1	6	PO-M	
15-Jul-08	027	457323	6269806	1	unidentified waterfowl	UWAT				2	2	2	PO-M	
15-Jul-08	028	456070	6270036	1	Mallard	MALL	1				1	1	PO-S	
15-Jul-08	028	456070	6270036	2	Mallard	MALL	2				2	2	PO-M	
16-Jul-08	029	445408	6288931	1	Canada goose	CAGO		3	IIB	2	2	5	SW-S	
16-Jul-08	029	445408	6288931	1	unidentified goldeneye	UGOL	1				1	1	PO-S	
16-Jul-08	030	444296	6289439	1	Mallard	MALL	3	1		4	7	8	PO-S	
16-Jul-08	031	444889	6288043	1	unidentified merganser	UMER	1	6	IIA		1	7	CR-M	
16-Jul-08	031	444889	6288043	2	unidentified merganser	UMER	1	15	IIB		1	16	CR-M	
16-Jul-08	032	446739	6288597	1	Bufflehead	BUFF	1				1	1	PO-M	
16-Jul-08	033	446081	6287516		unidentified goldeneye	UGOL				1	1	1	PO-M	
16-Jul-08	033	446081	6287516	1	unidentified sandpiper	USAN				1	1	1	CR-M	
16-Jul-08	034	449067	6289406	1	Mallard	MALL	1	5	IIB		1	6	SW-L	
16-Jul-08	035	448052	6287489	1	unidentified sandpiper	USAN				1	1	1	RI-S	
16-Jul-08	036	447554	6286609	1	unidentified goldeneye	UGOL	1			1	2	2	PO-M	
16-Jul-08	037	450668	6282325	1	Canada goose	CAGO				10	10	10	RI-L	
16-Jul-08	038	451189	6280614	1	Mallard	MALL	1	15	IIC		1	16	SW-M	
16-Jul-08	038	451189	6280614	1	unidentified waterfowl	UWAT				2	2	2	SW-M	
16-Jul-08	039	452130	6280227	1	unidentified goldeneye	UGOL				1	1	1	RI-L	
16-Jul-08	040	452296	6279258	1	unidentified goldeneye	UGOL	1	3	IIA		1	4	CR-M	
16-Jul-08	043	457137	6275820	1	unidentified merganser	UMER		4		1	1	5	RI-S	
16-Jul-08	044	460768	6272402	1	unidentified merganser	UMER				1	1	1	RI-L	
16-Jul-08	045	463055	6269671	1	Canada goose	CAGO	1	3	IIC	1	2	5	RI-L	
16-Jul-08	046	467044	6265207	1	unidentified sandpiper	USAN				1	1	1	RI-L	
16-Jul-08	047	451666	6260306	1	unidentified loon	ULOO				1	1	1	LK-M	
16-Jul-08	048	451637	6260568	1	Lesser scaup	LESC		1			0	1	PO-L	
16-Jul-08	048	451637	6260568	1	unidentified merganser	UMER	1	8	IIB		1	9	PO-L	
16-Jul-08	049	451136	6265415	1	American dipper	AMDI				2	2	2	MA-L	
16-Jul-08	050	450502	6264509	1	unidentified goldeneye	UGOL	1				1	1	PO-M	
16-Jul-08	050	450502	6264509	1	Mallard	MALL	1	11	III		1	12	PO-M	
16-Jul-08	051	452253	6267265	1	Canada goose	CAGO	1	6	IIA	1	2	8	PO-M	
16-Jul-08	052	450488	6268346	1	unidentified loon	ULOO		2	IIA	2	2	4	LK-L	
16-Jul-08	053	444635	6272323	1	unidentified goldeneye	UGOL	1				1	1	PO-S	
16-Jul-08	054	449087	6267607		unidentified goldeneye	UGOL				1	1	1	PO-S	
16-Jul-08	059	422055	6265407	1	unidentified sandpiper	USAN				1	1	1	CR-M	

^e Habitat descriptor: LK=lake, RI=river, PO=pond, MA=Marsh, SW=Swamp; size descriptor S=small, M=medium, L=large

Appendix 5.4-3

Summary of Water Dependent Bird Fall Staging Survey, 2008

Appendix 5.4-3. Summary of Water Dependent Bird Fall Staging Survey, 2008

Date	Waypoint ID	Easting	Northing	Group No.	Species	Species Code	No. Hens	No. Drakes	No. Juv	No. Unided	Total Juvenile	Total Adult	Total	Habitat Type*	Comment(s)
27-Sep-08	002	401210	6256812	1	unidentified merganser	UMER			2		2	0	2	LK-M	juveniles
27-Sep-08	003	401220	6258546	1	Common merganser	COME			3		3	0	3	LK-M	juveniles
27-Sep-08	005	394083	6246642	1	Canada goose	CAGO				28	0	28	28	LK-M	
27-Sep-08	005	394083	6246642	2	Mallard	MALL		2			0	2	2	LK-M	
27-Sep-08	005	394083	6246642	2	Green-winged teal	GWTE				9	0	9	9	LK-M	
27-Sep-08	006	394523	6246311	1	Canada goose	CAGO			8		0	8	8	LK-M	
27-Sep-08	007	398340	6249464	1	unidentified scoter	USCO			1		0	1	1	LK-S	likely surf scoter
27-Sep-08	007	398340	6249464	2	unidentified waterfowl	UWAT				2	0	2	2	LK-S	likely merganser or goldeneye
27-Sep-08	010	409196	6269092	1	unidentified merganser	UMER				3	0	3	3	RI-M	flying up river
27-Sep-08	012	423185	6282272	2	Barrow's goldeneye	BAGO				2	0	2	2	PO-M	
27-Sep-08	013	431926	6279504	1	Mallard	MALL				49	0	49	49	LK-L	
27-Sep-08	013	431926	6279504	2	unidentified merganser	UMER				2	0	2	2	LK-L	
27-Sep-08	013	431926	6279504	3	Barrow's goldeneye	BAGO				2	0	2	2	LK-L	
27-Sep-08	014	433870	6275046	2	Canada goose	CAGO				4	0	4	4	PO-S	Treaty Creek Pond off channel
27-Sep-08	015	445436	6272110	1	Canada goose	CAGO				11	0	11	11	MA-M	Marsh with channel of Treaty Creek
27-Sep-08	016	446865	6271711	1	Canada goose	CAGO				7	0	7	7	MA/PO-M	Marsh with pond
27-Sep-08	016	446865	6271711	1	Greater yellowlegs	GRYE				1	0	1	1	MA/PO-M	
27-Sep-08	017	448654	6270375	1	Mallard	MALL				5	0	5	5	MA/PO-S	off channel
27-Sep-08	018	449011	6269790	1	unidentified scaup	USCA				4	0	4	4	MA+PO	
27-Sep-08	019	450061	6268884	1	Mallard	MALL				3	0	3	3	LK-L	
27-Sep-08	019	450061	6268884	2	American wigeon	AMWI				1	0	1	1	LK-L	
27-Sep-08	020	450252	6268723	3	unidentified scaup	USCA				7	0	7	7	LK-L	
27-Sep-08	020	450252	6268723	1	Surf scoter	SUSC				7	0	7	7	LK-L	
27-Sep-08	021	450152	6268266	1	Trumpeter swan	TRSW				1	0	1	1	LK-L	
27-Sep-08	021	450152	6268266	2	Lesser scaup	LESC				15	0	15	15	LK-L	
27-Sep-08	024	451080	6265485	1	Mallard	MALL				25	0	25	25	MA-L	
27-Sep-08	025	450345	6264871	1	Green-winged teal	GWTE				4	0	4	4	MA-L	
27-Sep-08	026	451767	6259490	1	unidentified loon	ULOO			11		11	0	11	LK-M	juvenile arctic or red-throated loon
27-Sep-08	027	456188	6270112	1	Mallard	MALL				23	0	23	23	MA-M	pond & marsh
27-Sep-08	028	456810	6269987	1	Mallard	MALL			7		7	0	7	MA-M	young (class III)
27-Sep-08	029	446858	6288783	1	Barrow's goldeneye	BAGO				4	0	4	4	MA/SW-L	
27-Sep-08	030	446501	6287394	1	Canada goose	CAGO				4	0	4	4	SW-L	Teigen Bog-Swamp Complex
27-Sep-08	031	446932	6287518	1	Mallard	MALL				8	0	8	8	SW-L	Teigen Bog-Swamp Complex
27-Sep-08	032	444739	6288495	1	Mallard	MALL				2	0	2	2	SW-L	Teigen Bog-Swamp Complex
27-Sep-08	033	444251	6289477	1	Green-winged teal	GWTE				5	0	5	5	PO/SW-M	
27-Sep-08	033	444251	6289477	2	American wigeon	AMWI				3	0	3	3	PO/SW-M	Part of large swamp/bog complex at Teigen
27-Sep-08	034	443264	6289211	1	unidentified goldeneye	UGOL			2		2	0	2	PO/SW-M	likely juvenile barrow's goldeneye
27-Sep-08	035	444940	6275704	1	Mallard	MALL				1	0	1	1	PO-M	
27-Sep-08	036	439774	6283395	1	Mallard	MALL				3	0	3	3	PO-S	
27-Sep-08	037	429895	6283918	1	Common loon	COLO				1	0	1	1	LK-L	Hodkin Lake
27-Sep-08	038	431097	6284646	1	Barrow's goldeneye	BAGO				2	0	2	2	PO-M	off Hodkin Lake
27-Sep-08	039	427485	6283746	1	unidentified goldeneye	UGOL			1		1	0	1	LK-M	juvenile or hen
27-Sep-08	039	427485	6283746	2	unidentified goldeneye	UGOL			5		5	0	5	LK-M	juvenile or hen
27-Sep-08	040	424647	6283083	1	unidentified goldeneye	UGOL				4	0	4	4	LK-S	
27-Sep-08	041	425286	6282323	1	unidentified goldeneye	UGOL				2	0	2	2	LK-S	
27-Sep-08	042	425424	6282596	1	unidentified goldeneye	UGOL				1	0	1	1	LK-S	
27-Sep-08	043	427411	6282650	1	unidentified goldeneye	UGOL				1	0	1	1	LK-S	
27-Sep-08	044	407250	6277386	1	Canada goose	CAGO				5	0	5	5	LK-L	Tom McKay Lake

Habitat descriptor: LK=lake, RI=river, PO=pond, MA=Marsh, SW=Swamp; size descriptor S=small, M=medium, L=large.

Appendix 5.4-4

Summary of Water Dependent Bird Spring Staging Survey,
2009

Appendix 5.4-4. Summary of Water Dependent Bird Spring Staging Survey, 2009

Date	Waypoint ID	Eastings	Northing	Group No.	Species	Species Code	No. Hens	No. Drakes	No. Unided	Total	Habitat Type*	Comment(s)
26-Apr-09	002	447213	6288610	1	Hooded merganser	HOME	1			1	PO-S	
26-Apr-09	004	442004	6298656	1	Mallard	MALL	1	1		2	CR-M	
26-Apr-09	005	451290	6281411	1	Common merganser	COME			3	3	RI-L	
26-Apr-09	005	451290	6281411	2	Common merganser	COME	1	1		2	RI-L	
26-Apr-09	006	450237	6284439	1	Common merganser	COME	1	1		2	RI-L	
26-Apr-09	007	394776	6246097	1	Common merganser	COME	1	1		1	RI-L	
26-Apr-09	009	393595	6246537	1	Trumpeter swan	TRSW			3	3	LK-M	
26-Apr-09	009	393595	6246537	2	Canada goose	CAGO			85	85	LK-M	
26-Apr-09	009	393595	6246537	3	Trumpeter swan	TRSW			1	1	LK-M	
26-Apr-09	009	393595	6246537	4	Mallard	MALL			10	10	LK-M	
26-Apr-09	010	394430	6246909	1	Lesser scaup	LESC			9	9	LK-M	
26-Apr-09	010	394430	6246909	1	Bufflehead	BUFF			1	1	LK-M	
26-Apr-09	010	394430	6246909	1	Lesser scaup	LESC			3	3	LK-M	
26-Apr-09	010	394430	6246909	2	Barrow's goldeneye	BAGO	1	1		2	LK-M	
26-Apr-09	010	394430	6246909	2	Trumpeter swan	TRSW			1	1	LK-M	

* Habitat descriptor: LK=lake, RI=river, PO=pond, MA=Marsh, SW=Swamp; size descriptor S=small, M=medium, L=large.

Appendix 5.4-5

Incidental Water Dependant Bird Observations, 2008 and 2009

Appendix 5.4-5. Incidental Water Dependant Bird Observations, 2008 and 2009

Date	Discipline	Easting	Northing	Species	No. Observed	Comment(s)
15-Jun-08	Wildlife	433029	6280218	Spotted Sandpiper	2	at edge of valley/ West Teigen Lake entrance
15-Jun-08	Wildlife	410132	6269970	Canada Goose	2	in wetland
18-Jun-08	Wildlife	425715	6284687	Canada Goose	10	flyover
28-Jun-09	Wildlife	452746	6269618	Common Loon	3	
27-Jun-09	Wildlife	433087	6280289	Harlequin Duck	1	female
22-Jun-09	Wildlife	451936	6260951	Unknown loon	1	
27-Jun-09	Wildlife	433087	6280289	Spotted Sandpiper	1	
29-Jun-09	Wildlife	426340	6284314	Canada Goose	1	
23-Jun-09	Wildlife	397628	6253286	Common Loon	1	
23-Jun-09	Wildlife	430668	6283612	Spotted Sandpiper	1	
23-Jun-09	Wildlife	430295	6283558	Green-winged teal	1	
23-Jun-09	Wildlife	429878	6283539	Bonaparte's gull	1	
25-Jun-09	Wildlife	458158	6266013	Solitary Sandpiper	1	
25-Jun-09	Wildlife	457517	6266684	Solitary Sandpiper	1	
25-Jun-09	Wildlife	457517	6266684	Wilson's Snipe	1	
25-Jun-09	Wildlife	457533	6266754	Wilson's Snipe	1	
25-Jun-09	Wildlife	457533	6266754	Solitary Sandpiper	1	
23-Jun-09	Wildlife	407319	6259596	Solitary Sandpiper	1	nest
27-Jun-09	Wildlife	432633	6280071	Spotted Sandpiper	1	nest
30-Aug-09	Archeology	431410	6279664	Common Loon	3	
7-Jul-09	Fisheries	431719	6279637	Common Loon	2	
9-Jul-09	Fisheries	451723	6259433	Common Loon	2	
26-Apr-09	Wildlife	450426	6289438	Canada Goose	150	large groups of around 150 flying overhead

Appendix 6.2-1

Site Characteristics Recorded during the 2008 Western Toad
Aerial Reconnaissance Survey

Appendix 6.2-1. Site Characteristics Recorded during the 2008 Western Toad Aerial Reconnaissance Survey

ID	Date	Easting	Northing	Photos	Location	Length (m)	Width (m)	Area (ha)	Wetland Type	Shoreline Edge	Canopy (%)	Muddy Bank?	Flow (1-5)	Rating (1 Nil - 4 Good)	Comment
1	14-Aug-08	408752	6262925	2863	lower slope	15	10	0.015	tree hole	shrub	100	no	1	1	cold tree hole
2	14-Aug-08	408068	6262837	2865 - 2866	bottom	200	150	3.000	tree hole	shrub	100	no	1	2	
3	14-Aug-08	408723	6263097	2868	bottom	250	100	2.500	tree hole	shrub	100	no	1	1	
4	14-Aug-08	408736	6263708	2869	bottom	300	100	3.000	tree hole	shrub	100	no	1	1	
5	14-Aug-08	407901	6266121	2870	bottom	150	50	0.750	tree hole	shrub	100	no	2	1	
6	14-Aug-08	407331	6270110	2871	bottom	50	20	0.100	stream pond	gravel	100	no	4	1	cold pond with a gravel bank and alpine stream running
7	14-Aug-08	407406	6272624	2872 - 873	alpine	150	40	0.600	open	sedge	40	no	2	2	cold alpine pond with snowbanks nearby
8	14-Aug-08	407674	6273518	2875	alpine	30	7	0.021	open	sedge	0	no	3	2	cold alpine pond with snowbanks nearby
9	14-Aug-08	407632	6274335	2876	alpine	200	5	0.100	open	sedge	0	no	2	2	cold alpine pond with snowbanks nearby
10	14-Aug-08	406741	6274928	2877	alpine	350	150	5.250	open	rock	0	no	2	1	cold alpine pond with snowbanks nearby
11	14-Aug-08	406398	6274772	2878	alpine	1500	250	37.500	open	sedge	0	no	2	2	Large alpine lake
12	14-Aug-08	406938	6275085	2879	alpine	150	75	1.125	open	sedge/gravel	0	no	1	1	cold alpine pond with snowbanks nearby
13	14-Aug-08	407498	6275864	2880	alpine	150	15	0.225	open	gravel	0	no	1	1	cold alpine pond with snowbanks nearby
14	14-Aug-08	407559	6276009	2881	alpine	150	150	2.250	open	gravel	0	no	1	1	cold alpine pond with snowbanks nearby
15	14-Aug-08	408531	6277159	2882	alpine	150	20	0.300	open	gravel	0	no	1	1	cold alpine pond with snowbanks nearby
16	14-Aug-08	409007	6277498	2883	alpine	150	20	0.300	open	gravel	0	no	1	1	cold alpine pond with snowbanks nearby
17	14-Aug-08	409706	6278148	2884	bottom	300	100	3.000	open	sedge	0	no	2	2	pond in an avalanche track with several streams running through
18	14-Aug-08	409943	6278807	2885	bottom	300	100	3.000	open	sedge	15	no	2	2	
19	14-Aug-08	410880	6279878	2886	alpine	400	500	20.000	open	bog	50	no	1	1	high elevation and bog pond status makes this a poor
20	14-Aug-08	410806	6280315	2887	alpine	150	100	1.500	open	bog	25	no	1	1	
21	14-Aug-08	413100	6275210	2889	top slope	300	35	1.050	tree hole	shrub	100	no	2	1	may be bog on one end.
22	14-Aug-08	413647	6275405	2890	top slope	300	35	1.050	tree hole	shrub/bog	100	no	1	1	bog edge at one end
23	14-Aug-08	413738	6276130	2891	top slope	300	35	1.050	tree hole	shrub/bog	100	no	1	1	bog edge at one end
24	14-Aug-08	413909	6276395	2892	mid slope	25	20	0.050	tree hole	shrub/bog	100	no	1	1	bog edge at one end
25	14-Aug-08	416425	6277701	2893	mid slope	25	20	0.050	tree hole	shrub/bog	100	no	1	1	bog edge at one end
26	14-Aug-08	416667	6277784	2894	alpine	100	50	0.500	open	shrub/bog	50	no	1	1	high elevation and bog pond status makes this a poor
27	14-Aug-08	416848	6277831	2895	top slope	800	200	16.000	tree hole	shrub	100	no	2	2	just by its size, it may have the right conditions
28	14-Aug-08	417131	6277884	2896	mid slope	150	50	0.750	tree hole	shrub/bog	100	no	1	1	bog edge at one end
29	14-Aug-08	417420	6277956	2897	top slope	50	30	0.150	bog	bog	0	no	2	1	no flow, deep bog - likely cold
30	14-Aug-08	418017	6278077	2898	top slope	800	200	16.000	tree hole	shrub	100	no	2	2	
31	14-Aug-08	420934	6280021	2899	top slope	75	50	0.375	bog	bog	0	no	2	1	no flow, deep bog - likely cold
32	14-Aug-08	424176	6279620	2900	top slope	75	50	0.375	bog	bog	0	no	2	1	no flow, deep bog - likely cold
33	14-Aug-08	424434	6279390	2901	top slope	30	20	0.060	bog	bog	0	no	2	1	no flow, deep bog - likely cold
34	14-Aug-08	424793	6279437	2902	top slope	200	75	1.500	bog	bog	0	yes	2	2	looks like it might be muddy at one part
35	14-Aug-08	424944	6279461	2903	alpine	75	75	0.563	open	sedge/shrub	50	no	1	1	looks alpine and cold
36	14-Aug-08	425077	6279483	2904	alpine	350	400	14.000	open	sedge/gravel	25	Unk	2	2	may have muddy bits, but large and very high - so cold
37	14-Aug-08	425262	6279445	2905	alpine	100	25	0.250	open	sedge/shrub	15	no	2	1	cold sedge pond in alpine
38	14-Aug-08	425410	6279416	2906	apine	30	50	0.150	open	sedge/gravel	20	no	1	2	high elevation and bog pond status makes this a poor
39	14-Aug-08	425674	6279418	2907	alpine	300	150	4.500	lake	sedge/shrub	45	no	2	2	lake looks deep at the edges and no muddy banks.
40	14-Aug-08	426438	6279547	2908	alpine	150	75	100.000	fen	sedge/shrub	50	no	2	1	high elevation, darkish, deep, and no buddy banks.
41	14-Aug-08	427002	6279564	2909	alpine	200	75	1.500	bog	sedge/shrub	35	no	2	1	high elevation, deep, and no buddy banks.
42	14-Aug-08	427322	6279772	2910	alpine	200	75	1.500	lake	sedge/shrub	25	no	1	1	high elevation, darkish, deep, and no buddy banks.
43	14-Aug-08	427748	6279702	2911	alpine	300	100	3.000	lake	shrub/sedge	20	no	1	1	high elevation, darkish, deep, and no buddy banks.
44	14-Aug-08	428388	6282306	2912	alpine	60	30	0.180	open	sedge/moss	35	no	1	1	high elevation and abrupt edge makes this a poor pond
45	14-Aug-08	428217	6282643	2913	alpine	1500	750	112.500	lake	tree/shrub/sedge	90	no	2	2	high elevation, shaded, deep, but a large area so conservatively given higher rating.
46	14-Aug-08	428249	6283001	2914	alpine	75	50	0.375	tree hole	tree/shrub/sedge	75	no	1	1	high elevation, darkish, deep, and no buddy banks.
47	14-Aug-08	428419	6283127	2915	alpine	100	75	0.750	tree hole	tree/shrub/sedge	75	no	1	1	high elevation, darkish, deep, and no buddy banks.
48	14-Aug-08	429351	6283658	2916	mid slope	250	100	2.500	lake	tree/shrub/sedge	50	no	2	1	high elevation, darkish, deep, and no buddy banks.
49	14-Aug-08	429278	6283785	2917	bottom	2000	750	150.000	lake	shrub/tree/sedge	50	Unk	2	2	high elevation, shaded, deep, but a large area so conservatively given higher rating.
50	14-Aug-08	429859	6284480	2918	bottom	50	30	0.150	open	sedge	25	no	2	1	flooded creek path/pond in sedge meadow with fairly high flow through.
51	14-Aug-08	430297	6284641	2919	bottom	30	30	0.090	open	sedge	25	no	2	1	flooded creek path/pond in sedge meadow with fairly high flow through.
52	14-Aug-08	431110	6284367	2920	bottom	75	125	0.938	pond	sedge/shrub/trees	50	no	1	1	pond in sedge complex in forest - looks deepish and
53	14-Aug-08	432268	6284039	2921	top slope	75	30	0.225	pond	sedge/gravel	35	no	1	1	pond on bedrock with flank dams, looks deep, in fairly open canopy.
54	14-Aug-08	434163	6283698	2922	bottom	100	45	0.450	pond	sedge	0	no	3	2	pond which may be old beaver dam or horseshoe pond, but without muddy bank. Ranked higher due to possibility it may be beaver dam
55	14-Aug-08	434351	6283490	2923	bottom	75	20	0.150	pond	sedge	40	no	2	2	flooded creek path/pond in sedge meadow with trees surrounding on bedrock.
56	14-Aug-08	434806	6283299	2924	bottom	150	50	0.750	pond	sedge/shrub	50	no	2	1	flooded creek path/pond in sedge meadow with trees surrounding on bedrock. Fairly low elevation, so may be warm, but looks dark.
57	14-Aug-08	435121	6283355	2925	bottom	150	50	0.750	pond	sedge/shrub	50	no	2	1	flooded creek path/pond in sedge meadow with trees surrounding on bedrock. Fairly low elevation, so may be warm, but looks dark.

Appendix 6.2-1. Site Characteristics Recorded during the 2008 Western Toad Aerial Reconnaissance Survey

ID	Date	Easting	Northing	Photos	Location	Length (m)	Width (m)	Area (ha)	Wetland Type	Shoreline Edge	Canopy (%)	Muddy Bank?	Flow (1-5)	Rating (1 Nil - 4 Good)	Comment
58	14-Aug-08	435443	6283370	2926	bottom	300	150	4.500	pond	sedge/shrub	50	no	2	2	flooded creek path/pond in sedge meadow with trees surrounding. Fairly low elevation, so may be warm, but looks dark.
59	14-Aug-08	435526	6283260	2927	bottom	150	50	0.750	pond	sedge/shrub	50	no	2	1	flooded creek path/pond in sedge meadow with trees surrounding on bedrock. Fairly low elevation, so may be warm, but looks dark.
60	14-Aug-08	435547	6283292	2928	bottom	150	50	0.750	pond	sedge/shrub	50	no	2	1	flooded creek path/pond in sedge meadow with trees surrounding on bedrock. Fairly low elevation, so may be warm, but looks dark.
61	14-Aug-08	434996	6282787	2929	bottom	50	25	0.125	pond	sedge/shrub	50	no	1	1	flooded creek path/pond in sedge meadow with trees surrounding. Small and shallow, but with pond weed.
62	14-Aug-08	435487	6282805	2930	bottom	350	100	3.500	pond/creek	sedge/shrub	50	no	2	1	series of flooded creeks in sedge meadows. Some deep, some with pond weed.
63	14-Aug-08	435951	6283074	2931	bottom	100	25	0.250	pond/creek	sedge/shrub	50	no	2	1	series of flooded creeks in sedge meadows. Some deep, some with pond weed.
64	14-Aug-08	436224	6282498	2932	bottom	100	25	0.250	pond/creek	sedge/shrub	50	no	2	1	flooded creek path/pond in sedge meadows with lots of smaller sedge ponds.
65	14-Aug-08	440446	6283494	2933	bottom	100	10	0.100	creek/tree hole	sedge/trees	75	no	3	1	slow moving deep streams through sedge meadow through forest.
66	14-Aug-08	441932	6286245	2934	bottom	20	5	0.010	overflow	mud/shrubs	20	yes	1	3	muddy overflow feature along river, but quite shaded by overflow creek adjacent to main river.
67	14-Aug-08	442399	6286927	2935	bottom	100	35	0.350	overflow/creek	shrubs	50	no	3	1	beaver dam on valley bottom with inflow from slope, so likely cold, no muddy banks, so not great.
68	14-Aug-08	443542	6289075	2936	bottom	200	75	1.500	beaver dam	shrubs/sedges	50	no	2	2	matrix of low elevation beaver dams and overflows on valley bottom between highway 37 and river. No muddy banks, so not great, but correct position, so higher score.
69	14-Aug-08	443879	6289667	2937	bottom	400	350	14.000	beaver dam/overflow	shrubs/sedges	50	no	2	2	beaver dam on valley bottom with no muddy banks, so not great.
70	14-Aug-08	443976	6289188	2938	bottom	200	75	1.500	beaver dam	shrubs/sedges	50	no	2	2	dark overflow pond behind river berm in forest.
71	14-Aug-08	444905	6288639	2939	bottom	50	6	0.030	overflow channel	trees/shrubs	100	no	3	1	Dark overflow feature in forest - likely result of highway construction.
72	14-Aug-08	445404	6288485	2940	bottom	300	100	3.000	flooded forest	trees	100	no	Unk	1	Active overflow features along river adjacent to highway, likely from highway construction.
73	14-Aug-08	446458	6288492	2941	bottom	500	350	17.500	overflow channel	shrubs/sedge/trees	50	no	3	1	Flowing slow creek through sedge meadow.
74	14-Aug-08	445548	6288672	2945	bottom	300	6	0.180	river channel through sedge meadow	sedge	25	no	3	1	Some muddy features, but looks fairly high flow.
75	14-Aug-08	443906	6289903	2946	bottom	200	150	3.000	overflow features	sedge/shrubs	35	yes	2	3	not great, since flow likely come from high up so cold, but muddy features.
76	14-Aug-08	432949	6280453	2950	bottom	50	20	0.100	avalanche pond	gravel	0	yes	1	2	Lakes likely cold, but had muddy banks.
77	14-Aug-08	432793	6280166	2952	bottom	1500	500	75.000	lake	gravel/sand/mud/shrubs/trees	30	yes	1	2	avalanche toe pond without through-flow or mud.
78	14-Aug-08	432757	6280136	2953	bottom	30	15	0.045	avalanche pond	herbs	0	no	1	1	muddy banks unlikely, but difficult to see.
79	14-Aug-08	432529	6278537	2954	bottom	300	150	4.500	lake	shrubs/trees/sedges	40	no	1	2	high elevation, no flow, and no muddy bank.
80	14-Aug-08	432515	6277474	2955	alpine	25	50	0.125	pond	sedges/shrubs	0	no	1	1	high elevation, no flow, and no muddy bank.
81	14-Aug-08	431636	6278024	2956	alpine	25	50	0.125	pond	sedges/shrubs	0	no	1	1	medium elevation, no flow and no muddy bank.
82	14-Aug-08	431149	6279220	2957	alpine	5	5	0.003	tree hole	sedges/trees	50	no	1	1	medium elevation and has mud, but muddy area is in larger lake, so water temp likely not high
83	14-Aug-08	431425	6279326	2958	bottom	75	50	0.375	pond	sedges/mud	25	yes	3	2	no flow and no mud
84	14-Aug-08	431653	6279160	2959	bottom	25	25	0.063	pond	sedges	0	no	1	1	Some flow and fairly open, but no obvious muddy features. Large size, means a conservative rating.
85	14-Aug-08	432194	6278300	2960	bottom	300	100	3.000	pond	sedges	50	Unk	2	2	medium elevation flooded stream through sedge meadow with no muddy areas.
86	14-Aug-08	431823	6278808	2961	bottom	200	50	1.000	river channel through sedge meadow	sedges	0	no	2	1	medium elevation, tree hole, and no muddy areas.
87	14-Aug-08	415485	6277728	2965	mid slope	150	100	1.500	tree hole	sedges/shrubs	75	no	1	1	medium elevation, deep, and no muddy areas.
88	14-Aug-08	415136	6277707	2966	mid slope	30	20	0.060	tree hole	sedges	100	no	1	1	medium elevation, deep, and no muddy areas.
89	14-Aug-08	411163	6271716	2967	mid slope	30	20	0.060	tree hole	sedges	100	no	1	1	medium elevation, deep, and no muddy areas.
90	14-Aug-08	410416	6271380	2968	mid slope	30	20	0.060	tree hole	sedges	100	no	1	1	medium elevation, deep, and no muddy areas.
91	14-Aug-08	410181	6271296	2969	mid slope	30	20	0.060	tree hole	sedges	100	no	1	1	medium elevation, deep, and no muddy areas.
92	14-Aug-08	409675	6270110	2970	bottom	200	50	1.000	overflow	sedges/shrubs	50	no	3	2	active beaver dammed overflow stream adjacent to river. No apparent muddy areas, but in some cases tadpoles overflow pond on gravel bar adjacent to river. Looks muddy, so likely fairly high flow. Also dark.
93	14-Aug-08	409149	6269080	2971	bottom	350	25	0.875	overflow	sedges/shrubs	50	no	2	1	treehole - heavily shaded.
94	14-Aug-08	408051	6264765	2972	bottom	15	10	0.015	tree hole	trees/shrubs	100	no	1	1	treehole - heavily shaded, large and deep.
95	14-Aug-08	408051	6263072	2973	bottom	200	150	3.000	tree hole	trees/shrubs	100	no	1	1	pond in sedge/moss meadow in forest. Open, but no muddy banks, but high elevation.
96	14-Aug-08	433317	6277204	2977	top slope	75	25	0.188	pond	moss/sedges	50	yes	1	2	heavily shaded and deep.
97	14-Aug-08	433500	6276886	2978	top slope	200	200	4.000	pond	gravel/mud/mosses/sedges	25	yes	2	2	shaded bank and deep, no flow.
98	14-Aug-08	433466	6276044	2979	bottom	250	150	3.750	lake	trees/shrubs	100	no	1	1	shaded bank and deep, no flow.
99	14-Aug-08	433651	6274986	2980	mid slope	35	20	0.070	avalanche pond	gravel/shrubs	0	no	1	1	shaded bank and deep, no flow.
100	14-Aug-08	434172	6274554	2981	mid slope	20	15	0.030	avalanche pond	gravel/shrubs	0	no	1	1	

Appendix 6.2-1. Site Characteristics Recorded during the 2008 Western Toad Aerial Reconnaissance Survey

ID	Date	Easting	Northing	Photos	Location	Length (m)	Width (m)	Area (ha)	Wetland Type	Shoreline Edge	Canopy (%)	Muddy Bank?	Flow (1-5)	Rating (1 Nil - 4 Good)	Comment
101	14-Aug-08	442355	6272627	2982	bottom	250	100	2.500	beaver pond	shrubs/trees	50	no	2	2	unlikely, but large area and low elevation means that water may be warm.
102	14-Aug-08	443177	6272170	2983	bottom	100	25	0.250	beaver pond	shrubs/trees	100	no	2	1	unlikely due to heavy canopy, dark, deep water.
103	14-Aug-08	444073	6272213	2985	bottom	200	50	1.000	avalanche pond	shrubs/sedges	0	no	2	2	unlikely because no mud, but may be warm - open and low elevation
104	14-Aug-08	444822	6271984	2986	bottom	200	50	1.000	avalanche pond	shrubs/sedges	0	no	2	2	unlikely because no mud, but may be warm - open and low elevation
105	14-Aug-08	445045	6272043	2987	bottom	250	15	0.375	overflow stream	shrubs/sedges	50	no	3	1	high flow and shaded.
106	14-Aug-08	445432	6271842	2988	bottom	400	15	0.600	overflow stream	shrubs/sedges	50	no	3	1	high flow and shaded.
107	14-Aug-08	446663	6271509	2989	bottom	100	100	1.000	beaver pond	shrubs/sedges	50	no	2	1	relatively high flow and shaded.
108	14-Aug-08	446870	6271496	2990	bottom	100	100	1.000	beaver pond	shrubs/sedges	50	no	2	1	relatively high flow and shaded.
109	14-Aug-08	447938	6270776	2991	bottom	250	100	2.500	beaver pond/overflow	trees/shrubs	75	yes	3	1	high flow and heavily shaded.
110	14-Aug-08	448222	6270425	2992	bottom	250	50	1.250	beaver pond/overflow	trees/shrubs	75	yes	3	1	high flow and heavily shaded.
111	14-Aug-08	448621	6270220	2993	bottom	100	100	1.000	beaver pond/overflow	trees/shrubs	75	yes	3	1	high flow and heavily shaded.
112	14-Aug-08	449501	6269868	2994	bottom	75	75	0.563	beaver pond/overflow	trees/shrubs	75	yes	3	1	high flow and heavily shaded.
113	14-Aug-08	450956	6269355	2995	bottom	1500	1000	150.000	lake	sedges/shrubs/trees	50	Unk	Unk	2	large lake, so likely cold, but conservative rating.
114	14-Aug-08	452842	6268512	2996	bottom	25	25	0.063	overflow pond	shrubs/sedges/tress	50	no	3	1	shaded and fast flowing.
115	14-Aug-08	453464	6268510	2997	bottom	75	75	0.563	overflow pond	shrubs/sedges/tress	50	no	3	1	shaded and fast flowing.
116	14-Aug-08	454577	6268541	2998	bottom	75	75	0.563	beaver pond/overflow	shrubs/trees	75	no	2	1	heavily shaded.
117	14-Aug-08	455320	6268643	2999	bottom	500	200	10.000	beaver pond/overflow	shrubs/sedges/trees	50	Unk	2	2	Typically deep and fairly fast flowing, but some shallow muddy areas on river bar.
118	14-Aug-08	456385	6269322	3000	bottom	25	25	0.063	avalanche pond	sedges/shrubs	0	no	2	2	muddy and medium elevation.
119	14-Aug-08	456663	6269469	3001	bottom	100	50	0.500	beaver pond/overflow	trees/shrubs	100	no	1	1	shaded tree hole.
120	14-Aug-08	456974	6269616	3002	bottom	250	200	5.000	beaver pond/overflow	sedges/shrubs	10	yes	2	2	muddy and low elevation, but muddy areas on outflow fan, so likely not too warm.
121	14-Aug-08	457569	6269968	3003	bottom	250	100	2.500	beaver pond/overflow	shrubs/trees	75	no	2	1	heavily shaded.
122	14-Aug-08	457842	6270105	3004	bottom	100	75	0.750	beaver pond/overflow	shrubs/trees	75	no	2	1	heavily shaded.
123	14-Aug-08	458282	6270135	3005	bottom	100	75	0.750	beaver pond/overflow	shrubs/trees	75	no	2	1	heavily shaded.
124	14-Aug-08	458791	6270076	3006	bottom	25	15	0.038	beaver pond/overflow	shrubs/trees	100	no	1	1	heavily shaded.
125	14-Aug-08	459212	6270116	3007	bottom	25	15	0.038	beaver pond/overflow	shrubs/trees	100	no	1	1	heavily shaded.
126	14-Aug-08	457791	6270959	3008	mid slope	10	15	0.015	tree hole	shrubs/trees	75	no	1	1	heavily shaded.
127	14-Aug-08	453131	6270097	3009	bottom	500	100	5.000	beaver pond	shrubs/trees/sedges	50	no	2	1	heavily shaded and deep, no mud.
128	14-Aug-08	450035	6270361	3010	bottom	400	75	3.000	lake	shrubs/trees	60	no	1	1	heavily shaded and deep, no mud.
129	14-Aug-08	445379	6275570	3011	bottom	75	50	0.375	beaver pond	shrubs/sedges	30	no	2	1	deep and no mud.
130	14-Aug-08	442618	6276671	3012	bottom	50	5	0.025	pond	sedges/shrubs	25	no	2	1	pond in sedge meadow.
131	14-Aug-08	442152	6277224	3013	bottom	50	20	0.100	pond	sedges/shrubs	25	no	2	1	pond in sedge meadow.
132	14-Aug-08	442024	6277661	3014	bottom	25	20	0.050	beaver pond	sedges/shrubs	25	no	2	1	pond in sedge meadow.
133	14-Aug-08	440145	6277842	3015	top slope	25	5	0.013	pond	sedges/moss	50	no	1	1	high elevation ponds with no flow.
134	14-Aug-08	439916	6279218	3016	top slope	150	25	0.375	pond	sedges/moss	50	no	1	1	high elevation ponds with no flow.
135	14-Aug-08	439559	6280445	3017	top slope	25	15	0.038	pond	sedges/moss	50	no	1	1	high elevation ponds with no flow.
136	14-Aug-08	437926	6280965	3018	top slope	25	15	0.038	pond	sedges/moss	50	no	1	1	high elevation ponds with no flow.

Appendix 6.2-2

Abiotic Site Characteristics Recorded during Western Toad
Ground Surveys, 2008 and 2009

Appendix 6.2-2. Abiotic Site Characteristics Recorded during Western Toad Ground Surveys, 2008 and 2009

Site	Date	Easting	Northing	Elevation (m)	Photos	Weather	Rain	Air Temp (Co)	Water Temp (Co)	Size X	Size Y	Flow (1-5)	Water Depth (cm)	Muck Depth (cm)	Tannin
1	14-Aug-08	432793	6280166	1,083	399-403	overcast	yes	15	4.5	1000	450	2	15	2	no
2	14-Aug-08	432530	6278537	1,321	420-424	overcast	yes	7	5.6	200	150	1	130	50	no
4	14-Aug-08	432194	6278300	1,113		overcast	yes	7	8	35	50	1	30	35	no
3	14-Aug-08	432354	6278132	1,138	426-431	overcast	yes	8.5	7	50	20	1	50	30	no
5	17-Aug-08	433716	6277188	1,159	478-480	overcast	no	14	12	150	100	1	15	20	no
6	17-Aug-08	433593	6277208	1,168	483-484	overcast	no	16	13	20	10	1	25	2	no
7	17-Aug-08	433774	6277142	1,161	489-491	overcast	no	16	6	20	15	1	15	2	no
8	17-Aug-08	432303	6277638	1,147	492-495	overcast	no	14	11	5	8	1	50	50	no
9	17-Aug-08	432354	6277701	1,139	495-496	overcast	no	14	15	5	8	1	80	30	no
10	17-Aug-08	432210	6277610	1,145	497-499	overcast	no	14	13	200	150	2	20	15	no
11	17-Aug-08	427201	6280543	1,253	500-503	overcast	no	14	16	30	10	1	20	2	no
12	17-Aug-08	427208	6280486	1,253	504-507	overcast	no	14	15	10	10	1	15	30	no
13	17-Aug-08	427345	6280413	1,236	508-509	overcast	no	14	15	25	20	2	20	5	no
14	17-Aug-08	427369	6280247	1,222	511-512	overcast	no	14	15	250	200	1	20	2	no
15	17-Aug-08	428070	6279935	1,193	513-514	overcast	no	16	15	1000	350	1	20	2	no
16	17-Aug-08	428099	6280050	1,202	515-518	overcast	no	14	9	75	50	1	20	1	no
17	17-Aug-08	426350	6279885	1,175	519-524	overcast	no	16	18	50	75	1	20	1	no
18	17-Aug-08	426885	6279854	1,194	525-528	overcast	no	13	14	700	400	2	20	0	no
19	17-Aug-08	426782	6280020	1,187	529-532	overcast	no	13	15	150	30	2	15	2	no
20	17-Aug-08	426671	6279934	1,180	533-536	overcast	no	13	16	15	15	3	30	10	no
21	17-Aug-08	426508	6279913	1,177	538-540	overcast	no	13	16	20	10	2	15	2	no
23	3-Aug-09	427031	6279990	1,191	144-149	clear	no	25	7	10	5	1	20	15	no
24	3-Aug-09	427394	6279913	1,181	161-166	clear	no	24	8	300	150	1	25	10	no
25	3-Aug-09	427822	6279760	1,190	167-172	clear	no	25	13	10	5	2	20	10	no
26	3-Aug-09	410327	6271734	309	189-191	clear	no	20	8	4	8	1	30	20	y
27	3-Aug-09	431851	6279485	918	220-233, 235	clear	no	28	17	35	35	1	20	5	no
28	3-Aug-09	438769	6279897	1,069	001-005	clear	no	14	12	35	20	1	22	3	no
15	3-Aug-09	428070	6279935	1,184	181-185	clear	no	26	12	250	150	1	35	5	no
17	3-Aug-09	426344	6279886	1,174	117-120	smoky	no	22	14	35	35	0	14	10	no
19	3-Aug-09	426782	6280020	1,187	138-143	clear	no	25	8	35	20	2	8	10	no
20	3-Aug-09	426671	6279934	1,177	133-137	clear	no	24	12	10	10	3	12	10	no
21	3-Aug-09	426508	6279913	1,175	125-129	clear	no	23	8	30	15	2	8	10	no
22	3-Aug-09	431719	6279637	915	194-219	clear	no	28	18	500	250	2	10	5	no
29	4-Aug-09	439039	6279564	1,102	009-010	clear	no	16	8	2	8	1	20	20	no
30	4-Aug-09	439175	6279481	1,093	011-013	clear	no	18	11	8	1	2	10	10	no
31	4-Aug-09	439195	6279496	1,089	014-017	clear	no	20	14	150	10	1	15	5	no
32	4-Aug-09	439258	6279418	1,097	018-023	clear	no	16	7	80	20	1	75	50	y
33	4-Aug-09	439306	6279355	1,097	024-027	clear	no	15	8	6	8	1	75	50	y
34	4-Aug-09	439393	6279327	1,094	028-031	clear	no	15	6	10	3	1	65	30	y
35	4-Aug-09	439563	6279444	1,069	032-037	clear	no	24	14	200	100	1	75	50	y
36	4-Aug-09	439585	6279701	1,071	39-60	clear	no	25	12	250	100	1	20	2	no
65	4-Aug-09	451690	6259504	693	68-79	clear	no	25	11	75	75	1	22	8	no
37	4-Aug-09	452060	6259286	698	080-082	clear	no	20	8	5	5	1	30	20	y
38	4-Aug-09	442582	6274284	1,324	141-146	clear	no	15	6	2	5	1	10	5	no
39	4-Aug-09	443205	6274453	1,264	147-148	clear	no	10	5	10	15	1	30	5	no
40	4-Aug-09	443248	6274481	1,262	150-152	clear	no	15	8	4	8	1	30	5	y
41	4-Aug-09	444998	6275762	882	154-173	clear	no	26	16	50	75	2	20	5	no
42	4-Aug-09	442019	6277245	888	174-176	clear	no	21	12	200	50	1	22	5	no
43	5-Aug-09	441656	6286385	591	178-191	clear	no	18	12	50	50	1	10	6	no
44	5-Aug-09	442098	6287380	581	192-197	clear	no	22	7	350	3	3	5	0	no
45	5-Aug-09	443296	6288870	569	198-214	clear	no	26	16	75	100	2	15	5	no
46	5-Aug-09	443733	6289478	573	215-224	clear	no	25	7	50	10	3	15	5	no
47	5-Aug-09	442381	6287549	588	233-247	clear	no	18	16	75	50	2	20	5	no
48	5-Aug-09	442174	6287288	585	248-254	clear	no	20	8	200	5	3	20	5	no
49	5-Aug-09	432162	6278246	1,108	278-282	clear	no	16	6	5	5	1	75	20	y
50	5-Aug-09	432138	6278299	1,110	283-286	clear	no	16	7	100	150	1	60	30	y
51	5-Aug-09	432068	6278367	1,107	287-289	clear	no	16	8	50	2	1	50	10	y
52	5-Aug-09	431833	6278613	1,077	290-292	clear	no	16	8	50	2	1	50	20	y
53	5-Aug-09	431912	6279156	982	293-304	clear	no	17	7	5	5	1	30	50	y
3	5-Aug-09	432354	6278132	1,138	268-276	clear	no	16	8	5	10	1	65	20	y
54	6-Aug-09	439711	6283379	642	306-323	clear	no	18	14	200	150	2	20	30	no
55	6-Aug-09	440012	6283539	636	324-332	clear	no	11	5	200	150	1	20	30	y
56	6-Aug-09	431843	6277644	1,148	333-336	clear	no	14	5	15	15	1	38	20	y
57	6-Aug-09	431980	6277612	1,156	337-342	clear	no	14	3	10	10	1	38	20	y
58	6-Aug-09	432251	6277588	1,146	343-346	clear	no	14	4	10	10	1	38	20	y
59	6-Aug-09	433538	6276887	1,124	369-374	clear	no	16	6	60	2	2	10	6	no
60	6-Aug-09	433319	6277238	1,134	378-381	clear	no	17	8	5	10	1	40	10	y
61	6-Aug-09	433342	6277211	1,137	382-385	clear	no	16	8	4	8	1	30	20	y
62	6-Aug-09	433297	6277263	1,134	388-393	clear	no	17	9	20	6	1	20	10	y
63	6-Aug-09	441902	6277758	884	394-396	clear	no	20	8	4	8	1	30	20	y
64	6-Aug-09	441965	6277662	888	397-402	clear	no	21	7	10	5	1	65	20	y

Appendix 6.2-3

Biotic Site Characteristics Recorded during Western Toad
Ground Surveys, 2008 and 2009

Appendix 6.2-3. Biotic Site Characteristics Recorded during Western Toad Ground Surveys, 2008 and 2009

Site	Date	Wetland Type	Fish Present?	Water Level Variable	Canopy (%)	Canopy Type			Bank Substrate (%)					Bank Slope					Vegetation Type (% Shoreline)					
						open and sunny	canopy set back	dense, dark canopy	Mud	Shrub	Gravel	Sphagnum	Dense sedges/aquatic veg	Other	1-mudflats	2-gently sloping	3-moderate	4-steep	5-drop off	other	Emergent (species)	Floating	Submerged	
1	14-Aug-08	Lake	unk	no	30	70		30			100						100				30 (sedges)			
2	14-Aug-08	sedge wetland	no	no	50	50		50				100							100		50 (sedges)	0	0	
4	14-Aug-08	sedge wetland	unk	no	30	70		30				100								100	50 (sedges)	0	0	
3	14-Aug-08	sedge wetland	no	no	0	100						100								100	50 (sedges)	0	0	
5	17-Aug-08	sedge wetland	no	no	0	100					30	40	30					50	50			0	0	
6	17-Aug-08	sedge wetland	no	no	100			100				100								100	20 (sedges)	0	0	
7	17-Aug-08	sedge wetland	no	no	0	100						100								100	100 (sedges)	0	0	
8	17-Aug-08	sedge wetland	no	no	0	100							100							100	100 (sedges)	0	0	
9	17-Aug-08	sedge wetland	no	no	0	100							100							100		0	0	
10	17-Aug-08	sedge wetland	unk	no	0	100							50						50	50		0	0	
11	17-Aug-08	bog	no	no	0	100						100								100	80 (sedges)	0	0	
12	17-Aug-08	sedge wetland	no	15	0	100							100							100		0	0	
13	17-Aug-08	sedge wetland	no	no	0						100									100		0	0	
14	17-Aug-08	alpine meadow	no	no	0			100					100							100		0	0	
15	17-Aug-08	alpine meadow	yes	no	60	40			60		50	50						50	50			0	0	
16	17-Aug-08	alpine forest	no	no	50			50	50				100							100	10 (sedges)	0	0	
17	17-Aug-08	alpine forest	no	no	0			100					100							100		0	0	
18	17-Aug-08	alpine forest	unk	no	50			50	50		50			50						50		0	0	
19	17-Aug-08	alpine forest	no	no	0	100							100							100		0	0	
20	17-Aug-08	alpine forest	unk	15	0			100				40	60							100		0	0	
21	17-Aug-08	alpine forest	no	10	20			80	20		30	70						30	70			0	0	
23	3-Aug-09	marsh pond	no	no	0	100							100					100				0	0	
24	3-Aug-09	lake	unk	no	40	60			40	50			50					50				0	0	
25	3-Aug-09	sedge wetland	no	no	25	75		25					50						100		5 (sedge)	0	0	
26	3-Aug-09	river	no	no	0	100							100							100	20 (sedge)	0	0	
27	3-Aug-09	beaver pond	no	no	0	100							50							50		0	0	
28	3-Aug-09	fen	no	no	0	100							100							100		0	0	
15	3-Aug-09	lake	yes	no	0	100					25	75								100		0	0	
17	3-Aug-09	bog	no	no	15	100							100							100	15 (sedges)	0	0	
19	3-Aug-09	sedge wetland	no	no	0	50		50					100						100			0	0	
20	3-Aug-09	sedge wetland	no	no	0	100							100							100	5 (sedges)	0	0	
21	3-Aug-09	sedge wetland	no	no	0			100						100					100		50 (sedges)	0	0	
22	3-Aug-09	lake	yes	no	0	100							10						90	10		0	0	
29	4-Aug-09	sedge wetland	no	no	0	100								100								0	0	
30	4-Aug-09	swamp	no	no	100			100					100							100	100 (sedge)	0	0	
31	4-Aug-09	fen	no	no	80				100					100						100		0	0	
32	4-Aug-09	sedge wetland	no	no	0	100								100						100		0	0	
33	4-Aug-09	sedge wetland	no	no	0	100								100						100		0	0	
34	4-Aug-09	sedge wetland	no	no	0	100								100						100	100 (sedge)	0	0	
35	4-Aug-09	fen	unk	no	0	100								100						100	20 (sedge)	0	0	
36	4-Aug-09	lake	unk	no	0	100							50	50						50	50		0	0
65	4-Aug-09	beaver pond	unk	no	0	100									10				90			0	0	
37	4-Aug-09	sedge wetland	no	no	0	100							100							100	5 (sedge)	0	0	
38	4-Aug-09	sedge wetland	no	25	0	100								100						100	20 (sedge)	0	0	
39	4-Aug-09	sedge wetland	no	15	0	100								100						100		0	0	
40	4-Aug-09	sedge wetland	no	25	0	100								100						100	100 (sedge)	0	0	
41	4-Aug-09	beaver pond	unk	no	50	100								75						25	75 (sedge)	0	0	
42	4-Aug-09	fen	unk	no	50	100								80								0	0	
43	5-Aug-09	beaver pond	no	no	20	100									75	25				25		0	0	
44	5-Aug-09	none	yes	15	20	100									25				75			0	0	
45	5-Aug-09	beaver pond	yes	20	50	100									50				50			0	0	
46	5-Aug-09	beaver pond	yes	no	80	100									50				50			20 (sedge)	0	0

Appendix 6.2-3. Biotic Site Characteristics Recorded during Western Toad Ground Surveys, 2008 and 2009

Site	Date	Wetland Type	Fish Present?	Water Level Variable	Canopy (%)	Canopy Type			Bank Substrate (%)						Bank Slope						Vegetation Type (% Shoreline)						
						open and sunny	canopy set back	dense, dark canopy	Mud	Shrub	Gravel	Sphagnum	Dense sedges/aquatic veg	Other	1-mudflats	2-gently sloping	3-moderate	4-steep	5-drop off	other	Emergent (species)	Floating	Submerged				
47	5-Aug-09	beaver pond	yes	no	25	100			100							100								0	0		
48	5-Aug-09	stream	yes	20	60	50	50		20		80					20	80							5 (sedge)	0	0	
49	5-Aug-09	sedge wetland	no	no	0	100							100											5 (sedge)	0	0	
50	5-Aug-09	sedge wetland	unk	no	0	100							100											5 (sedge)	0	0	
51	5-Aug-09	sedge wetland	no	no	50	50	50						100											5 (sedge)	0	0	
52	5-Aug-09	sedge wetland	no	no	50	50	50						100											5 (sedge)	0	0	
53	5-Aug-09	sedge wetland	no	no	0	100							100											20 (sedge)	0	0	
3	5-Aug-09	sedge wetland	no	no	0	100							100											0	0	0	
54	6-Aug-09	beaver pond		35	50	50		50	50	50					50		50							20 (sedge)	0	0	
55	6-Aug-09	swamp			80		100						100				50	50						0	0	0	
56	6-Aug-09	sedge wetland	no	no	0	100			50	50			100				100			100				0	0	0	
57	6-Aug-09	sedge wetland	no	no	0	100			50	50			100				100			100				0	0	0	
58	6-Aug-09	sedge wetland	no	no	0	100			50	50			100				100			100				0	0	0	
59	6-Aug-09	sedge wetland	no	10	0	100			100				100						100					10 (sedge)	0	0	
60	6-Aug-09	sedge wetland	no	no	0	100							100								100				5 (sedge)	0	0
61	6-Aug-09	sedge wetland	no	no	0	100							100								100				0	0	0
62	6-Aug-09	sedge wetland	no	no	0	100							100						100						15 (sedge)	0	0
63	6-Aug-09	sedge wetland	no	no	0	100							100								100				5 (sedge)	0	0
64	6-Aug-09	sedge wetland	no	no	0	100							100								100				5	0	0

Appendix 6.2-4

Amphibian Observation Data, 2008 and 2009

Appendix 6.2-4. Amphibian Observation Data, 2008 and 2009

Site	Date	Time Searched (min)	No. Toads		No. Frogs		No. Salamander	Notes
			Adults	Tadpoles	Adults	Tadpoles		
1	14-Aug-08	35	0	0	0	0	0	Large, deep lake.
2	14-Aug-08	30	0	0	0	0	0	Deep pond in sedge meadow
4	14-Aug-08	30	0	0	3	0	0	series of 5 shallow ponds in sedge meadows
3	14-Aug-08	30	0	0	0	0	0	Deep pond in sedge meadow
5	17-Aug-08	30	0	0	0	0	0	single pond in sedge meadow
6	17-Aug-08	30	0	0	0	0	0	single pond in sedge meadow
7	17-Aug-08	30	0	0	4	0	0	single pond in sedge meadow
8	17-Aug-08	10	0	0	0	0	0	small open pond in sedge meadow
9	17-Aug-08	10	0	0	0	0	0	small open pond in sedge meadow
10	17-Aug-08	25	0	0	0	0	0	medium sized pond in sedge meadow
11	17-Aug-08	20	0	0	0	0	0	3 interconnected alpine bogs
12	17-Aug-08	20	0	0	2	0	0	small open pond in sedge meadow
13	17-Aug-08	20	0	0	2	0	0	small open pond in sedge meadow
14	17-Aug-08	20	0	0	0	0	0	rocky bottom on alpine pond
15	17-Aug-08	45	0	0	0	0	0	large alpine lake
16	17-Aug-08	25	0	0	0	0	0	rocky bottom on alpine pond
17	17-Aug-08	25	0	0	0	0	0	rocky bottom on alpine pond
18	17-Aug-08	25	0	0	0	0	0	rocky bottom on alpine pond
19	17-Aug-08	25	0	0	0	0	0	a series of small alpine ponds with macrobiotic mat
20	17-Aug-08	25	0	0	0	0	0	a small pond in a stream with a rocky bottom and macrobiotic mat
21	17-Aug-08	25	0	0	0	0	0	a small pond in a stream with a rocky bottom and macrobiotic mat
23	3-Aug-09	10	0	0	0	0	0	
24	3-Aug-09	20	0	0	0	0	0	
25	3-Aug-09	10	0	0	0	0	0	
26	3-Aug-09	20	0	0	0	0	0	
27	3-Aug-09	25	3	600	0	0	0	swabed KSM #1 toad for Chytrid.
28	3-Aug-09	10	0	0	0	0	0	
15	3-Aug-09	15	0	0	0	0	0	
17	3-Aug-09	20	0	0	0	1	0	
19	3-Aug-09	15	0	0	0	0	0	
20	3-Aug-09	10	0	0	0	0	0	
21	3-Aug-09	20	0	0	0	0	0	
22	3-Aug-09	25	0	400	0	0	0	Fisheris saw tadpoles and an adult here as well, minnows observed in water.
29	4-Aug-09	15	0	0	0	0	0	
30	4-Aug-09	10	0	0	0	0	0	swamp pond in forest.
31	4-Aug-09	10	0	0	0	0	0	
32	4-Aug-09	20	0	0	0	0	0	large pond in a sedge meadow with a bit of flow. Very cold and deep.
33	4-Aug-09	20	0	0	0	0	0	a smallish pond in a large sedge meadow complex.
34	4-Aug-09	20	0	0	0	0	0	another medium sized pond in the same sedge wetland as 33
35	4-Aug-09	20	0	0	0	0	0	

Appendix 6.2-4. Amphibian Observation Data, 2008 and 2009

Site	Date	Time Searched (min)	No. Toads		No. Frogs		No. Salamander	Notes
			Adults	Tadpoles	Adults	Tadpoles		
36	4-Aug-09	20	0	0	0	0	0	
65	4-Aug-09	15	1	0	0	0	0	Fisheries detected adult toad here. Pond near 1X0.5km lake. Is inflo stream with a beaver dam. Incidental muskrat obs.
37	4-Aug-09	20	0	0	0	0	0	seasonal slpine pond
38	4-Aug-09	20	0	0	0	0	0	alpine pond
39	4-Aug-09	20	0	0	0	0	0	
40	4-Aug-09	20	0	0	0	0	0	another alpine pond
41	4-Aug-09	30	1	0	0	0	0	Toad #2 swabbed
42	4-Aug-09	25	0	0	4	0	0	large pond against the tree line on south side of TMF
43	5-Aug-09	20	0	0	0	0	0	
44	5-Aug-09	20	0	0	0	0	0	stream with spirulina-like veg on roacks, looked slow moving from the air, but is quicker on the ground.
45	5-Aug-09	35	1	0	0	0	0	highly likely breeding site with 5-6 year old female toad swabbed (#3),no aquatic veg on the bottom or emergent veg.
46	5-Aug-09	15	0	0	0	0	0	outflow from a beaver dam on a branch of the main Tiegen Creek - water too cold and fast flowing for toads
47	5-Aug-09	25	0	500	0	0	0	deep mud, aquatic veg in old oxbow, lots of tadpoles
48	5-Aug-09	18	0	0	0	0	0	cold and fairly fast moving side channel of river is outflow for beaver dam.
49	5-Aug-09	20	0	0	0	0	0	
50	5-Aug-09	20	0	0	0	0	0	
51	5-Aug-09	20	0	0	0	0	0	
52	5-Aug-09	20	0	0	0	0	0	
53	5-Aug-09	20	2	0	0	0	0	saw two toads. Uphill from the large lake with lots of toad observations and breeding.
3	5-Aug-09	15	0	0	0	0	0	
54	6-Aug-09	40	0	0	1	0	0	looked good from the air, with lots of mud, but deep water and little veg in the water, no emergent veg.
55	6-Aug-09	40	0	0	0	0	0	
56	6-Aug-09	20	0	0	0	0	0	
57	6-Aug-09	20	0	0	0	0	0	
58	6-Aug-09	20	0	0	0	0	0	
59	6-Aug-09	25	0	0	0	0	0	
60	6-Aug-09	18	0	0	0	0	0	
61	6-Aug-09	20	0	0	0	0	0	
62	6-Aug-09	15	0	0	0	0	0	
63	6-Aug-09	20	0	0	0	0	0	
64	6-Aug-09	20	0	0	1	0	0	