PROSPERITY
A Gold-Copper Project of Taseko Mines Limited

Taseko Prosperity Gold-Copper Project

Appendix 5-6-A

Taseko Mines Limited

Taseko Mines Limited
Prosperity Project
Wildlife Data Report
1997-1999

DRAFT

for:

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PART ONE: MINE SITE

1.0 INTRODUCTION

In order to be able to predict likely effects of the Prosperity Project proposed mine site on the indigenous fauna, background information on both the wildlife distributions and populations in the area, as well as on the distribution and value of different habitats needed to be combined. A wildlife program within the proposed mine development area and surroundings was therefore conducted from 1995 to 1999. This program identified key wildlife populations and habitat uses, developed capability/suitability interpretations for focal species, and provided a baseline to predict and mitigate potential effects of the mine site development.

Part one of this report describes the methods and documentes the data collection for all wildlife surveys carried out by Madrone Consultants Ltd. in the mine site study area and associated access road for the Prosperity Project of Taseko Mines Ltd. Details of the inventory work and assessments specific to each inventory group are presented under species group headings. Discussion of the likely effects of the project on each species group are presented in Section 9.0.

1.1 Study Area

The Prosperity Project area is located 250 km southwest of Williams Lake, in the Chilcotin region of the BC Interior (NTS 1:50,000 topographic mapsheets 92-O/5, 92-O/6, 92-O/11, 92-O/12

For the purpose of wildlife inventory baseline studies and habitat assessment for the Prosperity Project area, the mine site study area consists of the area mapped for terrestrial ecosystems, TEM mapping (Appendix 1, Figure 1), which includes the access road. The mapped area covers over 18,000 hectares covering the general area around the mine site development area, including the tailings and storage areas. The study area includes portions of the Fish Creek, Tete Angela Creek , and Beece Creek watersheds.

1.2 Wildlife Inventory

Baseline wildlife studies have been underway since 1993, with Madrone Consultants Ltd. joining the project in 1997. Previous to 1997, wildlife inventory data was summarized by Hallam Knight Piesold (Hallam Knight Piesold, 1997).

A wildlife inventory program was conducted within the area of TEM from 1997 to 1999 by Madrone Consultants Ltd. A range of inventory programs was conducted, and included aerial surveys for ungulates and the larger carnivores (summer and winter), snow tracking surveys for carnivores (and ungulates), breeding bird surveys, raptor nest surveys, a bat inventory project, and an amphibian sampling program.

For the better documented species and species groups, an effort was made to identify relative abundance in the area. For the more poorly documented groups, including amphibians and bats, the emphasis was on obtaining preliminary reconnaissance level

data to detect what species are likely present in the area, and to determine if there was any need for further work.

Surveys were conducted to identify key wildlife populations and habit uses, verify the capability/suitability mapping, and to provide a baseline to predict and mitigate impacts. A range of inventory programs was conducted, and included: aerial surveys for ungulates, snow tracking surveys for a number of furbearers, breeding bird surveys, raptor nest surveys, a bat inventory project, and an amphibian survey program.

Field surveys were concentrated in sensitive and high value wildlife areas, carried out during the seasons and times of day which facilitated detection of the target species or species groups. Wherever appropriate standards established by the provincial Resources Inventory Committee (RIC) were applied.

1.3 Wildlife Habitat Assessment

In addition to wildlife inventory, wildlife habitats were identified and mapped through the Terrestrial Ecosystem Mapping (TEM) process (see Section 3.0). In the area of the mine site, the habitats mapped through TEM were assessed for their values to a variety of wildlife species. Habitat capability/suitability interpretations and ratings were developed for ungulates, large carnivores, waterfowl, and select red- and blue-listed species with potential to occur in the study area.

Wildlife species considered significant for the purposes of this study included both regionally important, and rare or threatened species. Rare or threatened provincial status is determined by the Conservation Data Centre for B.C. (CDC) based in Victoria, whereas the Committee On the Status of Endangered Wildlife In Canada (COSEWIC), based in Ottawa, determines national status of a given species.

The list of species for developing detailed suitability/capability ratings, and the seasons and life requisites to be assessed for each, were selected through consultation with the Cariboo Region of the Ministry of Environment, Lands and Parks (MELP), with additional input from the Canadian Wildlife Service (CWS). Appendix 2 indicates the wildlife species that were selected for more detailed assessment, and summarizes their status. Detailed species accounts, as well as habitat ratings tables, were developed and are presented in an associated technical report (Madrone Consultants Ltd., 1999). The individual species accounts consist of information regarding the status, biology, distribution, and habitat rating assumptions for each species. Many other species were also considered during our analyses, but explicit capability/suitability ratings were not applied. These other species are discussed in the context of the relevant species groups, below.

For the mine site study area, 10 focal wildlife species were selected for more detailed species-habitat model assessment: Great Blue Heron, Mallard, Barrow's Goldeneye, Prairie Falcon, Sandhill Crane, Fisher, Balck Bear, Grizzly Bear, California Bighorn Sheep, Moose and Mule Deer.

The species list for detailed assessment was determined in 1998, following the ecosystem mapping and wildlife inventory work. Prior to this, wildlife habitat notes had been taken in conjunction with a wide range of sampling programs. This information was used, in conjunction with the direct inventory results, to develop habitat ratings. An extension of the TEM mapping area in 1998 provided an opportunity to verify wildlife habitat assessments using standard RIC methodology of the day (i.e. 1998 wildlife habitat forms). Further field verification was completed during additional wildlife inventory sampling in 1999.

1.4 Red and Blue-Listed Species

The CDC maintains "tracking lists" for rare, threatened and vulnerable elements of biodiversity (including ecosystems, plants and vertebrate wildlife), and establishes their provincial status. The CDC maintains "red" and "blue" lists for these elements. In brief, red-listed elements are those considered rare, threatened and endangered, while blue listed elements are considered potentially vulnerable. They may be infrequent, locally frequent or even locally common elements, but are thought to be at risk, usually from present day trends of development and land use (see Appendix 2).

Invertebrates are poorly known and red and blue lists for this group are not established. They were not specifically targeted in this inventory project. However, incidental observations of invertebrates - particularly butterflies and dragonflies - noted during the course of other inventories were recorded (see Appendix 3).

1.5 Objectives

The prime objectives for wildlife inventory within the mine site study area were:

- Develop a reasonably comprehensive understanding of the biodiversity of the study area.
- Identify significant species, populations and habitats in the study area (including red and blue-listed elements).
- Assess relative abundance of key wildlife species (where possible).
- Identify habitat associations for key wildlife species.
- Identify potential impacts of the proposed development upon these elements and evaluate the significance.
- Where needed, provide management recommendations to maintain biodiversity and wildlife values over the duration of the project and after closure.
- Assist in the development of mitigation and restoration plans.
- Identify any areas/species/habitats that require further, more detailed inventory in future years.

Wildlife inventory methods and associated limitations varied substantially between different species groups, and are discussed in the relevant sections below.

1.6 Personnel

Project planning, reconnaisssance work, and overall project review were the work of Gillian Radcliffe and Tania Tripp. Gillian Radcliffe supervised field crews and participated in all aspects of wildlife inventory. Amphibian surveys were conducted by Carolyn Whittaker, Julie Williams in 1997, and Julie Williams and Tania Tripp in 1999. Breeding and migratory bird inventory was conducted by Derrick Marven and Tania Tripp in 1997 and 1998. In addition, Dave Alcroft recorded bird species present during TEM fieldwork in July, 1997. Bat surveys were conducted by Salman Rasheed, Carolyn Whittaker and Julie Williams in 1997. Gillian Radcliffe, Carolyn Whittaker and Tania Tripp collected habitat suitability/capability data in order to develop ecosystem unit habitat ratings for wildlife.

2. REPTILES

2.1 Methodology

Based on range and known ecology, only three reptile species were identified as potentially occurring in the study area. These are the three garter snake species that occur in B.C. – all of which are relatively common and widespread in the province. Potential for the blue-listed Rubber Boa to occur in the study area was also investigated. The study area appeared to be of limited value for this species, based on its biology, known distribution and habitat, and the chances of occurrence were predicted to be extremely low.

As there are no known or likely red or blue-listed reptile species in the mine site study area, no specific inventory work was proposed.

Instead, species likely to be present in the area were identified along with any specific needs or concerns regarding reptiles in the mine site area. Reptile searches were performed opportunistically, while searching for amphibians, and in areas of dry grassland which provided suitable habitat. As well, other field crews were provided guidance for recording incidental observations.

2.2 Results/Baseline Conditions

No red or blue listed species were detected in the study area during the 1997-1999 inventory sessions at the Prosperity Project Area. There is potential for western terrestrial (*Thamnophis elegans*), northwestern (*Thamnophis ordinoides*) and common (*Thamnophis sirtalis*) garter snakes to occur where appropriate habitats are present.

One Garter Snake (*Thamnophis* spp.) was observed at small lake located southeast of Fish Lake in 1997. Garter snakes have also been observed using Prosperity Camp and the surroundings in previous years by camp staff..

During 1999 amphibian surveys in July, two common garter snakes (*Thamnophis sirtalis*) were observed hunting along the shoreline of a large pond to the immediate southwest of Big Onion Lake (Appendix 1, Figure 2 - survey sites A31 and A33). Amphibian and

invertebrate prey was available at the sites as well as security habitat amongst the downed trees and tall grasses.

No other snakes were observed during any of the field sampling programs from 1997-1999 (including all inventory crews). However, there have been at least two other records of garter snakes in the study area. Project biologists in previous years reported that northwestern garter snakes have been recorded in the sedge meadows north of Fish Lake camp, and also note unidentified garter snakes sunning on rocks on an escarpment west of Fish lake, in August 1995.

2.3 Habitat Assessment

Field crews working on this project have spent a large number of total man-days in the area, often in habitats that might be expected to support snakes, including all the warm aspect grassy slopes and many herbaceous wetlands. Work in the summer months was usually in good conditions, with fairly warm, sunny weather, although nights were often quite cold. The extreme paucity of sightings of garter snakes under these conditions suggests the overall population in this area is very low. It seems likely that the generally high elevations, cool temperatures and short growing season over most of the area may well limit the ability of snakes to colonize this area.

Suitable habitat for reptiles was limited within the area of study as confirmed by the limited number of detections from 1993 to 1999. No specific needs or concerns regarding reptiles in the mine site area are anticipated at this time.

3. AMPHIBIANS

Amphibians appear to be declining on a global basis, and many species are highly susceptible to environmental changes, as their permeable skins make them very sensitive to water quality changes. As a group they are, therefore, of increasing concern and attention from the regulatory agencies and the public. Very little work has been done on amphibians in the general study area, or even within the Chilcotin Region (e.g. Ward & Chapman 1995), which supported the establish baseline data in terms of species present, and relative abundance.

Although, no red or blue listed amphibian species were known or likely to occur within the mine site study area, an effort to establish baseline data in terms of species present, and relative abundance, was deemed necessary. This requirement was met through a systematic amphibian sampling program in the mine site study area during 1997 and 1999. The greatest survey efforts were directed at the proposed development area in 1997, and the fish compensation sites in 1999. Elsewhere, sampling of wetland, pond and lake habitats, as well as terrestrial habitats were planned to cover a cross-section of the different ecosystem types present. A permit to capture, identify and measure the amphibians within the study area was obtained through the MELP, Williams Lake.

Following the work in 1997 a methodology and data report was submitted to MELP personnel (Madrone Consultants Ltd., 1997).

Field sampling was designed to yield reconnaissance level information on the presence of amphibian species (RIC present/not detected methods). An effort was made to establish baseline data in terms of species present, and habitat uses, with the main emphasis on amphibians dependent upon water bodies for breeding and /or their entire life cycle. The main amphibian sampling program was conducted in 1997, with some additional areas sampled in 1999. Observations by project biologists prior to 1997 were also included in result discussions.

Specific objectives of the amphibian inventory program were:

- to identify species present in the area for terrestrial and aquatic amphibians;
- to establish baseline information on populations and habitats, with the main emphasis on amphibians dependent upon water bodies for breeding and /or entire life cycle;
- to develop species/habitat interpretations;
- to predict potential impacts; and
- to identify needs for mitigation and monitoring if deemed necessary.

For the purpose of this study a number of different survey techniques were combined to determine presence/not detected of those species that occurred in the study area. A sampling plan combining a wide range of sampling techniques was developed to maximize chances of detecting all amphibian species in the area. Methods utilized a combination of road surveys (after rain), systematic and time constrained searches, pitfall and minnow traps, and opporunistic searches.

Methods followed standards established by the Resource Inventory Committee of BC (RIC, 1997a).

3.1 Methodology

The greatest survey efforts were directed at the sites of proposed development. Elsewhere, sampling covered a broad cross-section of the different ecosystem types present, including wetland, pond and lake habitats, as well as terrestrial habitats. As ecosystem mapping was not available during the inventory program, sites were selected and stratified based on preliminary information (working legend and existing fieldguides) combined with examination of the air photos. Habitat notes were taken at each sampling station and classification of the sites was discussed with the project vegetation ecologists.

In 1999, sampling was conducted in a number of additional sites, in areas proposed for the fish compensation program. Sites were selected with the use of air photos and completed TEM mapping.

3.1.1 Road Surveys

Road surveys are ideal for paved roads with little vehicle traffic. These conditions are not present within the area of study. Road surveys are most effective 1-2 days after a heavy rain and when wind conditions are less than force 3 on the Beaufort Scale (gentle

breeze) (RIC, 1997a). The road is driven at a slow speed about an hour after dusk with headlights and flashlights used to detect animals on the road.

This method was utilized as a reconnaissance survey of the gravel roads to the Prosperity Project Camp and Fish Lake in 1997. The road was walked after dusk, using flashlights to detect animals on the road.

3.1.2 Systematic Search Method

Daytime surveys were done in breeding ponds. The basic pond survey was used in the areas being intensively surveyed in 1997. Smaller ponds were completely surveyed, while larger lakes, such as Fish Lake, were stratified and suitable habitat was sampled. Whenever possible, pond perimeters were stratified and used as transects (Resource Inventory Committee, 1997a).

Survey zones included: shoreline (where water meets land), shallow water (all water from the shoreline to <1m in depth), and the shore (from the water line to 3m inland). The first team member would survey the shore, while the second would cover the shoreline, staying 2m behind the first team member.

For shallow water surveys the surveyor stopped every 5 meters and visually searched the areas for eggs or small clusters. Then the surveyor scooped the dipnet in front and to each side of their walking direction. A dip contained 2-3 cm of sediment along the bottom (for 1m).

When available, a third surveyor walked along the shoreline stopping every 5m visually searching and sampling, using a dip net. The shoreline was sampled, flushing amphibians toward shoreline or searching vegetation, while walking slowly. If vegetation was tall, walking speed was increased. Moist debris was examined for adult and/or juvenile amphibians.

3.1.3 Time Constrained Searches

This method measured the success by number of person hours (Resource Inventory Committee, 1997a), referred to as an opportunistic search. For the purpose of this study, time constrained searches were combined with systematic searches, in order to maximize detection. Areas that were sampled by this method were those sites likely to contain breeding areas or migrating areas.

Time constrained searches during 1999 surveys consisted of two surveyors searching the shoreline for 30 minutes each, for a combined search time of 60 minutes. Surveyors went in opposite directions along the shoreline to cover as much area as possible. Dip nets were used to sweep along the surface and bottom of the shoreline for amphibians to a depth of 1 metre. Information recorded on Pond-Breeding Amphibians Constrained Search forms (RIC, 1997a) included: water temperature, average depth of water, weather conditions, and measurements for snout to vent lenth, total length and weight of the animals captured and released.

3.1.4 Cover Objects

Cover objects serve as important habitat for amphibians that are in the terrestrial phase of their life cycle. During time constrained searches these objects were turned over and surveyors recorded any visual observations of animals. Cover objects were also flipped

while traveling to and from survey sites opportunistically. All objects were replaced after the underside was searched.

3.1.5 Minnow Traps

Minnow traps were set in an opportunistic manner in stratified habitats during 1997 inventory. Catchability was influenced by size of larvae, presence of vegetation, and the presence of aquatic predators. Results are expressed as the number of animals per trap for a period of time (an hour, several hours or a day).

3.1.6 Pitfall Trap Arrays

The standard array format was used during 1997 surveys (RIC, 1997a). This format consists of drift fences arranged in a triad array with pitfall traps at either end of the fences. The fences were approximately 4m in length. Results are expressed as the number of animals captured per trap array, per night. Arrays were sampled over a period of a seven days following light rain. Wood covers were used over plastic 4 litre plastic containers. Water and detritus, in the buckets, reduced the chances of mortality resulting from dehydration.

Pitfall trap arrays were not repeated in the July inventory session due to their low efficiency in determining presence/absence during June inventory. Instead, inventory effort concentrated on the most time effective and efficient method, time constrained searches.

3.2 Results/Baseline Conditions

A systematic amphibian-sampling program was conducted in the mine site development area and surroundings in 1997 and 1999. Two field sessions were carried out in 1997, one from June 10th to 19th, and a second session from July 26th to 29th. Additional sampling was conducted in 1999 from July 28th to the 30th. The field program was led by a wildlife biologist, present at all sampling, with up to two technical assistants.

A total of 35 stations were actively sampled for amphibians (see Appendix 1, Figure 2). In addition, all amphibian observations made by other crews during sampling programs (vegetation, birds etc.) were recorded as incidental observations. Wherever possible, animals observed or captured were identified to species. Captured animals were measured (standard measurements as per RIC?), were often photographed, and were released.

Sampling efforts were largely directed towards amphibian sampling, although opportunistic searches for reptiles were also conducted where relevant, mainly in wetlands and dry grassland habitats. Any incidental observations by any of the field crews were also recorded.

No blue or red-listed species were detected in the study area during inventory sessions in the Prosperity Project Area.

Species detected using the time constrained search methodology included the Spotted Frog (*Rana pretiosa*), Western Toad (*Bufo boreas*) and Long-toed Salamander (*Ambystoma macrodactylum*). Other methods of inventory were not as successful.

Although no specific auditory surveys were conducted, field crew routinely listened for calls during fieldwork for this and other inventory components. Despite this, calls were reported only once. Some amphibian calls were heard June 10 by one researcher, following rain, but the calls were not identified. Otherwise calls were not detected.

Table 1 presents a brief summary of survey methods used, and species detected (see Appendix 1, Figure 2 for amphibian survey site locations).

Table 1: Summary of Survey Methods and Species Observed.

Survey Method	June 1997 Inventory	Species Observed	July 1997 Inventory	Species Observed	July 1999 Inventory	Species Observed
Road Surveys	One survey	A-BUBO	None		None	
Incidental Observations	5 incidents	A-RAPR, A-BUBO	*2 incidents	A-AMMA	2 incidents	A-RAPR
Time Constrained Searches	15 searches	A-RAPR, A-BUBO, A-AMMA	10 searches	A-RAPR, A-BUBO, A-AMMA	11 searches	A-RAPR, A-BUBO, A-AMMA
Minnow Traps	8 trap intervals	A-RAPR	None		None	
Pitfall Traps	7 trap nights, 2 arrays	No animals trapped	None		None	

Key of Terms
A = Amphibian; AMMA = *Ambystoma macrodactylum* (Long-toed Salamander)
RAPR = *Rana pretiosa* (Spotted Frog); BUBO = *Bufo boreas* (Western Toad)

*These two records were additional incidental observations of adult Long-toed Salamanders, made on August 26th and 30th by the bird inventory crew at Wolftrap Lake and at the previously surveyed site A13.

One of the highest concentrations of amphibians were detected near Little Onion Lake at a pond created by a beaver dam during a time constrained search (Appendix 1, Figure 2, Site A35). Appendix 4 contains the sampling site descriptions, conditions and results of amphibian surveys from 1997 and 1999.

3.3 Survey Limitations

There are a number of different factors that influence amphibian sampling efforts. In order to reduce biases resulting from these limitations a combination of survey techniques was used.

Amphibian are a difficult group to inventory and quantify because their numbers often fluctuate dramatically over a number of years, and in response to various environmental conditions. Capture of many species varies greatly with weather conditions, time of year, time of day, and with survey technique. For these reasons as broad a range of techniques as possible was used in an effort to ensure all species present were likely to be captured through some method/time/condition permutation

The most significant limitation was the warm, dry weather. Due to the potential of amphibian desiccation resulting from the permeability of their skin, amphibians will be more active in moist environments particularly following rain. In dry environments or

dry periods activity will be minimized and may actually cease until conditions are more favorable (RIC, 1997). Consequently, many amphibians, including long-toed salamanders, are much more difficult to detect during dry conditions than following rain. We had very little rain during field sampling programs; the only rainfall occurring during the field visits was on the evening of June 10.

Pitfall traps were not effective in catching any amphibians, again very likely due at least in part to the extremely dry conditions. Road surveys, most effective following rain when road surfaces are moist, were also largely ineffective in detecting amphibians. However, opportunities for road surveys were fairly minimal, as paved roads (not present in the study area) with little vehicle traffic are preferred in this method.

Time constrained searches were generally performed in moist or wet habitats, as the dry weather limited their effectiveness in the drier terrestrial habitats.

Minnow traps were not effective in trapping tadpoles (although two adult spotted frogs were found in traps). Trapping for tadpoles may have been premature as many hatchlings were observed, possibly too early in development to be detected through this method.

Few adult long-toed salamanders were detected during surveys. This may have been a result of the dry weather in July 1997, and the fact that these animals have an early breeding season. Juveniles found through time constrained searches had likely overwintered from 1996. Adults disperse rapidly into woodland habitats after breeding, where they go under bark or under rocks and logs. They are largely nocturnal (we did very little nocturnal sampling) and are reported to be active above ground for only short periods during spring and early summer. As the season progresses, only a small percentage of the population will be using the surface. For Long-toed salamanders, individuals observed on the surface during favorable conditions may represent only 10 percent of the population (Ted Davis, pers. comm.).
Adult toads similarly disperse into terrestrial habitats after the breeding season. This makes them harder to locate than anuran species (such as the spotted frog), which remain closer to water (Marnell, 1997). While adults are usually diurnal, they may become nocturnal during warm periods in the northern parts of their range, especially at high elevations (Stebbins, 1985). Cold nights may apparently cause them to burrow at high elevations, which again wil render them hard to locate.

3.4 Habitat Assessment

Amphibians require varied habitat to accommodate their biphasic life cycle. Aquatic habitat is needed for breeding, terrestrial habiatt for hiding cover and foraging, and hibernation habitat. Amphibians also require connectivity between these different habitats for migration and dispersal movements.

Amphibian habitat was present throughout the study area where wetland complexes, shallow open water and lakes occurred. Wherever shallow standing water was present amphibians were frequently detected.

Amphibians were regularly associated with beaked sedge-fen (BF) ecosystem units, which often have open water associated with them. Shrubby wetland units (i.e. WM3a and WS3a) surveyed were not found to be productive for amphibians due to dryness of the units and dense vegetative growth.

The most important habitat biologically for the species detected in the study area is breeding habitat. The most productive breeding pond identified was an ephemeral pond in the burn site north of the mining camp (Appendix 1, Figure 2 – site B12). Other shallow, temporary ponds near camp were alsofound to offer good breeding habitat for spotted frogs and western toads. These species seemed to be well distributed thoughout sedge fens, shallow wetlands and low scrub fen-willow and birch ecosystems.

Very little information was obtained on the terrestrial habitats of adult toads and long-toed salamanders for the area. Searches of cover objects and general habitat in terrestrial habitats were unproductive. It is unknown if this was due to dry weather conditions or to a generally low population of these species in the area.

As no red or blue listed species appear to be present, no detailed species accounts or mapping has been developed. However, some general habitat relationships were observed.

The greatest productivity of amphibians appeared to be associated with small, shallow vegetated ponds, such as on the southeast side of Fish Lake, where long-toed salamanders and smaller numbers of spotted frogs were observed. Spotted frogs and western toads were also found to use the shallow areas along the shoreline of Fish Lake and along Fish Creek. A shallow lake with fringing sedge/meadow vegetation – unnamed T lake - had the greatest toad breeding population as well as spotted frog tadpoles.

The emphasis of this study was on potential breeding sites and important aquatic habitat. Spotted frogs and western toads were found to use the shallow areas along the shoreline of Fish Lake and Fish Creek as well as other lakes surveyed in the study area. Numerous spotted frogs and western toads were also observed in the fish traps at the inlet and outlet of Fish Lake indicating their use of deeper sections of the creeks and lake.

4. BIRDS

4.1 Introduction

As an important part of B.C.'s biodiversity, birds are found throughout the province in all biogeoclimatic zones and habitat types. In order to identify and assess the potential effects of the proposed mine development plan on birds that use the area, a baseline bird inventory program was proposed by Taseko Mines Ltd. and conducted by Madrone Consultants Ltd.

Inventory focused on the identification of red- and blue-listed and COSEWIC bird species that had potential to occur in the study area, as well as use by all other birds (waterfowl, herons and cranes, diurnal raptors, shorebirds, owls, woodpeckers and sapsuckers, passerines and others). Survey sites focused on habitats within the mine development areas, where rare species were most likely to occur. Areas immediately outside of the mine development plan (within TEM boundary) were also surveyed according to priority habitat types (e.g. wetlands, riparian, mature forest, and grassland). However, the greatest inventory effort and re-sampling occurred within the mine development plan areas (open pit, waste rock storage areas, and tailings options).

4.2 Methodology

Bird data was collected for the mine site by a variety of observers over the past five years. However, systematic bird inventory based on provincial standards by the Ministry of Environment, Lands and Parks, Resource Inventory Committee (RIC) methods were implemented in 1997.

The main inventory techniques used for documenting bird use within the mine site study area were breeding and migratory bird surveys (for all bird groups), using 100m radius point counts within TEM polygon boundaries. Plots were established along transects to cover the widest range of ecosystem types represented in the study area.

Other supplemental surveys included call playback stations for raptors (diurnal and nocturnal birds of prey). Numerous incidental sightings were also recorded by other field crews, camp staff, and camp monitors.

Species selected for capability/suitability ratings for the mine development area and surrounds were the Great Blue Heron, Mallard, Barrow's Goldeneye, Prairie Falcon, and Sandhill Crane. These species were rated for potential breeding habitat (suitability of habitat within the mine site development areas). Habitat assessments for each of these species are provided under the group to which the species belong (i.e. Mallard is discussed under waterfowl). A detailed review of the focal species is found in the *Species-Habitat Models for the Prosperity Project Area* (Madrone Consultants, 1999).

In addition, baseline habitat assessments were done for broad category bird groups found in the area: waterfowl, herons and cranes, diurnal raptors, shorebirds, owls, woodpeckers

and sapsuckers, passerines and others. Some general habitat relationships were observed for these individuals and/or groups and are briefly discussed in the following sections.

4.2.1 Breeding Bird Surveys

Breeding bird surveys were conducted from June 9th to the 20th throughout the study area (Appendix #, Figure #). Additional sampling was conducted at TEM plots, by the wildlife biologist, during July 22nd to July 28th, 1997.

A single observation point consisted of a 10 minute observation period of a 100m radius plot; this is recommended as the optimum length of time to observe and/or hear songbirds present within a 50-100 metre plot (Resource Inventory Committee, 1997b). Bird detections were based on positive identification by song, call and/or visual. Plot locations were recorded on a combination of sources including 1:50,000 maps, air photos and GPS (when satellite coverage was available). The same observation point methodology was used for migratory bird surveys.

Whenever possible, surveys were conducted during the hours of highest songbird activity, optimal hours for breeding bird surveys (starting at sunrise and continuing for approximately 5 hours). However, hours were extended beyond, in order to maximize the area of coverage during fieldwork.

4.2.1.1 Supplemental Raptor Survey Methodology

For the proposed mine development areas, inventory of raptorial birds was conducted to identify species present in the area as well as their nesting and foraging areas.

In order to identify raptor species within the study area and in particular to try to determine if red and blue listed species were present, call playback tapes were utilized for inventory of raptor species that respond well to this approach, such as owls. Calls were played in the highest quality habitat present in the study area, for the species of interest, in order to maximize the probability of detection.

Summer and winter aerial surveys were also conducted in order to attempt to locate raptor nests that are typically visible from the air, such as eagle and osprey nests. Aerial transects covering the area mapped for TEM were surveyed (see Appendix 1, Figure 4).

a) Diurnal Raptors

Where appropriate, a call playback was used to inventory raptor presence (detected/not detected). Within the area of study, the Northern Goshawk was determined to be the most likely diurnal raptor to respond to this method of inventory. Territorial bird calls, conspecific to the species of desired detection, were played three times for 30 second intervals, with 30 second silent pauses in-between intervals. Each of the three broadcasts were played at 120 degrees to each other, for maximum coverage in all directions. A minimum of a 10 minute listening period was used between broadcasting of different species. The same methodology was applied to nocturnal raptor surveys.

b) Nocturnal Raptors (Owls)

Call Playback was used for owls on 5 of the 11 nights during the June breeding bird survey field program. Inventory was conducted during the dusk and evening hours (between 8:00 pm to 12:00 pm), at sites selected for highest probability of detection.

The following is a list of species' calls that were used during nocturnal raptor inventory, based on habitat, season and knowledge of response to this inventory method: Great Horned Owl, Long-eared Owl, Great Gray Owl, Saw-whet Owl, Pygmy Owl, Western Screech Owl, and Flammulated Owl.

4.2.2 Migratory Bird Surveys

For the proposed mine development, an inventory of migratory species was conducted, as well as an assessment of their relative abundance and nesting an/or foraging habitats, in order to identify potential impacts.

Migratory bird inventory was conducted over 8 days, August 26th to September 2nd, 1997. This time period (late summer, early fall) was optimal for observing migratory birds utilizing the study area. The length of the migratory survey was shorter due to the narrowed, but not limited to, habitat focus on wetland and riparian habitats, which are "preferred" migratory staging areas.

Length of site survey time varied according to the size of the lake and/or number of birds present. In addition to waterfowl surveys, migratory passerines and other bird groups were surveyed using the 10 minute count, 100m radius method. Many of the spring survey sites were re-visited during the fall session.

4.2.3 Equipment and Forms

The equipment required for bird surveys included: Radio Shack Power Horn/Speaker (to broadcast sound for Call Playback surveys), tape recorder, compass, RIC survey sheets, GPS unit (GeoExplorer), binoculars, spotting scope, air photos, forest cover maps, topographic maps (92 O/5, 6, 11, and 12 for the Mine site Study Area) and the appropriate field forms.

Field forms used to record bird observations was taken from the Resource Inventory Committee *Standardized Inventory Methodologies for Components of British Columbia's Biodiversity: Forest and Grassland Songbirds* (Version 1.1, January 1997b). Table 2 lists the survey types and associated RIC field forms that were used.

Table 2: Survey Types and Associated RIC Forms.

Type of Survey	**RIC Forms**
Breeding Bird Surveys	• Bird Encounter Survey Form (10 min. Point Count of a 100m radius plot)
Migratory Bird Surveys	• Bird Encounter Survey Form (Lake Surveys and Point Counts of a 100m radius plot)
Call Playback for Raptors	• Animal Observation Form - Bird Call Playback

4.3 Results/Baseline Conditions

4.3.1 Survey Coverage

In 1997 inventory was conducted during three field sessions, covering the period of June 9th to September 2nd. Multiple visits occurred for many sites throughout the area, to obtain coverage of both breeding and migratory birds. A total of 247 site visits were completed within the TEM study area boundary, a number of which occurred within different points of the same polygon (See Appendix 1, Figure 5 for polygon coverage of bird surveys). Of the 247 site surveys, 19 had no bird detections. The survey resulted in a total of 1470 bird observations, consisting of singular, pair, or flock detections. For polygon specific data, refer to the inventory database Appendix 5.

4.3.1.1 Biogeoclimatic Zones

Two biogeoclimatic zones were present in the study area, the Sub-boreal Spruce (SBS) and the Montane Spruce (MS). Of the 157 polygons surveyed, 72 occurred within the MS and 85 within the SBS (please refer to the vegetation sections of the report for zone and subzone descriptions). Within the MS polygons, a total of 386 detections resulted, while in the SBS there were 1084 detections recorded. The higher number of detections in the SBS was probably due to the lower elevation location of that zone, as well as the presence of the alluvial flats area, as well as a higher decidous component.

4.3.1.2 Ecosystem Polygons

Of 1252 terrestrial ecosystem polygons, 157 (12.5%) were surveyed for birds, with the highest concentration of sites occurring within the mine site development areas. Of the 157 polygons surveyed, 66 were re-visited at least once. Table 3 summarizes the number of polygons surveyed and the number of inventory plots completed within the TEM study area. Of the 157 polygons visited, 78 (50%) were located within the mine site development area.

Table 3. Bird Surveys Periods and number of polygons surveyed within the TEM boundary and number of inventory plots completed.

Survey Period	# of Polygons Surveyed within TEM boundary	# of Inventory Plots
June 1997	95	156
July 1997	49	49
Aug/Sept 1997	46	62

4.3.2 Overview

In total, 88 bird species were detected during breeding bird surveys within the TEM boundaries including: 10 waterfowl species, 6 diurnal birds of prey, 3 grouse, 5 shorebirds, 1 gull, 3 owls, 1 sapsucker, 3 woodpeckers, 3 corvids, and 53 passerine/other species. See Appendix 3 for a list of all bird species detected during the breeding and migratory bird surveys of the Prosperity Project Area during 1997 and 1998.

In comparison, migratory bird surveys detected a total of 78 bird species: 16 waterfowl species, 8 diurnal birds of prey, 3 grouse, 6 shorebirds, 1 owl, 3 woodpeckers, 3 corvids, and 40 passerine/other species.

The majority of birds detected during breeding bird surveys, were assumed to nest in the area (based on the time of year surveyed). Only a portion of the species recorded were confirmed by nest and/or nesting behaviour observations (e.g. carrying nesting material, collecting food for young, etc.). Approximately, nine species were confirmed for breeding status based on active nest site observations and consisted of Barn Swallow, Cliff Swallow, Tree Swallow, Hairy Woodpecker, Mountain Chickadee, Northern Flicker, Warbling Vireo, Osprey and Common Snipe. Almost all other species had singing males observed, indicating that they were on, or establishing breeding territories.

The species which occurred at the highest number of plots were considered most abundant for the study area. Table 4 lists the top 10 most abundant birds recorded during each of the three bird inventory sessions in 1997. Refer to Appendix # for site specific numbers of individuals detected during each field session, for each plot.

Table 4: Top ten most common species within the Propserity Project Area: relative abundance based on the number of plot detections per species.

	June 1997 Surveys Species	#/% of plot detections/ 128 plots	July 1997 Surveys Species	#/% of plot detections/ 61 plots	Aug/Sep 1997 Species	#/% of plot detections/ 58 plots
1	Ruby-crowned Kinglet	61 (47%)	White-winged Crossbill	32 (52%)	White-winged Crossbill	23 (40%)
2	American Robin	41 (32%)	Pine Siskin	21 (34%)	Yellow-rumped Warbler	23 (40%)
3	Yellow-rumped Warbler	34 (26.5%)	Yellow-rumped Warbler	21 (34%)	Pine Siskin	21 (36%)
4	Dark-eyed Junco	27 (21%)	Ruby-crowned Kinglet	13 (21%)	Clark's Nutcracker	17 (29%)
5	Northern Flicker	20 (15.6%)	Lincoln's Sparrow	12 (19%)	Northern Flicker	11 (19%)
6	Olive-sided Flycatcher	18 (14%)	Dark-eyed Junco	10 (16%)	Ruby-crowned Kinglet	10 (17%)
7	Chipping Sparrow	18 (14%)	Gray Jay	10 (16%)	Dark-eyed Junco	10 (17%)
8	Bald Eagle	15 (11.7%)	Spruce Grouse	10 (16%)	Osprey	10 (17%)
9	Clark's Nutcracker	15 (11.7%)	Boreal Chickadee	10 (16%)	Lesser Scaup	9 (16%)
10	Townsend's Solitaire	15 (11.7%)	Red-breasted Nuthatch	7 (11%)	Red-breasted Nuthatch	8 (14%)

4.3.2.1 Rare and Endangered Species

No red-listed species were located within the mine site development area during surveys. No red- or blue-listed species were located in or around the study area surveyed during breeding bird inventory in June and July of 1997 (see Appendix 2 for CDC Tracking Lists). During a cliff survey in 1999, Prarie Falcons (red-listed) were confirmed to breed within the TEM boundary, outside of the mine development area.

During migratory bird surveys in 1997, two blue-listed species were observed within the proposed mine site development area, the Great Blue Heron and a Red-necked Phalarope. Occurrences of these two species were low in numbers. For herons, one to three individuals have been recorded in a given year since 1995, all recorded during migration through the area. No breeding records exist for the mine site study area for either of these blue listed species.

Other red- and blue-listed bird species detected prior to 1997 include: Prairie Falcon (red-listed), and Western Grebe (red-listed). Although suspected, Prairie Falcon identification and use of the cliff areas was not confirmed until 1999.

4.3.3 Waterfowl (loons, mergansers, grebes, geese, ducks, and swans)

All lakes and open water which occurred within the study area were surveyed for waterfowl, and included the following lakes: Fish Lake, Little Fish Lake, Wolftrap Lake, Wasp Lake, and Little Onion Lake. A total of 16 lakes and open water sites were surveyed within the mine site study area, as well as additional lakes and ponds outside of the immediate TEM boundary for comparison (Big Lake, Vick Lake, Slim Lake, Rat Cabin Lakes, Big Onion Lake and Groundhog Lake). Lakes outside of the study area provided a comparative reference to the relative abundance observed within the study area.

The overall relative abundance for waterfowl in the study area, according to breeding and migratory survey data from 1997, was low (8% of observations). Of 1470 survey

records, 118 were of waterfowl (singular, pairs, and flocks), consisting of 414 individuals observed of the 2480 (16%) birds recorded (some of which were likely the same birds observed on different days). From 1993 to 1996 observations had similar results with low relative abundance for waterfowl (Hallam Knight Piesold, 1997).

Waterfowl species recorded within the 1997 TEM boundary included: Common Loon, Pacific Loon, Pied-billed Grebe, Red-necked Grebe, Eared Grebe, Canada Goose, Green-winged Teal, Mallard, Blue-winged Teal, American Wigeon, Ring-necked Duck, Lesser Scaup, Barrow's Goldeneye, Bufflehead, White-winged Scoter, and Hooded Merganser. The flock of 8 Pacific Loons was observed feeding at Fish Lake over a two day period (June 12th and 13th) before continuing their migration to breeding grounds in the north. Other species recorded from 1993 to 1996 included: Western Grebe (blue-listed) and Common Merganser.

The most common species detected in 1997 was the Common Loon (25% of waterfowl observations but only 9% (41/412) of actual individual waterfowl numbers), many of the records were likely duplicate counts of the same birds. Detections were usually of single birds or a pair on a lake. Almost every fish bearing lake in the study area and surrounding had a resident Common Loon. This species was also the most commonly detected bird during 1993-1995 surveys in the area.

In terms of numbers, Lesser Scaup was the most abundant waterfowl species for the study area, consisting of 15% of waterfowl observations and 195 of the 412 (47%) individual waterfowl counted. For surveys from 1993 to 1995, Mallard was the most abundant.

The largest flock of waterfowl recorded during 1997 surveys was of 36 Lesser Scaup at Wasp Lake. Other sites with similar sized flocks of Lesser Scaup included Fish Lake, and Little Fish Lake. It was believed that the same flock was moving between lakes during the survey period, and were therefore double counted. A flock of 20 Green-winged Teal was recorded in a wetland/open water complex of Tete Angela (polygon #19), in the northern boundary of the TEM study area.

One blue-listed waterfowl species was detected within the mine site between 1993 and 1997. A single Western Grebe was recorded at Fish Lake during the migratory season (August 25-28, 1995). This species is blue-listed during migration and red-listed for breeding sites. There are presently only four active breeding colonies in B.C., none of which occur near the study area. The breeding colony in closest proximity to the mine site was a historical site in Williams Lake.

Relative abundance of waterfowl in the study area was considered to be low compared to numbers on other similar sized lakes outside of the study area (e.g. Big Lake). Fish Lake was surveyed seven times in 1997. During the best of the seven surveys there was a total of 13 species present consisting of 72 individual birds. In comparison, a single survey of Big Lake resulted in approximately 290 birds representing 12 waterfowl species. The

lower elevation valley location and presence of emergent vegetation at Big Lake are the main factors accounting for the difference in waterfowl numbers between the two lakes.

Another reason for low waterfowl numbers at the mine site is in part due to the location of migratory corridors. The main flyways for fall migration occur to the west (i.e. coastal flyway) and east (i.e. Fraser Valley flyway) of the study area.

In addition, the presence of human recreational traffic by foot, boat, and ATVs likely disturb some species of waterfowl during resting and feeding, which may result in nesting avoidance in the area.

4.3.3.1 Mallard

The Mallard is a dabbling duck that is widespread throught the province of British Columbia where it inhabits wetlands, ponds and lakes. Wherever open water is present, they are likely to occur.

Of the 116 waterfowl observations, in 1997, 16 (13%) were of Mallards, usually of single birds or a pair. Of 181 waterfowl observations (covering a wider study area at the time) from 1993 to 1995, 34 (18%) were of Mallards. The largest flock of Mallards recorded between 1993 and 1997 was observed on Big Onion Lake during migration, consisting of 24 birds. Similar sized flocks were recorded on multiple occasions at Big Onion Lake, which is located outside of the mine site development area.

The lack of emergent vegetation around Fish Lake, which is important as security habitat for Mallards and many other waterfowl species limits the suitability of the lake for breeding and resting. Security habitat for nesting consists of dense vegetation, usually on dry land near wetlands. Although nesting habitat does not appear to be limiting for Mallards in the area, they still occur in low numbers, likely preferring lower elevation sites. The majority of breeding records for the province range from sea level to 1300 metres, with the mine site located at 1300-1500 metres.

Mallards appear to breed in low numbers within the mine site study area. One nesting site was located adjacent to shallow open water and emergent vegetation at the outlet of Fish Lake. A pair was seen on numerous occasions at the spot and young were present in the summer.

Overall, the mine site study area has been rated as having low to moderate habitat suitability for feeding and breeding by this species (see Appendix 1, Figure #). For further details regarding the biology and habitat requirements of this species please refer to *Species-Habitat Models for the Prosperity Project Area – Technical Report* (Madrone Consultants, 1999).

	High	Moderate	Low	Nil
Feeding Habitat				
Nesting Habitat				

4.3.3.2 Barrow's Goldeneye

Barrow's Goldeneyes are distrubuted along coastal B.C., and are widely distributed throughout the interior, with populations concentrated in the soth-central portion of the province. Barrow's Goldeneye are a cavity nesting duck, using cavities excavated by woodpeckers or created by natural events. Wildlife trees, with holes to nest in, are a limiting factor to the breeding success of this species. Ponds, lakes, wetlands and slow streams, preferably fishless, provide suitable rearing, feeding and molting habitat.

Low numbers of Barrow's Goldeneye inhabit the mine site study area during the breeding season. Four of the 116 (total of 12 individuals) waterfowl detections within the study area during 1997 were of this species. They were located on Little Fish Lake, Fish Lake, and Big Onion Lake. Between 1993 and 1997, this species has frequently been recorded on Big Onion Lake, mainly in low numbers (less than 16 to a flock) during migration. The largest flock size was of 16 birds on August 28, 1994 at the south inlet of Big Onion Lake.

Suitable nesting habitat occurs around the lakes in the mine site and surrounding TEM boundary. Two pairs were recorded using the forest at the outlet of Fish Lake on April 30, 1993. Another pair was recorded in the same area on May 17, 1994. A breeding record also exist for Beece Creek near the northern shore of Lower Taseko Lake (southwestern TEM boundary) (Sopuck et al., 1997).

Overall, the mine site study area has been rated as having low to moderate habitat suitability for the feeding and breeding requirements of this species (see Appendix 1, Figure #). For further details regarding the biology and habitat requirements of this species please refer to *Species-Habitat Models for the Prosperity Project Area – Technical Report* (Madrone Consultants, 1999).

	High	Moderate	Low	Nil
Feeding Habitat				
Nesting Habitat				

4.3.4 Herons and Cranes

4.3.4.1 Great Blue Heron

No Great Blue Herons were present during breeding bird surveys in 1997 or prior. A review of bird use in the Taseko Management Zone (TMZ) also concluded that herons were present in the area but were uncommon (Sopuck et al., 1997). No breeding records exist for the TMZ or its vicinity.

During migratory bird surveys in 1997 and during previous fall observations, herons were recorded feeding at Fish Lake. When present, they occurred in small numbers (i.e. 1-3 birds). Up to three individual herons were observed within the study area on August 27th to September 1st, 1997, along the lake and wetland edges near open water. Great Blue Herons were also recorded in the area, during migration, prior to 1997. The earliest

record for herons in the area was on July 27, 1992 and as late as November 25, 1992. These birds are likely a result of post-breeding dispersal from other areas.

Great Blue Herons have a blue-listed status for the province, as their heronries (nesting colonies) are vulnerable to human disturbance, which can result in nest abandonment. Heronries are usually located high in large Douglas-fir, lodgepole pine or deciduous trees, preferraly close to shallow, fish bearing lakes and streams.

Overall, the study area has been rated as low to moderate for feeding habitat for herons, and low to nil for nesting suitability/capability (see Appendix 1, Figure #), with the lakes and open water sites containing the best feeding habitat within the study area. On a provincial basis, the study area does not contain any high quality habitat for either breeding or feeding for this species, reflected by their relative low abundance observed in the area.

	High	Moderate	Low	Nil
Feeding Habitat				
Nesting Habitat				

For further details regarding the biology and habitat requirements of this species please refer to *Species-Habitat Models for the Prosperity Project Area – Technical Report* (Madrone Consultants, 1999).

4.3.4.2 Sandhill Crane

The Sandhill Crane is blue-listed for the province of British Columbia, as it is a sparsely distributed breeding bird in central, northeastern and southern B.C. During migration, however, it can be common to very abundant along primary travel routes. They occur where there are shallow wetlands, marshes, swamps, bogs, flooded fields, or meadows, but have low tolerance for human disturbance.

No Sandhill Cranes were detected during bird surveys in 1997. Previous to 1997, there is one record of a single Sandhill Crane being seen at Fish Lake mining camp on June 16, 1992. Comments in the wildlife log book state that the bird was flying with extended wings measuring approximately 1.5m in length.

Regardless of the single observation, the area of study was assessed as containing sub-optimal breeding and feeding habitat for this species, based on provincial distributions, known breeding sites and habitat requirements.

Overall, the mine site study area has been rated as having low habitat suitability for the feeding and breeding requirements of this species (see Appendix 1, Figure #). For further details regarding the biology and habitat requirements of this species please refer to *Species-Habitat Models for the Prosperity Project Area – Technical Report* (Madrone Consultants, 1999).

	High	Moderate	Low	Nil

Feeding Habitat				
Nesting Habitat				

4.3.5 Diurnal Raptors (Hawks and Eagles)

Ten species of diurnal raptor were detected during 1997 surveys: Osprey, Bald Eagle, Northern Harrier, Sharp-shinned Hawk, Cooper's Hawk, Northern Goshawk (blue-listed), Red-tailed Hawk, American Kestrel, Merlin. No additional species were recorded prior to 1997. These species accounted for 7% of bird survey observations (108/1470), many of which occurred in the fall, likely due to hawk migration and juvenile dispersal. Ospreys and Bald Eagles were detected more frequently than other raptor species as observed in previous years. The Sharp-shinned Hawk and Cooper's Hawk were only detected during fall migration.

Diversity of raptors in the area was thought to be quite high, mainly due to the presence of many fish bearing lakes in the area, wetlands, and fields for hunting. Seven of the ten species detected were seen on many occassions in the same sites, indicating nesting and/or hunting territories. Some intraspecific behaviour was noted over prime hunting sites, such as Fish Lake, and territories (ie. Red-tailed Hawk, Osprey and Bald Eagle interactions).

There is regular use of Fish Lake and its surrounding habitat by Osprey and Bald Eagle. Both species have nested on site in previous years. Four nests were identified in the TEM study area, three Osprey and one eagle nest tree. Only one of which, an Osprey nest, was active in 1997, confirmed to have fledged two juveniles.

Bald Eagles were the only diurnal raptor which decreased in the number of detections from spring to fall. This was due to eagles feeding on the trout run in the spring (at Fish Lake) and then dispersing to various salmon runs in the fall. The resident eagle population was estimated at 6-8 birds. Three individual adult eagles in full white plumage, 1 young adult in half white plumage and 2 juveniles were identified. No breeding activity was recorded at the nest in 1997. The presence of whitewash and various feathers under the nest indicated that the nest site was used regularly by the eagles (i.e. for perching, hunting, roosting, and preening). A young eagle was observed near the nest site on a few occasions, perhaps a previous year's fledgling. The last active record for this nest was in 1995, with one fledgling recorded.

Northern Harriers, at least two individuals, were commonly seen hunting along the wetland/meadow complexes to the immediate north and south of Fish Lake. Records from previous years also reported them using these same sites.

Northern Goshawk (blue-listed) has been recorded 12 times since 1993, usually during the fall migration (most records are from August,1995). In 1997 there were few records of this species (one feather and one fly over observation). In August of 1995 a pair of goshawks were seen exhibiting territorial behaviour against an eagle and an Osprey; however, neither a nest nor dependent young were found.

To try to determine whether they were nesting in the area, territorial Northern Goshawk calls were played in the best habitat present in the mine site development area. No detections resulted. However, it is possible that they nest in the general area, as appropriate habitat is present. Outside of the study area, a juvenile was present at Rat Cabin Lakes, north of the study area. The juvenile was observed from the helicopter while landing and proceeded to call a number of times after landing, and then went silent.

Red-tailed Hawk sightings were frequent within the area surveyed. Both light and dark (Harlan's) morphs were observed. Surveys indicated that a nesting territory was established immediately north of the mining camp, adjacent to a linnear wetland/meadow complex which follows Fish Creek. A light phase bird was record in the same site during previous years and may be the same individual returning year to year.

Areas with recently burned forest habitat (less than 10 years) were heavily utilized by American Kestrels. Four individuals were recorded on the burned slope above and adjacent to the alluvial fan area on one morning (August 27th). This group of birds was likely a result of breeding in the area.

4.3.5.1 Prairie Falcon

The Prairie Falcon is red-listed in B.C. due to low numbers, historic extirpation of some populations, and a restricted distribution of current populations. According to known breeding ranges for the province and aerial surveys for raptor nests, the likelihood of this species occurring within the mine site study area is considered to be low to nil.

However, appropriate nesting habitat is present along a small section of cliffs located along the western study area boundary of the TEM boundary. In 1996 a pair was observed hovering around these cliffs. During an aerial survey on July 21, 1996 a "white-washed" ledge was noted. In August 1998 another aerial survey of the bluffs was flown, with a white-washed ledge spotted as well. Breeding along the cliffs was suspected to occur regularly at this site, but had not been confirmed (i.e. no adults, eggs or juveniles present). In 1999, breeding was confirmed during a cliff survey on July 30th. Three Prairie Falcons were observed utilizing the same section of cliff noted in previous years (TEM polygon #1070).

Overall, the mine development area has been rated as having low to nil habitat suitability for the feeding and breeding requirements of this species. To the west of the development area isolated moderate and high value nesting habitat is present as well as suitable foraging habitat (see Appendix 1, Figure #). For further details regarding the biology and habitat requirements of this species please refer to *Species-Habitat Models for the Prosperity Project Area – Technical Report* (Madrone Consultants, 1999).

	High	Moderate	Low	Nil
Feeding Habitat				
Nesting Habitat				

4.3.6 Upland Game Birds (Grouse and Ptarmigan)

Three species of grouse were detected within the mine site study area boundary from 1993 to 1997: Ruffed (13 observations), Blue (2 observations) and Spruce (17 observations of Franklin's subspecies). Spruce Grouse were the most frequently detected of the three in 1997, with numerous males observed displaying throughout the area. However, in terms of numbers, Ruffed Grouse were more abundant, as recorded in previous years.

Grouse use was concentrated in the riparian, cottonwood, mixed forest stand along the alluvial fan of Fish Creek, just before Taseko River. A family of Ruffed Grouse (7 birds) were flushed at this site. Habitat use occurred throughout the area, in young and mature pine and spruce stands alike, especially where grasses were present in the understorey.

During winter surveys for furbearers, White-tailed Ptarmigan were present at the south end of Fish Lake, feeding and roosting near adjacent wetland/willow habitat. They have also been noted north of camp (March 2, 1992 and March 5, 1996) and from Fish Lake to Little Fish Lake (March 9, 1992, February 1994 and 1996).

4.3.7 Shorebirds, Terns and Gulls

Shorebirds observed during 1997 breeding and migratory bird surveys included: Solitary Sandpiper, Spotted Sandpiper, Long-billed Dowitcher, Killdeer, Black Tern and Common Snipe. Only one gull species was detected, Bonaparte's Gull, which occurred at Wasp Lake. There appeared to be at least two pairs nesting in the area. Although no nests were found during searches, thet were likely present based on sign and behaviour.

Of the 1470 bird observations, shorebirds and gulls combined made up 37 of them (2.5%), and consisted of 55 individual recordings of the total 2480 (2.2%). No more than two pairs of each species was detected during surveys. These numbers were very low, possibly indicating lack of quality nesting and feeding habitat. Spotted Sanpipers were the most frequently observed species for this category of birds, during 1993-1997 surveys, and were found throughout the TEM study area.

Prior to 1997, Greater Yellowlegs were recorded in the area, with one record located within the mine site at Fish Lake on August 28, 1995. The other observations mainly occurred in the Taseko valley around Big Onion Lake.

Shorebird use was concentrated around the shorelines of the larger lakes, especially where small "islands" were present. A pond, located at the outlet of Fish Lake, contained some of the best nesting habitat for shorebirds and waterfowl in the area of study, with shallow water, emergent vegetation, and small grass "islands". This area, as well as the small islands on Fish Lake, received the highest concentration of use by shorebirds within the study area (excluding the pair of Common Snipe, which were using wetland units east of Little Fish Lake). Terns and gulls utilized the forests adjacent to the larger lakes and the lakes themselves for feeding on fish.

During migratory bird surveys, a single Red-necked Phalarope (blue-listed) was observed feeding at Fish Lake. In 1994, a single Red-necked Phalarope (blue-listed) was also observed during migration (August 28, 1994), but at the north end of Big Onion Lake. The presence of this species in the fall was fairly insignificant in the overall scope of things, as it is blue-listed for breeding sites. As this bird does not breed near the study area and is a common fall migrant throughout the province, and the likelihood for breeding in the future is low, based on habitat, no impact is foreseen for this species by removal or alteration of the present habitat within the mine development area.

4.3.8 Nocturnal Raptors (Owls)

The following three owls were detected during 1997 surveys: Great Gray Owl (visual detection on at least 8 occasions), Great Horned Owl (visual detection once, heard 3 times and responded to small owl calls in the Alluvial Fan area once), and the Northern Saw-whet Owl (one detection, flew in to small owl call broadcasts).

A single Great Gray Owl was seen many times, by numerous observers. It was consistently seen close to Fish Creek from the outlet of the lake to the end of the wetlands, directly north of camp. These records may be the most southerly summer records for this species in British Columbia. In previous years, 1993-1996, a Great Gray Owl has been seen using the wetland/meadow habitat north of Fish Lake mining camp.

There were fewer owl observations during migratory surveys, as expected, with only a Great Horned Owl detected. It was heard calling on two of the seven nights of during migratory surveys at Prosperity Camp. A Great Horned Owl was heard calling from the mature pine forest adjacent to the wetlands immediately west of camp during winter surveys, at the same site that one was calling from on numerous occasions during the breeding bird surveys; likely the same bird. Records from previous years have detected this bird at the same sites – mainly the wetlands and forest around camp, and outlet of Fish Lake.

Overall assessment of owl habitat in the area is low on a provincial and regional context, due to the lack of open/grassland and deciduous habitats, unfavourable climate and higher elevations. A study of the Taseko Management Zone, which encompasses the southwest corner of the TEM study area, also had few owl detections. No responses were received to Pygmy Owl call playbacks or two nocturnal owl calls, conducted at 18 sites in the MS zone (Sopuck et.al., 1997).

4.3.9 Woodpeckers and Sapsuckers

The following woodpeckers and sapsuckers were detected within the TEM study area during 1997 surveys: Red-naped Sapsucker (9 observations), Hairy Woodpecker (18 obs.), Three-toed Woodpecker (4 obs.), Northern Flicker (44 obs.), and Pileated Woodpecker (2 obs.). Previous surveys also had Northern Flickers as the most abundant woodpecker in the area, in numbers and frequency of detection.

Sapsuckers and woodpeckers were abundant in the alluvial fan and burned hillside habitats. All woodpecker species detected, except for three-toed, were found in the

alluvial fan area. Hairy Woodpecker abundance was highest in burned habitat sites, where numerous snags were present for nest excavation. Active Hairy Woodpecker and Northern Flicker nest trees were also located within the burned site, which is located outside of the mine site development area. In another 5-10 years, it's value will decrease with the growth of new trees (currently open and grassy).

Northern Flickers were also confirmed to be nesting in the area, with freshly excavated holes, and visuals of adults exiting and entering cavities. A pair of Pileated Woodpeckers were heard calling to each other along the alluvial fan habitat (deciduous, burn, wetland/forest complex). Three-toed Woodpeckers were mainly identified through observation of mainly old feeding sign on pine and spruce trees. There were only two visuals during 1997, both incidental observations by TEM crew members.

4.3.10 Passerines and Others (flycatchers and peewees, swallows, corvids, thrushes and pipits, wood-warblers, sparrows, blackbirds, other)

cAs expected, passerine and other bird species made up the majority of detections during surveys, as they are the largest category of birds throughout the province. However, passerines were still considered to be low for the area when compared to regional populations and distributions. This is thought to be primarily due to the upper elevation location. The lack of a deciduous component in the mine development area is likely a factor in low numbers as well.

During migratory surveys, large flocks of passerine species were observed moving through the area (i.e. White-winged Crossbills, Pine Siskins, and Yellow-rumped Warblers). As expected, based on breeding bird surveys, there were many juvenile birds as a result of breeding in the area (e.g. Yellow-rumped Warblers). In contrast to the spring surveys, the majority of observations were of females and juveniles rather than males (see Appendix 5).

Previous to 1997, Olive-sided Flycatcher, Western Wood Pewee, Willow Flycatcher, Hammond's Flycatcher, and Dusky Flycatcher were observed in the study area. Olive-sided Flycatcher and Western Wood Pewee were the most abundant flycatcher species in the area.

Tree Swallow, Violet-green Swallow, Northern Rough-winged Swallow, Cliff Swallow and Barn Swallow were all recorded within the study area. Cliff and Barn Swallows were the most frequently detected swallow species, mainly due to their proximity to camp where they were constantly seen. If any group of birds will benefit from mine site development, it will be the swallows. All of the cabins at the Fish Lake mining camp had swallow nest construction present, mainly Barn and Cliff Swallow. A total of 61 Cliff Swallow nests were counted in 1993, 25 in 1994, and 30 in 1995. Barn Swallows were not as abundant as Cliff, with 1 to 10 nests observed between 1993 and 1997 within the mine camp.

Gray Jays, Clark's Nutcrackers and Common Ravens were present in the study area, with Gray Jays the most abundant of the three species. Gray Jays were detected within every

habitat type surveyed, but were most abundant along the edge habitats of Fish Lake. Clark's Nutcrackers have been recorded nesting within the mine development area and it is likely that the other detected corvid species breed within the area as well.

One Stellar's Jay was recorded on June 18, 1993, at Wasp Lake, but no detections have been noted since that time. American Crows, very unusual for the area, were observed at the outlet of Big Onion Lake on August 28, 1994, using the low elevation grasslands.

Yellow-rumped Warblers were one of the most abundant bird species for the sites survyed (see Table 4). Other warblers detected in the area included: Common Yellowthroat, Townsend's, Wilson's, and Yellow Warblers. On June 21, 1993, a single Northern Parula Warbler was recorded 50m due south of Prosperity Camp in the tall willow thickets near Fish Creek. This sighting was positively identified by the head ornithologist for surveys at the time (DJK). This record is noteworthy as this species is very uncommon in British Columbia (vagrant). Following years of surveys did not detect this species again.

Chipping Sparrow, Savannah Sparrow, Song Sparrow, Lincoln's Sparrow, White-crowned Sparrow were all well-distributed in the area.

Red-winged Blackbird, Brewer's Blackbird, and Brown-headed Cowbirds were present in the study area. Some parasitism by cowbirds occurs in the area, but the extent is unclear. Although not directly observed, it is likely that the cowbirds are using most of the warbler nests as surrogates for their eggs.

Other birds recorded in the area include: Mountain Chickadee, Boreal Chickadee, Black-capped Chickadee, Red-breasted Nuthatch, Golden-crowned Kinglet, Ruby-crowned Kinglet, Townsend's Solitaire, Bohemian Waxwing, Cedar Waxwing, Warbling Vireo, Dark-eyed Junco, Pine Grosbeak, Red Crossbill, White-winged Crossbill, Common Redpoll, Pine Siskin, and Evening Grosbeak. Please refer to the Appendix 3 for a full list of all birds observed in the mine site study area.

4.4 Habitat Assessment Overview

Within the study area (TEM boundaries), the sites with the highest abundance of birds were located in the higher quality, low elevation, alluvial fan habitat as expected. The majority of passerine and other bird species recorded, appeared to utilize the medium shrub carr wetland and cottonwood/deciduous riparian habitat, along Fish Creek, more so than any other habitat type surveyed. These high use areas are located outside of the mine site development area. Therefore, no potential effects are expected for these high use sites.

The large burned hillside area, lakes and open water, located within the area mapped for terrestrial ecosystems were also high use habitat for birds. Numerical comparison between the areas surveyed is difficult due to the different number of plots completed in each area (see Table 3). For the Fish Lake area, the islands on the lake were of high value for breeding birds, in part due to the safety provided from predators.

The lakes, ponds and wetland habitat within the Prosperity Project Area provided low to moderate habitat for most migratory birds. Few birds, sometimes none, were present on these lakes/ponds/wetlands, while outside of the study area (in lower elevations) higher numbers were observed (ie. Big Lake).

5. BATS

British Columbia supports the highest bat diversity among the Canadian provinces, with sixteen species occurring in British Columbia (Table 1). The Prosperity Project area occurs in the distribution range of 12 of these 16 species. Of the sixteen species found in the province, and 12 that can possibly occur in the Prosperity Project area, 4 species also occur on the Ministry of Environment, Lands and Parks (MELP) Red (i.e., indigenous species that are threatened or endangered) or Blue (i.e., indigenous species that are sensitive or vulnerable) list. In addition, 8 bat species that are identified as Regionally Important Wildlife species (i.e., are native taxa that are not considered at risk provincially, but are affected by forest or range practices and require specific habitat management prescriptions in order to maintain regional populations) have distributions that occur in the Prosperity Project area within MELP Region 5 (Cariboo Region) (MELP, 1997). Four bat species found in the Prosperity Project Area are also listed nationally by the Committee on the Status and Endangered Wildlife in Canada (COSEWIC) (Table 1)

A need for a concentrated sampling effort for bats, within the mine site study area, to establish baseline information on species and populations in the area was identified. No information was available on red- or blue-listed species for this area. Because of the relatively high elevations of the proposed development area, bat diversity was unlikely to be high, and many of the potential species (based on range) were predicted to be absent. However, some relatively rare species were identified as possibilities and therefore baseline inventory surveys were deemed necessary. As there were no pre-existing data for bats in this area, the inventory work was preliminary in nature - i.e. it was a reconnaissance level inventory only.

Objectives for the bat inventory program included:

- to identify species present, including red- and blue-listed species;
- for red- and blue-listed species, identify species/habitat relationships;
- to identify relative abundance where possible;
- to identify and plan for any further inventory needs (e.g. if any more detailed, site-specific work is warranted);
- to identify general levels of use by bats; and
- to identify any further site-specific needs for inventory.

The CDC tracking lists for the Chilcotin Forest District area included 4 species of bat on either the red or blue list. However, there was no information available on red or blue listed bat species for this area, or even on bats in general for the area. Background

research identified 12 (out of a provincial total of 16) bat species which had ranges encompassing the general area, and which could therefore potentially occur within the Prosperity Project TEM area. Brief species profiles were compiled for these species and are presented in Madrone Consultants Ltd. 1999 (ref tech report)

Because of the relatively high elevations of the proposed development area, bat diversity was unlikely to be very high, and many of the potential species (based on range) were predicted to be unlikely to occur. However, some relatively rare species were possibilities, and therefore some baseline inventory surveys were planned to identify bat species in the study area.

5.1 Methodology

5.1.1 Site Selection

Because of the potential for some relatively rare species to occur, and the existing lack of knowledge on bat use in the area, a concentrated sampling effort for bats, within the core study area, was made. As there were no pre-existing data for bats in this area, the inventory work was preliminary in nature - i.e. it was a reconnaissance level inventory only.

Within the Prosperity Project mine site study area, nine sampling locations were identified from preliminary reconnaissance (Appendix 1, Figure #). Site selection emphasized the development area for the various proposed options for project development and project area coverage. Identified sampling sites represent areas where significant habitat alteration may occur, while accounting for the likelihood of successfully capturing bats.

5.1.2 Netting

All sampling methodology followed Ministry of Environment, Lands and Parks, Resource Inventory Committee (RIC) Standardized Methodology for Bats (RIC, 1997c). Specifically, mist nests were used to capture bats. Selection of specific netting sites was based on habitat characteristics that influence bats (i.e., over or around bodies of water, such as rivers, creeks, small ponds, small lakes and marshes and flyways [natural openings which direct bats]). Mist nets were erected and net configurations ranged from single nets to multiple nets forming 'T' and 'L' shapes, or nets stacked on top of each other. Nets were erected just before sundown and remained set till at least 01:00 hrs. Attempts were made to capture bats from June 10th to June 18th and July 26th to 31st, 1997, inclusive.

Captured bats were kept in a cloth bag for a minimum of one hour (to allow emptying of the digestive tract) before measurements were taken. Bat species were identified, and mass, forearm length, reproductive condition and sex were recorded.

5.1.3 Bat Detectors

Two ultrasonic bat detectors (Pettersson Elektronik® Model D100) were used at each site. One detector was set at 40 kHz frequency, and the other detectors at 25 kHz

frequency. Each detector was monitored for bat activity, every night for the duration of the netting session.

5.2 Results/Baseline Conditions

5.2.1 Netting Locations and Bats Captured

A total of nine nights of netting over eight sites from June 10 to June 18, and for six nights over 3 sites from July 26th to July 31st, 1997 were completed. Two sites had repeat visits, Bat Survey Site #2 (B2) and Bat Survey Site #5 (B5) (Appendix 1, Figure #).

Nine bats were captured over nine nights in June, yielding a capture rate of 1.0 bats per night. The number of bats captured per night ranged from zero to three. In July, 13 bats were captured over six nights, yielding a capture rate of 2.17 bats per night. The number of bats captured per night ranged from zero to six. In total, 22 bats composed of 4 species were captured (see Appendix 6).

5.2.2 Species Composition and Reproductive Condition

No red- or blue-listed species were detected in the study area. Little Brown Bats (*Myotis lucifugus*), were the only species captured during the nine night sampling period in June. Pregnant females and adult males were present in the captured sample of nine Little Brown Bats.

During the six night netting sample in July, Little Brown Bats as well as Long-legged Myotis (*Myotis volans*), Silver-haired Bat (*Lasionycteris noctivagans*) and Western Long-eared Myotis (*Myotis evotis*) were captured. Four post-lactating female *Myotis lucifugus* were present in the captured sample of 13 bats (Appendix 6, Table 1).

5.2.3 Bat Detector Data

Myotis spp. were heard every night using the bat detectors during June and July sampling. Big Brown Bats (*Eptesicus fuscus*) and *Lasionycteris noctivagans* were also heard during June and July sampling (Appendix 6, Table 2).

Nine bats were captured over nine nights in June, yielding a capture rate of 1.0 bats per night. The number of bats captured per night ranged from zero to three. In July, 13 bats were captured over six nights, yielding a capture rate of 2.17 bats per night. The number of bats captured per night ranged from zero to six. In total, 22 bats composed of 4 species were captured (refer to data report).

No red or blue-listed species were detected in the study area. Little Brown Bats (*Myotis lucifugus*), were the only species captured during the nine night sampling period in June. Pregnant females and adult males were present in the captured sample of nine Little Brown Bats.

During the six night netting sample in July, Little Brown Bats as well as Long-legged Myotis (*Myotis volans*), Silver-haired Bat (*Lasionycteris noctivagans*) and Western Long-eared Myotis (*Myotis evotis*) were captured. Four post-lactating female *Myotis lucifugus* were present in the captured sample of 13 bats (Table 4).

Myotis spp. were heard every night using the bat detectors during June and July sampling. Big Brown Bats (*Eptesicus fuscus*) and *Lasionycteris noctivagans* were also heard during June and July sampling (Table 5).

5.3 Habitat Assessment

No red-listed bats are tracked for the area of the province that the mine development area located within, as they do not occur there. Bat inventory during the spring and summer of 1997 indicated that it would be highly unlikely for the blue-listed bat species (Fringed Myotis, Pallid Bat, Spotted Bat, Townsend's Big-eared Bat and Western Small-footed Myotis) to occur in the mine site study area due to a lack of roosting habitat, distance from potential hibernacula, high elevations and cool temperatures.

No bat species were selected for detailed habitat capability/suitability mapping. The following identifies general habitat values in the area.

6. OTHER SMALL MAMMALS

Background research was conducted to develop a list of small mammal species that could potentially occur in the area, based on range and known ecology. This group of mammals includes insectivores such as shrews, lagamorphs and rodents.

Minor small mammal trapping was conducted prior to 1997 (a total of 300 trap nights were conducted by HKP). However, as there are no small mammals on either red or blue tracking lists for the area, it was decided that inventory efforts for 1997 were better aimed at species groups where relatively rare species may occur (i.e. bats). As well, fieldwork from 1993-1996 did not indicate any specific inventory need for this group.

Consequently, inventory efforts in 1997 were focused at species groups where relatively rare species had potential to occur. No field inventory was proposed for small mammals in 1997, other than for bats. Potentially significant values were identified if they required further investigations. Background research to develop a list of likely species and all incidental observations of small mammal activity was recorded, to assist in developing habitat interpretations.

Objectives for small mammal impact assessment for the mine site area included:

- to identify species present, including red- and blue-listed species;
- to identify and plan for any further inventory needs (e.g. if any more detailed, site-specific work is warranted);
- to develop species/habitat interpretations; and

- to predict potential effects of mine development.

6.1 Methodology

6.1.1 Spring and Summer Surveys

In 1996 a small mammal trapping program was conducted; full details of the methods are provided in HKP Ltd. (1997). This methodology captures only the smaller members of this group – i.e. the mice, voles and shrews. A total of 300 trap nights were conducted. Six different sites were sampled, with 50 traps set at each site for one night, giving a total of 300 trap nights.

During inventory programs in 1997 for birds, amphibians and TEM mapping, any evidence of use or direct observation of small mammals were noted as incidental information (see Appendix 5). The species, habitat type, location and activity were recorded whenever possible.

6.1.2 Winter Surveys

During winter surveys for ungulates and mid-sized mammals, all animal tracks identified were recorded. The species, habitat type, location and activity were recorded (see Appendices 5 and 7).

6.2 Results/Baseline Conditions

Limited small mammal trapping (300 trap nights) was conducted by HKP prior to 1997 (Hallam Knight Piesold, 1997).

Small mammals confirmed to use the habitat located within the study area boundaries included: Red squirrel (*Tamiascuris hudsonicus*), Yellow-pine chipmunk (*Tamias amoenus*), Southern red-backed vole (*Clethrionomys gapperi*), Deer mouse (*Peromyscus maniculatus*) and Snowshoe hare (*Lepus americanus*). Small mustelids including Long-tailed weasel (*Mustela frenata*), mink (*Mustela vison*), ermine (*Mustela erminea*), and marten (*Martes americana*) were also recorded in the study area.

Additional species recorded in the area by HKP included: Meadow voles (*Microtus pennsylvanicus*), Bushy-tailed woodrat (*Neotoma cinerea*), Common pika (*Ochotona princeps*), Western jumping mouse (*Zapus princeps*) and Common shrew (*Sorex cinereus*) (Hallam Knight Piesold, 1997).

It is expected that dusky (*Sorex monticolus*) and Northern water shrew (*Sorex palustris*) are likely present in the area as well.

A summary of field observations for the mammals in this group, for study area, is provided in Appendix #, Table #.

6.2.1 Spring and Summer Surveys

Between June 9th to the 19th and from August 26th to September 2nd, 1997 field crews recorded incidental observations of small mammals use in the area. Shrews were seen running along the road by the Fish Lake recreation area on two occasions, but could not

be identified to species. Their tracks and trails were also noted in the fine dust along the roadsides.

As expected, muskrats were present in lake and shallow open water areas. One active muskrat lodge was located at the southern end of Fish Lake. Muskrats appear to have a low to moderate distribution throughout the area.

The most frequently recorded small mammals within the study area included red squirrel and yellow pine chipmunk. Over 150 visual and or auditory detections of squirrels were recorded (Appendices 5 and 7). Caches, middens, holes, nests and eaten cones were frequent evidence of use recorded. Cone caches were observed to be more common around the base of spruce trees than other tree species. Chipmunks were also seen and heard on numerous occasions with sign consisting mainly of holes at tree bases and eaten cone cores.

Snowshoe hare were also abundant during 1997 surveys. Hare sign was concentrated in young lodgepole pine forests of structural stages 4 and 5, especially where grassy understorey was present. Hare fecal pellets were seen at many of the bird survey plots as well as bedding sites, which were located in the ground hollows underneath the root boles of downed trees. Sign was also high during winter surveys.

6.2.2 Winter Surveys

During winter surveys track transects were completed to assess furbearer use in the study area. In addition, other small mammal use was noted. Results indicated that red squirrel and snowshoe hare sign were the most abundant small mammals active in the winter. Tracks, trails, visuals, pellets, middens, and/or evidence of feeding were recorded (see Appendix #).

Small mustelid tracks were abundant in the wetland habitat immediately west of camp (polygon #548, WS3a). Typical of mustelids, the tracks went all over the place in search of prey, checking out all potential prey sites.

Shrews, mice and voles

The small mammal trapping program captured a total of 7 individuals of 4 different species in the project area. Species identified from this program were Dusky shrew, Southern red-backed vole, Meadow vole, and Western jumping mouse.

Only a single Dusky shrew was caught. An unidentified shrew was noted in a sedge fen near camp in July 1996, and two other small shrews were observed in summer of 1997. It is likely that several shrew species are present, but as they are small, secretive and largely nocturnal, they are difficult to detect.

A number of different mice and vole species are likely to be present but may not all have been detected in the area. A handful of records of unidentified mice/ vole records exist from tracks and latrines at various times; the sign could be ascribed to a number of species.

Two Deer mice was caught during trapping, and one was killed at camp by a cat. This species is likely quite common and the camp log notes there are lots in the camp buildings. A Western jumping mouse was also caught during trapping……

Red-backed vole is an important prey species for many predators and may well be quite common in the area, although only a single individual specimen was caught in the limited trapping program. Another freshly killed specimen was found during winter surveys in March 1998. Meadow voles were recorded five times between 1993 and 1996, including one trapped specimen in 1996.

Large Rodents

Muskrats were present in lake and shallow open water areas as expected, mainly in sites with considerable herbaceous wetland vegetation along the shoreline. Suitable sites appear to be quite localised, and the main areas of activity were near the south end of Fish Lake alongside Fish Creek, and ….. Several lodges/push-ups are on record, and a single animal was observed just south of Fish Lake (at bat sampling site __). Overall, muskrats appear to be fairly limited both in range and number.

Beaver activity is evident throughout the area wherever there are suitable aquatic habitats. Numerous records exist of beaver dams, many of lodges, and sign of active felling is widespread in many riparian areas. were seen along Fish Creek (seen swimming to the west side of the lake with a stick) and at Wasp Lake during bat surveys. Beavers have numerous active dams along the length of Fish Creek north of camp. Beaver sign is also especially evident at the outlet of Fish Lake, and at Little Fish Lake (where a lodge is located along with a number of downed trees) where many trees have been downed or are in the process of harvesting. Lodges were seen at Vick Lake, Little Fish Lake, Big Onion Lake and all along Fish Creek.

Porcupine sign in the study area was very low, and sign of activity was only recorded in a couple of locations despite numerous surveys across the area. There have been no reported sightings and no dens found. Evidence of use was recorded in young pine forests at the northwest portion of the study area (near Onion Hill and the extensive burned area), and in ___ but in both cases sign of use was not recent. It seems likely that porcupine abundance in the area is very low.

Squirrels and Chipmunks (Sciurids)

The Red squirrel is the most frequently recorded small mammal within the study area, and appears to be quite abundant – probably the most abundant small mammal – and well distributed throughout the area. Hundreds of visual and/or auditory detections of squirrels have been recorded, throughout the year. As well, cone caches, middens, holes, nests and eaten cones, and in winter, tracks, were frequent evidence of use in most forested habitats. Cone caches were notably more common around the base of spruce trees than around other tree species. Yellow pine chipmunks were seen and heard much less often than squirrels, but are nonetheless quite common, and are present in a wide variety of habitats. They were observed on many occasions, and sign consisted mainly of holes at

tree bases and eaten cones. A handful of records of unidentified chipmunks also exist, probably of this species???

Hares and Pikas (Lagomorphs)
Snowshoe hare was recorded quite often in summer. Pellets were seen at many survey plots (e.g. TEM, bird surveys), along with daybed sites located in the ground hollows underneath the root boles of downed trees. However, the majority of records are from winter, when snow tracking clearly revealed winter activity levels. Several hundred observations have been recorded, suggesting snowshoe hare is fairly abundant. However the hare appears to be less well distributed through the area than the red squirrel.

There is one record of a Common Pika from the area, when a call was apparently heard form the lava talus near camp. No calls were heard during 1997 fieldwork and no sign was observed during detailed work in the area. The talus was searched but revealed no evidence of Pika in late summer (e.g. herbaceous cuttings drying). No Pika sign was observed in other potentially suitable habitats elsewhere in the study area.

6.3 Habitat Assessment

Squirrels were recorded in all forest stands mature enough to support cone crops, even in stage 4 stands in some cases. Pine dominated forests of stage 5 and above supported high squirrel activity. Although squirrels were sometimes observed using non-forested habitats, sign was usually close to a forest edge.

Hare sign was associated with young Lodgepole pine forests of structural stages 4 and 5, especially where grassy understorey was present.

7. MID-SIZED MAMMALS

Habitat values for mid-sized mammal species within the study area (e.g. furbearers and coyotes) were identified with the use of an ecosystem map and data collected in the field during the 1997 field season. The main goal for mid-sized mammal review was to identify their habitat values in order to predict and mitigate for potential mine development effects. However, although the blue-listed fur-bearing species fisher and wolverine may utilise the proposed development area at times, these species tend to be wide-ranging and are difficult to directly inventory. By nature they are likely to occur in very low densities. Therefore, the approach used for assessment was to perform winter surveys and supplement the data with trapper returns, harvest returns, past records (HKP data) and the general literature in order to develop some general habitat-based interpretations for this group of mammals.

Objectives for the mid-sized mammal inventory program included:
- to identify species present;
- to identify relative abundance where possible;

- to develop species/habitat profiles for Fisher;
- to identify any significant habitat values; and
- to develop appropriate management/mitigation plans if warranted.

7.1 Methodology

7.1.1 Spring and Summer Surveys

No specific fieldwork was planned for the spring and summer, other than incidental observations during the 1997 ecosystem and wildlife inventory program, as this group of mammals is difficult to inventory during the growing season.

7.1.2 Winter Surveys

Mid-sized mammals are most appropriately inventoried during the winter, when their tracks are evident in the snow. Transects to determine presence of mid-sized mammals in the study area were completed during the winter of 1998. In order to provide relative abundance of fur-bearers in relation to the habitat type, road transects were done by truck and foot and consisted mainly of 200 metre transects running perpendicular to the 5km road from the mine camp.. Snowmobiles were used to access survey areas in the southern portion of the mine site study area and to the north of camp, including the Cone Hill area. Other forms of transportation included snowshoe, truck and helicopter.

7.2 Results/Baseline Conditions

Mid-sized mammal species confirmed to be present within the study area (TEM) boundaries included coyote, porcupine, fisher, marten, river otter, long-tailed weasel, mink, beaver, and lynx.

7.2.1 Spring and Summer Surveys

Between June 9th to the 19th and from August 26th to September 2nd, a number of records were obtained for mid-sized mammals within the study area. Beaver, porcupine, long-tailed weasel and coyote were detected, mainly by sign. Additonal species detected prior to 1997 include Maten, Red Fox and Lynx.

Beavers were seen swimming to the west side of Fish Lake with a stick, and at Wasp Lake during bat surveys. Beavers have numerous active dams along the length of Fish Creek north of camp. Beaver sign is especially evident at the outlet of Fish Lake, and at Little Fish Lake where many trees have been downed or are in the process of being harvested. Lodges were seen at Vick Lake, Little Fish Lake, Big Onion Lake and Fish Creek. Data prior to 1997 by HKP also observed high beaver activity in the study area, with numerous dams concentrated along Fish Creek.

Porcupine sign was very low within the area of study. No animals have been recorded in the mine site study area from 1993 to 1999. The sign observed is quite old. Evidence of use was recorded in young pine forests at the northwest portion of the study area (near Onion Hill and the extensive burned area). No beaver observations were noted during surveys from 1993 to 1996 (HKP, 1997).

During the spring and summer, only one mustelid, a Long-tailed weasel, was identified as present, based on a visual of the animal during an early morning bird survey. The individual was seen hunting in and out of the boulders along the roadside near the same

area that had porcupine sign. Long-tailed weasel were also observed by camp staff at the Fish Lake Camp in January and February of 1994.

On August 26, 1995 HKP had a visual record of a Fisher three km east of Taseko Lodge, at Beece Creek in a mesic pine-aspen unit. The deciduous habitat in the valleys, Beece Creek and Taseko River, likely support resident fisher. This habitat type is not present in the mine development area.

Marten were recorded during the spring and summer months during June of 1993 and during August of 1995 (HKP, 1997). Both sightings occurred in young pine forest. One record was based on fresh scat found east of Fish Lake Camp, while the other were tracks seen southeast of Prosperity Camp.

Coyote sign was common throughout the study area, concentrated around Fish Lake. Scat was abundant along the trail at the east side of Fish Lake. Coyotes were also seen from the helicopter on a couple of occasions, near Fish Lake, and to the north by Tete Angela Creek. Coyotes were heard in the daytime calling by Taseko River. Previous wildlife records support the 1997 observations of high coyote use of Fish Lake and the surrounding area (HKP, 1997).

Red fox (Vulpes vulpes) scat was observed in June of 1993 and August of 1994 near Fish Lake. Sign was located in a open pine forest with pinegrass and kinnikinnick understorey, while the other scat was found within a open pine forest with some spruce, scrub birch and willow (HKP, 1997).

Lynx sign was observed during June of 1993 and August of 1994 and 95. Scat was located in young and mature pine forests. Over 200 scat were located at a small lake 2 km southeast of Fish Lake which contianed rodent fur and bones. The sign was concentrated near an active denning area, where one adult was sighted. The den area was located in mature pine forest with a juniper and kinnickinnick understorey (HKP, 1997).

7.2.2 Winter Surveys

According to survey results, coyotes were the predominant carnivore present in the area during the winter.

Records of Fisher were obtained during winter surveys in 1998. Fresh fisher tracks were present around an old moose carcus. Print measurements for the fisher tracks were ~ 3.2 inches by 3 inches (double register of hind foot over front foot). Mustelid scent spraying was also noted. Fisher tracks led away from the carcus into an adjacent open forest stand mixed with wetland. The animal traveled and hunted along the tree bases and under CWD. Fisher scat and spraying sign was also observed.

On January 31, 1993 during previous winter surveys a Marten was recorded at Fish Lake Camp in a young, closed pine forest with juniper and shepherdia understorey. An Ermine was also observed in this habitat type near Fish Lake Camp in February of 1993 (HKP, 1997).

Lynx tracks were common within young pine forests stands of structural stage 4/5, where their snowshoe hare prey were abundant. High hare sign was observed during 1998 winter surveys.

7.3 Habitat Assessment

Fisher

	High	Moderate	Low	Nil
Reproductive – Security				
Growing – Feeding				
Winter – Feeding				
Winter - Security				

8. LARGE MAMMALS (UNGULATES AND LARGE CARNIVORES)

Large mammals have been a particular focus in the HKP fieldwork program in the mine site study area (Hallam Knight Piesold, 1997).

Following work up to 1996, large mammal inventory objectives included:

- identify species and populations using the study area;
- quantify populations (density estimates/ relative abundance) where possible (e.g. for ungulates, bears);
- identify seasonal habitat values for ungulates and bears;
- identify travel corridors;
- identify any specific management needs; and
- develop appropriate mitigation and management strategies if required.

No specific field inventory was proposed for 1997 for large mammals in the mine site study area other than the collection of wildlife and habitat data during ecosystem field sampling program, and incidental observations from other inventory crews.

In 1998, a winter survey program was developed and completed to fill in data gaps for baseline information. Aerial surveys were conducted to assess ungulate abundance in the winter. The surveys were completed to verify the capability/suitabilty mappng and to provide a baseline to predict and mitigate potential effects of the mine development.

The use of the habitat within the study area by large carnivores (e.g. grizzly bear) was also assessed on site and supplemented with literature reviews and communication with locals. Potential effects on grizzly bear habitat, based on mapping and classification, were identified. A similar approach was used to assess habitat vlues for black bear, moose and deer.

8.1 Methodology

8.1.1 Spring and Summer Surveys

Data was collected from the bird survey crew and TEM crews in regards to ungulate and large carnivore use in the spring and summer. Incidental observations recorded species, location, habitat type and activity whenever possible (see Appendices 5 and 7).

8.1.2 Winter Surveys

Winter surveys were carried out for moose and mule deer to provide data on the relative number of individual species in relation to their use of critical winter habitats. This data was used in conjunction with data collected in the summer to determine habitat use.

Winter surveys were carried out during March 4th to the 7th in 1998 by Madrone Consultants Ltd. Previous to that winter surveys were completed by HKP in 1996 and 1997. Surveys were completed using snowmobiles, truck, foot and helicopter. Refer to Figures # for the locations of winter survey transects, points and aerial flight lines.

The winter surveys covered the TEM boundary, which encompassed the mine development site. Two survey periods were completed during the winter to give an idea

of critical winter habitat use. The surveys should ideally be conducted in late January and again in late February 1998, dependent on snow depths sufficient to push animals onto their critical or optimum winter habitats.

a) Aerial Transects

Two aerial transects were completed in the winter of 1998 in order to determine relative abundance of ungulates and mid- and large-sized mammals in relation to winter habitat use and possibly habitat types (see Figure # for aerial flight transect map). Aerial survey methodology followed RIC Standards for *Aerial-based Inventory Techniques for Selected Ungulates* (RIC, 1997d). The flight lines used by HKP were duplicated for comparative purposes. HKP completed one winter aerial survey in January of 1993 and 5 additional aerial surveys: April, June and August 1993, March and July 1996 (Hallam Knight Piesold, 1997).

A Bell Jet-Ranger 206 helicopter was used for aerial observations. The surveys followed a standardized flight plan, consisting of east-west transects spaced 1km apart and parallel to each other. Each transect was flown at an average height of 75-125 metres and an average ground speed of 100 km/h. Aerial surveys were flown during periods of clear, calm weather with good viewing conditions. From 1993 to 1998, the pilot navigated from a pre-determined flight plan, marked directly on 1:50,000 scale topographic maps (NTS sheets 92-O/5, 92-O/6, 92-O/11, 92-O/12).

Wildlife sightings were marked directly on the appropriate mapsheets. Each observation during the aerial survey included the species, number, sex, habitat type, and estimated distance from the transect centreline (i.e. 0-50m; 50-100m or more than 100m). All tracks, visuals and other sign were recorded. Ground truthing occurred where necessary.

b) Ground Transects

Ground transects were intended to provide relative abundance of fur-bearers and ungulates present in relation to the habitat type. Approximately 30km of winter track count transects were conducted in representative habitats of the SBPS and MS biogeoclimatic zones of the project area. Transects were done by truck, snowmobile, snowshoe and foot and consisted of 100m segments up to 3 km in length. Road transects consisted mainly of 200m transects running perpendicular to the 5km road from the mine camp northwest. Snowmobiles were used to access survey areas in the southern portion of the mine site study area and to the north of camp, including the Cone Hill area for ungulates and mid-sized and large-sized mammals.

Due to the patchiness of the habitat at Prosperity, tansects were of variable length. It was rare to find a patch of habitat that was unifrom over more than 1,000 metres of transect. The length of transect was determined in the field by counting the number of paces when on foot and the use of an odometer on snowmobiles. The distance was later verified by measurements on topographic maps. A 1:20,000 TEM map was used to record transect locations and to identify habitat types and site series surveyed.

During the track count, every animal track that crossed the intended transect route was counted. However, if it was obvious that the same animal had zigzagged across the intended transect route one or more times, then only one track was counted. Also, if the animal track followed the intended transect route for several tens of metres, the track was

still counted only once. The identificaiton of animal tracks was based mainly on the experience of the observers and consultation with reference books.

8.2 Results/Baseline Conditions

Considerable data has been collected on the ungulates in particular since 1993. This, together with habitat data and additional wildlife observations from the 1997 field season, enabled the development of species/habitat relationships by season for moose, mule deer and bears.

8.2.1 Spring and Summer Surveys

Moose are common in the area during the spring and summer. Moose were recorded at a number of sites within the study area and are known to occur commonly throughout the year. The predominant habitat type that moose sign was seen in occurred in the young pine forests (stage 4/5) and wetlands containing browse species (e.g. willow, scrub birch, sedges, etc.). Moose use appeared concentrated around Fish Lake, and the alluvial flats by Taseko River (the roses were browsed to the ground in the winter). Moose sign observed from June 9-19th and August 26th to Sep 2nd included: pellets, browse, tracks, trails, removed bark, rubbing marks on trees, hair caught in dense pine forest branches, bedding sites, scars on aspen trees, visual of adults feeding in Fish Lake and cows and calves along Fish Lake shoreline and on the main island (8 visuals in total for the area). Locals have observed that cows utilize the large island on Fish Lake as a safe haven for calving in the spring. The Fish Lake area is used by moose during the rutting season as well (Rush Dalziel, Taseko Lake Guide outfitter, pers. comm.).

Mule deer use in the area was low overall during surveys from 1993 to 1997. Very little deer sign was recorded during the 1997 spring and summer, with two incidental visual records (both on the road to camp, one very close to camp). Pellets and tracks were recorded, especially around the camp. Deer use was much more prevalent/evident during winter surveys. Surveys from 1993 to 1996 recorded three deer sightings, two of which occurred in the Taseko River valley area. An unusual record for the area, HKP observed a White-tailed Deer in the study area, in the meadows 400m north of Fish Lake on August 30, 1994.

Along the valley some good spring forage habitat is present, especially the warm aspect slopes east of Big Onion Lake. Within the upper elevation part of the study area, Tete Hill was assessed as containing the best winter range for deer within the study area.

Mountain Goats have rarely been recorded near the study area. Goat habitat is therefore not considered to be a management concern in this area.

Sign of grizzly bear use in the study area was also quite low. Grizzly bears are known to occur in low numbers in the immediate vicinity and have been recorded at Wasp Lake and the surrounding southern portion of the study area. Grizzly bears have not been recorded near camp and are known to be of rare occurrence in the study area, as they take advantage of the lusher habitat along the valley bottom of Taseko River and the skree slopes to the west of Lower Taseko Lake. On August 28, 1995 one Grizzly bear was seen at the north shore of Wasp Lake digging in ant-hills amongst a young pine stand with feathermoss understorey (HKP, 1997).

Black bear sign was also limited and consisted of tracks on the road, scat, old claw marks on aspen trees in the alluvial flats area. Black bears are sure to utilize the Fish Creek area during spawning of the lake trout. A black bear was seen in camp on a number of occasions and was recorded as trying to gain access to the cook house. It also frequented the garbage dumpster which has since had a bear guard gate installed. Between 1993 and 1996 surveys only five records of black bear sign were noted within the study area, based on scat and feeding sign.

Wolf sign was low during 1997 and 1998 surveys. Wolves were heard one night by the bat crew at the south end of Fish Lake. Large canid scat was present along the foot trail on the east side of Fish Lake, but only some could be positively identified to belonging to wolves.

Domestic cattle and horses were also common throughout the area, as evidenced visually and by evidence of use. Cattle were most frequently seen in the alluvial flats area by Taseko River, where they roam freely during the spring and summer. The horses were present in the southern portion of the study area by Wasp Lake during the winter. During the summer the horses are used for guiding by Taseko Lodge.

8.2.2 Winter Surveys

Moose sign was present throughout the area. Heavy browse by moose on willows and scrub birch was observed. Wetland habitat contained the majority of moose tracks recorded. This correlates well with the feeding sign observed at these sites (Appendices 5 and 7).

A single moose carcus was also located during winter surveys. The cause of death was unknown as very little of the animal was left. There were numerous tracks, belonging to different scavengers, around the skeleton.

The mature forest stands around Tete Hill were found to have moderate deer use. Numerous tracks fresh and old, bedding sites, and scat were observed in the Tete Hill area. High lichen loading (mainly *Bryoria* sp.) was also present within some of the older forest stands. Snow interception was also good with protected areas in mature/old-growth forest stands and under individual trees. The bare ground around the base of some of the spruce trees showed evidence of use for bedding.

Some wolf sign was recorded in the southern and south-eastern section of the study area. One dead coyote was located in the same area that wolf activity was noted. Numerous coyote and wolf tracks were present around the kill site. The animal had been scavenged and little was left. Fresh tracks from a pack of wolves were also recorded just outside of the southeastern boundary during aerial surveys for ungulates (near Wolftrap Lake).

8.3 Habitat Assessment

Habitat assessment was based on a combination of inventory results/observations and capability/suitablity values assigned to TEM ecosystem units. The rating scale of 1 to 6 is indicative of the capability/suitablity of a given ecosystem unit to provide life requisites for a given species in comparison to the best habitat in B.C. Ratings are based on the present knowledge of distributions and habitat use within the province and associated benchmarks established by MELP, Wildlife Branch, Victoria.

- High (1) indicates that the ecosystem unit provides 76-100% of the best quality habitat relative to the best in B.C.
- Moderately High (2) – 51-75%
- Moderate (3) – 26-50%
- Low (4) – 6-25%
- Very Low (5) – 1-5%
- Nil (6) – 0%

Moose

Life Requisite	High (1)	2	3	4	5	Nil (6)
Growing – Feeding						
Growing – Security						
Winter – Feeding						
Winter – Security/TH						

Mule Deer

	High (1)	2	3	4	5	Nil (6)
Growing – Feeding						
Growing – Security						
Winter – Feeding						
Winter – Security/TH						

Grizzly Bear

	High (1)	2	3	4	5	Nil (6)
Early Spring – Feeding						
Summer – Feeding						
Fall – Feeding						
Growing – Security/TH						
Denning/Hibernation						

Black Bear

	High (1)	2	3	4	5	Nil (6)
Denning/Hibernation						

8.4 Bear Safety Management for the Prosperity Mine Area

Bears and bear habitat should be respected. We do not need to force bears to leave their habitat, teach them to eat human foods, or place bears in situations where humans or bears could get hurt. Preparation, awareness and education are essential to ensure encounters with bears in the wild are conflict free. Conservation Officers unfortunately have to kill approximately 800 black Bears and 50 Grizzlies each year, including bear cubs and Grizzlies from areas where population levels are dangerously low. Relocating bears that are used to eating garbage is not usually a viable option, since they often return to the easy food source, or they will often fail to survive in their new habitat.

Black Bears and Grizzly Bears, although less frequent are present in and around the Prosperity Mine site and the Transmission corridor. Many of the areas frequently traveled by mine personnel pass through prime habitat. Measures need to be taken to prevent negative bear encounters at the Camp, on the roads into and adjacent to camp and along the Transmission Corridor. Bears will habituate to human food. Bears have excellent senses of hearing and smell, and better sight than many people believe. Bears will aggressively defend food and all female bears defend their cubs. Female bears make attack if surprised at close range, or if one is between her and her cubs. Care should be taken to prevent bear encounters with all personnel associated with the mine development and workings.

Camp Facilities

- all food should be stored in a “bear proof” facility;
- all garbage must be incinerated daily;
- outdoor cooking grills should be cleaned after use and stored inside;
- kitchen waste water and sewage should be treated and disposed of underground;
- if there are pets at camp, care should be taken not to leave the animal vulnerable to a bear encounter and all pet food should be store in bear proof containers; and
- fish or meat remains should never be left outdoors.

Human Safety

- all personnel of the mine facilities should be required to attend bears safety lectures; the Ministry of Environment offers bears hazard safety training programs;
- information on bears, bear safety, and other wildlife species should be easily available to personnel working in camp;
- a restricted firearm should be present in camp for safety purposes only; and
- bear deterrents, such as “bear bangers” and capsicum spray should be available to individuals working away from camp.

Safety in the Wild

- make noise so presence is known;
- be careful near feeding areas such as salmon spawning streams and berry patches, never approach a freshly killed animal;
- hunters and fishermen should be careful about attracting bears with the smell of game or fish;

- if camping, store food out of reach and if possible, smell;
- if a bear is seen; do not run, leave the area without getting between a sow and her cubs; avoid eye contact;
- if attacked by a *Grizzly*: curl into a ball and protect the back of your neck; and
- if attacked by a *Black Bear*: curl into a ball, if it persists fight back with yelling, rocks and sticks.

9. ENVIRONMENTAL ASSESSMENT

The use of the habitats within the mine development study area by wildlife was assessed on site and supplemented with literature reviews and communication with locals. Potential development effects on wildlife habitats, based on mapping and classification, were identified for amphibians, birds, small mammals, mid-sized mammals, ungulates and large carnivores. A plan to specifically address concerns regarding bear management was also developed for the mine area.

Following analysis of wildlife inventory data and an assessment of wildlife habitats within the mine site study area, a conceptual reclamation plan aimed at minimizing impacts to wildlife communities was developed. This plan will eventually provide for replacement of existing habitats with relatively natural communities upon closure. In conjunction with this, plans for mitigation for some of the short-term impacts on wildlife were also developed.

Significance criteria have been developed to assess the potential effect(s) within a provincial, regional and local wildlife management unit level context for comparitive purposes. The key factors included in the criteria were the importance and resilience of a given wildlife component. Where potential effects were determined to be significant at either of the three scales mitigation and/or reclamation measures have been developed.

Through the assessment process it was determined that the mine site development and operations were likely to result in some direct and indirect effects on a variety of wildlife, mainly by displacement from the existing habitat.

The following sections outline the potential effects, significance criteria, mitigation and benefit enhancement, residual effects, monitoring and management recommendations, cumulative effects assessment, and accidents and malfunctions for amphibians and reptiles, birds, small mammals, mid-sized mammals, ungulates and large carnivores.

9.1 Potential Effects (AMPHIBIANS)

9.1.1 Direct, Indirect and Cumulative

Valued ecosystem components (VECs) for amphibians have been identified for the Prosperity Project area and include breeding habitat.

Potential effects of the mine site development on breeding habitat include removal/alteration of habitat, resulting in displacement from feeding and breeding sites (i.e. loss of lakes, open water and wetland habitats).

Site development during the breeding season will result in the direct mortality of eggs and tadpoles through habitat clearing. Other more indirect effects may include disruption of behaviour patterns/movement routes through habitat fragmentation, changes in predator-prey balance, loss of habitat, and alterations in the water quality. Cumulative

effects based on continued habitat removal, disruption of dispersal, and water quality degradation, are expected to be moderate to high for amphibian populations within area of development.

9.1.2 Extent/Significance

The extent to which amphibian populations at the proposed mine site development area will be affected is expected to be high. However, the capacity of the breeding habitat within the area developed is considered to be of low suitability/capability for the three amphibian species which occur in the wildife management unit (WMU) 5-4. Alternate, higher suitability/capability feeding and nesting sites are accessible for amphibians in adjacent streams and lakes.

In addition, all three amphibian species involved are provincially common, and while breeding populations may be lost in a few existing lakes, the losses are not thought to be significant on a regional or local WMU scale.

9.1.3 Mitigation and Benefit Enhancement

No mitigation during the mine site development and operation is proposed other than the development of a plan to address concerns regarding bear management and potential bear/human conflicts.

Ideally, removal or alteration of lake, open water and wetland habitat would be completed during the fall and winter after amphibians have dispersed from breeding ponds.

Benefit enhancement activities specific to amphibians are not proposed within the development area or immediate surrounding, as the area does not have the capacity to support large amphibian populations due to the high elevation and typically dry climate. Some benefits to amphibians may occur as a result of the fish compensation plan, with creation of stream channels through dry habitat.

There is evidence that reclamation of disturbed wetlands can provide habitat for amphibians (Lacki, 1992). The type of reclamation would be dependent on the construction design of the reclaimed area, proximity to source populations, and the degree of acidity and heavy metal concentrations in the water.

9.1.4 Residual Effects

No significant effects are forseen following consideration of mitigation, compensation and benefits enhancement measures for amphibian populations within the development area. Duration of habitat removal will last for the life of the mine, after which reclamation of the area will ensure replacement of breeding habitat (i.e. ponds, lakes and/or wetlands). Amphibians are likely to recolonize the reclaimed area from adjacent breeding sites when appropriate habitat and environemental conditions are established.

9.1.5 Monitoring and Management

Water quality and hydrological monitoring will track acidity and heavy metal concentration conditions in the area that may effect amphibians within and outside of the development area. No additional monitoring is proposed for amphibians at this time.

9.1.6 Accidents and Malfunctions

We require project development plan which includes a number of accidental event and malfunction scenarios. The potential enviro effects of these scenarios needs to be assessed and additional mitigation measures developed as necessary to ensure that no significant residual effects are likely.

9.1.7 Capacity of Renewable Resources

Following the assessment of direct and indirect effects, cumulative effects, and the effects of accidental events and malfunctions, it has been determined that ….(regarding the capacity of renewable resources to meet the needs of the present and those of the future).

Amphibians appear to be declining on a global basis, and many species are highly susceptible to environmental changes, as their permeable skins make them very sensitive to water quality changes in particular. As a group they are receiving increasing attention from the regulatory agencies and the public.

The proposed development is likely to both directly and indirectly impact amphibian populations in the area. Direct mortality during construction and operation, habitat loss, a variety of effects from changes in local conditions of air, soil, water quality, and hydrology, alteration of behavior patterns, and shifts in local predator-prey systems may all influence amphibian populations in the study area. The proposed fish enhancement program can also be expected to affect local amphibian populations.

Unlike many of the other animals in the study area, amphibians are for the most part unlikely to move out of the area as construction begins. This group is likely to suffer extensive mortality as habitats are removed. Breeding populations of all three species in ponds and wetlands will be directly killed as work proceeds. Breeding sites adjacent to the lake will be destroyed, and some downstream habitats may also be lost.

Some of the remaining ponds and wetlands around the perimeter may be reduced in value due to mining activities fragmenting the landscape, or altering local hydrology. For example, breeding ponds may be rendered temporarily or permanently inaccessible through the placement of supporting infrastructure. Movement routes to and from breeding sites may be disrupted. Small populations may be come isolated, rendering them more vulnerable to stochastic extirpations or weather changes.

Amphibians are not tolerant of changes in water quality or pH levels. It is possible that with operation of the mine that alterations would lead to mortality or reduced locomotion, or reduced breeding success for amphibians using the wetlands in the immediate vicinity.

Other potential hazards would result from any accidental spills of chemicals or discharge of waste water from processing, from the tailings etc. Any ill effects of such incidents are most likely to be seen first in amphibian populations.

Other indirect effects could result from shifts in predators or prey in the area. For example any reduction or increase in predators such as eagles, hawks, may result in a corresponding shift in amphibians as predation pressure increases or decreases. Martell (1997), for example, notes that human activities in the past 100 years may have changed distributions by altering the composition of predators. Changes in predator - prey balances are however likely to be temporary in nature and are expected to be relatively minor compared to other sources of impact.

The proposed fish enhancement program is likely to further reduce breeding populations in the area. At present a small number of lakes (quantify areas affected) not currently occupied by fish are proposed as sites for fish release. Lakes without fish are however excellent breeding sites for many amphibians. A number of studies have indicated fish introductions as a significant threat to amphibian populations. Lanno (1996) for example found that fish introductions and aquaculture practices were the most serious threat to resident amphibian populations. Martell (1997) reports that the stocking of lakes with

sport fish may have contributed to the decline and local extirpations of some amphibian populations. The long-toed salamander is especially vulnerable to predation by introduced fish in portions of the Cascades (Leonard et al. 1993 cited in Martell 1997). Indeed, in Martell's study, larvae of this species were not observed in any waters harboring fish in the Glacier park area. Trout were present in close proximity to only 2 of 25 sites where long-toed salamanders were recorded, and at 2 of 14 sites where toads were recorded. In the two sites where toad tadpoles did occur near trout, the tadpoles were mainly restricted to shallow areas inaccessible to fish.

Significance:
The losses of good amphibian habitats in the study area amount to some __ ha of good breeding habitats (out of __ in the broader mapping area). However, all three amphibian species identified were also recorded in areas and breeding habitats outside of the development area. Those amphibian species detected including the spotted frog and the western frog are well distributed throughout the study area and throughout the province. The long-toed salamander, although not detected consistently throughout the study area, is also common and well represented provincially. These species do not therefore require special management.

Population amphibian losses from the development are likely to be locally significant, i.e. within the context of the Taseko Assessment area, at least for the duration of the life of the mine. However, they are unlikely to significantly affect Provincial or Regional populations of the three species concerned.

Mitigation

Impacts within the mine footprint cannot be avoided. However, timing windows to restrict certain activities to avoid the main breeding season will help to minimize impacts.

When amphibians have metamorphosed, the young adults disperse largely in terrestrial habitats. Development activity confined to the winter months is likely to have the least impact. Although the terrestrial habitats (with accompanying amphibians) will also be removed, some young adults will have dispersed out of the area by this time. Adults which migrated in to ponds to breed within the development area will be unable to do so in the next spring, but at least some of them may find other alternative breeding habitats. Overwintering juveniles in these ponds will inevitably be killed. However, impacts on the breeding populations will be somewhat reduced by initiating the first phase of clearing and blasting in the fall, so that much of the greatest disturbance will have been completed by spring.

In the areas proposed for tailings and waste rock, it may be most prudent to clear large areas each winter for the subsequent years deposition of fill/tailings, rather than progressively deposit fill on vegetated areas throughout the year. By preventing animals from occupying these areas, this would avoid the direct killing of many animals, including many amphibians, which would otherwise occur during the breeding season.

Around the main developments, additional mitigation will be through many of the same measures identified for minimizing impacts on vegetation. That is, careful planning to avoid as many wetlands as possible, spraying to reduce dust (and therefore limit air quality issues), acid rock management to minimize potential acid rock problem and so on.

Closure and Reclamation

Following reclamation, it is anticipated that existing habitats, including the ponds and wetlands that serve as amphibian breeding sites, will be restored in an approximation of those that occur at present. There is evidence that mitigation of disturbed wetlands can provide habitat for amphibians (Lackie, 1992). Lacki (1992:513) found that "wetlands established for water quality improvement can provide habitat for reptiles and amphibians, with the species composition dependent on the construction design, the proximity to source populations, and the degree of acidity and heavy-metal concentrations in drainage waters".

It seems reasonable to suppose that (barring circumstances such as climate change or a massive fire), there will still be healthy populations of all three amphibians in the general area when the mine is closed. These will act as reservoirs for colonization of reclaimed areas once the mine has closed. All three amphibian species detected, and especially the long-toed salamander and the boreal toad, were found breeding in a number of ephemeral ponds within disturbed burn areas. Their ability to utilize relatively temporary features like this bodes well for their ability to recolonize wetlands and ponds in the reclaimed areas following closure of the mine.

The amount of time it will take for full restoration to occur is unclear, and will depend on a variety of factors. All three species, and especially the spotted frog and boreal toad, have a high reproductive capacity, and populations can build up quickly if environmental variables are favorable. In theory it should not take many generations for healthy populations to become established in the post-mine wetlands and ponds. However, this is likely to be influenced by the location of the habitats in relation to surroundings. The animals may not disperse across large areas of young forest, for example. Thus the spatial proximity of breeding habitats to surrounding habitats will influence recolonisation. The effects of adjacent forestry must be considered in this process. Large clearcuts adjacent to the restored mine areas may result in different colonization patterns and rates than the presence of extensive mature forest stands will produce.

As part of mitigation, it is proposed that an assessment of amphibian habitats is made at mine closure, and again five years later. Any need for site specific mitigation, such as specific vegetation planting to provide shade, or the possible deliberate reintroduction of amphibians into potential breeding sites, can be evaluated at that time. New knowledge on the ecology of the species concerned is very likely to be available by then which may improve/ facilitate effective restoration of the populations, to approximate pre-mine levels.

Monitoring and Management

Amphibian declines have been occurring worldwide since the late 1970s, and as a result these animals are getting increased attention from the public and regulatory agencies. The permeability of their skin (facilitating transcutaneous gas exchange) and their position in the food chain both indicate that "amphibians may be the best animals to use as biological indicators of ongoing and impending environmental degradation" (Wilbur, 1990:418). However, using amphibians as bioindicators is problematic as little data is available to determine the changes in amphibian populations, or the causes for these

changes. More studies are required to determine the relationship between environmental alteration and amphibian declines (Phillips, 1990).

One study (Phillips, 1990) suggests that amphibian declines may be related to changes in environmental acidity, but the cause-effect relationship is not direct. Complex ecosystems and interactivity between environmental variables and impacts on amphibians compound the cause-effect relationship. Other possible reasons cited for declines include heavy metal and pesticide contamination, an imbalance in small mammal populations that prey on amphibians, predation by fish stocked in lakes by wildlife managers, global climate changes, and habitat changes including deforestation and land development (Phillips, 1990).

The feasibility of developing a monitoring program for the proposed mine development area was explored. At the present time an absences of historical data on amphibian populations in the study area, making monitoring problematic. It is likely to take many years of systematic sampling before trends in populations within the areas can be identified or ascribed to any particular environmental variable.

For the purposes of monitoring amphibians as indicators of environmental changes and stresses, it is necessary to gather information on population changes, physical and chemical environmental changes, along with appropriate experimental studies as dictated by each individual system (Wilbur, 1990). Freda *et al.* (1991) suggest that temporary ponds may be the most appropriate habitat to use for long-term monitoring as these are the major breeding areas for a large number of species and breeding seasons and larval periods are abbreviated.

Selection of the habitat to monitor would depend on a number of different factors including: the acid-sensitivity of the species; life history characteristics; availability of historical data; geographic distribution of habitat and resident species; importance of the habitat to breeding success; logistics (Freda *et al.*, 1991). There are also a number of factors influencing the selection of indicator species including: the sensitivity of the embryo and larvae to acidity levels; regional distribution (should be widespread); use of breeding sites should be predictable; embryo and larvae should be easily collected and studied (Freda *et al.*, 1991).

It is suggested that a minimum of 15 small ponds should be selected which are geographically proximate and ponds should be similar in pH or grouped with equal numbers of ponds from high, medium and low pH ranges. Freda *et al.* (1991) outline a detailed methodology for long-term monitoring of temporary breeding ponds for affect of pH. This monitoring program would be best paired with laboratory testing on toxicity performed according to the standards developed in 1994 by the Environmental Protection Agency-*A Guide for Conducting Acute Toxicity Tests with Fishes, Macro-invertebrates, and Amphibians* (in Juliana, 1994)

Amphibian populations fluctuate naturally due to a myriad of environmental factors. In order to establish links between mining impacts and detrimental impacts to amphibian a number of sampling sites that contain similar species mixes, pH levels, and other environmental factors must be identified. It is suggested that 15 ponds be selected in order to reduce the variance. It would be necessary that some of these ponds be maintained as control sites where no mining impact would be expected.

Breeding sites downstream of Fish Lake would likely be impacted by the mining, and monitoring water quality and pH of sites downstream may be a means of reducing the potential of high mortality due to toxic seepage. Temporary ponds are the most significant breeding habitat for amphibians. These ponds depend almost exclusively on rainfall to fill and thus may not be as effective for indicating environmental contamination resulting from toxin seepage into watersheds in the Taseko mine area.

Information that would be required for monitoring aside from identifying an adequate number of ponds with similar attributes would be: population changes (this would require a good understanding of the population prior to beginning construction of the mine); physical and environmental chemical changes in water quality (presence of leached chemicals, changes in pH), and susceptibility of animals to chemical changes (requiring laboratory studies). It would also be necessary to understand the importance of the breeding habitat to breeding success as presence of egg masses and tadpoles or larvae does not necessarily signify breeding success.

An effort to assess the impact of the fish compensation program on amphibians should be made. As Martell (1997) notes, definitive conclusions about fish impacts on amphibians (in the Glacier study area) remain elusive due to the absence of historic data. However, the Prosperity Project provides an excellent opportunity to quantify the effects of trout introductions by sampling prior to the fish introduction program, and again at regular intervals following introduction. It is assumed that environmental data will be collected and monitored at the introduction sites as part of the fish program. As long as a number of comparable lakes are similarly sampled as controls, this would provide some good, quantifiable data.

It is suggested this project might be undertaken as partial compensation for impacts which will inevitably occur on amphibians – i.e. the proponent will contribute to furthering scientific knowledge which in future may help abate fish introduction program impacts on amphibians elsewhere.

Residual Effects

Providing restoration results in relatively natural habitats without associated contamination with heavy metals, and provided there are no problems with acid mine drainage, then residual effects of the mine should be minimal if measured 50?? years after closure. However, some residual effect of the fish introduction program can be expected in the form of reduced breeding amphibian populations in the affected lakes. See above for proposed action.

Summary

9.2 Potential Effects (BIRDS)

9.2.1 Direct, Indirect and Cumulative

Valued ecosystem components (VECs) for birds have been identified for the Prosperity Project area and include: breeding and migratory birds in general, 5 focal species (Prairie Falcon (red-listed), Great Blue Heron (blue-listed), Sandhill Crane (blue-listed), Mallard and Barrow's Goldeneye), and high value habitat (lakes, riparian zones, wetlands and cliffs).

Potential effects of the mine site development on the above VECs include removal/alteration of habitat, resulting in displacement from feeding and nesting sites (i.e. loss of lake and wetland breeding habitats in Fish Lake area). For cavity nesting birds, the removal of wildlife trees will have a direct effect on the availabililty of the required nesting habitat, which are a limiting factor to breeding success. Loss of feeding habitat will result.

Site development during the breeding season may result in the direct mortality of nestlings/eggs through habitat clearing. A more widespread effect of removal and alteration of habitat will be the displacement of birds to other habitats. Although alternate feeding and nesting sites are accessible for most species in adjacent streams and lakes, successful relocation is not ensured.

Increased human disturbance in the area will also result in direct and indirect effects on bird use of the area. Disturbance during critical life stages s (i.e. breeding, moulting and migration) by development noise, habitat removal/alteration, human access, vehicles and aircrafts may result in additional energy expenditure. During these periods, especially during breeding, birds naturally have high energy requirements and are therefore vulnerable to additional expenditure. Disturbance effects can result in poor breeding success, including loss of eggs and/or nestlings. Predation during absence of the female from the nest, and nest abandonment may also result from disturbance. The effect of human disturbance will vary between different species.

There is a definite lack of information for each individual specie's response to noise disturbance. However, it is safe to assume that some birds will be negatively affected by disturbance through noise. Some species may adapt more readily than others. Birds in the area have already been exposed to mining exploration noise and habitat disturbance from geological exploration and core sampling.

9.2.2 Extent/Significance

Impact on breeding and migratory bird populations of affected species are unlikely to be significant at a regional or provincial level. Many breeding habitats in the area surrounding the development will be unaffected. No effects are anticipated for any breeding red- or blue-listed species other than potential noise sensitivity of Prairie Falcons.

At a local wildlife management unit level, all resident birds will experience localized effects, mainly displacement into adjacent areas. Effects will be greatest on resident birds dependent on mature and older forests, or on wetlands. Impacts are likely to last longest for birds that use forest habitat for breeding. However, most of the forest clearing will be done through logging by forest companies prior to the mine development and have already begun throughout the surrounding area.

Waterfowl

No significant effect is expected for waterfowl on a provincial, regional or at a local wildlife management unit level (Cariboo Region 5, Wildlife Management Unit 5-4) as a result of the mine development. Northeast section of WMU 5-4.

Herons and Cranes

Removal or alteration of the present habitat within the mine site development area is not expected to have any significant effect on herons on a provincial, regional or local WMU level. In addition, ample low to moderate quality feeding and nesting habitat is located adjacent to the study area and in the immediate surroundings as alternate feeding and resting sites during migration.

As no moderate or high quality feeding or nesting habitat is present within the area of study, the mine development is not expected to have any potential effects on cranes. No significant effect is expected for cranes on a provincial, regional or local level.

Diurnal Raptors (Hawks and Eagles)

No significant effect is expected for the above diurnal raptors on a provincial, or regional level as a result of the mine development. Resident ospreys and eagles will be displaced from their breeding and feeding habitat, which is located within the mine development area. However, fish in adjacent lakes, such as Rat Cabin Lakes to the north of the study area and Big Onion Lake in Taseko River valley, provide alternate foraging sources for these species.

Prairie Falcons are considered to be regionally significant due to the lack of breeding records for the region and their red-listed provincial status. The cliffs that area used for nesting (aeryie) would not be displaced by the construction of the mine development area. However, it is unknown to what extent helicopter andd other construction noise will affect the continued use by these birds.

Prairie Falcons which breed in the TEM study area could potentially be displaced indirectly by blasting activity during construction/operation; as they are known to be sensitive to human disturbance, especially noise. Displacement could result during the initial stages of the life of the mine or later. The water intake pipeline from Taseko River is currently planned to run west from the mine site facilities down to the river and over the cliffs in the process. Site specific surveys are recommended at the development permit stage. Construction of the pipeline should occur from September to March to avoid the breeding season, when this species would be most susceptible to disturbance.

Upland Game Birds (Grouse and Ptarmigan)
No significant effect is expected for upland gamebirds on a provincial, regional, or local level as a result of the mine development.

Shorebirds, Terns and Gull
No significant effect is expected for shorebirds, terns or gulls on a provincial, regional, or local level as a result of the mine development.

Nocturnal Raptors (Owls)
No significant effect is expected for owls on a provincial, regional level as a result of the mine development. The area has been assessed as containing sub-optimal breeding and feeding habitat for owls, based on provincial distributions, known breeding sites and habitat requirements. At the local level, some residential owls will be displaced through habitat removal, such as the Great Gray Owl. Others species, such as the Great-horned Owl, are less likely to leave the area as long as plenty of prey is present.

Woodpeckers and Sapsuckers
No significant effect is expected for woodpeckers and sapsuckers on a provincial, regional, or local level as a result of the mine development. Alternate habitat for nesting and feeding is present within and adjacent to the TEM study area for any that may be directly displaced.

Passerines and Others
As expected, passerine and other bird species made up the majority of detections during surveys, as they are the largest category of birds throughout the province. However, passerines were still considered to be low for the area when compared to regional populations and distributions. This is thought to be primarily due to the upper elevation location. The lack of a deciduous component in the mine development area is likely a factor in low numbers as well.

Within the study area (TEM boundaries), the sites with the most birds contained higher quality habitat (i.e. the lower elevation alluvial area), as expected. The majority of passerine and other bird species recorded, appeared to utilize the medium shrub carr wetland and cottonwood/deciduous riparian habitat, along Fish Creek, more so than any other habitat type surveyed. These high use areas are located outside of the mine site development areas, therefore, no potential effects are expected for these high use sites.

9.2.3 Mitigation and Benefit Enhancement
Wildlife populations within and adjacent to the footprint of mine operations will inevitably be displaced from the existing habitats. However, a number of mitigation measures have been designed to reduce the potential effects. These measures include identifying appropriate construction windows, and developing a plan to specifically address concerns regarding bear management and potential bear/human conflicts. Provision has also been made in the reclamation plan for replacement of much of the

forest and wetland wildlife habitat with similar natural communities at the mine site upon closure, thereby minimising long-term impacts to wildlife communities.

Impacts from habitat removal, causing displacement of most birds, within the mine development area cannot be avoided. However, timing windows to restrict certain activities during critical life stage periods (i.e. breeding, migration and moulting), will help to minimize both direct and indirect effects. Mitigation measures recommended for the minimization and elimination of these direct effects consist mainly of the planning of blasting and clearing during the non-breeding season (winter months as much as possible). The restriction of access to, and avoidance of migration staging areas, breeding and nesting sites by aircraft, vehicles and human activity will also minimize disturbance effects on many wildlife species.

Displacement of raptors from the area of mine development will occur. In order to mitigate this effect, options for erecting raptor nesting platforms adjacent to fish compensation lakes (Little and Big Onion lakes system) should be assessed. If nesting of Prairie Falcons is confirmed along adjacent cliffs, a plan to avoid disturbance should be developed; consisting mainly of careful routing of helicopter access to avoid nesting cliffs.

Alternate nesting habitats and options for enhancement for cavity nesting ducks (e.g. Barrows Goldeneye) around unaffected lakes in the area should also be assessed, as habitat for cavity nesting birds is limited in the area.

As part of the reclamation plan, upon closure, replacement of natural habitats should occur in proportion to current occurrence. It is essential to ensure that wetlands and open water habitat are adequately replaced during reclamation. The addition of large coarse woody debris to the area following closure, may help to speed up the overall ecosystem recovery, and provide habitat for small mammals The site should also be assessed for options to provide snags, nest boxes, and other potential nest sites for many forest dwelling birds, to hasten re-location of local breeding populations. Some of the recommended mitigation measures for birds include:

- identification of appropriate timing windows for different operations to minimize disturbance to wildlife;
- provision of nest boxes to mitigate for loss of wildlife trees;
- management for maintenance of and future provision of wildlife trees and coarse woody debris; and
- mine staff education to minimize disturbance to wildlife.

9.2.4 Residual Effects

No residual effects are expected to occur for breeding or migratory bird populations after mine closure and the reclamation plans have been implemented, and forests are allowed to mature. Following reclamation, it is anticipated that existing habitats, will be restored in an approximation of those that occur at present.

Full recovery of resident populations within 100 years of closure, possibly much sooner, is possible. Recovery of mature/old forest habitat, following closure, should occur but will take a long time to replace. After restoration work it will still take perhaps 100 years for trees to achieve sufficient size to support tree nesting ducks such as Barrows Goldeneye.

9.2.5 Monitoring and Management

Taseko Mines Ltd. staff at the Prosperity Project site have kept a log of wildlife observations for the area. The data was compiled by the Taseko Mines Limited on-site environmental montor. The wildlife log for 1993 to 1996 was compiled in the HKP data report (1997).

As part of the environmental monitoring program for the mine site, it is recommended that breeding birds continue to be recorded by the site monitors as part of their wildlife log. The on site monitor(s) should be trained to conduct surveys of nest site/nesting success of Prairie Falcon on a yearly basis during May to early August. Scanning of the cliffs with a spotting scope proved to be sufficient for detection of presence in 1999. Ideal cliff watch hours occur between 11 and 2 PM, when birds of prey are often seen soaring on warm afternoon thermals and hunting.

The water and vegetation monitoring programs will test for metals and other chemical accumulation in the environment; baseline condition information has been collected for comparison. This data may be used to interpret indirect effects on small mammals and amphibians in the area, which are prey to a number of other birds and mammals.

Monitoring of Prairie Falcon activity along the cliffs is recommended. Surveys should be done from the beginning of June to mid-July as adult and nestling falcons are most active and most visible at nest sites during this time (Hooper, 1997). Yearly surveys during the nesting season are recommended in order to confirm the presence of nesting by this species, as there are few nesting records for the region.

9.2.6 Accidents and Malfunctions

9.2.8 Capacity of Renewable Resources

9.3 Potential Effects (SMALL MAMMALS)

9.3.1 Direct, Indirect and Cumulative

Small mammals including bats, voles, shrews, mice, rats, hares, beaver, porcupine, mink, ermine and weasel, VECs have been identified for the Prosperity Project mine site area and include high value habitat such as cliffs, wetlands, coarse woody debris, and mature forest stands. No red- or blue-listed small mammals are known to occur within the area of study.

For bats the removal of wildlife trees and mature forests will have a direct effect on the availabililty of the required roosting habitat. Removal of wetlands and alteration of hydrology will result in loss of foraging habitat for bats. Some blue-listed bat species may forage within or near the study area. Alternate, higher value foraging habitat is available along the valley and alluvial fan area to the west of the development.

Potential effects of the mine site development on the above VEC include removal/alteration of habitat, resulting in displacement from feeding and breeding sites. Loss of coarse woody debris (CWD), which provides essential security cover for rodents, will cause a decrease in available cover within the mine site development area. Site development during the breeding season will result in the direct mortality of nesting rodents through CWD clearing. However, the introduction of buildings and housing facilities will likely create an alternate, plentiful source of cover for common rodent species such as deer mice and chipmunks. Clearing of land may actually create an increase in local rodent populations, that will benefit from additional grassy and hydroseeded habitat for feeding.

Increased human disturbance in the area is not considered to result in direct or indirect effects on rodent use of the area. On the contrary, rodent populations often increase rapidly with the introduction of human settlements due to abundant food sources such as storerooms and garbage.

Beaver habitat will be directly effected through changes in the hydrology of the Fish Creek drainage through reduced flow and dam removal.

9.3.2 Extent/Significance

The extent to which small mammal populations at the proposed mine site development area will be affected is expected to be low. Alternate high value habitat for feeding and breeding is accessible in the immediate surroundings of the development. For bats the best foraging habitat is located along the Taseko River valley, which contains some cottonwood stands, standing dead trees, cliffs, wetlands, open water and ponds, warmer temperatures and abundant insects. The valley area will remain unaffected by the mine site development.

All small mammal species known to use the study area are common on a provincial, regional and WMU level. Therefore, short term loss of habitat is not considered to have a significant effect on small mammal populations within the smallest scale comparitive area/scale – the WMU.

9.3.3 Mitigation and Benefit Enhancement

No mitigation prior to or during the mine site development and operation is proposed. Ideally, removal or alteration of high value habitat would be completed during the fall and winter after the breeding cycle. Benefit enhancement activities specific to small mammals are not proposed within the development area or immediate surrounding. Some indirect benefits for some small mammal species may occur as a result of human settlement on site. Following closure, large quantities of coarse woody debris (CWD)

should be introduced into future forest sites, in order to speed overall ecosystem recovery.

9.3.4 Residual Effects

Following the consideration of mitigation, compensation and benefits enhancement measures no residual effects for small mammal populations are forseen. Duration of habitat removal will last for the life of the mine. Reclamation of the area will ensure eventual replacement of forest habitat and CWD.

9.3.5 Monitoring and Management

No specific monitoring or management of small mammals is required. However, the on site environmental monitor should keep track of rodent levels within human settlements for prevention of human health risks.

9.3.6 Accidents and Malfunctions

9.3.7 Capacity of Renewable Resources

9.4 Potential Effects (MID-SIZED MAMMALS)

9.4.1 Direct, Indirect and Cumulative

For mid-sized mammals such as fisher, coyote and lynx VECs have been identified for the mine site area and include: one focal species (blue-listed Fisher), high value habitat such as young and mature forests, CWD, wildlife trees, and prey base. No red-listed small mammals are known or expected to occur within the area of study.

Potential effects of the mine site development on the above VEC include removal/alteration of habitat, resulting in displacement from feeding and breeding sites.

9.4.2 Extent/Significance

The extent to which mid-sized mammal populations at the mine site development area will be affected is expected to be low. Alternate high value habitat for feeding and breeding is accessible in the immediate surroundings of the development.

Except for Fisher, all mid-sized mammal species known to use the study area are common on a provincial, regional and WMU level. Short term loss of habitat is not considered to have a significant effect on populations within the WMU, the smallest scale comparitive context.

9.4.3 Mitigation and Benefit Enhancement

No mitigation prior to or during the mine site development and operation is proposed. Benefit enhancement activities specific to mid-sized mammals are not proposed within the development area or immediate surrounding.

9.4.4 Residual Effects

Following the consideration of mitigation, compensation and benefits enhancement measures for mid-sized mammal populations within the development area no residual effects for mid-sized mammal populations are forseen. Duration of habitat removal will last for the life of the mine. Reclamation of the area will ensure eventual replacement of forest habitat, CWD and associated prey base.

9.4.5 Monitoring and Management

No specific monitoring or management is required. However, the on site environmental monitor should keep track of all sightings within the development area throughout the year in the form of a wildlife log as established at the Prosperity Project camp since 1993.

9.4.6 Accidents and Malfunctions

9.4.7 Capacity of Renewable Resources

9.5 Potential Effects (UNGULATES AND LARGE CARNIVORES)

9.5.1 Direct, Indirect and Cumulative

For ungulates and large carnivores VECs have been identified for the mine site area and include: four focal species, which include Moose, Mule Deer, Black Bear and Grizzly Bear (blue-listed), high value habitat such as riparian, grassland, wetland and mature forests. No red-listed ungulates or large carnivores are known or expected to occur within the area of study.

Potential effects of the mine site development on the above VEC include removal/alteration of habitat, resulting in displacement from feeding and breeding sites.

The development of the proposed mine site, and associated transmission line and access roads, will have direct effects on wildlife in the area, through habitat removal and human disturbance. Inventory of wildlife species, their relative abundance, presence/absence and required habitat features, prior to development, provides the basis for mitigation, compensation (if required) and reclamation recommendations and management programs.

The southern portion (Little Fish Lake and south) of the study area is well known as a travel corridor for moose, deer and bear (from the Taseko Lake to the river through the forest towards the numerous open wetlands and shallow water lakes).

It is also thought that Bighorn sheep use the western boundary of the study area (below the plateau) for traveling north and south along the warm aspect slopes which have high forage values (to and form adjacent escape terrain).

Noise from the proximity of Options 3, 4 and 5 to the southern corridors may have an initial negative indirect effect on travel use to the south (some animals may become accustomed to the noise and continue to use the southern travel route).

9.5.2 Extent/Significance

The extent to which ungulate and large carnivore populations at the mine site development area will be affected is expected to be low. Alternate high value habitat for feeding and breeding is accessible in the immediate surroundings of the development.

All four of the focal species are known to use the study area to some degree. However, short term loss of habitat is not considered to have a significant effect on populations within the WMU.

9.5.3 Mitigation and Benefit Enhancement

No mitigation prior to or during the mine site development and operation is proposed. Benefit enhancement activities specific to ungulates and large carnivores are not proposed within the development area or immediate surrounding.

At a later stage in the process, more detailed planning will include contouring and seeding to create warm aspect feeding sites, contouring water edges to provide different depths for diving versus dabbling ducks, seeding with high value native plants appropriate for the ecological conditions etc.

9.5.4 Residual Effects

Following the consideration of mitigation, compensation and benefits enhancement measures no residual effects for mid-sized mammal populations are forseen. Duration of habitat removal will last for the life of the mine. Reclamation of the area will ensure eventual replacement of habitat.

9.5.5 Monitoring and Management

No specific monitoring or management is required. However, the on site environmental monitor should keep track of all sightings within the development area throughout the year in the form of a wildlife log as established at the Prosperity Project camp since 1993.

9.5.6 Accidents and Malfunctions

9.5.7 Capacity of Renewable Resources

9.6 Conclusion

In summary, Amphibian surveys

For birds (raptors, waterfowl and passerines), the baseline inventory surveys indicated that the Prosperity Project Area had a relatively low number of breeding bird species, compared to other, better habitat areas (e.g. Fraser River Valley, Williams Lake, Taseko Valley, etc.). Excluding Fish Lake, all areas considered to be of high value within the study area, appear to be located outside of any proposed impact/development locations. For the species occurring within impact areas, alternative habitat, of the same quality and better, is available throughout the surrounding area.

At a later stage in the process, more detailed planning will include contouring and seeding to create warm aspect feeding sites, contouring water edges to provide different depths for diving versus dabbling ducks, seeding with high value native plants appropriate for the ecological conditions etc.

The wildlife inventory program meets the requirements outlined project report specifications for the proposed mine site. As such the potential and residual effects of the project can be effectively reduced through mitigation and compensation measures as outlined in the project report.

As long as sufficient natural areas remain in the surrounding landscape, contingent upon forestry and landscape level planning in the region, these will act as reservoirs for wildlife recolonisation of the mine area following closure. Consequently, following reclamation, and barring subsequent human settlement in the area, wildlife populations can be expected to recover to pre-mine levels. The key is to ensure that in the short term the population losses are not sufficiently large nor sufficiently prolonged to result in the permanent loss of a species from the area.

Detailed analysis indicates that in fact no wildlife species is likely to be permanently eliminated from the area, and that only a small number of species will experience locally significant declines in the short term.

In the short term there will be some displacement and disturbance of local wildlife populations, and there may be some localized long-term impacts upon several provincially common amphibian species as a result of the fish compensation program. However, residual effects following the implementation of mitigation techniques and decommissioning/reclamation are not expected to be significant at a provincial or regional level.

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PART TWO: TRANSMISSION LINE

1. INTRODUCTION

In order to be able to select a right of way that would cause minimal impact to thenative wildlife, and to be able to predict likely effects of the transmission corridor on the indigenous fauna, background information on both the wildlife distributions and populations in the area, as well as on the distribution and value of different habitats needs to be combined. A background literature review was therefor conducted to identify key wildlife populations and habitat uses as far as possible. Capability/suitability interpretations for focal species were developed, and provided a baseline to predict and mitigate impacts.

Part two of this report describes the methods and documentes the data collection for all wildlife surveys carried out by Madrone Consultants Ltd. along the proposed transmission line for the Prosperity Project of Taseko Mines Ltd. Details of the inventory work and habitat assessments specific to each inventory group are presented under species group headings.

For purposes of discussion, the mammals have been divided into several broad taxonomic categories, as follows:

- **Bats**: All of the family Chiroptera
- **Other Insectivores, Rodents, and Lagomorphs**: All small mammals other than bats. A diverse group which includes many families, and encompasses all the shrews (Insectivora), and the voles, mice, lemmings, woodrats, chipmunks and squirrels (Rodentia). Two larger rodents, the beaver and porcupine, are also included in this group, as well as pika and snowshoe hare (Lagomorpha).
- **Ungulates**: Moose, mule deer, bighorn sheep and mountain goat
- **Carnivores**: Includes bears (black and grizzly), cats (cougar, lynx), dogs (wolf, coyote, fox) and all members of the Mustelidae family (wolverine, fisher, marten, weasels, badger, river otter and mink)

Potential effects of development are discussed for mammals as a whole in section ___, followed by specific sections pertaining to these different groups or idnividual species wihtin these groups, where applicable.

1.1 Study Area

The proposed transmission line corridor crosses the 100 Mile House Forest District, Williams Lake Forest District, and the Chilcotin Forest District, which are all part of the Cariboo Forest Region. The project area includes portions of the Bunchgrass (BG), Inteior Douglas-fir (IDF), Sub-Boreal Pine Spruce (SBPS), Montane Spruce (MS), and Engelmann Spruce Subalpine Fir (ESSF) biogeoclimatic zones. The proposed transmission line will run from the Prosperity Project area mine site to the east, where it will connect with the Dog Creek substation transmission line.

For the purpose of wildlife inventory baseline studies and habitat assessment for the Prosperity Project area, the transmission line study area consisted of the area mapped for sensitive ecosystems, SEI mapping. In total, 1:20,000 mapping was completed for 14 mapsheets, covering a three kilometre wide by approximately 128 kilometre long corridor encompassing the proposed right-of-way. The entire length of the corridor consists predominately of SBPSxc and IDFdk4 subzones, with approximately a 19 km length of IDFxm to BGxw2, BGxh3, BGxw2, IDFxm habitat near the Fraser River valley.

1.2 Overview

Wildlife habitats have been identified and mapped through the SEI process (see Section 6.0). The habitats mapped through SEI have then been assessed for their values to a variety of wildlife species. Habitat capability/suitability interpretations and ratings have been developed for ungulates, large carnivores, waterfowl, and potentially occurring red- and blue-listed species.

The list of species for developing detailed suitability/capability ratings, and the seasons and life requisites to be assessed for each, were selected through consultation with the MELP, Williams Lake, with additional input from the CWS. Appendix 2 indicates the wildlife species that were selected for more detailed assessment, and summarizes their status. Detailed species accounts for all of these species have been developed and are included in an associated technical report (Madrone Consultants Ltd., 1999). Many other species were also considered during our analyses, but explicit capability/suitability ratings were not applied. These other species are discussed in the context of the relevant species groups, below.

The species list for detailed assessment was determined in 1998. Prior to this, brief wildlife habitat notes had been taken in conjunction with some recconnaissance level field sampling. This information was used, in conjunction with the direct inventory results, to develop preliminary habitat ratings. These preliminary ratings were used to undertake an initial assessment of potential impacts and to assist in ROW routing. Subsequently, wildlife habitat assessments for polygons falling along the proposed centerline were later verified in the field in 1999, using standard RIC methodology of the day (i.e. 1998 wildlife habitat forms).

These baseline studies meet the wildlife inventory and habitat assessment requirements of the PRS.

For the transmission corridor, the Sensitive Ecosystem Inventory (SEI) mapping was used as the basis for predicting potential effects of the transmission line development and operation. As part of the assessment wildlife values have been assigned to the SEI units mapped for each of the focal species.

In addition, species information has been assembled and provincial rating schemes are being utilized to attach suitability values to habitats along the corridor. The species lists for both the mine site and transmission corridor route were produced through consultation

with the Regional Wildlife Section Head, MELP. Wherever appropriate standards established by the provincial Resources Inventory Committee (RIC) were applied.

As the SEI polygons map out all wetlands, grasslands, old-growth forests and other units such as cliffs, rock outcrops and talus, the vast majority of the most important wildlife habitats are thought to have been captured through this process.

However, all areas are habitat for some species, and the remaining extensive seral forests still serve to support some moderate moose range, for example, and have habitat values for other wildlife species. While we considered that these values are generally not sufficiently high to influence the positioning of, or mitigation within, the ROW, there are a few exceptions to this. Some forested areas identified in the drier Douglas-fir dominated areas, especially the IDFxm, although selectively logged and often quite disturbed, are in fact functioning as significant wildlife habitats. Some areas on either side of the Fraser appear to be of relatively high value for mule deer winter range, and areas on the west side in particular appear to have quite high summer and winter values for bighorn sheep. These additional areas within the corridor will be identified on the interpretive maps in an effort to ensure no significant values have been overlooked.

Addittional wildlife survey programs consisted of breeding bird, and habitat rating verification as part of the species-habitat models.

These baseline studies meet all the requirements of the PRS, other than for a breeding bird survey, which has not yet been conducted. As above, this exception is not expected to have a bearing on the overall acceptability of the project.

1.3 Objectives

To assess habitat availability, and suitability along the proposed transmission corridor route for focal wildlife species, in order to identify baseline conditions, potential and residual effects, and develop mitigation and benefit enhancement measures is needed.

To identify and assess the potential impact of the transmission corridor on red- and blue-listed wildlife species, COSEWIC species, ungulates, raptors, waterfowl and other birds that use the areas within and adjacent to the transmission corridor, focal/representative species were determined through consultation with MELP, CWS and Taseko Mines Ltd. Detailed background information and assessment are provided in the Wildlife Technical Report.

The prime objectives for wildlife surveys along the proposed transmission line were:

Assessed the corridor route for:

- Overall biodiversity
- Relatively rare elements
- Important wildlife habitat values

1.4 Focal Wildlife Species

As with the mine site study area, wildlife species considered significant for the purposes of the transmission line study included both regionally important, and rare or threatened species. Rare or threatened status is determined by the Conservation Data Centre for B.C. (CDC) based in Victoria. The CDC maintains "tracking lists" for rare, threatened and vulnerable elements of biodiversity (including ecosystems, plants and vertebrate wildlife), and establishes their provincial status. It maintains "red" and "blue" lists for these elements. In brief, red-listed elements are those considered rare, threatened and endangered, while blue listed elements are considered potentially vulnerable. They may be infrequent, locally frequent or even locally common elements, but are thought to be at risk, usually from present day trends of development and land use. These red and blue lists, and the tracking lists, are frequently referred to in the project report (see Appendix 2).

Actual CDC records of rare ecosystems within the general area are relatively few, and there are none directly along the corridor. However, occurrence records generally reflect individual projects and opportunistic recordings; records are also greatly influenced by centers of human settlement and human travel corridors.

The corridor falls within three different Forest Districts, although the majority of both options occur within the Williams Lake Forest District. The CDC tracking lists (Appendix 2) indicate that up to 8 red and 23/24 blue-listed species have potential to occur within habitat located along the transmission line corridor. An analysis of existing CDC occurrences and known habitat preferences and ecology of the different species, provides a sound indication of the potential of the corridor to support the red- and blue-listed species known to occur in the area. This information is briefly presented in Appendix 8 with the probability of occurrence for each species rated based on existing records, known range, and known habitats. A 6 point scale has been used: known (1), probable (very likely) (2), likely (3), possible (4), unlikely (5), and very unlikely (6).

The greatest concentrations of red- and blue-listed vertebrates are likely to occur in the vicinity of the Chilcotin/Fraser junction and south around the Fraser canyon. Many relatively rare species are associated with the dry grasslands of the BG and the IDFxm that occur in the general area, and they can be expected to utilize the Fraser River grasslands in the vicinity of the proposed crossing. These species include Flammulated Owl, Lewis' Woodpecker, Long-billed Curlew, Townsend's Big-eared Bat, and potentially others.

1.5 Habitat Assessment

Potential habitat for each focal species was assessed through ArcView 3.1, based on the Sensitive Ecosystem Inventory (SEI) mapping produced for the proposed transmission corridor route. Ratings were linked, based on habitat values for the primary ecosystem label of each polygon (the dominant habitat type), and viewed species by species for the presence of suitable potential feeding and breeding habitat types. For birds, feeding habitat values/ratings were overlayed as stripes with nesting habitat shown in solid. Each species was individually examined along the length of the corridor for conflicts, potential

impacts and presence/absence of high quality habitat for the various life requisites and season (s) being rated.

In order to assess the baseline conditions for the following focal species, a literature review and habitat synopsis was produced, based on the Provincial Standards for Wildlife Habitat Ratings, in order to produce habitat suitability interpretations for each species. Please refer to the Technical Report, which contains the species accounts and ratings tables. Each species was assessed for habitat availability, suitability and potential along the length of the corridor. The ArcView analysis results are provided below.

A 4-class rating scheme of high (H = 100-76% of the provincial best), moderate (M = 75-26%), low (L = 25-1%) and nil (N = no habitat value) is employed (as suggested for the majority of bird species by Resource Inventory Committee, 1998) and requires an intermediate knowledge of habitat use (Table #). A six class rating scheme is used for most of the large mammals, as they have been studied in much more detail, therefore the knowledge of habitat requirements and relationships is higher.

This rating scheme is used when assigning habitat ratings to the ecosystem units present within the Prosperity Project area. The habitat ratings express the ability of the units to fulfil habitat requirements for the specific life requisites and seasons rated for each species, as outlined in the species accounts (see the Wildlife Technical Report).

1.6 Wildlife Habitat Maps

Interpretive maps have been developed with ArcView software, which illustrate the distribution and extent of key wildlife habitats for a variety of selected species. These will vary depending upon subzone/variant and the actual habitats mapped within the corridor.

Where figures best illustrated the location of moderate to high habitat values, they were included. For many of the species reviewed and rated, much of the corridor is of little to no value. Therefore, the "best" areas for each species were selected and illustrated.

In addition, a handful of polygons have been added in ArcView, which are not SEI polygons, in order to accommodate the additional key wildlife habitats not included within SEI polygons, as they have been selectively logged.

1.6 Personnel

Project planning, reconnaisssance work, and overall project review were the work of Gillian Radcliffe (senior wildlife ecologist) and Tania Tripp (wildlife biologist).

An initial recci on May 29, 1997, a second one day visit to test the SEI methodology to see if it was feasible, and to look at bird values (Jan, Gill, Dave, July 29), and a third visit comprising two and a half days in the field to conduct SEI groundtruthing, from September 8th to the 10th inclusive. The Sept.9, 1997 field day was conducted in conjunction with Ray Coupe (MOF) and Chris Swan (MELP). Carolyn Whittaker, Tania

Tripp and Gillian Radcliffe completed the winter surveys in 1998. Derrick Marven and Tania Tripp completed breeding bird surveys in June of 1999.

2. REPTILES AND AMPHIBIANS

Very little work has been done on reptiles or amphibians in the general study area, or even within the Chilcotin Region (e.g. Ward & Chapman 1995). Review of location records and literature and discussions with MELP did not identify any significant concerns regarding reptiles in this area.

Based on range and known ecology, four reptile species were identified as potentially occurring in the transmission line study area. These species include the three garter snake species that occur in B.C. – all of which are relatively common and widespread in the province, the Rubber Boa (blue listed). Short species profiles were produced for these latter species (Madrone Consultants Ltd., 1999 – Appendix III). From this brief review, corridor habitat appeared to be of limited value for the Rubber Boa, and the chances of occurrence (based on known distribution and habitat) were predicted to be extremely low.
A number of amphibians were also identified with the potential to occur in the study area. However, only one of these was a blue-listed species – the Great Basin Spadefoot Toad. A species profile for this species was presented in the species-habitat models technical report (Madrone Consultants Ltd., 1999 - Appendix III). Based on the review and on preliminary field observations, the likelihood of occurrence along the proposed ROW was considered to be extremely low. Although not one of the species identified for special consideration and CAPSU, potential habitats were evaluated in the field.

As no red or blue listed species appear to be present, no detailed species accounts or mapping has been developed. However, some general habitat relationships were observed.

Amphibians require varied habitat to accommodate their biphasic life cycle, they require aquatic habitat for breeding, terrestrial habitat for hiding cover and foraging, and habitat for hibernation (RIC, 1997). These animals also require connectivity between these different habitats for migration and movement.
We have very little information on the terrestrial habitats of adult toads and long-toed salamanders for the area. Searches of cover objects and general habitat in terrestrial habitats were very unproductive. It is unknown if this was due to dry weather conditions or to a generally low population of these species in the area.

No specific amphibian sampling was done along the proposed utility corridor. Reconnaissance level survey work of wildlife habitat along the corridor in 1997 and 1998, did not indicate a need for inventory. All potential red- and blue-listed reptiles and amphibians that could occur along the corridor were assessed for their likelihood of occurrence through a literature review of their ranges and habitat types and a reconnaissance field check. Only two blue-listed species had potential to occur, rubber

boa and great basin spadefoot toad. During refinement of focal species selection, for wildlife habitat ratings and accounts, it was agreed to by Madrone, the proponent and MELP, that further detailed analysis of these two species was not a priority.

Objectives for amphibian and reptile work along the corridor included:

- Identify species likely to be using the corridor area
- Identify any potential red- and blue-listed species
- During general reconnaissance work, identify if any potential habitats for red- or blue-listed species occur
- Identify potential impacts
- Based on the above, determine if there are any specific field sampling needs warranted

2.1 Approach and Methodology

During general reconnaissance work, notes were taken to identify potential reptile and amphibian habitats, with focus on potential for red- or blue-listed species. In addition, literature was reviewed to assess the likelihood of occurrence (i.e. range and habitat type used by potential species).

2.2 Results of Broad Habitat Assessment

The corridor was assessed at a broad level for amphibian and reptile habitat. The wetland complexes located along the corridor (i.e. Jamieson Wetlands and Willan Lake area) will likely provide good amphibian habitat for common frog and salamander species.

The following reptiles have potential to occur: rubber boa (blue-listed), as well as possibly racer, gopher snake, and western rattlesnake near the eastern end of the corridor (in the BG and IDF dry, grassland habitat) Great basin spadefoot toad (blue-listed) also has some potential, although very low, to occur within this part of the corridor.

3. BIRDS

No detailed fieldwork was scheduled or conducted for the Transmission Corridor, although general reconnaissance surveys were conducted to assess habitat and further inventory requirements. Objectives for assessing baseline bird use of the corridor included:

- Identify potential red- and blue-listed species
- For red- and blue-listed species, conduct literature review and develop species profiles.
- Determine if there are any specific sampling needs
- Potentially suitable habitats for the red- and blue-listed species will be determined prior to fieldwork, and intensity of inventory effort will be apportioned accordingly.
- If appropriate, develop inventory program for 1998/1999

3.1 Approach and Methodology

During broad level habitat surveys, any raptor nests or particular bird values observed during the proposed reconnaissance fieldtrip, or during initial sensitive ecosystem (SEI) fieldwork were noted.

3.2 Results/Baseline Conditions

There is potential for some red- and blue-listed bird species to occur within habitat located along the corridor. These species were assessed for likelihood of occurrence through a literature review and reconnaissance level survey. All SEI habitat units were assessed for their suitability for use by these species through habitat ratings tables. Habitat units were rated High, Moderate, Low or Nil for their suitability during the reproductive season for nesting and feeding requirements.

Willan Lake was visited in 1998 to assess effects of corridor crossing near this active Ducks Unlimited site, as DU expressed their concern about the routing in this area. Upon assessment, mitigation of bird collisions was recommended through the use of visibility markers on the lines where they cross to the south of this wetland – to prevent collisions upon take-off and approach to and from the lake. However, it is not anticipated that the routing of the corridor to the south of this site will have a significant effect on the use of the site for the following reasons: there is already a road and phone lines running south of the lake; road traffic and easy access already present; and there is a good tree line height along the south end of the lake to prevent low flying approaches to the lake therefore decreasing likelihood of collisions with the corridor lines.

Other waterfowl and breeding bird habitat has been assessed with the use of the Sensitive Ecosystem Inventory map of the corridor. At this time no surveys have determined presence/absence of individual species and abundance. However, the current corridor route is not anticipated to have a significant effect on waterfowl populations at a regional level. At a local level, there are some potential effects which may be mitigated for, mainly bird collision potential (see Section 8.0).

3.3 Habitat Suitability Assessment

Great Blue Heron

	High	Moderate	Low	Nil
Feeding Habitat	57	242	700	107
Nesting Habitat	Not Present	215	241	650

Foraging potential is abundant along the length of the corridor, while potential nesting habitat is limited. The west end of the corridor is predominately of low value for nesting and foraging due to climatic conditions of these subzones and variants. Conditions improve to the east along the corridor in the IDF biogeoclimatic zone.

Of all the focal species for the mapped area of the proposed transmission corridor, the Great Blue Heron is the most likely to be present throughout. There are numerous open water and wetland sites that would be ideally suited for foraging by this species. To date, there are no known rookeries (nesting colonies) located within the mapped area. However, it is likely that they exist where there is a concentration of moderate to high potential habitat, such as in the Jamieson Wetlands Area (see figure). The mapping presents an exaggerated view of nesting availability, as mature and old growth forests located adjacent to a water source – where they feed – are preferred.

The Willan Lake Area has some decent potential, as well as Mons Lake. The best is likely the Jamieson Wetlands Area, with ample foraging habitat and plenty of moderate nesting potential as well. Habitat along Word Creek also appears to be quite suitable for nesting and feeding. Herons are likely to feed along the shore edges and side pools of the Fraser River. However, little to no nesting and foraging habitat is present within the BG zone. Moving further eastward, the IDFdk3 habitat improves again with many open water units for foraging.

Mallard

	High	Moderate	Low	Nil
Feeding Habitat	64	Not Present	199	843
Nesting Habitat	1	252	178	675

High value nesting habitat is not illustrated well through this rating and mapping process, as the units rated high for nesting often occur in the second or third decile of the polygon label (i.e. they usually consist of less than 20% of the polygon habitat). Therefore, it is suggested that all high quality feeding sites be treated as having high nesting values associated with them, which is often the case with this common waterfowl species.

All of the lake and open water sites located within the 3 km wide transmission corridor boundary provide potential feeding sites for Mallards during the growing season, with some remaining ice free in the lower zones during the winter as well. Adjacent nesting habitat is also often located in complex with these areas.

The ROW centre line does not intersect any high value potential feeding or nesting habitat. On a provincial and regional scale, no significant effect on mallard and other waterfowl populations is expected to occur. However, it is anticipated that there is potential for waterfowl collisions with the structure, especially when located around staging areas, or adjacent to lakes and open water flyway sites. See Section # which addresses this issue for a number of bird species.

Intersects #686 which has high potential for feeding by Mallards – open water unit. Polygon numbers #966 and 967 are also of high feeding value for mallards with moderate potential nesting habitat adjacent to the sites. The ROW currently would have a line travelling to the immediate north of the small lake. This area has received two site visits and has been assessed as prime waterfowl habitat – a number of other wildlife species are

also known to utilize this site (including cattle degradation – standing in the lake edge). Bullrushes in the open water site (good cover).

Barrow's Goldeneye

	High	Moderate	Low	Nil
Feeding Habitat	64	None	102	940
Nesting Habitat	None	205	249	652

The same polygons that are important feeding habitat for Mallards are also suitable for Barrow's Goldeneye.

Although there appears to be ample nesting habitat, the reality is that quality and likelihood of use are limited by whether /adjacency to wetlands/water source. Open water group at the west end in the MSxv surrounded by patches of LG7 (rated low for nesting). Feeding habitat is limited along the corridor, therefore ample old/mature stands are of little value unless water source for feeding is within suitable distance for travelling (see species account for nesting habitat requirements and ratings assumptions).

In the SBPSxc, Willan Lake Area, LK7 is rated moderate for nesting potential. This area also contains open water and lake units for feeding. Around the lake itself there is no suitable nesting unless odd snag is present, which is not drawn out at this scale or/and through this process. This site is not on the ROW.

East end of Mons Lake and Jamieson Wetlands area also contain a number of stands rated moderate for nesting potential which are also adjacent to open water and lake units (see Figure #).

No waterfowl values are present in the BGxh3 variant immediately adjacent to the Fraser River because of the lack of open water and presence of steep, eroded slopes. Some waterfowl may utilize the river and it's shoreline for travel, feeding and security. The Fraser River is good for Mergansers, and other river waterfowl. Mallards will utilize the eddies and river banks.

In the IDFdk3 there are a number of potential nesting sites adjacent to small lakes and open water units as well (see Figure #).

Other Waterfowl Considerations

Although Mallard and Goldeneye are the focal waterfowl species for this study, their habitat needs reflect the habitat needs of the majority of dabbling and diving ducks and for cavity nesting as well as ground nesting ducks. Therefore, where habitat is limited for feeding by either of these species, it is also limited for other waterfowl and vice a versa.

Waterfowl habitat is plentiful along the corridor route, with Ducks Unlimited projects located within the boundaries mapped for the corridor. One or two areas of concern

along the actual ROW regarding bird collisions around wetland areas where waterfowl may congregate during migration – Willan Lake, Jamieson Wetlands, and Brigham Lake areas.

Prairie Falcon

Many raptors migrate through and also hunt over the open grasslands along the Fraser Canyon, including species such as the Prairie Falcon and Swainson's Hawk – both of which are red-listed.

	High	Moderate	Low	Nil
Feeding Habitat	1	151	452	502
Nesting Habitat	1	None	5	1100

Mons Lake area has some low to moderate foraging suitability, but lacks nesting habitat. To the northwest of Mons Lake, a small section of cliff is present (polygon #1129), with a primary road running to the south of the cliff, which follows a section of Big Creek (immediately adjacent to Big Creek and polygon #539).

Abundant moderate feeding habitat within the BG and IDFxm zones adjacent to and near the Fraser River.

Mapsheet 92O/076 contains some the only other suitable nesting habitat within the area mapped for the transmission corridor (air photo M3-5 – 30BCC93028#181-183). The creek is un-named on trim maps at this time, but is located to the immediate east of Mons Creek and flows into Big Creek to the North. Although the rock faces located in this area are not extensive, they would provide appropriate nesting habitat for many cliff dwelling birds and therefore may be adequate for Prairie Falcon feeding and nesting. In the case of foraging habitat, this area is limited – predominately low to moderate for feeding suitability, with some high habitat located along Big Creek meandering "cliffs" and relect slumps, where nesting swallows would be abundant (great habitat for lacustrine nesting birds – not rock).

The other polygons containing cliff units are not appropriate nesting habitat, as they contain 10 to 20% cliff within the polygon and are not extensive cliff habitat, ie. lacustrine material with slope erosion near creek banks. Further field verification is recommended for sites with seemingly appropriate nesting habitat, where located along the right of way (ROW). Even the one polygon (#1129) containing CL unit as the primary label is inappropriate for nesting (immediately adjacent to Big Creek).
Only the cliff units are rated both high for feeding and nesting.

Nesting habitat is the limiting life requisite for this area.

The highest concentration (extensive) of moderate foraging habitat is located within the BG and IDFxm along the Fraser River. Excellent soaring habitat along the river and adjacent plateau benches (we observed hawks soaring over these thermals whilst in the field).

Polygon #999 at the northwest end of Brigham Lake is rated Low for nesting and moderate for feeding as it is a large rock outcrop location.

Overall, the area mapped for the transmission corridor contains low suitability/capability for nesting and feeding habitat for Prairie Falcons. According to MELP, Williams Lake, there is a known nesting site along Riske Creek.

Sharp-tailed Grouse

Sharp-tailed Grouse populations may be affected by cattle grazing due to a reduction in breeding and nesting areas, and forage species. They have been recorded to abandon their dancing grounds (leks) and adjacent nesting areas when nesting and brooding cover is removed by grazing. Nests can also be vulnerable to trampling (Hooper and Pitt, 1993). Fire suppression, urbanization, and agriculture are also causing declines in grasslands. Some hunting pressure may still be a problem as well.

"In some areas of the Chilcotin-Cariboo today, sharptail populations seem to be increasing because of large clearcuts adjacent to wetlands with willows and scrub birch thickets" (R.W. Ritcey pers. comm., cited in Campbell *et al.*, 1990).

	High	Moderate	Low	Nil
Feeding Habitat	31	68	384	623
Nesting Habitat	29	5	148	924

Beginning at the west end of the IDFdk4 variant, there is some potential foraging habitat of low value, and very few polygons rated low for both feeding and nesting suitability.

SBPSmk should be rated low for feeding – so that they polygons are coloured up the same as in the IDFdk4 boundary zone.

The best potential nesting and foraging habitat for this species is located near the Fraser River, within the IDFxm and the BG zone (see figure). There are a number of polygons rated high for suitability of feeding and nesting requirements in this area. Where the ROW intersects these sites, field checking is recommended to confirm the presence/absence and potential of the habitat for Sharp-tailed Grouse (Tania – ask Gill about the one large poly that her and Ksenia went through and whether the habitat is appropriate or not). The habitat within the BGxh3 zone is of low nesting potential and moderate feeding due to the steep nature of the area (grassland condition is not accounted for through this mapping process, therefore ratings may be much lower than they appear).

Sandhill Crane

During breeding bird surveys in June 1999, along the transmission corridor, cranes were heard calling west of terrestrial ecosystem mapping (TEM) polygon 574. Cranes were also heard and seen using the wetlands near TEM polygon 1204. Although no detections occurred within survey plots, cranes were obviously using suitable habitat in the area.

	High	Moderate	Low	Nil

Feeding Habitat	None	296	550	260
Nesting Habitat	None	207	522	377

At the west end of the corridor, in the MSxv, there is a small area of moderate nesting and foraging value, with surrounding wetland habitat of low breeding and foraging potential as well. This area around a open water unit, polygon #1040, and surrounding wetland complexes (BF and SW2) would be an ideal location for inventory of this species during breeding season. However, the upper elevation location is not as conducive to use by this species as for the lower elevation SBPS and IDF zones.

Kloatut Lake has some low potential, with habitat quality increasing to the east in the SBPSxc zone.

I think that the habitat within the SBPS is rated too high for breeding in the forested LK7 units and WM3 units.

The Willan Lake Area also has some low potential for breeding and foraging. Low to moderate quality foraging habitat is plentiful along the length of the corridor, with a concentration of moderate habitat located within the IDFdk3 and 4 around the lakes, open water and wetland unit complexes. Big Creek and Mons Lake Area concentration of low habitat with some moderate. The Jamieson Wetland Area has the highest potential (see Figure) for use by this species. Any field visits in the future should check this area for the presence of Sandhill Cranes as well as a number of other focal species which are likely to utilize this large wetland complex. Unlike many of the other focal species, the BG zones along the Fraser River are of little to no value to Sandhill Cranes during the growing season. However, these wide open grassy areas may be ideal for staging areas during migration.
Numerous open water units within the IDFdk3 (see figure).
Brigham Lake Area also of moderate potential for use by this species (see figure).

Nesting and/or migrating and staging Sandhill Cranes (blue-listed) are occur within habitats on both corridor options, especially in the more extensive wetland complexes.

Upland Sandpiper
This species is declining in the eastern portion of its range, as habitats (old fields) mature to woodland or are replaced by suburbanization (Ehrlich *et.al*., 1988). The extent to which range practices may impact this species is unknown.

	High	Moderate	Low	Nil
Feeding Habitat	None	67	294	745
Nesting Habitat	None	30	120	956

High value spring feeding habitat is limited along the length of the corridor. Potential nesting habitat is also rare.

Ratings colour up the Willan Lake Area as having some moderate foraging potential (SBPSxc, BF2 present) for this species, but no suitable or capable sites for nesting. Therefore, the area may be used during migrations and post breeding dispersal for feeding, but not for breeding. Some patches of low value nesting habitat occur in the IDFdk4 around wetland sites and lakes. Low value feeding habitat is present throughout the Jamieson Wetland Area, but no appropriate nesting habitat occurs based on this evaluation. AF and SM stage 2 are abundant within the Jamieson Wetland area (IDFdk4).

As with many of the other focal species, the Upland Sandpiper has the highest potential of occurrence within the IDFxm and BG subzones along the Fraser River area. The BGxh3 colours moderate for feeding and nesting potential by this species within the SW and SS stage 3 and WA stage 2 units.

In the IDFxm to the east side of Fraser River, the PP2 and NP2 are rated moderate for nesting and foraging potential. To the east of the IDFxm subzone, the IDFdk3 subzone variant has much lower overall value, with some clusters of low value sites/polygons around the Brigham Lake Area.

Long-billed Curlew

Recreational activities and agricultural developments may reduce nesting success. In addition, forest encroachment is reducing available habitat (TWG, 1993). Breeding range much reduced and shrinking. Recent studies also indicate some losses from organochlorine poisoning, but primary problem is habitat loss and degradation.

"Grazing studies have consistently found that curlews are more abundant in heavier- than lighter-grazed grasslands. Conclusions about potential benefits of livestock grazing for curlews should be cautious, however, since they may respond negatively to the presence of grazing animals" (Hooper and Pitt, 1996).

	High	Moderate	Low	Nil
Feeding Habitat	31	None	80	995
Nesting Habitat	33	2	189	882

Concentration of low value potential feeding and nesting habitat in the Jamieson Wetland Area (unit SM2). Moderate value potential feeding areas are indicated in the IDFxm (units NP and WP stage 2) – plateau above the Fraser River (some large sized polygons containing NP2). High potential habitat in the BGxw2 (WN2). No appropriate habitat in the BGxh3 due to the steep slopes and river. The IDFdk3 contains some low habitat, patchy distribution where WJ and BW2 are abundant – at the far east end of the proposed corridor there is a group of low potential habitat. Suitable nesting habitat is limiting to the distribution of this species within the area and within this part of the province (climatic conditions and habitat are not conducive to nesting). The only high potential foraging and nesting habitat is located within the IDFxm and BGxw2 subzones, near the Fraser River.

Flammulated Owl

Clearcutting of mature, interior Douglas-fir forests will reduce habitat availability for this species. Forest harvesting, such as thinning to increase cattle forage, may make them more vulnerable to predation as well (Hayward, 1988). "It is not known how readily owls will move to new habitat when they are temporarily displaced by logging activities. The single most important threat to the survival of FLOWs in B.C. is the elimination or excessive modification of its habitat" (Hayward, 1988).

These owls have shown a strong fidelity to nesting areas, but often utilize different cavities from one year to the next (Goggans, 1986). Hayward (1988) suggests that some selective harvesting of the preferred mature fir habitat can be tolerated, but that snags for nesting cavities must remain. Snag protection is important in maintaining critical habitat for this and many other species. According to Campbell *et al.* (1988), nesting sites may be in short supply because resident Northern Saw-whet Owls nest in the same habitat and occupy the available nest cavities earlier than the migrating Flammulated Owls.

Current population trends are uncertain, as only recently have owls been found in sufficient numbers to survey (Hayward, 1988). Their secretive nature, small size, and quiet vocalizations, make them difficult to detect.

Habitats: Trans corridor only. Potentail breeding habitat occurs in lower elevations of the IDFxm on west side of Fraser River in upper forests of the BGxw2, and possbily some sites along the east side as well. Selectively logged forests in the IDFxm whose snags and larger WT's remain should provide good potential habitat, although thickets/dense roosting cover may be lacking in places.

Potential Impacts: Clearing corridor could remove potential nesting trees. During fieldwork it was noted a number of large diameter dead/dying WT's, some with cavities, were present along/close to the centre line. Likely therefore to decreese nesting opporutnities for this and other cavity nesters.

May increase somem foraging opportunities by creating long grassy (open corridors) adjacent to forest edge – likely to benefit for feeding. Predators of FLOW/competitors (e.g Northern Saw whet for nest cavities). If increase edge effects, it may promote predator populations or increase accessibility to fLOW nests, or cause increase in its competition, therefore could be a negative effect. Overall impact likely to be insignificant.

Mitigation: Surey area to be cleared for large WT's/snags. Identify potential nesting opportunities. Then, when clearing,

- Leave all where possible
- Only top off tree if this will render OK (eg live trees)
- Where cleared – consider snag creation in adjacent stands (but very limited number of cavity trees) and consider provision of nest boxes to compensate for losses.

	High	Moderate	Low	Nil
Feeding Habitat	None	117	388	601

Nesting Habitat	None	None	104	894

Absence of any suitable habitat until reach the IDFdk4 zone, where there is low to moderate foraging and nesting habitat. Mature and old growth stands are dispersed throughout these subzones. The IDFdk4 transition subzone, from the SBPSxc, begins near Mons Lake.

Extensive stands of LP (site series 01 – Douglas-fir, Lodgepole Pine – Feathermoss) structural stage 7 are present around Mons Lake, which provide for potentially moderate foraging and nesting habitat.

Although much of the mature forest habitat located within the IDF and BG zones indicate that moderate foraging and nesting habitat is present, on a provincial scale and based on the known nesting range

Jamieson Wetland Area also contains a concentration of moderate nesting and foraging habiat (LP site series 01, stage 7).

Highest concentration of moderate habitat appears to be located east of the Fraser River in the IDFdk3. No polygons have been rated as high for nesting or feeding in this part of the province – this area does not provide optimal/prime benchmark habitat for this species according to current information on breeding distribution and occurrence records. However, within the Region, this area provides moderate habitat for Flammulated Owls.

Short-eared Owl

SEOW populations are affected due to destruction of nests by farm machinery, cattle and land development. They are thought to be declining in most of their range, especially in the prairie provinces, Pacific coast and parts of the southeast (Erhlich *et al.*, 1988). On the up side, this species has managed to adapt to some human-altered habitats such as golf courses and airports (Doyle, 1997).

Ground nesting birds are particularly sensitive to human disturbance and could cause nest abandonment by this species. Three of four females flushed from nest scrapes by researchers moved and re-nested a short distance away (Holt, 1992).

Nesting areas can also be negatively affected by logging, residential development, recreational activities and livestock (Cooper, 1996).

Causes of mortality are diverse. Collisions with powerlines have been recorded, but there are few data from B.C. Significant powerline-related mortality occurs in areas with high numbers of cranes, powerlines, and feeding areas near powerlines (Lewis, 1974; Tacha *et al.*, 1979; Morkill and Anderson, 1991; Littlefield, 1994). In B.C., there are few known sites that meet these criteria. Therefore, mortality from collision with powerlines can be expected to be low. Powerlines cross between feeding and roosting areas in Pitt Polder, but no mortality has been reported (Cooper pers. comm. with M. Gebauer in 1996 document).

	High	Moderate	Low	Nil

Feeding Habitat	78	166	276	586
Nesting Habitat	None	209	147	750

Brigham Lake Area (IDFdk3) contains a concentration of moderate nesting habitat and high foraging sites. This area has high capability/suitability for this species. Further inventory is required to confirm the quality of the habitat.

Extensive fields of NP structural stage 2 grassland habitat within the IDFxm (moderate nesting, high foraging suitability/capability).

Jamieson Wetland Area contains a plentitude of habitat rated as moderate for both nesting and foraging requisites of this species. Little to no values at the west end of the corridor – lack suitable habitat and climatic conditions.

Lewis' Woodpecker

Snag removal, agricultural clearing, fire suppression, logging, and orchard spraying, have direct effects on populations in southern B.C. Some consider competition with starlings to be another impact on their numbers. However, Cannings *et al.* (1987) do not think that this competition has affected breeding success in the Okanagan valley, as they have observed the woodpecker successfully defending its nest site from starlings.

At one time this bird was widespread throughout the Vancouver region and south-east Vancouver Island where logging and forest fires had left an abundance of tall "snags": and standing trunks. These sites served as nesting sites and foraging lookouts for the Lewis' Woodpecker. "After 1940, the cutting of snags for firewood and as a safety requirement of the Forest Service caused a decline in the woodpecker population (Campbell *et al.*, 1990).

	High	Moderate	Low	Nil
Feeding Habitat	None	134	381	591
Nesting Habitat	None	47	118	941

Some low potential feeding and nesting habitat within the IDFdk4 (LC stage 7).
SBPSmk looks funny for this species as well – change to low values for this subzone as with IDFdk4 as they are adjacent to each other.

The best suitable habitat potential is located within the IDFxm and BG subzones. To the east of Fraser River, there is some moderate potential in the older forest stands and in selectively felled stands where old vets/snags remain.

Yellow-breasted Chat

Vulnerable to habitat clearing, for agricultural and residential/industrial developments. In addition, pesticide applications may affect chat territories next to farmlands, directly (through direct contact with pesticides) or indirectly (through loss of insect food). Blue jays, chipmunks and Brown-headed Cowbirds are record to predate nests (RBCM, 1997).

	High	Moderate	Low	Nil
Feeding Habitat	None	55	124	927
Nesting Habitat	None	4	119	983

Habitat becomes suitable within the IDFxm subzone and into the BG and somewhat in the IDFdk3 as well. However, it is very unlikely that this species would occur in this part of the province as it is a far distance from the core populations in the Okanagan. None-the-less, this analysis has erred on the side of caution and rated up to moderate for some units within the mapped area. These units are often associated with riparian areas such as Word Creek.

There is one polygon within the IDFxm which is rated moderate suitability for both feeding and nesting habitat (polygon #946). This polygon contains predominately AR stage 5, and aspen and rose stand in the IDFxm. This site is located approximately 1 km to the south of the ROW towards the east end of the corridor. Therefore, this moderate potential habitat is not considered to be of any conflict with the current corridor route. Another site which shows good potential for this species is located in the BGxw2 on the east side of the Fraser River, polygon #864. This site contains a pure AS stage 5 stand following Meason Creek. Site is surrounded by habitat rated moderate for feeding. This site is also located a fair distance away from the ROW, approximately 1.5 km from the centre line. The AS is a trembling aspen – snowberry – Kentucky bluegrass unit.

Two polygons to the west of Fraser River, within the IDFxm, rate moderate for both feeding and nesting habitat requirements – both sites are aspen stands (polygon #784, which is AR4 and GR2 is located approximately 200m from the centre line. A primary logging road currently transects this polygon and cattle grazing is high in the area. Two intermittent streams run through this polygon as well. This site is surrounded by moderately rated foraging habitat and low nesting habitat potential. Field checks of this site indicate that they area is heavily used by cattle, however cattle activity has not been linked with disturbance of this species – if the habitat is there and the climatic conditions are right, it will be used (if birds are present in the area). Polygon #778 contains AR4 and NG2, and is located approximately 500m from the centre line (very small polygon – 1.08 hectares) – also located near Word Creek.

The IDFdk3 zone contains only low value habitat for this species.

Sagebrush Brewer's Sparrow

The Brewer's Sparrow depends on sagebrush shrubs for nest sites (RBCM, 1996). The main threat to the sparrow is the conversion of sagebrush habitat for other land uses. Primarily removal of sagebrush land to increase forage for cattle is the limiting factor throughout its range in the Okanagan (COSEWIC, 1997). As well, cattle may damage and/or disturb nests and degrade foraging areas.

In addition, use of insecticides for insect control may harm the birds directly or through contamination or reduction of their prey species (RBCM, 1996). They are also commonly parasitized by cowbirds (Rising and Beadle, 1996).

	High	Moderate	Low	Nil
Feeding Habitat	None	24	25	1057
Nesting Habitat	None	9	25	1072

The IDFxm, IDFdk3, BGxh3 and BGxw2 are the only subzones within the area mapped which contain potentially suitable habitat for this species of bird. It is extremely unlikely that members of this species would occur in this part of the province and therefore are not rated as having high value on a provincial scale (even rating things moderate is rating on the cautious side/favourable). The SW structural stage 3 habitat is rated moderate for potential use for feeding and nesting.

The rest of the corridor does not contain appropriate/suitable habitat for the meeting the life requisites of this species. The IDFxm and BG subzones are the only locations which contain habitat similar to that used to the south (warm, dry, sagebrush and grass country – see above species account for details).

3.4 Bird Collision Overview

A variety of factors influence bird collisions with powerlines, including bird behaviour, line routing, and weather conditions. Over the last decade many objects have been put on the market to prevent bird collisions, but few studies have evaluated their effectiveness.

The literature current up to 1998 frequently focuses on the dangers of overhead groundlines, which are thin, hard to see, and often cause bird mortality. They are primarily used in high lightening risk areas throughout the U.S. In B.C., they are only used along stretches up to 4 km from a substation, not elsewhere. The lack of overhead groundlines in B.C. has not however eliminated the bird injury/mortality problem.

There are many types of bird interactions with powerlines, some of which differ according to the bird group or species.

Birds of prey perch, roost and often nest on tall objects. The appeal of powerlines can result in negative and positive interactions. The wingspan of larger birds can result in electrocution, often resulting in mortality. Electrocution occurs when the bird contacts two 'live'/energized conductors at the same time, or when it simultaneously contacts grounded hardware and an energized conductor. Most lines that electrocute raptors are energized at voltage levels between 1 and 69 kV. This is closely related to the line design rather than the voltage rating.

Collisions with powerlines can also result in injury and/or death and occur most often during feeding, fighting or mating. The distraction of the activity likely causes a lack of awareness of objects such as powerlines.

Powerlines can also provide useful perching and nesting structures, if properly insulated to prevent electrocution. Where powerlines cross habitat that does not naturally contain such structures (i.e. Bunchgrass Zone), it is usually not advised to encourage these activities, as it may alter local ecology.

Literature indicates that presence of thick fog, causing poor visibility, can lead to collisions with powerlines for many bird species. Wind and storms can also create collision conditions. Bird deflectors, reflective of light or other forms, may ameliorate this problem.

The Fraser River Valley is subject to frequent fog and low cloud conditions in the spring, fall and winter seasons. Local prevailing wind conditions should be determined, as they will affect line movement (little to no line "play" is preferred for wildlife as well as for maintenance cost). Mitigation measures to increase the visibility of the transmission lines are recommended.

Sandhill Crane (blue-listed) deaths due to powerline collisions may occur during poor weather conditions and/or poor placement of structures (i.e. near feeding or resting areas). Electrocution is definitely possible, when they fly through, on closely spaced conductors (i.e. distribution lines) because of their very large wingspan. This is may not be an issue for transmission lines if spacing of conductors is wide enough. The same applies to all birds with large wingspans.
Occasionally Great Blue Herons (blue-listed) collide with poles as well. In windy conditions, they can be literally blown into the structures. In general, herons are not a problem because of their slow flying speed.

Trumpeter Swans fly at the same speed, whether they can see or not. This fact explains why swan collisions with powerlines are a problem (in addition to electrocution on distribution lines). Collisions occur in the vicinity of fields and open areas, where they are feeding, resting and nesting.

4. BATS

No detailed bat inventory was proposed or deemed necessary. However, red- and blue-listed bat species were given an initial assessement for their likelihood of occurrence within the habitat located along the corridor. It was determined by the proponent and MELP that habitat should be rated for Townsend's big-eared bat.

4.1 Approach and Methodology

Habitat ratings were developed, along with a species account describing general biology, ecology and feeding requirements of this blue-listed species. The ratings were then viewed using mapping software to assess the amount of high, moderate, low and nil value habitat present along the corridor (assessment provided in Section 8.0).

4.2 Results/Baseline Conditions

No bat inventory was deemed necessary for the transmission corridor.

5. OTHER SMALL MAMMALS

No detailed small mammal inventory was proposed for the transmission corridor.

5.1 Approach and Methodology

Although not required, the following objectives were met as part of the wildlife habitat assessment program for the transmission corridor:

- Identify species that may occur.
- Identify any red- or blue-listed species in zone of influence.
- Develop species/habitat profiles if necessary.
- On reconnaissance trip, assess habitat potentials and likely impacts.
- Determine if any needs for further inventory (e.g. localised sampling).
- Develop management/mitigation recommendations as appropriate.

5.2 Baseline Conditions (Results of Assessment)

No red- or blue-listed small mammals (excluding bats) are expected to occur along the transmission corridor. A number of common small mammals, voles, shrews and mice are expected to be abundant throughout the area. The development of the corridor line is not anticipated to have any significant impact on rodent populations for the area.

5.3 Habitat Suitability Assessment

Townsend's Big-eared Bat

	High	Moderate	Low	Nil
Growing – Feeding				
Winter - Hibernation				

6. MID-SIZED MAMMALS

No detailed inventory was proposed for the transmission corridor, as approved through the Project Report Specifications reviewed by the Environmental Impact Assessment Office (EAO). However, habitat assessment for Fisher, a blue-listed species, was agreed to through consultation with MELP and the proponent.

6.1 Approach and Methodology

Although not required, the following objectives were met as part of the wildlife habitat assessment program for the transmission corridor:

- Identify species present within zone of influence.
- Identify any red- or blue-listed species in zone of influence.
- Identify habitat relationships for red- and blue-listed species.

- Identify any potential habitat values along transmission corridor.
- Identify potential impacts.
- If significant values/potential impacts are identified, plan for any further inventory needs.
- Develop mitigation/management plans as appropriate.

During aerial winter surveys for ungulates, any observations of use by mid-sized mammals (mustelids, coyotes and lynx) were recorded.

6.1.1 Spring and Summer Surveys

Summer 1999 Habitat Assessment Fieldwork

6.1.2 Winter Surveys:

On January 29, 31 and March 5, 1998, corridor air surveys were conducted to assess ungulate winter range habitat. In addition, sign of use by mid-sized and large mammals were noted.

6.2 Baseline Conditions (Results of Inventory)

There is no specific field data for the transmission corridor, other than broad level winter surveys in 1998.

6.2.1 Spring and Summer Surveys

Summer 1999 Habitat Assessment Fieldwork

6.2.2 Winter Surveys

During winter surveys, sign of coyotes, porcupine, beaver, mustelids (fisher, marten, mink, etc.) and lynx were observed along the corridor. River otter use was confirmed at Big Creek during a ground check. Along this riparian habitat, other mustelid use included a small one (likely mink) as well as fisher/marten (size of tracks fell within overlap of female fisher and male martens).

6.3 Habitat Suitability Assessment

Fisher

	High	Moderate	Low	Nil
Reproductive – Security				
Growing – Feeding				
Winter – Feeding				
Winter - Security				

Other Mid-sized Mammal

7. LARGE MAMMALS (UNGULATES AND LARGE CARNIVORES)

7.1 Approach and Methodology

- Identify habitats along the corridor and their potential wildlife values.
- Identify any red- or blue-listed species within the zone of influence of the corridor.
- Identify potential impacts of the corridor on population, and any wildlife issues.
- Develop appropriate management strategies - e.g. an access management plan, vegetation management plans along the corridor.
- Identify any needs for further quantification of populations and potential impacts.

Develop mitigation if warranted.

7.1.1 Spring and Summer Surveys

No specific spring and summer surveys were conducted or required for ungulates and large carnivores.

7.1.2 Winter Surveys

Winter surveys were carried out for ungulates (Moose, Mule Deer and Bighorn Sheep), mid-sized mammals and large mammals along the transmission corridor to provide data on the relative number of individual species in relation to their use of winter habitats. This data was used in conjunction with data collected in the summer to determine habitat use in relation to the sensitive ecosystem unit types.

Winter surveys were carried out during January 29th and 31st as well as March 5th 1998 by Madrone Consultants Ltd., previous to that a winter survey of the corridor was also done by Triton in 1997. An aerial transect of the transmission line were carried out on route to and from Williams Lake, to minimize helicopter expense and maximize use. Ground transects were completed in areas of winter habitat concern, determined during the aerial transects.

7.2 Baseline Conditions (Results of Inventory)

7.2.1 Spring and Summer Surveys

The area around the Fraser River crossing is not optimal for sheep due to degradation from cattle grazing and limited escape terrain. However, sheep herds occur further north (Junction Range) and to the south (Gang Ranch area), and sheep are known to range up and down on both sides of the Fraser through this area. Although degraded, the grasslands do provide some reasonable forage.

7.2.2 Winter Surveys

Numerous moose and deer tracks were recorded throughout the length of the corridor, use was estimated to be moderate with some areas of high use (e.g. Jamieson Wetlands). Many of the ungulate tracks were present in openings and following along roads. As winter conditions were mild during 1998, critical winter range habitat could not be determined. At the Fraser River crossing 8 young rams California bighorn sheep, were seen on the eastern plateau above the river. Another adult ram was seen on the west side of the river on the steep, rocky banks. Deer sign was most abundant west of the Fraser River within the IDFxm.

7.3 Habitat Capability/Suitability Assessment

For comparing wildlife capability, it is important to remember that

1) High capability is not necessarily that significant where the habitats concerned are under some land use which renders them of low suitability, and where a change in land use is unlikely (e.g. areas on either side of the Fraser are mapped as moderate mule deer capability, but in fact are now largely agricultural fields).

2) High quality habitats for rare or threatened species are more significant than high quality habitats for relatively common species. Thus it could be argued that a small amount of high or moderate capability habitat for Bighorn Sheep is likely to be more significant than more extensive high or moderate capability habitats for moose or mule deer.

3) The capability mapping is generalized capability for large scale planning purposes; at the scale we are dealing with it can be misleading. Winter is likely to be the most limiting factor for all species we are dealing with, and high quality winter ranges are thus much more significant than areas which may have moderate capability but where in fact winter suitability is low.

7.3.1 Ungulates

The corridor transects some high and/or moderate capability habitat for the three focal ungulate species. The corridor encounters a small percentage (less than 4% of total corridor area) of high capability wildlife habitat for Moose (Table 4). Moderate wildlife capability habitat is present for Moose (15.5% of total corridor area), Big Horn Sheep (2.1%) and Mule Deer (13.6%).

Table 4: Wildlife Capability/Suitability of Transmission Line.

SPECIES	Transmission Line Corridor
Bighorn Sheep	high - none moderate - 790 ha low - 857 ha

Mule Deer	high - none moderate - 5,162 ha low - 8,071 ha winter range: 9,759 ha
Moose	high - 1,275 ha moderate - 5,860 ha low - 27,317 ha

Mule Deer

Some reasonably good Mule Deer winter range appears to occur on both sides of the Fraser along option 6, on the upper, forested slopes; especially on the west side. The plateau areas further west afford very little in the way of winter range.

	High (1)	2	3	4	5	Nil (6)
Growing – Feeding						
Growing – Security						
Winter – Feeding						
Winter – Security/TH						

California Bighorn Sheep

Some moderate Bighorn Sheep range occurs in the grasslands and adjacent open forests around the Fraser River of option 6.

	High (1)	2	3	4	5	Nil (6)
Reproduction - Security						
All Season – Feeding						
Growing – Security						
Winter – Security/TH						

Moose

High moose use was observed in many areas of option 6 on the plateau, and especially along Big Creek, Bambrick Creek / Willan Lake, Kloatut Lake, and Tete Angela Creek areas.

	High (1)	2	3	4	5	Nil (6)
Growing – Feeding						
Growing – Security						
Winter – Feeding						
Winter – Security/TH						

Ungulate Habitat Assessment Overview

At the extreme west end there is a very small section of SBPSxc but the west end is mainly located in the MSxv, where there are low to some moderate (3) values in winter and moderate in summer. The best habitat within the MSxv is along Tete Angela Creek. Moderate quality in the summer. Some moderately high values in SH3 and 6 units but none along the centreline, which only crosses cool aspect forests. In the Kloatut Lake area there is some moderate summer and winter habitat. The ESSFxv2 has low winter values and some moderate summer values. Along Big Creek, the riparian area habitat has some moderate winter habitat and is also good during the summer. There are no significant values for moose within the BG zone.

Moderate values for moose are present from Vert Creek to Brigham Lake (east end) area, in summer and winter. Values gradually decline to the eastern end of the corridor to fairly low capability/suitability.

7.3.2 Large Carnivores

Grizzly Bear

	High (1)	2	3	4	5	Nil (6)
Early Spring – Feeding						
Summer – Feeding						
Fall – Feeding						
Growing – Security/TH						
Denning/Hibernation						

Black Bear

	High (1)	2	3	4	5	Nil (6)
Denning/Hibernation						

8. ENVIRONMENTAL IMPACT ASSESSMENT

Madrone Consultants Ltd. worked with the client and engineers to identify particular areas of concern and develop mitigation strategies to minimize potential effects of the transmission line development and operation. The vast majority (some 80%) of the SEI polygons are automatically avoided by the proposed 50m wide ROW. In some areas – especially around the Fraser River – a considerable number of SEI polygons are crossed. However, it was apparent from the mapping that in such areas there was little to be gained by moving the centerline to either the north or south, within the 3km wide corridor.

8.1 Potential Effects – Wildlife

8.1.1 Direct, Indirect and Cumulative Effects

The construction of the transmission line will have direct and indirect effects on wildlife, including habitat removal, habitat change, changes to travel patterns, and increased human disturbance. Inventory of wildlife species, habitats and habitat features, prior to development, provides the basis for mitigation, compensation (if required) and reclamation recommendations and management programs.

Similarly, along the transmission line, construction and operation are likely to result in some direct and indirect effects on a variety of wildlife species, including provincially red- and blue-listed species. The more significant potential effects are likely to result from changes such as increased human access, emplacement of poles and wires, and the consequent changes in animal movements and behaviour patterns, rather than from direct habitat loss.

There is potential for direct mortality of some birds due to aerial collisions along the corridor, especially along the Fraser River and wherever the line crosses wetlands. Direct mortality may also occur where additional roads allow increased access to legal or illegal harvesting of ungulates and large carnivores. Increased access by humans is likely to increase disturbance and harassment effects.

Clearing of vegetation during construction and operation will result in loss of security habitat for some wildlife such as deer, moose, bear and furbearers. Indirect and/or direct habitat loss may channel ungulates along the corridor, changing local movement patterns and increasing their susceptibility to hunting or road kills.

Indirect mortality and reduction in breeding success may be immediate but may also take many years to show up - e.g. a reduction in winter range, or reduction in the quality of winter range or spring range for Mule Deer or for Bighorn Sheep, may only manifest itself during or after an unusually severe winter.

Indirect effects can occur via competing species - e.g. by increasing disturbed areas available to species which prefer “edges” (e.g. cowbirds, starlings, least weasel). Habitat

alterations may increase the populations of these species, which compete for food with, predate or parasitize species which prefer forest "interior" conditions, as occurs with a number of songbirds. Similar effects can occur through the introduction of weedy plant species, which can outcompete native plants and may impact on red- or blue-listed species directly. Introduced weedy species may also reduce the quality of range for wildlife.

Reptiles and Amphibians

Amphibians appear to be declining on a global basis, and many species are highly susceptible to environmental changes, as their permeable skins make them very sensitive to water quality changes in particular. As a group they are receiving increasing attention from the regulatory agencies and the public.

The proposed development is likely to both directly and indirectly impact amphibian populations in the area. Direct mortality during construction and operation of the corridor should be minimal, habitat loss, a variety of effects from changes in local conditions of air, soil, water quality, and hydrology, alteration of behavior patterns, and shifts in local predator-prey systems may all influence amphibian populations in the study area.

Indirect effects could result from shifts in predators or prey in the area. For example any increase in predators such as eagles, hawks, may result in a corresponding shift in amphibians as predation pressure increases or decreases. Martell (1997), for example, notes that human activities in the past 100 years may have changed distributions by altering the composition of predators. Changes in predator - prey balances are however likely to be temporary in nature and are expected to be relatively minor compared to other sources of impact (e.g. agriculture, forestry?).

8.1.2 Extent/Significance

It is anticipated that with the application of mitigation measures proposed, that possible effects on wildlife should be localised and relatively temporal. Furthermore, decommissioning of the transmission line at closure should provide for recovery of the line to relatively natural conditions.

Reptiles and Amphibians

The losses of good amphibian habitats along the corridor should be minimal, as the footprint of the towers will be very small, and wetlands and ponds/lakes (i.e. most of the potnential breeding sites) will be avoided as far as possible.

8.1.3 Mitigation and Benefit Enhancement

A variety of mitigation techniques are being incorporated into the transmission line design to reduce or eliminate potential effects. This may involve possible realignment where high concentrations of significant habitats occur close together, and where this is feasible from an engineering perspective. Proposed mitigation for the different wildlife

species will be built on knowledge of the species their habitat use outlined in the species accounts.

Potential mitigation will involve a whole series of considerations and is only in the very preliminary stages at this time. Key areas for consideration throughout the corridor will include:

- identification of appropriate timing windows for different operations to minimize disturbance to wildlife;
- identification of sites with particular wildlife-related access concerns, and of measures to implement to restrict human access;
- provision of nest boxes to mitigate for loss of wildlife trees;
- visual buffering along powerline ROW by using irregular margins, strategic shrub/small tree planting to restrict lines-of-site;
- avoiding powerline placement in wetlands;
- increasing visibility of powerline sections where bird collisions may be an issue (various techniques); and
- including techniques to minimize potential bird electrocutions into the powerline design.
- limiting new access;
- identify need for cattle drift fences if necessary to limit access to cattle to ensure no overuse/new use of any wetlands;
- maintenance of adequate security cover for wildlife; and
- Vegetation management along the ROW – use of herbicide, plant species for under the lines, influence on wildlife habits and habitats.

Line routing, based on knowledge of the ecology of the area and bird behaviour, is the most important level of mitigation for the potential of bird collisions. It is essential to place the line where it is least likely to be in the path of known landing and take off sites (these are the areas where the impacts will occur, especially during poor visibility conditions). If the line exists on this path there will be casualties. Lines can be marked with fairly simple devices to make them more visible.

Following are some of the potential mitigation measures.

- Transport Canada manufactures red ball flight line indicators for airplanes, which can also serve to make the line more visible to birds. The colour red is considered to be less effective for bird deterrence than yellow, but better than nothing. Smaller yellow ones could be installed at the same time as the required red ones. A possible consideration for the Fraser River Crossing.

- Flight diverters provide visibility so that they can avoid collision. Yellow is thought to be better according to the few studies that have been done to compare colours/objects. Some of the benefits to using insulating wrap-ons are that they come in a number of highly visible colours, are UV protected, light weight, and do not conduct.

- Visibility increases with diameter of the line, therefore larger transmission lines with larger diameter wires and are more visible than the thinner distribution lines. Larger lines can also support more weight, therefore there are more options as to what can be hung on them for flight diverters.

- Upside-down fish floats hung on the wires are considered to increase visibility, and can cost less than "specialized" objects.

- Underground powerlines should be considered on a site specific basis. They are generally preferred where they cross wetland habitat or high use bird areas. The cost to fix the line could end up being more expensive than to bury it in the first place (i.e. large bird collisions can cause outages, which require a site visit, plus the cost of power loss).

- Trees and or high shrubs, in the vicinity of the wires, are helpful in that they create a natural obstacle for the birds to fly over. At the same time, the natural diversion, directs the birds upwards in preparation for powerline clearance (depending on the structure, height, etc.). Use of vegetation is not always feasible, due to safety regulations, transmission structure, and location. In addition, tall shrubs and trees are not present in all habitat types that lines cross.

Benefit Enhancement

In addition to providing natural perching substrates, it can be cost effective to not clear wildlife trees completely. B.C. Hydro has developed a training program and reference guide for leaving some of the wildlife trees (i.e. lower snags, leave more decayed wood, create low snags), which can be implemented.

Creation of alternate nesting habitat is recommended where existing habitat is removed without availability of replacement habitat (i.e. old-growth forest removed along transmission line). Detailed designs exist for construction and installation of nesting platforms for raptors.

Reptiles and Amphibians

Impacts within the mine footprint cannot be avoided. However, timing windows to restrict certain activities to avoid the main breeding season will help to minimize impacts.

When amphibians have metamorphosed, the young adults disperse largely in terrestrial habitats. Development activity confined to the winter months is likely to have the least impact.

8.1.4 Residual Effects

Provision has also been made in the reclamation plan for replacement of much of the forest and wetland wildlife habitat with similar natural communities upon closure, thereby minimising long-term impacts to wildlife communities.

Reptiles and Amphibians

Following reclamation, it is anticipated that existing habitats, including the ponds and wetlands that serve as amphibian breeding sites, will be restored in an approximation of those that occur at present.

8.1.5 Monitoring and Management

Improved access may require additional time on the part of Conservation Officers patrolling the area. An inability to effectively manage/monitor hunting may occur.

8.1.6 Conclusion

APPENDIX 1: STUDY AREA FIGURES

APPENDIX 2: PROSPERITY PROJECT FOCAL WILDLIFE SPECIES FOR HABITAT RATINGS

Table 1a: Species, seasons, and life requisites used for habitat ratings and wildlife interpretations for the Prosperity Project Mine Site and Transmission Corridor - Birds.

Species	Mine Site	Corridor	Season	Life Requisite
Great Blue Heron (blue-listed)	**X**	**X**	Growing	Feeding
			Reproductive	Security
Mallard	X	X	Growing	Feeding
			Reproductive	Security
Barrow's Goldeneye	X	**X**	Growing	Feeding
			Reproductive	Security
Prairie Falcon (red listed)	**X**	**X**	Growing	Feeding
			Reproductive	Security
Sharp-tailed Grouse (blue-listed)		X	Growing	Feeding
			Reproductive	Security
Sandhill Crane (blue-listed)	X	**X**	Growing	Feeding
			Reproductive	Security
Long-billed Curlew (blue-listed)		**X**	Growing	Feeding
			Reproductive	Security
Upland Sandpiper (red-listed)		**X**	Spring	Feeding
			Reproductive	Security
Flammulated Owl (blue-listed)		**X**	Growing	Feeding
			Reproductive	Security
Short-eared Owl (blue-listed)		**X**	Growing	Feeding
			Reproductive	Security
Lewis' Woodpecker (blue-listed)		**X**	Growing	Feeding
			Reproductive	Security
Yellow-breasted Chat (red-listed)		**X**	Growing	Feeding
			Reproductive	Security
Sagebrush Brewer's Sparrow (red-listed)		**X**	Growing	Feeding
			Reproductive	Security

X = rated in this area

Table 1b: Species, seasons and life requisites used for habitat ratings and wildlife interpretations for the Prosperity Project Mine Site and Transmission Corridor - Mammals.

Species	Mine Site	Corridor	Season	Life Requisite
Townsend's Big-eared Bat (blue-listed)		**X**	Growing	Feeding
			Winter	Hibernation
Fisher (blue listed)	**X**	**X**	Reproductive	Security
			Growing	Feeding
			Winter	Feeding
			Winter	Security/Thermal
Black Bear	**X**	**X**	Winter	Hibernation
Grizzly Bear (blue listed)	**X**	**X**	Early spring	Feeding
			Summer	Feeding
			Fall	Feeding
			Growing	Security/Thermal
			Winter	Hibernation
California Bighorn Sheep (blue-listed)		**X**	Reproductive Season	Security
			All season	Feeding
			Growing	Security
			Winter	Security/Thermal
Moose	**X**	**X**	Growing	Feeding
			Growing	Security
			Winter	Feeding
			Winter	Security/Thermal
Mule Deer	**X**	**X**	Growing	Feeding
			Growing	Security
			Winter	Feeding
			Winter	Thermal/Security

X = rated in this area

APPENDIX 3: CONSERVATION DATA CENTRE TRACKING LISTS

	Williams Lake (FD #62)	Chilcotin (FD #65)	100 Mile House (FD #64)
AMPHIBIANS			
Great Basin Spadefoot Toad (B)	S2S3	n/a	S2S3
REPTILES			
Rubber Boa (B)	S3S4	S3S4	S3S4
BIRDS			
Western Grebe (R)	S1B, S3N	n/a	n/a
American White Pelican (R)	n/a	S1B, SZN	n/a
American Bittern (B)	S3	n/a	S3
Great Blue Heron (B)	S3S4B, SZN	S3S4B, SZN	S3S4B, SZN
Swainson's Hawk (B)	S3	S3	S3
American Peregrine Falcon (R)	S2	n/a	n/a
Sharp-tailed Grouse (B) (*columbianus* ssp.)	S3	S3	S3
Sandhill Crane (B)	S3B, SZN	S3B, SZN	S3B, SZN
Upland Sandpiper (R)	S1S3B, SZN	n/a	n/a
Long-billed Curlew (B)	S3B, SZN	S3B, SZN	S3B, SZN
Flammulated Owl (B)	S3S4	n/a	S3S4
Short-eared Owl (B)	S2N, S3B	S2N, S3B	S2N, S3B
White-throated Swift (B)	S3	n/a	n/a
Lewis' Woodpecker (B)	S3	S3	S3
Sagebrush Brewer's Sparrow (R)	S2	n/a	n/a
Bobolink (B)	S3	n/a	n/a
FRESHWATER FISH			
White Sturgeon (Fraser R. pop.) (R)	S2	S2	n/a
Giant Pygmy Whitefish (R)	S1	n/a	n/a
Bull Trout (B)	S3	S3	S3
MAMMALS			
Pallid Bat (R)	S1	n/a	n/a
Spotted Bat (B)	S3	S3	S3
Western Small-footed Myotis (B)	S2S3	S2S3	S2S3
Fringed Myotis (B)	S2S3	S2S3	S2S3
Townsend's Big-eared Bat (B)	S2S3	S2S3	n/a
Wolverine (*luscus* ssp.) (B)	S3S4	S3S4	S3S4
Fisher (B)	S3S4	S3S4	S3S4
Badger (B)	S3	S3	S3
Grizzly Bear (B)	S3	S3	S3
California Bighorn Sheep (B)	S3	S3	S3
Woodland Caribou (Southern pop.) (B)	n/a	n/a	S2S3

Note: The lists include species that have been reported to have occurred somwehere within the given forest district. The tracking lists thus represent a conservative, broad coverage assumption of potential occurrence.

APPENDIX 4: WILDLIFE SPECIES LIST FOR THE PROSPERITY PROJECT MINE SITE STUDY AREA 1997-1999

CODE	COMMON NAME	SCIENTIFIC NAME
	AMPHIBIANS	
A-BUBO	Northwestern Toad	*Bufo boreas*
A-RAPR	Spotted Frog	Rana pretiosa
A-AMMA	Long-toed Salamander	*Ambystoma macrodactylum*
	REPTILES	
R-UTHA	Garter snake	*Thamnophis* sp.
	BIRDS	
B-PALO	Pacific Loon	*Gavia pacifica*
B-COLO	Common Loon	*Gavia immer*
B-PBGR	Pied-billed Grebe	*Podilymbus podiceps*
B-HOGR	Horned Grebe	*Podiceps auritus*
B-RNGR	Red-necked Grebe	*Podiceps grisegena*
B-EAGR	Eared Grebe	*Podiceps nigricollis*
B-GBHE	Great Blue Heron	*Ardea herodias*
B-CAGO	Canada Goose	*Branta canadensis*
B-GWTE	Green-winged Teal	*Anas crecca*
B-MALL	Mallard	*Anas platyrhynchos*
B-NOPI	Northern Pintail	*Anas acuta*
B-BWTE	Blue-winged Teal	*Anas discors*
B-AMWI	American Wigeon	*Anas americana*
B-RNDU	Ring-necked Duck	*Aythya collaris*
B-LESC	Lesser Scaup	*Aythya affinis*
B-WWSC	White-winged Scoter	*Melanita fusca*
B-BAGO	Barrow's Goldeneye	*Bucephala islandica*
B-BUFF	Bufflehead	*Bucephala albeola*
B-HOME	Hooded Merganser	*Lophodytes cucullatus*
B-COME	Common Merganser	*Mergus merganser*
B-OSPR	Osprey	*Pandion haliaetus*
B-BAEA	Bald Eagle	*Haliaeetus leucocephalus*
B-NOHA	Northern Harrier	*Circus cyaneus*
B-SSHA	Sharp-shinned Hawk	*Accipiter striatus*
B-COHA	Cooper's Hawk	*Accipiter cooperii*
B-NOGO	Northern Goshawk	*Accipiter gentilis*
B-RTHA	Red-tailed Hawk	*Buteo jamaicensis*
B-AMKE	American Kestrel	*Falco sparverius*
B-MERL	Merlin	*Falco columbarius*
B-PRFA	Prairie Falcon	*Falco mexicanus*
B-SPGR	Spruce Grouse	*Dendgragapus candensis*
B-BLGR	Blue Grouse	*Dendragapus obscurus*
B-RUGR	Ruffed Grouse	*Bonasa umbellus*

B-KILL	Killdeer	*Charadrius vociferus*
B-SOSA	Solitary Sandpiper	*Tringa solitaria*
B-SPSA	Spotted Sandpiper	*Actitis macularia*
B-LBDO	Long-billed Dowitcher	*Limnodromus scolopaceus*
B-COSN	Common Snipe	*Gallinago gallinago*
B-RNPH	Red-necked Phalarope	*Phalaopus lobatus*
B-BOGU	Bonaparte's Gull	*Larus philadelphia*
B-BLTE	Black Tern	*Chlidonias niger*
B-MODO	Mourning Dove	*Zenaida macroura*
B-GHOW	Great Horned Owl	*Bubo virginianus*
B-GGOW	Great Gray Owl	*Strix nebulosa*
B-NSWO	Northern Saw-whet Owl	*Aegolius acadicus*
B-CONI	Common Nighthawk	*Chordeiles minor*
B-RUHU	Rufous Hummingbird	*Selasphorus rufus*
B-BEKI	Belted Kingfisher	*Ceryle alcyon*
B-RNSA	Red-naped Sapsucker	*Sphyrapicus nuchalis*
B-HAWO	Hairy Woodpecker	*Dendrocopus villosus*
B-TTWO	Three-toed Woodpecker	*Picoides tridactylus*
B-NOFL	Northern Flicker	*Colaptes auratus*
B-PIWO	Pileated Woodpecker	*Dryocopus pileatus*
B-OSFL	Olive-sided Flycatcher	*Contopus borealis*
B-WWPE	Western Wood-Pewee	*Contopus sordidulus*
B-ALFL	Alder Flycatcher	*Empidonax alnorum*
B-HAFL	Hammond's Flycatcher	*Empidonax hammondi*
B-DUFL	Dusky Flycatcher	*Empidonax oberholseri*
B-PSFL	Pacific-slope Flycatcher	*Empidonax difficilis*
B-EAKI	Eastern Kingbird	*Tyrannus tyrannus*
B-TRSW	Tree Swallow	*Tachycineta bicolor*
B-VGSW	Violet-green Swallow	*Tachycineta thalassina*
B-NRWS	Northern Rough-winged Swallow	*Stelgiopteryx serripennis*
B-CLSW	Cliff Swallow	*Hirundo pyrrhonota*
B-BNSW	Barn Swallow	*Hirundo rustica*
B-GRJA	Gray Jay	*Perisoreus canadensis*
B-CLNU	Clark's Nutcracker	*Nucifraga columbiana*
B-CORA	Common Raven	*Corvus corax*
B-BCCH	Black-capped Chickadee	*Parus atricapillus*
B-MOCH	Mountain Chickadee	*Parus gambeli*
B-BOCH	Boreal Chickadee	*Parus hudsonicus*
B-RBNU	Red-breasted Nuthatch	*Sitta canadensis*
B-HOWR	House Wren	*Troglodytes aedon*
B-AMDI	American Dipper	*Cinclus mexicanus*
B-GCKI	Golden-crowned Kinglet	*Regulus satrapa*
B-RCKI	Ruby-crowned Kinglet	*Regulus calendula*
B-MOBL	Mountain Bluebird	*Sialia currucoides*
B-TOSO	Townsend's Solitaire	*Myadestes townsendi*
B-SWTH	Swainson's Thrush	*Catharus ustulatus*

B-HETH	Hermit Thrush	*Catharus guttatus*
B-AMRO	American Robin	*Turdus migratorius*
B-VATH	Varied Thrush	*Ixoreus naevius*
B-WAPI	American (Water) Pipit	*Anthus spinoletta*
B-BOWA	Bohemian Waxwing	*Bombycilla garrulus*
B-EUST	European Starling	*Sturnus vulgaris*
B-SOVI	Solitary (Cassin's) Vireo	*Vireo solitarius*
B-WAVI	Warbling Vireo	*Vireo gilvus*
B-REVI	Red-eyed Vireo	*Vireo olivaceus*
B-OCWA	Orange-crowned Warbler	*Vermivora celata*
B-YEWA	Yellow Warbler	*Dendroica petechia*
B-YRWA	Yellow-rumped Warbler	*Dendroica coronata*
B-TOWA	Townsend's Warbler	*Dendroica townsendi*
B-BLWA	Blackpoll Warbler	*Dendroica striata*
B-NOWA	Northern Waterthrush	*Seiurus noveboracensis*
B-MAWA	MacGillivray's Warbler	*Oporornis tolmiei*
B-COYE	Common Yellowthroat	*Geothlypis trichas*
B-WIWA	Wilson's Warbler	*Wilsonia pusilla*
B-WETA	Western Tanager	*Piranga ludoviciana*
B-SPTO	Spotted Towhee	*Pipilo erythrophthalmus*
B-CHSP	Chipping Sparrow	*Spizella passerina*
B-VESP	Vesper Sparrow	*Pooecetes gramineus*
B-SASP	Savannah Sparrow	*Passerculus sandwichensis*
B-SOSP	Song Sparrow	*Melospiza melodia*
B-LISP	Lincoln's Sparrow	*Melospiza lincolnii*
B-WCSP	White-crowned Sparrow	*Zonotrichia leucophrys*
B-DEJU	Dark-eyed Junco	*Junco hyemalis*
B-RWBL	Red-winged Blackbird	*Agelaius phoeniceus*
B-BRBL	Brewer's Blackbird	*Euphagus cyanocephalus*
B-BHCO	Brown-headed Cowbird	*Molothrus ater*
B-PIGR	Pine Grosbeak	*Pinicola enucleator*
B-RECR	Red Crossbill	*Loxia curvirostra*
B-WWCR	White-winged Crossbill	*Loxia leucoptera*
B-PISI	Pine Siskin	*Carduelis pinus*
B-EVGR	Evening Grosbeak	*Coccothraustes vespertinus*

MAMMALS

M-EPFU	Big Brown Bat	*Eptesicus fuscus*
M-LANO	Silver-haired Bat	*Lasionycteris noctivagans*
M-MYLU	Little Brown Bat	*Myotis lucifugus*
M-MYEV	Western Long-eared Myotis	*Myotis evotis*
M-MYVO	Long-legged Bat	*Myotis volans*
M-LEAM	Snowshoe Hare	*Lepus americanus*
M-ONZI	Muskrat	*Ondatra zibithecus*
M-CACA	Beaver	*Castor canadensis*
M-ERDO	Porcupine	*Erethizon dorsatum*

M-TAAM	Yellow-pine Chipmunk	*Tamias amoenus*
M-TAHU	Red Squirrel	*Tamiasciurus hudsonicus*
M-CALA	Coyote	*Canis latrans*
M-CALU	Gray Wolf	*Canis lupus*
M-LYCA	Lynx	*Lynx canadensis*
M-LOCA	River Otter	*Lontra canadensis*
M-MAPE	Fisher	*Martes pennanti*
M-URAM	Black Bear	*Ursus americanus*
M-ALAL	Moose	*Alces alces*
M-ODHE	Mule Deer	*Odocoileus hemionus*
M-BOTA	Domestic Cow	*Bos taurus*

BUTTERFLIES

Northern Cloudywing
Persius Duskywing
Two-banded Checkered Skipper
Canadian Tiger Swallowtail
Western White
Veined White
Large Marble
Sara Orangetip
Cluded Sulphur
Purplish Copper
Western Pine Elfin
Western Tailed Blue
Silvery Blue
Greenish Blue
Icaroides blue
Acmon Blue
Aphrodite Fritillary
Hydaspe Fritillary
Freija Fritillary
Northern Pearl Crescent
Mourningcloak
Red Admiral
White Admiral
Dark Wood Nymph
Common Alpine
Chryxus Arctic

APPENDIX 4: PROSPERITY PROJECT: AMPHIBIAN OBSERVATIONS AND ENVIRONMENTAL DATA FOR INVENTORY OF THE PROSPERITY PROJECT MINE SITE STUDY AREA: 1997 AND 1999.

Location	Method	Date	Time	Interv.	C.C.	C.	P.	°C Air	°C Water	W.	M.C.	Unk. Frog	A-RAPR	A-BUBO	A-AMMA	Habitat Type	Site description
A1	INCIDENT	6/10/97	2:20 PM		2	H	0			2	M	1A	1A, 1J			low shrub fen-willow and birch	along shallows of Little Fish Lake
A2	INCIDENT	6/10/97	9:15 PM		3	H	0	6		1	M		1A			low shrub fen-willow and birch	shallows of Fish Creek
A2	TCS	6/10/97	9:30 PM	60	3	H	0	6		1	M					low/medium shrub fen-willow and birch	along shore of FIsh Creek
A3	TCS	6/11/97	2:30 PM	60	2	H	0	16		1	M					cottonwood	Fish Creek at Taseko flats (faster flowing section)
A3	TCS	6/15/97	10:15 PM	60	0	H	0	8	12	1	VW					Cottonwoods	searched creek at bat net site, B05 only observed minnows
A3	MTRAPS	6/16/97	2:15 AM	240	0	H	0	3	7	0	VW					Cottonwoods	set traps in faster flowing water to trap possible tailed frogs, only caught minnows
A4	MTRAPS	6/11/97	9:30 PM	210	3	M	LR	10	10	2	M					very wet sedge fen	shallows of Fish Creek
A4	INCIDENT	6/11/97	9:45 PM	210	3	M	LR	10	10	2	M		1A			very wet sedge fen	shallows of Fish Creek
A4	MTRAPS	6/12/97	9:45 PM	405	2	0	0		16	0	M					wet sedge fen, low shrub fen-willow and birch	shallows of Fish Creek
A4	TCS	6/12/97A	9:14 PM	60	1	H	0	9	12	1	M		1A			very wet sedge fen	shallows of Fish Creek
A5	RSURV	6/12/97	1:30 AM	45	3	M	LR	8		2	M			A		young pine stand	on gravel road between camp and Fish Creek
A6	TCS	6/12/97B	9:14 PM	60	1	H	0	9	12	1	M		1A, 50+ hatchlings			wet sedge fen	small backpool of FIsh Creek
A6	MTRAPS	6/13/97	1:36 PM	876	1	H	0	22.5	18	3	VM		2A			wet sedge fen	small backpool on Fish Creek
A6	TCS	6/13/97	2:20 PM	60	1	H	0	22.5	18	3	VM		2A, 2J			wet sedge fen	small backpool on Fish Creek
A6	TCS	7/27/97	8:40 PM	60	1	H	0	15		1	W					Wet sedge fen; shallow breeding pond	Shallow back channel by Fish Creek Inlet
A7	TCS	6/13/97	9:15 PM	60	3	H	0	12	9	1	M		1A, 2J			wet sedge fen	animals found along meandering creek flowing into Fish Lake
A7	MTRAPS	6/14/97	1:00 PM	1040	0	0	0	22	11	1	VM					wet sedge fen	traps set in shallows of meandering creek (full of trout)
A7	TCS	6/14/97	1:10 AM	60	0	0	0	22	11	1	M					wet sedge fen/ low shrub fen-willow and birch	searched small backpools upstream of bat net site

Location	Method	Date	Time	Interv.	C.C.	C.	P.	°C Air	°C Water	W.	M.C.	Unk. Frog	A-RAPR	A-BUBO	A-AMMA	Habitat Type	Site description
A8	MTRAPS	6/15/97	12:43 PM	883	3	H	0	21	10	3	VW					wet sedge fen	traps set in shallows of Fish Creek inflow (numerous trout)
A9	TCS	6/15/97	1:10 PM	60	2	H	0	21	9	2	M		2A			wet sedge fen	animals found in small pools adjacent to bank of Fish Lake
A10	TCS	6/15/97	2:00 PM	60	2	H	0	21	10	2	VW		1A,1J			shallow open water, very wet sedge fen	eastern side of Fish Lake, med. pond
A11	TCS	6/16/97	10:00 PM	60	2	H	0	9	13	1	W					low shrub fen-willow and birch	searched along shore west of bat net site
A11	MTRAPS	6/17/97	12:00 PM	853	3	H	0	18	9	3	M					low shrub fen-willow and birch	traps set in shallows of Wasp Lake
A12	TCS	6/17/97	10:00 PM	60	2	H	0	5.5	13	2	VM					low shrub fen-willow and birch	searched shallows of Fish Creek
A12	MTRAPS	6/18/97	1:21 PM	900	3	H	0	16		2	M					low shrub fen-willow and birch	traps empty except boatman beetles and minnows
A13	TCS	6/18/97	2:01 PM	60	2	H	0	14	12	3	VM	1A	eggs	100+H		shallow, open water	ephemeral pond in burn site
A13	TCS	7/28/97	3:10 PM	30	1	H	0	25.5	24	1	W		100+T	100+T		Small pond on the top of the burn site; sampled previously.	Burn Site
A14	TCS	6/18/97	4:00 PM	60	2	H	0	13	11	3	VM		2A	100+H		shallow, open water	ephemeral pond beside road
A15	TCS	6/18/97	4:32 PM	60	2	H	0	13	11	3	VM					dry grassland	slight hill beside forestry camp site
A16	TCS	6/18/97	8:47 PM	60	2	H	0	12	14	2	VM			1A, 100+H		shallow, open water low shrub fen-willow and birch	ephemeral pond adjacent to the road
A17	TCS	7/26/97	4:25 PM	60	1	H	0	21		2	W					Sedge meadow, wet with some standing water; followed small backchannel to northeast and followed shoreline.	Lake listed for fish enhancement north of Wolftrap Lake
A18	TCS	7/26/97	5:15 PM	45	1	H	0	21		2	W					Sedge meadow, wet with some standing water; searched small tributary, checked small ephemeral pond and flipped cover objects.	Lake listed for fish enhancement south of Wolftrap Lake
A19	TCS	7/27/97	2:30 PM	60	1	H	0	25.5	24	1	W		1A		12L	Small ephemeral pond in the ditch of the road: disturbed site with black plastic remnants.	Burn Site
A20	TCS	7/28/97	1:15 PM	120	1	H	0	19	22	2	W		4A, 100+T	1A, 1000+T		Very productive shallow lake.	Shallow T-shaped Lake southeast of Fish Lake
A21	TCS	7/28/97	2:40 PM	60	1	H	0	20		1	W		50+T, 5J, 1A		3A (1A colour morph)	Shallow ephemeral pond below mineral lick site.	Ephemeral pond east of Fish Lake and below min
A22	TCS	7/28/97	8:18 PM	60	0	H	0	13	19	2	W					Shallow open water; well vegetated pond; also searched small tributary.	Edge of lake north of Prosperity Camp

Location	Method	Date	Time	Interv.	C.C.	C.	P.	°C Air	°C Water	W.	M.C.	Unk. Frog	A-RAPR	A-BUBO	A-AMMA	Habitat Type	Site description
A23	TCS	7/29/97	1:15 PM	60	4	L	0	16	14	4	W					Wet sedge fen/low scrub carr-transect run for 600m.	Small pool off of Vick Lake Road
A24	TCS	7/29/97	3:32 PM	60	4	L	0	16	15	4	W				19L	Shallow, open water; small breeding pond, surrounded by volcanic rock.	Site off of Vick Lake Road at km 8
A30	TCS	7/28/99	12:41 PM	60	3	H	0	23	19	3						WM3a shrubby wetland unit – flooded with ave. 60 cm water	South end of Big Onion Lake, TEM polygon #1230
A31	TCS	7/28/99	2:00 PM	60	3	VH	0	23	20	5				1T	4H	Beaked sedge fen wetland with up to 4 feet of water	South end of Big Onion Lake, TEM polygon #1188
A32	TCS	7/28/99	3:12 PM	60	3	VH	0	21	20	5				1A	3H	Beaked sedge fen wetland with up to 4 feet of water	South end of Big Onion Lake, TEM polygon #1188
A33	TCS	7/28/99	4:12 PM	60	3	VH	0	20	20	5						Beaked sedge fen wetland with up to 6 ft open water in centre	South end of Big Onion Lake, TEM polygon #1188
A34	TCS	7/28/99	5:45 PM	60	3	VH	0	20	19	3					7H	Beaked sedge fen wetland with up to 5 ft of water in centre	South end of Big Onion Lake, TEM polygon #1185
A35	TCS	7/29/99	9:25 AM	60	2	H	0	18	17	2			53T		9H	Grassy and rocky shoreline of a beaver pond – water to >6ft	East of Big Onion Lake, TEM polygon #1277
A36	TCS	7/29/99	11:00 AM	60	2	H	0	22	19	1				1T	5H	Shoreline of Little Onion Lake	North end of Little Onion Lake, TEM polygon #1222
A37	TCS	7/29/99	3:40 PM	60	2	H	0	25	21	1					2H	Beaked sedge fen shoreline wetland – flooded to 3 ft water	Wasp Lake, TEM polygon #1028
A38	TCS	7/29/99	4:20 PM	60	2	VH	0	25	20	2						Beaked sedge fen shoreline wetland – flooded to 3 ft water	Wasp Lake, TEM polygon #928
A39	TCS	7/30/99	8:40 AM	60	2	VH	0	18	16	1						Beaked sedge fen shoreline flooded up to 3 ft water	Mocha Lake, north of Little Onion Lake, TEM polygon #1221
A40	TCS	7/30/99	9:40 AM	60	2	VH	0	18	16	1						Beaked sedge fen wetland adj to small lake surrounded by forest, up to 4 ft of water	TEM polygon #1220
Array A	PITFALLS	6/12/97	5:30 PM	1 night	2	H	0	22		2	M					low shrub fen-willow and birch	Trap set A
Array A	PITFALLS	6/13/97	4:51 PM	1 night	1	H	0	19		3	D					medium shrub carr-willow	Trap set A
Array A	PITFALLS	6/14/97	4:09 PM	1 night	3	H	0			1	D						
Array A	PITFALLS	6/15/97	6:52 AM	1 night	3	H	0	14		1	D						
Array A	PITFALLS	6/16/97	4:45 PM	1 night	4	M	0	11		3	D						
Array A	PITFALLS	6/17/97	7:40 PM	1 night	1	H	0	14		2	D						
Array A	PITFALLS	6/18/97	4:20 PM	1 night	2	H	0	12		2	D						
Array B	PITFALLS	6/13/97	5:30 PM	1 night	2	H	0	19		0	D						Trap set B

Array B	INCIDENT	6/13/97	2:10 PM		2	H	0	19		0	D			1J		low shrub fen-willow and birch	found toad in mud on shore of Fish Creek
Array B	PITFALLS	6/14/97	3:54 PM	1 night	3	H	0			1	D						
Array B	PITFALLS	6/15/97	5:30 PM	1 night	3	H	0	14		1	D						
Array B	PITFALLS	6/16/97	4:55 PM	1 night	4	M	0	11		3	D						
Array B	PITFALLS	6/17/97	7:41 PM	1 night	1	H	0	14		2	D						
Array B	PITFALLS	6/18/97	4:45 PM	1 night	2	H	0	12		2	D						
B02	INCIDENT	6/12/97	11:30 PM		1	H	0	7		1	VM			1A		low shrub fen-willow and birch in creek-shallow water	swimming across creek at bat net

LEGEND TO APPENDIX A:

Interv. = Interval (person minutes)
C.C. = Cloud Cover
C. = Ceiling
P. = Precipitation
C Air = Air temperature in celcius
C Water = Water temperature in celcius
W. = Wind (Beaufort Scale)
M.C. = Moisture Class

Unkn. Frog = Unknown Frog species
A-RAPR = Spotted Frog (*Rana pretiosa*)
A-BUBO = Western Toad (*Bufo boreas*)
A-AMMA = Long-toed Salamander (*Ambystoma macrodactylum*)

APPENDIX 5: INVENTORY DATA – 1997-1998

APPENDIX 6: BAT INVENTORY DATA - 1997

Table 1: Summary of Bat Species Captured for the Prosperity Project Area, June and July, 1997.

BAT ID.	CAPTURE DATE	CAPTURE LOCATION*	SPECIES	FOREARM LENGTH (MM)	WEIGHT (G)	SEX	REPRO. CONDITION
01 - 1	06/11/97	B02	M-MYLU	37.0	6.2	M	ADULT
02 - 2	06/11/97	B02	M-MYLU	36.3	6.5	M	ADULT
03 - 3	06/11/97	B02	M-MYLU	37.0	6.1	M	ADULT
04 - 1	06/12/97	B02	M-MYLU	37.5	7.5	M	ADULT
05 - 2	06/12/97	B02	M-MYLU	38.9	9.0	F	PREGNANT
06 - 3	06/12/97	B02	M-MYLU	37.2	7.5	F	ADULT
10 - 1	07/26/97	B02	M-MYLU	36.7	7.0	F	ADULT
11 - 2	07/26/97	B02	M-MYLU	37.1	8.0	F	POST-LACTATING
12 - 3	07/26/97	B02	M-MYLU	37.7	8.5	F	POST-LACTATING
13 - 4	07/26/97	B02	M-MYLU	37.2	7.5	F	POST-LACTATING
14 - 5	07/26/97	B02	M-MYLU	39.2	9.0	F	POST-LACTATING
15 - 1	07/27/97	B02	M-MYLU	36.5	8.0	M	ADULT
16 - 2	07/27/97	B02	M-MYLU	37.4	7.0	M	ADULT
17 - 3	07/27/97	B02	M-MYVO	37.2	8.5	F	ADULT
18- 4	07/27/97	B02	M-MYLU	39.1	8.5	F	ADULT
19 - 5	07/27/97	B02	M-MYLU	38.0	7.5	M	ADULT
20 - 6	07/27/97	B02	M-LANO	43.1	13.0	M	ADULT
07 - 1	06/13/97	B03	M-MYLU	38.0	8.0	M	ADULT
08 - 2	06/13/97	B03	M-MYLU	35.7	6.5	M	ADULT
09 - 1	06/14/97	B04	M-MYLU	37.8	9.0	F	ADULT
21 - 1	07/29/97	B05	M-MYEV	37.2	7.0	M	ADULT
22 - 1	07/31/97	B05	M-MYEV	39.3	6.5	F	ADULT

M = Mammal
MYLU = *Myotis lucifugus*
MYVO = *Myotis volans*
LANO = *Lasionycteris noctivagans*
MYEV = *Myotis evotis*

F = Female
M = Male
B = Bat Survey Site followed by ID#

Table 2: Summary of Peterson Bat Detector Data for the Prosperity Project.

DATE	SAMPLING LOCATION	FREQUENCY	#OF SEPARATE PASSES HEARD*	#OF SEPARATE BUZZES HEARD	BAT SPECIES
June 10, 97	B01	30	8	0	M-EPFU
June 10, 97	B01	40	11	0	M-*Myotis* spp.
June 11, 97	B02	20	1	0	M-LANO
June 11, 97	B02	30	30	10	M-EPFU
June 11, 97	B02	40	109	13	M-*Myotis* spp.
June 12, 97	B02	30	12	5	M-EPFU
June 12, 97	B02	40	13	6	M-*Myotis* spp.
July 26, 97	B02	20	3	0	M-LANO
July 26, 97	B02	30	3	1	M-EPFU
July 26, 97	B02	40	121	75	M-*Myotis* spp.
July 27, 97	B02	20	3	0	M-LANO
July 27, 97	B02	30	24	9	M-EPFU
July 27, 97	B02	40	90	52	M-*Myotis* spp.
July 30, 97	B02	20	8	0	M-LANO
July 30, 97	B02	30	24	5	M-EPFU
July 30, 97	B02	40	9	3	M-*Myotis* spp.
June 13, 97	B03	30	3	0	M-EPFU
June 13, 97	B03	40	3	0	M-*Myotis* spp.
June 14, 97	B04	20	1	1	M-LANO
June 14, 97	B04	30	14	14	M-EPFU
June 14, 97	B04	40	35	16	M-*Myotis* spp.
June 15, 97	B05	40	7	5	M-*Myotis* spp.
July 29, 97	B05	30	1	0	M-EPFU
July 29, 97	B05	40	9	3	M-*Myotis* spp.
July 31, 97	B05	30	1	0	M-EPFU
July 31, 97	B05	40	1	0	M-*Myotis* spp.
June 16, 97	B06	40	9	3	M-*Myotis* spp.
June 17, 97	B07	40	1	0	M-*Myotis* spp.
July 28, 97	B10	40	19	14	M-*Myotis* spp.

*Number of separate passes does not represent number of different bats because the same bat could have made several passes, but at different times of the sampling period.

Key to Table 2

M = Mammal
LANO = *Lasionycteris noctivagans*
EPFU = *Eptesicus fuscus*
F = Female
M = Male
B = Bat Survey Site followed by ID#

Table 3: Sampling Locations, Netting Effort and Number of Bats Captured for the Prosperity Project Mine Site Study Area in 1997.

DATE	SAMPLING LOCATION	UTM COORDINATES	NETTING EFFORT	TEMP.* °C	NUMBER OF BATS CAPTURED
June 10	B01 - Fish Creek (50 m north of Prosperity Camp)	456350; 5701250	6 m long over creek, 6 m long along creek	6.5 / 2.5	0
June 11	B02 - Fish Creek (1 km south of Prosperity Camp)	456500; 5700500	9 m long over beaver pond, 9 m long along beaver pond	14.0 / 8.0	3
June 12	B02		9 m long over beaver pond, 9 m long over beaver pond	9.0 / 6.0	3
July 26	B02		2 x 9 m long stacked over beaver channel, 6 m upstream of stacked 9 m over beaver channel, 6 m and 9 m along shoreline and over beaver pond, respectively, in an 'L' configuration	11.0 / 6.0	5
July 27	B02		2 x 9 m long stacked over beaver channel, 6 m upstream of stacked 9 m over beaver channel, 9 m over beaver pond, 42' long and 6 m long net over bend in beaver pond	10.5 / 6.0	6
July 30	B02		2 x 6 m stacked in riparian area over Fish Creek, 2 x 9 m stacked over beaver channel, 9 m over beaver channel, 42' long over beaver pond	9.0 / 2.5	0
June 13	B03 - SE. mouth of creek, SE edge of Fish Lake, 2 km from Prosperity Camp	458400; 5699700	42' long along flyway, 2 x 9 m long stacked over shrubs, 6 m long perpendicular to stacked net, 9 m long along forest edge with a perpendicular 6 m net.	9.5 / 5.0	2
June 14	B04 - S. end of Fish Lake	458200; 5698500	42 ' long across mouth of Fish creek inlet, 9 m long below 42' net, 2 x 6 m long in 'L' configuration along shore of Fish Lake, 2 x 9 m long stacked along shore	8.0 / 5.0	1
June 15	B05 - on Fish Creek, SE of the junction of Fish Creek and Taseko River	452600; 5704100	2 x 9 m stacked along Fish Creek, 2 x 6 m long over Fish Creek, 9 m long in forest clearing, 9 m long in flyway, 42' long in forest clearing.	9.0 / 2.0	0
July 29	B05		2 x 6 m long stacked over Fish Creek, 9 m long along Fish Creek, 42' long net over Fish Creek downstream of stacked 6 m, 9 m long net in clearing	11.5 / 7.0	1
July 31	B05		2 x 6 m stacked over Fish Creek, 2 x 9 m along Fish Creek, 42' in roadway, 6 m long over Fish Creek	9.0 / 3.5	1
June 16	B06 - SE. end of Wasp Lake	461650; 5693100	6 m across road, 6 m over Wasp Lake edge, 9 m over grassy clearing, 42' over grassy clearing, 2 x 9 m long stacked along Wasp Lake edge.	7.0 / 5.0	0

DATE	SAMPLING LOCATION	UTM COORDINATES	NETTING EFFORT	TEMP.* °C	NUMBER OF BATS CAPTURED
June 17	B07 - 1.5 km N of Prosperity Camp in beaver ponds W. of old helipad	455700; 5701900	2 x 6 m over channel in 'L' shape, 42' long over beaver pond, 9 m long along channel, 2 x 9 m long stacked over grassy meadow.	5.0 / 5.0	0
June 18	B08 - 17 km north of Prosperity Camp, E. of Vick Lake	456700; 5710600	no nets set up	6.0 / 5.0	0
July 28	B09 - Small pond East of Cone Hill.	458200; 5707500	2 x 9 m stacked over stream channel, 42' long over meadow, 2 x 6 m stacked part way into beaver pond, 9 m long over meadow	14.0 / 6.0	0

*Temperature represents temperature at the start of the netting session, followed by the temperature at the end of the netting session.

APPENDIX 7: WINTER SURVEY DATA – 1997-1998

APPENDIX 8: POTENTIAL FOR RED AND BLUE LISTED TERRESTRIAL VERTEBRATES ALONG THE TRANSMISSION LINE CORRIDOR.

RARE / VULNERABLE WILDLIFE	PROBABILITY OF OCCURRENCE	COMMENTS/ HABITAT PREFERENCES
Generalized map of areas:	high: 3,849 ha moderate: 2,736 ha	
Actual occurrences	Along corridor: none	
SPECIES COMMON NAME (Red-listed species in boldface)		
Great Basin Spadefoot Toad	(5) Very unlikely	Ponds, rain filled depressions within semiarid sagebrush or grassland areas, or open forest with sandy soil. No suitable habitats observed along lines to date.
Rubber Boa	(4) Possible	Steep rocky areas, talus for sunning, wintering, hunt in low elevation open grasslands. Records from along the Fraser River n this area
Painted Turtle	(4) Possible	Not on tracking list but is a small possibility towards eastern end of both routes, in suitable ponds and lakes
Western Grebe	(5) Breeding unlikely	Very localized breeding; 4 active localities known in B.C. Used to nest on Williams Lake but have disappeared.
American White Pelican	(2)Probable for feeding (6) No potential for breeding. Closest feeding records are from around Alkali Lake. Pelicans could potentially feed occasionally at larger fish-bearing lakes.	Need shallow lakes well stocked with fish for foraging; will forage up to 150km from nesting colony. In B.C. nest only at Stum Lake.
American Bittern	(3) Likely in the larger wetland areas	Wetlands and riparian sites, with cattails, bulrushes, sedges, willows. Five breeding locations known for the Cariboo-Chilcotin
Great Blue Heron	(3) Likely to feed and (4) possible to breed near/within corrridor habitat	Nesting in large Fd, Pl and deciduous. Three nesting colonies confirmed in the Cariboo region.
Swainson's Hawk	(4) Possible	Hunt in open grasslands and mountain slopes - eat small mammals, grasshoppers. Use lower elevation grasslands with tree groves nearby for

		nesting.
American Peregrine Falcon	(3) Likely to hunt within or near trans line study area (recorded breeding at Williams Lake)	Nest on high cliffs above rivers and lakes, feed on small and mid sized birds, ep. Waterfowl, shorebirds
Prairie Falcon	(3) Likely to hunt within corridor (5) Nesting unlikely as approp. cliffs habitat is not present	Not on tracking list, but nest on steep cliffs along river canyons, with grasslands below; forage in extensive open country. Use cliffs along Chilcotin and Fraser Rivers.
Sharp-tailed Grouse	(4) Possible	Open grasslands, riparian areas, recent clearcuts. Nest in grass or under shrubs.
Sandhill Crane	(3) Likely to occur periodically; some breeding possible in larger wetland areas (check Jamieson Meadows, Kloatut Lake) but no known records	Marshes, swamps, bogs, meadows. Sensitive to disturbance.
Upland Sandpiper	(4) Possible	Grasslands, usually above 700m, for nesting and on migration - forage for grasshoppers etc. very secretive
Long-billed Curlew	(1) Known to occur on east side of Fraser River grassland plateaus	Grasslands, meadows, hayfields. Prefer large tracts open grassland. Mainly feed on insects. Most birds in province are in the Cariboo-Chilcotin area.
Flammulated Owl	(2) Likely around forested habitat adjacent to Fraser River	Mature, open Fd forests, especially slopes above open grasslands. Use old woodpecker cavities.
Short-eared Owl	(2) Probable	Hunt and breed in open habitats, fiels, grasslands, meadows; nest on ground in shrubby grass fields adjacent to grasslands.
White-throated Swift	(4) Foraging possible (5) Unlikely for breeding – approp. nesting habitat not present	Nest in colonies in cracks, crevices in cliffs, rock walls, usually over a large river. Feed along canyons, over rivers, lakes.
Lewis' Woodpecker	(1) Known to occur on east side of Fraser River grassland plateaus	Use solitary, large diameter dead Fd trees for nesting within open grasslands for foraging. Feed on insects, fruit. Cottonwood riparian habitat is also used for nesting and foraging.
Sagebrush Brewer's Sparrow	(5) Very unlikely to occur	Open brushlands - medium to high density sagebrush preferred for nesting and foraging; southeast facing slopes best
Yellow-breasted Chat	(5) Very unlikely to occur	Not on tracking list. Shrubby habitats, wet areas near streams, ponds, also old clearings, fields. Nests in aspen, brush

Sprague's Pipit	(4) Possible	Not on tracking lists. Occasional sightings for the Cariboo region, but not seen every year.
Bobolink	(4) Possible	Tall grass, sedge meadows, uncut fields - feed on insects, grass seeds etc.
Pallid Bat	(6) Very unlikely	Feeds in grasslands, parkland, forest, wetland and riparian areas. Roosts in warm aspect cliffs and rock outcrops, talus. Out of normal range in study area.
Spotted Bat	(2) Probable	Roost in steep high cliffs within a few km of feeding areas - riparian, marshes, fields, open forest.
Western small-footed Myotis	(2) Probable	Dry interior valleys, roosts in crevices in talus, caves, cliffs, rocks, mines especially where near to lakes. Forage over grasslands, wetlands, riparian areas, open forests.
Fringed Myotis	(4) Possible	Arid grasslands. Roost in rock crevices, caves, buildings, trees, mine tunnels. Feed over grasslands, Fd forests, wetlands.
Townsend's Big-eared Bat	(2) Probable	Feed over grasslands, parkland, forest, wetland and riparian areas. Roost in buildings, tunnels, caves. Coastal forests and arid grasslands.
Wolverine (*luscus* subsp.)	(4) Possible	Likely to occur occasionally on either route - quality of ungulate winter ranges will be main feature
Fisher	(2) Probable	May occur but probably very limited by lack of old-growth forests
Badger	(4) Possible	Possible towards eastern end corridor
Grizzly Bear	(4) Possible	Likely to occur occasionally but no significant grizzly habitat is present
California Bighorn Sheep	(1) Known to occur	Herds located near Fraser River where security habitat and winter range area present.
Woodland Caribou	(6) No potential for occurrence	Generally out of the known ranges

Known (1), Probable (very likely) (2), Likely (3), Possible (4), Unlikely (5), and No potential (6)

SUMMARY OF SMALL MAMMAL INFORMATION COLLECTED

SPECIES – COMMON NAME	# RECORDS/ OBSERVATIONS 93-96 (hkp)	COMMENTS	1997 program	Other records
Shrews	1 S. cinereus trapped, aug 96; 1 noted in July 1996	In sedge meadow near small lake	Shrews were seen running along the road by the Fish Lake recreation area on two occasions, but could not be identified to species. Their tracks/trails were also noted in the fine dust along the roadsides.	
Snowshoe Hare	c.40 records with up to 5 animals; Taseko log >30 records	Almost all in Pl stands, often in young stands, occasionally in wetlands Lots of winter tracks	>100 form winter ground surveys, a couple of visuals only, mostly tracks	
Common Pika	1 1, aug 96, now out of area (nr Big Lk)	Call noted from lava cliffs near camp.	Cava cliff area searched but no sign found	
Southern Red-backed Vole	2 trapped aug 96			
Meadow Vole	4 records 1 trapped aug 96	3 visuals, 1 nest, al lin meadows, scrub birch		
Muskrat	2; 1 in Taseko log records		Observed in wetlands near outlet from Fish Lake, north of Lake	
Beaver	Numerous records >100 of up to 5	Numerous dams and cut trees along Fish Creek,		

	individuals? Many in Taseko log	north and south of camp. Also Little Fish Lake area, Vick Creek. Throughout in suitable habitats. A few lodges.		
Bushy-tailed Woodrat	1 record 1 in Taseko log, at camp	1 nest in cave above camp search in 1997 found no remaining sign of this		
Deer Mouse	1 2 trapped aug 96, +3 1 in Taseko log; lots in buildings mentioned	At camp – killed by cat		
Unidentified Mouse	5	Sign only		
Porcupine		All sign		
Yellow pine Chipmunk	c.15 records, 1 to 2 animals each time Taseko log has 1 northwestern recorded and 6 unidentified records of up to 2	Wide variety habitats	4 winter track records	
Red Squirrel	Numerous (>130), up to 4 individuals Taseko log - >30	Middens, calls, some visuals and feeding sign. All kinds of forest, especially Pl Sheperdia and Pl aspen.	A little under 100 winter records form ground surveys	
Western Jumping Mouse	1 trapped aug 96			

SUMMARY OF CARNIVORE INFORMATION COLLECTED

SPECIES OR GROUP	# RECORDS/ OBSERVATIONS	COMMENTS	1997 Program	Other records
Coyote	28, up to 3 animals Taseko log >50, up to 3 animals	HKP – mostly scat, 2 visuals	59 records form winter surveys, mostly tracks	
Gray wolf	5 Taseko log 26 records, up to 7 animals, many visuals	HKP – 2 records 1 animal, Fish Creek; 1 group of 5 SE of Fish Lake; 3 on easat shore Fish Lake, all based on scat, no visuals	3 sets winter tracks single animals only 1 set probable wolf from winter surveys	
Red Fox	2, scat only Taseko log 5 records including 1 visual			
Cougar	Taseko log 4 records 2 of which visual, 1 included 2 sets of tracks			
Lynx	6, including 1 visual Taseko log 19,mostly tracks	HKP notes an active denning area	14 records all of tracks fomr winter gorund surveys	
Bobcat				
Wolverine	Taseko log - 1, no details			

River Otter	Taseko log - 1, family of 3		1 record of possible otter tracks in meaadows north of camp. Uncomfirmed.	
Marten	6, includes 1 visual Taseko log 9, all tracks		11 records all of tracks form winter surveys	
Fisher	1 visual Taseko log 4, all tracks	HKP – I visual in Beece Creek area, 3km east of lodge	4 records from winter surveys, all tracks 1 probablle	
Weasels	1 Ermine visual Taseko log - 2 long-tailed, visuals, 2 unident	HKP – 1 seen at Camp		
Mink				
Black Bear	3 Tasseko log - C30, visuals, often in camp, includes recordsin surroinding areas	2 visuals, 1 scat, 1 male feeding in sedge fen, one cub on warm aspect open pl forest, one in birch willow; sept- tracks near Big Onion Lake		
Grizzly Bear	2 records, sign, tracks 1 more in Sept. Taseko log 9, mostly H8B, tracks usualy, 1 seen by hunter 3 miles east of camp	Digging of ant-hill, north shore Wasp Lake, and tracks, also norht shore Wasp Lake		
Unidentified bear	21 Taseko log - 5	Anted logs, scat, mostly around Fish Lake		

Badger	1 sighting by resident aat lodge			
Unidentified carnivore			Three probabl llynx One mid sized carnivore	

Assorted unidentified small mamals trails – mice.
11 unidentified small mustelids – weasels or mink
1 large canid set – probalby wolf