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Faro Mine Complex Closure Wildlife and Wildlife Habitat Local Study Area Baseline

Prepared for
Faro Project Management Team

Submitted by
Gartner Lee Limited

February, 2008

Gartner Lee

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In association with

Aurora Wildlife Research

February, 2008

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4 Faro Project Management Team

1 Gartner Lee Limited

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Executive Summary

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Baseline wildlife information was summarized for the Faro Project and surrounding area in the Faro Region of east central Yukon Territory. A review of current literature, from published and government sources, and consultation of local authorities was used to assess the distribution and abundance of vulnerable or threatened wildlife species or species of local concern within the study area.

Seven species or species groups occurring within the study area were identified as potential Valued Ecosystem Components (VECs) for baseline study. These species were selected based on several factors including their territorial and federal status, socio-economic value, vulnerability to project effects, and stakeholder concern. These species could be considered as candidate VECs needed for purposes of completing an environmental impact assessment.

VECs identified included thinhorn (fannin) sheep, grizzly bear, moose, woodland caribou, migratory birds, furbearers and small mammals.

Moose densities are relatively high in the Study Area, and thinhorn sheep regularly migrate through the Vangorda/Grum mine infrastructure. Woodland caribou are less common locally, but a portion of winter range of the Tay River herd is relatively close to the Study Area. There is a diversity of birds identified as potentially occurring in the area, and many furbearer species that are trapped likely occur in the area. Several small mammals species have been trapped in the area, and appear relatively common.

The presence of contaminants in wildlife from the Faro Mine is also summarized herein, as were known from a previous study (Gartner Lee Limited 2006). High elevations of levels of lead are present in red-backed voles and shrews, and moderately elevated levels of copper, iron, thallium and nickel were also observed in most small mammals. Among hunted and trapped wildlife, elevations of lead were found in caribou, American marten, willow ptarmigan, and beaver. Moderate elevations were also detected for mercury and selenium in American marten, willow ptarmigan, and moose.

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1. Introduction

The diversity, distribution and migration patterns of wildlife play an important role in ecosystem function. Wildlife abundance and distribution on the land are influenced by habitat patterns, climate, forage, terrain, and predator-prey relationships.

The objectives of the wildlife baseline assessment for the Closure and Reclamation Plan for the Faro Mine Complex (the Project) are to identify the current baseline condition of wildlife. In particular, those conditions include population, distribution, abundance, migration patterns (at a local scale), and baseline contaminants presence (although earlier work has documented contaminants presence in wildlife from the Faro Mine Complex in detail [Gartner Lee Limited 2006]).

The environmental assessment of the effects of the Project will then:

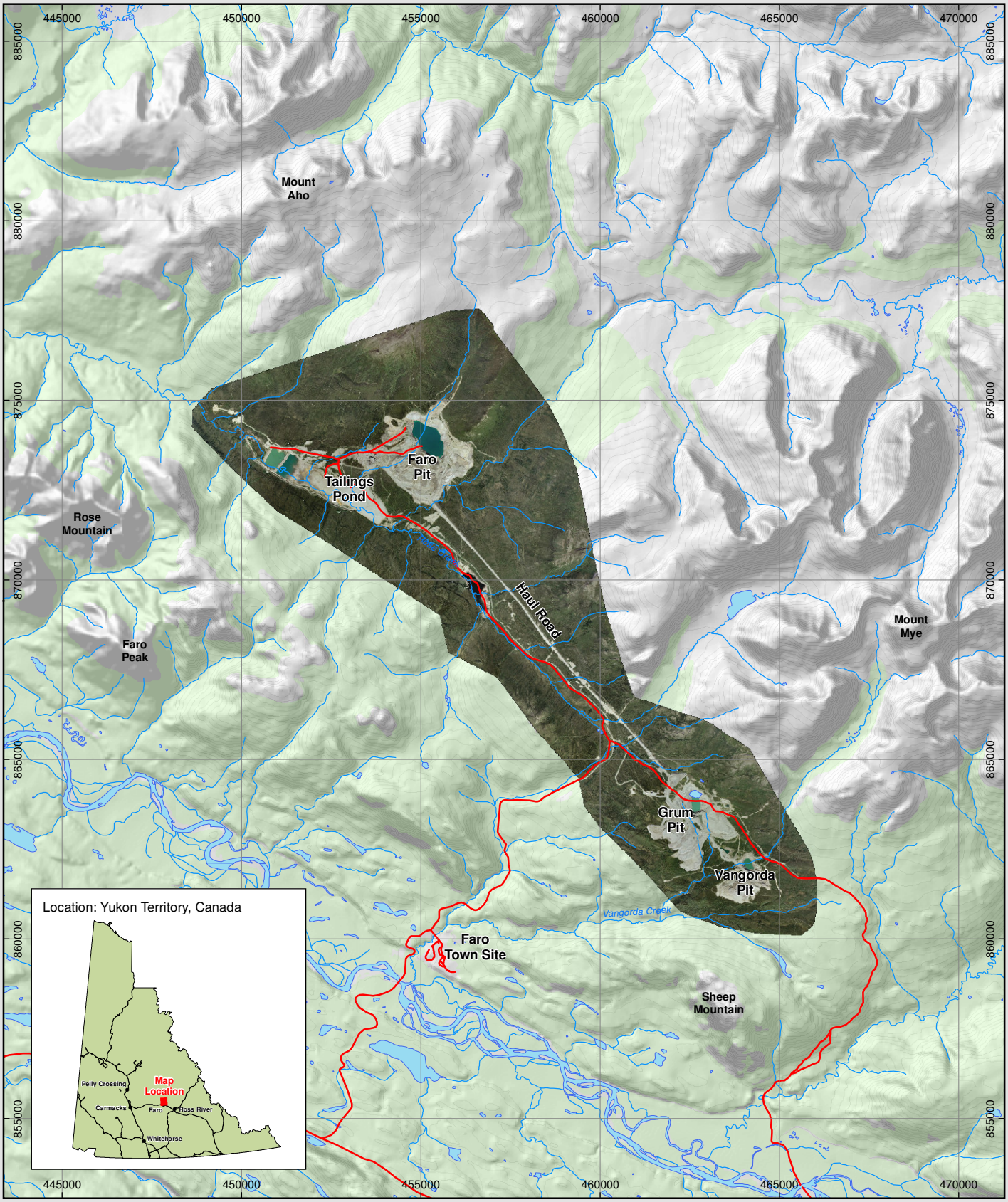
- identify effects of the Project on the baseline condition of identified wildlife;
- identify mitigation measures;
- evaluate the predicted residual effects and their significance; and
- identify wildlife monitoring requirements.

1.1 Regional Setting

The Faro Mine Complex is located within the Yukon Plateau-North Ecoregion, in the Boreal Cordillera Ecozone of the Yukon (Environment Canada 2005). Vegetation is predominantly white spruce with willow, dwarf birch, ericaceous shrubs, and occasionally, lodgepole pine. Characteristic wildlife includes woodland caribou (*Rangifer tarandus caribou*), grizzly bear (*Ursus arctos*), black bear (*Ursus americanus*), thinhorn sheep (*Ovis dalli*), moose (*Alces alces*), beaver (*Castor canadensis*), red fox (*Vulpes vulpes*), wolf (*Canis lupus*), snowshoe hare (*Lepus americanus*), common raven (*Corvus corax*), rock and willow ptarmigan (*Lagopus muta* and *L. lagopus, respectively*), and golden eagle (*Aquila chrysaetos*). Many wildlife species are important in the area for both economic and socio-economic reasons. Major communities in the area include Faro, Keno Hill, Mayo, and Ross River (Figure 1.3-1; Environment Canada 2005).

1.2 Issue-Focused Approach

The approach of this baseline documentation was focused to provide information relevant to those issues identified as important to stakeholders in the study area, and issues that may be associated with project impacts. While impact assessment is pending, a preliminary issue identification that considered potential project impacts took place to guide the baseline documentation. Key issues were identified through community meetings and regulatory consultation with First Nations (Selkirk First Nation and Ross River Dena Council), the Town of Faro, Government of Yukon biologists, local residents, and scientific opinion of Project scientists.



Map Sources/Notes:
National Topographic Database (NTDB) provided by the Government of Canada, Natural Resources Canada at 1:50,000 scale.
Hillshade imagery obtained from the Yukon Department of Environment, Information Management & Technology Department.
Orthophoto produced from 1:40,000 aerial photography (Aug. 9, 2003)

N
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E
S

0.5 0 0.5 1 1.5 2 2.5 3 3.5 4 Km

1:150,000

NAD 27, Zone 08

Legend

Existing Features
- Community
- Road

Elevation Contours
- Contour interval (100m)

Hydrological Features
- Watercourse
- Waterbody

Boundaries
- Vegetation

Faro Project
Wildlife

Project Location

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Figure 1.2-1
Version 1

File: 70384 C1 Fig 1.3-1 ProjectLocation 19Feb08.mxd

1.3 Summary of Project Activities/Impacts

There is a range of possible activities associated with the Project that will result in potential impacts to wildlife. These are important to identify early in the baseline documentation and impact assessment process so that information or data necessary to address issues are available. Although a preferred option for closure has not been selected, review of the various alternatives was completed to identify potential project-environment interactions.

Activities associated with the Project that would have the greatest relevance to wildlife include the use of heavy equipment to construct soil or water covers on tailings, relocation of tailings, revegetation of tailings, construction of soil covers and revegetation of waste rock, re-contouring and/or relocation of waste rock dumps, berm and dam construction, and removal of dams, buildings, and roads. Additionally, closure activities will result in increased human presence at the site as well as an increase of traffic to and from the site, and will require activities to manage human-wildlife interactions. An increased population base in the area may also result in more hunting pressure on wildlife species.

The potential impacts to wildlife for Project related activities include sensory disturbance, change in habitat availability, change in mortality risk, and change in contaminant releases. Activities may result in both direct and/or indirect effects. Direct effects are often measured and assessed at the local scale of a project (such as on-site habitat disturbance), while indirect effects are often predicted and measured at a regional scale (such as habitat change due to sensory disturbance [noise or dust], or changes in hunting pressure due to increased community populations).

1.4 Preliminary Wildlife Concerns and Issues

Preliminary issue identification has taken place, and is provided below for a context in understanding the focus of baseline efforts to date. The issues below are preliminary, and reflect the issues anticipated from First Nations (Selkirk First Nation and Ross River Dena Council), the Town of Faro, and governmental agencies (such as Health Canada, Government of Yukon, Environment Canada, etc.)

1.4.1 Anticipated Issues from Communities and First Nations

Wildlife Contamination:.....quality and health of country food sources

Moose Populations:.....impacts to the abundance and distribution of moose

Sheep Populations: .....impacts to the abundance and distribution of sheep and impacts to migratory routes

Furbearing Species: .....impacts to the abundance and distribution of furbearing species

1.4.2 Anticipated Issues from Regulators

Wildlife Contamination:.....quality and health of country food sources

Migratory Birds and Waterfowl: .impacts to abundance, distribution and migration of birds.

Species at Risk Impacts:.....impacts to abundance, distribution, and migration of any Species at Risk

Problem Wildlife Management: ..mortality risk to grizzly and black bears, wolverine, foxes and wolves.

Sheep Populations: .....impacts to abundance, distribution, and migration, and mortality risk of sheep

Caribou Populations:.....impacts to abundance, distribution, and migration, and mortality risk of caribou

Moose Populations:.....impacts to abundance, distribution and mortality risk of moose

Small Mammals:.....the impacts to abundance and distribution of small mammals

2. Valued Ecosystem Components

Valued Ecosystem Components (VECs) can be defined as environmental attributes or components that are perceived as important for ecological, social, cultural, and/or economic reasons. The intent of selecting VECs is to focus the baseline programs (and subsequent impact assessment) on those species or species groups that are most closely associated with the issues identified by communities, First Nations, and/or regulators. Several species of mammals, birds, and amphibians may occur in the Project area on a year-round or seasonal basis. Preliminary VECs for this project were selected by incorporating information from numerous sources and considering a number of criteria, including:

- the legal status of the species at the Federal and Territorial levels;
- known presence and relative abundance within the study area;
- socio-economic value (hunting, trapping, wildlife viewing, public profile) and regional importance (regional conservation concerns);
- concerns of First Nations, local communities, and regulators;
- the professional judgment of project scientists;
- VECs chosen for previous environmental assessments and current wildlife monitoring programs in the region;
- vulnerability to potential project effects; and
- the role as an indicator species for a specific wildlife group.

The following is a preliminary list of VECs considered representative of important wildlife species:

- Fannin sheep (thinhorn sheep colour variant)
- Grizzly bear
- Moose
- Woodland caribou
- Furbearers
- Small mammals
- Migratory birds

This list will be finalized through consultation and the collection of Traditional Knowledge data.

Among the VECs identified, moose, furbearers and Fannin sheep were considered especially important for their economic and cultural values, and subsistence harvest uses. It should be recognized that the list of VECs presented herein is preliminary, and further issue scoping and consultation associated with the impact assessment may refine the VECs selected at a later date.

3. Study Area

The Study Area used in this baseline description was limited to the immediate project footprint and surrounding areas (i.e., within a 1 km radius surrounding the site). This area totals 81.2 km^2, of which 16.1 km^2 is made up of the footprint of the current mine infrastructure and roads. The intent of this study area delineation, usually termed a 'Local Study Area' is to capture direct effects on wildlife from the project activities in project impact assessment. Herein, all references to a 'Study Area' refer to this local scale.

Regional scale data collection, description, and assessment were beyond the scope of this work. However, it was necessary to include regional data where feasible and appropriate, primarily to provide a context for local scale data. In most cases, there were no data available that were specific to the local area, and regional scale data were used to form conclusions regarding local conditions.

4. Wildlife Baseline Conditions

4.1 Data Collection Methods

As no project-specific wildlife field studies occurred relating to the baseline, data collection methods were limited to incidental sightings of wildlife during a vegetation classification survey conducted in August of 2007, and the use of existing data sources. Those sources included published literature, government reports, reports from previous studies and Environmental Impact Assessments (EIAs), incidental sightings, and available Community and Traditional Knowledge reports.

4.2 Baseline Conditions

4.2.1 Woodland Caribou

Overview

Both barren-ground and woodland caribou are found within the Yukon. In the Faro area, caribou belong to the Northern mountain population of woodland caribou (*Rangifer tarandus caribou*). The Northern Mountain woodland caribou populations are listed as Sensitive in the Yukon (Canadian Endangered Species Conservation Council, 2006), and federally designated as Special Concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2007); additionally they are listed as Special Concern on Schedule 1 of the *Species at Risk Act (SARA)*. The caribou in the Faro area are likely from the Tay River caribou herd, of the Northern Mountain population. There are three other populations within the Region including the Finlayson herd located southeast of the Study area, the Pelly herd located south of the Study Area and the Moose Lake herd located west of the Study Area.

The Government of Yukon Department of Renewable Resources has formed a Caribou Management Team to develop interim caribou management guidelines for the Yukon. The guidelines outline management principles, concepts and assumptions regarding woodland caribou (Department of Renewable Resources, Government of Yukon 1996a). Commitment to caribou populations within the Faro region is demonstrated in the “Integrated Wildlife Management Plan - Ross River Traditional Territory” (Kaska Dena Traditional Territory, 1997). However, the management plan focuses on the management of the Finlayson caribou herd population rather than the Tay River herd, therefore demonstrating a concern for caribou but not one specific to the Tay River herd. The management plan also presents other caribou concerns, including harvesting parturient wildlife and meat wastage caused by late rut harvesting, untrained hunters or the wrong ammunition.

Population

The total number of woodland caribou in the Yukon is estimated between 30,000 and 35,000 (Department of Renewable Resources, Government of Yukon 1996a). These caribou are found within one of 23 recognized herds in Yukon, whose populations range in size from about 100 to 10,000 (Department of Renewable Resources, Government of Yukon 1996a). Woodland caribou in the Yukon occur at densities well below habitat carrying capacity and are held there by predation and human harvest (Department of Renewable Resources, Government of Yukon 1997a).

The population of the Tay River herd was last estimated to be 3,758 +/- 571 animals, based on a 1991 survey conducted by the Government of Yukon Department of Renewable Resources, (1997a). This equates to approximately 0.15 caribou per square kilometre, although densities are likely much higher on winter ranges where caribou may congregate. An attempt to resurvey the area in 2003 was hampered by poor weather conditions, and no recent estimate is available (J. McLelland, pers. comm. 2007).

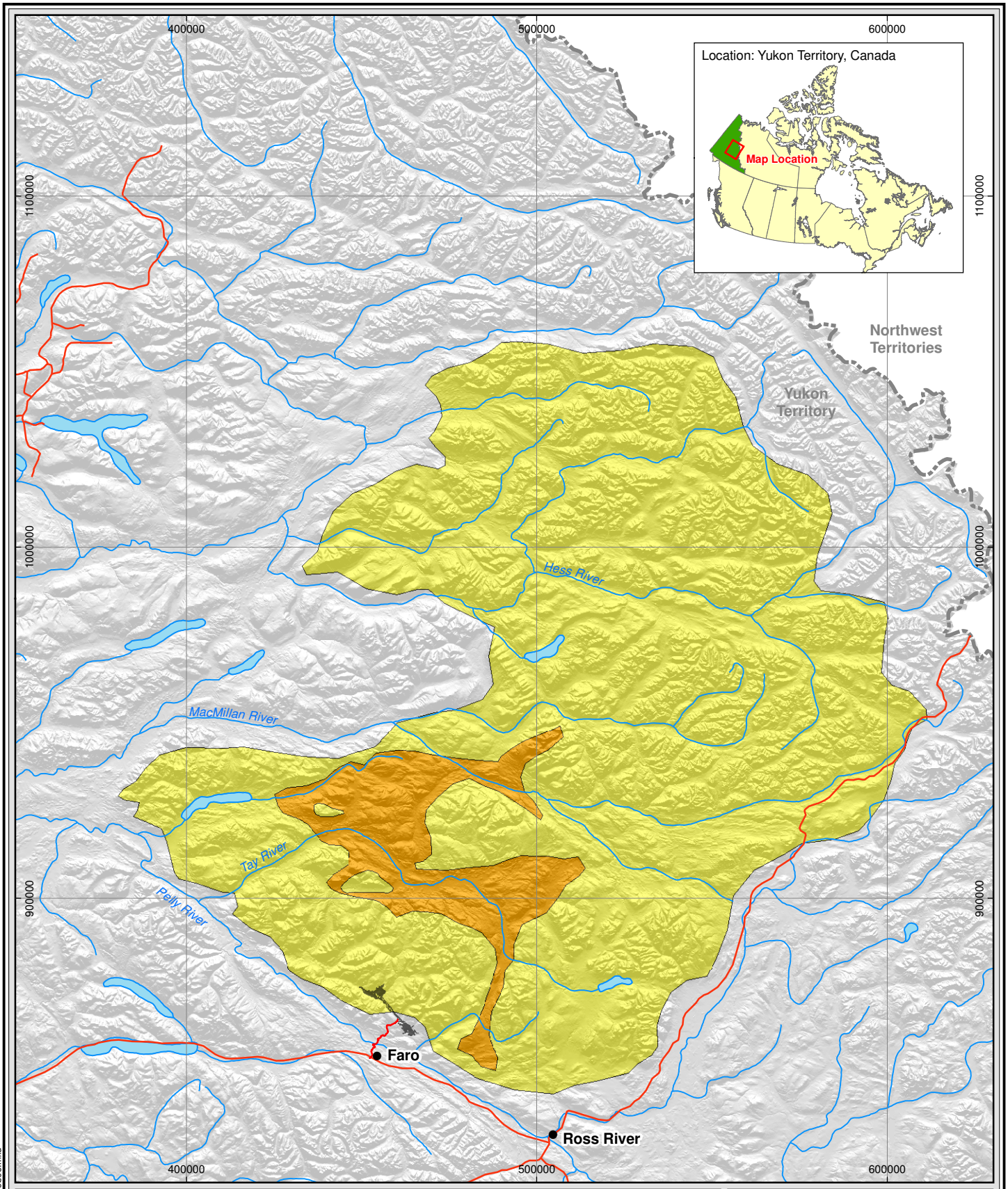
Within the Study Area for this Project, only a handful of caribou are likely found at any time of the year, although the wintering distribution of caribou may result in concentrations of wintering caribou occurring close to the site.

Movements and Distribution

The range of the Tay River herd is approximately 25,000 km^2, covering the area north of the Pelly River, west of North Canol Road and south of the upper Stewart River (Figure 4.2-1; Department of Renewable Resources, Government of Yukon 1997a). The majority of caribou in the Tay River herd are found along the Tay and South Macmillan rivers (Department of Renewable Resources, Government of Yukon 1997a).

Tay River caribou move between winter ranges, and generally non-distinct calving, post-calving, and summer ranges over the course of the year. Cows in the Tay River herd calve and spend the post-calving period over an extensive area (Department of Renewable Resources, Government of Yukon 1997a). Surveys conducted twice a year from 1989 to 1991 found all calving locations for the herd to be located south of the upper Stewart River and north of the Pelly River. No calving locations fell within the Study Area for the project; the closest recorded calving locations were within 50 km of the Project. The Tay River herd's summer and rutting distribution largely defines the outer boundaries of the herd range, and encompasses the Project Study Area.

The winter range for the Tay River herd tends to be in the snow shadow region between mountain ranges where forage is more accessible. Winter distribution is generally characterized by a northward movement out of mountainous areas towards the forested drainages north of the Study Area. The herd's winter range does not encompass the Study Area, however the southwest toe of the winter range falls within close proximity to the Project. During the winter of 1991, a census found a concentration of caribou within 10 km of Faro town site, indicating a potential for wintering caribou to occur within the Study Area.



Map Sources/Notes:
Base data obtained from the Yukon Department of Environment, Information Management & Technology Branch.
Project footprint delineated by Gartner Lee Limited.
Tay river caribou herd range provided by Gartner Lee Limited.
Boundaries are approximate.

N
W
E
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10 5 0 10 20 30 Km

1:1,500,000

Yukon Albers

Legend

Existing Features
- Community
- Road

Tay River Caribou Herd Range
- Herd Range
- Winter Range

Boundaries
- Territorial Boundary
- Project Footprint

Hydrological Features
- Watercourse
- Waterbody

Faro Project
Wildlife

Range of theTay River Caribou Herd

19 February 2008

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Figure 4.2-1
Version 1

File: 70384 C1 Fig 4.2-1 TayRiverCaribouRange 19Feb08.mxd

Harvest

The harvest of caribou from the Tay River herd is relatively low, and is assumed to be limited by access in the fall hunting season. Over the past 16 years, the harvest ranged from 21 to 52 animals annually (Figure 4.2-2), with a mean annual harvest of 35.4 (Department of Renewable Resources, Government of Yukon 1997a; excluding subsistence harvest). This annual harvest is approximately one percent of the population, and is considered sustainable (i.e., <3% of adults, Department of Renewable Resources, Government of Yukon 1996a). Harvest of caribou in fall is typically via spur roads from the North Canol Road, and fly-in hunts based out of Ross River or Faro. Access to the winter range is minimal, and as such First Nation's harvest in winter is assumed to be quite low (Department of Renewable Resources, Government of Yukon 1997a). While harvest of caribou in the Study Area is likely very low, it is a highly accessible area, therefore creating potential for harvest.

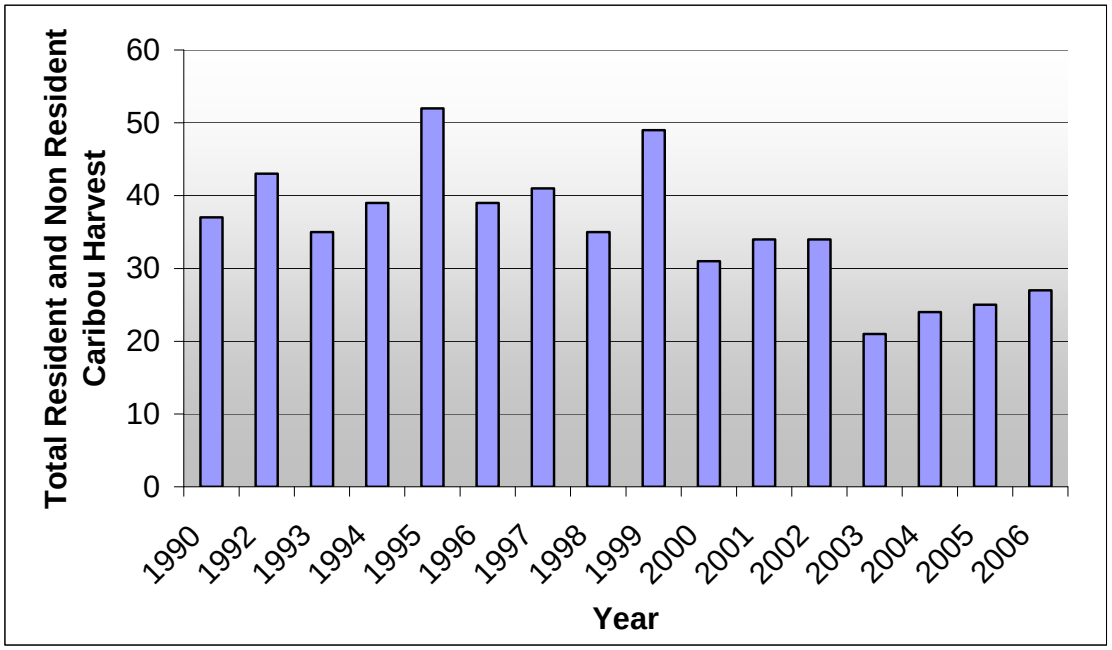


Figure 4.2–2 Harvest of the Tay River Caribou Herd, 1990 to 2006

Habitat Use and Diet

During calving surveys conducted from 1989 to 1996 cows tended to be solitary (Department of Renewable Resources, Government of Yukon 1997a) and most often found in alpine habitats. These same alpine habitats were generally selected during the post-calving season. During the rut, caribou were found in many of the same areas chosen during the summer months, but with a wider distribution. In winter, caribou tended to move out of the alpine and mountainous areas and into

drainages north of Faro. Collared caribou from the Tay River herd were found to be more confined to valley bottoms in late winter than compared with early winter (Department of Renewable Resources, Government of Yukon 1997a).

Spring and summer diets of caribou are generally varied, with use of sedges, forbs, grasses, mushrooms, and most nutrient-rich young shoots of willows, birch, or horsetails (Banfield 1974). Winter food for woodland caribou consists primarily of lichen, and most Yukon herds have about 70% lichen in the diet (Department of Renewable Resources, Government of Yukon 1997a). To date no specific data are available on the diet of caribou in the Tay River herd, however it is likely to be similar to that identified by Banfield (1974).

Summary

The Tay River caribou herd is relatively small and widely dispersed, but appears generally stable in population levels given the current harvest pressure. The Department of Renewable Resources, Government of Yukon (1997a) identified the conservation of the winter range as crucial to the long-term survival of the herd. In consideration of the development of the Mine Closure Project, it expected that a potential increase in hunting pressure (due to potential Community population changes), and potential indirect impacts to the winter range, would necessitate mitigation planning to reduce potential Project impacts.

4.2.2 Moose

Overview

Moose are the largest and one of the most widespread mammals in the Yukon. Currently, moose are listed as Secure in the Yukon (Yukon Wildlife Act 2007), and federally they are listed Not At Risk (COSEWIC 2007; SARA 2007). Moose have high socio-economic value in the Yukon as a game and subsistence species.

The Government of Yukon Department of Renewable Resources has developed interim moose management guidelines for the Yukon (Department of Renewable Resources, Government of Yukon 1996b). The guidelines focus on the protection of key habitats by establishing protected areas through the development and implementation of land use guidelines. The 1996 management plan committed to regular population and composition surveys. The plan also highlights concerns related to over-hunting in high priority areas. The moose populations in and near the Project are considered a high management priority (R. Ward, pers. comm. 2007), although no Key Wildlife Areas have been designated within the Faro area.

Population

Moose populations in the Yukon are managed among Game Management Subzones (GMS), and moose in the Faro area generally occur within GMS's 4-42 to 4-46 (Figure 4.2-3). Compared to

other regions in the Yukon, moose in the Faro area occur at very high densities; approximately 405 moose per 1,000 km^2 (Department of Environment, Government of Yukon 2004). Earlier surveys conducted in 1997 and 1998 limited to a portion of the region documented extremely high densities of moose (Department of Environment, Government of Yukon 1997b, 1998). The 1997 survey documented the highest moose density in the Yukon; 586 moose/1,000 km^2, although the survey area was smaller than that of the 2004 survey. While the actual population of moose in the Study Area is unknown (and may fluctuate during among years), regional data indicates that relative to other parts of the Yukon, high densities of moose are consistently present in the area.

Movements and Distribution

Although moose may use different habitats among seasons, there are no distinct seasonal ranges for moose in the Faro area (R. Ward, pers. comm. 2007). A satellite-telemetry study done in the Faro area (Ward 2003b) found home range among the moose collared spanned from 64 km^2 to 274 km^2, with no obvious relationship between moose sex and home range size. Home range sizes and daily movement distances tended to be greater in the spring/summer period than in the winter period. Moose that summer in the sub-alpine tended to migrate a longer distance in comparison to moose that summer in the lowlands (Ward 2003a).

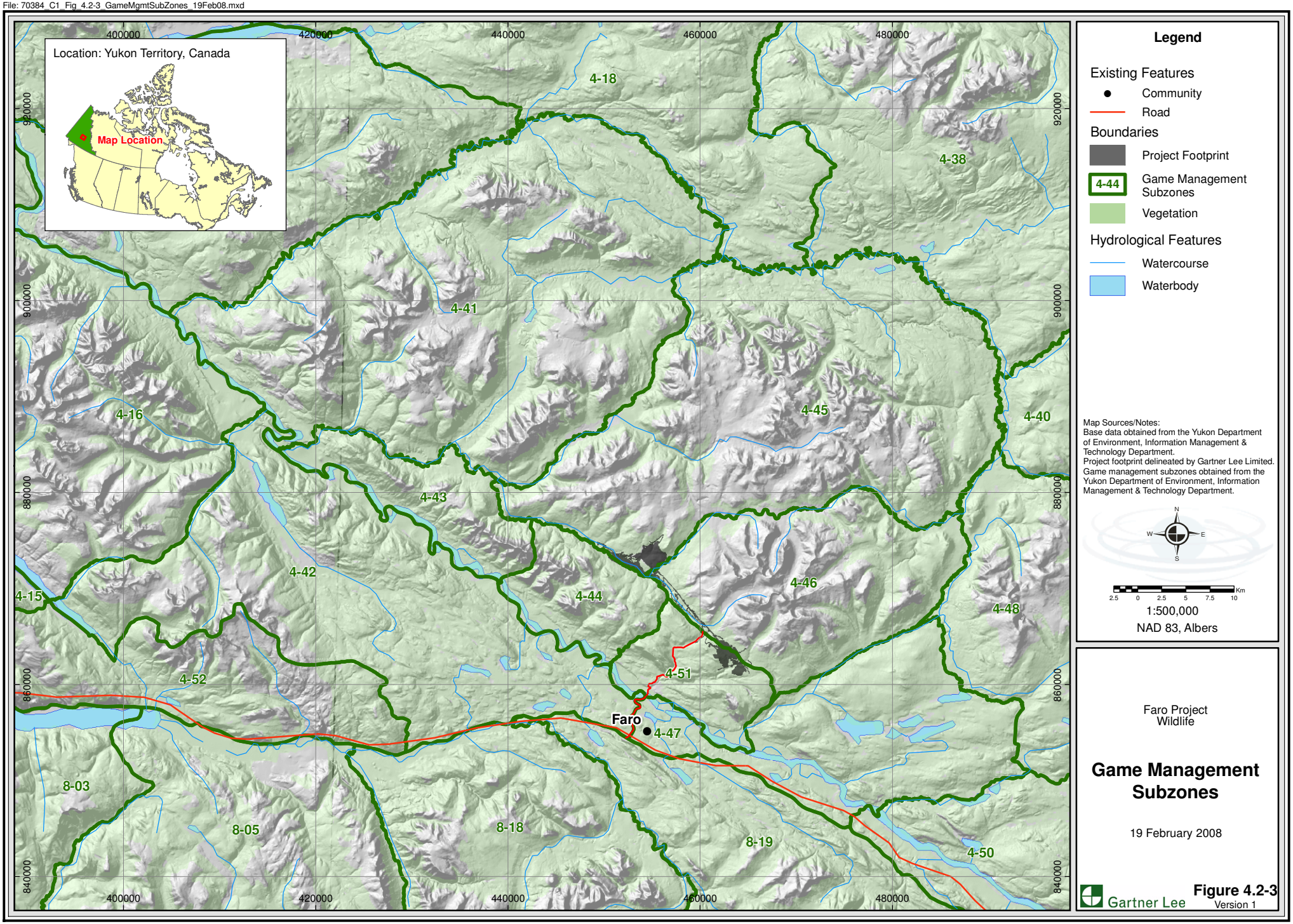
Harvest

The average annual reported harvest in the Game Management Subzones of the Faro region (4-41 to 4-46) is approximately 2% of the estimated moose population within the region. The sustainable range of harvest for moose populations in the Yukon is 3-4% (Government of Yukon Department of Renewable Resources 1996b), and overall harvest throughout the region is estimated to be within sustainable limits. From 1979 to 2006, total harvest (excluding subsistence First Nations harvest and unreported illegal kills and harvest) has averaged 34 moose per year, ranging from 10 to 61 animals (Data provided by Government of Yukon Department of Environment (unpublished data; Table 4.2-1 below).

Table 4.2–1 Total Resident and Non-Resident Moose Harvest in Game Management Subzones near the Faro Mine Area

GMS	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
4-41	1	1	0	4	5	11	9	6	7	11	8	6	8	4	7	3	14	10	15	18	12	9	15	7	2	1	5	4
4-42	1	2	0	5	5	5	5	4	1	2	2	3	5	0	4	0	5	7	6	6	6	3	3	6	5	6	7	4
4-43	1	2	1	1	0	0	1	2	3	1	0	1	2	0	6	1	2	0	1	0	0	1	6	0	1	2	0	0
4-44	1	4	3	6	1	2	7	5	3	7	3	0	1	1	2	1	0	4	9	6	1	6	2	0	1	3	3	2
4-45	3	2	6	5	6	9	5	11	3	6	14	4	7	3	14	10	23	13	19	21	15	20	21	9	21	16	24	36
4-46	2	3	4	8	1	3	1	1	3	4	3	1	1	1	2	6	3	2	4	6	7	0	10	2	6	6	7	3
4-47	0	2	1	5	4	3	1	0	0	2	5	2	5	1	3	2	1	2	3	4	1	1	1	2	2	4	4	3
4-51	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	1	0
Total	**10**	**17**	**15**	**35**	**22**	**33**	**29**	**29**	**20**	**33**	**36**	**20**	**31**	**12**	**41**	**25**	**48**	**38**	**57**	**61**	**42**	**40**	**58**	**26**	**38**	**38**	**51**	**52**

File: 70384_C1_Fig_4.2-3_GameMgmtSubZones_19Feb08.mxd



Legend

Existing Features
- Community
- Road

Boundaries
- Project Footprint
- 4-44 Game Management Subzones
- Vegetation

Hydrological Features
- Watercourse
- Waterbody

Map Sources/Notes:
Base data obtained from the Yukon Department of Environment, Information Management & Technology Department.
Project footprint delineated by Gartner Lee Limited.
Game management subzones obtained from the Yukon Department of Environment, Information Management & Technology Department.

N W E S

2.5 0 2.5 5 7.5 10 Km

1:500,000

NAD 83, Albers

Faro Project
Wildlife

Game Management Subzones

19 February 2008

Gartner Lee

Figure 4.2-3
Version 1

However, due to access, harvest in the subzones north and west of Faro is at or above 5% of the estimated moose population, which is above the recommended maximum allowable rate (Department of Environment, Government of Yukon 2004). This is primarily within GMS 4-45, which is both an important rutting and post-rutting area for moose, and an important hunting area for Faro residents (Department of Environment, Government of Yukon 2004). There is concern that if this trend continues and becomes more widespread, the local moose populations may be at risk of declining (Department of Environment, Government of Yukon 2004).

Moose are harvested by resident and non-resident (guided) hunters alike. Local inhabitants of the Town of Faro have expressed concern regarding the amount of non-resident hunting in the area. The average number of moose taken annually by non-residents (of the Yukon) in the Faro area averages approximately 25% of the total harvest (ranging from 3% to 52%, excluding First Nations; Figure 4.2-4).

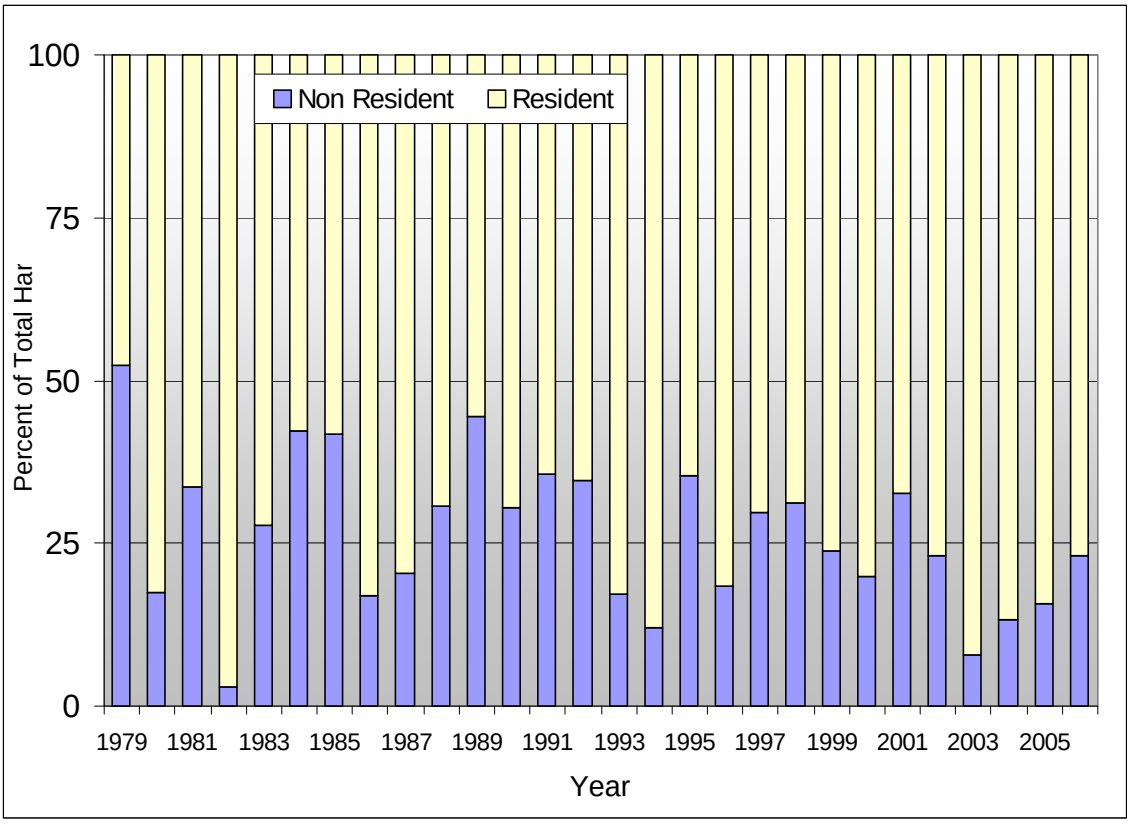


Figure 4.2–4 Percent of Total Moose Harvest by Yukon Residents and Non-Resident, 1979 to 2006.

Habitat Use and Diet

Satellite-telemetry data from 2002 and 2003 indicated that during the spring and early summer, moose spend the much of their time in the lowland areas (Ward 2003a). As summer progressed, moose generally moved from lowlands to sub-alpine habitats, although some remained in lowland areas year round (Ward 2003a). During the rut, moose concentrated in sub-alpine habitats. In the Faro area moose were observed in the sub-alpine plateau north of the Faro townsite (2004 rut and post-rut survey; Department of Environment, Government of Yukon 2004). As winter commenced, moose in the Faro area moved into adjacent lowlands and/or concentrated in sub-alpine/willow and older post-burn habitats (Ward 2003a).

Terrain within the Study Area tends to be primarily sub-alpine mid slope with lowland and high shrub cover areas riparian areas near most drainages and rivers. Seasonally, moose would most likely be found within the low-lying areas in the spring, and in lowland and sub-alpine areas in summer. However, evidence of moose browse and pellets were observed in all habitat types near the mine site however, and animals were observed on two occasions (in summer) in riparian lowland habitats during a vegetation classification survey conducted in August 2007.

Summary

Government, First Nations, and stakeholders consider moose populations in the area near Faro a high priority to manage and conserve. Moose densities are relatively high in the area, as is harvest pressure in some parts of the range. Thus far, the Government has closely regulated and monitored populations that encompass the Study Area. In consideration of implementation of the Project, it is expected that the potential increases in hunting pressure (due to Community population changes) would necessitate mitigation planning to reduce potential Project impacts.

4.2.3 Thinhorn Sheep

Overview

Thinhorn sheep in the Yukon include two recognized subspecies; Dall sheep (*Ovis dalli dalli*), which are white in colour, and the generally darker Stone sheep (*Ovis dalli stonei*). In the Pelly Mountains and Ogilvie Mountains of the Yukon, a colour variant of thinhorn sheep that is somewhat intermediate between Dall and Stone sheep occurs, and are known as fannin sheep. The genetic and evolutionary distinctions and subspecies designations among Dall, Stone, and fannin sheep are currently in question (Loehr *et al.* 2005, Worley *et al.* 2004), but locally in the Study Area only fannin sheep are present, and are characterized by their saddle-shaped colourations. Fannin sheep in the Study Area generally occur on Sheep Mountain, Rose Mountain, and Mount Mye, although presence varies by season, as discussed below. Currently, thinhorn sheep are recognized as Secure in the Yukon (Canadian Endangered Species Conservation Council, 2006), and federally they are listed Not At Risk (COSEWIC 2007). However, fannin sheep have high socio-

economic value in the Yukon as a game and subsistence species, and for their non-consumptive value (wildlife viewing) shown in the sheep and sandhill crane (*Grus canadensis*) viewing festival currently supported by the Town of Faro.

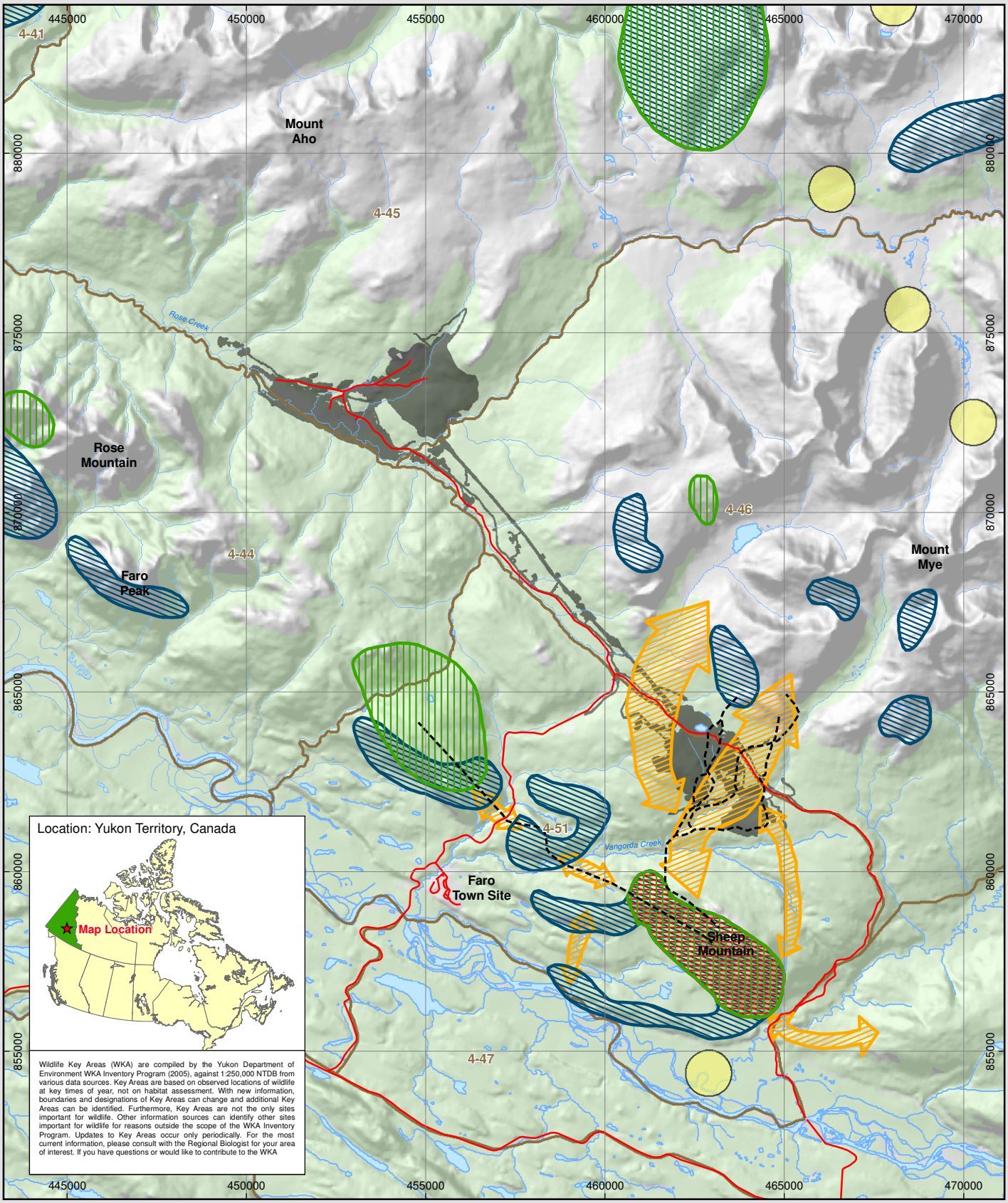
The Government of Yukon Department of Renewable Resources developed sheep management guidelines for the Yukon in 1996 (1996c), and prepared a Management Plan Proposal for the Sheep Mountain population in 1988 (Department of Renewable Resources, Government of Yukon 1988). The primary objective of the management guidelines is the "conservation of sheep populations and their habitat within the framework of ecosystem biodiversity" (Department of Renewable Resources, Government of Yukon 1996c). Locally, interest in Fannin sheep has grown, and is demonstrated by the development of infrastructure and interpretative trails that support wildlife viewing near the Town of Faro. Managers have also focused efforts to reduce disturbance on wintering sheep, by declining woodcutting applications and barricading areas to deter snowmobile access.

Population Status

There are approximately 22,000 thinhorn sheep in the Yukon, with densities ranging from less than 2 sheep/100 km^2 to more than 30 sheep/100 km^2 (Department of Renewable Resources, Government of Yukon 1996c). The sheep are believed to be at, or near, historic population levels, and have recolonized some ranges where they had previously disappeared (Department of Renewable Resources, Government of Yukon 1996c). Of the Yukon thinhorn sheep population, about 2,500 are Fannin sheep (Department of Renewable Resources, Government of Yukon 1996c). Sheep population abundance is particularly affected by winter weather, and snow conditions affect both birth rate and lamb survival (Department of Renewable Resources, Government of Yukon 1996c).

Sheep have been studied near Faro since the mid-1970s. Estimates of the number of sheep utilising Sheep Mountain, Mount Mye and Rose Mountain (see Figure 4.2-5 for mountain locations) have been made through a combination of aerial surveys (Montreal Engineering Company Ltd. 1976; McLeod 1981; Department of Renewable Resources unpublished survey data (1980, 1987, 2002); Hoeffs 1988, 1990; Horejsi 1988; Department of Renewable Resources, Government of Yukon 2002) and field observations (detailed in Schweinsburg 1990). The number of sheep counted within each survey area has varied depending on factors such as season, technique, intensity, and survey conditions, and as a result, it is difficult to extrapolate demographic trends from those data sources.

The only recent estimate of sheep abundance in and near the Study Area took place in 2002 (Department of Renewable Resources, Government of Yukon 2002), and included surveys of GMS 4-41, 4-43, and 4-44. In GMS 4-41 (largely to the northwest and beyond the Study Area), 183 sheep were observed, including 94 nursery sheep (assumed to be ewes), 31 lambs, and 58 rams. While difficult to compare directly, the 2002 survey indicated that since 1981, the number of nursery sheep in GMS 4-41 increased from 44 to 94 (an annual increase near 3.5%), which was attributed in part to animal movements at the time of surveys (Department of Renewable



Map Sources/Notes:
National Topographic Database (NTDB) provided by the Government of Canada, Natural Resources Canada at 1:50,000 scale.
Hillshade imagery obtained from the Yukon Department of Environment, Information Management & Technology Department.
Project footprint delineated by Gartner Lee Limited.
Sheep key areas and game management subzones obtained from the Yukon Department of Environment, Information Management & Technology Department.

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1:150,000

Yukon Albers

Legend

Existing Features
- Road

Thinhorn Sheep Key Areas
- Spring Lambing
- Early Winter Rut
- Winter Range
- Movement Corridor
- Mineral Lick

Migration Routes
- Sheep Migration Route

Boundaries
- Project Footprint
- Vegetation
- Game Management Subzones

Hydrological Features
- Watercourse
- Waterbody

Closure and Remediation Plan
For The Faro Mine Complex

Thinhorn Sheep

19 February 2008

Gartner Lee

Figure 4.2-5
Version 1

File: 70384 C1 Fig 4.2-5Sheep 19Feb08.mxd

Resources, Government of Yukon 2002). In portions of GMS 4-43 and 4-44 combined (i.e., Rose Mountain area, also largely to the west and beyond the study area), 73 sheep were observed (45 nursery sheep, 17 lambs, and 11 rams). Populations were considered stable in 4-43 and 4-44 due to similarities to a 1991 survey (71 sheep counted), and in 2002 all GMS's populations were not thought to be over harvested.

It is believed that the sheep population using the ranges on Sheep Mountain and on Mount Mye (within GMS 4-51 and 4-46, respectively) remained relatively stable in the 1980s (Schweinsburg 1990) at between 60 and 80 individuals (Department of Renewable Resources, Government of Yukon 1987, 1988). Observed recruitment levels in the late 1980s (indicated by proportion of lambs/yearling in the population) were considered to be indicative of a growing population (Schweinsburg 1990), but given the variations in range use, it is difficult to be certain that sheep counts conducted over the years on Mount Mye and/or Sheep Mountain are representative of one sheep population. Prior to the work of Schweinsburg (1990) it was thought that one population of sheep wintered on Sheep Mountain and summered on Mount Mye. However, it appears that sheep that winter on Sheep Mountain can be found on either Sheep Mountain, Mount Mye or on the mine site (Vangorda) during summer as well as potentially in other areas, e.g., Rose Mountain (Schweinsburg 1990). There also appears to be some sheep that are independent of the Mount Mye/Sheep Mountain group that summer in areas around Blind and Swim lakes (approximately 15 km to the southeast of the Vangorda pit) and winter on windswept slopes near to their summer range (Schweinsburg 1990).

Movements and Distribution

Fannin sheep in the Study Area occupy relatively distinct seasonal ranges during the early winter and rut, mid to late winter, lambing, and summer, and several identified migratory routes have been documented that link these areas in the Study Area. Most migratory routes and winter, early winter and rut, and spring lambing ranges have been identified as Key Wildlife Areas by the Fish and Wildlife Branch of the Department of Environment (Figure 4.2-5).

Seasonal Ranges

- *Winter Range*

  Winter habitat use patterns have been determined from: inferences based on habitat characteristics and local knowledge (Montreal Engineering Company Ltd. 1976); aerial counts of sheep during winter (Department of Renewable Resources, Government of Yukon 1980, 1987); inferences based on the interpretation of field sign and observations made by field worker and locals (McLeod 1981), radio tracking (nine ewes were radio tracked between 1989 and 1990), and visual observations of sheep and interviews with locals (Schweinsburg 1990).

  The southern slopes of Sheep Mountain have been identified as an area of sheep winter range (Figure 4.2-5; Montreal Engineering Company Ltd. 1976; Department of Renewable Resources, Government of Yukon 1980; McLeod 1981; Department of Renewable Resources,

Government of Yukon 1987; Schweinsburg 1990). Telemetry locations and field observations indicate that nursery sheep (ewes, lambs and yearlings) spent early winter on the upper slopes of Sheep Mountain while rams spent this time on the western edge of Sheep Mountain.

Other wintering areas are located on Faro Peak and bluffs to the northwest of Sheep Mountain. The southern slopes of Mount Mye have also been designated as winter range, and are the closest wintering areas to the project, within 1 km of the Grum pit. Additional wintering areas include: the windswept slopes near Blind and Swim Lakes (Schweinsburg 1990), Pelly River Bluff, 2.5 km east of Faro (Schweinsburg 1990), Rose Mountain (GMS 4-43 and 4-44), and potentially areas northeast of Faro on Vangorda Creek (McLeod 1981; Schweinsburg 1990).

- *Lambing Range*

The location of lambing areas was determined from aerial surveys; inferences based on the interpretation of field sign and observations made by field worker and locals (McLeod 1981), radio tracking (nine ewes were radio tracked between 1989 and 1990), visual observations of sheep and interviews with locals (Schweinsburg 1990).

Initial studies indicated that lambing areas on Sheep Mountain were found downslope of the early winter range (Montreal Engineering Company 1976). Schweinsburg (1990) later argued that ewes move from the lower slopes of Sheep Mountain in late winter, to lamb at higher elevations. There is also some indication that ewes may lamb on Mount Mye (Schweinsburg 1990).

- *Summer Range*

Summer distribution of sheep has also been described based on aerial surveys, radio tracking, and visual observations of sheep (Schweinsburg 1990). Sheep were generally dispersed more widely over their summer range than the winter range. A large area has been identified as summer range and includes Mount Mye (Montreal Engineering Company Ltd. 1976, McLeod 1981, Hoeffs 1988, Hoeffs 1988, Schweinsburg 1990), Rose Mountain (McLeod 1981), Blind Creek and Swim Lakes area (Schweinsburg 1990), Sheep Mountain and the Anvil Mine Complex (Schweinsburg 1990). The summer range is not identified as a Wildlife Key Area, perhaps because of the more general and wider distribution of sheep.

- *Early Winter and Rutting*

Location of rutting areas was determined from visual field observations (Schweinsburg 1990). Rams were observed rutting on Sheep Mountain (Schweinsburg 1990) presumably during fall/early winter. Other rutting areas may be possible, as less study and observations have taken place during the rut, and given the relatively wide distribution of sheep in summer and the documented winter ranges, rutting is very likely not limited to Sheep Mountain.

Migratory/Movement Routes and Timing

Twice a year Fannin sheep migrate through the infrastructure of the Vangorda/Grum area of the Faro Mine Complex. Spring migration occurs between mid-May and late June, when Sheep migrate from their winter ranges to summering areas, often on Mount Mye (McLeod 1981; Schweinsburg, 1990). Fall migration takes place in mid-September to mid-October, when sheep move from summer range to early winter and rutting areas on Sheep Mountain. Nursery herds tend to migrate earlier than rams (Schweinsburg 1990). Sheep in the Study Area have tended to show some resilience to disturbance and continue to re-use migratory routes (such as migrations through Vangorda mine area), despite ongoing anthropogenic disturbances.

Several migration routes have been documented by studies in the area. Three such routes are documented that navigate terrain between Mount Mye and Sheep Mountain through the Study Area that are used in both spring and fall (Figure 4.2-5). They include:

a) The main migration route (termed Route E in McLeod (1981)) between Mount Mye and Sheep Mountain for spring and fall migration goes from Sheep Mountain to the confluence of Shrimp Lake and Vangorda Creek, crosses the haul road 1 km west of Vangorda Creek and then continues to the base of Mount Mye (Montreal Engineering Company Ltd. 1976; McLeod 1981; Horejsi 1988; Schweinsburg 1990). This route directly passes between the Vangorda and Grum deposits.

b) A second route (Route F in McLeod (1981)) was also identified by Montreal Engineering Company Ltd. (1976), McLeod (1981), and Schweinsburg (1990). From Sheep Mountain, this route goes to the confluence of Shrimp Lake and Vangorda Creek, it then follows a cat road, crosses the airstrip to the site of the proposed Vangorda open pit and continues to Mount Mye via the west side of Vangorda Creek.

c) A third route (Route D in McLeod (1981)) was also identified by McLeod (1981), Horejsi (1988), and Schweinsburg 1990). From Mount Mye, this route goes south from Mount Mye and crosses the haul road 1 km east of the Grum Camp. The route then follows down to the confluence of Shrimp Lake and Vangorda Creek to on to Sheep Mountain.

McLeod (1981) also identified one addition migration route (route A), which is southwest of the Study Area and runs parallel to the project, following west from Sheep Mountain along the ridge to Rose Mountain.

Harvest

Licensed harvest of sheep in the Yukon is relatively small at less than 2% of the total estimated population (Department of Renewable Resources, Government of Yukon 1996c). In the Game Management Subzones (GMS) 4-46 and 4-47, licensed hunting has been closed since 1982 (J.

Carey, pers. comm. 2007). Game Management Subzone 4-46 encompasses Mount Mye, and is the zone in which the most western part of the Study Area occurs. Harvest in subzones 4-41 to 4-45 is open to licensed and regulated harvest; in these zones the average total harvest is 7.9 sheep/year (range 3-15) (see Figure 4.2-6), including harvest recorded in 4-46 (It is not clear as to whether these harvests are legal as the area has been closed since 1982). Although total population estimates are uncertain, the harvests are assumed to be sustainable at current levels, as the number of sheep taken is relatively stable (Department of Environment, Government of Yukon 2004) and indices of sheep abundance also indicate stable to possibly increasing populations (Department of Environment, Government of Yukon 2004).

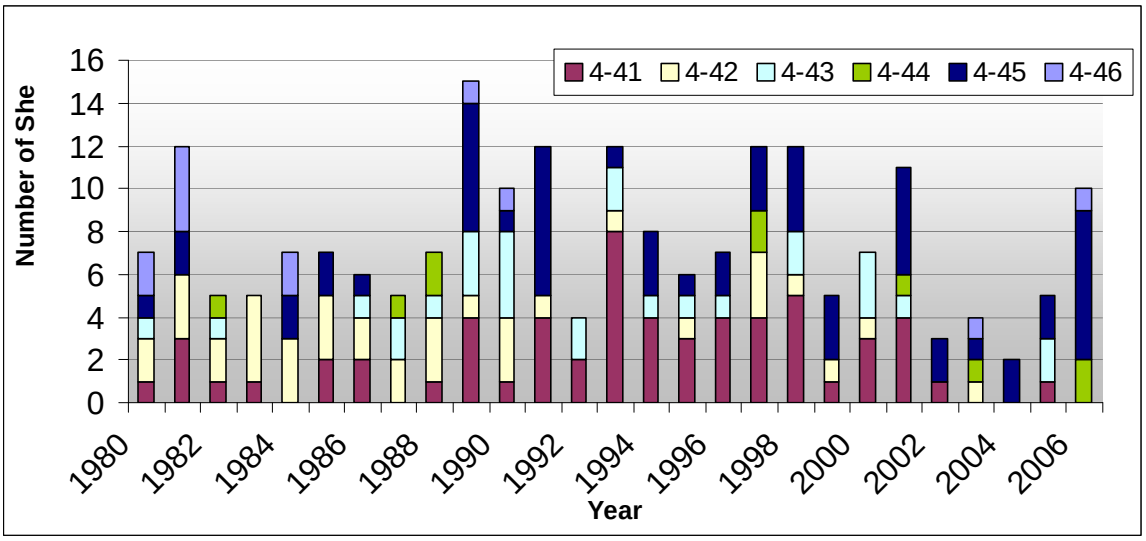

Figure 4.2–6 Total Harvest of Fannin Sheep in Game Management Subzones 4-41 to 4-46, 1980 to 2006

Habitat Use and Diet

Sheep typically require windblown and grassy slopes as winter range; steep, secure areas where ewes can safely bear their lambs; steep rugged cliffs where they can escape from predators; and access to mineral licks in spring (Government of Yukon Department of Renewable Resources 1996c). Because such habitats are used on a seasonal basis, areas of movement between the ranges is also recognized as important movement corridors. Unfortunately, there has been no formal habitat mapping conducted on sheep habitat within the Study Area (i.e., within 1 km of the Project), or on Mount Mye, Rose Mountain, Blind Creek or Swim Lakes. Although Staniforth (1988) classified vegetation communities on Sheep Mountain, there is no comprehensive and consistent habitat map of the Study Area available. Thus, the boundaries of seasonal ranges are possibly imprecise.

In general terms, both Mount Mye and Rose Mountain are composed of upland vegetation types within alpine, subalpine and boreal forest habitats, while Sheep Mountain is composed of upland and lowland (riparian) vegetation types, within the a primarily boreal forest habitat type. The area around the Faro Mine Complex itself (i.e., the Study Area) is largely comprised of upland boreal habitat. Sheep Mountain and the western slopes above Blind Creek were burned in 1969, as were the areas near and covering the Vangorda – Grum deposits at the eastern extent of the Study Area.

Vegetation mapping was conducted at a scale of 1:20,000 using 27 sample plots within an area of 42.7 km^2 on Sheep Mountain (Staniforth 1998). Vegetation characteristics were noted, as was the presence of water, litter, coarse woody material, elevation, slope, aspect, topography, and drainage. Staniforth (1998) identified three habitat units significant to sheep during winter. It is likely that the communities could be extrapolated to other areas within the Study Area:

1. a Sage-Graminoid community that occurs on the open windswept south-facing slopes and is considered the most important to sheep, as it would be the most snow-free during winter;
2. a Rose/Forb community found mainly at the edges of south-facing aspen (*Populus tremuloides*) groves, in low-lying gullies and high snow accumulation areas; and,
3. a Grass-Forb community that occurs at the edge of the aspen groves but on the more northerly aspects.

Rocky outcrops that provide escape terrain occur in association with all three of the important winter range communities outlined above. As these vegetation communities occurred in very small patches, they could consistently be differentiated and were grouped into one habitat type, termed Rock/Grass/Forb, by Staniforth (1998). This unit covered a total of 4.9 km^2 or 11% of the Sheep Mountain study area. The Sheep Mountain study area was located south of the Vangorda Grum area.

In spring, sheep that winter on the southern slopes of Mount Mye are found on the lower slopes of Sheep Mountain to feed on sage (*Artemesia frigida*) and later on new herbaceous growth and aspen leaves (Schweinsburg 1990a).

Summary

Fannin sheep are highly important to stakeholders as an economic resource within the region, and are the most-visible species that interact directly with the project. The population appears generally stable, given the current harvest regulations, and a reasonable understanding of seasonal ranges and movement patterns is available. In consideration of the implementation of the Project, it is expected that the potential direct impacts to migrating sheep will be scrutinized, and will necessitate detailed mitigation planning.

4.2.4 Grizzly Bears

Overview

Grizzly bears (*Ursus arctos*) are found throughout the Yukon, and belong to the northwestern population of Canadian bears (Ross 2002). The northern interior grizzly population range encompasses northern British Columbia, most of the Yukon and into the southern Mackenzie District of Northwest Territories. The Government of Yukon Department of Renewable Resources developed interim management guidelines for grizzly bears in 1997 (1997c), and identified a primary principle of "the conservation of grizzly bears as an integral part of northern ecosystems and biodiversity". Federally, grizzly bears are designated as Special Concern (COSEWIC 2007) due to habitat loss, low reproduction, and slow recovery rates. Under the *Species at Risk Act* grizzly bears are not currently scheduled, although they were proposed for inclusion under Schedule 1 in 2004. Currently, grizzly bears are considered Sensitive in the Yukon (Canadian Endangered Species Conservation Council, 2006).

Population

To a large degree, the availability and quality of forages, in addition to mortality rates, influences reproductive rates and population densities of bears. Northern interior grizzly bears in the Yukon have the lowest recruitment rates of all terrestrial mammals, due to low reproduction rates and litter size, and high mortality (Department of Renewable Resources, Government of Yukon 1997c). The current territory-wide estimate of grizzly bears in the Yukon is 6,000 to 7,000 grizzly bears (Department of Renewable Resources, Government of Yukon 1997c). This is consistent with the 6,300 bears estimated by Banci (1991, in Ross 2002). Since 1991, the grizzly population in the Yukon is considered to have remained stable, with some local exceptions (Ross 2002).

The population of the Study Area is arguably too small a scale to estimate abundance within, as the Study Area (81 km^2), is much smaller than the average grizzly bear home range. It would not be uncommon to have up to a few bears occur on occasion in the Study Area, but in general, few bears (if more than one) are expected to be present within the Study Area at any one time. Seasonal changes in bear foraging may result in more or less bears in the area, such as during times when bears may pursue moose calves or sheep lambs.

Harvest

The harvest of grizzlies is regulated by the Yukon Hunting Regulations. Harvest data available from 1980 to 2001 (Department of Environment, Government of Yukon, unpublished data; Table 4.2-2) indicates that the average bear mortality in the GMS's that encompass the study area (4-44 to 4-46, 4-51) ranged from 0.34 to 0.83 bears/year (more current data has been requested, and was pending at the time of this report preparation). Within GMS 4-51, in which the Vangorda/Grum deposits are located, all mortalities (10 bears between 1990-2001) were due to problem kills rather than hunting. Most other GMS's had predominately hunting related mortalities (Table 4.2-2).

According to the Yukon Grizzly Bear Management Guidelines (1997c), females are being harvested in many areas at, or above sustainable levels while fewer than the allowable males are taken. In the Faro area, the overall male to female harvest ratio for all GMS's is approximately 2:1, although more female bears were taken than in males in GMS 4-45. As population estimates are unknown in the region, is difficult to comment on whether the harvest is sustainable, but the area-based mortality measure of 6.31 bears/year/1,000 km^2 in GMS 4-51 is exceedingly high in comparison to neighbouring GMS's.

Table 4.2–2 Reported Grizzly Bear Mortalities from 1980 – 2001

GMS	4-41		4-42		4-43		4-44		4-45		4-46		4-47		4-51*		All GMS's**	
Area (Km2)	1299.8		825.5		170.3		147.9		1035.8		422.5		420.8		132		4454.6	
Sex	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*
Reported Hunts	15	8	8	5	1	2	6	0	5	6	4	2	2	1	0	0	41	24
Problem kills, Defence of Life/ Property	3	1	1	2	0	0	2	0	0	1	1	0	1	0	6	4	14	8
Annual Mortality (bears/year)	0.82	0.41	0.41	0.32	0.05	0.09	0.36	0.00	0.23	0.32	0.23	0.09	0.01	0.05	0.50	0.33	2.5	1.46
Annual Mortality (bears/year/1,000 km^2)	0.63	0.31	0.50	0.39	0.27	0.53	2.46	0.00	0.22	0.31	0.54	0.22	0.32	0.11	3.79	2.52	0.56	0.33
Total Annual Mortality (bears/year/1,000 km^2)	0.94		0.89		0.80		2.46		0.53		0.76		0.43		6.31		0.89	

Notes: * *Includes data between 1990 and 2001 only.*
** *Although GMS 4-51 included data only between 1990 and 2001, it was assumed that mortalities recorded represented data from a time period equal to that of other GMS's in order to calculate annual mortality rates. Thus, the total annual mortalities/year, and total annual mortalities/year/1,000 km^2 are slightly underestimated.*

Movements and Distribution

Grizzly bears are known to utilize large home ranges averaging over 1682 km^2 for males and 491 km^2 for females (Department of Renewable Resources, Government of Yukon 1997c). The Study Area (81 km^2) would comprise only 16% of a female home range, and less than 5% of a male bear's home range.

Habitat associations of grizzly bears generally reflect local plant phenology and are strongly seasonal. In a mountainous region like Faro this may result in elevational movements in response to seasonal changes in vegetation (LeFranc *et al.* 1987). Bears may den at relatively high-elevations and in spring descend to valley bottoms to forage on young plants, previous-year berry crops, and pursue ungulates or ungulate carcasses. Then, as snowmelt proceeds, they may ascend upslope to follow the emergence of fresh vegetation (Ross 2002).

Terrain within the Study Area is primarily made up of moderately sloped upland areas with low-lying and riparian habitats around the Rose and Vangorda creeks, and several tributaries and drainages. Seasonally, grizzly bears may found within the low-lying areas in the spring and on mid to upper slopes in early summer, and in upland areas of berry production in later summer and fall.

Habitat Use and Diet

Grizzly bears typically have a wide-ranging diet that is primarily herbivorous in most areas. MacHutchon (1996) quantified grizzly bear food habits in Ivvavik National Park in the Yukon, and found important spring foods to include hedysarum roots (*Hedysarum spp*.) and over-wintered berries. Summer diet focused on horsetails (*Equisetum spp*.) and bearflower (*Boykinia richardsonii*), while ripened berries primarily made up the diet in fall, with a focus on roots when berries were not available. Prey included arctic ground squirrels (*Spermophilus parryii*) during summer and fall and caribou when migrating through in spring and summer. Bears within the Faro Region would likely have comparable food habits, although the growing season in the southern Yukon is comparably longer than in the north, therefore an increase in plant diversity and food availability may be expected. Bears in the Study Area would likely still rely heavily on berries, and berry-laden bear scat (Figure 4.2-7) was observed during a vegetation classification survey conducted in the Study Area in July 2007. Bears in the Study Area would also likely prey on alternative ungulate species as sheep and moose are much more common to this area than caribou.

Figure 4.2–7 Bear Scat Observed, August 2007, Vangorda/Grum Area

Summary

With the exception of harvest data, there is a general lack of specific information regarding grizzly bears in the Study Area. However, the habitats within the Study Area appear to support high densities of prey species such as moose and thinhorn sheep, in addition to vegetation cover that often included berry-producing plants. Combined with the unfortunate but regular problem kill rates of near one bear/year in the Study Area GMSs, it is likely that the area including and surrounding the Study Area has a relatively high production and/or density of grizzly bears. Clearly though, project mitigation planning should carefully address methods to reduce human-bear conflicts as the project progresses.

4.2.5 Furbearers

Overview

Trapper harvest of furbearers is an important economic activity in much of the Yukon, including in and near the Study Area. The largest portion of trappers' incomes is from the sale of lynx (*Lynx canadensis*) and marten (*Martes americana*) pelts, but wolverine (*Gulo gulo*) red fox (*Vulpes vulpes*), wolf (*Canis lupus*), muskrat (*Ondatra zibethicus*) and beaver (*Castor canadensis*) are also important. As indicated in Figure 4.2-8, relatively few lynx are taken but their high pelt prices means greater income. Other species of furbearers harvested by trapping may include mink (*Mustela vison*), ermine (*Mustela erminea*), and red squirrel (*Tamiasciurus hudsonicus*).

From 1999 to 2005, Territory-wide trapping records collected by Statistics Canada (2007) indicated that the number of marten trapped annually far exceeds all other species, with the exception of squirrel in some years (Figure 4.2-8). Annual marten harvest's ranged from 1,646 to 4,362. Although not necessarily an indication of abundance (as harvest numbers are influenced by pelt prices, trapper effort, and other factors), trapping records can indicate species presence, and potentially broad population trends (Poole and Mowat 2001).

All of the furbearers identified above occur in the Faro area, and could potentially occur in the Study Area. Among these animals, wolverines are listed as Sensitive in the Yukon (Canadian Endangered Species Conservation Council, 2006) and as Special Concern by COSEWIC (2007). All other species are considered Secure in the Yukon (Canadian Endangered Species Conservation Council, 2006), although no population or abundance surveys for furbearers have taken place in the Faro area in recent years (H. Slama, pers. comm. 2007). Local data on fur harvest was still pending at the time of issuance of draft report.

Furbearer habitat preference varies by species. Marten tend to be associated with late successional coniferous stands, especially those dominated by spruce (*Picea spp*.) and fir (*Abies spp.*), similar to that of the Study Area, which is composed of a mixture of mature spruce and fir forests on upland slopes.

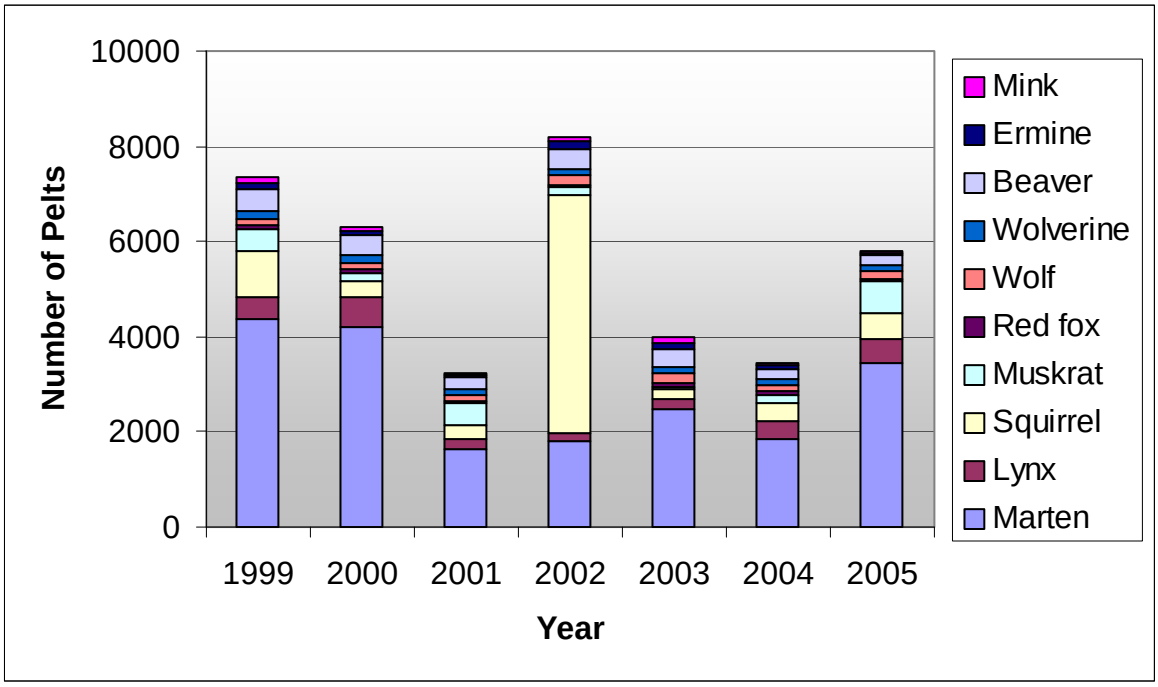

Figure 4.2–8 Number of Wild Harvested Fur Pelts in the Yukon Territory, 1999-2005

4.2.6 Birds

Of the territory's 279 know bird species (60 of which are casual or accidental; Birds of the Yukon Database, Canadian Wildlife Service 2007), 68 species have been recorded in or near the Study Area (see Tables 4.2-3 and 4.2-4), based on data records compiled for NTS mapsheets 105K3 and 105K6 (Canadian Wildlife Service 2007). These data include bird records from the 1860s to 1998, and are a compilation of incidental sightings and survey data.

The most common birds in the CWS database include dark-eyed junco, common raven, American robin, Swainson's thrush, lesser yellowlegs and the sandhill crane. None of the birds are currently listed in under the *Yukon Wildlife Act* or scheduled federally under *SARA*. Five species have been listed by COSEWIC as "Not at Risk" including: American coot, common loon, golden eagle, bald eagle and great grey owl. One species, rusty blackbird, has been listed by COSEWIC as Special Concern.

Table 4.2–3 Status of Waterbird Species Potentially Present in the Local Study Area (Canadian Wildlife Service 2007)

Species	Scientific Name	Species Status		
		Yukon	SARA Schedule	COSEWIC
American coot	*Fulica americana*	Not currently listed	Not currently scheduled	Not at risk
American wigeon	*Anas americana*	Not currently listed	Not currently scheduled	Not assessed
Arctic tern	*Sterna paradisaea*	Not currently listed	Not currently scheduled	Not assessed
Barrow's goldeneye	*Bucephala islandica*	Not currently listed	Not currently scheduled	Not assessed
Blue-winged teal	*Anas discors*	Not currently listed	Not currently scheduled	Not assessed
Bonaparte's gull	*Larus philadelphia*	Not currently listed	Not currently scheduled	Not assessed
Bufflehead	*Bucephala albeola*	Not currently listed	Not currently scheduled	Not assessed
Common loon	*Gavia immer*	Not currently listed	Not currently scheduled	Not at risk
Glaucous gull	*Larus glaucescens*	Not currently listed	Not currently scheduled	Not assessed
Green-winged teal	*Anas crecca*	Not currently listed	Not currently scheduled	Not assessed
Herring gull	*Larus argentatus*	Not currently listed	Not currently scheduled	Not assessed
Hooded merganser	*Lophodytes cucullatus*	Not currently listed	Not currently scheduled	Not assessed
Horned grebe	*Podiceps auritus*	Not currently listed	Not currently scheduled	Not assessed
Lesser scaup	*Aythya affinis*	Not currently listed	Not currently scheduled	Not assessed
Lesser yellowlegs	*Tringa flavipes*	Not currently listed	Not currently scheduled	Not assessed
Mallard	*Anas platyrhynchos*	Not currently listed	Not currently scheduled	Not assessed
Mew gull	*Larus canus*	Not currently listed	Not currently scheduled	Not assessed
Northern pintail	*Anas acuta*	Not currently listed	Not currently scheduled	Not assessed
Northern shoveler	*Anas clypeata*	Not currently listed	Not currently scheduled	Not assessed
Pacific loon	*Gavia pacifica*	Not currently listed	Not currently scheduled	Not assessed
Redhead	*Aythya americana*	Not currently listed	Not currently scheduled	Not assessed
Ring-necked duck	*Aythya collaris*	Not currently listed	Not currently scheduled	Not assessed
Ruddy duck	*Oxyura jamaicensis*	Not currently listed	Not currently scheduled	Not assessed
Sandhill crane	*Grus canadensis*	Not currently listed	Not currently scheduled	Not assessed
Semipalmated plover	*Charadrius semipalmatus*	Not currently listed	Not currently scheduled	Not assessed
Sora	*Porzana carolina*	Not currently listed	Not currently scheduled	Not assessed
Spotted sandpiper	*Actitis macularius*	Not currently listed	Not currently scheduled	Not assessed
Tundra swan	*Cygnus columbianus*	Not currently listed	Not currently scheduled	Not assessed

Table 4.2–4 Status of Landbird Species Potentially Present in the Study Area (Canadian Wildlife Service 2007)

Species	Scientific Name	Species Status		
		Yukon	SARA Schedule	COSEWIC
Alder flycatcher	*Empidonax alnorum*	Not currently listed	Not currently scheduled	Not assessed
American pipit	*Anthus rubescens*	Not currently listed	Not currently scheduled	Not assessed
American robin	*Turdus migratorius*	Not currently listed	Not currently scheduled	Not assessed
American tree sparrow	*Spizella arborea*	Not currently listed	Not currently scheduled	Not assessed
Bald eagle	*Haliaeetus leucocephalus*	Not currently listed	Not currently scheduled	Not at risk
Bank swallow	*Riparia riparia*	Not currently listed	Not currently scheduled	Not assessed
Belted Kingfisher	*Ceryle alcyon*	Not currently listed	Not currently scheduled	Not assessed
Bohemian waxwing	*Bombycilla garrulus*	Not currently listed	Not currently scheduled	Not assessed
Boreal chickadee	*Poecile hudsonica*	Not currently listed	Not currently scheduled	Not assessed
Chipping sparrow	*Spizella passerina*	Not currently listed	Not currently scheduled	Not assessed
Cliff swallow	*Petrochelidon pyrrhonota*	Not currently listed	Not currently scheduled	Not assessed
Common raven	*Corvus corax*	Not currently listed	Not currently scheduled	Not assessed

Table 4.2–4 Status of Landbird Species Potentially Present in the Study Area (Canadian Wildlife Service 2007)

		Species Status		
Common Yellowthroat	*Geothlypis trichas*	Not currently listed	Not currently scheduled	Not assessed
Dark-eyed junco	*Junco hyemalis*	Not currently listed	Not currently scheduled	Not assessed
Golden eagle	*Aquila chrysaetos*	Not currently listed	Not currently scheduled	Not at risk
Gray jay	*Perisoreus canadensis*	Not currently listed	Not currently scheduled	Not assessed
Gray-cheeked thrush	*Catharus minimus*	Not currently listed	Not currently scheduled	Not assessed
Gray-crowned rosy finch	*Leucosticte tephrocotis*	Not currently listed	Not currently scheduled	Not assessed
Great Gray Owl	*Strix nebulosa*	Not currently listed	Not currently scheduled	Not at risk
Great Horned Owl	*Bubo virginianus*	Not currently listed	Not currently scheduled	Not assessed
Hermit thrush	*Catharus guttatus*	Not currently listed	Not currently scheduled	Not assessed
Lapland longspur	*Calcarius lapponicus*	Not currently listed	Not currently scheduled	Not assessed
Lincoln's sparrow	*Melospiza lincolnii*	Not currently listed	Not currently scheduled	Not assessed
Northern flicker	*Colaptes auratus*	Not currently listed	Not currently scheduled	Not assessed
Northern shrike	*Lanius excubitor*	Not currently listed	Not currently scheduled	Not assessed
Northern waterthrush	*Seiurus noveboracensis*	Not currently listed	Not currently scheduled	Not assessed
Red-winged blackbird	*Agelaius phoeniceus*	Not currently listed	Not currently scheduled	Not assessed
Ruby-crowned kinglet	*Regulus calendula*	Not currently listed	Not currently scheduled	Not assessed
Rusty blackbird	*Euphagus carolinus*	Not currently listed	Not currently scheduled	Special concern
Savannah sparrow	*Passerculus sandwichensis*	Not currently listed	Not currently scheduled	Not assessed
Swainson's thrush	*Catharus ustulatus*	Not currently listed	Not currently scheduled	Not assessed
Three-toed Woodpecker	*Picoides dorsalis*	Not currently listed	Not currently scheduled	Not assessed
Townsend's solitaire	*Myadestes townsendi*	Not currently listed	Not currently scheduled	Not assessed
Tree swallow	*Tachycineta bicolor*	Not currently listed	Not currently scheduled	Not assessed
Violet-green swallow	*Tachycineta thalassina*	Not currently listed	Not currently scheduled	Not assessed
White-crowned sparrow	*Zonotrichia leucophrys*	Not currently listed	Not currently scheduled	Not assessed
White-winged crossbill	*Loxia leucoptera*	Not currently listed	Not currently scheduled	Not assessed
Yellow warbler	*Dendroica petechia*	Not currently listed	Not currently scheduled	Not assessed
Yellow-rumped warbler	*Seiurus noveboracensis*	Not currently listed	Not currently scheduled	Not assessed

Based on the CWS database, ten species have confirmed breeding status in Faro area, however it is likely that most of the 68 species recorded near the study area are breeding birds. Much of the data available is sourced through road-based surveys, and breeding confirmation is likely difficult. The ten confirmed breeding species include; pacific loon, American widgeon, Northern shoveler, lesser scaup, Barrow's goldeneye, golden eagle, American coot, spotted sandpiper, violet-green swallow and red-winged blackbird. None of the species are listed as At Risk under the *Yukon Wildlife Act*, *SARA*, or COSEWIC.

Waterbirds

Many waterbirds are migratory and, as such are protected under the federal *Migratory Birds Convention Act* (*MBCA*). Areas of the Yukon make up the Pacific Flyway, a migratory route known to provide critically important areas for large numbers of waterfowl that migrate north to nest and raise young. Waterbird species that have been observed in the Faro region either through survey or by incidental sightings are found in Table 4.2-3. The most abundant birds included the sandhill crane and the lesser yellowlegs, with nine sightings of the sandhill crane and six sightings of the lesser yellowlegs (Canadian Wildlife Service 2007). Several gulls (unknown species) were

observed at the mine site near the tailing areas, where pooled water in the containment areas may provide habitat in the Study Area. The observations were recorded during a vegetation classification survey conducted in August 2007.

Waterbirds need suitable habitat for staging and congregation behaviours. These tend to be areas that have abundant food and are ice-free in early spring. Waterbird habitat in the Study Area is restricted to the lowland areas around Rose, Next and Vangorda creeks as most of the Study Area is made up of mid slopes that do not provide suitable habitat for waterbirds. Most creeks in the Study Area are too small for much of the staging and congregation behaviours exhibited by waterbirds.

Waterbirds are of low concern in the development of the project as the Study Area is not likely to contain much suitable habitat. Upland breeding birds a higher concern as they utilize a wide variety of habitats some of which are likely to be contained within the Study Area.

- *Trumpeter Swan*

  Currently the trumpeter swan (*Cygnus buccinator*) is listed as Specially Protected under the Yukon Wildlife Act, and warrants some discussion. Federally, it is not listed under the *Species at Risk Act* and COSEWIC (2007) designates it as Not at Risk. COSEWIC de-listed the bird in 1996 from its previous rank of Vulnerable as its populations recovered. The trumpeter swan is usually found on lakes and marshes with permanent water and or slow moving creeks or rivers with semi-permanent flow, having emergent and submergent vegetation (Sinclair *et al.*, 2003). Prime breeding, brood rearing or moulting habitat can be found within the shallow wetlands of river floodplains. The Rocky Mountain population utilizes central and southeastern portions of the Yukon Territory as breeding habitat (Sinclair *et al.*, 2003), and there have been 76 confirmed breeding bird records of trumpeter swans in the Yukon (Yukon Zinc Corporation 2005), although none of these records were located within the Study Area. The Study Area contains only three relatively small creeks, and is unlikely to contain suitable trumpeter swan habitat.

Landbirds

Many landbirds (including upland game birds, passerines, woodpeckers, and raptors) are migratory, and, as such are protected under the federal *Migratory Birds Convention Act* (MBCA). Landbird species that have been observed in the Faro region either through survey or by incidental sightings (Canadian Wildlife Service 2007) are identified in Table 4.2-4. The Study Area is made up primarily of upland areas containing mature spruce, fir, and pine forests, and likely contains suitable habitat for many landbirds, and the bird species observed in the region (Table 4.2-4) could be considered potentially present in the Study Area. The most abundant birds included the common raven, Swainson's thrush, American robin and dark-eyed junco, with nine sightings of the common raven, eight sightings of the dark-eyed junco and five sightings each for the American robin and Swainson's thrush (Canadian Wildlife Service 2007).

A Harlan's hawk (*Buteo jamaicensis harlani;* a red-tailed hawk subspecies) was also observed on site (Figure 4.2-9) in August of 2007. Although not recorded previously in the Faro region, the sighting is not unexpected; the dark morph of the hawk occurs regularly in northwest Canada and Alaska (Preston and Beane 1993). The red-tailed hawk is considered Not at Risk by COSEWIC (2007), and is identified as Secure in the Yukon (Canadian Endangered Species Conservation Council, 2006). As a subspecies of the red-tailed hawk the Harlan's hawk was not referenced by either COSEWIC or the Yukon Government.

Figure 4.2–9 Harlan's Hawk Observation, Haul Road Between Faro and Vangorda/Grum Deposits, August 2007

A colony of bank swallows was also observed on the mine site (Figure 4.2-10), along a road cut adjacent to the water retention ponds in the Tailings Impoundment. The cut created a small, sandy cliff that appears to provide suitable nesting habitat for swallows, which typically nest in cut banks of rivers and other waterbodies. The Study Area is within the known range of bank swallows (Garrison 1999), and they have been previously documented in the region (Table 4.2-4). Bank swallow's are not listed by COSEWIC (2007), and are identified as Secure in the Yukon (Canadian Endangered Species Conservation Council, 2006).

Figure 4.2–10 Bank Swallow Colony Observation, Faro Tailings Area, August 2007

4.2.7 Small Mammals

Small mammals are considered an important species in the Yukon due to their significance as both furbearing species (primarily squirrels) as well as prey species for carnivores. In a contaminant-related study conducted from 2004 to 2005 Gartner Lee Limited (2006) documented the presence of several small mammal species. These species included northern red-backed vole (*Clethrionomys rutilus)*, common shrew (*Sorex cinereus*), heather vole (*Phenacomys intermedius*), deer mouse (*Peromyscus maniculatus*), Siberian lemming (*Lemmus sibiricus helvolus*), and least chipmunk (*Tamias minimus*). During this study, four trapping programs were conducted. A total of 121 small mammals were trapped including: 77 small mammals in September 2004; 12 in November 2004 (in the Swim Lake reference area, beyond the Study Area); 29 in July 2005; and 3 in September 2005. Few samples were collected in September 2005, as the trapping program focused on shrews from under-represented sites. Of the total small mammals trapped, the most common species collected were northern red-backed vole (65), followed by common shrews (30), deer mouse (15), heather voles (6), least chipmunk (2), and Siberian lemming (1). All species observed in 2004 and 2005 are considered Secure by the Government of Yukon (Canadian Endangered Species Conservation Council 2006).

4.2.8 Amphibians

While amphibians were not identified as a preliminary VEC, it should be noted that a wood frog (*Rana sylvatica*) was observed on site during a vegetation classification survey conducted in July 2007 (see Figure 4.2-11). Wood frogs are likely the only amphibian present in the Study Area, although western toads (*Bufo boreas*), boreal chorus frog (*Pseudacris maculata*), Columbia spotted frog (*Rana luteiventris*) and long-toed salamander (*Ambystoma macrodactylum*) have also been observed in the Yukon (Department of Environment, Government of Yukon 2005), although primarily at the far southern extent of the Yukon.

Figure 4.2–11 Wood Frog Observation, Vangorda/Grum Area, August 2007

5. Contaminants in Wildlife

5.1 Data Collection Methods

The influence of the current state of the Faro Mine on terrestrial resources, including wildlife, was evaluated in a multi-year study, completed in 2006 (Gartner Lee Limited 2006). That work documented in detail the contaminant release pathways, and elevated concentration and deposition rates of contaminants in and beyond the Study Area in small mammals and hunted wildlife.

During this study, small mammals were collected and tested for heavy metal concentrations, including lead, zinc, copper, arsenic, iron, silver, thallium, barium, chromium, mercury, nickel, selenium, antimony, cadmium, and cobalt (Gartner Lee Limited 2006).

Among hunted and trapped wildlife, 10 species were collected for tissue analyses in 2004 and 2005 (Gartner Lee Limited 2006). Those species included woodland caribou, moose, sheep, American marten, hoary marmot (*Marmota caligata*), Arctic ground squirrel, muskrat, beaver, willow ptarmigan (*Lagopus lagopus*), and ruffed grouse (*Bonasa umbellus*). Ungulate tissue samples were obtained from animals hunted in fall 2004 and 2005; American marten and willow ptarmigan were obtained from local trappers, and the Faro Yukon Environment office provided the marmot, ground squirrels and two beavers (Gartner Lee Limited 2006).

5.2 Baseline Conditions

The level of contaminants in wildlife (lead and zinc primarily, but also other metals) is an important wildlife issue associated with the current state of the mining facilities in Faro (Middler 2007). The airborne transportation of tailings related contaminants is likely the greatest source of elevated concentrations of mine-related contaminants in the Study Area.

Among small mammals sampled, the study concluded that lead was elevated in the muscle, liver and kidney of northern red-backed voles and in whole bodies of common shrews in areas affected by the mine. The magnitude of the elevated concentrations of lead in comparison to the reference area ranged from 11 times greater in vole muscle tissue to over 157 times greater in whole bodies of shrews. Moderately elevated levels of copper, iron, thallium and nickel were also observed in small mammals. Metal elevations considered low or similar to reference levels were observed for all other metals tested for.

Similar to the results for small mammals, high elevations of lead were detected in the liver and kidney of caribou, ranging from 1.1 to 1.6 times greater than samples from the Finlayson herd. The Finlayson herd, located east of the Study Area, are not likely exposed to the effects of the mining

facility. Lead was also elevated in American marten, willow ptarmigan, and beaver. Lead elevations ranged from 4.6 times for beaver kidney to 18.7 for willow ptarmigan livers. Moderate elevations were also detected for mercury and selenium in American marten, willow ptarmigan, and moose. Low elevations, or samples that were difficult to statistically compare to reference samples, were found for all other metals with the exception of antimony, in which no elevations were found in comparison to reference samples. However, elevations of iron in sheep kidney in comparison to the Yukon Hunter Survey data were 1.1 times greater, and silver concentrations were 5.1 times greater in woodland caribou muscle than in the nearby Finlayson herd.

6. Mitigation and Monitoring Recommendations

Detailed mitigation planning and monitoring recommendations are beyond the scope of this work, but should be considered following determination of the preferred methods of closure for each project component (Tailings Impoundment, Vangorda/Grum area, and Faro area). Considerations of mitigation opportunities and needs should be geared towards meeting pre-established objectives, and focused on remedy of project issues identified through consultation and project planning. Mitigation needs will include elements that are incorporated within the physical design of the project (i.e., Mitigation by Design), or elements that reflect the best means of completing project activities (such as activity timing, operating procedures, or avoidance of certain areas).

Monitoring of wildlife during the Project is the best means of implementing adaptive management needs. As the Project is expected to positively impact wildlife habitat overall, mitigation planning should focus on reducing disturbance associated with physical activities and be linked closely with reclamation plans.

7. Summary

Based on a review of existing literature and known data sources, this report summaries baseline condition of wildlife in the area of the Faro Mine. Grizzly bears and wolverine are the only listed species that may occur within the Study Area on a regular basis. However, it is difficult to assess the predictable numbers of those species that may occur in the Study Area, as site-specific studies for those and most other species do not exist in the Study Area. From known distributions and breeding habitat, it is unlikely that any bird species of concern will occur within the Study Area. Small mammals have been found throughout the study area in abundance and are not likely a concern in the development of the project.

Fannin sheep are a species of concern to stakeholders of the Project, as both an economic resource within the region, and because they are the most-visible species that interact directly with the project. A reasonable understanding of seasonal ranges and movement patterns is available, as sheep are known to migrate directly through the Study Area.

Ungulate winter range for caribou and sheep is a management concern due to heavy snowfall in the region. The Tay River herd and fannin sheep range have the greatest potential to interact with the Study Area in winter, as those Key Wildlife Area ranges are in the closest proximity to the Study Area. Information is available on winter range distribution and population for both Fannin sheep and the Tay River herd, and may be used to develop project mitigation plans.

Increased harvest pressure on moose, grizzly bear and caribou is a concern of both local stakeholders and the Yukon Government. The moose harvest rate in particular in the GMSs near the Study Area tends to be near the limit of sustainable levels. The Tay River population appears stable, however because the herd is small and widely dispersed an increase in hunting pressure may have more immediate impacts. Grizzly bear populations face pressure as there is a high problem kill rate in several of the Study Area GMSs. Careful project mitigation planning should be employed to address an increase in hunting pressure and to reduce human-bear conflicts.

The presence of contaminants in wildlife from the Faro Mine is summarized, as were known from a previous study (Gartner Lee Limited 2006). High elevations of levels of lead are present in red-backed voles and shrews, and moderately elevated levels of copper, iron, thallium and nickel were also observed in most small mammals. Among hunted and trapped wildlife, elevations of lead were found in caribou, American marten, willow ptarmigan, and beaver. Moderate elevations were also detected for mercury and selenium in American marten, willow ptarmigan, and moose.

8. References

Banci, V., 1991:

Updated status report on the grizzly bear *Ursus arctos horribilis* in Canada. Unpublished report written for the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 171 pp.

Canadian Endangered Species Conservation Council, 2006:

The General Status of Species in Canada. Available at the following URL: http://www.wildspecies.ca/wildspecies2005/index.cfm?lang=e

Canadian Wildlife Service, 2007:

Bird Species Recorded in Faro. Birds of the Yukon Database. Whitehorse, Yukon.

Carey, J., 2007:

Personal communication. Email between Jean Carey (Sheep/Goat Management Biologist, Department of the Environment, Government of Yukon) and Jesse Dunford (Gartner Lee Limited) held on October 1, 2007.

COSEWIC, 2007:

Canadian species at risk, September 2007. Committee on the Status of Endangered Wildlife in Canada. Ottawa.

Department of Environment, Government of Yukon. 2005:

Yukon Amphibians, Yukon Department of Environment, Whitehorse, Yukon. 24 pp.

Department of Environment, Government of Yukon. 2004:

2004 Faro Area Moose Survey Results, Population Status, Harvest. Yukon Fish and Wildlife Branch, Yukon Renewable Resources, Whitehorse, Yukon.

Department of Environment, Government of Yukon. 2002:

Draft Report, Survey in Anvil Range, unpublished data.

Department of Renewable Resources, Government of Yukon, 1980.

Anvil Range Sheep Observations, unpublished data.

Department of Renewable Resources, Government of Yukon, 1987.

Anvil Range Sheep Observations, unpublished data.

Department of Renewable Resources, Government of Yukon, 1988:

Proposal management Plan for Sheep Mountain near Faro and its Fannin sheep population. Yukon Fish and Wildlife Branch, Yukon Renewable Resources, Whitehorse, Yukon.

Department of Renewable Resources, Government of Yukon, 1996a:
Caribou Management Guidelines. Yukon Fish and Wildlife Branch, Yukon Renewable Resources, Whitehorse, Yukon.

Department of Renewable Resources, Government of Yukon, 1996b:
Moose Management Guidelines. Yukon Fish and Wildlife Branch, Yukon Renewable Resources, Whitehorse, Yukon.

Department of Renewable Resources, Government of Yukon, 1996c:
Sheep Management Guidelines. Yukon Fish and Wildlife Branch, Yukon Renewable Resources, Whitehorse, Yukon.

Department of Renewable Resources, Government of Yukon, 1997a
Woodland Caribou Studies in Central Yukon. Yukon Fish and Wildlife Branch, Whitehorse, Yukon.

Department of Renewable Resources, Government of Yukon, 1997b:
Summary of the 1997 Faro Moose Survey Results. Yukon Fish and Wildlife Branch, Yukon Renewable Resources, Whitehorse, Yukon.

Department of Renewable Resources, Government of Yukon, 1997c:
Grizzly Bear Management Guidelines. Yukon Fish and Wildlife Branch, Yukon Renewable Resources, Whitehorse, Yukon.

Department of Renewable Resources, Government of Yukon, 1998:
Summary of Faro Moose Composition Survey Results. Yukon Fish and Wildlife Branch, Yukon Renewable Resources, Whitehorse, Yukon.

Department of Renewable Resources, Government of Yukon, 1999a:
Summary of 1999 Faro Moose Trend and Composition Survey Results. Yukon Fish and Wildlife Branch, Yukon Renewable Resources, Whitehorse, Yukon.

Department of Renewable Resources, Government of Yukon, 1999b:
Integrated Wildlife Management Plan - Ross River Traditional Territory. Yukon Fish and Wildlife Branch, Yukon Renewable Resources, Whitehorse, Yukon.

Garrison, Barrett A. 1999:
Bank Swallow (*Riparia riparia*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Laboratory of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/414doi:bna.414

Gartner Lee Limited, 2006:
Anvil Range Mine Complex – Terrestrial Effects Study: Investigation into Metal Concentrations in Vegetation, Wildlife and Soils, September 2006.

Hoefs, M., 1988:

Proposal Management Plan for Sheep Mountain near Faro and its Fannin Sheep Population. Fish and Wildlife Branch, Department of Renewable Resources, Government of Yukon.

Hoefs, M., 1990:

Aerial Survey of Mount Mye and Adjacent Sheep Populations. Department of Renewable Resources, Government of Yukon, unpublished data.

Horejsi, B., 1988:

Stone Sheep and the Grum-Vangorda Open Pit Mine Near Faro, Yukon: Impact Assessment and Mitigation Recommendations. OK Biological Services Ltd., Calgary, AB. 35 pp.

Kaska Dena Traditional Territory, 1997:

Integrated Wildlife Management Plan – Ross River Traditional Territory. URL: http://www.yfwmb.yk.ca/comanagement/territories/kaska/index.php

LeFranc, M.N, M.B. Moss, K.A. Patnode and W.C. Sugg (eds), 1987:

Grizzly Bear Compendium. Interagency Grizzly Bear Committee and National Wildlife Federation, Washington, DC.

Loehr, J. *et al.*, 2005:

Gender and age class specific reactions to human disturbance in a sexually dimorphic ungulate. Canadian Journal of Zoology 83: 1602-1607

MacHutchon, A.G. and D.W. Wellwood, 2003:

Grizzly bear food habits in the northern Yukon, Canada. Ursus 14(2):225–235

McLelland, J., 2007:

Personal communication. Email between Jamie McLelland (Caribou Technician) and Jesse Dunford (Gartner Lee Limited) held on October 2, 2007.

McLeod, H., 1981:

Co-operative Investigation of Migration Patterns of the Mt. Mye Sheep Population. Prepared for the Cyprus Anvil Mining Corporation of Faro, Yukon and the Yukon Fish and Wildlife Branch.

Middler, H., 2007:

Faro Mine Closure Planning Process Selkirk First Nation Community Home Visits. Prepared for Faro Mine Closure Planning Office, 2007.

Montreal Engineering Company Limited, 1976:

Preliminary Engineering and Environmental Investigation of the Proposed Kerr-Aex Grum Joint Venture. Prepared for Kerr Addison Mines Limited.

Poole, K.G. and G. Mowat, 2001:

Alberta furbearer harvest data analysis. Alberta Sustainable Resource Development, Alberta Species at Risk Report No. 31. Edmonton, AB. 51 pp.

Preston, C.R. and R.D. Beane, 1993:

Red-tailed Hawk (*Buteo jamaicensis*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Laboratory of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/052doi:bna.52

Ross. P.I., 2002:

Update COSEWIC status report on the grizzly bear Ursus arctos in Canada, in COSEWIC assessment and update status report on the Grizzly Bear Ursus arctos in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 1-91 pp.

H. Slama, pers. comm., 2007:

Personal communication. Email between Helen Slama (Fur Harvest Technician) and Jesse Dunford (Gartner Lee Limited) held on November 9, 2007.

Schwartz, C.C., S.D. Miller and M.A. Haroldson, 2003:

Grizzly Bear. Wild Mammals of North America: Biology, Management and Conservation. Second Edition. John Hopkins University Press. Baltimore, Maryland. pp 556-586

Schweinsburg, R.E., 1990:

Sheep Studies at Faro Yukon. Department of Environment, Government of Yukon. Unpublished.

Sinclair, P.H. *et al.*, 2003:

Birds of the Yukon Territory, UBC Press, Vancouver. pp 595

Staniforth, J., 1998:

Vegetation Communities of Sheep Mountain Faro, Yukon Territory, Draft. Department of Environment, Government of Yukon. Unpublished.

Statistics Canada, 2007:

Fur Statistics 2006. Agriculture Division. Ottawa.

Ward, R.M.P., 2003a:

Faro Moose Radio-Telemetry Study 2002/2003 Results. Yukon Fish and Wildlife Branch, Yukon Renewable Resources, Whitehorse, Yukon.

Ward, R.M.P., 2003b:

Preliminary Assessment of Faro Voluntary Reporting and Moose Harvest Restriction Project. Yukon Fish and Wildlife Branch, Yukon Renewable Resources, Whitehorse, Yukon.

Ward, R., 2007:

Personal communication. Email between Rick Ward (Moose, Elk and Deer Management Biologist, Yukon Department of Environment) and Jesse Dunford (Gartner Lee Limited) held on September 17, 2007.

Worley, K. *et al.*, 2004:

Population genetic structure of North American thinhorn sheep (*Ovis dalli*). Molecular Ecology 13: 2545-2556

Yukon Zinc Corporation, 2005:

Wolverine Project Environmental Assessment Report. Section 7: Environmental Assessment Findings.