10.4 WILDLIFE

10.4.1 Baseline

10.4.1.1 Introduction

Terms of Reference were followed

The wildlife baseline has been prepared to meet the Terms of Reference established by the Mackenzie Valley Environmental Impact Review Board (MVEIRB) for the environmental assessment (EA) of the Snap Lake Diamond Project. The baseline describes existing wildlife, including migratory birds, and wildlife habitat, prior to project development.

Traditional knowledge was integrated into baseline studies

Wildlife species represent an integral part of the terrestrial environment in the Slave Geological Province and some species are especially important to the culture and health of communities in the area. Therefore, it was particularly appropriate to include traditional knowledge in the study of baseline conditions which were then used to describe wildlife and wildlife habitat in the pre-project environment. Traditional knowledge information was obtained from the research, experience, and expertise of the Elders of Aboriginal people.

Wildlife, especially caribou, are essential to the traditional way of life

Issues relating to wildlife and wildlife health were identified by all communities. People's way of life, culture, and identity are based on the importance of wildlife, and caribou is the lifeblood of the people as described vividly in the following quotations:

> …*Our main source of food is the caribou...* (ND 18 09 99) Lutsel K'e Dene First Nation 2001).
>
> *I'd be concerned mostly with caribou, and also some of the larger predators of caribou, grizzly bears, wolves. Caribou is the most important species … Ducks and geese and moose might be subject to shortages (in my freezer), but not caribou. …It's always a happy time to be able to go out and get some caribou, a family activity, when they're close and access is easy, winter hunting* (Adrian D'hont, North Slave Métis Alliance, N.D.).

Terms of Reference and traditional issues were addressed by specific wildlife studies

The Terms of Reference for baseline information and the importance of wildlife identified through traditional knowledge were addressed primarily by specific wildlife studies. Quantitative studies were augmented by more qualitative work done prior to the baseline.

Quantitative baseline information is available for the Snap Lake area

From spring 1999 through fall 2000, quantitative baseline information was collected on wildlife species and habitat surrounding the Snap Lake Diamond Project. The methods used are described for each species in Section 10.4.1.3. The results of these baseline studies form the basis of this section.

Qualitative information was collected prior to 1988

Qualitative information on wildlife species and wildlife habitat adjacent to the Snap Lake Diamond Project prior to 1999 was assembled. The presence and distribution of wildlife based on observations by exploration staff (*i.e.*, wildlife sighting logs), were reported in 1998 (Hallam Knight Piesold Ltd. 1998). Habitat types were classified based on air photos and ground-based assessment (Hallam Knight Piesold Ltd. 1998). However, the habitat classification system was updated for the 1999-2000 study to the current ecological land classification (ELC) system developed by Resources, Wildlife and Economic Development (RWED).

An esker wildlife screening report was prepared in 1998

An esker wildlife screening report (EBA 1998), which included a survey on 6 October 1998 to assess wildlife habitat and use within the proposed bulk sample and processed kimberlite disposal site, borrow sites, and two winter roads was completed during the advanced exploration program. A list of expected and confirmed species that occupy the area seasonally or annually was also provided.

10.4.1.2 Study Area

Study area depends on project effects and species home range

Defining an appropriate area to study the effects of the Snap Lake Diamond Project on wildlife species depends on both the extent of project-related effects and the attributes of a given species. For example, the large home range of caribou and grizzly bears may result in several individuals being periodically influenced by the mine, while the small home range of songbirds may result in no effect on individuals nesting 10 km from the mine. Alternatively, another local population of songbirds nesting within 1 km of the mine may be frequently subjected to one or more project-related activities.

Local and regional study areas were defined for the Snap Lake Diamond Project

Within the above context, local and regional wildlife study areas were selected to capture the maximum zone of influence of the Snap Lake Diamond Project. The local study area (LSA) was selected to assess the immediate direct and indirect effects of the mine on individual animals and wildlife habitat. The regional study area (RSA) was selected to capture any effects that may extend beyond the LSA and subsequently impact the demography of the regional population.

The local study area is the project footprint plus 500 m

The LSA for wildlife is the same as the LSA used for the ELC and biodiversity assessments. Thus, all terrestrial assessments are based on the same LSA. The LSA includes the project footprint, plus a 500-m buffer surrounding the project footprint (Figure 10.4-1).

Five criteria were used to define the regional study area

The following criteria were used for delineating the RSA:

- LSA;
- winter and esker access roads;
- distribution of habitat types available for wildlife;
- wolf denning habitat; and,
- caribou migration routes.

Regional study area includes the traditional migratory route of Bathurst caribou herd

The RSA was defined by a radius of 31 km from the centre of the Snap Lake Diamond Project (Figure 10.4-1). This was done to insure that the study area remained within the Taiga-Shield ecozone, which is the interface between the taiga and the Canadian Shield. This ecozone is known to be important as denning habitat for wolves in the region (Heard and Williams 1992). The scale of the RSA also provides a biologically relevant means of determining the distribution of habitat types available to wildlife species during their seasonal or annual movements. This can then be used to predict the maximum zone of influence of direct and indirect habitat loss from the proposed project footprint plus winter and esker access roads. Finally, the RSA encompasses Camsell Lake and the southern portion of MacKay Lake, which have historically been an important migratory route for the Bathurst caribou herd (Weledeh Yellowknives Dene 1997; Lutsel K'e Dene First Nation 2001).

During the baseline studies, the RSA was further divided to include an area of more intensive study

For the baseline studies of some species, the RSA was further divided to include an area of more intensive study closer to the mine site. The areas included in the more intensive studies varied by species. For example, to provide additional caribou coverage, the transects of the aerial survey for caribou were doubled within an 11 km radius of the mine site in 2000.

Figure 10.4-1 Local and Regional Study Areas for Wildlife

10.4.1.3 Methods

10.4.1.3.1 Valued Ecosystem Components

Valued ecosystem components were selected to study potential impacts

Because it is not economically or logistically possible to study the potential impacts of mining activities on all wildlife species, a group of valued ecosystem components (VECs) were selected. Criteria for choosing VECs to study were based on the ecological, social, cultural, and economic aspects of the ecosystem. The VECs were also chosen for consistency with the wildlife effects monitoring program for the BHP EKATI™ mine and the EA for the Diavik Diamonds Project. Eight VECs were selected for study in the EA of the Snap Lake Diamond Project:

- Bathurst caribou herd;
- barren-ground grizzly bears;
- wolves;
- foxes;
- wolverines;
- upland breeding birds (passerines, shorebirds, ptarmigan);
- raptors (peregrine falcon, gyrfalcon); and,
- waterfowl.

10.4.1.3.2 Caribou

Survey method for studying migratory movement, abundance, and distribution of caribou is described

Systematic and unbounded (*i.e.*, not fixed width transects; all animals seen were recorded) aerial surveys for caribou were conducted in the RSA during 1999 and 2000. In addition, the winter access road was surveyed during the spring of each year. Surveys were conducted from a helicopter along predetermined transects at an altitude of 120-180 m above ground level (agl), and a speed of 145-160 kilometre per hour (km/hr). The same line transects were followed during each survey with the aid of the 1:250,000-scale map and national topographic system (NTS) co-ordinates programmed into the helicopter global positioning system (GPS) unit. In 1999, distance between transects was 8 km resulting in a predicted 25% coverage of the RSA (*i.e.*, maximum transect width was estimated at 2 to 3 km). To provide additional coverage close to the Snap Lake Diamond Project in 2000, distance between transects was decreased to 4 km within an 11-km radius of the project footprint, increasing the coverage to 50% within this area (Figure 10.4-1). The remainder of the RSA was surveyed using established transects that were separated by a distance of 8 km (*i.e.*, 25% coverage) as before. The crew consisted of the pilot and three trained observers; most often including an Aboriginal Elder and youth. All observations of caribou and other VECs were recorded on a data sheet and located on a 1:250,000-scale map. Wildlife observed outside the study area during turns at the end of transects were not recorded.

Surveys were timed to coincide with the peak movement of caribou through the area

Surveys were timed to coincide with the peak movement of caribou through the area. Movements of satellite collared caribou (provided by RWED) were used to identify peak caribou movements in the region in addition to ground observations of caribou by pilots in the region and at MacKay Lake Lodge. During 1999, surveys were conducted on 30 March, 2 April, and 21 July to 23 July. During 2000, complete aerial surveys were flown on 11 April, 14 April, 4 May, 7 May, 10 May, 21 July and 17 August. In addition, reconnaissance flights using a fixed-wing aircraft were flown over traditional migration routes within and adjacent to the RSA on 16 April, 18 April and 23 April 2000 to confirm the lack of caribou in the area.

Detailed information was recorded during surveys

The following information was recorded for caribou observations:

- GPS location;
- location plotted directly on 1:250,000-scale map;
- ELC type (RWED's ecological classification);
- number of caribou;
- dominant composition of caribou group;
- direction of caribou movement or activity if not moving; and,
- location of tracks/trails (2000 only).

The number of tracks or trails was ranked to assess caribou distribution

In 2000, estimates of caribou snow-track density (number per 4 km) were obtained during the survey on 4 May. The number of tracks within a 4-km segment of the aerial transect was arbitrarily ranked as low (≤5 tracks), medium (6 to 20 tracks) or high (>20 tracks). In addition, on 18 August, point locations of the estimated number of historic caribou trails were recorded along aerial transects (Figure 10.4-2). The number of trails were also classified as low, medium, or high based on the equivalent ranking system. Information on snow-track density and historic trails was used to help determine the distribution of caribou movement through the RSA during the northern and southern migration periods.

Snow tracks along the entire winter access road were also ranked

To provide baseline information on the interaction of caribou with the winter access road, snow-track surveys were conducted along the entire road route between 12 April and 14 April 2000. Two observers, using snow machines, followed the road and recorded the location and number of tracks classified as low, medium, or high (as above) that crossed the road.

Figure 10.4-2 Caribou and Historic Caribou Trails in the Regional Study Area

Additional information was collected during caribou aerial surveys

The following definitions were applied while conducting caribou aerial surveys. Composition of the group was classified according to nursery (adult females with calves, adults with calves) or non-nursery (adult females, adult males, adult females and males) groups. The directional movement of animals and trails was recorded to the nearest 45 degrees of magnetic north (*e.g.*, N, NW, S, SW), and activity was categorized as bedded, standing, feeding, walking, trotting, or running. Incidental observations of other species were also made, and the GPS location of grizzly bears, black bears, wolves, wolverines, and raptors were recorded on the map and data sheet.

RWED provided information on satellite-collared caribou

In addition, locations of satellite-collared caribou have been obtained from RWED (courtesy of Anne Gunn), at weekly intervals from 26 February 1999 through 1 October 2000 (RWED 2000).

10.4.1.3.3 Grizzly Bears, Wolves, and Foxes

The importance of eskers for many species was identified through traditional knowledge

Traditional knowledge identified that eskers provide important travel routes for many mammal species (*e.g.*, caribou, musk-ox, furbearers, humans), and den sites for carnivores, especially wolves (Lutsel K'e Dene First Nation 2001). The following quotes from Lutsel K'e Elders stresses the importance of eskers for several species of wildlife.

> *Caribou always move along eskers when they are travelling through this kind of land. Musk-ox too. That is because it is smooth travelling compared to rough rocks elsewhere* (Joe Michel).
>
> *Those little bushes, T'â bathe (bog birch), that is where the bears stay in the summer, in the shade. That's why it is said to never go downhill off eskers quickly, because bears might be there* (Liza Enzoe).
>
> *Eskers are the main places where wolves make their dens. Also you can find fox and ground squirrel's holes in eskers* (Jim Fatte).
>
> *The wolves too make their dens on the eskers, just about anywhere on the eskers. You can see them in the springtime if you are travelling around* (Noel Drybones).

Aerial surveys for grizzly bears, wolves, and foxes were completed on all main eskers

Esker surveys were done to collect information on carnivores that use eskers as denning habitat. Using a helicopter, each side of the esker was surveyed separately at a flight speed of 80 km/hr and an altitude of 30 m agl. The crew consisted of the pilot and two trained observers including an Elder or Aboriginal technician. All potentially active bear dens were checked on the ground for verification of overwinter occupancy (*i.e.*, fresh dirt and bedding material). Active wolf dens were not groundtruthed and were subjected to minimum disturbance (*i.e.*, minimum time was spent flying around the den site).

Surveys were conducted in late May

Grizzly bears within the Slave Geological Province typically emerge from winter dens from mid-April through mid-May (McLoughlin 2000). Therefore, aerial surveys for carnivore den sites (grizzly bears, wolves, and foxes) were conducted from 28 May to 30 May 1999 and 25 May to 26 May 2000 on all main eskers within the RSA (90.6 km of eskers; Figure 10.4-1).

Ground surveys for grizzly bear, wolf, and fox dens were conducted along the esker south of the project

Concurrent with the aerial surveys flown each year, a ground survey for carnivore dens was also conducted along the large esker in the southern portion of the RSA (approximately 10 km south of Snap Lake; Figure 10.4-1). Three people (including two Aboriginal technicians) walked along this esker system following completion of the aerial surveys. One person surveyed the top portion of the esker, while the other two people each surveyed one side of the esker.

Locations of dens were recorded during surveys

The locations of all active grizzly bear, wolf, and fox dens were recorded with GPS units and plotted on a 1:50,000-scale map. GPS co-ordinates of all other incidental wildlife observations were also recorded. All active wolf dens located during the spring 2000 survey were surveyed again on July 26 to determine occupancy.

10.4.1.3.4 Wolverines

Wolverine snow track survey was conducted in 1999 and 2000

A wolverine track survey was conducted from 30 March to 1 April 1999 and 12 April to 15 April 2000 by snow machine. Two people (including an Aboriginal technician) travelled a predetermined route of 100 km (11 km from the mine site) in a clockwise direction around the predicted mine footprint (Figure 10.4-1). The distance between observers did not exceed 25 m, and surveys were conducted 5 to 17 days since the last snowfall. For each observation, the following information was recorded:

- number of individual tracks;
- direction of travel (N, S, E, W); and,
- GPS co-ordinates.

10.4.1.3.5 Upland Breeding Birds

Nineteen plots were sampled to estimate the density, species richness, and species diversity of upland breeding birds

Surveys for upland breeding birds (passerines, ptarmigan, and upland breeding shorebirds) were conducted among nineteen sample plots from 9 June through 16 June 1999 and 7 June through 13 June 2000 in the RSA. In this study, the sample plot represents the unit of replication. In 1999, 11 sample plots were located within 5 km from the mine site (0.8 to 4.3 km) and eight plots were established at distances greater than 10 km from the mine site (11.7 to 23.4 km). In 2000, eight plots were located within 5 km of the mine site and 11 plots were located greater than 10 km from the mine site (Figure 10.4-3). GPS co-ordinates were recorded for each corner of a plot and each corner was identified with a permanent marker. Sample plots were stratified across three habitat types (ELC units): heath tundra (30% to 80% boulders), sedge wetland, and riparian shrub. However, due to the characteristically small size and irregular shape of habitat patches in the area, many of the heath tundra plots were interspersed with small patches of sedge wetland, riparian shrub, or spruce forest ELC units. Accordingly, the shape of sample plots were square, rectangular, or irregular. The size of sample plots ranged from 0.01 km^2 to 0.25 km^2 (*i.e.*, 1 to 25 ha).

Sample plots were completely censused

Surveys of sample plots were carried out by one Aboriginal trainee and two experienced technicians. Within each sample plot, 100 m wide strip transects were surveyed by two observers separated by a distance of 50 m. Thus, each observer surveyed a 25-m wide strip on either side, and the entire sample plot was censused. At 100-m intervals along each transect, observers would check the distance between them to ensure that survey width was consistent. Upon reaching the end of a transect, observers turned and surveyed the next transect parallel to the first while ensuring that the outside observer on the previous transect adopted the inside position on the adjacent transect. The purpose of maintaining these positions between observers was to prevent double counting of breeding birds and minimize bias in parameter estimates. Surveys were conducted between 4 a.m. and 10 a.m. Weather conditions were also recorded.

Birds were identified as residents or incidentals within a plot

The following criteria were used to identify breeding birds within a sample plot: territorial displays, territorial calls, feeding, and/or visual location of a nest with adults. For each observation, the species, behaviour, location, and ELC unit were recorded. Birds identified outside the sample plot (*e.g.*, fly-overs) were recorded as incidental observations and not included in parameter estimates. However, incidental observations were used to generate a complete list of all avian species observed in the RSA.

Species density, richness, and diversity were estimated

Data were used to estimate density (number of birds/0.25 km^2), species richness (number of unique species), and species diversity (Shannon-Wiener index).

Figure 10.4-3 Location of Sample Plots for Upland Breeding Birds

10.4.1.3.6 Raptors

Methods for estimating distribution of nesting gyrfalcons and peregrine falcons are described

An intensive survey of all suitable nesting habitat within the entire RSA for gyrfalcon and peregrine falcon nest sites has not occurred. Instead, raptor surveys were conducted during aerial surveys of eskers within the RSA for carnivore dens in 1999. Surveys were focused on areas that were deemed to have the most suitable nest sites, such as prominent rock outcrops and cliff faces. Nest sites that were co-incidentally recorded during other wildlife surveys in the RSA were then subsequently visited for verification of breeding activity. All nests located in 1999 were checked in late May 2000 for occupancy during esker surveys for carnivore dens. In addition, an intensive aerial survey of all suitable raptor nesting habitat within a radius of 11 km from the mine site was done by helicopter in late May 2000. All known nests were visited in late July to determine the outcome of the breeding attempt.

Detailed information was collected during surveys of breeding attempts

A breeding attempt was assumed to be occurring if a pair of birds was observed at a nest site, if eggs were seen in a nest, or if a single bird was exhibiting incubation behaviour (*i.e.*, not moving from a nest scrape). If a nest was not immediately obvious and only a single bird was observed at a cliff, then experienced observers landed near the site and quickly verified the presence of a nest with eggs. If a nest could not be located quickly, it was assumed that a breeding attempt was occurring if the adult exhibited signs of defending the area. During visits in late July, the number of chicks or fledglings in a nest were recorded. It was assumed that all the young in a nest at this late stage would survive to independence. The following information was recorded:

- species;
- location of nest (or roost) site using a GPS and subsequently recorded on a 1:50,000-scale map;
- behavioural observations (*e.g.*, brooding, nest defense);
- number of eggs and chicks in nest (if observed); and,
- weather variables.

10.4.1.3.7 Waterfowl

Eighteen lakes were surveyed for waterfowl

Surveys for waterfowl were conducted from 11 June to 16 June 1999 and 12 June to 13 June 2000 on 18 lakes (including the water management pond area). Ten lakes were within 10 km of the mine site and 8 lakes were greater than 11 km from the mine site (Figure 10.4-4). Surveys of the

Figure 10.4-4 Location of Lakes Surveyed for Waterfowl

10 lakes closest to the mine site were repeated on 22 July and 24 July 1999. Lakes were large enough to support loons, but not too large that identification of individuals was compromised. Maximum diameter for any lake was 500 m, and perimeters ranged from 761 m to 2,391 m. Shoreline characteristics were similar among lakes and typically consisted of 40% to 95% sedge (median = 75%) and 5% to 60% rock. All lakes were noted on a 1:50,000-scale map and GPS coordinates were recorded.

The entire lake was surveyed and observations were standardized by length of shoreline

Surveys were conducted during late-morning through mid-afternoon when waterfowl typically roost on lakes. For each lake, the number of individuals and species observed per linear distance of shoreline (*i.e.*, perimeter) was recorded during a 15-minute period. For those lakes that could be surveyed more than once during the observation period, the maximum number of individuals observed was recorded. Brood size was recorded opportunistically.

10.4.1.4 Results

10.4.1.4.1 Caribou

The Bathurst caribou herd migrates north and south through the regional study area

The Bathurst caribou herd is the largest of five major barren ground caribou herds in the Northwest Territories (NWT). The population size is estimated at 349,000 +/- 95,000. The herd exhibits periodic changes in seasonal migration routes and winter range (Case *et al*. 1996; Gunn *et al*. 1997). Annual home range for the Bathurst caribou herd is approximately 250,000 km^2 and overlaps the RSA of the Snap Lake Diamond Project. Caribou spend the winter near the forest, usually concentrated in areas to the southeast and northwest of the eastern arm of Great Slave Lake. The herd gathers in spring in preparation for the northern migration to calving grounds located south of Bathurst Inlet. In mid-summer, caribou begin to migrate south to the wintering grounds.

Observations by Elders and traditional knowledge suggest that few caribou travel through the Snap Lake Diamond Project area

On-site observations and the traditional knowledge of Lutsel K'e Elders indicated that relatively few caribou migrate through the Snap Lake Diamond Project area (Lutsel K'e Dene First Nation 2001). Although the animals will travel along the south shore of MacKay Lake towards Gordon Lake (*i.e.*, north west of Snap Lake), the area around Snap Lake, particularly east of the mine area, is very rocky making it difficult for caribou to travel. The following three quotes from Lutsel K'e Elders provide a summary of caribou movement and numbers through the RSA.

> *Caribou like to go in smooth places, not where it is rough. They go in valleys and on ridges usually* (Ernest Boucher).

> *The caribou around here [MacKay Lake narrows] don't really pass through the Snap Lake [the mine site]. They pass towards the north west of the mine* (Joe Michel).
>
> *One of the women who work here [Snap Lake site] said there were 20 caribou here on June 4. There were even many groups around towards the south-east. They [the caribou] don't move through here [Snap Lake site] in big groups, but in smaller groups, clusters moving through the area. Lots of caribou may pass through here, but in smaller groups. There is lots of food around the south side [around the eskers] and it isn't too rocky* (Liza Enzoe).

In 1999, caribou movement through the Snap Lake area was variable

Data from satellite-collared caribou and aerial surveys supported the observations and information provided by the Elders. Satellite information collected by RWED indicated that collared caribou moved west of Snap Lake during the northern migration in 1999 (Figure 10.4-5). The polygons shown on Figure 10.4-5 represent the outside perimeter of all collared caribou for each date shown. Complete aerial surveys of the study area on 30 March and 2 April (early northern migration) resulted in the observation of one female adult caribou. Collared caribou calved south of Bathurst inlet and began to move south during early to mid-July, passing through the MacKay-Camsell-Snap lakes area (Figure 10.4-6). Aerial surveys from 21 July through 23 July counted a total of 6,951 caribou. Most of the animals were observed in the western portion of the study area and were moving through the spruce forest between Snap Lake and Camsell Lake. On 21 December, collared caribou were within their traditional wintering area (Figure 10.4-6).

In 2000, caribou travelled through the Snap Lake area during the northern migration and were distributed within the Camsell-Snap Lake area during late autumn

During 2000, data on satellite-collared caribou indicated that some portion of the Bathurst herd passed through the Camsell-Snap lakes area during the northern migration (Figure 10.4-7). Although complete aerial surveys and reconnaissance surveys from 11 April to 23 April sighted minimal caribou (total = 311 animals), aerial surveys from 4 May through 10 May counted 3,856 caribou within the study area (including 410 animals along the winter access road). During July and August of the southern migration, satellite-collared caribou were distributed north of the Camsell-Snap lakes area (Figure 10.4-8). Complete aerial surveys of the study area on 21 July and 17 August sighted a total of 298 animals. From 16 September through 1 October collared animals were distributed within the Camsell-Snap lakes area and wildlife logs indicated that small groups of caribou were observed within 10 km of the project footprint. By 5 December, caribou were distributed among their traditional wintering grounds (Figure 10.4-8).

Figure 10.4-5 Distribution of Satellite-Collared Caribou During the Northern Migration, 1999

Figure 10.4-6 Distribution of Satellite-Collared Caribou During the Southern Migration, 1999

Figure 10.4-7 Distribution of Satellite-Collared Caribou During the Northern Migration, 2000

Figure 10.4-8 Distribution of Satellite-Collared Caribou During the Southern Migration, 2000

Caribou locations and track density indicated that caribou moved through the northern and western portion of the regional study area during the northern migration

The combined aerial survey information on caribou group size and location for 1999 and 2000 suggests that caribou generally moved through the northern and western half of the RSA during the northern migration (Figure 10.4-9). Few caribou were observed in the eastern portion of the RSA. Aerial surveys are timed to coincide with peak migration but represent a "snapshot" of numbers and distribution of caribou in the area on any one day. Additional information on the distribution of caribou during migration through the RSA is gained by recording density of caribou trails during the northern migration when snow covers the land and lakes. Data for caribou aerial surveys are presented in Table X.4-1 (Appendix X.4). A large number of caribou observations were recorded between Camsell Lake and MacKay Lake. Medium and high caribou trail density locations were more common along transects in the western portion of the study area (Figure 10.4-10).

Caribou were distributed more evenly over the regional study area during the southern migration

In contrast to information collected on caribou group size and location during the northern migration, the distribution of animals within the RSA was relatively more uniform during the southern migration (Figure 10.4-11). Although disproportionately more caribou groups were observed in the western part of the study area, a number of caribou groups were also located east of Snap Lake. Few observations of caribou, however, were made among the extensive boulder fields to the north and south of Lac Capot Blanc.

Historic trails indicate at least some movement through most of the study area

An historical, long-term picture of caribou movements through the area can be gained by looking at the distribution and density of historic tails through the RSA. The location and number of historic trails indicates that some movement occurred through the eastern portion of the study area, but most caribou travelled north and west of Snap Lake during the southern migration (Figure 10.4-12).

Annual and seasonal variation in abundance and distribution of caribou has been shown

To summarize, traditional knowledge and scientific data exemplify the year-to-year variation in the location of the Bathurst caribou herd during the northern and southern migration. Within any given year and migration period, the number of caribou that travel through the Camsell-Snap lakes area can vary markedly (Table 10.4-1). When caribou do travel through the area, it appears that they mostly move through the northern and western portion of the RSA adjacent to Camsell and MacKay lakes.

Figure 10.4-9 Caribou Numbers Along Transects During the Northern Migration, 1999-2000

Figure 10.4-10 Caribou Snow-track Density (Number/4 km) Along Transects During the Northern Migration, 2000

Figure 10.4-11 Caribou Numbers Along Transects During the Southern Migration, 1999-2000

Figure 10.4-12 Number of Historic Caribou Trails Along Transects During the Southern Migration, 2000

Table 10.4-1 Number of Caribou Observed during the Northern and Southern Migration, 1999 and 2000

Year	Northern Migration	Southern Migration
1999	1	6,951
2000	3,856	298

10.4.1.4.2 Grizzly Bears, Wolves, and Foxes

Grizzly bears of the Slave Geological Province have extensive home ranges

Barren-ground grizzly bears of the Slave Geological Province are unique in that they possess the largest home ranges of any grizzly bears studied in North America. McLoughlin *et al.* (1999) found the mean annual range of adult male grizzly bears to be 6,685 km^2 and the mean annual range of females to be 2,074 km^2. In addition, a general trend from a high rate of movement in spring and summer to lower rates in autumn was observed for both male and female grizzly bears. This pattern of movement may be associated with seasonal variance in the distribution and abundance of food supply (McLoughlin *et al.* 1999). Poor quality habitats for grizzly bears in spring and early summer are associated with larger home ranges. The decrease in movement in autumn is likely correlated with an increase in food supply as caribou return to the central region of the Slave Geological Province area and berries increase in abundance (McLoughlin *et al.* 1999). Autumn also signals the time for hibernation of grizzly bears. Den entrance generally occurs in the last week of October and den emergence occurs in the last week of April (McLoughlin *et al.* 1999).

No active bear dens were located within the regional study area, but grizzly bears were sighted

During 1999 and 2000, no active bear dens (*i.e.*, dens used during the most recent winter) were located within the RSA. However, recent tracks, feces, and sign of grizzly bear excavations for ground squirrels were observed within the regional study area. Furthermore, on 17 August 2000, a grizzly bear was sighted 6-km north of the project footprint, and three grizzly bear sightings were reported near the project footprint on 12 May, 23 May, and 24 May 2001. Although not a VEC, black bears were observed incidentally within the RSA on several occasions.

Current information suggests that eskers are not preferred denning habitat for grizzly bears

The lack of dens found in esker habitat in the Snap-Camsell-MacKay lakes area may reflect the pattern of grizzly bear den site selection observed by Elder Noel Drybones who has never seen dens on eskers, but rather "*on the outskirts of eskers where there are small patches of hilly sand*" (Lutsel K'e Dene First Nation 2001). As part of a study on grizzly bear ecology in the central Arctic, McLoughlin (2000) also found that esker habitat accounted for only 7 of 56 den sites. Over a two-year period, 23/56 dens were located in heath tundra habitat, 8/56 in riparian tall shrub/birch seep habitat, 5/56 in spruce forest, and 11/56 in heath tundra with >30% boulder habitat (McLoughlin 2000).

Grizzly bears may preferentially select heath / heath-boulder habitat for den sites

Restricting the search to esker habitat, as in this study, may have limited the likelihood of locating an active den in the RSA, especially if the abundance of bears is naturally low. If den site selection for barren-ground grizzly bears is similar in the central and southern Arctic, then one could expect to find proportionately more dens in the heath/heath-boulder tundra habitats within the RSA.

Spring aerial surveys located two active wolf dens in 1999 and four active dens in 2000

In 1999, two active wolf dens were located within the RSA. One den was located 12-km northwest of the project footprint. The other was located 29-km northwest of the project footprint, and this den was also occupied during the spring of 2000 (Figure 10.4-13). Spring surveys in 2000 also located three additional wolf dens: 29-km southwest, 18-km southeast, and 25-km northwest of the project footprint (Figure 10.4-13). The subsequent survey on 26 July 2000 with RWED carnivore biologist Dean Cluff and furbearer biologist Robert Mulders indicated that all four dens located in the spring were unoccupied; the wolves likely had moved out of the study area. In contrast, wolves that den north of MacKay Lake in the central tundra region of the Slave Geological Province typically do not abandon den sites until after mid-August (BHP 2001; Cluff *et al*. 2001). At the landscape scale, these animals also show a strong preference for esker habitat during the pup-rearing period, but the importance of eskers to pup survival is not clear (Cluff *et al*. 2001).

Home ranges of foxes are 15-25 km^2

There is little information on the ecology and behaviour of Arctic and red foxes in the Slave Geological Province. Home ranges for adult foxes have been estimated to be 15 to 25 km^2 (Banfield 1974; Larivière and Pasitschniak-Arts 1996).

Eight active fox dens were found in 1999 and two active dens were recorded in 2000

In 1999, eight active fox dens were located within the RSA, while surveys in 2000 confirmed two fox dens were active (Figure 10.4-13). Data for carnivore den surveys is provided in Table X.4-2 (Appendix X.4). Den sites were located 8 to 30 km from the project footprint. During the construction phase of the EKATI™ diamond mine, active fox dens were recorded within 1 km of the mine site (BHP 1998). Given the opportunistic and habitual nature of these animals, foxes will likely attempt to den near the Snap Lake Diamond Project.

Figure 10.4-13 Location of Active Wolf and Fox Den Sites, 1999-2000

10.4.1.4.3 Wolverines

The home range size of wolverines is variable

Data on the distribution, abundance, and ecology of wolverines in the NWT is limited. Across the Arctic tundra, taiga, and northern boreal forest, wolverine populations appear to be present at low density which is likely a function of the large home range size of individuals (Pasitschniak-Arts and Larivière 1995). For example, home range sizes of adults above 60°N varies from 48 to 535 km^2 (Magoun 1985; Banci 1987; Mulders 1997).

Wolverine track density estimates were within the range of estimates determined for studies at the BHP EKATI™ mine

In 1999, a survey for wolverine tracks along a 100-km route (11-km from the mine site) recorded 19 recent tracks. In addition, four individual animals were observed opportunistically during ground and aerial surveys. In 2000, a total of 26 recent tracks were detected, but no animals were observed during any wildlife surveys. Thus, the average density (number per linear km) of tracks recorded during 1999 and 2000 was 0.23 tracks/km. This is within the range of track densities (0.10 to 0.33 tracks/km) observed along a 170-km survey route around the EKATI™ diamond mine during 1998 to 2000 (BHP 2001). Wolverine track survey data are presented in Table X.4-3 (Appendix X.4).

10.4.1.4.4 Upland Breeding Birds

Twenty-two species of upland breeding birds were identified as breeding within the regional study area

Thirty-eight species of passerines (small perching birds), shorebirds, gulls, ravens, and ptarmigan were observed within the RSA in 1999 and 2000 (Table X.4-4; Appendix X.4). Of these species, twenty-two upland breeding bird species (passerines, ptarmigan, and shorebirds) were identified as breeding within the RSA. Average density for 1999 and 2000 ranged from 0.5 individuals/0.25 km^2 for lesser yellowlegs to 39.2 individuals/0.25 km^2 for Lapland longspurs (Table 10.4-2). Within habitats, 20 species were detected among the heath tundra plots, while the number of species detected among sedge wetland and riparian shrub plots was 16 and 14, respectively. The rose-breasted grosbeak and rusty blackbird were unique to riparian shrub habitat.

Analysis controlled for variation in plot size among habitats

Because of the variation in plot size among habitats, and the potential influence of plot size on bird density, richness, and diversity, analysis of covariance was used to determine the effect of habitat and year on parameters, while controlling for plot size. If plot size did not influence the results, then a two-way analysis of variance was used to determine if density, richness, and diversity were statistically correlated with habitat and year.

Table 10.4-2 Mean (±1SE) Annual Density (1999 and 2000) of Upland Breeding Bird Species

Species	Density (Individuals / 0.25 km^2)
American pipet	4.7 ± 0.2
American robin	6.5 ± 1.3
American tree sparrow	25.8 ± 5.0
Blackpoll warbler	24.1 ± 9.7
Common redpoll	13.0 ± 4.6
Grey-cheeked thrush	10.4 ± 2.3
Harris' sparrow	24.2 ± 2.1
Horned lark	5.6 ± 1.5
Hoary redpoll	13.5 ± 11.5
Lapland longspur	39.2 ± 7.8
Least sandpiper	13.1 ± 2.4
Lesser yellowlegs	0.5 ± 0.5
Lesser golden plover	1.5 ± 1.5
Rose-breasted grosbeak	12.5 ± 12.5
Rusty blackbird	12.5 ± 12.5
Savannah sparrow	22.9 ± 3.6
Snow bunting	1.0 ± 1.0
Spotted sandpiper	0.5 ± 0.5
White-crowned sparrow	7.4 ± 2.0
Willow ptarmigan	4.9 ± 2.9
Yellow warbler	32.5 ± 3.0
Yellow-rumped warbler	14.7 ± 11.7

Results indicated that species richness was positively correlated with plot size, while density and diversity were independent of plot size

Analysis indicated that species richness was correlated with plot size ($F_{1,31}$ = 7.72, P = 0.01), but density and diversity were independent of plot size ($F_{1,31}$ <1.87, P >0.15). Analysis of covariance also indicated that, after controlling for the effect of plot size, species richness did not vary significantly between years ($F_{1,31}$ = 1.47, P = 0.23) or among habitats ($F_{2,31}$ = 2.67, P = 0.09; Table 10.4-3). Analysis of variance generated no significant interaction between habitat and year for either species density or diversity ($F_{2,32}$ <0.57, P >0.50). Breeding bird density was significantly higher in 2000 than in 1999 ($F_{1,32}$ = 5.44, P = 0.03), and was greatest in riparian shrub, followed by sedge wetland and heath tundra habitat ($F_{2,32}$ = 25.20, P <0.01; Table 10.4-3). Species diversity was higher in riparian shrub and heath tundra habitats than the sedge wetland habitat ($F_{2,32}$ = 3.71, P = 0.04), but did not vary significantly between 1999 and 2000 ($F_{1,32}$ = 0.18, P = 0.68).

Table 10.4-3 Mean (±1SE) Density, Species Richness, and Species Diversity of Upland Breeding Birds among Habitat Types and Year

Habitat Type	Density		Richness		Diversity	
	1999	2000	1999	2000	1999	2000
Heath tundra	57.5 ± 3.0 (8)	79.2 ± 5.1 (7)	5 ± 1 (8)	7 ± 1 (7)	1.5 ± 0.1 (8)	1.5 ± 0.1 (7)
Riparian shrub	231.3 ± 43.8 (2)	293.8 ± 39.7 (4)	7 ± 1 (2)	8 ± 1 (4)	1.6 ± 0.1 (2)	1.8 ± 0.1 (4)
Sedge wetland	115.0 ± 18.1 (9)	175.3 ± 29.9 (8)	6 ± 1 (9)	6 ± 1 (8)	1.3 ± 0.1 (9)	1.3 ± 0.2 (8)

Note: ( ) = number of plots.

Species diversity, but not species richness, differed significantly among habitats

To summarize, the number of different species (*i.e.*, richness) did not differ significantly among the habitats sampled in 1999 or 2000. Although species diversity (which is a function of species richness and density) was greater in heath tundra and riparian shrub habitats than sedge wetland habitat, it was similar between years for all habitats. Estimates of breeding bird density differed significantly between 1999 and 2000, which was not unexpected given that populations typically exhibit annual changes in abundance due to natural variation in reproductive success and overwinter survival.

Higher densities of birds in riparian and wetland habitats may be related to habitat patch size and the proportion of suitable breeding sites

However, the large difference in density among habitats was striking, particularly the high density of birds in the riparian shrub habitat. One explanation may be related to the interaction among plot (habitat patch) size, habitat type, and number of suitable breeding sites within a patch. For example, patch size ranged from 0.08 to 0.25 km^2 in heath tundra habitat, 0.01 to 0.08 km^2 in sedge wetland habitat and 0.01 to 0.02 km^2 in riparian shrub habitat. This was largely correlated with the large size of heath tundra patches and the small size of riparian shrub habitat patches on the landscape around the Snap Lake Diamond Project. It is possible that as patch size increases, in any habitat, the number of breeders also increases but the number of suitable breeding sites within a patch decreases disproportionately. Small patches of riparian shrub (1 to 2 ha) may mostly consist of suitable breeding sites, while larger patches of heath tundra (8 to 25 ha) also contain suitable reproductive sites with disproportionately more non-suitable sites. As a result, the average density of individuals breeding within a patch of habitat changes with patch size, which is also related to the ratio of good and poor quality breeding sites. Thus, for any given breeding habitat, density may naturally be higher in small patches than larger patches.

10.4.1.4.5 Raptors

Four active peregrine falcon nests were located in 1999 and 2000, while five active gyrfalcon nests were located in 1999, and two active nests were found in 2000

Eight species of raptors (birds of prey) were observed in the RSA during 1999 and 2000 (Table X.4-5, Appendix X.4 for raptor survey data). However, only two species (peregrine and gyrfalcons, which are VECs) were confirmed as breeders within the RSA (Figure 10.1-14). In 1999, four peregrine falcon and five gyrfalcon nests were found in the RSA. Surveys in 2000 located one active gyrfalcon nest and five active peregrine falcon nests (Table 10.4-4). Because peregrine and gyrfalcons often nest at alternate locations within a breeding territory during consecutive years, nest site locations immediately adjacent to each other (*i.e.*, within 1 to 2 km) should be considered as one territory (Figure 10.4-14). Although nest sites were not surveyed for fledglings in 1999, the mean number of fledglings per active peregrine nest in 2000 was 2.0. An intensive search in 2000 of suitable nesting habitat within 11 km of the project site did not reveal any breeding pairs. Nest sites were located 11 to 30 km from the project footprint (Figure 10.4-14).

Table 10.4-4 History of Occupancy for Raptor Nest Sites Located within the Regional Study Area

Site Name	Species	Occupied		Young
		1999	2000	
PER99-1	PERE	yes	yes	2
PER99-2	PERE	yes	no	0
PER99-3	PERE	yes	yes	3
PER99-4	PERE	yes	yes	0
PER00-1	PERE	--	yes	3
GYR99-1	GYR	yes	no	0
GYR99-2	PERE	yes	yes	2
GYR99-3	GYR	yes	yes	1
GYR99-4	GYR	yes	no	0
GYR99-5	GYR	yes	no	0

Note: GYR = gyrfalcon; PERE = peregrine falcon; Young = number of young produced in 2000; -- = not located.

Figure 10.4-14 Location of Active Gyrfalcon and Peregrine Falcon Nest Sites, 1999-2000

The low density of falcon nests in the regional study area is typical of Arctic tundra ecosystems

The low number of peregrine and gyrfalcon nest sites located within the RSA is related to the survey method but is consistent with natural densities of falcons found elsewhere in the Arctic tundra (Poole and Bromley 1988; Court *et al*. 1988; Johnstone 1997). Surveys for raptor nests and wolf dens were carried out concurrently, and therefore, nest locations were biased towards those constructed adjacent to eskers in the study area. A few raptor sites were also found while conducting surveys for caribou and waterfowl, but in general, nest site locations were biased towards esker habitat (Figure 10.4-14).

Estimates of breeding pairs in the regional study area is consistent with other Arctic data

An intensive, systematic search of all suitable nesting habitat within the RSA, similar to the intensive search within 11 km of the mine site, would likely have generated a more accurate estimate of the number of peregrine and gyrfalcon nests on the landscape. However, the current estimate of breeding pairs of peregrine and gyrfalcons in the RSA is within the range of densities recorded in the Arctic (Poole and Bromley 1988; Court *et al*. 1988; Falk and Møller 1988; BHP 2001).

10.4.1.4.6 Waterfowl

Surveys recorded low densities of waterfowl within the regional study area

A total of 18 waterfowl species were observed flying over or roosting on lakes within the RSA during 1999 and 2000 (see Table X.4-6; Appendix X.4 for waterfowl survey data). Surveys of lakes during June recorded an average density of 2.2 and 2.4 individuals per 1,000 m of shoreline (N = 18 lakes) in 1999 and 2000, respectively. The average density during the July 1999 surveys was 1.4 individuals per 1,000 m of shoreline (N = 10 lakes). In addition, one female red-necked grebe with 8 young was observed on a lake within 10 km of the project footprint during July 1999 surveys. In 1999, seven individuals (two northern pintails, two black scoters, two oldsquaws and one bufflehead) were observed on the lake designated as the water management pond. In 2000, six individuals (five oldsquaws and one northern pintail) were observed on the water management pond.

Low primary productivity in lakes and marginal nesting habitat may be associated with low waterfowl density

The low density of waterfowl among lakes within the RSA may be due to limited high quality nesting habitat (both upland and water nesting species) and low abundance of food resources. For example, although the shoreline of lakes was comprised of 40% to 95% sedges, the narrow width of emergent vegetation would restrict the number of suitable reproductive sites for water nesting birds. Similarly, the sparse amount of tall vegetative cover surrounding lakes provides only marginal quality habitat for upland nesting species. Finally, the nutrient status of lakes on the landscape were classified as oligo-mesotrophic (low to moderate productivity; Section 9.4), which would also limit the abundance of waterfowl breeding or staging in the RSA.

10.4.2 Impact Assessment

10.4.2.1 Introduction

The environmental assessment process involved formulation and assessment of three key questions that encompass all elements of the Terms of Reference

The EA process involved the formulation and assessment of the following three key questions that encompass all elements of the Terms of Reference (discussed in Section 10.1.1) for determining the potential direct and indirect effects of the Snap Lake Diamond Project on wildlife and wildlife habitat:

Key Question W-1: What impacts will the Snap Lake Diamond Project have on wildlife habitat?

Key Question W-2: What impacts will the Snap Lake Diamond Project have on wildlife movement and behaviour?

Key Question W-3: What impacts will the Snap Lake Diamond Project have on wildlife abundance?

The evaluation of wildlife impacts required a series of steps

The following approach was used for the evaluation of impacts to wildlife:

- confirmation of VECs;
- delineation of the LSA and RSA (Section 10.4.1.2);
- development of residual impact classification approach and criteria (Section 10.1);
- development of a linkage diagrams for wildlife;
- determination of the validity of each linkage within each key question for each VEC;
- description of proposed mitigation;
- analysis of impacts;
- classification of residual impact for each valid linkage; and,
- monitoring.

Valued ecosystem components were selected to focus the assessment

VECs selected are representative of public, traditional, and scientific values. The impact assessment was performed on the following wildlife species and their associated habitats:

- Bathurst caribou herd;
- barren-ground grizzly bears;
- wolves;
- wolverines;
- Arctic and red foxes;
- upland breeding birds (passerines, shorebirds, ptarmigan);
- raptors; and,
- waterfowl.

COSEWIC listed VECs were given special consideration throughout the EA for wildlife and wildlife habitat

As identified in Section 2.6.6 of the Terms of Reference (Section 10.1.1), species listed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2001) as "Endangered", "Threatened" or of "Special Concern" were given special consideration throughout the EA for wildlife and wildlife habitat. VECs listed as "Species of Special Concern" included the grizzly bear, wolverine, and peregrine falcon.

Linkage diagram summarizes links between activities and effects

Key questions were used to develop cause and effect pathways, or linkage diagrams. The linkage diagram illustrating the pathways between project activities and effects on wildlife is shown in Figure 10.4-15. Linkages are analyzed more fully as the first step in addressing each question.

Traditional knowledge was key to determining potential impacts

A key aspect in validating the linkage between potential effects of the Snap Lake Diamond Project and impacts on wildlife and wildlife habitat involved the use of traditional knowledge and concerns expressed by the Elders of Aboriginal people. The following sections provide information on the link between mine-related activities and each of the key questions concerning potential impacts on wildlife.

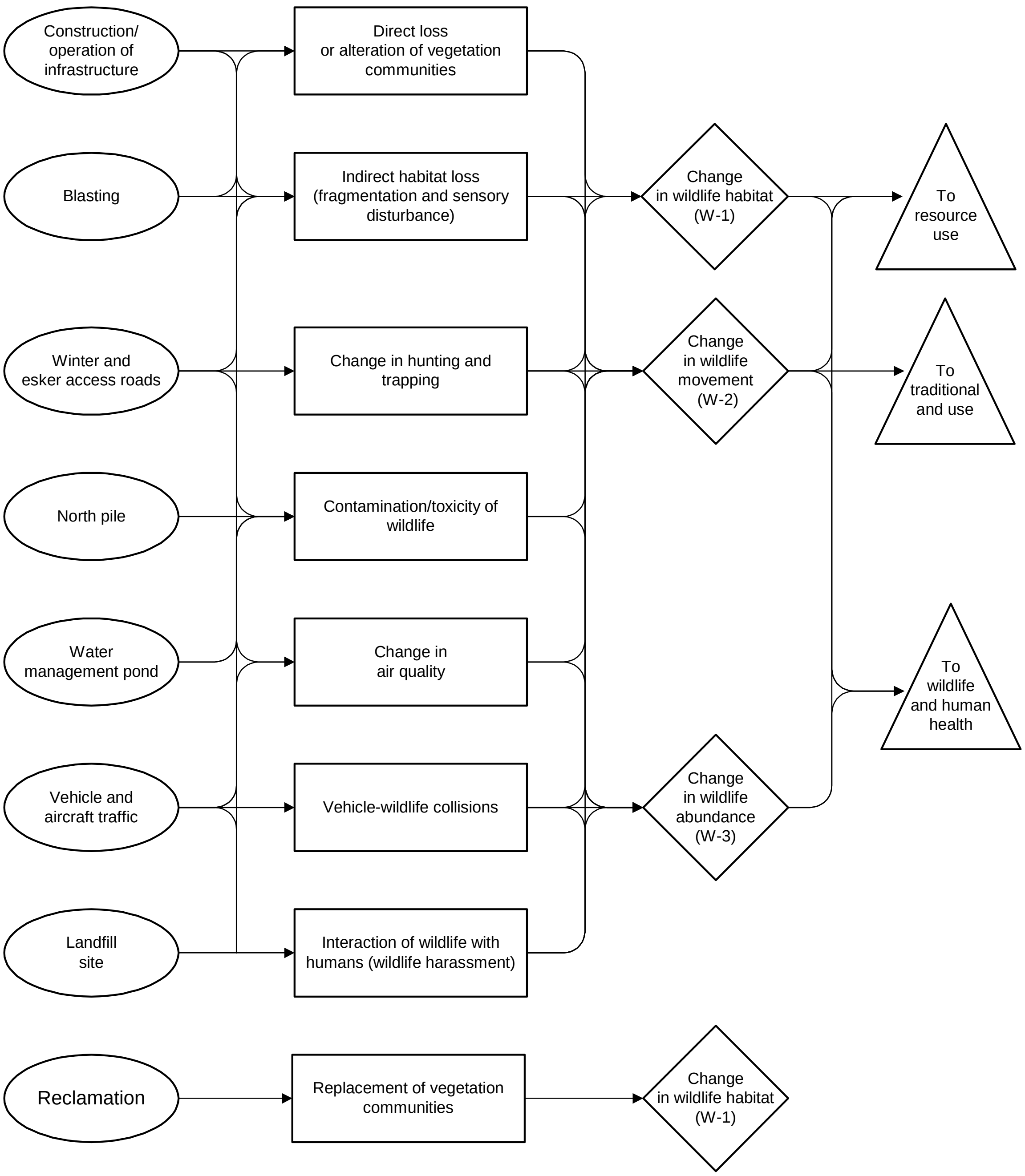
10.4.2.2 Key Question W-1: What Impacts Will the Snap Lake Diamond Project Have on Wildlife Habitat?

10.4.2.2.1 Linkage Analysis

Direct and indirect impacts included

Assessment of the potential impacts of the Snap Lake Diamond Project on wildlife habitat is focused on the effects of both direct and indirect loss of habitat.

Figure 10.4-15 Wildlife Linkage Diagram



Mine activities during construction, operation, and closure that potentially cause direct effects on wildlife habitat are listed

Activities that may result in direct and indirect habitat loss or alteration include construction and operations of the Snap Lake Diamond Project, and reclamation during operation and closure. Specifically, the following activities and facilities will influence direct and indirect habitat change for wildlife:

- facility construction and operation (*e.g.*, power plant, water treatment plant, camp complex, unheated storage building, aggregate crushing, and batch plant);
- construction and operation of surface storage areas (potentially acid generating rock and processed kimberlite at the north pile, kimberlite ore, associated containment berms, container storage, explosives storage area, portable crusher rock/esker stockpile area, and fuel storage areas);
- construction and operation of the water management facilities (sedimentation ponds, ditches, sumps, aboveground water pipelines, the water management pond [including associated dams], potable water intake, pump house, and water discharge);
- granular resource extraction from one esker; and,
- construction and operation of roads and airstrip.

Direct habitat loss decreases the landscape's potential to support wildlife

Direct habitat loss is the most visible impact that occurs when terrain is cleared for mine site facilities (*i.e.*, mine infrastructure). Of all possible sources of impact from project construction and operations, habitat loss is one of the most important as it reduces the landscape's capacity to support wildlife. Therefore, direct habitat loss due to the mine site facilities is a valid linkage. Because some facilities will be present for the life of the Snap Lake Diamond Project, habitat loss can be a medium-term event. For other facilities, habitat loss may be temporary. Reclamation upon decommissioning is often the first step in re-establishing a natural ecosystem. On closure, successful reclamation can reverse some of the effects of habitat loss.

The release of fugitive dust may effect plant growth

Plant items (*e.g.*, foliage and berries) provide a primary or alternative source of energy for wildlife. Aquatic and terrestrial vegetation also provides cover for wetland and upland birds, and mammals. Accumulation of fugitive dust produced from the mine site may result in negative effects on plant growth within the LSA and RSA (Weledeh Yellowknives Dene 1997; Lutsel K'e Dene First Nation 2001). This would cause an indirect effect on the quality of habitat available. For example, one Lutsel K'e Elder commented that:

Dust identified from traditional knowledge

> *One of my main concerns is dust and the cumulative effect on vegetation. The dust will be blowing from different places, year after year. It will affect the vegetation* (Louie Abel).

Dust from roads and site operations may affect plant communities

Processes associated with mineral extraction regularly cause problems of excessive dust levels (Farmer 1993). Non-winter roads are also a common source of dust, which has been associated with negative effects on Arctic plant communities (Farmer 1993). The impacts of dust on vegetation is a valid linkage that is addressed in Section 10.3.2.4. Moreover, changes in plant health or diversity may result in an indirect alteration of habitat for wildlife within the LSA and RSA. Therefore, the linkage between dust and wildlife habitat is also valid.

Potential impacts of air emissions are covered in Sections 7.3 and 10.3

Other air emissions from mine facilities may also be linked to an indirect loss or alteration of habitat. Gaseous emissions, particularly when containing high concentrations of SO_2 and NO_x, may lead to acid deposition. However, the annual ground level input of SO_2 and NO_x compounds was found to be far below the NWT standards (Section 7.3). Also, isopleths of potential acid input (PAI) to soils are confined to the project footprint (Section 10.3); the habitat in this area will be assessed as a direct loss due to disturbance. The project meets target loading for sensitive soils beyond the footprint. Therefore, the separate linkage between PAI and wildlife habitat is invalid and will not be assessed.

Replacement of Vegetation Communities

Reclamation measures may result in the alteration of habitat

Habitat change may occur as a result of the replacement of vegetation communities during reclamation. The goal is to return vegetation levels to equivalent levels observed during baseline studies. Although reversible, the re-establishment of natural vegetation communities may take decades following the closure of a site. For example, the Weledeh Yellowknives Dene (1997) commented that it may take 50 years for reindeer lichen to be re-established. In addition, because reliable reclamation techniques have yet to be developed in the NWT and there is little naturally occurring soil in the northwest peninsula, habitat change may result from reclaimed plant species differing from the original plant species (Section 10.3). For this reason, the linkage between reclamation measures and wildlife habitat is valid and will be assessed.

The validity of the linkages between each of the potential impacts and each VEC is presented in Table 10.4-5

In summary, a direct loss or alteration of habitat from the construction of the project infrastructure and storage areas (north pile, kimberlite ore) may affect habitat for all wildlife species (Figure 10.4-15). Therefore, the linkage is valid for all VECs. The linkages between indirect habitat loss and dust are valid for all VECs. Replacement of terrain components and associated vegetation communities could likewise also affect all VECs during closure and post-closure. Therefore, the linkage is valid. A summary of the validity of the linkages for Key Question W-1 for each of the potential impacts and each VEC is presented in Table 10.4-5.

Table 10.4-5 Summary of Linkage Validation for Impacts to Wildlife Habitat

Valued Ecosystem Component	Linkage Validation [a]		
	Footprint (Direct)	Fugitive Dust (Indirect)	Replacement of Habitat (Direct)
Bathurst caribou	Y	Y	Y
Barren-ground grizzly bears	Y	Y	Y
Wolves	Y	Y	Y
Wolverines	Y	Y	Y
Foxes	Y	Y	Y
Raptors	Y	Y	Y
Upland breeding birds	Y	Y	Y
Waterfowl	Y	Y	Y

[a] Y = Yes; N = No.

10.4.2.2.2 Mitigation

Numerous mitigation procedures will reduce the potential loss and alteration of habitat

During feasibility studies for the Snap Lake Diamond Project, options were investigated to determine the most effective strategy for minimizing the effect on wildlife habitat. The following mitigation measures were included:

- restricting the mine surface footprint to a relatively small area of 560 ha;
- using only underground mining, which occurs under wet conditions;
- conducting primary crushing underground;
- excavating only small amounts of material off-site from one esker;
- minimizing the amount of clearing;
- conducting pre-project surveys to identify wildlife sensitive locations and protected areas for avoidance;
- minimizing road and airstrip widths;
- minimizing the use of haul trucks;
- using covered conveyors during operations;
- applying water to the airstrip and roads in the active mine site to aid in dust suppression during six months of the year;
- selecting a wet process for diamond recovery;
- implementing other dust control measures during construction, operation, and closure;
- having both mining and stationary combustion equipment meet emission guidelines;

- reclaiming areas during operations (*e.g.*, progressive reclamation of the north pile) and promoting natural vegetation regeneration throughout the mine life;
- assessing vegetation cover during the two to three growing seasons following reclamation efforts (monitoring of north pile reclamation will be ongoing during operations); and,
- developing appropriate re-vegetation programs for reclamation efforts that result in inadequately vegetated areas.

10.4.2.2.3 Impact Analysis

Direct and indirect impacts identified

Analysis of the potential impacts from the Snap Lake Diamond Project on change in wildlife habitat is based on the following elements:

- direct habitat loss from site clearing;
- indirect habitat loss from dust; and,
- replacement of habitat through reclamation.

Direct Habitat Loss From Site Clearing

Analysis of direct habitat loss focused on those habitats that are suitable for wildlife to carry out natural activities

Assessment of the impact from direct habitat loss for wildlife VECs was based on: (1) the expected area of the mine footprint as a proportion of the LSA and RSA, and (2) the relationship between the home range size of an individual and expected habitat loss. Although several habitat types will be directly influenced by the mine infrastructure, the analysis focuses on those habitats that represent suitable places for wildlife to carry out natural activities (*e.g.*, den, nest, travel, and forage). For the VECs considered in this study, baseline information indicated that important habitats include heath/boulder, heath tundra, esker complex, open and closed spruce forest, birch seep, riparian tall shrub, sedge wetland, deep water, and shallow water.

Percentages within the local study area may be high, but the number of hectares is low

At the local level, the proportional loss of habitat types due to the Snap Lake Diamond Project is 83% for birch seep, 64% for open spruce forest, 53% for heath/boulder, 42% for sedge wetland, and 7% for deep water habitats within the LSA. Although the percentage of original habitat lost is high, the absolute amount (559.5 ha) is low (Table 10.4-6).

There will be no loss of esker, heath tundra or riparian tall shrub habitat from the mine footprint

At the local level (LSA), the expected loss or alteration of habitat types is 0% for eskers, heath tundra, riparian tall shrub, closed spruce forest, and shallow water (Table 10.4-6). Eskers represent quality habitat for all VECs except upland breeding birds and waterfowl, while riparian tall shrub is preferred by grizzly bears, upland breeding birds, and possibly wolverines. The zero loss of esker, heath tundra, and riparian tall shrub habitat is due to the near absence of these habitat types within the LSA. Therefore, the mine footprint will have no impact on esker, heath tundra and riparian tall shrub habitat for wildlife.

Relative habitat loss depends on scale

At the landscape level (RSA), the anticipated loss of any habitat type due to the mine footprint is less than 1% which is largely due to the small size of the mine footprint relative to the size of the RSA (Table 10.4-6). Although the proportional loss of habitat is diluted by the scale of the RSA, it is biologically relevant to consider the magnitude of effects on wildlife at this level, particularly for species that have a large home range size or the ability to effectively disperse over large distances. The EA Terms of Reference specifically indicate that the boundaries shall reflect the maximum zone of influence of the proposed development for each VEC selected.

Table 10.4-6 Expected Direct Loss or Alteration of Existing Habitat Types in the Local and Regional Study Areas

Habitat Type	Baseline Local Study Area		Loss/Alteration of Local Study Area		Baseline Regional Study Area		Loss/Alteration of Regional Study Area	
	(ha)	%	(ha)	%	(ha)	%	(ha)	%
Bedrock	0.0	0.0	0.0	0.0	99.3	<0.1	0.0	0.0
Boulder	0.0	0.0	0.0	0.0	1,991.9	0.7	0.0	0.0
Heath/bedrock	0.0	0.0	0.0	0.0	716.6	0.2	0.0	0.0
Heath/boulder	784.8	54.7	414.6	52.8	137,530.4	45.6	433.6	0.3
Heath tundra	2.0	0.1	0.0	0.0	8,743.4	2.9	0.2	<0.1
Esker complex	0.0	0.0	0.0	0.0	552.0	0.2	0.5	0.1
Open spruce forest	69.3	4.8	44.5	64.2	18,169.8	6.0	47.8	0.3
Closed spruce forest	0.0	0.0	0.0	0.0	1,520.2	0.5	0.0	0.0
Mixedwood deciduous forest	0.0	0.0	0.0	0.0	0.4	<0.1	0.0	0.0
Birch seep	6.2	0.4	5.1	82.8	2,661.6	0.9	5.9	0.2
Riparian tall shrub	0.0	0.0	0.0	0.0	0.2	<0.1	0.0	0.0
Tussock-hummock	108.3	7.5	53.9	49.8	15,011.8	5.0	57.1	0.4
Sedge wetland	21.2	1.5	8.9	42.1	7,240.0	2.4	12.4	0.2
Deep water	443.5	30.9	32.5	7.3	107,229.7	35.5	85.6	0.1
Shallow water	0.0	0.0	0.0	0.0	201.9	0.1	0.0	0.0
Burn	0.0	0.0	0.0	0.0	47.6	<0.1	0.0	0.0
Disturbed	0.0	0.0	0.0	0.0	172.1	0.1	0.0	0.0
Unclassified	0.0	0.0	0.0	0.0	0.2	<0.1	0.0	0.0
Total	**1,435.3**	**100.0**	**559.5**	**39.0**	**301,889.1**	**100.0**	**643.2**	**0.2**

Research suggests that a loss of 40-90% of original suitable habitat may trigger a decline in animal abundance

Current empirical and theoretical studies have examined the relationship between loss of suitable habitat and landscape type, and the likelihood of population decline (Andrén 1994; Fahrig 1997; With 1997; Mönkkönen and Reunanen 1999; Andrén 1999). These studies suggest that critical thresholds for declines in bird and mammal species occur between 10% and 60% of original habitat. In other words, a decrease in species abundance and diversity may be observed when the amount of suitable habitat lost exceeds a threshold value of 40 to 90%. Subsequently, the magnitude of direct habitat loss from the Snap Lake Diamond Project on VECs was determined by comparing the percentage of habitat lost within an individual's home range (Table 10.4-7) to these threshold value estimates.

Magnitude of direct loss of habitat is predicted to be negligible to moderate for many wildlife valued ecosystem components

Based on estimates of home range size, the fraction of suitable habitat lost from an individual's home range due to the Snap Lake Diamond Project is expected to range from <0.01 to 0.4% for caribou, grizzly bears and wolves (Table 10.4-7). The proportional loss of habitat within the home range of these species is well below the threshold value of 40 to 90%, and therefore, the magnitude of direct habitat loss is anticipated to be negligible (Table 10.4-8). Similarly, the loss of suitable waterfowl habitat (sedge wetland, birch seep, and water) due to site clearing (1.0 to 6.7%) is also predicted to be negligible. In contrast, the proportional loss of heath/boulder habitat from the home range may approach 9% for wolverines, and 28% for foxes (Table 10.4-7). Although the relative loss of suitable habitat for an individual wolverine is similar to waterfowl, the listing of wolverine as a "species of special concern" (COSEWIC 2001) increased the magnitude of the impact from negligible to low (Table 10.4-8). Because the proportional loss of suitable habitat from an individual fox home range is approaching the minimal threshold value of 40%, the magnitude of the impact is predicted to be moderate.

Home range size of peregrine falcons and gyrfalcons is uncertain

Currently, there is a lack of information on the home range size of peregrine and gyrfalcons during the reproductive season in the Slave Geological Province (SGP). In Alaska, White and Nelson (1991) followed an adult male peregrine in a helicopter for approximately 19.5 hours and estimated a foraging home range size of 319 km^2. The greatest straight-line distance from the nest to a resting site was 14.6 km. Another study of two breeding female peregrines in Scotland generated hunting ranges of 23 km^2 and 117 km^2 (Mearns 1985). White and Nelson (1991) also followed a reproductive pair of gyrfalcons and estimated the straight-line travel distance from the nest site to be 3.2 km for the female, while the male ranged within 24 km of the nest site. Because of the low number of individuals monitored and the short duration of the studies, these estimates of home range size for peregrine and gyrfalcons are tenuous.

Table 10.4-7 Predicted Proportional Loss (%) of Habitat Types within an Individual's Home Range Due to the Footprint of the Snap Lake Diamond Project

Habitat Type	Valued Ecosystem Component							
	Bathurst caribou (250,000 km^2)[a]	Barren-ground grizzly bears (2,074–6,685 km^2)[b]	Wolves (1,130–2,022 km^2)[c]	Wolverines (48-535 km^2)[d]	Foxes (15–25 km^2)[e]	Raptors (23 – 319 km^2)[f]	Upland Breeding Birds (0.005–0.05 km^2)[g]	Waterfowl (5 km^2)[h]
Bedrock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Boulder	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Heath/bedrock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Heath/boulder	<0.01	0.06-0.2	0.2-0.4	0.8-8.6	16.6-27.7	1.3 – 22.4	100.0	83.0
Heath tundra	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Esker complex	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Open spruce forest	<0.01	<0.01-0.02	0.02-0.04	0.08-0.9	1.8-3.0	0.1 – 2.0	100.0	9.0
Closed spruce forest	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mixedwood deciduous forest	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Birch seep	<0.01	<0.01	<0.01	0.01-0.10	0.2-0.3	0.02 – 0.2	100.0	1.0
Riparian tall shrub	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tussock–hummock	<0.01	0.01-0.03	0.03-0.05	0.1-1.1	2.2-3.6	0.2 – 2.3	100.0	10.8
Sedge wetland	<0.01	<0.01	<0.01	0.02-0.2	0.4-0.6	0.03 – 0.4	100.0	1.8
Deep water	<0.01	<0.01-0.02	0.02-0.03	0.06-0.7	1.3-2.2	0.1 – 1.4	100.0	6.7
Shallow water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Burn	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Note: For each valued ecosystem component, values in parenthesis represent estimates of home range size.
Sources:
a) Case *et al*. 1996;
b) McLoughlin *et al*. 1999;
c) Walton *et al*., 2001;
d) Magoun 1985; Banci 1987; Mulders 1997;
e) Banfield 1974; Larivière and Pasitschniak-Arts 1996;
f) Based on Mearns 1985; White and Nelson 1991;
g) Based on migratory songbirds (Schoener 1968); and inverse estimates of density from BHP 2001 and the Snap Lake Baseline;
h) Based on mallards (Mauser *et al*. 1994).

Table 10.4-8 Classification of Residual Impacts of Site Clearing to Wildlife Habitat

VEC	Direction	Magnitude	Geographic Extent	Duration	Reversibility	Frequency	Environmental Consequence
Direct Habitat Impact Due to Site Clearing							
Bathurst caribou	negative	negligible	local	medium-term	reversible (long-term)	low	low
Barren-ground grizzly bears	negative	negligible	local	medium-term	reversible (long-term)	low	low
Wolves	negative	negligible	local	medium-term	reversible (long-term)	low	low
Wolverines	negative	low	local	medium-term	reversible (long-term)	low	low
Foxes	negative	moderate	local	medium-term	reversible (long-term)	low	low
Upland breeding birds	negative	low	local	medium-term	reversible (long-term)	low	low
Raptors	negative	negligible	local	medium-term	reversible (long-term)	low	low
Waterfowl	negative	negligible	local	medium-term	reversible (long-term)	low	low

Loss of home range is 22.4%

The proportional loss of a raptor's home range due to the Snap Lake Diamond Project may reach 22.4% (Table 10.4-7), which is below the range of critical threshold values for habitat loss.

Magnitude of direct habitat loss for raptors is expected to be negligible

Of greater pertinence to potential impacts on raptors, however, is the direct loss of places to breed or the loss of foraging opportunities as a result of direct habitat loss to prey species. As baseline surveys indicate that no previously used nests exist within the LSA, and that many suitable locations for nesting exist within close proximity (*i.e.*, within 10 km of the mine site), the magnitude of the impact of breeding habitat loss from the Snap Lake Diamond Project is predicted to be negligible. Raptors are also unlikely to be impacted by the loss of foraging opportunities caused by direct habitat loss to their prey species (primarily upland breeding birds) because of the low number of individual breeding birds impacted. Overall, the magnitude of direct habitat loss for raptors is expected to be negligible.

Magnitude of habitat loss for upland breeding birds is expected to be low

An analysis of the impact of direct habitat loss for upland breeding birds indicated that habitat losses equalling the home range (0.5 to 5 ha) of a number of individuals is anticipated within the LSA. Thus, it is expected that the abundance of upland breeding birds within the LSA will decrease, but the effective loss from the local population within the RSA should be minimal. For example, baseline data provide a mean estimate of 5.8 birds/ha in sedge wetland habitat. The loss of 8.9 ha of sedge wetland in the LSA would potentially remove nesting and foraging habitat for 52 birds in the area (assuming that abundance is directly related to habitat). The loss of other habitats such as heath/boulder and tussock hummock will also displace a number of individuals from these less suitable patches of habitat. But given the density of upland breeding birds, the number of potential breeding pairs lost by the removal of habitat should not influence the year-to-year change in abundance of any population. The number of pairs would be less than 52, which is the total number of individuals. Overall, it is anticipated that the impacts are highly likely to be local in extent and for relatively few individuals, and the magnitude of the impact is predicted to be low. The confidence is low because of the conservative assumption that displaced birds will not relocate in adjacent habitat. The impact is expected to be less than predicted.

Indirect Habitat Loss from Dust

Fugitive dust accumulation on vegetation may result in a loss of habitat; however, loss of much of this habitat has been assessed as direct habitat loss

The impact analysis for the potential influence of dust and air emissions on the atmospheric environment and terrestrial vegetation is reported in Section 7.3.3 and 10.3.2.4, respectively. In general, the impact of dust from mine-related activities on the atmosphere adjacent to the mine is anticipated to be local. Total suspended particulates exceeded the NWT standards within the LSA and a small area near the edge of the LSA near the quarry. To be conservative, the impact assessment assumed the entire project footprint (559.5 ha) was a direct loss of habitat. Therefore, most of the ELC units exposed to dust are located within the ELC units already assessed as lost habitat due to site clearing. The land area in the LSA beyond the project footprint (*i.e.*, in the 500 m buffer) receiving the maximum exposure to dust is 55 ha. Dust will blow beyond this area, but the majority of deleterious effects on plants occurs immediately adjacent to the dust source (*e.g.*, a road) (see also Section 10.3.2.4). An additional 36.7 ha of terrestrial ELC units, located within 50 m of the winter and esker access roads, may be affected by dust, particularly from haul trucks travelling on the esker access road. Including the winter access road in these predictions likely over-estimates the project's regional impact since trucks on this road will not normally be carrying loads that generate dust. Impacts to ELC vegetation units (or habitat types) are described in Section 10.3.2.2. Subsequently, the results are applied to the analysis for wildlife habitat, with the following considerations.

There is a concern related to dust, particularly the uncertainty related to impacts

In an ecosystem where plant primary productivity is already limited by a relatively short active growing season, low temperatures, and low precipitation rates, predicting the magnitude of the impact from dust accumulation on vegetation carries a high degree of uncertainty. A quote by a Lutsel K'e Elder emphasizes this concern.

> *I've worked the mine last spring, Winspear [De Beers–Snap Lake] from what I've seen about ten-mile radius north, west, south and east, toward the north east side about ten miles radius I've walked. When I was walking around I sunk my feet in to the snow. I kind of wondered about it. Two days later I travelled in a helicopter around the area and noticed dust that fly from the trucks that haul gravel. At that time the wind was mostly coming from the north. I've noticed the dust particles fly at least ten miles radius to the eastside on to the ground, which will effect the environment and caribou habitat* (JD).

Dust settling on vegetation is likely to remain during the snow-free period

The production of fugitive dust is expected to be seasonal to infrequent (*e.g.*, esker access road) throughout the life of the mine, although dust settling on vegetation may remain in the snow-free period during years of low rainfall. Also, during the winter, dust that accumulates on snow may settle on vegetation during the spring melt. Because sublimation of snow does not result in "washing away" of dust, dust that has accumulated on snow during the winter may be deposited on the vegetation until removed by rain.

Replacement of Habitat

Reliable reclamation techniques are yet to be developed in the NWT

Re-contouring of the esker borrow area with mine rock is anticipated to provide functional habitat for carnivores and caribou (Section 10.3.2.2.4). Replacement of vegetation communities is also expected to result in the recovery of other wildlife habitats. However, it may take many decades before any substantial re-growth is observed. Although reclamation of development sites has been shown to be an effective means of replacing vegetation communities (and hence wildlife habitat) in western and central Alberta (*e.g*., McCallum 1989; Roe and Kennedy 1989), reclamation techniques in the NWT are still being developed and consequently the long-term outcome of the reclamation is uncertain. The decommissioning and reclamation issues and mitigation plan for the Snap Lake Diamond Project are described in Appendix III.11 (Decommissioning and Reclamation Plan).

10.4.2.2.4 Residual Impact Classification

Impacts are classified according to direction, magnitude, geographic extent, duration, frequency, and reversibility

Despite mitigation, activities related to the Snap Lake Diamond Project will result in direct and indirect changes to wildlife habitat. The residual impacts from these changes were evaluated using the methods described in Section 10.1.5. In general, the impacts are classified using the following criteria: direction, magnitude, geographic extent, duration, frequency, and reversibility. The residual impact was classified for each element (*i.e.*, direct and indirect loss, replacement) of habitat change and each VEC.

Direct Habitat Loss From Site Clearing

Magnitude of direct loss of habitat is predicted to be negligible-low for many wildlife valued ecosystem components

Based on estimates of home range size, the fraction of suitable habitat lost from an individual's home range due to the Snap Lake Diamond Project is expected to be negligible to low for caribou, grizzly bears, wolves, raptors, wolverines, foxes, and waterfowl (Table 10.4-8). Therefore, the magnitude of the impact of habitat loss or alteration on VEC species is predicted to be low (Table 10.4-8).

For all valued ecosystem components, the geographic extent is local, frequency is low and duration is medium-term

Impacts from direct habitat loss due to site clearing are predicted to be local in geographic extent, low in frequency, and medium-term in duration (Table 10.4-8). Frequency of effects from habitat loss on wildlife is considered to be low as the loss of habitat will only occur once during initial construction on the landscape. Direct habitat loss will be medium-term since activities that directly impact habitat will end after closure. However, reclamation will extend beyond the life of the mine and the impact will be reversible in the long term (100 years), after vegetation has been established (Table 10.4-8). As mentioned earlier, it may take decades for vegetation cover to be re-established.

The environmental consequence of direct habitat loss is low

Taking all criteria into consideration, the environmental consequence of direct habitat loss from site clearing activities on all VECs is predicted to be low (Table 10.4-8).

A high level of confidence is associated with the prediction of environmental consequence

There is a high level of confidence in the prediction of low environmental consequence on wildlife from loss of habitat due to the mine footprint. The relatively small area of the footprint will result in a marginal loss of suitable habitat types for all VECs that permanently or temporarily inhabit the RSA. In addition, the large home range of caribou and carnivores and the effective dispersal capacity of VECs should provide a high degree of ecological resilience to the marginal loss of habitat.

Indirect Losses from Fugitive Dust

The environmental consequence of direct loss of habitat from dust is predicted to be low

The accumulation of dust on vegetation may have a low magnitude of impact on vegetation within 500 m of the mine footprint and within 50 m of the winter road (described in Section 10.3). The impact on vegetation health is classified in Table 10.3-26. The impact on vegetation is assessed differently than the magnitude of the impact on the home ranges of each wildlife VEC. The 500 m buffer in the LSA (excluding the project footprint, which is a direct impact) and the 50 m winter road buffer are small in comparison to many of the home ranges. Therefore, the magnitude of the impact on wildlife species is negligible with the exception of upland breeding birds which have small home ranges. Because there may be dust on the esker access road, the geographic extent is regional. The health effects of dust on plants are expected to be reversible in the short-term. Although this may occur in the short-term when the dust is washed off, there is a high level of uncertainty considering the small surface area of photosynthetic tissues of Arctic plants, short growing season, and limited amount of precipitation. It is possible that the impact may be reversible in the long-term rather than the short-term. In both cases, the environmental consequence would be low. Dust will be generated during construction, operation, and closure of the project; therefore, the duration is medium-term (Table 10.4-9). In addition, the production of dust is expected to occur at a variable, but generally moderate frequency.

Table 10.4-9 Classification of Residual Impacts of Dust to Wildlife Habitat

Valued Ecosystem Component	Direction	Magnitude	Geographic Extent	Duration	Reversibility	Frequency	Environmental Consequence
Indirect Habitat Impact Due to Dust							
Bathurst caribou	negative	negligible	regional	medium-term	reversible (short-term)	moderate	low
Barren-ground grizzly bears	negative	negligible	regional	medium -term	reversible (short-term)	moderate	low
Wolves	negative	negligible	regional	medium -term	reversible (short-term)	moderate	low
Wolverines	negative	negligible	regional	medium -term	reversible (short-term)	moderate	low
Foxes	negative	negligible	regional	medium -term	reversible (short-term)	moderate	low
Raptors	negative	negligible	regional	medium -term	reversible (short-term)	moderate	low
Upland breeding birds	negative	low	regional	medium -term	reversible (short-term)	moderate	low
Waterfowl	negative	negligible	regional	medium -term	reversible (short-term)	moderate	low

Replacement of Habitat

The magnitude of the impact from reclamation is predicted to be negligible

The objective of reclamation will be to return wildlife habitat to a capability equivalent to that present before development of the project. The replacement of vegetation communities during reclamation activities, therefore, is a positive impact to each VEC. The magnitude of impact from reclamation is, however, anticipated to be negligible (Table 10.4-10). Reasons for this include:

- the northwest peninsula has little naturally occurring soil; and,
- reclamation techniques in the NWT are still being developed.

Table 10.4-10 Classification of Residual Impacts of Reclamation to Wildlife Habitat

VEC	Direction	Magnitude	Geographic Extent	Duration	Reversibility	Frequency
Habitat Impact Due to Reclamation/Re-vegetation						
Bathurst caribou	positive	negligible	regional	long-term	irreversible	moderate
Barren-ground grizzly bear	positive	negligible	regional	long-term	irreversible	moderate
Wolf	positive	negligible	regional	long-term	irreversible	moderate
Wolverine	positive	negligible	regional	long-term	irreversible	moderate
Fox	positive	negligible	regional	long-term	irreversible	moderate
Raptors	positive	negligible	regional	long-term	irreversible	moderate
Upland breeding birds	positive	negligible	regional	long-term	irreversible	moderate
Waterfowl	positive	negligible	regional	long-term	irreversible	moderate

Note: environmental consequence is not predicted for positive impacts.

Reclamation is predicted to be irreversible

Geographic extent of reclamation efforts will extend regionally within the esker quarry and within the project footprint (Table 10.4-10). Duration of re-vegetation is expected to be long-term as reclamation is anticipated to carry on beyond closure of the mine (Table 10.4-10). Frequency of reclamation efforts is expected to be moderate, as re-vegetation efforts will occur periodically during the life of the mine when facilities are no longer required (Table 10.4-10). The north pile will be reclaimed progressively over the operation of the mine. Although the negative impacts of the disturbance are expected to be reversible in the long-term, the positive effect of reclamation is expected to be irreversible (*i.e.*, the positive effects of reclamation will be permanent once they occur).

Reclamation is a positive direction

The direction of reclamation activities for all VECs is predicted to be positive (Table 10.4-10). The environmental consequence of positive impacts is not assessed.

Reclamation techniques are uncertain

This prediction is associated with a moderate level of confidence. Because reliable reclamation techniques have yet to be proven in the NWT, there is some uncertainty in the success of reclamation efforts.

Uncertainties Associated With Climate Change

Climate change is an important aspect which may have an influence on all predictions

An assessment of direct change in habitat could not be completed without a discussion on climate change and its potential effects on ecological systems. Of particular relevance to wildlife is the observed reduction in tundra habitat over the last few decades which has been linked to global warming (Hughes 2000). Because of the current decline in the quantity of tundra habitat, any further losses (*e.g.*, loss of habitat through the mine footprint) may have the potential of having a greater negative impact than expected.

Mean annual global temperature could increase 1 to 3.5°C by 2100

Declines in tundra habitat have been correlated with a 3°C change in mean annual temperature and a corresponding latitudinal shift in isotherms of approximately 300 to 400 km (Hughes 2000). That is, if there is a 3°C change in mean annual temperature, this shift is expected to occur. Analysis of current climate models has predicted a further reduction of tundra habitat (reviewed by Ferguson 1999). Many of these models predict that the mean annual global surface temperature will increase 1° to 3.5°C by 2100, with more pronounced warming at higher latitudes (Hughes 2000). However, there is a high uncertainty and controversy related to the models used. These models are usually developed at a larger scale (*e.g.*, global) than this EA and incorporating their results into the Snap Lake Diamond Project EA involves a high degree of uncertainty.

The boreal forest tree-line could shift as much as 500 km northwards

Over the next 100 years, the geographic range for some North American tree species could shift as much as 500 km to the north (Intergovernmental Panel on Climate Change 1996), although predictions of climate change have a high degree of uncertainty. If this were to occur, the boreal forest would occupy a substantial portion of the land that is now covered by tundra vegetation (Melillo 1999). This could result in the direct loss of forbs and lichens that are critical for the over-winter nutrition of caribou (Klein and White 1978). In addition, the northward advance of forest may result in reducing the effectiveness of migration as an anti-predator strategy for caribou, which currently enables caribou to escape wolf predation (Heard and Williams 1992). Thus, the alteration of habitat currently occurring as a result of climate change may make any additional losses of habitat through mining activities more important. However, within the time frame of climate change, reclamation of the Snap Lake Diamond Project site is anticipated to provide habitat with a capacity to support wildlife. Monitoring studies will be conducted during construction and operation of the Snap Lake Diamond Project to determine the potential effects of mining activities on direct and indirect habitat loss for wildlife and the success of reclamation methods.

10.4.2.2.5 Monitoring

More work is recommended into the study of the effects of fugitive mine dust in the NWT

The literature on effects of granitic and kimberlite dust on plant vegetation is scarce. Until more work is completed on the effects of mineral dust in the Arctic, a high degree of scientific uncertainty is associated with the predictions (and probability of occurrence) of fugitive dust effects on tundra vegetation. Elders suggest that fugitive dust should be monitored to see how far it goes and to make sure that it does not kill the vegetation (Lutsel K'e Dene First Nation 2001). Subsequently, the potential effects of fugitive dust on vegetation will be monitored during construction and operation of the mine (Section 10.3.2).

10.4.2.3 Key Question W-2: What Impacts Will the Snap Lake Diamond Project Have on Wildlife Movement and Behaviour?

10.4.2.3.1 Linkage Analysis

Data on wildlife movements within the Snap Lake area are limited

Aboriginal people consider that wildlife movements can be affected through the creation of physical or psychological barriers such as roads, airstrips, and facilities (Weledeh Yellowknives Dene 1997; Legat *et al*. 2001; Lutsel K'e Dene First Nation 2001). The topic also has been widely discussed by non-Aboriginal people (*e.g.*, Bromley 1985; Jalkotzy *et al.* 1997), and literature reviews have been completed for a few individual species (*e.g.*, Nelleman and Cameron 1998; Cronin *et al.* 1998; Burson *et al*. 2000; Yost and Wright 2001). The literature on the effects of barriers to movement on wildlife is disproportionate for large mammals and species managed for harvest. Considerably less data are available for those species that contribute to the biodiversity of the Snap Lake Diamond Project area. For example, of the five major wolverine studies in North America, only one occurred in an Arctic environment (Mulders 1997).

Habitat fragmentation may result in a reduced quality of habitat

Habitat fragmentation occurs when extensive, continuous tracts of habitat are partitioned into smaller and more isolated patches (Meffe and Carroll 1994). Road construction is a major contributor to habitat fragmentation (Reed *et al.* 1996). For most wildlife species, small, over-dispersed habitat patches are considered to be of lower quality than larger, continuous tracts. The process of fragmentation often results in unconnected habitat fragments with a high proportion of open perimeters. Fragmentation, therefore, increases the amount of habitat edge, decreases the amount of habitat interior, and increases the distance between habitat patches. Effects of fragmentation on the landscape are assessed in Section 10.3.2.3.

Wildlife move in search of feeding, nesting, denning, or resting areas

Other effects may result from the disruption of natural movement corridors. Wildlife typically travel between habitats or areas on a daily and seasonal basis. Often this movement is in search of suitable feeding, nesting, denning, or resting areas (Burt 1943). For example, caribou, wolves, and grizzly bears travel over large areas to find suitable shelter and food during different seasons of the year.

Disturbance from mine-related activities can influence wildlife in several ways

Mining activities may change the behaviour of wildlife. Sensory disturbance can result in increased levels of stress and energy expenditure, and disruption of feeding and/or breeding behaviour. For example, disturbance may cause caribou to spend less time feeding or resting and more time staying alert or moving away from sources of disturbance (BHP 2001). Alternatively, the creation of roads and other elevated areas may provide caribou with relief from insects. Finally, the presence of infrastructure (landfill site, buildings) can potentially attract wildlife species, such as grizzly bears, wolverines, and foxes from adjacent areas by offering food rewards and shelter. Disturbance from mining activities may then lead to changes in the feeding and mating behaviour of animals attracted to the project. Thus, there are several key aspects associated with changes in wildlife movement and behaviour from the Snap Lake Diamond Project. These include the following:

- attraction of wildlife from adjacent areas;
- impediment or disruption of movement through traditional travel routes;
- alteration of behaviour (*e.g.*, time spent feeding, resting, travelling) that can influence energy balance, and survival and reproduction rates; and,
- reduction of movement of individuals among local populations.

Several activities may result in alteration to wildlife movement and behaviour

Assessment of the potential impacts on wildlife movement and behaviour is focused on the effects of mine-related activities (Section 10.4.2.3). Activities from the Snap Lake Diamond Project which could result in changes to wildlife movement and behaviour include:

- blasting (noise and ground vibrations);
- human (*e.g.*, walkers), vehicle and aircraft traffic (noise and other sensory disturbance);
- habitat fragmentation (noise, and psychological and physical barriers); and,
- winter and esker access roads (noise, and psychological and physical barriers).

Valid and invalid linkages are summarized

Noise from facilities, vehicles, and aircraft may affect wildlife movement and behaviour. Elders have raised concerns regarding the displacement of caribou and other wildlife from historically used areas due to the smells and noise from machinery and mine facilities (Weledeh Yellowknives Dene 1997; Legat *et al.* 2001). The disturbance effects of roads on wildlife are well-documented (*e.g.*, Nelleman and Cameron 1998; Cronin *et al.* 1998; Burson *et al*. 2000; Yost and Wright 2001). The linkage between noise and wildlife movement and behaviour is valid, and this impact will be assessed. For the remaining elements, the linkage is valid for all wildlife VECs and activities, except the winter and esker access roads (Figure 10.4-15). The linkage between winter and esker access roads (both roads restricted to winter use), and disturbance for grizzly bears is invalid because the seasonal use of these roads will begin subsequent to the initiation of hibernation of grizzly bears and conclude before grizzly bears emerge from hibernation in the spring. Similarly, for raptors, upland breeding birds and waterfowl, the operation of these roads will occur subsequent to the birds migrating south and prior to the birds returning in the spring. A summary of the validity of the linkages for Key Question W-2 for each of the potential impacts and each VEC is presented in Table 10.4-11.

Table 10.4-11 Summary of Linkage Validation for Impacts to Wildlife Movement and Behaviour

Valued Ecosystem Component	Linkage Validation [a]			
	Sensory Disturbance (Change in Movement/Behaviour)			
	Blasting	Human, Vehicle, and Aircraft Traffic	Habitat Fragmentation	Winter Access and Esker Access Roads
Bathurst caribou	Y	Y	Y	Y
Barren-ground grizzly bears	Y	Y	Y	N
Wolves	Y	Y	Y	Y
Wolverines	Y	Y	Y	Y
Foxes	Y	Y	Y	Y
Raptors	Y	Y	Y	N
Upland breeding birds	Y	Y	Y	N
Waterfowl	Y	Y	Y	N

[a] Y = Yes; N = No.

10.4.2.3.2 Mitigation

Several mitigation measures have been proposed to minimize changes to wildlife movement and behaviour

During feasibility studies for the Snap Lake Diamond Project, options were investigated to determine the most effective strategy for minimizing the effect on wildlife movement and behaviour (Section 2). The following mitigation is expected to limit the negative impacts to wildlife movement and behaviour:

- identifying sensitive wildlife locations to avoid (*e.g.*, avoiding construction of the footprint along major migration routes of caribou);
- restricting the mine footprint to a relatively small area (560 ha);
- minimizing the amount of noise from the mine site with the use of appropriate exhaust mufflers;
- minimizing road and airstrip widths;
- underground blasting;
- minimizing the use of haul trucks along roads;
- encouraging vegetation regeneration and encroachment on roads, airstrip and the active mine site; and,
- environmental sensitivity training for project and exploration personnel.

10.4.2.3.3 Impact Analysis

Noise and ground vibration from blasting is expected to be undetectable beyond 1 km

To aid in the classification of impacts from blasting on wildlife, an analysis of the noise and vibrations from the Snap Lake Diamond Project was conducted. The results suggested that because blasting is underground and the frequency of sound waves is typically less than 20 hertz (Hz), noise from blasting will likely be inaudible or masked by background levels from the other mining activities (Appendix IX.5-5). In addition, for an expected maximum charge of 227 kg (maximum charge predicted), the attenuation of ground vibrations is estimated at 25.2 millimetres per second (mm/s) at 100 m, 4.6 mm/s at 250 m and 1.3 mm/s at 500 m from the blast (Appendix IX.5-5). At a distance of 500 m, the ground vibrations would be perceived by a person standing on the tundra, but the energy transferred would be negligible. At a distance of 1 km, ground vibration from a blast would be largely undetectable (Appendix IX.5-5).

Impact analysis was conducted independently for each valued ecosystem component

For the remaining analysis, the potential impacts from mine-related activities (*e.g.*, vehicle and aircraft traffic, winter and esker access roads) on the change in wildlife behaviour and movement is conducted independently for each VEC.

Bathurst Caribou Herd

Relatively low numbers of caribou pass through the Snap Lake area

Baseline studies indicated that relatively low numbers of caribou pass through the RSA and that there is large year-to-year variation in the timing of movement by the Bathurst caribou herd during the northern and southern migration through the Snap Lake area. In addition, winter track density and historic trail density (index of the location of the southern migration) indicated that most long-term movement occurred adjacent to MacKay Lake and Camsell Lake.

Mining activities may affect the migration and energy budget of caribou

Winter and esker access roads have the potential to alter the movement of the Bathurst caribou herd during the northern migration, while vehicle and aircraft traffic and underground blasting activities, may interfere with the northern and southern migration. Mining activities may also alter the behaviour of caribou (*e.g.*, time spent feeding and resting) which could change the energy balance of individuals. Roads, for example, have the potential to disrupt caribou movements. One Lutsel K'e Elder explains:

> *Anytime you block the caribou with a road or piles of rocks or similar things, the caribou can never cross it. On top of that all the noise chases the caribou away* (Liza Enzoe).

Studies of effects of roads on caribou movement provide conflicting results

Case *et al.* (1996) also found that high volumes of traffic at short intervals may result in caribou refusing to cross the road. However, other studies have shown that, even when exposed to effects of road traffic and oil-field infrastructure, substantial changes in caribou distribution and behaviour did not occur (Cronin *et al*. 1998; Burson *et al.* 2000; Yost and Wright 2001).

Grizzly Bears

COSEWIC (2001) has designated grizzly bears as a "species of special concern"

The large home range of grizzly bears can place bears in contact with humans even when developments are at a considerable distance from the centre of the home range. If barren-ground grizzly bears have a similar sensitivity to human activities as other grizzly bear populations (review in McLellan 1990), then disturbance from the mine may cause bears to avoid the area. If disturbance from the mine decreases the quality of potential den sites near the mine, bears may be forced to den farther from the mine or in poorer quality habitat. Potential displacement to more marginal quality den sites may decrease overwinter survival of adult bears or result in a decline in successful production of offspring. The decline in quality denning habitat may also increase crowding and conflicts between individuals, which could increase mortality in adult and juvenile bears. Because of these characteristics, and low population density, COSEWIC listed grizzly bears as a "species of special concern" in 2001.

Baseline studies found no active bear dens within the regional study area

Baseline studies completed during 1999 and 2000 found no active bear dens located within the RSA, but because searches for dens were restricted to esker habitat, the likelihood of finding dens in other habitats within the RSA was low. Current research on grizzly bears in the central Arctic has indicated that bears may prefer to den in heath tundra habitat, with limited use of esker habitat (McLoughlin 2000). Recent tracks, feces, and signs of bear excavations for ground squirrels, however, were observed in the RSA. In 2000, one grizzly bear was sighted 6 km from the project footprint, and in 2001, three sightings of grizzly bears were recorded within the RSA. Overall, anecdotal observations of grizzly bears within the RSA are low.

Wolves

Wolves are an important component of the tundra ecosystem

As a large carnivore, wolves can influence all trophic levels of the tundra ecosystem. Wolves that travel through and/or den in the Snap Lake area depend on caribou as their main source of prey. During fall, wolf packs from this population likely follow the Bathurst caribou herd to their wintering grounds near the treeline. Summer range sizes for wolves can be extensive. In studies completed in 1997 and 1998, Walton *et al.* (2001) found that the mean summer range size for female wolves in the central Arctic was 1,130 km^2. For males, the mean summer home range size was 2,022 km^2. Large home ranges can place wolves in contact with humans even when developments are at a considerable distance from the core of the home range.

Wolves prefer to den in habitat containing eskers and/or heath tundra

Eskers are an important landscape component for wolves (Lutsel K'e Dene First Nation 2001). Cluff *et al.* (2001) compared 12 habitat types available in their study area and found that wolves selected home ranges that contained more eskers and heath tundra habitat, but the importance of eskers to pup survival is not clear (Cluff *et al.* 2001). No preference or avoidance by wolves was detected for any other type of habitat, except boulder fields, which were less common within an individual home range. Wolves typically den in or near eskers, and these become focal points of activity during the summer. As the pack is less mobile while caring and feeding young pups, it is also the time when they may be most sensitive to disturbance (BHP 2001). If disturbance from the mine decreases the quality of potential sites near the mine, wolves may be forced to den further from the mine or in poorer quality habitat. This may result in a decline in the success of producing offspring.

Baseline studies revealed the presence of wolf dens within the regional study area

In 1999, two active wolf dens were located within the RSA and one was also occupied during the spring of 2000. Spring surveys in 2000 also located three additional wolf dens and the subsequent survey on 26 July 2000 indicated that all four dens located in the spring were unoccupied (no animals were observed). In contrast, wolves that den north of MacKay Lake in the central tundra region of the Slave Geological Province typically do not abandon den sites until after mid-August (BHP 2001; Cluff *et al*. 2001). Therefore, the amount of time that wolves are influenced by mining activities near Snap Lake during the denning period may be less than for wolves denning near Lac de Gras.

Wolverines

Baseline studies detected the presence of wolverines in the regional study area

The home range size of wolverines will likely result in some individuals contacting the Snap Lake Diamond Project. Mine operations, therefore, have the potential to change the use of habitats and den sites adjacent to the mine footprint. Wolverines are also annual residents of the area. Baseline studies in 1999 and 2000 recorded an average density of 0.23 tracks/km within the RSA. Four individual wolverines were observed during ground and aerial surveys in 1999, and incidental observations of wolverines have been made during the advanced exploration program. In addition, this western population of wolverines has been listed as a "species of special concern" by COSEWIC (2001).

EKATI™ mine track surveys are relevant

There is limited information of how development affects wolverine movement and behaviour. However, wolverine track surveys completed at the EKATI™ mine during the past three years indicate that wolverines are currently still moving within or through the area (BHP 2001). The average density of wolverine tracks recorded within the Snap Lake area during 1999 and 2000 (0.23 tracks/km) was within the range of track densities (0.10 to 0.33 tracks/km) observed around the EKATI™ mine during 1998 to 2000 (BHP 2001).

Foxes

Baseline surveys identified the presence of fox dens within the regional study area

In 1999, eight active fox dens were located within the RSA, while surveys in 2000 confirmed two fox dens were active. Den sites identified in the baseline studies were located 8-30 km from the project footprint. However, one fox den has been observed within the project footprint in 2001. Similarly, during the construction phase of the EKATI™ diamond mine, active fox dens were recorded within 1 km of the project footprint (BHP 1998).

Raptors

Raptors are considered indicators of environmental change

Raptors are commonly considered valuable indicators of environmental change (Furness and Greenwood 1993). Their position as predators at the top of the food chain makes them sensitive to changes within the environment, and some species are known to be sensitive to the effects of direct disturbance by humans or destruction of habitat (Newton 1979).

Peregrine falcons, a COSEWIC listed species, and gyrfalcons breed within the RSA

Two species of raptors have been recorded breeding in the RSA. The tundra peregrine falcon (*tundrius* subspecies), which breeds within the RSA, is listed as a "species of special concern" by COSEWIC (2001) because of low population density and continued concern about their vulnerability to persistent organic chemicals. Gyrfalcons, the official bird of the NWT, are the largest of all falcons and nest in many areas of the NWT. Both species are migratory. Peregrine falcons winter in central and south America while gyrfalcons wintering range is restricted to within North America. Both species are only present within the RSA during the breeding season.

Mining activities are unlikely to affect raptors breeding within the RSA

Populations of raptors tend to be sustained by the reproductive success of relatively few individuals in a population at a few specific nest sites that are used year after year (Newton 1979; Johnstone 1997). Maintenance of a population is therefore highly likely if these frequently used nest sites are protected in some way from potential disturbance or destruction of habitat. Baseline surveys have recorded a total of five active gyrfalcon and peregrine falcon nest sites within the RSA of the Snap Lake Diamond Project. No nest sites were detected within 11 km of the project footprint. At this distance from the mine, the movement, behaviour and habitat use of raptors is unlikely to be affected and protection of the population will likely be attained.

Survey methods underestimate raptor breeding densities in the RSA

The count of nest sites within the RSA is likely an underestimate of the breeding population of raptors within the 11-31 km area of the RSA because an intensive survey of all suitable nesting habitat has not occurred. An intensive search of this area would likely reveal more nest sites.

Exploration personnel will be trained to avoid disturbance of raptors

Exploration within the RSA is the most likely activity to expose raptors to disturbance. There is the potential that people moving through the defended territory of a nesting raptor could disturb it during courtship, incubation, or brooding. In general, this sort of disturbance, if it occurred, would be very brief and is unlikely to change the outcome of the breeding attempt (*i.e.*, a raptor will rapidly revert to incubating once the person has moved on) (G. Court, Provincial Wildlife Status Biologist, Alberta Environmental Protection, *pers comm.*). As part of the environmental management system (EMS), exploration personnel will be given training to identify when they are possibly disturbing a raptor and the need to move away to let the raptor resume nesting behaviour.

Raptors can be robust to the effects of disturbance

While susceptibility to disturbance can vary between individuals, in general, both raptor species can be robust to the effects of disturbance during breeding. At Rankin Inlet, the site of a long-term intensive study of peregrine falcons, a nest within 2 km of the town and airport maintained near continual occupancy and high reproductive success over the 14-year duration of the study despite frequent disturbance from air, boat, and snowmobile traffic (Johnstone 1997). Moreover, all study nests occurred within 20 km of town and were exposed to frequent visits, however, no deleterious effects were detected. At the EKATI™ mine, one peregrine nest has been active within 4 km of the Misery Road since its construction and operation (BHP 2001). In southern Canada, peregrine falcons are well known for successful breeding in urban settings, including on industrial facilities where high levels of noise are experienced (Cade & Bird 1990). Similarly, wintering gyrfalcons have been recorded using industrial facilities as perches or roosts (G. Court, Provincial Wildlife Status Biologist, Alberta Environmental Protection *pers comm.*).

Upland Breeding Birds

Breeding bird density was found to be highest in riparian shrub habitat

The reproductive season for upland breeding birds begins around the first week of June and continues until approximately the third week of June, which is a relatively narrow window of sensitivity to noise and other disturbance. Baseline results from 1999 and 2000 suggest that density estimates were greatest in riparian shrub, followed by sedge wetlands, and heath tundra. Loss of these habitats would have the greatest impact on habitat fragmentation for upland breeding birds. However, no riparian shrub or heath tundra habitat will be lost due to the mine footprint.

No noticeable effects have been observed at EKATI™ mine

Monitoring studies at the BHP EKATI™ mine, which is substantially larger than the Snap Lake Diamond Project, have detected no noticeable effects on upland breeding bird density, species richness, or diversity immediately adjacent to the mine site during the past five years (BHP 2001). Although results also indicated significant year-to-year differences in the density and community composition of upland breeding birds, similar to baseline results for the Snap Lake Diamond Project, these differences were likely more associated with natural changes in individual species abundance than the effects of local mine activities (BHP 2001).

Waterfowl

A low density of waterfowl was observed in the regional study area

Eighteen waterfowl species were observed flying or roosting on lakes within the RSA during 1999 and 2000. Density, however, was 1.4 to 2.4 individuals per 1,000 m of shoreline. Although noise and sensory disturbance can alter the movement and behaviour of wildlife, particularly hunted species like waterfowl (Bommer and Bruce 1996), the specific effects of mine-related sensory disturbance on many species of waterfowl are unknown. Loons are known to be negatively influenced by human activities (Ehrlich *et al.* 1988), but baseline surveys recorded only two red-throated loons on lakes located 3.6 and 12 km from the mine footprint. Finally, the minimal loss of sedge wetland and lake habitat due to the Snap Lake Diamond Project will be associated with limited habitat fragmentation.

10.4.2.3.4 Residual Impact Classification

Impacts are classified according to direction, magnitude, geographic extent, duration, frequency, and reversibility

Despite mitigation, activities related to the Snap Lake Diamond Project will result in changes to wildlife movement and behaviour. Residual impacts from these changes were evaluated using the methods described in Section 10.1.5. In general, the impacts are classified using the following criteria: direction, magnitude, geographic extent, duration, frequency, and reversibility. Residual impacts were classified for each wildlife VEC.

Bathurst Caribou Herd

The magnitude of impact from mining activities is predicted to be low

Some studies have shown that, even when exposed to effects of road traffic and oil-field infrastructure, substantive changes in caribou distribution and behaviour did not occur (Cronin *et al*. 1998; Burson *et al.* 2000; Yost and Wright 2001). Monitoring studies at the EKATI™ mine have found no detectable effect from the infrastructure on the relative abundance or group composition (*i.e.*, groups with calves vs. groups without calves) of caribou (BHP 2001). In addition, although caribou responded to blasts 60% of the time within 1 km of the blast, the response was low; animals were alert but typically did not move (BHP 1999). Considering the smaller footprint of the Snap Lake Diamond Mine relative to the EKATI™ mine, and that all blasting will be underground, it is anticipated that the magnitude of disturbance from blasting will be low. The magnitude of disturbance from people, vehicles, and aircraft traffic, and associated habitat fragmentation effects will be low for caribou (Table 10.4-12).

The geographic extent of all mining activities is predicted to be regional

The geographic extent of sensory disturbance and associated habitat fragmentation on movement and behaviour is regional (Table 10.4-12). Ground vibration effects from blasting are predicted to extend 1 km into the RSA, but with little residual energy. Continuous noise from the site will be close to or less than ambient sound levels at approximately 6 km from the site (Section 8.4.2). Trucks passing by a location along the winter access road may be audible at distances up to approximately 10 km from the roadway (Section 8.4.2); however, air traffic noise will be audible for short intervals throughout the RSA.

Table 10.4-12 Classification of Residual Impacts to Wildlife Movement and Behaviour

VEC	Direction	Magnitude	Geographic Extent	Duration	Reversibility	Frequency	Environmental Consequence
Blasting							
Bathurst caribou	negative	low	regional	medium-term	reversible (short-term)	moderate	low
Barren-ground grizzly bear	negative	low	regional	medium-term	reversible (short-term)	moderate	low
Wolf	negative	negligible	regional	medium-term	reversible (short-term)	moderate	low
Wolverine	negative	low	regional	medium-term	reversible (short-term)	moderate	low
Fox	negative	negligible	regional	medium-term	reversible (short-term)	moderate	low
Raptors	negative	negligible	regional	medium-term	reversible (short-term)	moderate	low
Upland breeding birds	negative	low	regional	medium-term	reversible (short-term)	moderate	low
Waterfowl	negative	negligible	regional	medium-term	reversible (short-term)	moderate	low
Vehicle and Aircraft Traffic							
Bathurst caribou	negative	low	regional	medium-term	reversible (short-term)	moderate	low
Barren-ground grizzly bear	negative	low	regional	medium-term	reversible (short-term)	moderate	low
Wolf	negative	low	regional	medium-term	reversible (short-term)	moderate	low
Wolverine	negative	low	regional	medium-term	reversible (short-term)	high	low
Fox	negative	low	regional	medium-term	reversible (short-term)	high	low
Raptors	negative	low	regional	medium-term	reversible (short-term)	moderate	low
Upland breeding birds	negative	low	regional	medium-term	reversible (short-term)	moderate	low
Waterfowl	negative	low	regional	medium-term	reversible (short-term)	moderate	low
Winter and Esker Access Roads							
Bathurst caribou	negative	low	regional	medium-term	reversible (short-term)	moderate	low
Wolf	negative	low	regional	medium-term	reversible (short-term)	moderate	low
Wolverine	negative	low	regional	medium-term	reversible (short-term)	moderate	low
Fox	negative	low	regional	medium-term	reversible (short-term)	moderate	low

Table 10.4-12 Classification of Residual Impacts to Wildlife Movement and Behaviour (continued)

VEC	Direction	Magnitude	Geographic Extent	Duration	Reversibility	Frequency	Environmental Consequence
Habitat Fragmentation							
Bathurst caribou	negative	negligible	regional	medium-term	reversible (long-term)	low	low
Barren-ground grizzly bear	negative	negligible	regional	medium-term	reversible (long-term)	low	low
Wolf	negative	negligible	regional	medium-term	reversible (long-term)	low	low
Wolverine	negative	negligible	regional	medium-term	reversible (long-term)	low	low
Fox	negative	negligible	regional	medium-term	reversible (long-term)	low	low
Raptors	negative	negligible	regional	medium-term	reversible (long-term)	low	low
Upland breeding birds	negative	negligible	regional	medium-term	reversible (long-term)	low	low
Waterfowl	negative	negligible	regional	medium-term	reversible (long-term)	low	low

Note: Grizzly bears, raptors, upland breeding birds, and waterfowl are not included in the classification for winter and esker access roads because they are not active in the region when winter roads are in operation.

Most activities that may have an impact are predicted to cease upon mine closure

Any physical and/or psychological barriers that winter and esker access roads, blasting, vehicle and aircraft traffic and habitat fragmentation create for caribou are predicted to be of medium-term duration (*i.e.*, the effect will cease upon closure of the mine) (Table 10.4-12). The reversibility of habitat fragmentation, however, will likely be long-term. This is due to uncertainty of reclamation techniques and success in the NWT. However, it is anticipated that re-vegetation will occur within the successional time frame of the native plant species, and therefore, the impact is expected to be reversible within the long-term (100 years).

Most mine activities are predicted to be of moderate frequency

The frequency of impacts from winter and esker access roads will be moderate due to the seasonal use of the roads (Table 10.4-12). The effects of blasting also will be of moderate frequency as it is predicted to occur periodically during the life of the mine. Frequency of impact from vehicle and aircraft traffic will also be moderate due to the seasonal residency of caribou in the area. The frequency of habitat fragmentation is predicted to be low, occurring once during initial construction of mine site facilities.

Any possible changes to caribou movement and behaviour are reversible

Any possible alteration of movement and/or behaviour of the Bathurst caribou herd resulting from sensory disturbance or habitat fragmentation associated with the Snap Lake Diamond Project has the potential to be reversible (Table 10.4-12). For example, reclamation efforts may restore habitat on the peninsula, although it will likely occur after closure of the mine. Disturbance from blasting, vehicle and aircraft traffic, and the winter and esker access roads will cease with closure of the mine.

The environmental consequence is predicted to be low

The overall environmental consequence on caribou movement and behaviour from mining activities and habitat fragmentation is predicted to be low (Table 10.4-12). There is a moderate to high level of confidence in the probability of this prediction. For example, results from monitoring studies at the EKATI™ diamond mine during 1998 revealed that both nursery and non-nursery groups spent about 15% less time feeding within 7 km of the footprint (BHP 2001). During 1999, however, the behaviour of caribou did not appear to be influenced by mine-related activities.

Disturbance effects will vary through space and time

Because the migratory movement of caribou to their wintering grounds is unpredictable (Legat *et al*. 2001), the number of caribou travelling through the potential zone of influence will probably change from year to year. Animals may not always travel through or close to the mine site. In addition, depending on the level of mining activities, the zone of influence may expand or contract each year. The real question is "Will this decrease in time spent feeding influence the health (likelihood of persistence) of the Bathurst caribou herd?" The elements needed to answer this question likely consist of the number of animals that pass through the zone of influence, the amount of time animals spend in the zone of influence, the amount of fat (body condition) an animal has before being influenced, and weather and winter range condition (BHP 2001). Part of the current monitoring program at the Snap Lake Diamond Project is focused on collecting more information on the number and distribution of caribou that migrate through the RSA. Traditional knowledge recommended monitoring of caribou during the spring and fall migration periods (Lutsel K'e Dene First Nation 2001). The intent of the monitoring program and the recommendations of the Elders are in agreement that further monitoring is required.

There is a moderate to high level of confidence associated with a prediction of low environmental consequence

The smaller footprint, much shorter hauling distances, and below ground operations associated with the Snap Lake Diamond Project relative to the size of the infrastructure and above-ground operations at the EKATI™ mine will result in a much smaller zone of influence. In addition, the relatively low numbers of caribou passing through the RSA implies that less than 1% of the Bathurst herd may be exposed to mining activities at any given time. Assuming that the number and distribution of caribou moving through the Snap Lake area approximates long-term natural variation, then the level of confidence in the prediction of a low impact of mining activities on caribou movement and behaviour is moderate to high.

Grizzly Bears

Mine activities are predicted to have little effect on grizzly bear movement and behaviour

Grizzly bear movements and behaviour will not be affected by winter and esker access roads because the roads will only be in use when bears are in hibernation. Given the large home range size of grizzly bears relative to the small footprint of the mine, the impact from mining activities on grizzly bear movement (attraction or avoidance) and behaviour is expected to be low (Table 10.4-12). Further support for anticipating a low magnitude is provided by previous studies which have demonstrated that, even with substantial infrastructure and road traffic, grizzly bears continue to carry out daily activities within close proximity to development (Burson *et al*. 2000; Yost and Wright 2001). Cluff *et al.* (2000) also have documented one female bear continuing to use the area between the Misery road (EKATI™ mine) and the Diavik mine after construction of the road.

Habitat fragmentation is predicted to be negligible in magnitude

Habitat fragmentation is predicted to be negligible in magnitude (Table 10.4-12). This prediction is largely due to the large home range size of grizzly bears relative to the small footprint of the mine (see Table 10.4-7, Section 10.4.2.2).

Many scores of impact criteria were equivalent for most VECs

Classifications and explanations for geographic extent, duration, frequency, and reversibility of mine-related impacts on the movement and behaviour of grizzly bears are equivalent to caribou (Table 10.4-12).

The prediction of environmental consequence was associated with a moderate level of scientific uncertainty

The overall environmental consequence on grizzly bear movement and behaviour from all activities and habitat fragmentation is anticipated to be low (Table 10.4-12). The level of scientific uncertainty associated with this prediction is moderate, as den surveys have only been completed for two years and have been restricted to esker habitat. If den site selection for barren-ground grizzly bears is similar to those in the central Arctic, then it should be expected that proportionately more dens would be detected in the heath tundra/heath boulder habitat within the RSA (McLoughlin 2000).

Further reasons for uncertainty

Although some studies have determined that bear movements and behaviour are largely unaffected by development (Burson *et al.* 2000; Yost and Wright 2001), caution must be heeded towards these results. These studies occurred in parks that exhibit the presence of different types of vehicles and habituation of bears. For example, the observation of one bear maintaining its home range within the vicinity of the Misery Road and Diavik mine site (Cluff *et al.* 2000) is based on only one individual and one year of study. Thus, there is a moderate level of uncertainty associated with a probability of occurrence of a low environmental consequence from mining activities on grizzly bear movement and behaviour. Current monitoring studies at the

Snap Lake Diamond Mine are investigating more fully the potential influence of mine-related disturbance on grizzly bears in the area.

Wolves

Disturbance effects are predicted to be low in magnitude

Although noise from site activities may alter behaviour and movement, particularly during the pup-rearing period, the current location of wolf dens (nearest den was 12 km from the project footprint) and home range size suggests that disturbance effects should be low in magnitude (Table 10.4-12). For example, studies at the EKATI™ mine found that the average pup count per den site (two dens were within 11 km of the footprint) within the BHP study area was 4.3 pups/den. This is similar to an average pup count of 4.6 for eight dens observed on the barren-grounds over the summer (BHP 2001). Assuming that data from the den surveys (number of natal dens and pup production) reflect the health of wolf packs inhabiting the BHP study area, then these results suggest that the current level of disturbance from the mine has not negatively influenced the presence of wolves (BHP 2001). Given that the footprint of the proposed Snap Lake Diamond Project is substantially smaller than that of the EKATI™ site, it is predicted that similar results should be observed.

The impact from blasting activities is predicted to be of negligible magnitude

For blasting activities, the magnitude of impact is predicted to be negligible (Table 10.4-12). The nearest observed wolf den was located 12 km from the mine footprint and it is expected that possible ground vibrations will have dissipated at 1 km from the blast location. Blasting activities are predicted to occur at a moderate frequency during the life of the mine.

Little prime habitat for wolves occurs within the mine footprint

Habitat fragmentation is also expected to be negligible in magnitude due to the large home range size of wolves and relatively small footprint of the mine (see Table 10.4-7, Section 10.4.2.2). In addition, little prime habitat for wolves (*i.e.*, no eskers, moderate amount of heath tundra) occurs within the mine footprint. Effects of habitat fragmentation on wolves are predicted to be regional in geographic extent, medium-term in duration, low in frequency, and reversible in the long-term (Table 10.4-12).

Mine activities are predicted to be of moderate frequency

The effects of blasting, winter and esker access roads, and vehicle and aircraft traffic are expected to be regional in geographic extent, moderate in frequency, medium-term in duration, and reversible in the short-term (Table 10.4-12). The frequency of effects is predicted to be moderate because wolf residency is seasonal (*i.e.*, during the pup-rearing period) in the Snap Lake area.

A moderate level of scientific uncertainty was associated with the prediction of environmental consequence

Based on the above classifications, the overall environmental consequence for all activities that may affect wolf movement and behaviour is anticipated to be low (Table 10.4-12). Similar to grizzly bears, there is a moderate level of scientific uncertainty associated with this prediction. For example, wolf den surveys have only been completed for two years. In addition, searches for wolf dens were restricted to eskers. Although eskers are an important landscape component within wolf home ranges, heath tundra also represents important habitat (Walton *et al.* 2001). There is potential, therefore, for individuals to use heath tundra habitat adjacent to the mine site which could result in mine activities generating a larger effect on wolf movement and behaviour than predicted. De Beers, in association with RWED, is currently monitoring all major eskers and recently active wolf dens in the RSA to better understand the potential impacts of mining activities on wolves.

Wolverines

Mine activities will have a low magnitude of impact on wolverine movement

All activities are predicted to generate a low magnitude of impact on wolverine movement (attraction or avoidance) and behaviour (Table 10.4-12). This is due to the large home range size of wolverines relative to the small footprint of the mine (Table 10.4-7, Section 10.4.2.2).

Wolverines may be subjected to vehicle/aircraft traffic year-round

Classifications and explanations of geographic extent, duration, and reversibility are equivalent to those values predicted for the previous VECs (Table 10.4-12). Except for frequency of exposure to vehicle and aircraft traffic, frequency of activities will also be the same as values predicted for the other VECs. Frequency of effects from vehicle and aircraft traffic on wolverine movement and behaviour, however, is predicted to be high (Table 10.4-12). Because wolverines are an annual resident of the RSA, they may be continually exposed to vehicle and aircraft traffic throughout the year.

The environmental consequence of mine activities is predicted to be low

The environmental consequence from all activities on wolverine movement and behaviour is predicted to be low (Table 10.4-12). There is a moderate degree of confidence in the prediction (and associated probability of occurrence) of environmental consequence based on the results of monitoring at the EKATI™ mine. The current monitoring program for the Snap Lake Diamond Project is collecting information on the relative abundance of wolverines in the RSA.

Foxes

Impacts from activities and habitat fragmentation are predicted to have low magnitude

Low levels of magnitude are predicted for the effects of mine-related activities and habitat fragmentation on fox movement (attraction or avoidance) and behaviour (Table 10.4-12). Because the nearest fox den observed was 8 km from the project footprint, it is predicted that ground vibrations from blasting, and vehicle aircraft traffic should have a minimal influence on these individuals. Although foxes do not possess an extensive home range (Table 10.4-7, Section 10.4.2.2), the magnitude of habitat fragmentation is predicted to be negligible due to the small footprint of the mine and the distribution of fox dens in the area.

Foxes are predicted to be frequently exposed to road/aircraft traffic

Classifications and explanations of geographic extent, duration, and reversibility are equivalent to that predicted for the previous species (Table 10.4-12). Except for frequency of exposure to vehicle and aircraft traffic, frequency of activities will also be the same as values predicted for the other VECs. Frequency of effects from vehicle and aircraft traffic on foxes, however, is predicted to be high as foxes are an annual resident of the RSA and LSA. (Table 10.4-12).

Environmental consequences are predicted to be low

The environmental consequence from all activities on the movement and behaviour of foxes is anticipated to be low (Table 10.4-12). There is, however, a moderate level of scientific uncertainty associated with these predictions. For example, although the nearest den site was located 8-km away from the project footprint, den surveys were restricted to eskers only. Given the opportunistic nature of this species, there is the possibility for fox dens to be nearer to the mine site than previously observed during baseline studies. For example, one fox den has been observed within the project footprint in 2001. This could result in an increase in the environmental consequence of the project on fox movement and behaviour.

Raptors

Mining activities are predicted to have a negligible magnitude of impact

Disturbance from ground vibrations associated with blasting activities is anticipated to be negligible in magnitude because no raptor nests were discovered within 10 km of the project footprint during baseline surveys (Table 10.4-12). Moreover, some species of raptors, including peregrines, can be resistant to pulse-type disturbances during brooding or incubation. Similarly, habitat fragmentation is also expected to have a negligible effect due to the small footprint of the mine, the highly mobile nature of both species which are accustomed to travelling over different habitat types during foraging, and the distribution of nests (Table 10.4-12). The proposed mitigation measures and the distribution of raptors in the area suggests that the magnitude of disturbance from vehicle and aircraft traffic on raptor movement and behaviour should be low (Table 10.4-12).

Possible habitat fragmentation effects are predicted to be long-term in duration

Similar to other VECs, any effects of blasting, and vehicle and aircraft traffic on raptors are predicted to be of regional extent, medium-term in duration, moderately frequent, and reversible in the short-term

(Table 10.4-12). Habitat fragmentation is regional in extent, and the reversibility of this impact is long-term (Table 10.4-12). Reclamation efforts may restore habitat on the peninsula, but it will likely occur after closure of the mine. The frequency of habitat fragmentation is predicted to be low, occurring once during initial construction of mine site facilities.

Environmental consequence is predicted to be low

The overall environmental consequence of all activities on raptor movement and behaviour is anticipated to be low (Table 10.4-12). There is a high level of confidence in the predictions for environmental consequence, primarily because exposure to disturbance will be low and certainty to the robustness to the effects of pulse-type disturbance to breeding peregrine and gyrfalcons is high. Also, confidence in the efficacy of mitigation aimed at reducing disturbance to breeding raptors by ground personnel is high. De Beers, in association with RWED, has been monitoring the success of raptor breeding attempts within the RSA of the Snap Lake Diamond Project, and will investigate further monitoring priorities to test the prediction of low environmental consequence.

Upland Breeding Birds

Mining activities are predicted to have a low magnitude of impact

The magnitude of impact from blasting is predicted to be greater for upland breeding birds than raptors because surveys indicated that upland breeding birds were nesting within 1-2 km of the project footprint (Table 10.4-12). However, ground vibrations from blasting should only minimally affect bird movements and behaviour, as most of the energy from the blast will have dissipated at a distance of 1 km. In this respect the magnitude of the impact should be low (Table 10.4-12). Although noise from facilities, and vehicle and aircraft traffic may change the movement and behaviour of birds, the magnitude of impact is anticipated to be low.

Habitat fragmentation effects are predicted to be negligible in magnitude

The magnitude of habitat fragmentation on upland breeding bird movement and behaviour is expected to be negligible (Table 10.4-12). Although the loss of sedge wetland and heath tundra/boulder habitat will influence several individuals, the effect of fragmentation should be marginal on the local population.

Scores for geographic extent, duration, and frequency of blasting and vehicle/aircraft traffic are equivalent to raptors

Potential effects from blasting and vehicle/aircraft traffic, are expected to be regional in geographic extent, medium-term in duration, of moderate frequency, and reversible. Ground vibration effects from blasting are predicted to extend into the RSA for 1 km, but with little remaining energy. Above background noise levels from vehicle and aircraft traffic, and facilities is also expected to extend varying distances into the RSA (Section 8.3). Duration of these effects will end with closure of the mine. The frequency of impacts will be moderate due to the seasonal residency of migratory bird species (Table 10.4-12). The impacts from both activities are predicted to be reversible in the short-term (*i.e.*, any potential negative effects should not extend beyond the life of the mine) (Table 10.4-12).

Potential habitat fragmentation effects are predicted to be reversible in the long-term

Habitat fragmentation is regional in geographic extent. Frequency is low, occurring once during initial construction. Reversibility, however, is long-term as re-vegetation will likely extend beyond the life of the mine (Table 10.4-12).

Environmental consequence is anticipated to be low

The overall environmental consequence on upland breeding bird movement and behaviour from the effects of blasting, vehicle and aircraft traffic, winter and esker access roads, and habitat fragmentation is expected to be low (Table 10.4-12).

Studies at BHP indicated mining activity was not affecting breeding bird populations

A moderate to high degree of confidence is associated with the predictions (*i.e*., probability of occurrence) of environmental consequence. Monitoring at BHP has not looked at disturbance related to blasting at an individual level. There is the potential that the population parameters measured at BHP would not detect effects of blasting on individual nest success. The 2001 monitoring program at the Snap Lake Diamond Project collected further information on the density, diversity, and richness of upland breeding bird species within the RSA.

Waterfowl

Mining activities are predicted to have a negligible magnitude

The magnitude of impact from blasting is predicted to be negligible on waterfowl movement and behaviour (Table 10.4-12). The relatively low density of waterfowl and the expectation that ground vibrations will not extend beyond 1 km from the blasting area form the basis of this prediction. Disturbance from vehicle and aircraft traffic is anticipated to be low in magnitude (Table 10.4-12). Waterfowl that may encounter vehicle or aircraft traffic will likely be temporarily disturbed. Similar to other VECs, the magnitude of habitat fragmentation on movement and behaviour of waterfowl should be negligible (Table 10.4-12).

Aside from effects of habitat fragmentation, all other effects should be reversible in the short-term

The geographic extent of these impacts on waterfowl is expected to be regional (Table 10.4-12). Except for the impact of habitat fragmentation, the duration of impacts will be medium term, and should also be reversible in the short-term (Table 10.4-12). Because of the time necessary for re-vegetation of disturbed areas, the potential effects of habitat fragmentation may extend well beyond the life of the mine as previously discussed (*i.e.*, reversible in the long-term).

Environmental consequence is predicted to be low

Based on the above classifications, the overall environmental consequence from blasting, vehicle and aircraft traffic, and habitat fragmentation on waterfowl movement and behaviour is predicted to be low (Table 10.4-12). There is a moderate-high degree of scientific uncertainty associated with these predictions. For example, analysis of information collected at the EKATI™ diamond mine suggests that the current level of mining activities has not negatively influenced the presence of loons adjacent to the mine site (BHP 2001), although loons are relatively sensitive to human disturbance (Ehrlich *et al.* 1988). But no data are available for comparing the reaction of loons with other waterfowl species to mine-related activities.

10.4.2.4 Key Question W-3: What Impacts Will the Snap Lake Diamond Project Have on Wildlife Abundance?

10.4.2.4.1 Linkage Analysis

Ten mine activities have the potential to cause wildlife mortality

Assessment of the potential impacts on wildlife abundance is focused on mine-related activities and facilities described in Section 10.4.1.4, and illustrated in Figure 10.4-15. Overall, the following activities/facilities were considered to have a potential influence on wildlife abundance:

- direct and indirect mortality from attraction to project footprint;
- direct mortality from wildlife-human interactions;
- direct mortality from vehicle/aircraft collisions;
- potential toxicity from north pile seepage;
- trapping of wildlife in water management pond;
- direct mortality from ventilation raises;
- direct and indirect mortality from fugitive dust (Section 11.3);
- direct and indirect mortality from inhalation of toxic air emissions (Section 11.3);
- direct and indirect mortality from toxic spills (*e.g.*, antifreeze); and,
- increase in legal and illegal hunting and trapping activities from increased access due to the winter and esker access roads.

Each of these elements is discussed below.

Attraction of Wildlife to the Project

Wildlife may be attracted to the project for several reasons

Carnivores have a keen sense of smell and can be attracted from long distances to a landfill if food items are frequently present. Carnivores are also attracted to aromatic waste material such as oils and aerosols. Wildlife may also become attracted to infrastructure that can serve as den or nest sites, or a temporary refuge to escape extreme heat or cold. The presence of contaminants or toxic substances may be accidentally ingested by animals feeding on food waste or seeking shelter, which can result in the decrease in health or death of an animal. Therefore, the linkage between carnivores (grizzly bears, wolves, wolverines, and foxes) attracted to the Snap Lake Diamond Project and change in abundance is valid.

Increased numbers of nest predators may lead to a decrease in breeding birds

Edible food items at a landfill site also have the potential to attract nest predators such as gulls and ravens. The presence of a large number of these birds may result in an increase in the frequency of predation on the nests of upland breeding birds and an associated decrease in the number of young produced. Therefore, the linkage due to the indirect effects on this VEC is valid.

Wildlife-Human Interactions

Increased wildlife-human interactions may occur as a result of mining activities

There is the potential for an increase in the risk of injury or death to wildlife through an increase in the chance of collisions with vehicles or human confrontation. Wildlife-human interactions may occur around buildings, the airstrip, and landfill site. Wildlife-human interactions can encompass many activities ranging from the feeding of wildlife to the destruction of animals determined as “nuisance” individuals. For example, a total of 10 wolverines have been destroyed or removed since January 1998 in the Lac de Gras area (Rob Mulders, RWED, pers. comm.). In addition, several foxes had to be destroyed as they became habituated to the landfill site at the Misery camp on the BHP lease area. The following quote expresses the concern that Lutsel K’e Elders have regarding animal attractants and the feeding of wildlife at the mine site.

> *They have to try and keep the animals away from the mine site. They have to keep garbage hidden away and make sure people don’t feed and touch the animals. Or else they will stay at the mine site and never leave* (Noel Drybones).

Wildlife that become habituated to a mine site are often destroyed

If wildlife become habituated to a food or shelter source, there is the potential for animals to threaten human life and property. This will often result in the destruction of the individual animal. Relocation of wildlife tends to be expensive, as it requires considerable effort. In addition, the survival of relocated individuals is typically unknown. For these reasons, the linkage between wildlife–human interactions and wildlife abundance is valid.

Vehicle and Aircraft Traffic

Road mortality is an important issue for nearly all developments

The linkage between vehicle and aircraft traffic and wildlife abundance is valid since virtually all wildlife species are subject to road mortality. This topic has been the subject of various literature reviews (*e.g.,* Kelsall and Simpson 1987; Jalkotzy *et al.* 1997) and has been a concern for most developments.

Road mortality often goes unreported

Only a portion of the mortality that occurs is ever reported (Kelsall and Simpson 1987). One reason for low reporting is that mortality data are difficult to obtain. Mortality is typically dispersed along many kilometres of road, and carcasses of small mammals and birds killed on roads are often quickly scavenged. As well, reports of wildlife road mortality are usually received only if collisions result in human injuries or if the collision results in expensive repair to the vehicle. Frequency of road mortality is often related to specific locations, traffic volume, and speed (Jalkotzy *et al.* 1997). It is expected, for example, that as vehicle speed increases the chance of death or injury to wildlife also increases.

Collisions may occur on the airstrip and in the air

Aircraft traffic has the potential to cause direct mortality of birds on the ground and while in flight. Also, terrestrial wildlife that are present on the airstrip may be struck by aircraft during landing or takeoff.

Potential Toxicity from North Pile Run-off and Seepage

Elders are concerned about potential sources of water pollution

Elders of the Weledeh Yellowknives Dene (1997) are concerned about potential water contaminants that may come from waste rock, processed kimberlite, and mine water storage areas. Similarly, Lutsel K'e Elders expressed the following concerns for contamination of water and mitigation for reducing potential negative effects.

> *I don't want the water to be contaminated. If a little bit of land is contaminated, its OK, but if the water is contaminated everything suffers. I am concerned about dirty snow melting and entering the watershed* (JB Rabesca).

> *If the water gets polluted, it would take a lot of pollution and long time for it to get down to Artillery Lake and the East Arm. Right now, I'm not worried about it. Snap Lake is just a little pond, it*

> *[the water] has to go through big lakes like MacKay and Aylmer. But we always have to be on the safe side and watch it well* (Louie Abel).

> *All the dirty water from the mine should be caught in ditches, and maybe run into a pond. But they [ditches and pond] have to be really waterproof, so that nothing can leak out. Maybe they can put cement or something in [as a liner] to make it waterproof. If they clean the water, its OK to put it in the lake, but if not, they should just keep it in that pond so that it doesn't effect the main water [Snap Lake]* (Louie Abel).

The linkage between some species and some parts of the water management system (e.g., ditches) is valid

The water management system including collection ponds and ditches will temporarily retain surface and groundwater before the water enters the water treatment plant and is discharged into Snap Lake. This includes water that may have been in contact with the north pile. There is general concern that wildlife may drink from the collection ponds or associated containment ditches, which may result in negative changes to wildlife health. Collection ponds, sumps and the water management pond will be fenced, but some areas such as ditches will not be fenced. Therefore, the linkage between the north pile run-off and seepage is valid for some VECs. However, wildlife health effects caused by drinking this water are assessed in Environmental Health (Section 11.3.1).

Water Management Pond

Linkage is invalid because water management pond will be fenced

During operation of the mine approximately half of the processed kimberlite material will be used as underground backfill, while the remaining half will be deposited in the north pile. However, during the advanced exploration program, processed kimberlite was deposited into the water management pond and has formed a sludge-like composite. The creation of a kimberlite "sludge" composite has the potential to directly injure or kill wildlife that may become trapped in the water management pond. In response to the concerns expressed through traditional knowledge consultation, De Beers will fence the water management pond to prevent access by larger wildlife (*e.g.*, fox and larger). Therefore, this linkage is invalid. This linkage will not be assessed.

Ventilation Raises

Exhaust raises that will ventilate the mine will be completely enclosed

Two exhaust raises will be located north of Snap Lake, on the north portion of the deposit where the ore body is located beneath land. Without mitigation, curious animals (*e.g.*, grizzly bears and wolverines) could fall into the ventilation raises, subsequently leading to direct mortality and/or injury. However, these ventilation raises will be completely enclosed with chain-link fencing, which is anticipated to fully mitigate potential negative effects. Therefore, the linkage between ventilation raises and change in abundance of wildlife is not valid.

Potential Wildlife Toxicity from Fugitive Dust

Because potential health effects from fugitive dust may be felt through the entire food chain, it is assessed in Environmental Health (Section 11.3)

Fugitive dust may have negative effects on wildlife health. Elders of the Weledeh Yellowknives Dene and Lutsel K'e Dene First Nation are concerned that the accumulation of potentially toxic dust on vegetation may have impacts that can influence an entire food chain (Weledeh Yellowknives Dene 1997; Lutsel K'e Dene First Nation 2001). For example, grizzly bears, wolves, and wolverines may hunt and scavenge caribou that have previously been exposed to dust on forbs and lichen. Foxes may scavenge caribou that have previously fed on contaminated plants. Raptors may feed on small mammals that may have fed on contaminated vegetation. Songbirds, shorebirds, ptarmigan, and waterfowl may also be exposed to potential toxic dust that has entered terrestrial and aquatic food chains. Therefore, the potential impact of toxic dust on wildlife health is valid; however, it is assessed in Environmental Health (Section 11.3).

Potential Toxicity from Air Emissions

Because the inhalation of air emissions has the potential to change the health of all VECs, it is also assessed in Section 11.3

Air emissions from the power plant, vehicles, and aircraft contain noxious compounds such as SO_2, NO_x, and polycyclic aromatic hydrocarbons (PAH; Section 7). Inhalation of these substances by wildlife may have an indirect influence on wildlife abundance by reducing the health of individuals. Therefore, the potential impact of air emissions on wildlife health is valid; it is assessed in Environmental Health (Section 11.3).

Toxic Spills

Contamination via exposure to toxic spills has the potential to affect all VECs

Toxic spills (*e.g.*, antifreeze, ammonium nitrate) within the project footprint or along access roads have the potential to have negative effects on wildlife abundance (Weledeh Yellowknives Dene 1997). Direct contamination and indirect contamination through the food chain may cause negative effects on wildlife abundance. Therefore, this linkage is valid and the impacts will be assessed in this section. Spills involving large quantities that result from accidents and malfunctions are assessed in Section 13.

Winter and Esker Access Roads

Roads can increase access for both legal and illegal hunting and trapping

Winter and esker access roads can have multiple effects that may impact wildlife abundance (*i.e.*, see vehicle traffic and toxic spills sections above). Elders of the Weledeh Yellowknives Dene are concerned about the possible outcome of increased access from roads and the associated increase in "waste meat" (Weledeh Yellowknives Dene 1997). Other studies have also shown that increased access can result in heightened wildlife mortality from human hunters and poachers (Shideler *et al.* 1986; McLellan 1988; Brody and Pelton 1989). Therefore, the linkage between hunting and trapping due to increased access and wildlife abundance is valid.

Winter and esker access roads

The linkage between winter and esker access roads and change in wildlife abundance is valid for all VECs except for grizzly bears, raptors, upland breeding birds, and waterfowl (Table 10.4-13). The operation of the winter and esker access roads occurs during the period when grizzly bears are hibernating. Raptors, upland breeding birds, and waterfowl are not present during the use of the roads as the birds all migrate south before the onset of road use each winter and return after the roads have closed in late winter.

Table 10.4-13 Summary of Linkage Validation for Impacts to Wildlife Abundance

VEC	Linkage Validation[a]					
	Attraction of Wildlife to the Project	Wildlife-Human Interactions	Vehicle/ Aircraft Traffic	Water Management Pond	Toxic Spills	Winter and Esker Access Roads
Bathurst caribou	N	Y	Y	N	Y	Y
Barren-ground grizzly bears	Y	Y	Y	N	Y	N
Wolves	Y	Y	Y	N	Y	Y
Wolverines	Y	Y	Y	N	Y	Y
Foxes	Y	Y	Y	N	Y	Y
Raptors	N	Y	Y	N	Y	N
Upland breeding birds	Y	Y	Y	N	Y	N
Waterfowl	N	Y	Y	N	Y	N

[a] Y = Yes; N = No.

10.4.2.4.2 Mitigation

Effective strategies to minimize impacts were investigated

During feasibility studies for the Snap Lake Diamond Project, options were investigated to determine the most effective strategy for minimizing the negative effects of the Snap Lake Diamond Project on wildlife abundance (Section 2). For each activity or facility, the following mitigation is proposed.

Attraction of Wildlife to the Project

Measures have been proposed to minimize potential negative effects of the landfill

To minimize attraction to the landfill, the following mitigation measures have been developed and form part of the waste management program as part of an overall ISO14001 compliant EMS. These included:

- education and reinforcement of proper waste management practices to all workers and visitors to the site;
- separation of food waste and non-food waste at source;
- burning food wastes and non-toxic combustible wastes in approved oil-fired incinerators;
- containing all food waste containers outside of buildings within the waste transfer area (*i.e.*, no outside peripheral garbage cans on-site);
- appropriate fencing around the waste transfer area;
- burning waste oil in waste-oil furnaces or taken off-site for recycling;
- designating contained areas for worker lunch and coffee breaks;
- educating people on the risk associated with feeding wildlife and careless disposal of food garbage; and,
- ongoing review of the efficacy of the waste management program and improvement through adaptive management via the EMS.

Wildlife-Human Interactions

A number of mitigation measures will be used to minimize mortality via wildlife harassment

De Beers will undertake general mitigation measures for the Snap Lake Diamond Project to reduce sensory disturbance effects and wildlife harassment that may result from construction and operations. The following specific mitigation procedures will be adopted to reduce mortality due to wildlife harassment:

- locating the mine footprint away from important wildlife habitat wherever possible;
- adhering to the waste management program;
- instructing construction personnel to maintain clean work areas and not to harass animals encountered;
- designing and constructing buildings to limit the possibility of animals finding suitable shelter;
- preventing the potential for space under stairs and stair landings;
- minimizing blind spots around buildings whenever possible;

- providing windows on all doors exiting buildings;
- providing a set of rules for recreational walking on- and off-site; and,
- training of staff by RWED wildlife officers on procedures when wildlife are encountered.

Vehicle/Aircraft Traffic

Mitigation will be included to minimize the number of collisions with wildlife

Specific mitigation to minimize the possible impacts of vehicle-aircraft collisions on wildlife include the following:

- minimizing the use of haul trucks;
- establishing and enforcing speed limits;
- providing wildlife with the "right of way";
- warning drivers when wildlife are moving through an area; and,
- having safe, effective methods for removing wildlife from the airstrip prior to aircraft landing and takeoff.

Toxic Spills

Several mitigation measures have been proposed to minimize the effects of toxic spills

Mitigation measures to minimize the effects of toxic spills on wildlife abundance include:

- use of the spill contingency plan;
- using approved construction and material handling procedures;
- storage of fuel in double-walled containers or single-walled containers in lined and bermed containment areas;
- use of transfer hoses with double-locked mechanisms;
- careful manual measurement of fuel content in tanks when transferring fuel;
- training of personnel in fuel handling operations;
- maintaining additional fuel storage capacity for emergencies;
- storage of flammable chemicals in fireproof containers following the NWT Mine Safety Regulations;
- regular inspection of stored chemicals;
- spill containment consideration for all storage areas;
- possessing adequate area and access for loading/unloading containers and spill containment in small volume areas;

- containment of ammonium nitrate in an enclosed area;
- isolation and immediate clean-up of any spills; and,
- keeping spill response equipment readily available.

Winter and Esker Access Roads

Mitigation for limiting legal and illegal hunting and trapping

Mitigation protocols to minimize wildlife loss through increased access for legal and illegal hunting and trapping include:

- infrequent use of esker access roads;
- seasonal use of winter access roads; and,
- restricting the use of firearms on the project area.

10.4.2.4.3 Impact Analysis

Information on the effects of mining on wildlife in the Slave Geological Province is limited

The amount of information available for the effect of mine-related activities and facilities on wildlife species inhabiting the Slave Geological Province is extremely limited and has been presented in Section 10.4.1.4. Current knowledge of the ecology and behaviour of species (Section 10.4.3.2) and examples from the literature were used to conduct the residual impact classification.

10.4.2.4.4 Residual Impact Classification

Impacts are classified according to direction, magnitude, geographic extent, duration, frequency, and reversibility

Despite mitigation, activities related to the Snap Lake Diamond Project may result in changes to wildlife abundance. Residual impacts from these changes were evaluated using the methods described in Section 10.1.5. In general, the impacts are classified using the following criteria: direction, magnitude, geographic extent, duration, frequency, and reversibility. Residual impacts from each mine-related activity were classified for each VEC.

Attraction of Wildlife to the Project

Mitigation is expected to minimize attraction of wildlife to the project

The implementation of the waste management program, education, and enforcement of policies pertaining the handling and disposal of food waste are expected to result in minimal numbers of wildlife (including gulls and ravens) attracted to the Snap Lake Diamond Project. Therefore, the magnitude of this effect on the abundance of wolves, foxes, and upland breeding birds is anticipated to be low. However, the low reproductive rates and small population size of grizzly bears and wolverines make these species more sensitive to individual mortality. Thus, the magnitude of impact for these species is moderate. The loss of even one individual from the local population may be considered a moderate magnitude given their status as "species of special concern" (COSEWIC 2001).

The landfill site will be buried with host rock during closure of the mine

The geographic extent of potential effects from the landfill site is local as the site will be located within the LSA. The duration of potential impacts from the landfill site will be medium-term (Table 10.4-14). It will be completely buried with host rock at mine closure.

Frequency of potential mortality will be moderate

The frequency of mortality from wildlife being attracted to the project is expected to be moderate (Table 10.4-14) since there may be more than one fatality during construction and operations. The definition of low frequency is that the event would occur only once.

Table 10.4-14 Classification of Residual Impacts to Wildlife Abundance

VEC	Direction	Magnitude	Geographic Extent	Duration	Reversibility	Frequency	Environmental Consequence
Attraction of Wildlife to the Project							
Barren-ground grizzly bears	negative	moderate	local	medium-term	reversible (short-term)	moderate	low
Wolves	negative	low	local	medium-term	reversible (short-term)	moderate	low
Wolverines	negative	moderate	local	medium-term	reversible (short-term)	moderate	low
Foxes	negative	low	local	medium-term	reversible (short-term)	moderate	low
Upland breeding birds	negative	low	local	medium-term	reversible (short-term)	moderate	low
Wildlife-Human Interactions							
Bathurst caribou	negative	low	regional	medium-term	reversible (short-term)	moderate	low
Barren-ground grizzly bears	negative	moderate	regional	medium-term	reversible (short-term)	moderate	low
Wolves	negative	low	regional	medium-term	reversible (short-term)	moderate	low
Wolverines	negative	moderate	regional	medium-term	reversible (short-term)	moderate	low
Foxes	negative	low	regional	medium-term	reversible (short-term)	moderate	low
Raptors	negative	negligible	regional	medium-term	reversible (short-term)	moderate	low
Upland breeding birds	negative	negligible	regional	medium-term	reversible (short-term)	moderate	low
Waterfowl	negative	negligible	regional	medium-term	reversible (short-term)	moderate	low

Table 10.4-14 Classification of Residual Impact to Wildlife Abundance (continued)

VEC	Direction	Magnitude	Geographic Extent	Duration	Reversibility	Frequency	Environmental Consequence
Vehicle/Aircraft-Wildlife Collisions							
Bathurst caribou	negative	low	regional	medium-term	reversible (short-term)	moderate	low
Barren-ground grizzly bears	negative	moderate	regional	medium-term	reversible (short-term)	moderate	low
Wolves	negative	low	regional	medium-term	reversible (short-term)	moderate	low
Wolverines	negative	moderate	regional	medium-term	reversible (short-term)	moderate	low
Foxes	negative	low	regional	medium-term	reversible (short-term)	moderate	low
Raptors	negative	moderate	regional	medium-term	reversible (short-term)	moderate	low
Upland breeding birds	negative	low	regional	medium-term	reversible (short-term)	moderate	low
Waterfowl	negative	low	regional	medium-term	reversible (short-term)	moderate	low
Toxic Spills							
Bathurst caribou	negative	low	regional	medium-term	reversible (short-term)	moderate	low
Barren-ground grizzly bears	negative	moderate	regional	medium-term	reversible (short-term)	moderate	low
Wolves	negative	low	regional	medium-term	reversible (short-term)	moderate	low
Wolverines	negative	moderate	regional	medium-term	reversible (short-term)	moderate	low
Foxes	negative	low	regional	medium-term	reversible (short-term)	moderate	low
Raptors	negative	moderate	regional	medium-term	reversible (short-term)	moderate	low
Upland breeding birds	negative	low	regional	medium-term	reversible (short-term)	moderate	low
Waterfowl	negative	low	regional	medium-term	reversible (short-term)	moderate	low
Increased Access for Hunting and Trapping							
Bathurst caribou	negative	low	regional	medium-term	reversible (short-term)	moderate	low
Wolves	negative	low	regional	medium-term	reversible (short-term)	moderate	low
Wolverines	negative	moderate	regional	medium-term	reversible (short-term)	moderate	low
Foxes	negative	low	regional	medium-term	reversible (short-term)	moderate	low

Populations of wolves, foxes and upland breeding birds are predicted to recover from any losses

For wolves, foxes, and upland breeding birds, the impact of attraction to the project is predicted to be reversible in the short-term (Table 10.4-14). Any individual mortality that may occur will be expected to have a negligible effect on population size due to the high reproductive potential of these populations and associated ecological resilience. Thus for these VECs, the environmental consequence is predicted to be low and there is a high degree of certainty related to this prediction (Table 10.4-14).

The environmental consequence of attraction to the project on grizzly bears and wolverines will be low

The impact of attraction to the project on the abundance of grizzly bears and wolverines is anticipated to be reversible in the short-term. There is strong intention by De Beers to minimize the "attractiveness" of the Snap Lake Diamond Project to wildlife through rigorous application of the waste management program (Section 10.4.2.4.2). However, without information to test the efficiency of these mitigation measures, the success of the waste management program is currently uncertain. Given the uncertainty with mitigation and the low reproductive rates of grizzly bears and wolverines (*i.e.*, low ecological resilience), there is a high degree of uncertainty associated with the reversibility of impacts in the short-term. If the loss of individuals during construction and early phases of operation approaches natural mortality then the impact may be reversible in the long-term; this would not increase the environmental consequence. Due to the high degree of scientific uncertainty associated with this prediction (*i.e.*, probability of occurrence), monitoring of the efficacy of the waste management program will be carried out during the life of the mine.

Wildlife-Human Interactions

The magnitude of wildlife-human interactions is predicted to be negligible to moderate

Because of mitigation strategies, the potential for interactions between humans and carnivores or caribou (*i.e.*, feeding, harassment, and encounters) is expected to be low. Therefore, the magnitude of the impact on the abundance of caribou, wolves, and foxes from wildlife-human interactions is also expected to be low (Table 10.4-14). However, the loss of even one grizzly bear or wolverine from the local population may be considered moderate given their status as "species of special concern" (COSEWIC 2001), which would increase the magnitude for grizzly bears and wolverines (Table 10.4-14). The impact of wildlife-human interactions is predicted to be negligible for raptors, upland breeding birds and waterfowl as all three of these avian groups typically do not interact with humans.

Geographic extent, duration, and frequency are regional, medium-term, and moderate, respectively

The geographic extent of wildlife-human interactions is predicted to occur around buildings, the airstrip, and the landfill site within the active mine site. Interactions will also occur along the winter and esker access roads for all VECs; therefore, the geographic extent is regional. The duration of wildlife-human interactions is anticipated to be medium-term, terminating with closure of the mine and subsequent departure of mine personnel from the area. The frequency of wildlife-human interactions is expected to be moderate for all VECs (Table 10.4-14).

Potential impacts from wildlife-human interactions are predicted to be reversible

Any impacts of wildlife-human interactions on wildlife abundance are expected to be reversible. The departure of humans at closure of the mine will result in the cessation of any further possible interactions. While a small impact at the individual level is predicted, it is expected that any loss of individuals due to wildlife-human interactions will be more than replaced by recruitment, which makes the ecological resilience to this impact high.

Considering all criteria together, environmental consequence is predicted to be low

The environmental consequence from wildlife-human interactions is predicted to be low for all VECs (Table 10.4-14). However, the level of scientific uncertainty associated with this prediction is moderate, particularly for grizzly bears and wolverines. Consequently, monitoring studies at the Snap Lake Diamond Project will include the potential effects of wildlife-human interactions.

Vehicle/Aircraft-Wildlife Collisions

Collisions are predicted to have a low to moderate magnitude of impact on VECs

Vehicle/aircraft-wildlife collisions may occur on the project footprint, winter and esker access roads, and the airstrip. However, the implementation of mitigation strategies should minimize the likelihood of collisions with wildlife, and any individual mortality should be replaced at the population level. Therefore, the magnitude of the impact of aircraft/vehicle collisions on wildlife abundance is anticipated to be low for caribou, wolves, foxes, upland breeding birds, and waterfowl (Table 10.4-14). However, because grizzly bears, wolverines and peregrine falcons are listed as COSEWIC species, the loss of even one individual may be considered as a moderate impact.

Geographic extent and duration of traffic is expected to be regional and medium-term, respectively

The geographic extent of effects from vehicle/aircraft traffic is regional (Table 10.4-14). Potential collisions may occur within the project footprint, and along the winter and esker access roads. However, use of the esker access road will be infrequent and the winter access road will be seasonal (approximately 11 weeks). Duration of vehicle/aircraft traffic is anticipated to be medium-term, ending with the closure of the mine and the subsequent termination of traffic (Table 10.4-14).

Mortality from collisions is expected to be infrequent

The injury or death from vehicle or aircraft collisions is expected to be moderate in frequency (Table 10.4-14). By definition, low frequency means that the impact occurs once. Since there may be more than one fatality during construction and operations, the frequency is conservatively estimated as moderate. However, the small area of the footprint limits the kilometres of roads and the speed of traffic, and therefore, the opportunity for collisions. Also, the esker access road will not be constructed every year, reducing the potential for collisions.

Vehicle/aircraft collisions are predicted to have a low environmental consequence on all VECs

The impact of vehicle/aircraft collisions is predicted to be reversible in the short term for all VECs (Table 10.4-14). The closure of the mine will result in the cessation of vehicle and aircraft traffic in the area. In addition, the limited loss of individuals due to collisions should be more than compensated by recruitment into local populations during the life of the mine (*i.e.*, natural reproduction should exceed human-induced mortality, providing high ecological resilience). Subsequently, the environmental consequence of vehicle/aircraft collisions is anticipated to be low for all VECs (Table 10.4-14).

A high degree of certainty is associated with the predictions of environmental consequence

These predictions of environmental consequence are associated with a high degree of scientific certainty. Even with the much more extensive road network present at the BHP EKATI™ mine site, none of these species have been reported to be killed or injured from vehicle/aircraft collisions (BHP 2001).

Toxic Spills

The impact of toxic spills on most VEC populations is predicted to be of low magnitude

Changes to wildlife abundance from toxic spills are predicted to have a low magnitude of impact on caribou, wolves, foxes, upland breeding birds, and waterfowl (Table 10.4-14). Mitigation measures to minimize the possibility of toxic spills and prompt clean up of spills (*i.e.*, spill contingency plan) should maintain low levels of impact. Large spills that result from severe accidents and malfunctions are addressed in Section 13.

Toxic spills are predicted to have a moderate magnitude of impact on "species of special concern", although the probability of occurrence is low

The magnitude of impact from toxic spills on grizzly bears, wolverines, and raptors is predicted to be moderate (Table 10.4-14). The loss of even one individual from the local population may be considered moderate given their status as "species of special concern" (COSEWIC 2001). The probability of occurrence is low. One of these species would have to be present at the spill location just after the spill occurred, since the spill contingency plan requires prompt clean up of spills. Given the large home ranges of these species compared to the size of the spill location, the probability of an individual being present at that location and time is low.

Toxic spills are anticipated to be regional in geographic extent, medium-term in duration, and moderate in frequency

The geographic extent of the effect of toxic spills is predicted to be regional (Table 10.4-14). Spills may occur within the main project footprint, and along the winter and esker access roads. It is predicted that the duration will be medium-term (Table 10.4-14). Closure of the mine will prevent the potential of any further spills occurring. Clean up procedures will also prevent long term contamination within a spill area. The frequency of effects from toxic spills is expected to be moderate (Table 10.4-14). It is anticipated that spills will occur infrequently throughout the life of the mine.

Any decrease in wildlife abundance is predicted to be reversible in the short-term

It is predicted that the impact of toxic spills on change in wildlife abundance is reversible in the short-term (Table 10.4-14). The closure of the mine will bring an end to any possibility of toxic spills. In addition, any spills that might occur will be cleaned up immediately. It is also predicted that any loss of individuals will be replaced during the life of the mine (*i.e.*, high ecological resilience).

Environmental consequence is low

Overall, the environmental consequence of toxic spills on wildlife VECs is predicted to be low (Table 10.4-14).

Increased Access for Hunting and Trapping

The use of access roads is not predicted to greatly increase access for hunting/ trapping

Due to mitigation strategies, the seasonal use of the winter and esker access roads, and the travel distance from the communities involved, the magnitude of impact of increased hunter and trapper access on the abundance of caribou, wolves, and foxes is anticipated to be low (Table 10.4-14). Alternatively, the magnitude of the impact on wolverines is predicted to be moderate (Table 10.4-14), because of the slow reproductive rates of wolverines and the designation by COSEWIC (2001) as a "species of special concern."

The geographic extent of increased hunting/trapping is expected to be regional

Because the winter and esker access roads extend into the RSA, the geographic extent of hunting and trapping effects is regional (Table 10.4-14). The duration of increased access from winter and esker access roads is expected to be medium-term, as maintenance of winter road access will cease upon closure of the mine (Table 10.4-14). The frequency of effects from increased hunting and trapping is expected to be moderate during the mine life (Table 10.4-14). This is due to the seasonal use of the winter and esker access roads (*i.e*., the roads will only be operational during the winter months) and the distance that hunters and trappers must travel.

Impacts from hunting and trapping should be reversible in the short-term

The impact of increased access from hunting and trapping on the abundance of caribou, wolves, wolverines, and foxes is predicted to be reversible in the short-term (Table 10.4-14). It is expected that even if a small number of individuals are lost to increased hunting and/or trapping, these losses should be overcome during the life of the mine.

Increased access for hunting/ trapping is predicted to have a low consequence on wildlife abundance

The environmental consequence of increased access for hunting or trapping of caribou, wolves, wolverines, and foxes is predicted to be low (Table 10.4-14). However, there is a moderate level of scientific uncertainty associated with these predictions. Because of their low reproductive rates (*i.e.*, low intrinsic ecological resilience), wolverines may be more susceptible to increased rates of hunting and trapping. In addition, although the use of these roads will increase access into the RSA during the winter, it is relatively uncertain if this will result in greater hunting and trapping activities in the area. As recommended by a Lutsel K'e Elder "*We have to watch all these roads nowadays*" (Antoine Michel). Consequently, the potential effects of increased access from the winter and esker access roads on wildlife abundance should be included in the monitoring program.