

THOR LAKE RARE EARTH METALS BASELINE PROJECT

Environmental Baseline Report:
Volume 6 – Wildlife Resources

FINAL INTERIM REPORT



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ABBREVIATIONS

BCMPC	Bathurst Caribou Management Planning Committee
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CWD.....	Coarse Woody Debris
CWS.....	Canadian Wildlife Service
FDR.....	Field Data Report
GNWT	Government of the Northwest Territories
KI.....	Key Indicator
LSA	Local Study Area
MVRMA.....	<i>MacKenzie Valley Resource Management Act</i>
NWT	Northwest Territories
NWTENR	Northwest Territories Environment and Natural Resources
PFS	Prefeasability Study
SARA	<i>Species At Risk Act</i>
TDR.....	Technical Data Report
RSA.....	Regional Study Area
VEC.....	Valued Ecosystem Component
UTM	Universal Transverse Mercator
WGGSNWT	Working Group on General Status of NWT Species

1 INTRODUCTION

Avalon Rare Metals Inc (Avalon) is currently undertaking a Prefeasibility Study (PFS) for the development of the Nechalacho Deposit, located on mineral leases it holds at its Thor Lake site in the Northwest Territories. The deposit is located approximately 100 km southeast of Yellowknife and 4 km north of the Hearne Channel of Great Slave Lake. The Thor Lake site is within the Taiga Shield ecozone, characterized by Precambrian bedrock outcrops with many lakes and wetlands in glacially carved depressions. The site is located within the Akaitcho Territory, an area currently under negotiation related to a comprehensive land claim between the federal government and the Akaitcho First Nations, representing First Nations in LutselK'e, Fort Resolution, Ndilo and Dettah. Thor Lake lies within the Mackenzie Valley region of the NWT and is, therefore, subject to the provisions of the *Mackenzie Valley Resource Management Act* (MVRMA) in addition to other federal and territorial legislation of general application.

The Thor Lake site has been subject to mineral exploration by others since the 1970s. Previous exploration focused on beryllium resources in the T-zone and included drilling and bulk sampling. Since acquiring the property in 2006, Avalon has focused on delineating the rare earth resource within the Nechalacho Deposit, which is not part of the T-zone. Preliminary development concepts being considered for the Nechalacho Deposit during the PFS include development of an underground mine, mineral concentration, tailings disposal, waste rock disposal, fuel and concentrate storage, power generation and transportation infrastructure (airstrip, upgraded site roads, wharf on Great Slave Lake). Concentrate would be shipped off-site seasonally for refinement into a marketable rare earth product.

Stantec (formerly Jacques Whitford) initiated environmental baseline studies at the Thor Lake site in fall 2008. Aquatic monitoring of drilling was undertaken during fall 2007 and winter 2008.

This interim Technical Data Report (TDR) describes the methods used to compile and focus the baseline information more relevant to the Thor Lake Site (Section 2) and presents an overview of the baseline conditions for wildlife, including summary results for field work conducted in 2009 (Section 3).

2 METHODS

2.1 Study Area

As described in the introduction, the proposed mine site (NAD 83, UTM Zone 12V, 416680 E, 6887012 N) is centered on Thor Lake, southeast of Yellowknife and just north of Hearne Channel. Generally, the area is comprised of a flat to gently rolling rocky landscape that is sparse to densely forested with black spruce (*Picea mariana*), white spruce (*P. glauca*), Jack pine (*Pinus banksiana*), and paper birch (*Betula papyrifera*). Wetlands are numerous and variable and range from bogs, fens, and marshes to small (2 – 15 ha) and medium-sized (15 – 50 ha) lakes. Very large water bodies,

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such as the East Arm of Great Slave Lake, Blachford Lake, and Grace Lake, are approximately 4 km from Thor Lake.

The study area is divided into two subcomponents: the local study area (LSA) and the regional study area (RSA). The LSA includes the proposed mine site and areas associated with development. The RSA is defined by a 15-km radius buffer centered on Thor Lake (truncated along the north shore of Great Slave Lake) and would be used as context for assessing project effects within the LSA. The size of the RSA reflects the estimated area necessary to evaluate project effects for species with large home ranges (e.g., caribou, moose). The LSA and RSA together are referred to as the Thor Lake Project Area („Project Area“).

2.2 Selection Process for Identifying Wildlife Key Indicators

In order to focus the collection of baseline data and to develop an understanding of baseline conditions for wildlife at the Nechalacho Deposit, a set of potential „key indicator“ species was selected using the following criteria:

- Conservation status
- Likelihood of occurrence, including length of stay (e.g., year-round, winter, summer) and activity (e.g., breeding, feeding)
- Sustenance value
- Socio-economic value
- Ecological value.

We began our review of potential key indicator species using a pool of 344 terrestrial vertebrate species known to occur in the Northwest Territories. Table 1 provides the percentage of species within each major taxonomic group of vertebrates for each of the seven conservation status classes for the Northwest Territories. We selected those species ranked as “At Risk”, “May be at Risk”, and “Sensitive” to form a smaller pool of candidate key indicators. Within each major taxonomic group, we then used federal conservation status assessments, likelihood of occurrence in the Project Area, and sustenance, socio-economic, and ecological values, to determine key indicator species. Likelihood of occurrence was evaluated using distribution maps and migration information available through *The Birds of North America* (<http://bna.birds.cornell.edu/bna/>) and *NatureServe* (Patterson, *et al.* 2003, Ridgely, *et al.* 2003). Sustenance and socio-economic values were assessed using information from hunting regulations for Wildlife Management Unit R (which includes Thor Lake) (NWTENR 2007), and from Environment Canada’s *Migratory Birds Hunting Regulations* (Environment Canada 2008) (Table 2). Details of the key indicator selection process within each major taxonomic group are provided in the respective sections below.

Table 1: Percentage of Terrestrial Mammal, Bird, Reptile and Amphibian Species in Each NWT General Status Rank

General Status Rank*	Reptiles and Amphibians (n = 8 species)	Terrestrial Mammals (n = 65 species)	Birds (n =240 species)
Extirpated	0%	0%	0%
At Risk	0%	2%	1%
May be at Risk	50%	2%	2%
Sensitive	17%	9%	17%
Secure	33%	65%	60%
Undetermined	0%	23%	19%
Introduced/Invasive	0%	0%	1%

NOTE:

* WGGNSNWT 2006

Table 2: Harvested Game Species in Wildlife Management Unit R*

Species/Group	Bag Limit
¹ Moose	One
¹ Caribou (<i>R.t. groenlandicus</i>)	Two (male only)
¹ Caribou (<i>R.t. caribou</i>)	One
¹ Gray Wolf	One or more (tags required)
¹ Wolverine	One or more (tags required)
¹ Black Bear	One (adult without cub)
¹ Hare, Marmot, Woodchuck, Porcupine, Squirrels	No limit
² Ducks	25 per day; possession = no limit
² Geese	15 per day; possession = no limit
² Wilson’s Snipe	10 per day; possession = no limit
² Ptarmigan and Grouse	10 per day; possession = 40
² American Coot	25 per day; possession = no limit

NOTE:

¹ NWTENR 2007

² CWS 2008

Information in this table is for summary purposes only and should not be considered legal

2.2.1 Mammals

Several species at risk may occur in the Project Area (see Table 3). Nine species (and four subspecies) of mammal are listed as either “At Risk”, “Sensitive”, or “May be at Risk” in the Northwest Territories (WGGNSNWT 2006). These species are further divided and listed as either

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“Endangered”, “Threatened”, or of “Special Concern” by the Committee on the Status of Endangered Wildlife in Canada (Table 3; COSEWIC 2008), or as “Threatened” by the *Species at Risk Act* (SARA) (SRPR 2008). Only Wood Bison and Woodland Caribou (*R.t. caribou*) are listed by all three agencies, although both have a low probability of occurrence in the Thor Lake Project Area.

Moose (which is used for sustenance) and Marten (a fur-bearer) are not listed by COSEWIC or SARA and are presently considered “Secure” (WGGSNWT 2006), with high socio-economic and sustenance value, in the Northwest Territories. Moose occur at the edge of their range in the Northwest Territories, with an estimated population of 20,000 animals. Annual harvest of Moose ranges from 1,000 – 2,000 animals per year, with a meat replacement value of about \$900,000 per year in the Northwest Territories (Table 4). Marten are a mainstay for harvesters (Table 4), enabling northerners to incorporate traditional elements into a modern lifestyle. Compared to Fisher, which is sensitive in the Northwest Territories and has a low probability of occurrence in the Thor Lake Project Area, Marten is much more economically valuable.

Caribou are important in the lives of many people in the Northwest Territories (see Table 4), and management of people’s use of caribou is necessary to ensure long-term viability of caribou populations as a resource (GNWT 2009d). Of the three subspecies of caribou that occur in the Northwest Territories, Barren-Ground Caribou (*R.t. groenlandicus*) have the largest distribution and are the most-likely subspecies to occur in the Thor Lake Project Area. Barren-Ground Caribou are divided into five distinct herds (i.e., populations), and based upon inspection of satellite-collar data, the Bathurst herd is the most-likely population to occur in the Thor Lake Project Area (GNWT 2009e). The Bathurst Caribou Management Planning Committee (BCMPC) was formed to address specific issues facing the herd. Concern for the Bathurst herd began in the 1990s when (diamond) mining activity began to surge in parts of the herd’s range. Despite population monitoring, uncertainties regarding the cumulative effects of mining operations (e.g., road development, mine site activity, reduced or fragmented habitat) on caribou remain (GNWT 2009e).

With the exception of Lynx, which has a relatively high economic value in the Northwest Territories, economic or sustenance value from other mammals is generally fairly small. Historically, Beaver was an important animal for fur and meat, but reduced pelt values and other sustenance sources have lowered its importance. Ecologically, however, Beaver play an important role in creating and maintaining wetland ecosystems that benefit other animals (e.g., Moose, waterbirds) through the creation of wetland and riparian habitats. Given their ability to dramatically alter ecosystem function, local and regional landscapes, and the distribution and abundance of many other species, Beaver is considered a keystone species (Müller-Schwarze and Sun 2003).

Mammal key indicators for which baseline information are needed for the Thor Lake Project Area include Moose, Caribou (*R.t. groenlandicus*; Bathurst herd), Marten, and Beaver. We do not consider Lynx as a necessary key indicator because its conservation status is secure.

Table 3: Mammal Species of Conservation Concern in the Northwest Territories

Species	Subspecies	NWT Status ¹	COSEWIC ²	SARA ³	Occurrence ⁴
Wood Bison	<i>B.b. athabascae</i>	At Risk	Threatened	Threatened	Low
Mountain Goat		May Be At Risk			Low
Caribou	<i>R.t. caribou</i>	Sensitive	Threatened	Threatened	Low
Caribou	<i>R.t. groenlandicus</i>	Sensitive	Special Concern		Medium
Caribou	<i>R.t. pearyi</i>	At Risk	Endangered		Low
Wolverine		Sensitive	Special Concern		Medium
Fisher		Sensitive			Low
Grizzly Bear		Sensitive	Special Concern		Low
Polar Bear		Sensitive	Special Concern		Low
Little Brown Myotis		Sensitive			Low
Collared Pika		Sensitive			Low

NOTE:

¹ “Sensitive” or “May be At Risk” (WGGSNWT 2006)

² “Endangered”, “Threatened”, or “Special Concern” (COSEWIC 2009)

³ “Threatened” (SRPR 2008); ⁴ for the Thor Lake Project Area – High: probably occurs, likely breeds; Med.: may occur, may breed; Low: probably does not occur. Species distributions were evaluated using range maps posted on NatureServe (Patterson, *et al.* 2003) and the GNWT (2009f) website.

Table 4: Socio-economic Value of Fur-bearing and/or Sustenance Mammals in the Northwest Territories

Species	Estimated Annual Economic Benefit ¹	Occurrence ²
Moose	\$900,000	High
Caribou (<i>R.t. caribou</i>)	important for food, footwear, gloves and jackets	Low
Caribou (<i>R.t. groenlandicus</i>)		Medium
Caribou (<i>R.t. pearyi</i>)		Low
Gray Wolf	\$25,000+	High
Arctic Fox	\$20 – 30,000+	Medium
Red Fox	\$10,000+	High
Lynx	\$50 – 100,000+	High
Marten	\$500,000+	High
Black Bear	\$24,000+	High
Grizzly Bear	< \$5000	Low

NOTE:

¹ GNWT (2009f)

² as in Table 3

2.2.2 Birds

As of 2006, 273 species of bird are known to occur in the Northwest Territories (WGGSNWT 2006). Among these, 33 are vagrant, having occurred only once or a few times. A large majority of the remaining 240 species are migratory, spending the summer (primarily mid-May to mid-September) in the Northwest Territories to breed. For some species, particularly those associated with open lakes and wetlands (e.g., loons, grebes, geese, ducks, and shorebirds), large to very large aggregations of migrants utilize traditional staging areas for the purpose of building or replenishing fat reserves immediately before or after the migration journey. For example, on Great Slave Lake, up to 24,000 scaup, 32,000 Canada geese, and 7,700 Tundra Swans have occurred at local stop-over sites (Sirois 1994). Smaller lakes and wetlands throughout the Northwest Territories are expected to host smaller numbers of migrants and breeders, but collectively these areas may account for a substantial proportion of the overall population for some species. Surf Scoters, for example, are common breeders on small lakes surrounding Great Slave Lake (Sirois 1994). Despite a few noteworthy observations for birds, baseline data prior to 2008 was generally lacking for the Thor Lake Project Area.

There are 49 bird species listed as either “at risk”, “sensitive”, or “may be at risk” in the Northwest Territories (Table 5; WGGSNWT 2006). These species are further divided and listed as either “endangered”, “threatened”, or of “special concern” by COSEWIC (2008) and the Species at Risk Act (SARA) (SRPR 2008) (Table 5). There are four species listed by all three agencies: Peregrine Falcon, Yellow Rail, Eskimo Curlew, and Ivory Gull. Only Yellow Rail has a medium probability of occurrence in the Thor Lake Project Area. Peregrine Falcon and Ivory Gull have a low probability of occurrence, and Eskimo Curlew is probably extinct. Among species listed only by WGGSNWT (2006) and COSEWIC (2008), Whooping Crane probably does not occur, Red Knot may occur only during migration, and Short-eared Owl, Common Nighthawk, Olive-sided Flycatcher, and Rusty Blackbird are probably regular summer visitants that likely breed. Among species listed only by WGGSNWT (2006), Surf Scoter, Northern Pintail, Lesser Yellowlegs, Barn Swallow, Boreal Chickadee, White-throated Sparrow, and Harris’s Sparrow have a high probability of occurrence in the Thor Lake Project Area, and Trumpeter Swan, Lesser Scaup, White-winged Scoter, Long-tailed Duck, Semipalmated Sandpiper, Least Sandpiper, Long-billed Dowitcher, Red-necked Phalarope, American Pipit, Blackpoll Warbler, and American Tree Sparrow have a medium probability of occurrence.

Socio-economic value and sustenance applies to several bird species occurring in the Northwest Territories. The majority of these are waterbirds (e.g., Canada Goose, Snow Goose, several duck species), although sustenance hunting of grouse and ptarmigan also occurs. Traditionally, feathers may have been collected by First Nations from some bird species for traditional uses, but the kinds of species, frequency of occurrence, and number of individuals birds involved, is poorly known.

Birds of prey (i.e., hawks, eagles), and particularly their morphology and reproductive status, have been used extensively to monitor environmental contamination and bio-accumulation effects (Furness and Greenwood 1994). This uptake, and subsequent concentration, of contaminants in the tissues and organs is magnified via the direct predation and consumption of other animals that have previously fed on other animals or plant matter that are contaminated. Adult and nestling birds can be observed directly for morphological defects, and reproductive success can be monitored through

direct nest observation. Of interest to the Thor Lake Project Area is Bald Eagle, which feeds on waterbirds, fish, muskrat, and carrion, and Osprey, which feeds exclusively on fish.

Breeding songbirds in the Thor Lake Project Area are expected to occur in all habitat types, and because most species within this group have relatively small home ranges or territories, they are generally good indicators of local and regional habitat change (i.e., conversion or fragmentation) and are reasonably efficient to monitor. Because of the large number of songbird species often present in an area, however, it is often useful to evaluate songbirds at a community level on the basis of broad habitat associations.

In 2009 we collected baseline data for key indicators from the Thor Lake Project Area for water birds (swans, geese, ducks, loons, grebes, and shorebirds) and diurnal birds of prey (Bald Eagle and Osprey). We have not identified Common Nighthawk or Short-eared Owl as key indicator species; however, incidental observations of these species will be assessed accordingly, and mitigation will be developed if considered necessary.

Table 5: Bird Species of Conservation Concern in the Northwest Territories

Species	Subspecies	NWT Status ¹	COSEWIC ²	SARA ³	Occurrence ⁴
Northern Pintail		Sensitive			Medium
Lesser Scaup		Sensitive			Medium
Brant		Sensitive			Low
Long-tailed Duck		Sensitive			Medium
Trumpeter Swan		Sensitive			Medium
Harlequin Duck		May Be At Risk			Low
White-winged Scoter		Sensitive			Medium
Black Scoter		Sensitive			Low
Surf Scoter		Sensitive			Medium
Common Eider		Sensitive			Low
King Eider		Sensitive			Low
Common Nighthawk		Secure	Threatened		Medium
Thick-billed Murre		Sensitive			Low
American Golden-Plover		Sensitive			Low
Black-bellied Plover		Sensitive			Low
Black Tern		Sensitive			Low
Ivory Gull		At Risk	Endangered	Special Concern	Low
Caspian Tern		Sensitive			Low
Ruddy Turnstone		Sensitive			Low
Sanderling		Sensitive			Low

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Species	Subspecies	NWT Status ¹	COSEWIC ²	SARA ³	Occurrence ⁴
Dunlin		Sensitive			Low
Red Knot	<i>C.c. rufa</i>	May Be At Risk	Endangered		Low
Least Sandpiper		Sensitive			Medium
Semipalmated Sandpiper		Sensitive			Medium
Long-billed Dowitcher		Sensitive			Medium
Hudsonian Godwit		Sensitive			Low
Eskimo Curlew		At Risk	Endangered	Endangered	Low
Whimbrel		Sensitive			Low
Red Phalarope		Sensitive			Low
Red-necked Phalarope		Sensitive			Medium
Lesser Yellowlegs		Sensitive			Medium
Buff-breasted Sandpiper		Sensitive			Low
American Bittern		Sensitive			Low
Peregrine Falcon	<i>F.p. anatum</i>	Sensitive	Special Concern	Threatened	Low
Whooping Crane		At Risk	Endangered		Low
Yellow Rail		May Be At Risk	Special Concern	Special Concern	Medium
American Tree Sparrow		Sensitive			Medium
White-throated Sparrow		Sensitive			High
Harris's Sparrow		Sensitive			High
Barn Swallow		Sensitive			High
Rusty Blackbird		May Be At Risk	Special Concern		Medium
American Pipit		Sensitive			Medium
Gray-headed Chickadee		May Be At Risk			Low
Boreal Chickadee		Sensitive			High
Blackpoll Warbler		Sensitive			Medium
Olive-sided Flycatcher		Sensitive	Threatened		High
American White Pelican		May Be At Risk			Low
Pied-billed Grebe		Sensitive			Low
Short-eared Owl		Sensitive	Special Concern		Medium

NOTE:

¹ "Sensitive" or "May be At Risk" (WGGSNWT 2006)

² "Endangered", "Threatened", or "Special Concern" (COSEWIC 2009)

³ "Threatened" (SRPR 2008); ⁴ for the Thor Lake Project Area – High: probably occurs, likely breeds; Med.: may occur, may breed; Low: probably does not occur. Species distributions were evaluated using range maps posted on NatureServe (Ridgely, *et al.* 2003).

2.2.3 Amphibians and Reptiles

There are five amphibian, and one reptile, species that occur regularly in the Northwest Territories (Table 6; WGGSNWT 2006). Only Boreal Chorus Frog and Wood Frog are considered “Secure” and have a high probability of occurrence in the Thor Lake Project Area. Western Toad and Northern Leopard Frog are listed as “May be at Risk”, “Sensitive”, or “Special Concern” by all three agencies, although the probability of occurrence in the Thor Lake Project Area is expected to be low, given the more southerly distribution of these species in the Northwest Territories. No species of amphibian or reptile are deemed to have high socio-economic or sustenance value in the Northwest Territories, and none of the reptile or amphibian species have been identified as having significant ecological roles. On the basis of this review, it is determined that no reptile or amphibian species will be considered as key indicators for the Project Area. However, incidental observations during other field studies will be documented, and dead or dying specimens should be collected for inspection.

Table 6: Amphibian and Reptile Species of Conservation Concern in the Northwest Territories

Species	NWT Status ¹	COSEWIC ²	SARA ³	Occurrence ⁴
Western Toad	May Be At Risk	Special Concern	Special Concern	Low
Canadian Toad	May Be At Risk			Low
Boreal Chorus Frog	Secure			High
Northern Leopard Frog	Sensitive	Special Concern	Special Concern	Low
Wood Frog	Secure			High
Common Garter Snake	May Be At Risk			Low

NOTE:

¹ “Sensitive” or “May be At Risk” (WGGSNWT 2006)

² “Endangered”, “Threatened”, or “Special Concern” (COSEWIC 2009)

³ “Threatened” (SRPR 2008); ⁴ for the Thor Lake Project Area – High: probably occurs, likely breeds; Med.: may occur, may breed; Low: probably does not occur. Species distributions were evaluated using range maps posted on NatureServe (2008).

2.3 Describing Baseline Wildlife Conditions

Baseline wildlife information for the selected key indicators was compiled from a variety of information sources. We used historical data and a comprehensive literature review to consolidate the extent of wildlife information.

2.3.1 Historical Data and Literature Review

Historical waterbird data collected by the Canadian Wildlife Service (CWS) summarize the abundance of waterbirds in the Project Area (Sirois and McCormick 1987, Sirois 1987, Sirois and Cameron 1989). A total of 21 species were observed during those surveys, of which 11 species occurred in each survey year (see Appendix A). The reports summarize relative abundance among species, and indicate both within and among year variation in peak spring waterbird migration.

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Two additional reports present information on wildlife for Thor Lake and the surrounding area. The first report is based on surveys conducted in 1988 (SRC 1989) and provides information on the presence of Beaver (e.g., eight active lodges, averaging one per 17.1 km²) and waterbirds (e.g., two aerial surveys tallied six species of 167 individuals). Common Merganser was observed on Thor Lake, whereas nearby smaller lakes and wetlands within the Project Area supported Common Loon, Mallard, and Ring-necked Duck. Additional bird observations included an adult Bald Eagle flying over Long Lake, just south of Thor Lake. Breeding was not confirmed for any bird species. In total, just one mammal and eight bird species were reported during this study (see Appendix A)

A second report (Golder Associates 1998) on wildlife for Thor Lake is based on data gathered from two field studies in 1998: ungulate browse/pellet survey from June 9–17; and a raptor survey on August 5. The ungulate browse/pellet survey provided indirect information on the presence of caribou (*subspecies unknown*) and moose (observed during the aerial raptor survey). Ungulate browse surveys were stratified among three main habitat types, with alder heath (32% of quadrants) receiving the greatest percentage of browse activity, followed by bog forest (27.5%) and lichen-rock (7.5%) habitats. Browsing of individual shrubs among these habitat types however, was typically <10% per shrub. Pellet counts provided additional indirect evidence of species presence, with pellet groups for caribou being more common than for moose, suggesting that the former spent more time in the LSA. The raptor survey confirmed nesting of Bald Eagle for the LSA (one active, one inactive). All other wildlife observations were recorded incidentally to other field activities. A total of six mammals and 22 birds were observed (see Appendix A).

2.3.2 2009 Field Program

2.3.2.1 Waterbird, Beaver Lodge, and Raptor Nest Survey

In 2009, Stantec Consulting Ltd. conducted a six-day aerial waterbird and beaver lodge survey (May 21 – 31) followed by a one-day aerial raptor nest survey on June 1. Detailed results are presented in a field data report (Stantec Consulting 2009). Briefly, for the Thor Lake Project Area, two species of mammal and 19 species of bird were observed (see Appendix A). Peak waterbird migration occurred on May 29 and was similar to the CWS survey of 1988. Total waterbird abundance in 2009 was also similar to CWS surveys in 1986 and 1988. The most numerous shorebird was Lesser Yellowlegs, with observations being mainly of individuals or pairs standing on trees at lake margins, or of birds flying along the shores of wetlands. Locally, breeding was confirmed for both Bald Eagle (Long Lake) and Osprey (400 m east of Thor Lake), and at the regional scale, five additional active Bald Eagle nests were observed. Common Merganser was observed nesting under the Thor Lake camp office in 2008 (Bill Mercer, pers. comm.).

3 RESULTS

3.1 Selected Wildlife Key Indicators

Wildlife key indicators selected for the Thor Lake Project Area are summarized in Table 7.

Table 7: Selected Wildlife Key Indicators

Key Indicator	Conservation Status	Sustenance	Socio-economic	Ecological value	Susceptible to Project Effects	Taxonomic Group
Moose		✓	✓		✓	Mammal
Caribou	✓	✓	✓		✓	Mammal
Marten			✓		✓	Mammal
Beaver				✓	✓	Mammal
Wetland-nesting waterfowl		✓	✓		✓	Bird
Upland-nesting waterfowl		✓	✓		✓	Bird
Shorebirds					✓	Bird
Bald Eagle					✓	Bird
Osprey					✓	Bird
Songbirds (communities)						
▪ Wetland/Wooded Bog					✓	Bird
▪ Coniferous Forest					✓	Bird
▪ Mixed and Deciduous forest					✓	Bird
▪ Open Shrubs/Sparsely Forested					✓	Bird
Olive-sided Flycatcher	✓				✓	Bird
Rusty Blackbird	✓				✓	Bird

3.2 Baseline Conditions for Wildlife Key Indicators

The following subsections provide an overview of baseline conditions for the 15 wildlife key indicators identified for the Thor Lake Project Area (see Table 7). Where appropriate, species or group summaries include an overview of status (e.g., WGGSNWT, COSEWIC, SARA), socio-economic importance (e.g., Moose), ecological importance (e.g., Beaver), expected or known occurrence in the Project Area (e.g., low, medium, or high; relative abundance; seasonality; length of stay), available information (e.g., current and historical observations), and susceptibility to project effects (e.g., water contamination, bio-accumulation, barriers to movement).

3.2.1 Moose

Moose (*Alces americanus*) are the largest member of the deer family and occur throughout the boreal forest and areas of tundra where suitable forage exists in the northern hemisphere (Bowyer, *et al.* 2003). Distribution of moose is limited by available forage, snow cover and shelter in northern latitudes and warmer temperatures in more southerly areas (Kelsall and Telfer 1974, Renecker and Hudson 1989, Karns 1998). Moose are well-suited to colder northern climates and are able to withstand temperatures below -30°C though will become heat-stressed at temperatures greater than -5°C in winter, and 14°C in summer (Renecker and Hudson 1986). Moose can readily move through snow depths of up to 70 cm, though snow density and hardness also play a role in total energetic costs (Coady 1974). Snow accumulation and depth is unlikely to unduly influence moose movements in the Project Area on the basis of climate normals and averages in Yellowknife (Environment Canada 2009).

The primary components of moose habitat include areas with abundant browse and nearby forest for shelter from heat and snow. Young forest stands with deciduous shrubs and forbs, riparian and aquatic areas with submerged or emergent plants, mineral licks, and isolated areas for calving are also important habitat features (Thompson and Stewart 1998). Use of habitat may be influenced by population demographics (density-dependence), the presence and abundance of predators (Thompson and Stewart 1998), and seasonal and climatic conditions that may influence forage availability. Relative to the Project Area, the nearest home range size estimates for moose are from the Mackenzie Valley (NWT) at 174 km² (±31 km²) (Stenhouse, *et al.* 1995), and from northeast Alberta at 97 km² (range: 60 – 183 km²) (Hauge and Keith 1981). Correspondingly, moose densities estimates for the NWT are relatively low, and range from 0.02 to 0.35 individuals per km² (Cluff 2005, GNWT 2009a). The estimated total population size for the NWT is 20,000 animals (GNWT 2009a).

Moose are primarily browsers, though will forage on leaves, grasses and aquatic plants. Food preference varies among seasons and is related to forage quality and accessibility (Renecker and Schwartz 1998). In winter, woody twigs from shrubs, deciduous trees and some pine (*Pinus* sp.) constitute the bulk of the diet (Schwartz and Renecker 1998, Thomas 1990). Potential browse species in the Project Area (Golder 1998) include, alder (*Alnus* sp.), balsam poplar (*Populus balsamifera*), dwarf birch (*Betula glandulosa*), paper birch (*B. papyrifera*), Alaska birch (*B. neoalaskana*), cranberry (*Viburnum* sp.), rose (*Rosa* sp.), Saskatoon/serviceberry (*Amelanchier alnifolia*), buffalo berry (*Shepherdia canadensis*), and willow (*Salix* sp.)

During aerial waterfowl surveys in 2009, five incidental moose observations were made, and all observations were associated with recently-thawed wetlands. Based on an analysis of Moose pellet group density in the Thor Lake Project Area, densities were highest in the rock-lichen woodland, and then in the alder-heath woodland and bog forest (Golder, *et al.* 1998). Overall browse rates, however, were generally low, with fewer than 10% of all shrubs in each broad vegetation community being browsed by Moose and Caribou combined (Golder, *et al.* 1998).

3.2.2 Caribou

Caribou (*Rangifer tarandus*) are circumboreal in distribution throughout the tundra and taiga of North America (Grubb 2005), and five subspecies of caribou are distributed throughout the northern forest and tundra regions of Canada and the United States. Approximately half of all caribou in Canada are barren-ground caribou (*R.t. groenlandicus*), which range throughout the Alaskan and Canadian tundra with some herds overwintering within the boreal forest (Miller 2003). Woodland caribou (*R.t. caribou*) range from the Yukon to Labrador (including Northwest Territories, British Columbia, Alberta, Saskatchewan, Manitoba, Ontario and Quebec) and occur within the boreal forest and suitable alpine tundra habitats (Government of Canada 2009a, Miller 2003). Grant's caribou (*R.t. granti*) range from north of the Yukon River in Alaska to east and north of Dawson City (Yukon) to the northwest corner of the Northwest Territories (Miller 2003).

Within the Northwest Territories, barren-ground caribou have the widest distribution with seven distinct herds (Cape Bathurst, Bluenose-West, Bluenose-East, Bathurst, Beverly, Ahik and Qamanirjuaq). All barren-ground caribou herds migrate within, and use, different ranges based on their seasonal food and habitat requirements (Nagy, *et al.* 2005). Relative to the Thor Lake Project Area, only the Bathurst herd's winter range overlaps (Boulanger, *et al.* 2004, Gunn, *et al.* 2008), as evidenced by eight winter observations (Appendix B) of collared caribou in the area between 1996 and 2007 (Boulanger, *et al.* 2004; Gunn, *et al.* 2008). The area used by the herd is on the border of the "less" and "more" frequently used winter range as defined by telemetry data gathered from 2000 to 2007 (Gunn, *et al.* 2008). Within the Northwest Territories, barren-ground caribou are considered secure (WGGSNWT 2006), although the Bathurst herd is declining. As of 2009, the Bathurst population estimate was 31,900 (\pm 11,000) animals, compared to 186,000 (\pm 40,000) in 2005 and 472,000 (\pm 72,900) in 1986 (GNWT 2009b, Gunn, *et al.* 2008).

Winter is the most variable of the seasonal ranges and is usually within forest cover, generally between Great Bear and Great Slave lakes and near the communities of Wekweti, Wha Ti and Gameti (Boulanger, *et al.* 2004, D'Hont, *et al.* 2009, GNWT 2009b). Members of the herd are also known to migrate to the Yellowknife and LutselK'e areas and have travelled as far south as northern Saskatchewan with the herd sometimes breaking up and overwintering to the northwest and southeast of Great Slave Lake (BCMPC 2004, D'Hont, *et al.* 2009, Gunn, *et al.* 2001). During winter, the adult bulls separate from cow-juvenile groups, and often move deeper into the boreal forest (Miller 2003). Spring migration back to calving grounds at Bathurst Inlet tends to depend on where the herd overwinters, with caribou travelling approximately 20 km/day (both pre- and post-calving) (Gunn, *et al.* 2001). Annual migration patterns between the different seasonal ranges tends to reflect variation in snow and ice cover conditions, which influences forage availability (Gunn, *et al.* 2001, Miller 2003).

Variations in climate and geography lead to differences in plant communities and forage availability throughout the range of different caribou populations. Long, cold winters and a short cool summer growing season are typical of caribou habitat (Miller 2003). Barren-ground caribou, such as the Bathurst herd, will range and forage throughout the tundra in the spring to fall and move into the boreal forest to overwinter. The forest generally consists of black spruce (*Picea mariana*), muskeg

and sedge (*Carex* spp.) bogs with lichens, ericaceous shrubs, willows (*Salix* spp.) and dwarf birch (*Betula glandulosa*) (Miller 2003). Above treeline, willow, alder (*Alnus* spp.) and sedge dominate wetter areas, with dwarf shrub-heath communities, fruticose lichens, mosses, willow, birch and rhododendron becoming more prominent throughout the tundra (Miller 2003). During the fall and winter, lichens dominant the caribou diet. Barren-ground caribou will also forage on fungi in the fall (Kelsall 1968; Miller 2003), browse on species such as willow and *Vaccinium* spp. and forage on shrubby evergreen leaves and remnant green graminoids during winter where available (Miller 2003).

3.2.3 American Marten

Other than the Endangered Newfoundland subspecies (*M. a. atrata*), American marten have not been assessed by COSEWIC (COSEWIC 2009). Within the NWT, marten are ranked as “Secure” (WGGG NWT 2006). Marten are managed as an important furbearer and make-up approximately half the fur trade value of NWT harvesters (GNWT 2009c). The income and lifestyle derived from marten harvesting (\$530,000 in 2003/2004) allows the continuation of traditional values and connection with the land within a developing modern northern society (GNWT 2009c).

American Marten (*Martes americana*) is distributed throughout the forested regions of Canada, Alaska and portions of the western United States (Powell, *et al.* 2003). Marten associate closely with structurally diverse, late successional stands of mesic to moist coniferous forest types (Buskirk and Ruggiero 1994) though they may also utilize stands with a deciduous component (Poole, *et al.* 2004). Commonly reported refuge sites include ground burrows, rock piles and crevices, downed logs, stumps, snags, brush or slash piles and squirrel middens (Steventon and Major 1982, Buskirk 1984, Bull and Heater 2000). Coarse woody debris (CWD) is an important habitat component, providing a number of important life requisites. Marten use CWD for thermal insulation and access to subnivean (i.e., in or under the snow layer) prey in winter, denning in spring and for hunting and protection from predators throughout the year (Steventon and Major 1982; Thompson and Harestad 1994; Buskirk and Powell 1994; Buskirk and Ruggiero 1994; Sherburne and Bissonette 1994; Taylor and Buskirk 1994; Thompson and Colgan 1994). Canopy closure of 50 – 75% is preferred (Thompson and Harestad 1994), and 30% canopy closure has been considered a minimum (Koehler and Hornocker 1977; Spencer, *et al.* 1983). Marten have; however, been observed using canopy-burned forest stands in winter for hunting (Sherburne 1992), and crossing relatively large non-forested openings (e.g., 300 m [Buskirk 1984]); these movements; however, were attributed to home range shifts or dispersion, rather than typical within home range movements.

Average marten home range size in the MacKenzie Valley and Yukon is 5.8 km² for males, and 3.9 to 4.8 km² for females (Latour, *et al.* 1992, Archibald and Jessup 1984). Up to 30% of habitat selection by marten at the landscape level may include forest cover openings (Chapin, *et al.* 1998, Hargis, *et al.* 1999, Potvin, *et al.* 2000). Density of marten in the Fort Good Hope area was documented as 0.4 to 0.5 marten/km² (Poole 1989) and is similar to the 0.4 to 0.6 per km² observed in the Yukon (Archibald and Jessup 1984).

3.2.4 Beaver

Beaver (*Castor canadensis*) is a year-round resident in the Northwest Territories, although during most of the ice-over period the species is in hibernation. Generally, Beaver density is low in the Northwest Territories compared to more southerly regions. For the Thor Lake project area, baseline conditions for Beaver were evaluated using the presence and spatial distribution of lodges, using data from historical sources and from an aerial survey in 2009. In 2009, Beaver lodge density for the Project Area was estimated at 0.23 lodges/km² (Stantec Consulting 2009), and was within the range of values observed for other northern boreal regions (e.g., 0.17 lodges/km² [Dennington and Johnson 1974], 0.10–0.38 lodges/km² [Fuller and Keith 1980], 0.26 lodges/km² [Poole and Croft 1990]). In 1989, in the vicinity of Thor Lake, the estimate of density for both active and inactive lodges combined was 0.14 lodges/km² (SRC 1989), and Beaver lodge density was notably higher to the west of the mine site, and consistent with our findings (Stantec Consulting 2009). The closest known Beaver lodge to the proposed mine site is from Ring Lake (SRC 1989), although in 2009 there did not appear to be an active lodge in that area.

3.2.5 Upland and Wetland Nesting Waterbirds

Thirty-five species of waterbird (loons, grebes, ducks, swans, and geese), and 38 species of shorebird (plovers and sandpipers), occur in the Northwest Territories. Several of these species are not expected to occur in the Thor Lake Project Area as they are largely restricted to ocean or tundra environments. There are, however, 25 species of waterbird and shorebird confirmed as occurring within 10 km of Thor Lake.

Four species of loon and two species of grebe are expected to breed in the Project Area. All loons breed at the margins of small wetlands and lakes, often on hummocky clumps of grass, floating vegetation mats, or on partially submerged rotting logs. Occasionally, loons will nest on small islets in wetlands and lakes, and generally, Common Loon avoids breeding on lakes that have predatory fish. The primary food of loons and Red-necked Grebe is small fish, although Red-necked Grebe and Horned Grebe also eat a variety of aquatic invertebrates, snails, molluscs, and some plant matter. Lake disturbance may cause nest abandonment, nest destruction, or separation of adults from young that can lead to predation. This applies especially to those species that nest on or along the shore (e.g., loons), among emergent vegetation (e.g., Horned Grebe), or on floating nest mounds either in exposed or concealed locations (e.g., Red-necked Grebe). In addition to breeding pairs, loons and grebes breeding in other areas likely migrate through the regional and local study areas. However, there is no information available on total numbers of birds, or possible aggregations or staging areas.

There are four species of goose that either occur, or may occur, in the Thor Lake Project Area. Canada Goose is the only goose species expected to breed, with nests typically positioned on grassy hummocks, beaver lodges and dams, mossy mounds, cattail beds, or rock piles that provide reasonable isolation from land-based predators (Mowbray, *et al.* 2002). Occasionally, Canada Goose will nest on the broken tops of large tree trunks, or in unused, but exposed hawk or raven nests. The species also readily adapts to artificial platforms and baskets lined with hay or straw that are mounted on a short pole within wetlands. The diet of Canada Goose is predominantly herbivorous,

with aquatic plants such as sedges, terrestrial grasses and leaves, and grains, comprising the bulk of the diet (Mowbray, *et al.* 2002). The occurrence of Canada Goose in the Project Area is apparently not very common, as the only known observations are from an aerial survey in 1987 where two geese and 55 birds were observed on May 26 and June 2 respectively (Sirois 1987), and from the 2009 aerial survey when 150 birds were observed migrating north (Stantec Consulting 2009). Breeding is expected to occur throughout the entire area, and although density estimates are not known, it is expected to be low compared to areas further south in Alberta. The expected residency period for Canada Goose in the Project Area is mid-May through early October.

Snow Goose and Greater White-fronted Goose are not expected to breed in the area, although potentially thousands of birds may migrate over in spring and autumn. During the 2009 spring aerial waterbird surveys, 396 Snow geese were observed migrating over the Project Area (Stantec Consulting 2009), and 10 Snow geese and 70 Greater-white-fronted geese were observed migrating in the spring of 1986 (Sirois and McCormick 1987). No additional reports are known for these species, and if Ross's Goose occurs in the area, it would be considered a rare visitor.

There are 16 species of duck known to occur in the Project Area (see Appendix A), and most are expected to breed in the area. Based on CWS aerial surveys in the late 1980s, and on our surveys in 2009, both Lesser and Greater scaup appear to be the most numerous migratory duck with substantial stopover abundance. Large numbers of Mallard, Surf Scoter, Northern Pintail, and American Wigeon also use the area for stopover during migration. Surf Scoter is considered a common breeder on small lakes surrounding Great Slave Lake (Sirois 1994), and it is likely that species such as American Wigeon, Northern Pintail, Lesser Scaup, Ring-necked Duck, Bufflehead, and Common Merganser are relatively common nesting species. Species that may nest in lower relative densities include White-winged Scoter, Red-breasted Merganser, and Long-tailed Duck.

Among the various waterbird species that occur in the region, preferred breeding locations can be generalized into two broad categories: 1) wetland-nesting species, and 2) upland-nesting species. Wetland nesting species include Canvasback, Long-tailed Duck, and Ring-necked Duck, and upland nesting species include American Wigeon, Blue-winged Teal, Bufflehead, Common Merganser, Common Goldeneye, Green-winged Teal, Mallard, Northern Pintail, Northern Shoveler, Red-breasted Merganser, Scaup sp., Surf Scoter, and White-winged Scoter. Several of the upland nesting species may also nest on shrubby or heavily vegetated islands within wetland and lake habitats. For generalization, we include the three cavity nesting species (Bufflehead, Common Goldeneye, Common Merganser) in the upland nesting category, as they are dependent on larger trees in close proximity to open water. The only confirmed breeding record of any waterbird species is for Common Merganser, which nested under the Thor Lake camp office in 2008 (Bill Mercer, pers. comm.).

3.2.6 Shorebirds

Several species of shorebird may occur in the Project Area, but only six are expected to breed regularly, and none of these are of conservation concern. The potential breeding species include Semipalmated Plover, Killdeer, Wilson's Snipe, Lesser Yellowlegs, Solitary Sandpiper, and Spotted Sandpiper, and all are summer visitants to the Thor Lake Project Area from mid-May through late

August. All species breed in close proximity to wet habitats, with Wilson’s Snipe mainly in bogs and shallow marsh vegetation, Solitary Sandpiper and Lesser Yellowlegs in spruce bogs, and Killdeer and Semipalmated Plover on gravel or rocky shorelines. For the purpose of this assessment, shorebirds will be used as a general indicator of wetland condition, and thus a general inventory of shorebird activity in the local study area will provide information on species presence and relative abundance. Any dead or dying birds should be collected for inspection.

During aerial waterbird surveys in late May 2009, Lesser Yellowlegs was the most frequently encountered shorebird, with individuals being detected from several survey transects (Stantec Consulting 2009). On May 23 and 27, respectively, one Killdeer and one Greater Yellowlegs were observed. A flock of 20 *Calidris* sp. was observed migrating north on May 27, 2009 and a flock of 35 Dowitcher sp. was observed migrating north on May 31, 2009. Small wetlands may be collectively important for small flocks of migrating shorebirds, but traditional stopover sites elsewhere along the migration route (e.g., Boundary Bay, BC, Quill Lakes, SK) support flocks numbering into the tens-of-thousands of individuals. In June and August 2008, Golder Associates (1998) reported the occurrence of Wilson’s Snipe and Semipalmated Plover in the Thor Lake Project Area.

3.2.7 Bald Eagle

In Canada, Bald Eagle breeding distribution is largely contiguous throughout all forested regions, with the northern limit defined approximately by the tree line (Buehler 2000). Ground nests are known from treeless areas in Alaska, but are generally rare elsewhere (Buehler 2000). The kinds of trees used for nesting are highly variable throughout the species range, but nest tree selection is often the largest or tallest tree within a suitable area (Buehler 2000). Of seven nests observed in the Thor Lake Project Area, all were situated in spruce, either at the edge of a small lake, or on an island. Bald Eagle occurs year-round in the Northwest Territories, although there is also a substantial migratory population. Among migrants, birds arrive in the Project Area in early April and depart in November. Telemetry data from a single bird that departed northern California on March 14 arrived in the Project Area on April 12, and in autumn was first recorded in northern Alberta on November 15.

Population trends are determined from extensive aerial surveys throughout the species range, but data is least accurate in Alaska and northern Canada where breeding densities are highest. Since the North American ban on the use of DDT in 1972, populations have undoubtedly increased, with a total estimated population size of 100,000 individuals in 1999 in North America (Buehler 2000). During a reconnaissance-type aerial survey for raptor nests in the Project Area on May 31, 2009, six of seven observed nests were within the Project Area, and five of these were active with adults and eggs present. A summary of all known Bald Eagle observations, including nests, for the Thor Lake Project Area are provided in Table 8.

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Table 8: Summary of Bald Eagle Observations in the Thor Lake Project Area

Species	Date*	UTM (Zone 12)	Status
Bald Eagle	June 1998		Thor Lake; 1 flying
Bald Eagle	August 1998		Near Blachford Lake; nest not active
Bald Eagle	August 1998		Small lake 400 m SE of Thor Lake; 2 young in nest
Bald Eagle	August 1998		West end of Long Lake; 1 flying
Bald Eagle	August 1998		Greta Slave Lake, 6 km east of dock site; 1 flying
Bald Eagle	August 1998		Thor Lake (on island); perched
Bald Eagle	August 1998		Great Slave Lake, 1 km west of dock site; 3 flying
Bald Eagle	May 2009	405339 6887313	Nest not active
Bald Eagle	May 2009	415011 6892067	Nest active
Bald Eagle	May 2009	419179 6893491	Nest active
Bald Eagle	May 2009	394062 6897811	Nest active; outside Thor Lake Project Area
Bald Eagle	May 2009	416298 6885362	Nest active at Elbow Lake
Bald Eagle	May 2009	423815 6891016	Nest active
Bald Eagle	May 2009	420729 6901222	Nest active

NOTE:

* All 2009 observations from Stantec Consulting (2009); all 1998 observations from Golder Associates (1998)

3.2.8 Osprey

Osprey has a widespread North American breeding distribution and is a highly migratory species with very few birds wintering in the southern United States. Historically, the summer breeding range of Osprey in the Northwest Territories was restricted to the southwest, but after DDT was banned in 1972 a North American range expansion occurred, and now includes the Yellowknife and north shore regions of Great Slave Lake (Poole, *et al.* 2002). Typical nests are built in trees, although a wide variety of artificial structures such as transmission towers, stadium lights, communications towers, power poles, and artificial platforms are used (Poole, *et al.* 2002). In the mid-1980s, when nesting in the Yellowknife region was well-established, the widespread use of transmission towers, and subsequent power outages caused by nest interference, prompted the use of artificial platforms (Poole 1985). Similar solutions have been implemented elsewhere to maintain Osprey populations and to minimize damage or interference with infrastructure.

Since 1990 there have been few precise counts of Osprey, although dozens, if not hundreds of local volunteer monitoring programs exist, especially where artificial nest platforms are used. Population estimates from the early 1980s were estimated at 24,000 – 31,000 breeding pairs in North America, but significant increases after 1990, by as much as 25 – 100%, have been observed among various states and provinces (Poole, *et al.* 2002). There is no population specific information for the Northwest Territories, but overall range is expanding in the region, but with expected densities being lower than in southern parts of the breeding range. In the eastern United States, nests may be as

close as 50 to 400 m apart, whereas in the boreal forest nests may be separated by dozens of kilometers (Poole, *et al.* 2002). Generally, nests are located in close proximity to open water, and multiple breeding pairs may share one or more foraging lakes (Poole, *et al.* 2002).

The first reported occurrence of an Osprey from the Project Area was from August 1998 (Golder Associates 1998), and the first confirmed breeding occurrence was from 1 June 2009 during an aerial raptor nest survey (Stantec Consulting 2009). The nest, located atop a large spruce, was approximately 3 km from Thor Lake and situated within the Local Study Area (Stantec Consulting 2009). Relative to Bald Eagle, Osprey is not expected to be a common nesting species in the Thor Lake Project Area, mainly because of interspecific competition with Bald Eagle. Generally, Bald Eagle arrives on its breeding territory earlier than Osprey, and may occupy nests previously built by Osprey (Poole, *et al.* 2002). Additionally, Bald Eagle is known to occasionally steal fish from Osprey and kill nestlings, which can limit Osprey population growth where Bald Eagle densities are high (Poole, *et al.* 2002). A summary of all known Osprey observations, including nests, for the Thor Lake Project Area are provided in Table 9.

Table 9: Summary of Osprey Observations in the Thor Lake Project Area

Species	Date*	UTM (Zone 12)	Status
Osprey	August 1998		Great Slave Lake, 0.5 km north; 1 flying
Osprey	May 2009	418358 6886028	Nest active

NOTE:

* All 2009 observations from Stantec Consulting (2009); all 1998 observations from Golder Associates (1998)

3.2.9 Songbirds

Songbirds are widespread throughout the Thor Lake Project Area and likely occur in all broad habitat types. However, responses by songbirds to changes within and among broad habitat types varies considerably among species, and thus describing which species occur predominantly in each broad habitat type can be useful for estimating relative project effects. The songbirds are grouped into four communities (Key Indicators) on the basis of habitat preference: 1) wetland/wooded bog, 2) coniferous forest, 3) mixed and deciduous forest, and 4) open shrub/sparsely forested. The expected common or regularly occurring species in each habitat type for the Thor Lake Project Area are described in the respective sections. Most songbird species in these groups are migratory, although some forest-dependent species are year-round residents (e.g., Gray Jay, Black-capped Chickadee). Among the migratory species, most occur in the Project Area from late spring (May) through mid-autumn (September). For species of conservation concern, such as for Rusty Blackbird and Olive-sided Flycatcher, baseline conditions are provided separately (see Sections 3.2.9.5 and 3.2.9.6).

3.2.9.1 Wetland/Wooded Bog

Species expected to occur in the wetland/wooded bog habitat type includes Bohemian Waxwing, Northern Waterthrush, Rusty Blackbird, Swamp Sparrow, Song Sparrow, Eastern Kingbird, and Red-winged Blackbird (Table 10). There is currently very little information on the occurrence of these

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species in the Project Area, as just one occurrence of a single Red-winged Blackbird (Golder Associates 1998). Among the Wetland/Wooded Bog species, four are identified as having significant decreasing breeding populations in Canada for the period 1980 – 2007 (Sauer, *et al.* 2008): Song Sparrow (-0.3%/yr), Eastern Kingbird (-2.9%/yr), Red-winged Blackbird (-2.9%/yr), and Rusty Blackbird (-10.1%/yr). Swamp Sparrow was the only species in this habitat guild that had a significant increasing trend (+1.8%/yr) in Canada for the period 1980 – 2007 (Sauer, *et al.* 2008). There is no information on the breeding population trend of Bohemian Waxwing, but based on winter counts for the period 1959 – 1988, no significant decreasing trend was reported for any state or province (Sauer, *et al.* 1996).

Table 10: Broad Habitat Associations for Songbirds Expected to Regularly Occur in the Wetland/Wooded Bog Habitat Type in the Thor Lake Project Area

Songbird Community	Species of Conservation Concern	General Comment
Wetland/Wooded Bog	Bohemian Waxwing	
	Northern Waterthrush	Willow swamps
	Rusty Blackbird	Threatened; spruce bogs
	Swamp sparrow	Black spruce; willow bogs
	Song Sparrow	Willow bogs
	Eastern Kingbird	
	Red-winged Blackbird	

3.2.9.2 Coniferous Forest

There are 10 species expected to occur regularly in the Coniferous Forest habitat type, which include: Olive-sided flycatcher, Ruby-crowned Kinglet, American Robin, Yellow-rumped Warbler, Blackpoll Warbler, Palm Warbler, Gray Jay, Hermit Thrush, Wilson’s Warbler, and Chipping Sparrow (Table 11). There is limited information on the occurrence of these species in the Project Area. In 1998, during field surveys in the vicinity of Thor Lake, Gray Jay, Hermit Thrush, Olive-sided Flycatcher, and Ruby-crowned Kinglet were observed (Golden Associates 1998). On June 1, 2009 during helicopter refueling at the Thor Lake camp, one ruby-crowned Kinglet, two Gray Jays, and six Yellow-rumped Warblers were heard singing. There is no local trend information available for these species, but at the national level, for the period 1980 – 2007, the following species have shown declines: Olive-sided Flycatcher (-4.4%/yr), Ruby-crowned Kinglet (-0.9%/yr), Yellow-rumped Warbler (-0.9%/yr), Wilson’s Warbler (-4.9%/yr), Chipping Sparrow (-0.9%/yr) (Sauer, *et al.* 2008). The only species in this community showing a positive trend was Hermit Thrush (+0.8%/yr), and all remaining species have an undefined trend.

Table 11: Broad Habitat Associations for Songbirds Expected to Regularly Occur in the Coniferous Forest Habitat Type in the Thor Lake Project Area

Songbird Community	Species of Conservation Concern	General Comment
Coniferous Forest	Olive-sided flycatcher	Threatened; natural forest edges
	Ruby-crowned Kinglet	
	American Robin	
	Yellow-rumped Warbler	
	Blackpoll Warbler	Black Spruce
	Palm Warbler	Black Spruce
	Gray Jay	
	Hermit Thrush	
	Wilson’s Warbler	Forest edges; wooded bogs
	Chipping Sparrow	Also other forest edges

3.2.9.3 Mixed and Deciduous Forest

There are six species expected to occur regularly in the Mixed and Deciduous Forest habitat type, which include: Swainson’s Thrush, Yellow Warbler, White-throated Sparrow, Black-capped Chickadee, Warbling Vireo, and Dark-eyed Junco (Table 12). There is limited information on the occurrence of these species in the Project Area. In 1998, during field surveys in the vicinity of Thor Lake, the only observed species from this community was Dark-eyed Junco (Golden Associates 1998). There is no local trend information available for these species, but at the national level, for the period 1980–2007, the following species have shown declines: Swainson’s Thrush (-0.9%/yr), Yellow Warbler (-0.6%/yr), White-throated Sparrow (-0.6%), Dark-eyed Junco (-2.2%/yr) (Sauer, *et al.* 2008). For the same time period, increases have been shown for Black-capped Chickadee (+1.0%/yr) and Warbling Vireo (+0.9%/yr).

Table 12: Broad Habitat Associations for Songbirds Expected to Regularly Occur in the Mixed and Deciduous Forest Habitat Type in the Thor Lake Project Area

Songbird Community	Species of Conservation Concern	General Comment
Mixed and Deciduous Forest	Swainson’s Thrush	
	Yellow Warbler	Also willow swamps
	White-throated Sparrow	
	Black-capped Chickadee	
	Warbling Vireo	
	Dark-eyed Junco	Also forest edges

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Section 3: Results

3.2.9.4 Open Shrubs/Sparsely Forested

There are eight species expected to occur regularly in the Open Shrubs/Sparsely Forested habitat type, which include: Gray-cheeked Thrush, Tennessee Warbler, Orange-crowned Warbler, Common Redpoll, Savannah Sparrow, Harris's Sparrow, White-crowned Sparrow, and Lincoln's Sparrow (Table 13). There is no information on the occurrence of these species in the Project Area, and no local trend information. At the national level, for the period 1980 – 2007, both Orange-crowned Warbler (-1.1%/yr) and Savannah Sparrow (-1.2%/yr) have shown significant declines. The remaining species either have no significant trend (Tennessee Warbler, White-crowned Sparrow, and Lincoln's Sparrow), or have insufficient data to evaluate trend (Gray-cheeked Thrush, Common Redpoll, and Harris's Sparrow).

Table 13: Broad Habitat Associations for Songbirds Expected to Regularly Occur in the Open Shrubs/Sparsely Forested Habitat Type in the Thor Lake Project Area

Songbird Community	Species of Conservation Concern	General Comment
Open Shrubs/Sparsely Forested	Gray-cheeked Thrush	
	Tennessee Warbler	
	Orange-crowned Warbler	
	Common Redpoll	
	Savannah Sparrow	Esp. grassy and open areas
	Harris's Sparrow	Esp. sparse black/white spruce
	White-crowned Sparrow	
	Lincoln's Sparrow	Also wet, grassy areas

3.2.9.5 Rusty Blackbird

Rusty Blackbird is a federally-listed species of Special Concern (COSEWIC 2009) and considered as May Be At Risk in the Northwest Territories (WGGSNWT 2006). Partners in Flight Canada identifies Rusty Blackbird as one of 22 priority species of conservation concern (Downes, *et al.* 2000). Causes of population decline are largely unknown; although it is thought that habitat conversion and habitat loss throughout much of its wintering range in the southeastern United States, particularly the Mississippi Valley floodplain, has been a significant contributing factor (Avery 1995, COSEWIC 2006). Additional loss of wet coniferous forests through forest harvesting activities in the breeding range have also likely contributed to the decline (COSEWIC 2006), and an increasing prevalence of acid precipitation may also be a contributing factor (Greenberg and Droege 1999).

During the breeding season, from May through August, Rusty Blackbird is a widespread species throughout much of the northern boreal forest. It is most characteristic of wet coniferous and mixed forests, and it occurs in a variety of wet forest-edge habitats including bogs, fens, marshes, swamps, and beaver ponds (Avery 1995). In some breeding areas the species is associated with the presence of beaver lodges, and increases and decreases in beaver lodge density has been correlated with

Rusty Blackbird populations (Avery 1995). In the Thor Lake Project Area, Rusty Blackbird occurs near the northern limit of its North American breeding distribution. Its status in this area; however, is largely unknown.

There is no population data available for Rusty Blackbird in the Thor Lake Project Area, however, the Breeding Bird Survey suggests that Rusty Blackbird populations have declined at an average annual rate of -10.1% per year in Canada, and by -8.8% per year in closed boreal forest, for the period 1980 to 2007 (Sauer, *et al.* 2008).

3.2.9.6 Olive-sided Flycatcher

Olive-sided Flycatcher (*Contopus cooperi*) is a species of conservation concern in Canada, and is presently designated as *Threatened* (COSEWIC 2009) because of long-term population declines throughout much of the species' range. The national rate of decline is estimated at -4.4%/yr for the period 1980-2007 (Sauer, *et al.* 2008), whereas an estimate on the rate of population change in the Northwest Territories is not available. In the Yukon Territory the trend appears to be declining, although data for that region is considered inadequate for proper assessment (Sauer *et al.* 2008). In British Columbia the rate of decline is significant (Sauer, *et al.* 2008), but much of the trend is attributed to surveys conducted in the southern half of the province where habitat conversion and fragmentation has been more substantial compared to northern areas.

In the Northwest Territories, Olive-sided Flycatcher is distributed mainly in the western region. From the east, it occurs in the Northwest Territories from central Saskatchewan west toward Yellowknife, and then gradually northward to just south of Inuvik, before continuing west into the Yukon (Altman and Sallabanks 2000). Throughout its breeding range the species is very much tied to the distribution of older, taller coniferous forests. In the vicinity of Thor Lake, Olive-sided Flycatcher occurs at the northern limit of its range. Breeding density in this area is expected to be low compared to areas further south.

Olive-sided Flycatcher arrives in the Northwest Territories in late May and early June, and departs in late July and early August. During its brief visit, breeding pairs generally establish territories at forest edges adjacent to clearings, especially where scattered tall trees or snags are available for perching on, or foraging from. Typical clearings and openings include both natural (e.g., meadows, burns, rivers, and wetlands) and human-made (e.g., harvest units) openings (Altman and Sallabanks 2000). Nests are typically built in coniferous trees, often >1.5 m above ground, and near the end of a branch. The nest tree is usually adjacent, or close, to a forest opening.

There is no population data available for Olive-sided Flycatcher in the Thor Lake Project Area, however, the Breeding Bird Survey suggests that Olive-sided Flycatcher populations have declined at an average annual rate of -4.4% per year in Canada, and by -3% per year in British Columbia, for the period 1980 to 2007 (Sauer, *et al.* 2008).

4 CLOSURE

Stantec has prepared this report for the sole benefit of Avalon Rare Metals Inc. for the purpose of documenting baseline conditions at its Thor Lake site. The report may not be relied upon by any other person or entity, other than for its intended purposes, without the express written consent of Stantec and Avalon. Any use of this report by a third party, or any reliance on decisions made based upon it, are the responsibility of such third parties.

The information provided in this report was compiled from existing documents and data provided by Avalon and field data compiled by Stantec (formerly Jacques Whitford AXYS Ltd.). This report represents the best professional judgment of our personnel available at the time of its preparation. Stantec reserves the right to modify the contents of this report, in whole or in part, to reflect any new information that becomes available. If any conditions become apparent that differ significantly from our understanding of conditions as presented in this report, we request that we be notified immediately to reassess the conclusions provided herein.

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Appendix A – Mammal and Bird Species Known to Occur in the Project Area

APPENDIX A

Mammal and Bird Species Known to Occur in the Project Area

Appendix A – Mammal and Bird Species Known to Occur in the Project Area

Wildlife Group	Species	1986 ¹	1987 ²	1988 ³	1989 ⁴	1998 ⁵	2009 ⁶
Mammals	Beaver				X	X	X
	Black Bear					X	
	Caribou (<i>R.t. groenlandicus</i>)*					X	
	Gray Wolf					X	
	Moose					X	X
	Red Squirrel					X	
Birds	American Coot				X		
	American Robin					X	
	American Wigeon	X	X	X		X	X
	Bald Eagle				X	X	X
	Blue-winged Teal						X
	Bonaparte's Gull						X
	Bufflehead	X	X	X			X
	Canada Goose			X			
	Canvasback		X				
	Common Goldeneye						X
	Common Loon	X	X	X	X	X	X
	Common Merganser						X
	Common Raven				X	X	X
	Dark-eyed Junco					X	
	Gray Jay					X	X
	Greater White-fronted Goose	X					
	Green-winged Teal						X
	Hermit Thrush					X	
	Horned Grebe		X				
	Lesser Yellowlegs						X
	Long-tailed Duck	X	X	X			
	Mallard	X	X	X	X	X	X
	Northern Flicker					X	
	Northern Pintail		X	X			
	Northern Shoveler		X	X			
	Olive-sided Flycatcher					X	
	Osprey					X	X
Pacific Loon ^a	X	X	X	X	X		

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Appendix A – Mammal and Bird Species Known to Occur in the Project Area

Wildlife Group	Species	1986 ¹	1987 ²	1988 ³	1989 ⁴	1998 ⁵	2009 ⁶
	Peregrine Falcon						X
	Red-breasted Merganser	X	X	X			X
	Red-necked Grebe	X	X	X			
	Red-tailed Hawk					X	
	Red-throated Loon	X		X			
	Red-winged Blackbird					X	
	Ring-billed Gull						X
	Ring-necked Duck		X		X		
	Ruby-crowned Kinglet					X	X
	Sandhill Crane					X	
	Scaup sp.	X	X	X			X
	Semipalmated Plover					X	
	Snow Bunting						X
	Snow Goose	X					X
	Sora					X	
	Surf Scoter	X	X	X			X
	Tree Swallow					X	
	Tundra Swan		X				X
	White-winged Scoter	X	X	X			
	Wilson's Snipe					X	
	Yellow Warbler					X	
	Yellow-rumped Warbler						X

NOTES:

¹ Sirois and McCormick (1987)

² Sirois (1987)

³ Sirois and Cameron (1989)

⁴ Melville, *et al.* (1989)

⁵ Golder Associates (1998)

⁶ Stantec Consulting Ltd. (2009)

^a formerly Arctic Loon

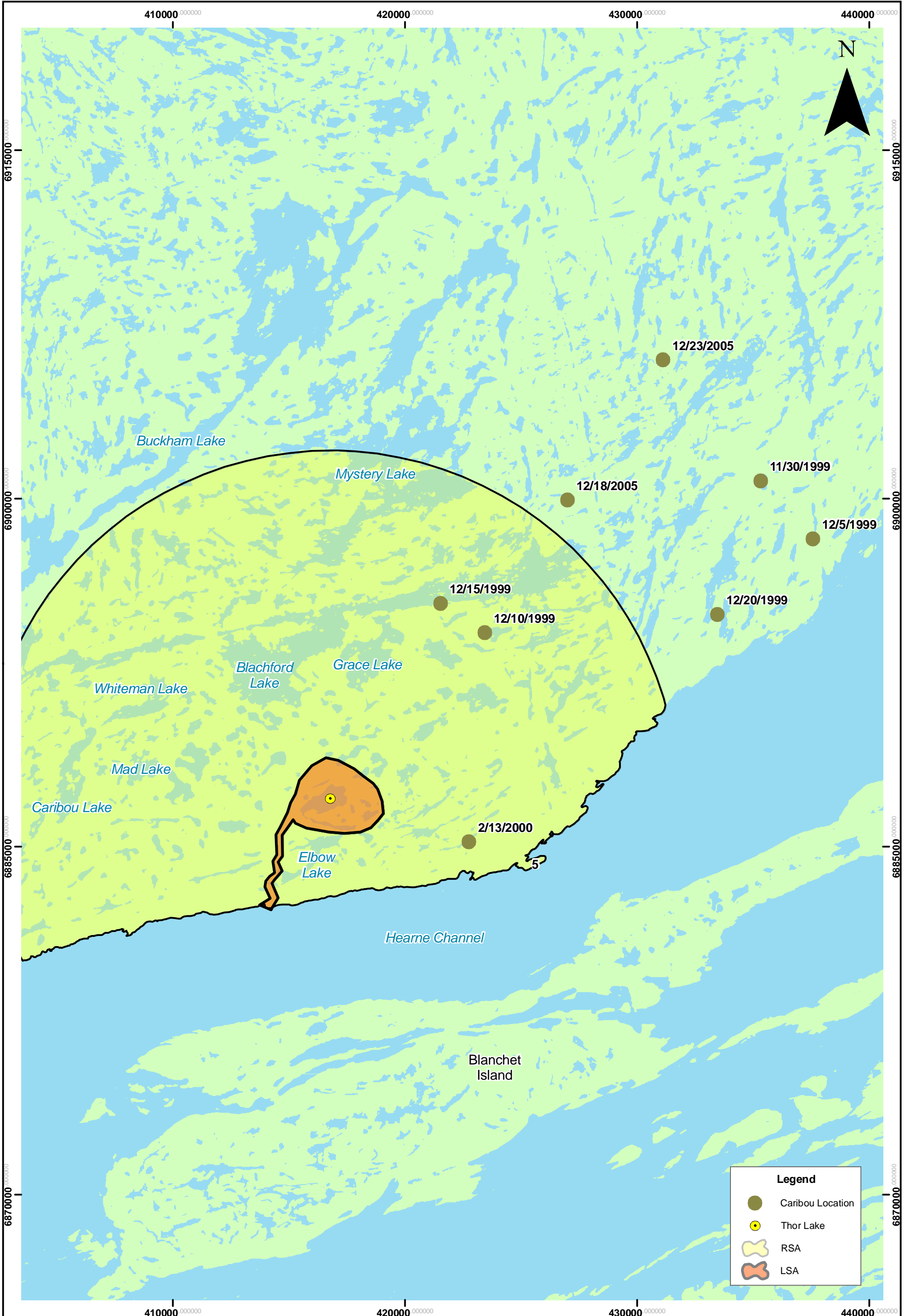
* subspecies is presumed based on distribution

**with the exception of scaup, unidentified species are omitted (e.g., hare sp.)



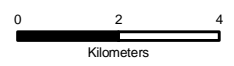
APPENDIX B

Locations of Radio-Collared Caribou



2009 Baseline Studies for Avalon Ventures Ltd. Proposed Thor Lake Rare Earth Metals Project

Locations of Radio-Collared Barren-Ground Caribou within 25-km of Thor Lake, 1999-2007 (Data Courtesy of Government of the Northwest Territories).



PREPARED BY



DRAFT DATE 22/02/2010		SCALE 1:150,000	
REVISION DATE 22/02/2010		PROJECT 1036222	APPENDIX B
DRAWN LS	CHECKED SP	APPROVED CB	VOL