APPENDIX A
Selection Criteria for Identification of Valued Environmental Components

INTRODUCTION

The Valued Environmental Component (VEC) criteria are described below for six mammal taxonomic groups (*i.e.*, Insectivores, Chiropterans, Lagomorphs, Rodents, Carnivores, and Artiodactyla) found in the Keeyask Transmission Project (Project) Study Area. Refer to Table A- 1 for a list of mammal species that could likely be found in the Project Study Area, with final rankings and cumulative scores. Habitat representations for these species are identified in Table A- 2.

INSECTIVORES

Those species belonging to Order Insectivora have a varied distribution and within North America include members of two families: Soricidae (shrews) and Talpidae (moles) (Wilson and Ruff, 1999). Species expected within the Project Study Area include only members of the Family Soricidae and include the masked shrew (*Sorex cinereus)*, American water shrew (*Sorex palustris)*, arctic shrew (*Sorex arcticus)* and pygmy shrew (*Sorex hoyi)*. These four species are considered widespread and are relatively abundant within Manitoba (Pattie and Hoffmann 1990).

As ecosystem components within the Project Study Area, shrews are found in a variety of habitat areas (Table A- 2) and predominately occur in forested and riparian areas where leaf litter and/or moss levels are present and insect levels are abundant (Wilson and Ruff 1999). Within the Project Study Area there is little socio-economic value tied to shrew species with exception to their existence within a larger functioning ecosystem where all species perform an important role in maintaining biodiversity. Based on the varying selection criteria used in selecting VECs for the Keeyask Transmission Project, shrew species ranked low based on meeting only a single selection criteria (Table A- 1). Due to their meeting only one of ten selection criteria, none were selected as VECs.

CHIROPTERANS

Chiropterans (bats) have a varied distribution worldwide and are broken into two sub orders: Microchiroptera and Megachiroptera; the former being present within the Project Study Area. The bat species in the Project Study Area belong to Family Vespertilionidae and include: little brown myotis (*Myotis lucifugus)* hoary bat (*Lasiurus cinereus)* and eastern red bat (*Lasiurus borealis*)*.* These species vary in distribution throughout Manitoba and range from infrequent (eastern brown bat) to common (little brown myotis) (Pattie and Hoffman 1990).

Habitat use by bats in the Project Study Area is linked to use of forested areas where they roost and riparian areas where insect prey is abundant (Pattie and Hoffman 1990). Selection

criteria for bat species found in the Project Study Area indicated only two selection criteria being met; including being provincially regulated species (Manitoba Conservation and Water Stewardship 2012d) (Table A- 1). An additional selection criterion was added recently for little brown bat that includes potential federal regulatory requirements. COSEWIC (February 3, 2012) recommended that three bat species be listed as endangered because of large population declines attributed to the disease white-nose syndrome. One of these species, the little brown myotis, might be found in the Project Study Area. While bat species do add to the biodiversity of mammal species found in Manitoba's north, none were selected as VECs for assessing environmental impacts from the Project.

LAGOMORPHS

Species from Order Lagomorpha are found worldwide and include pika and rabbits (Wilson and Ruff 1999). Snowshoe hare (*Lepus americanus*) is the only rabbit species found in the Project Study Area and belongs to Family Leporidae. Within the Project Study Area snowshoe hare are widely distributed and are present in a wide range of habitats (Table A-2).

Beyond their role as an abundant prey species, snowshoe hare potentially serve an important socio-economic role as a trapped and harvested species and a species that encourages the growth of forest understory through its foraging behaviour (Pattie and Hoffman 1990). Although snowshoe hare play an important role as a prey item for mammalian carnivore populations and can inhabit a wide range of habitat types (Table A-2), due to its meeting only six of ten selection criteria (Table A- 1) they were not selected as a VEC.

RODENTS

Order Rodentia is represented by a worldwide distribution of more than 2,000 species (Wilson and Ruff, 1999). Within the Project Study Area, 13 rodent species can be found (Table A- 1), including: one member of Family Castoridae: beaver (*Castor canadensis)*, one member of Family Dipodidae: meadow jumping mouse (*Zapus hudsonius),* one member of Family Erethizodontidae: porcupine (*Erethizon dorsatum)*, six members of Family Muridae: deer mouse (*Peromyscus maniculatus)*, Gapper's red-backed vole (*Clethrionomys gapperi)*, northern bog lemming (*Synaptomys borealis)*, heather vole (*Phenacomys intermedius)*, muskrat (*Ondatra zibethicus*), meadow vole (*Microtus pennsylvanicus*) and four members of Family Scuridae: least chipmunk (*Tamias minimus)*, woodchuck (*Marmota monax)*, red squirrel (*Tamiasciurus hudsonicus)*, and northern flying squirrel (*Glaucomys sabrinus)*. With the exception of porcupine, the above listed species are generally widespread within the Project Study Area and none are federally regulated; although there are provincial

regulations for handling red squirrels and beavers (Manitoba Conservation and Water Stewardship 2012d).

As rodent species are an ecologically diverse grouping, species habitat usage within the Project Study Area is varied (Table A- 2). Rodents are largely herbivorous and are important prey items to a variety of bird and mammal species (Pattie and Hoffman 1990). Rodent species recognized as playing important ecosystem roles include the beaver, considered a keystone species through its role as an ecosystem engineer and as a harvested fur-bearing species. Muskrat and woodchucks have also been harvested as fur-bearing species (Pattie and Hoffman 1990). Due to the relative adaptability of rodent species to various habitat types and the limited number of selection criteria met by these species (Table A- 1), only beaver was considered as a VEC, but was not selected.

CARNIVORES

Worldwide, 271 species are found within Order Carnivora (Wilson and Ruff, 1999). Of these 271 species, 16 are found within the Project Study Area including four member of Family Canidae: coyote (*Canis latrans)*, gray wolf (*Canis lupus)*, arctic fox (*Alopex lagopus)*, red fox (*Vulpes vulpes)*; two members of Family Ursidae: black bear (*Ursus americanus)* and grizzly bear (*Ursus arctos*); one member of Family Felidae: lynx (*Lynx canadensis);* and seven members of Family Mustelidae: American marten (*Martes americana)*, fisher (*Martes pennanti)*, ermine (*Mustela ermine)*, least weasel (*Mustela nivalis)*, mink (*Mustela vison)*, wolverine (*Gulo gulo)*, and river otter (*Lontra canadensis);* one member of Family Mephitidae*:* striped skunk (*Mephitis mephitis)* and one member of Family Procyonidae: raccoon (*Procyon lotor)*.

Habitat use by carnivore species is varied, with some species utilizing few habitat types *i.e.* raccoons and many more species utilizing multiple habitat types *i.e*. red fox, wolf, *etc*. Of carnivore species in the area, only wolverine and grizzly bears are federally regulated (as ‘species of special concern’ and ‘extirpated’ in the case of the case of the plains grizzly) (COSEWIC, n.d.a). Alternately, coyote, gray wolf, arctic fox, red fox, black bear, American marten, fisher, ermine, mink, wolverine, river otter, lynx, and grizzly bear are all provincially regulated (Manitoba Conservation and Water Stewardship 2012d).

While carnivore species typically ranked higher in meeting VEC selection criteria than shrew, bat, rabbit and rodent species (with exception to beaver), no predator species were selected as VECs. In addition to meeting few selection criteria, the adaptability of mammalian carnivores to varying habitat types precludes them being valuable indicators of habitat change in comparison to species which more heavily utilize specific habitat types.

ARTIODACTYLA

Of those 220 species worldwide belonging to Order Artiodactyla (even-toed ungulates), three are potentially located within the Project Study Area (Wilson and Ruff 1999). These three species belong to the deer family (Cervidae) and are caribou (*Rangifer tarandus),* white-tailed deer (*Odocoileus virginianus)*, and moose (*Alces alces).*

Habitat usage by cervid species in the Project Study Area vary in their selection of habitat. While habitat use by moose and white-tailed deer incorporates the use of aspen mixedwood, aspen mixture, and young regeneration habitat areas, caribou habitat use alternately incorporates tamarack mixture, tamarack pure, black spruce mixedwood, black spruce mixture, black spruce pure and jack pine pure areas (Table A- 2). The use of selection criteria to identify VECs indicated the highest rankings for caribou and moose (Table A- 1). This resulted in the selection of these species to be recommended as VECs to assess potential environmental impacts of the Keeyask Transmission Project.

VEC SELECTION

Based on the ranking of species using the predetermined selection criteria, caribou and moose were found to rank the highest among the criteria used for selection purposes (Table A- 1) and were selected as VECs for use in this study. The beaver also met a high number of selection criteria (eight of ten) as well as being a species representative of riparian habitat. Past hydroelectric project experience however, suggests that a relatively short transmission line right-of-way is unlikely to intersect with many beaver home ranges. As such, the value of its potential use as a VEC is diminished for describing potential habitat-related Project effects. Secondly, where moose also use riparian habitat, some redundancy of value as a VEC would be expected for these two species. For these reasons, the beaver was considered but it was not promoted to having VEC status in this assessment.

Caribou and moose are considered important among the mammal species present in the Project Study Area. Notably, caribou and moose have key habitat requirements relative to many of the other mammal species in the study area (Table A- 2). As such, these two species can represent the habitat requirements of many other wildlife species. This is mirrored in the reproductive strategies of moose and caribou relative to other species in that moose and caribou give birth to few young each season. This indicates the reliance of moose and caribou on stable environments relative to other species that alternately sustain population sizes, in the face of variable and unstable environmental conditions, through high birth rates (MacArthur and Wilson 1967; Smith and Smith 2001). Due to their reliance on a relatively narrow set of habitat and environmental conditions, and the relative importance placed on caribou and moose by society, these species are likely to perform well as VECs in identifying potential environmental changes from proposed project.

MOOSE

Justification:

- Important to people;
- Provincially regulated;
- Potential keystone species - important dietary item to gray wolves and black bears;
- Potential umbrella species - widespread throughout the province in forested and wetland regions;
- Potential indicator species - dependence on deciduous forests and swampy areas;
- Previously sampled in study area by WRCS;
- May face an increase in available habitat through Project-related effects;
- Potential for density-dependence related effects including increased chances of disease and parasite transmission; and
- Potential increase in species harvesting through increased hunter access.

Issues:

Potential effects due to:

- habitat loss and alteration of food and cover;
- changes in distribution and movements; and
- access-related issues including hunting and habitat fragmentation.

CARIBOU

Justification:

- Important to people;
- Federally and provincially regulated;
- Potential keystone species - important dietary item to gray wolves and black bears;

- Potential umbrella species - thought indicative of intact coniferous areas;
- Potential indicator species - reliance on old-growth coniferous forests;
- Previously sampled in study area by WRCS;
- May face an decrease in available habitat through project-related effects;
- Potential for density-dependence related effects including increased chances of disease and parasite transmission; and
- Potential increase in species harvesting through increased hunter access.

Issues:

Potential effects due to:

- habitat loss and alteration of food and cover;
- changes in distribution and movements;
- access-related issues including hunting and habitat fragmentation;
- landscape-level changes; and
- increases in alternate prey species (*i.e.*, moose) leading to locally higher predator species and predation effects.

Table A- 1: Mammal Ranking Selection Criteria for Species Most Likely to Occur in the Project Study Area

	Selection Criteria												
Species[1]	Importance to People	Federal Regulatory Requirement	Provincial Regulatory Requirement	Keystone Species	Umbrella Species	Indicator Species	Sampled in Project Study Area	Potential negative habitat related effects through loss of habitat and habitat alteration	Potential positive habitat related effects through gain of habitat and habitat alteration	Potential for density-dependence effects through competition for food resources and increased parasitism/disease transmission	Potential increase in species harvesting	Cumulative Total	Rank
Masked shrew									✓			1	10
American water shrew									✓			1	10
Arctic shrew									✓			1	10
Pygmy shrew									✓			1	10
Little brown myotis		✓	✓					✓				3	8
Hoary bat			✓					✓				2	9
Snowshoe hare	✓			✓			✓		✓	✓	✓	6	5
Least chipmunk								✓				1	10
Woodchuck									✓			1	10
Red squirrel			✓			✓	✓	✓				4	7
Northern flying squirrel						✓		✓				2	9
Beaver	✓		✓	✓		✓	✓		✓	✓	✓	8	3
Deer mouse									✓	✓		2	9
Gapper's red-backed vole									✓			1	10
Northern bog lemming									✓			1	10
Heather vole									✓			1	10
Muskrat	✓		✓				✓		✓	✓	✓	6	5
Meadow vole									✓			1	10
Meadow jumping mouse									✓			1	10
Gray wolf	✓		✓	✓	✓		✓		✓	✓		7	4
Arctic fox	✓		✓	✓	✓				✓	✓		6	5
Red fox	✓		✓	✓	✓		✓		✓	✓		7	4
Black bear	✓		✓	✓	✓		✓		✓	✓		7	4
American marten	✓		✓	✓	✓	✓				✓	✓	7	4
Fisher	✓		✓				✓			✓	✓	5	6
Ermine			✓							✓	✓	3	8
Least weasel							✓			✓	✓	3	8
Mink			✓				✓			✓	✓	4	7
Wolverine	✓		✓	✓				✓		✓	✓	6	5
River otter	✓		✓				✓			✓	✓	5	6
Lynx	✓		✓							✓		3	8
Caribou	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	10	1
Moose	✓		✓	✓	✓	✓	✓		✓	✓	✓	9	2

1. Porcupine, coyote, raccoon, striped skunk, and white-tailed deer were not considered as these species are at the edge of their ranges.

Table A- 2: Mammal Habitat in the Project Study Area

	Selection Criteria										
Species	Aspen Mixedwood	Aspen Mixture	Tamarack mixture	Tamarack pure	Black Spruce Mixedwood	Black Spruce Mixture	Black Spruce Pure	Jack Pine Pure	Low vegetation	Tall shrub	Young regeneration
Masked shrew[1]	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
American water shrew[1]			✓						✓	✓	
Arctic shrew[1]			✓	✓		✓	✓		✓	✓	✓
Pygmy shrew[1]			✓	✓	✓	✓	✓		✓		
Little brown bat[1]	✓	✓			✓			✓			
Hoary bat[1]	✓	✓		✓	✓	✓	✓	✓			
Snowshoe hare[2]	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Least chipmunk[1]	✓	✓		✓	✓	✓	✓	✓	✓		✓
Woodchuck[1]	✓	✓		✓	✓	✓	✓	✓	✓		✓
Red squirrel[1]	✓	✓	✓		✓	✓	✓	✓			
Northern flying	✓	✓		✓	✓	✓	✓	✓		✓	

Table A- 2: Mammal Habitat in the Project Study Area

	Selection Criteria										
Species	Aspen Mixedwood	Aspen Mixture	Tamarack mixture	Tamarack pure	Black Spruce Mixedwood	Black Spruce Mixture	Black Spruce Pure	Jack Pine Pure	Low vegetation	Tall shrub	Young regeneration
squirrel[1]											
Beaver[1]			✓						✓	✓	
Deer mouse[1]	✓	✓		✓	✓	✓	✓	✓	✓		✓
Gapper's red-backed vole[1]	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
Northern bog lemming[1]			✓	✓					✓		
Heather vole[1]			✓						✓	✓	
Muskrat[1]									✓	✓	
Meadow vole[1]			✓						✓	✓	✓
Meadow jumping mouse[1]			✓						✓		✓
Gray wolf[1]	✓	✓			✓					✓	
Arctic fox[2]			✓	✓		✓	✓		✓	✓	✓
Red fox[1]	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Table A- 2: Mammal Habitat in the Project Study Area

	Selection Criteria										
Species	Aspen Mixedwood	Aspen Mixture	Tamarack mixture	Tamarack pure	Black Spruce Mixedwood	Black Spruce Mixture	Black Spruce Pure	Jack Pine Pure	Low vegetation	Tall shrub	Young regeneration
Black bear[1]	✓	✓		✓	✓	✓	✓	✓	✓		✓
American marten[1]					✓	✓	✓	✓			
Fisher[1]	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Ermine[1]	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Least weasel[2]	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Mink[1]	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Wolverine[1]	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
River otter[1]			✓						✓	✓	
Lynx[1]	✓	✓	✓	✓	✓	✓	✓	✓			✓
Caribou[1]			✓	✓	✓	✓	✓	✓	✓		
Moose[1]	✓	✓			✓				✓	✓	✓

1. Modified from Kuhnke and Watkins (1999)
2. Pattie and Hoffman (1990)

APPENDIX B
Historical Occurrence of Mammal Species in the Keeyask Region

Common Name	Scientific Name	Breeds in Manitoba	Nature of Occurrence	Manitoba Distribution	Manitoba Abundance	Degree of Confidence in Manitoba Data	Most Likely Breeding Status in the Keeyask Region	Most Likely Distribution in the Keeyask Region	Expected Abundance in the Keeyask Region	Most Likely Species Rarity in the Keeyask Region	Found During Studies in the Keeyask Region
ORDER: INSECTIVORA (Insectivores)											
Masked shrew	*Sorex cinereus*	Yes	Resident	Very widespread	Very abundant	B	Breeding	Wide	Very abundant	Very common	Yes
American water shrew	*Sorex palustris*	Yes	Resident	Very widespread	Very abundant	C	Breeding	Wide	Scarce to Sporadic	Common	Yes
Arctic shrew	*Sorex arcticus*	Yes	Resident	Very widespread	Very abundant	C	Breeding	Wide	Sporadic	Common	Yes
Pygmy shrew	*Sorex hoyi*	Yes	Resident	Very widespread	Very abundant	C	Breeding	Wide	Sporadic	Common	Yes
ORDER: CHIROPTERA (Bats)											
Little brown myotis (bat)	*Myotis lucifugus*	Yes	Resident - Migratory	Very widespread	Very abundant (breeding) to scarce (non-breeding)	B	Breeding?	Wide	Scarce to Sporadic	Rare to uncommon	Yes? not confirmed
Eastern red bat	*Lasiurus borealis*	Yes	Migratory	Widespread	Sporadic (breeding)	C	Breeding?	Wide	Scarce to Sporadic	Rare	No
Hoary bat	*Lasiurus cinereus*	Yes	Migratory	Widespread	Sporadic (breeding)	C	Breeding?	Wide	Scarce to Sporadic	Rare	No

Common Name	Scientific Name	Breeds in Manitoba	Nature of Occurrence	Manitoba Distribution	Manitoba Abundance	Degree of Confidence in Manitoba Data	Most Likely Breeding Status in the Keeyask Region	Most Likely Distribution in the Keeyask Region	Expected Abundance in the Keeyask Region	Most Likely Species Rarity in the Keeyask Region	Found During Studies in the Keeyask Region
ORDER: LAGOMORPHA (Hares and Rabbits)											
Snowshoe hare	*Lepus americanus*	Yes	Resident	Very widespread	Very abundant	B	Breeding	Wide	Very abundant	Very common	Yes
ORDER: RODENTIA (Rodents)											
Least chipmunk	*Tamias minimus*	Yes	Resident	Very widespread	Very abundant	C	Breeding	Wide	Sporadic to Very abundant	Common to Very common	Yes
Woodchuck	*Marmota monax*	Yes	Resident	Very widespread	Very abundant	C	Breeding?	Narrow	Sporadic to Abundant	Rare to Uncommon	Yes Incidental
Red squirrel	*Tamiasciurus hudsonicus*	Yes	Resident	Very widespread	Very abundant	B	Breeding	Wide	Very abundant	Very common	Yes
Northern flying squirrel	*Glaucomys sabrinus*	Yes	Resident	Very widespread	Very abundant	C	Breeding	Wide	Abundant to possibly Very abundant	Very common	Yes Incidental
Beaver	*Castor canadensis*	Yes	Resident	Very widespread	Very abundant	B	Breeding	Wide	Very abundant	Very common	Yes
Deer mouse	*Peromyscus maniculatus*	Yes	Resident	Very widespread	Very abundant	C	Breeding	Wide	Very abundant	Very common	Yes
Gapper's red-backed vole	*Clethrionomys gapperi*	Yes	Resident	Very widespread	Very abundant	C	Breeding	Wide	Very abundant	Very common	Yes
Northern bog lemming	*Synaptomys borealis*	Yes	Resident	Very widespread	Very abundant	C	Breeding	Wide	Sporadic to possibly Abundant	Common to possibly Very common	Yes
Heather vole	*Phenacomys intermedius*	Yes	Resident	Very widespread	Very abundant	C	Breeding	Wide	Abundant	Very common	Yes

Common Name	Scientific Name	Breeds in Manitoba	Nature of Occurrence	Manitoba Distribution	Manitoba Abundance	Degree of Confidence in Manitoba Data	Most Likely Breeding Status in the Keeyask Region	Most Likely Distribution in the Keeyask Region	Expected Abundance in the Keeyask Region	Most Likely Species Rarity in the Keeyask Region	Found During Studies in the Keeyask Region
Muskrat	*Ondatra zibethicus*	Yes	Resident	Very widespread	Very abundant	B	Breeding	Wide	Abundant to Very abundant	Very common	Yes
Meadow vole	*Microtus pennsylvanicus*	Yes	Resident	Very widespread	Very abundant	C	Breeding	Wide	Very abundant	Very common	Yes
Meadow jumping mouse	*Zapus hudsonius*	Yes	Resident	Very widespread	Very abundant	C	Breeding	Wide	Very abundant	Very common	Yes
Porcupine	*Erethizon dorsatum*	Yes	Resident	Very widespread	Very abundant	C	Non-breeding?	Absent	Extirpated?	Absent	No
ORDER: CARNIVORA (Carnivores)											
Coyote	*Canis latrans*	Yes	Resident	Scattered	Very abundant	C	Breeding?	Narrow	Scarce	Rare	Yes
Gray wolf	*Canis lupus*	Yes	Resident	Very widespread	Abundant	B	Breeding	Wide	Sporadic to Abundant	Common to Very common	Yes
Arctic fox	*Alopex lagopus*	Yes	Migratory - Nomadic? (Occasional)	Scattered	Very abundant	B	Non-breeding	Narrow	Absent to Abundant	Rare to Uncommon	Yes Incidental
Red fox	*Vulpes vulpes*	Yes	Resident	Very widespread	Very abundant	B	Breeding	Wide	Abundant	Very common	Yes
Black bear	*Ursus americanus*	Yes	Resident	Very widespread	Very abundant	B	Breeding	Wide	Abundant to Very abundant	Very common	Yes
Grizzly bear (Plains)	*Ursus arctos*	No	Migratory - Nomadic? (Occasional)	Localized	NA	A	Non-breeding	Absent	Extirpated	Absent	No
Grizzly bear (Barren-ground)	*Ursus arctos*	No	Migratory - Nomadic? (Occasional)	Localized	NA	C	Non-breeding	Absent	Extirpated	Absent	No

Common Name	Scientific Name	Breeds in Manitoba	Nature of Occurrence	Manitoba Distribution	Manitoba Abundance	Degree of Confidence in Manitoba Data	Most Likely Breeding Status in the Keeyask Region	Most Likely Distribution in the Keeyask Region	Expected Abundance in the Keeyask Region	Most Likely Species Rarity in the Keeyask Region	Found During Studies in the Keeyask Region
Raccoon	*Procyon lotor*	Yes	Resident	Scattered	Very abundant	B	Breeding?	Narrow	Scarce	Rare	Yes
American marten	*Martes americana*	Yes	Resident	Very widespread	Very Abundant	B	Breeding	Wide	Sporadic to Very abundant	Common to Very common	Yes
Fisher	*Martes pennanti*	Yes	Resident	Widespread	Abundant	B	Breeding	Wide	Sporadic	Common	Yes
Ermine	*Mustela erminea*	Yes	Resident	Very widespread	Very abundant	B	Breeding	Wide	Abundant to Very abundant	Very common	Yes Incidental
Least weasel	*Mustela nivalis*	Yes	Resident	Very widespread	Very Abundant	B	Breeding	Wide	Abundant	Very common	Not identified to species
Mink	*Mustela vison*	Yes	Resident	Very widespread	Very Abundant	B	Breeding	Wide	Abundant to Very abundant	Very common	Yes
Wolverine	*Gulo gulo*	Yes	Resident	Very widespread	Abundant	B	Breeding	Narrow	Scarce to Sporadic	Rare	Yes
Striped skunk	*Mephitis mephitis*	Yes	Resident	Widespread	Very Abundant	B	Breeding	Wide	Scarce to Sporadic	Common	No
River otter	*Lontra canadensis*	Yes	Resident	Very widespread	Very Abundant	B	Breeding	Wide	Sporadic to Very abundant	Common to Very common	Yes
Lynx	*Lynx canadensis*	Yes	Resident	Very widespread	Very Abundant	B	Breeding	Wide	Abundant	Very common	Yes
ORDER: ARTIODACTYLA (Cloven-hoofed Mammals)											
Boreal woodland caribou	*Rangifer tarandus caribou*	Yes	Resident - Nomadic	Widespread	Abundant	B	Breeding?	Narrow	Scarce to Sporadic	Rare	Uncertain

Common Name	Scientific Name	Breeds in Manitoba	Nature of Occurrence	Manitoba Distribution	Manitoba Abundance	Degree of Confidence in Manitoba Data	Most Likely Breeding Status in the Keeyask Region	Most Likely Distribution in the Keeyask Region	Expected Abundance in the Keeyask Region	Most Likely Species Rarity in the Keeyask Region	Found During Studies in the Keeyask Region
Summer resident caribou	*Rangifer tarandus caribou*	Yes	Summer resident	Localized	Scarce to Sporadic	C	Breeding	Narrow	Scarce to Sporadic	Rare	Yes
Coastal caribou	*Rangifer tarandus caribou*	Yes	Nomadic	Localized	Scarce to Very abundant	B	Breeding?	Wide	Sporadic to Very abundant	Common to Very common	Yes
Barren-ground caribou	*Rangifer tarandus groenlandicus*	Yes	Nomadic	Localized	Scarce to Very abundant	B	Non-breeding	Wide	Sporadic to Very abundant	Common to Very common	Yes
White-tailed deer	*Odocoileus virginianus*	Yes	Resident	Scattered	Very Abundant	B	Non-breeding	Absent	Absent to Scarce	Absent	No
Mule deer	*Odocoileus hemionus*	Yes	Resident - Nomadic? -	Localized	Sporadic	C	Non-breeding	Absent	Extirpated	Absent	Yes Incidental
Moose	*Alces alces*	Yes	Resident	Very widespread	Very Abundant	B	Breeding	Wide	Sporadic to Abundant	Common to Very common	Yes

APPENDIX C
Mammal Field Data Summaries

METHODS

MAMMAL POPULATIONS SUMMER AND WINTER GROUND TRACKING SURVEY

Summer and winter ground tracking surveys were conducted in habitats within or near the footprints of the proposed Construction Power transmission line (two alternative routes, CP Route 1 and CP Route 2) and Generation Outlet Transmission lines (three alternative routes, GOT Route Alternative Options A, B, and C). The habitats selected for sampling included various types of riparian, coniferous, and deciduous habitats located between Gull Rapids and the transmission lines, (approximately 26 kilometres (km) south east of the proposed generating station) and Gull Rapids and Radisson Converter Station (approximately 45 km east of the proposed Keeyask Generating Station).Three summer surveys and one winter survey took place for the Construction Power transmission line sites. The summer surveys were completed between June 15 and June 20, July 3 and July 8, and July 23 and July 29. Three surveys also were completed for the generation outlet lines and took place between July 7 and July 16, July 27 and August 12, and August 24 and August 27. Winter surveys were completed between March 4 and March 10, 2010.

For the summer survey, a total of 90 construction power and 79 generation outlet line transects were sampled within 11 and 8 habitat types respectively, and distributed over the Keeyask Transmission Project Study Area (known as the Project Study Area) in proportion to habitat availability. Of these sites a subset was visited in the winter and consisted of 61 construction power transects and 58 generation outlet transects. Summer survey transects were comprised of 500 metre (m) thread lines placed approximately 60 centimetres off the ground with subsections created every 50 m. These 50 m subsections were created so that the line could be analyzed for variation within the 500 m line. Winter survey transects did not use thread as there was only one visit. All tracks observed in the snow with in 1 metre of the line were recorded. Several measurements including UTM location, species (track and scat data), sex, and age were recorded along each transect on the first visit. During the second and third visits of the summer surveys, only the locations of breaks in the thread and species information were collected. Results of this survey along the construction power and generation outlet lines can be found in Table C- 1 and Table C- 2.

MOOSE BROWSE SURVEYS

Moose browse information was collected based on Canfield (1941) and Hoskins and Dalke (1955) during the summer ground tracking studies along pre- determined ground tracking transects in the proposed Construction Power and Generation Outlet Transmission lines corridors. Two methods, uniformly distributed and browse encounter samples, were used to

adequately describe moose browse activity throughout various habitats. The following categories were used to describe browse for the survey:

Category	Browse Amount
0	No browse in plot
1	1 to 3 stems with browse
2	4 to 10 stems with browse
3	11 to 20 stems with browse
4	21 to 50 stems with browse
5	50+ stems with browse

1. Uniformly Distributed Samples - At the 100, 200, 300, 400, and 500 m mark along each transect, a 1 x 1 meter plot was established, and the total number of browsed stems was recorded and categorized. Browse identified during the survey were categorized according to browse amount shown above.

2. Browse Encounter Samples - The first five signs of browse encountered along the transect were surveyed using 1 x 1 m plot. The total number of browsed stems was recorded and categorized. Minimum plot separation was 10 m apart. A UTM coordinate was collected at each plot. Browse identified during the survey were categorized according to browse amount shown above.

AERIAL SURVEYS IN RIPARIAN HABITAT

To help predict how changes in habitat may affect aquatic furbearer abundance and distribution in creeks and rivers along the construction power lines, aerial surveys were completed October 3, 2009 and March 30, 2010 along waterways adjacent to the construction power lines and generation outlet lines. Surveys ranged in distance from 0 km to approximately 6 km from the Nelson River. Two observers and one data recorder surveyed about 182 km of wetland, lake, and river habitat. All instances of beaver signs were recorded including lodges and their status (active or inactive), food cache presence or any other beaver activity. Signs of muskrat and other wildlife were recorded incidentally. Species or their signs observed during this survey can be found in Table C- 3.

CARIBOU CALVING ISLAND STUDY

Caribou calving islands in and adjacent to the construction power and generation outlet lines were surveyed in conjunction with other caribou calving island survey programs in the area between July 7 and 18, 2009. Crews surveyed habitats with characteristics similar to known caribou calving islands and caribou sign was identified. The goal of the study was to identify active and inactive calving islands in 2009. Islands were identified through a desk exercise using orthophotography after peatland complexes were identified by vegetation experts at

ECOSTEM then further identified through visual observations, and georeferenced. Each island was then visited by a technician and searched for caribou signs. Species recorded during this survey can be found in Table C- 4.

In 2010 and 2011 a total of 4 islands in lakes, 29 islands in complexes and 5 general complexes were surveyed using trail cameras and tracking transects to identify caribou activity. Cameras were deployed in early May and remained until October for both years, while tracking data was collected in May, July/August and September/October for both years. Moose activity was also recorded on these caribou calving island complexes.

RESULTS

MAMMAL POPULATION–SUMMER AND WINTER GROUND TRACKING SURVEY

CONSTRUCTION POWER TRANSMISSION LINE

During the summer ground tracking surveys, a total of 1,248 individual animal sign were observed on 90 Construction Power transmission line (Table C- 5) on two alternative routes (CP Routes 1 and 2) for a total length of 42,980 m and 85,960 square metres (m^2), respectively (Table C- 6).These two routes differed in the number of surveyed transects (CP Route 1 = 55, CP Route 2 = 35) due to the available habitat data at the time of the study design. The total length and coverage of transects found between CP Route 1 and CP Route 2 was 26,550 m and 53,100 m^2 and 16,430 m and 32,860 m^2, respectively.

A total of 402 individual signs were identified during the winter tracking surveys completed on CP Routes 1 and 2 (Table C- 7). The total length and area of the winter survey on the two alternative routes (CP Route 1 = 46, CP Route 2 = 8) were of 30,800 m and 61,600 m^2 respectively (Table C- 8). In all, signs from nine mammal species were identified on the construction power transects during the winter and summer surveys (Table C- 7).

Snowshoe Hare (*Lepus americanus*)

Snowshoe hare signs recorded in the summer were the second most observed signs for all transects with 197 observations resulting in a proportion of transects with snowshoe hare signs of 0.42 (Table C- 5). Overall mean sign frequency for snowshoe hare signs was 0.22 sign/100 m^2; with all observations occurring on visit one, as snowshoe hare signs were only recorded on the initial installation of thread. Almost twice as many signs were observed on CP Route 1 as CP Route 2 (120 and 77 observations respectively) but the sign frequency was the same at 0.22 signs/100 m^2 (Table C- 9). It is important to note however that summer tracking transects are less suited to assess snowshoe hare abundance than winter transects, as signs

other than scat are more difficult to detect in summer and were inconsistently recorded. As snowshoe hare scat is generally scattered along a transect and it cannot be determined how many individuals it came from, summer data should be interpreted with caution. In winter, snowshoe hare comprised the largest number of signs observed during the surveys with 293 sign (226 signs on CP Route 1, 67 signs on CP Route 2) recorded on 33 transects (28 transects on CP Route 1, 5 transects CP Route 2) resulting in a proportions of 0.61 0.63 for CP Routes 1 and 2 respectively (Table C- 7).

Red Squirrel (*Tamiasciurus hudsonicus*)

Although the tracking surveys were not designed for detecting arboreal species, a total of 18 red squirrel signs was found on 5 transects resulting in a proportion of transects with red squirrel signs of 0.06 (Table C- 5). Overall mean sign frequency was 0.02 signs/100 m^2 (Table C- 5). The only red squirrel sign was observed during the first visit as red squirrel signs were only recorded on the initial installation of thread. Of the 18 red squirrel signs observed, 3 were found on CP Route 1 while 15 were observed on CP Route 2 for sign frequencies of 0.01 and 0.04 signs/100 m^2, respectively (Table C- 9). A total of 16 red squirrel signs were recorded on 3 CP Route 1 transects during the winter surveys for a proportion of transects with signs of 0.05 (Table C- 7).

Muskrat (*Ondatra zibethicus*)

Muskrat push-ups were observed during the March 31, 2010 aerial survey completed along and adjacent to the construction power transmission line. A total of 193 push-ups were identified and recorded. No sign of muskrat was observed during the summer or winter tracking surveys (Table C- 10).

Beaver (*Castor canadensis*)

Twenty-five beaver signs were observed on eight construction power line transects resulting in a proportion of transects with beaver signs of 0.09 (Table C- 5). The 25 observations resulted in a mean sign frequency of 0.03 signs/100 m^2 (Table C- 5). Beaver observations were only noted on the first survey as beaver signs were only recorded on the initial installation of thread. More than double the number of beaver signs was detected on CP Route 1 as compared to CP Route 2 (17 and 8 observations, respectively) however sign frequencies for each line were the same at 0.03 signs/100 m^2 (Table C- 9).

A total of 75 active and inactive beaver lodges were documented on water bodies on or adjacent to the construction power lines and generation outlet lines during the fall aerial survey. Most observations (71%) were on streams and 17% were on rivers (Table C- 10). Only 19 active lodges were observed during the survey (Table C- 10). No winter data was collected for beaver.

Gray Wolf (*Canis lupus*)

Observations of gray wolf signs were low with nine observations on nine transects resulting in a proportion of transects with gray wolf sign of 0.10 (Table C- 5). Overall mean sign frequency was 0.01 signs/100 m^2, with 0.01 signs/100 m^2 on visit one and a mean sign frequency of less than 0.01 signs/100 m/day for visits two and three (Table C- 8). Although the number of signs found on CP Routes 1 and 2 was similar (four and five observations, respectively) mean sign frequency on CP Route 1 was half of what was observed on CP Route 2 (0.01 and 0.02 respectively; Table C- 8). Only three wolf signs were observed during the winter surveys, all three on the same line, resulting in a proportion of transects with winter wolf signs of 0.02 (Table C- 6). All winter wolf signs were observed on CP Route 2.

Red Fox (*Vulpes vulpes*)

A total of six red fox signs was recorded on six of the CP Route ground tracking transects surveyed in summer, resulting in an overall proportion of transects with red fox signs of 0.07 (Table C- 4). Mean sign frequency for all visits was 0.01 signs/100 m^2 (Table C- 4). All red fox signs were found during the first visit. Four of the six signs were observed on CP Route 1 and two signs were found on CP Route 2 (Table C- 8). Both alternative routes had red fox sign frequencies of 0.01 (Table C- 5). Only one red fox sign was observed during the winter surveys for a proportion of transects with fox signs of 0.02 (Table C- 6).

Black Bear (*Ursus americanus*)

At total of 23 black bear signs were recorded on 16 of the construction power ground tracking transects surveyed in summer, resulting in a proportion of transects with black bear signs of 0.18 (Table C- 5). Overall mean black bear sign frequency was 0.03 signs/100 m^2 (Table C- 5) with 0.01 signs/100 m^2 on the initial visit and less than 0.01 signs/100 m/day for visits two and three (Table C- 5). The number of bear signs was similar for both CP Route 1 and CP Route 2 (n = 11 and n = 12, respectively) while sign frequency for CP Route 1 was half as much as CP Route 2 (0.02 and 0.04 signs/100 m^2, respectively; Table C- 9). Black bear signs were not observed during the winter surveys because they are generally inactive at that time of year.

American Marten (*Martes americana*)

Twenty-three American marten signs were found on 15 transects in summer, resulting in a proportion of transects with marten signs of 0.17 (Table C- 5). American marten had a mean sign frequency of 0.03 signs/100 m^2 and signs were only observed on the initial visit as marten signs were only recorded on the initial installation of thread (Table C- 5). Although the number of American marten observations was similar between CP Routes 1 and 2 (10 and 13 observations, respectively), CP Route 1 had half the sign frequency of CP Route 2 (0.02 and 0.04 signs/100 m^2, respectively; Table C- 4). A total of 43 American marten signs (32 signs on

CP Route 1, 11 signs on CP Route 2) were observed on 21 transects (19 and 3 transects for CP Route 1 and 2 respectively) during the winter survey along both CP Route 1 and CP Route 2 for a proportion of 0.41 and 0.38 for CP Route 1 and 2 respectively (Table C- 7).

Fisher (*Martes pennanti*)

Only one fisher sign was observed during summer ground tracking surveys, resulting in a proportion of transects with fisher signs of 0.01 (Table C- 5) and an overall mean sign frequency of less than 0.01 signs/100 m^2 (Table C- 5). The single fisher sign was observed on CP Route 1 (Table C- 8) during the first visit. No sign of fisher was observed during the winter survey.

Weasel (*Mustela* sp.)

A total of three weasel signs were observed on two transects resulting in a proportion of transects with weasel signs of 0.02 (Table C- 5). Overall mean sign frequency was less than 0.01 signs/100 m^2. Weasel signs were only observed on visit one on CP Route 2 for a sign frequency of less than 0.01 signs/100 m^2 (Table C- 8). One weasel sign was observed during the winter survey for a proportion of 0.02 (Table C- 7).

Mink (*Mustela vison*)

Only five mink signs were observed on four transects resulting in a proportion of transects with mink of 0.04 (Table C- 5). Mink had an overall mean sign frequency of 0.01 signs/100 m^2 with less than 0.01 signs/100 m^2 on visit one and less than 0.01 signs/100 m/day for visits two and three (Table C- 5). Of the five mink observations, four were located on CP Route 1 and one on CP Route 2 (Table C- 9). Mean sign frequency for both the CP Route 1 and CP Route 2 was relatively low at 0.01 and less than 0.01 signs/100 m^2, respectively (Table C- 8). Mink signs were not observed during the winter survey (Table C- 7).

River Otter (*Lontra canadensis*)

Twenty-seven river otter signs were observed on five transects resulting in a proportion of transects with otter signs of 0.06 (Table C- 5). River otter had an overall mean sign frequency of 0.03 signs/100 m^2, a visit one mean sign frequency of 0.03 signs/100 m^2 and a visit two and three mean sign frequency of less than 0.01 signs/100m/day (Table C- 5). River otter had more observations (n = 21) and a higher sign frequency on CP Route 1 (0.04 signs/100 m^2) than CP Route 2 (n = 6, 0.02 signs/100 $m^{2;}$ Table C- 7). River otter were also recorded in winter on three transects (nine signs total) resulting in a proportion of 0.02 and 0.25 for CP Route 1 and 2 respectively (Table C- 7).

Lynx (*Lynx canadensis*)

Eight lynx signs were observed on a total of six of the ground tracking transects surveyed in winter, resulting in a proportion of transects with lynx signs of 0.03 and a mean sign frequency of 0.00 and 0.08 on CP Route 1 and CP Route 2 respectively (Table C- 7). Seven of the eight signs were observed on CP Route 2 and one sign was found on CP Route 1. No lynx sign was observed during the summer tracking survey.

Moose (*Alces alces*)

Moose signs were the most commonly observed signs recorded during the summer construction power ground tracking surveys. A total of 858 moose signs were observed on 89 transects resulting in a proportion of transects with moose signs of 0.99 (Table C- 5). Moose had an overall mean sign frequency of 1.00 signs/100 m^2, a mean sign frequency of 0.91 signs/100 m^2 for the first visit and a mean sign frequency of 1.15 signs/100 m/day for visits two and three (Table C- 5). Of the 858 moose signs observed 475 were found on CP Route 1 while the remaining 383 were observed on CP Route 2 (Table C- 9). Moose signs were found on all but one transect and in all habitats surveyed (Table C- 11). The proportion of transects with signs to the total number of transects varied from 0.86 to 1.00 however this is likely due to a small sample size for some of the more uncommon habitats. Black spruce treed on thin peatland and black spruce treed on shallow peatland had the highest amount of observed moose signs (Table C- 12). Moose were also detected along the construction power line during the winter tracking survey completed in March 2010 (Table C- 7). A total of 28 signs were observed on 13 transects resulting in a proportion of transects with winter moose signs of 0.28 moose per transect surveyed and a mean sign frequency of 0.05 across all CP Route 1 winter transects. All moose signs observed in winter were located on CP Route 1 (Table C- 7).

Caribou (*Rangifer tarandus*)

A total of 53 caribou signs were detected on 17 of 90 ground tracking transects surveyed in summer 2009, resulting in a proportion of transects with caribou signs of 0.19 (Table C- 5). Caribou were the third most common signs observed during the surveys. Overall mean sign frequency for caribou was 0.06 signs/100 m^2 with a mean sign frequency of 0.05 signs/100 m^2 on the first visit and 0.08 signs/100 m^2 for visits two and three (Table C- 5). Of the 53 caribou signs observed 27 were found on CP Route 1 and 26 were observed on CP Route 2 however, CP Route 1's sign frequency was almost half of CP Route 2 (0.05 and 0.08 signs/100 m^2 (Table C- 9).

The majority of caribou signs were observed in black spruce treed on shallow peatland, black spruce treed on thin peatland and low vegetation on shallow peatland habitats (Table C- 13) and similarly between the initial visit and visits 2 and 3 (Table C- 14). Overall, proportions of transects with sign were low except for habitats with low sample sizes (Table C- 14).

A number caribou signs were observed identified on a number of islands surveyed in the Project Study Area during the 2009 survey in areas 34, 35 and 36 (Table C- 15, Table C- 16). Numbers of signs from females in each of the areas ranged from 7 to 9 while numbers of juvenile signs ranged from 7 to 12 (Table C- 16). Area 34 had the highest amount of caribou sign.

Caribou sign was not observed during the winter survey.

GENERATION OUTLET TRANSMISSION LINE

Animal signs from 12 species were observed on 80 Generation Outlet Transmission lines transects in both summer and winter tracking surveys (Table C- 17). Eight habitat types on three GOT Route Alternative Options (A, B and C) were surveyed in summer for a total length of 41,600 m and an area of 83,200 m^2 (Table C- 18). These three routes differed only slightly in the amount of surveyed transects (GOT Route Alternative Option A = 26, GOT Route Alternative Option B =28, and GOT Route Alternative Option C = 26), however one transect on GOT Route Alternative Option B was only surveyed during the initial visit reducing the total coverage for visits for two and three to 28,800 m^2 from a total of 29,300 m^2.

The total coverage for GOT Route Alternative Options A, B (23) and C (23) in winter was 13,400 m^2, 27,600 m^2 and 23,600 m^2, respectively, on a total of 58 transects (Table C- 19). In all, 787 signs were observed on 79 of the transects in summer (Table C- 20) while 1,066 signs were observed on 56 generation outlet transects in winter (Table C- 21).

Snowshoe Hare (*Lepus americanus*)

A total of 44 snowshoe hare signs was observed on 10 of the ground tracking transects surveyed in summer, resulting in a proportion of transects with snowshoe hare detected of 0.13 (Table C- 8). Overall snowshoe hare mean sign frequency was 0.02 signs/100 m^2 (Table C- 20). Snowshoe hare signs were only found during visit 1 and had a mean frequency of 0.05 signs/100 m^2 (Table C- 21). Snowshoe hare signs were observed on GOT Route Alternative Options A, B, and C with numbers of 12, 2, and 30, respectively for frequencies of 0.02, <0.01, and 0.04, respectively (Table C- 22, Table C- 23, Table C- 24). It is important to note however that summer tracking transects are less suited to assess snowshoe hare abundance than winter transects, as signs other than scat are more difficult to detect in summer. As snowshoe hare scat is generally scattered along a transect and it cannot be determined how many individuals it came from, summer data should be interpreted with caution.

Snowshoe hare signs were recorded frequently during the winter survey with a total of 785 observations on 41 transects resulting in a proportion of transects with snowshoe hare signs of 0.71 (Table C- 25). Snowshoe hare mean sign frequency varied between 2.26 0.56 and 1.01 signs/100 m^2 on GOT Route Alternative Options A, B, and C, respectively (Table C- 26, Table C- 27, Table C- 28).

Red Squirrel (*Tamiasciurus hudsonicus*)

Winter tracking surveys detected a total of 97 red squirrel signs was found on 24 transects resulting in a proportion of transects with red squirrel signs of 0.41 (Table C- 25). Overall mean sign frequency ranged from 0.29, 0.05 and 0.12 between GOT Route Alternative Options A, B, and C (Table C- 26, Table C- 27, Table C- 28). Red squirrel sign was not detected during the summer surveys.

Muskrat (*Ondatra zibethicus*)

Only one muskrat sign was observed on one of the ground tracking transects surveyed in summer, resulting in a proportion of transects detected with muskrat signs of 0.01 (Table C- 21). Muskrat mean sign frequency was less than 0.01 signs/100 m^2 and was only observed on visit one on one GOT Route Alternative Option A transect (Table C- 22, Table C- 23, Table C- 24). It is important to note that summer tracking studies are not designed to detect summer mammal signs. Muskrat push-ups were observed during the March 31, 2010 aerial survey completed along and adjacent to the construction power transmission line. A total of 79 push-ups were identified and recorded (Table C- 29).

Beaver (*Castor canadensis*)

Twenty-one beaver signs were observed on six transects resulting in a proportion of transects with signs detected of 0.08 (Table C- 20). Overall mean sign frequency was 0.01 signs/100 m^2 (Table C- 21), with visit one having a mean sign frequency of 0.02 signs/100 m^2. No fresh beaver sign was observed during visits two and three (Table C- 21). Beaver signs observed during the surveys ranged from 11 on GOT Route Alternative Option A to 2 on GOT Route Alternative Option B with mean sign frequencies for GOT Route Alternative Options A, B, and C equalling 0.01, less than 0.01 and 0.01, respectively (Table C- 22, Table C- 23, Table C- 24). No winter data was collected for beaver.

A total of 92 active and inactive beaver lodges were documented on lakes, ponds, rivers, and streams on or adjacent to the generation outlet lines, of which 83% were observed on streams (Table C- 29). Less than half of the lodges observed during the survey were active (n = 40; Table C- 29).

Gray Wolf (*Canis lupus*)

A total of 12 gray wolf signs were observed on 12 transects resulting in a proportion of transects with wolf signs detected of 0.15 (Table C- 20) and an overall sign frequency of 0.01 signs/100 m^2 (Table C- 21). All but one of the gray wolf sign was observed on the first visit resulting in a mean sign frequency of 0.01 signs/100 m^2 (Table C- 21). Of the gray wolf signs observed six were observed on GOT Route Alternative Option A, one was observed on GOT Route Alternative Option B and five were observed on GOT Route Alternative Option C resulting

in mean sign frequencies of 0.01 signs/100 m² or less (Table C- 22, Table C- 23, Table C- 24). During the winter surveys, 5 wolf signs were recorded on 4 of the 58 transects surveyed for a proportion of transects with wolf signs of 0.07 (Table C- 25).

Red Fox (*Vulpes vulpes*)

Four red fox signs were observed on four of the ground tracking transects surveyed in summer, resulting in a proportion of transects where red fox signs was detected of 0.05 (Table C- 20). Overall mean frequency of red fox sign was less than 0.01 signs/100 m^2 (Table C- 21). Signs were only observed during visit one with a mean sign frequency of 0.01 signs/100 m^2 (Table C- 21). Of the four red fox signs observed during the surveys, three were detected on GOT Route Alternative Option A while one was detected on GOT Route Alternative Option C resulting in mean sign frequencies of less than 0.01 signs/100 m² (Table C- 22, Table C- 23, Table C- 24).

Black Bear (*Ursus americanus*)

A total of 20 black bear signs were observed on 17 of the ground tracking transects surveyed in summer, resulting in a proportion of transects with signs of 0.21 (Table C- 20). Overall, black bear had a mean sign frequency of 0.01 signs/100 m² (Table C- 21), a visit one mean sign frequency of 0.01 signs/100 m^2 (Table C- 21) and a visit two and three mean sign frequency less than 0.01 signs/100 m/day (Table C- 21). Most black bear signs were observed on GOT Route Alternative Option A (n = 11 observations) although mean sign frequency was similar between GOT Route Alternative Options A and B (0.01 signs/100; (Table C- 22, Table C- 23). Mean sign frequency for GOT Route Alternative Option C was less than 0.01 signs/100 m² (Table C- 24). As black bears are hibernating during the winter, no black bear signs were observed during the winter survey.

American Marten (*Martes americana*)

American marten signs were only observed during winter tracking with a total of 57 signs over 18 transects (Table C- 25). Approximately one third of the winter generation outlet lines had marten signs with a proportion of transects with signs of 0.31 (Table C- 25). Of the marten signs observed during the winter surveys, 8 were detected on GOT Route Alternative Option A while 18 were detected on GOT Route Alternative Option B and 31 were detected on GOT Route Alternative Option C, resulting in mean sign frequencies of 0.04, 0.06 and 0.11 signs/100 m² on GOT Route Alternative Options A, B, and C respectively (Table C- 26, Table C- 27, Table C- 28).

Weasel (*Mustela* spp.)

Weasel signs were only detected during the winter tracking surveys (Table C- 25) completed on GOT Route Alternative Options A and B (Table C- 26, Table C- 27) for an overall proportion of

transects with signs of 0.12 and mean sign frequencies of 0.01 and 0.03 for GOT Route Alternative Options A and B, respectively (Table C- 26, Table C- 27).

Mink (*Mustela vison*)

Two mink signs were observed on one of the ground tracking transects surveyed in summer, resulting in a proportion of transects with signs detected of 0.01 (Table C- 20) and a mean sign frequency for visit 1 of less than 0.01 signs/100 m² (Table C- 21). Mink signs were only observed on visit one on GOT Route Alternative Option C (Table C- 24). One mink sign was observed on GOT Route Alternative Option B during the winter survey (Table C- 27).

River Otter (*Lontra canadensis*)

Five river otter signs were detected on one of the ground tracking transects surveyed in summer, resulting in a proportion of transects with river otter signs detected of 0.01 (Table C- 20). River otter signs had an overall mean sign frequency of less than 0.01 signs/100 m^2 and was only found during visit 1 with a mean sign frequency of 0.01 signs/100 m^2 (Table C- 21). River otter were only found on GOT Route Alternative Option A with a mean sign frequency of 0.01 signs/100 m^2 (Table C- 22). Winter tracking also detected river otter with 28 signs on 11 transects for a proportion of transects with signs on 0.19 (Table C- 25). River otter sign frequency was 0.03, 0.03, and 0.05 signs/100 m^2 on GOT Route Alternative Options A, B, and C respectively (Table C- 26).

Moose (*Alces alces*)

Moose signs were the most common sign observed during the surveys (Table C- 20). A total of 515 moose signs were observed on 77 ground tracking transects surveyed in summer, resulting in a proportion of transects with signs detected of 0.96 (Table C- 20). Overall, mean sign frequency for moose sign was 0.21 signs/100 m^2 (Table C- 21), with a mean sign frequency of 0.30 signs/100 m^2 for visit one and a mean sign frequency of 0.02 signs/100 m/day for visits 2 and 3 (Table C- 21). Moose signs on GOT Route Alternative Options A, B, and C were 252, 181, and 82 signs respectively with corresponding mean sign frequencies of 0.31, 0.21, and 0.10 signs/100 m^2 (Table C- 22, Table C- 23, Table C- 24). Moose signs were found in all eight habitats (77 transects) during both the initial visit and visits two and three (Table C- 21). During the first visit, the proportion of transects in all habitats where moose signs were observed was 0.70 while the proportion of transects in all habitats where moose signs were observed for visits two and three was 0.86 (Table C- 21).

Of the 514 moose signs that were detected the majority were recorded on black spruce treed on thin peatland, black spruce treed on shallow peatland, black spruce treed on mineral soil, jack pine treed on mineral or thin peatland and low vegetation on mineral or thin peat land (Table C- 30). Approximately half of all sign was recorded during the first survey (Table C- 31).

Proportions of transects were high for all habitat types however certain uncommon habitat types that had sign had small sample sizes.

A total of 40 moose signs on 17 transects were documented during the winter 2010 tracking transects (Table C- 25). Moose signs had a proportion of 0.29 on the winter transects. Mean sign frequency on GOT Route Alternative Options A, B and C were 0.05, 0.05 and 0.05 signs/100 m^2 respectively (Table C- 26, Table C- 27, Table C- 28).

Caribou (*Rangifer tarandus*)

Caribou signs were the second most abundant signs observed during the summer ground tracking surveys (Table C- 20). A total of 163 caribou signs were observed on 26 transects resulting in a proportion of transects with caribou signs of 0.33 (Table C- 20). Overall caribou sign frequency was 0.07 signs/100 m^2 (Table C- 21) with a mean sign frequency of 0.18 signs/100 m^2 on visit one and a mean sign frequency less than 0.01 signs/100 m/day for visits two and three (Table C- 21). The number of caribou signs detected on GOT Route Alternative Option A, B, and C was 36, 70, and 57, respectively resulting in mean sign frequencies of 0.04, 0.08 and 0.07 signs/100 m^2, respectively over three combined visits (Table C- 22, Table C- 23, Table C- 24). The majority of caribou signs (104) recorded on black spruce treed on mineral soil and black spruce treed on thin peatland habitats partially due to the large sampling of these habitats (Table C- 32). Also, most of the transects with caribou signs were sampled on the initial visit (150) while visit two and three had 13 transects with observed signs (Table C- 33).

Caribou sign was not observed during the 2010 winter survey.

CARIBOU CALVING ISLAND STUDY

A total of 10 caribou island complexes containing 23 islands were surveyed during the 2009 field season of which 18 were active (Table C- 13). Islands ranged in distance from 0 km to approximately 5.0 km from the construction power and generation outlet lines. A total of 75 caribou signs were found on the islands, of which 23 were determined to be female and 28 were determined juvenile.

Of the 4 islands in lakes, 29 islands in complexes and 5 general complexes that were surveyed using trail cameras and tracking transects a total of 21 complexes/islands with adult caribou and 8 complexes with caribou calves were recorded in 2010 and 2011 (Table C- 33). Generally, more caribou were detected in 2011 than in 2010 as more calving complexes were surveyed in 2011. Similarly for moose, more adults and calf signs were recorded in 2011 with 24 complexes/islands with adults and 12 complexes/islands with calves identified for both years (Table C- 35).

SPECIES AT RISK

None of the mammal species confirmed to occur in the Project Study Area is listed by the federal *Species at Risk Act* (SARA). The wolverine is listed as a species of special concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Wolverines were very rare in the Project Study Area. No wolverine sign was detected during ground tracking surveys for either the construction power lines or the generation outlet lines.

Little brown myotis (*Myotis lucifugus*), which appears to be sparse in the Keeyask region, was thought to be widespread and secure throughout its range (NatureServe 2012) until very recently. An emergency order to list this species under SARA has been requested (COSEWIC 2012), and it is considered endangered by COSEWIC. No field surveys were conducted for this species.

MOOSE BROWSE SURVEYS

Moose browse was recorded on most habitat types found in the Project Study Area. Moose browse was observed at the greatest proportion of sites in tall shrub on riparian peatland and in tamarack-black spruce mixture on wet peatland habitat (Figure C- 1). Other habitat types where moose browse was prevalent included broadleaf treed on all ecosites, black spruce mixedwood on mineral or thin soils, low vegetation on mineral or thin peatland, and tall shrub on mineral or thin peatland. No browse was observed in marsh, shallow water, tall shrub on shallow peatland, or tamarack-black spruce mixture on riparian peatland. As moose mainly feed on shrubby vegetation in winter (Drucker *et al.* 2010) browse was expected in tall shrub habitats.

It should be noted that the sample design was developed using habitat characterization data that has since been updated and improved. Due to the abundance and paucity of certain habitat types in the areas sampled, the sample size of some habitat categories were small or not available for sample purposes. This resulted in over- and under-sampling of some habitat types.

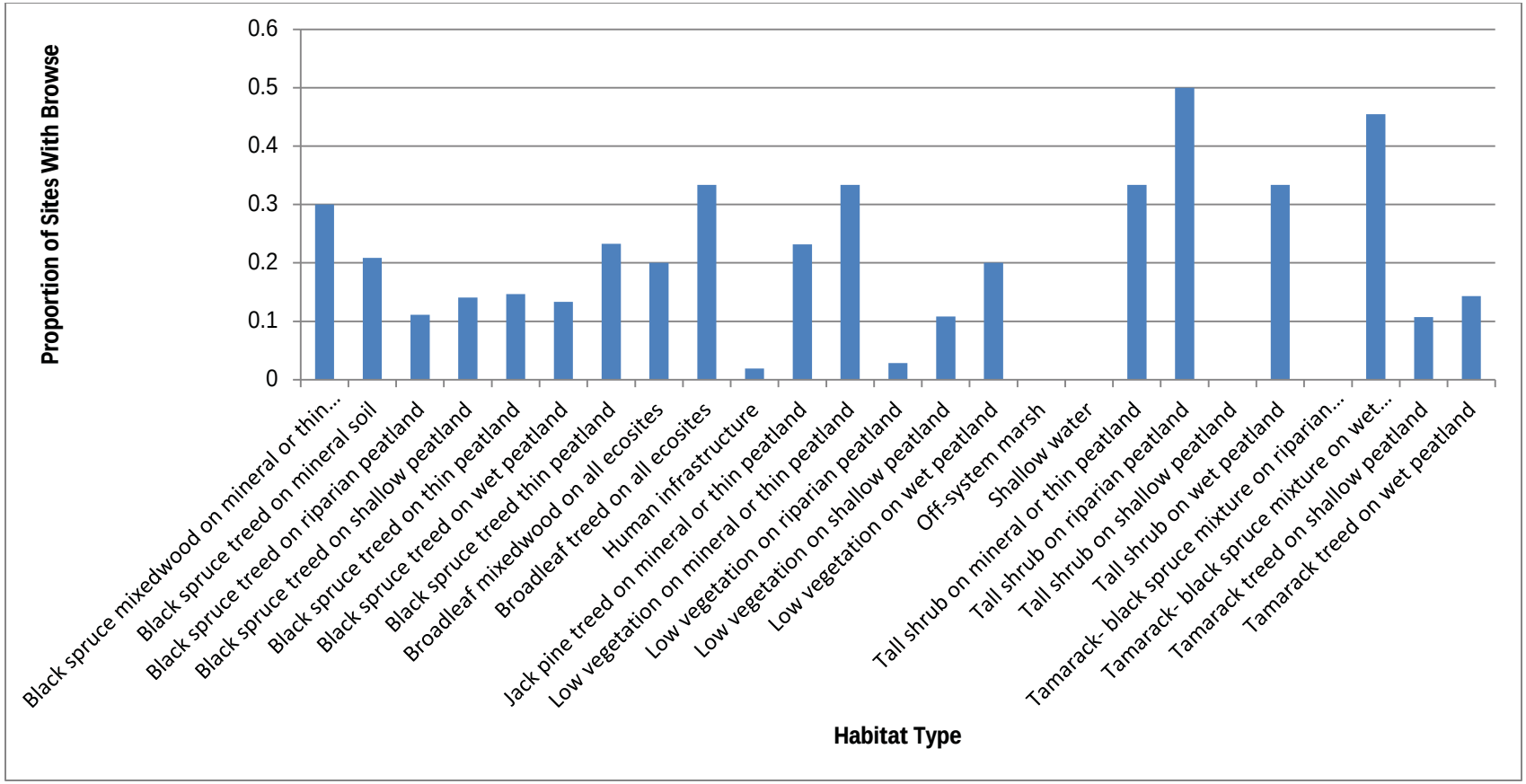

Figure C- 1: Moose Browse in Habitats in the Project Study Area

ALTERNATIVE ROUTE COMPARISONS

MAMMAL POPULATION–SUMMER GROUND TRACKING SURVEY

Construction Power Line

Overall, the relative abundance of most furbearer and caribou signs observed on the Construction Power transmission line routes was very similar with the exception of fisher, mink, red squirrel, river otter, and weasel; however, in all cases the number of signs was too small to make strong inferences between CP Route 1 and CP Route 2 (Figure 5). Even in the case of snowshoe hare where 61% were of all signs was observed on CP Route 1, sign frequency between the two routes were the same at 0.22 (Table C- 4). Like snowshoe hare signs, more moose signs were found on CP Route 1; however sign frequency for moose sign was higher on CP Route 2 (Table C- 4, Figure C- 2).

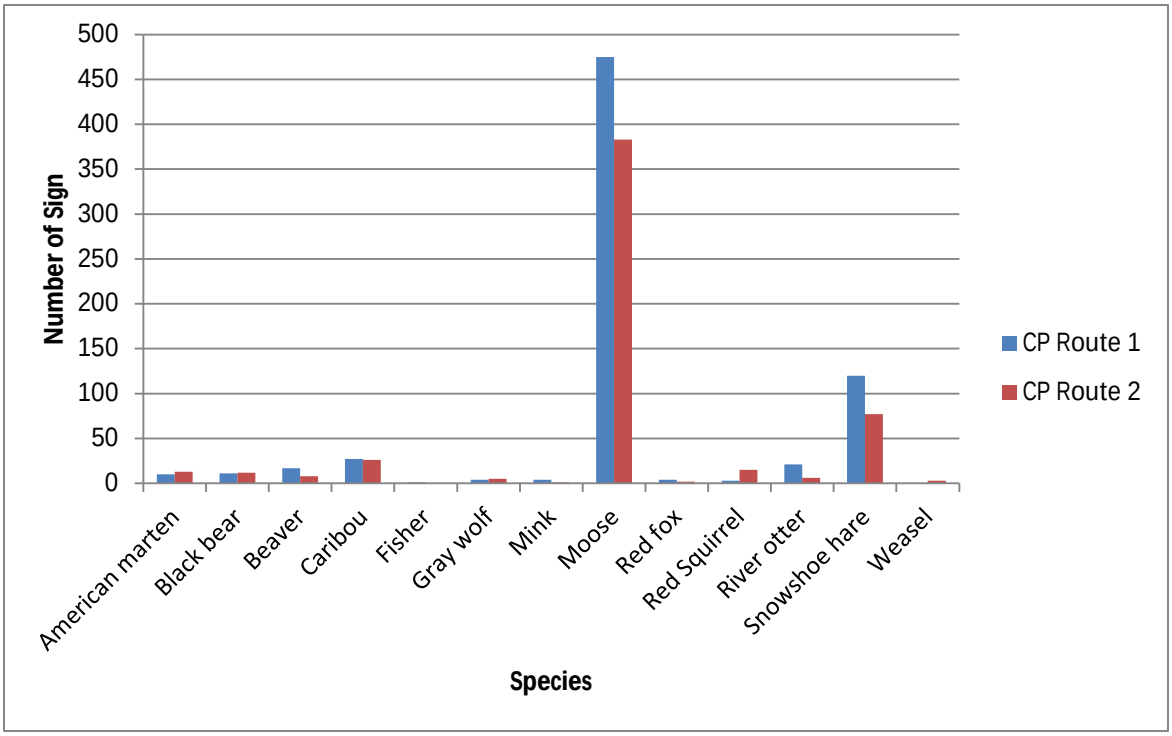

Figure C- 2: Number of Mammal Signs on Construction Power Transmission Line Routes 1 and 2

Generation Outlet Transmission Line

Forty-three percent of mammal signs found during the Generation Outlet Transmission lines ground tracking surveys was observed on GOT Route Alternative Option A, however, due to the length of the latter route, mean sign frequency was only 0.04 signs/100 m^2, whereas GOT Route Alternative Options B and C were 0.03 and 0.02 signs/100 m^2, respectively (Figure C- 3). The majority of moose signs, like the rest of the mammal signs, were found on GOT Route Alternative Option A (49%; Table C- 5 and Figure C- 3). However, unlike the other animal signs, moose signs had mean sign frequencies 50% and 200% higher than GOT Route Alternative Options B and C, respectively (Figure C- 3).

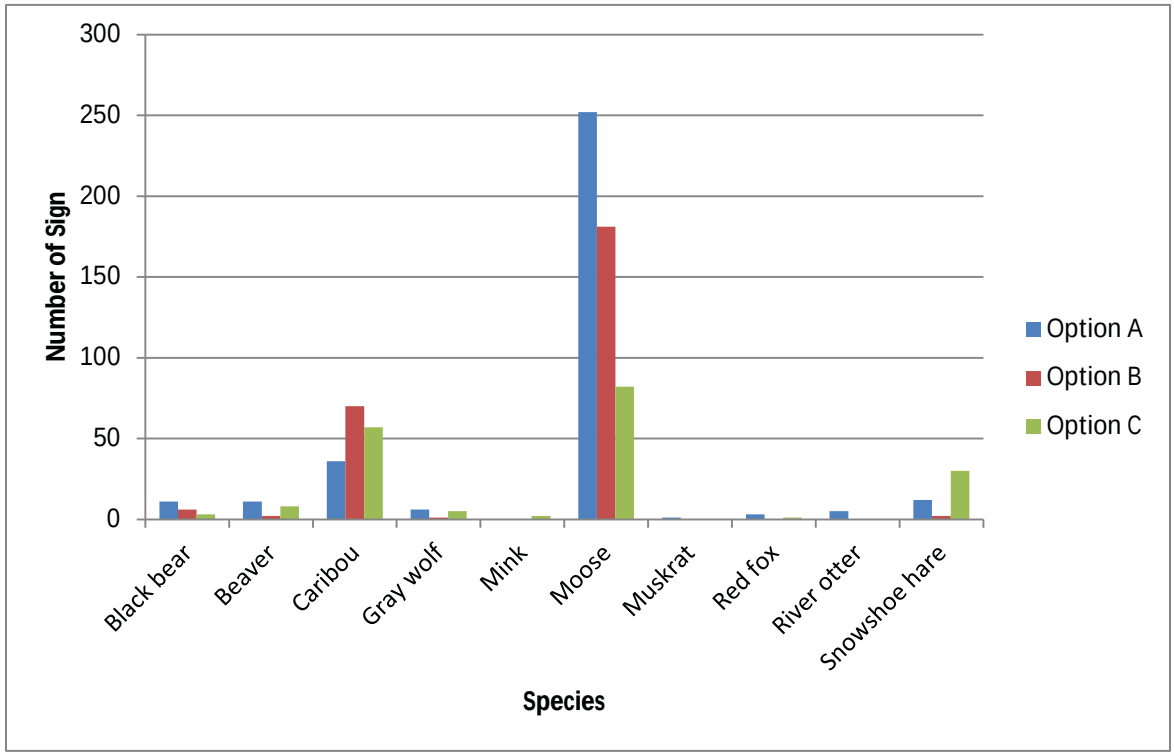

Figure C- 3: Number of Mammal Signs on Generation Outlet Transmission Line Route Alternative Options A, B, and C

MOOSE BROWSE SURVEY

Construction Power Transmission Line

The CP Route 2 sampling locations (n = 135) documented the largest proportions of browse when compared to CP Route 1 browse locations (n = 263) across most habitat types (Table C-36). Forest stands dominated by black spruce had the highest occurrence of browse. Low vegetation on shallow peatland and tamarack treed on shallow peatland had the lowest amount of browse sign.

Generation Outlet Transmission Line

Observations of browse were most common on GOT Route Alternative Options A and B compared to GOT Route Alternative Option C (Table C- 37). Black spruce and jack pine dominated stands appeared to have the most browse sign amongst all habitats sampled. Low vegetation on mineral or thin peatland also appeared to have more browse sign. Black spruce treed on riparian, shallow, or thin peatlands habitats appeared to have the lowest browse sign (Table C- 37), especially on GOT Route Alternative Options B and C.

Table C- 1: Mammal Signs Identified During the 2009 And 2010 Summer and Winter Tracking Transects on the Construction Power Transmission Lines

Common Name	Scientific Name
Snowshoe hare	*Lepus americanus*
Red squirrel	*Tamiasciurus hudsonicus*
Muskrat	*Ondatra zibethicus*
Beaver	*Castor canadensis*
Gray wolf	*Canis lupus*
Red fox	*Vulpes vulpes*
Black bear	*Ursus americanus*
Marten	*Martes americana*
Fisher	*Martes pennanti*
Weasel sp.	*Mustela spp.*
Mink	*Mustela vison*
River otter	*Lontra canadensis*
Lynx	*Lynx lynx*
Moose	*Alces alces*
Caribou	*Rangifer tarandus*

Table C- 2: Mammal Signs Identified During the 2009 and 2010 Summer and Winter Tracking Transects on the Generation Outlet Transmission Line

Common Name	Scientific Name
Snowshoe hare	*Lepus americanus*
Muskrat	*Ondatra zibethicus*
Beaver	*Castor canadensis*
Gray wolf	*Canis lupus*
Red fox	*Vulpes vulpes*
Black bear	*Ursus americanus*
Mink	*Mustela vison*
River otter	*Lontra canadensis*
Moose	*Alces alces*
Caribou	*Rangifer tarandus*

Table C- 3: Mammals and Mammal Signs Identified During the 2009 and 2010 Aerial Surveys Along the Generation Outlet and Construction Power Lines

Common Name	Scientific Name
Muskrat	*Ondatra zibethicus*
Beaver	*Castor canadensis*
Red fox	*Vulpes vulpes*
Moose	*Alces alces*

Table C- 4: Mammals and Mammal Signs Identified During the 2009 and 2010 Aerial Surveys Along the Generation Outlet and Construction Power Lines

Common Name	Scientific Name
Gray wolf	*Canis lupus*
Black bear	*Ursus americanus*
Moose	*Alces alces*
Caribou	*Rangifer tarandus*

Table C- 5: Species Detected Across 54 Construction Power Transmission Line Ground Tracking Transects During Three Visits in Spring and Summer 2009

Species	Number of Signs	Number of Transects With Signs	Mean Sign Frequency (signs/100 m^2)	Proportion of Transects With Signs	Standard Error
Snowshoe hare	197	38	0.22	0.42	0.05
Red squirrel	18	5	0.02	0.06	0.01
Beaver	25	8	0.03	0.09	0.02
Gray wolf	9	9	0.01	0.10	0.01
Red fox	6	6	0.01	0.07	<0.01
Black bear	23	16	0.03	0.18	0.01
Marten	23	15	0.03	0.17	0.01
Fisher	1	1	<0.01	0.01	<0.01
Weasel	3	2	<0.01	0.02	<0.01
Mink	5	4	0.01	0.04	<0.01
River otter	27	5	0.03	0.06	0.02
Moose	858	89	1.00	0.99	0.08
Caribou	53	17	0.06	0.19	0.02
Total	1,225	90	0.11	1.00	0.01

Table C- 6: Survey Length and Area Covered During the 2009 Spring and Summer Construction Power Transmission Line Ground Tracking Surveys

Line	Number of Transects	Total Length (m)	Total Coverage (m^2)
CP Route 1	55	26,550	53,100
CP Route 2	35	16,430	32,860
Total	90	42,980	85,960

Table C- 7: Species Detected Across Construction Power Transmission Line Ground Tracking Transects During One Visit in Winter 2010

	CP Route 1				CP Route 2			
Species	**Number of Signs**	**Number of Transects With Signs**	**Sign Frequency (signs/100 m^2)**	**Proportion of Transects With Signs**	**Number of Signs**	**Number of Transects With Signs**	**Sign Frequency (signs/100 m^2)**	**Proportion of Transects With Signs**
Snowshoe hare	226	28	0.42	0.61	67	5	0.80	0.63
Red squirrel	16	3	0.03	0.07	0	0	0	0
Gray wolf	3	1	0.01	0.02	0	0	0	0
Red fox	1	1	0.00	0.02	0	0	0	0
Marten	32	19	0.06	0.41	11	3	0.12	0.38
Weasel	0	-	0.00	-	1	1	0.01	0.13
River otter	3	1	0.01	0.02	6	2	0.06	0.25
Lynx	1	1	0.00	0.02	7	1	0.08	0.13
Moose	28	13	0.05	0.28	-	-	-	
Total	402	46	0.06	0.96	92	6	0.12	0.75

Table C- 8: Survey Length and Area Covered During the 2010 Winter Construction Power Transmission Line Ground Tracking Surveys

Line	Number of Transects	Total Length (m)	Total Coverage (m^2)
CP Route 1	46	25,600	51,200
CP Route 2	8	5,200	10,400
Total	54	30,800	61,600

Table C- 9: Species Detected on Construction Power Transmission Line Ground Tracking Transects During Three Visits in Spring and Summer 2009

	CP Route 1					CP Route 2				
Species	**Number of Signs**	**Mean Sign Frequency (signs/100 m^2)**	**Standard Error**	**Number of Transects With Signs**	**Proportion of Transects with Signs**	**Number of Signs**	**Mean Sign Frequency (signs/100 m^2)**	**Standard Error**	**Number of Transects With Signs**	**Proportion of Transects With Signs**
Snowshoe hare	120	0.22	0.06	22	0.4	77	0.22	0.07	16	0.46
Red squirrel	3	0.01	0.01	2	0.04	15	0.04	0.04	3	0.09
Beaver	17	0.03	0.02	4	0.07	8	0.03	0.01	4	0.11
Gray wolf	4	0.01	<0.01	4	0.07	5	0.02	0.01	5	0.14
Red fox	4	0.01	<0.01	4	0.07	2	0.01	<0.01	2	0.06
Black bear	11	0.02	0.01	8	0.15	12	0.04	0.01	8	0.23
Marten	10	0.02	0.01	8	0.15	13	0.04	0.02	7	0.2
Fisher	1	<0.01	<0.01	1	0.02	0	0	0	0	0
Weasel	0	0	0	0	0	3	0.01	0.01	2	0.06
Mink	4	0.01	<0.01	3	0.05	1	<0.01	<0.01	1	0.03
River otter	21	0.04	0.03	3	0.05	6	0.02	0.02	2	0.06
Moose	475	0.91	0.09	54	0.98	383	1.15	0.13	35	1
Caribou	27	0.05	0.02	10	0.18	26	0.08	0.04	7	0.2
Total	687	0.10	0.01	55	1	538	0.13	0.02	35	1

Table C- 10: Number of Muskrat Push-ups and Beaver Lodges Observed During the Construction Power Transmission Line Aerial Survey Fall 2009 and Spring 2010

Waterbody	Muskrat Push-ups	Total Lodges	Active Lodges	Inactive Lodges
Lake	193	1	0	1
Pond		8	0	8
River		13	6	7
Stream		53	13	40
Total	193	75	19	56

Table C- 11: Distribution of Moose Signs in Habitats on Construction Power Transmission Line Ground Tracking Transects Over Three Visits 2009

Habitat	Number of Signs	Number of Transects Surveyed	Proportion of Transects With Signs
Black spruce mixedwood on mineral or thin peatland	9	1	1.00
Black spruce treed on mineral soil	5	3	1.00
Black spruce treed on riparian peatland	14	2	1.00
Black spruce treed on shallow peatland	133	28	0.96
Black spruce treed on thin peatland	171	29	1.00
Black spruce treed on wet peatland	10	3	1.00
Black spruce treed thin peatland	61	7	0.86
Broadleaf mixedwood on all ecosites	28	2	1.00
Broadleaf treed on all ecosites	1	1	1.00
Human infrastructure	81	10	1.00
Jack pine treed on mineral or thin peatland	16	6	1.00
Low vegetation on mineral or thin peatland	31	7	0.86
Low vegetation on riparian peatland	53	8	1.00
Low vegetation on shallow peatland	97	12	1.00
Low vegetation on wet peatland	23	7	1.00
Nelson River shrub and/or low vegetation on ice scoured upland	8	1	1.00
Shallow water	1	1	1.00
Tall shrub on mineral or thin peatland	18	1	1.00
Tall shrub on riparian peatland	2	2	1.00
Tall shrub on wet peatland	5	2	1.00
Tamarack- black spruce mixture on wet peatland	13	4	0.75
Tamarack treed on shallow peatland	64	5	1.00
Tamarack treed on wet peatland	14	2	1.00

Table C- 12: Distribution of Moose Signs in Habitats on Construction Power Transmission Line Ground Tracking Transects by Visit 2009

	Visit 1			Visits 2 and 3		
Habitat	Number of Signs	Number of Transects Surveyed	Proportion of Transects With Signs	Number of Signs	Number of Transects Surveyed	Proportion of Transects With Signs
Black spruce mixedwood on mineral or thin peatland	1	1	1.00	8	1	1.00
Black spruce treed on mineral soil	3	3	0.67	2	3	0.33
Black spruce treed on riparian peatland	1	2	0.50	13	2	1.00
Black spruce treed on shallow peatland	60	28	0.79	73	28	0.79
Black spruce treed on thin peatland	82	29	0.72	89	29	0.83
Black spruce treed on wet peatland	3	3	0.33	7	3	1.00
Black spruce treed thin peatland	23	7	0.71	38	7	0.86
Broadleaf mixedwood on all ecosites	13	2	1.00	15	2	1.00
Broadleaf treed on all ecosites	1	1	1.00	0	1	-
Human infrastructure	42	10	0.90	39	10	0.90
Jack pine treed on mineral or thin peatland	10	6	1.00	6	6	0.67
Low vegetation on mineral or thin peatland	15	7	0.71	16	7	0.86
Low vegetation on riparian peatland	9	8	0.75	44	8	0.88

Table C- 12: Distribution of Moose Signs in Habitats on Construction Power Transmission Line Ground Tracking Transects by Visit 2009

	Visit 1			Visits 2 and 3		
Habitat	Number of Signs	Number of Transects Surveyed	Proportion of Transects With Signs	Number of Signs	Number of Transects Surveyed	Proportion of Transects With Signs
Low vegetation on shallow peatland	33	12	0.75	64	12	0.92
Low vegetation on wet peatland	3	7	0.43	20	7	0.71
Nelson River shrub and/or low vegetation on ice scoured upland	6	1	1.00	2	1	1.00
Shallow water	1	1	1.00	14	1	1.00
Tall shrub on mineral or thin peatland	4	1	1.00	0	1	-
Tall shrub on riparian peatland	1	2	0.50	1	2	0.50
Tall shrub on wet peatland	0	2	-	5	2	1.00
Tamarack- black spruce mixture on wet peatland	5	4	0.75	8	4	0.75
Tamarack treed on shallow peatland	32	5	1.00	32	5	1.00
Tamarack treed on wet peatland	1	2	0.50	13	2	1.00

Table C- 13: Distribution of Caribou Signs in Habitats on Construction Power Transmission Line Ground Tracking Transects Over Three Visits 2009

Habitat	Number of Signs	Number of Transects Surveyed	Proportion of Transects With Signs
Black spruce mixedwood on mineral or thin peatland	0	1	-
Black spruce treed on mineral soil	1	3	0.33
Black spruce treed on riparian peatland	1	2	0.50
Black spruce treed on shallow peatland	15	28	0.25
Black spruce treed on thin peatland	11	29	0.17
Black spruce treed on wet peatland	0	3	-
Black spruce treed thin peatland	1	7	0.14
Broadleaf mixedwood on all ecosites	1	2	0.50
Broadleaf treed on all ecosites	0	1	-
Human infrastructure	2	10	0.10
Jack pine treed on mineral or thin peatland	0	6	-
Low vegetation on mineral or thin peatland	0	7	-
Low vegetation on riparian peatland	6	8	0.13
Low vegetation on shallow peatland	12	12	0.17
Low vegetation on wet peatland	1	7	0.14
Nelson River shrub and/or low vegetation on ice scoured upland	1	1	1.00
Shallow water	0	1	-
Tall shrub on mineral or thin peatland	0	1	-
Tall shrub on riparian peatland	0	2	-
Tall shrub on wet peatland	0	2	-
Tamarack- black spruce mixture	1	4	0.25

Table C- 13: Distribution of Caribou Signs in Habitats on Construction Power Transmission Line Ground Tracking Transects Over Three Visits 2009

Habitat	Number of Signs	Number of Transects Surveyed	Proportion of Transects With Signs
on wet peatland			
Tamarack treed on shallow peatland	0	5	-
Tamarack treed on wet peatland	0	2	-

Table C- 14: Distribution of Caribou Signs in Habitats on Construction Power Transmission Line Ground Tracking Transects by Visit 2009

	Visit 1			Visits 2 and 3		
Habitat	Number of Signs	Number of Transects Surveyed	Proportion of Transects With Signs	Number of Signs	Number of Transects Surveyed	Proportion of Transects With Signs
Black spruce mixedwood on mineral or thin peatland	0	1	-	0	1	-
Black spruce treed on mineral soil	0	3	-	1	3	0.33
Black spruce treed on riparian peatland	0	2	-	1	2	0.50
Black spruce treed on shallow peatland	7	28	0.11	8	28	0.14
Black spruce treed on thin peatland	5	29	0.07	6	29	0.14
Black spruce treed on wet peatland	0	3	-	0	3	-
Black spruce treed thin peatland	0	7	-	1	7	0.14
Broadleaf mixedwood on all ecosites	0	2	-	1	2	0.50
Broadleaf treed on all ecosites	0	1	-	0	1	-
Human infrastructure	0	10	-	2	10	0.10
Jack pine treed on mineral or thin peatland	0	6	-	0	6	-
Low vegetation on mineral or thin peatland	0	7	-	0	7	-
Low vegetation on riparian peatland	0	8	-	6	8	0.13
Low vegetation on shallow peatland	11	12	0.08	1	12	0.08
Low vegetation on wet peatland	0	7	-	1	7	0.14

Table C- 14: Distribution of Caribou Signs in Habitats on Construction Power Transmission Line Ground Tracking Transects by Visit 2009

	Visit 1			Visits 2 and 3		
Habitat	Number of Signs	Number of Transects Surveyed	Proportion of Transects With Signs	Number of Signs	Number of Transects Surveyed	Proportion of Transects With Signs
Nelson River shrub and/or low vegetation on ice scoured upland	0	1	-	1	1	1.00
Shallow water	0	1	-	0	1	-
Tall shrub on mineral or thin peatland	0	1	-	0	1	-
Tall shrub on riparian peatland	0	2	-	0	2	-
Tall shrub on wet peatland	0	2	-	0	2	-
Tamarack- black spruce mixture on wet peatland	1	4	0.25	0	4	-
Tamarack treed on shallow peatland	0	5	-	0	5	-
Tamarack treed on wet peatland	0	2	-	0	2	-

Table C- 15: Mammal Signs Identified During the Caribou Calving Island Study Adjacent to the Generation Outlet and Construction Power Transmission Lines

Common Name	Scientific Name
Gray wolf	*Canis lupus*
Black bear	*Ursus americanus*
Moose	*Alces alces*
Caribou	*Rangifer tarandus*

Table C- 16: Distribution of Caribou Signs in Areas 34, 35, and 37 During the Caribou Calving Island Study, July 2009

Area	Number of Complexes	Number of Islands	Total Number of Caribou Signs	Female	Juvenile
34	4	10	29	9	12
35	5	10	23	7	7
37	1	3	23	7	9
Total	10	23	75	23	28

Table C- 17: Mammal Signs Identified on the Generation Outlet Transmission Line Ground Tracking Transects 2009 and 2010

Common Name	Scientific Name
Snowshoe hare	*Lepus americanus*
Red squirrel	*Tamiasciurus hudsonicus*
Muskrat	*Ondatra zibethicus*
Beaver	*Castor canadensis*
Gray wolf	*Canis lupus*
Red fox	*Vulpes vulpes*
Marten	*Martes americana*
Black bear	*Ursus americanus*
Mink	*Mustela vison*
River otter	*Lontra canadensis*
Moose	*Alces alces*
Caribou	*Rangifer tarandus*

Table C- 18: Coverage of Habitat Types During the Generation Outlet Transmission Line Ground Tracking Surveys Summer 2009

GOT Route Alternative Option	Number of Transects	Total Length (m)	Total Coverage (m^2)
A	26	13,800	27,600
B	28	14,650	29,300
C	26	13,150	26,300
Total	80	41,600	83,200

Table C- 19: Coverage of Habitat Types During the Generation Outlet Transmission Line Ground Tracking Surveys Winter 2010

GOT Route Alternative Option	Number of Transects	Total Length (m)	Total Coverage (m^2)
A	12	6,700	13,400
B	23	13,800	27,600
C	23	11,800	23,600
Total	58	32,300	64,600

Table C- 20: Species Detected Across All Generation Outlet Transmission Line Ground Tracking Transects Over Three Visits Summer 2009

Species	Number of Signs	Number of Transects With Signs	Proportion of Transects With Signs
Snowshoe hare	44	10	0.13
Muskrat	1	1	0.01
Beaver	21	6	0.08
Gray wolf	12	12	0.15
Red fox	4	4	0.05
Black bear	20	17	0.21
Mink	2	1	0.01
River otter	5	1	0.01
Moose	515	77	0.96
Caribou	163	26	0.33
Total	787	79	0.99

Table C- 21: Species Detected on Generation Outlet Transmission Line Ground Tracking Transects by Visit Summer 2009

	Visit 1			Visits 2 and 3		
Species	**Number of Signs**	**Mean Sign Frequency (signs/100 m^2)**	**Standard Error**	**Number of Signs**	**Mean Sign Frequency (signs/100 m/day)**	**Standard Error**
Moose	255	0.30	0.04	260	0.02	<0.01
Gray wolf	11	0.01	<0.01	1	<0.01	<0.01
Beaver	21	0.02	0.01	0	-	-
Snowshoe hare	44	0.05	0.02	0	-	-
River otter	5	0.01	0.01	0	-	-
Mink	2	<0.01	<0.01	0	-	-
Muskrat	1	<0.01	<0.01	0	-	-
Caribou	150	0.18	0.05	13	<0.01	<0.01
Black bear	9	0.01	<0.01	11	<0.01	<0.01
Red Fox	4	0.01	<0.01	0	-	-
Total	502	0.06	0.01	285	<0.01	<0.01

Table C- 22: Species Detected on Generation Outlet Transmission Line Alternative Route Option A Ground Tracking Transects During Three Visits Summer 2009

Species	Number of Signs	Mean Sign Frequency (signs/100 m^2)	Number of Transects With Signs	Proportion of Transects With Signs
Snowshoe hare	12	0.02	3	0.12
Muskrat	1	<0.01	1	0.04
Beaver	11	0.01	3	0.12
Gray wolf	6	<0.01	6	0.23
Red Fox	3	<0.01	3	0.12
Black bear	11	0.01	10	0.38
Mink	0	0	0	0
River otter	5	0.01	1	0.04
Moose	252	0.31	26	1.00
Caribou	36	0.04	9	0.35
Total	337	0.04	26	1.00

Table C- 23: Species Detected on Generation Outlet Transmission Line Alternative Route Option B Ground Tracking Transects During Three Visits Summer 2009

Species	Number of Signs on Option B	Mean Sign Frequency (signs/100 m^2)	Number of Transects With Signs	Proportion of Transects With Signs
Snowshoe hare	2	<0.01	2	0.07
Muskrat	0	0	0	0
Beaver	2	<0.01	1	0.04
Gray wolf	1	<0.01	1	0.04
Red fox	0	0	0	0
Black bear	6	0.01	5	0.18
Mink	0	0	0	0
River otter	0	0	0	0
Moose	181	0.21	27	0.96
Caribou	70	0.08	12	0.43
Total	262	0.03	27	96

Table C- 24: Species Detected on Generation Outlet Transmission Line Alternative Route Option C Ground Tracking Transects During Three Visits Summer 2009

Species	Number of Signs	Mean Sign Frequency (signs/100 m^2)	Number of Transects With Signs	Proportion of Transects With Signs
Snowshoe hare	30	0.04	4	0.15
Muskrat	0	0	0	0
Beaver	8	0.01	2	0.08
Gray wolf	5	0.01	4	0.15
Red fox	1	<0.01	1	0.04
Black bear	3	<0.01	3	0.12
Mink	2	<0.01	1	0.04
River otter	0	0	0	0
Moose	82	0.10	24	0.92
Caribou	57	0.07	5	0.19
Total	188	0.02	26	1.00

Table C- 25: Species Detected on Generation Outlet Transmission Line Ground Tracking Transects Winter 2010

Species	Number of Signs	Number of Transects With Signs	Proportion of Transects With Signs
Snowshoe hare	785	41	0.71
Red squirrel	97	24	0.41
Gray wolf	5	4	0.07
Red fox	33	9	0.16
Marten	57	18	0.31
Weasel	13	7	0.12
Mink	1	1	0.02
River otter	28	11	0.19
Lynx	7	4	0.07
Moose	40	17	0.29
Total	1066	56	0.97

Table C- 26: Species Detected on Generation Outlet Transmission Line Alternative Route Option A Ground Tracking Transects During One Visit Winter 2010

Species	Number of Signs	Mean Sign Frequency (signs/100 m^2)	Number of Transects With Signs	Proportion of Transects With Signs
Snowshoe hare	350	2.26	9	0.75
Red squirrel	46	0.29	9	0.75
Gray wolf	4	0.03	3	0.25
Red Fox	2	0.01	1	0.08
Lynx	0	0	0	0
Marten	8	0.05	4	0.33
Mink	0	0	0	0
Weasel	2	0.01	2	0.16
River otter	5	0.03	2	0.16
Moose	8	0.05	5	0.42
Total	425	0.27	12	1.00

Table C- 27: Species Detected on Generation Outlet Transmission Line Alternative Route Option B Ground Tracking Transects During One Visit Winter 2010

Species	Number of Signs	Mean Sign Frequency (signs/100 m^2)	Number of Transects With Signs	Proportion of Transects With Signs
Snowshoe hare	160	0.56	15	0.65
Red squirrel	15	0.05	7	0.30
Gray wolf	1	0.00	1	0.04
Red Fox	1	0.00	1	0.04
Lynx	2	0.01	1	0.04
Marten	18	0.06	7	0.30
Mink	1	0.00	1	0.04
Weasel	11	0.03	5	0.22
River otter	8	0.03	4	0.17
Moose	15	0.05	8	0.35
Total	232	0.08	20	0.87

Table C- 28: Species Detected on Generation Outlet Transmission Line Alternative Route Option B Ground Tracking Transects During One Visit Winter 2010

Species	Number of Signs	Mean Sign Frequency (signs/100 m^2)	Number of Transects With Signs	Proportion of Transects With Signs
Snowshoe hare	275	1.01	17	0.74
Red squirrel	36	0.12	8	0.35
Gray wolf	0	0	0	0
Red Fox	30	0.10	7	0.30
Lynx	5	0.02	3	0.13
Marten	31	0.11	6	0.26
Mink	0	0	0	0
Weasel	0	0	0	0
River otter	15	0.05	5	0.22
Moose	17	0.05	4	0.17
Total	409	0.14	22	0.96

Table C- 29: Number of Muskrat Push-ups and Beaver Lodges Observed During the Generation Outlet Transmission Line Aerial Survey Fall 2009 and Spring 2010

Waterbody	Muskrat Push-ups	Total Lodges	Active Lodges	Inactive Lodges
Lake	79	8	2	6
Pond		4	1	3
River		4	2	2
Stream		76	35	41
Total	79	92	40	52

Table C- 30: Distribution of Moose Signs in Habitats on Generation Outlet Transmission Line Ground Tracking Transects Summer 2009

Habitat	Number of Signs	Number of Transects on Surveyed	Proportion of Transects With Sign
Black spruce mixedwood on mineral or thin peatland	8	2	1.00
Black spruce treed on mineral soil	70	16	1.00
Black spruce treed on riparian peatland	7	6	0.83
Black spruce treed on shallow peatland	85	20	0.95
Black spruce treed on thin peatland	103	24	0.96
Black spruce treed on wet peatland	10	8	1.00
Black spruce treed thin peatland	13	6	1.00
Broadleaf treed on all ecosites	9	1	1.00
Human infrastructure	4	1	-
Jack pine treed on mineral or thin peatland	63	12	1.00
Low vegetation on mineral or thin peatland	61	14	0.86
Low vegetation on riparian peatland	8	5	1.00
Low vegetation on shallow peatland	35	12	1.00
Low vegetation on wet peatland	18	2	1.00
Off-system marsh	1	1	1.00
Shallow water	1	1	1.00
Tall shrub on mineral or thin peatland	3	3	-
Tall shrub on riparian peatland	5	2	1.00
Tamarack- black spruce mixture on riparian peatland	2	2	1.00
Tamarack- black spruce mixture on wet peatland	2	1	1.00
Tamarack treed on shallow peatland	6	2	1.00

Table C- 31: Distribution of Moose Signs in Habitats on Generation Outlet Transmission Line Ground Tracking Transects Summer 2009

	Visit 1			Visits 2 and 3		
Habitat	Number of Signs	Number of Transects Surveyed	Proportion of Transects With Signs	Number of Signs	Number of Transects Surveyed	Proportion of Transects With Signs
Black spruce mixedwood on mineral or thin peatland	4	2	1.00	4	2	1.00
Black spruce treed on mineral soil	42	16	0.81	28	16	0.63
Black spruce treed on riparian peatland	4	6	0.50	3	6	0.33
Black spruce treed on shallow peatland	50	20	0.65	35	20	0.90
Black spruce treed on thin peatland	50	24	0.63	53	24	0.83
Black spruce treed on wet peatland	1	8	0.38	9	8	0.75
Black spruce treed thin peatland	6	6	0.83	7	6	0.67
Broadleaf treed on all ecosites	6	1	1.00	3	1	1.00
Human infrastructure	4	1	-	0	1	-
Jack pine treed on mineral or thin peatland	31	12	0.42	32	12	0.92
Low vegetation on mineral or thin peatland	20	14	0.57	41	14	0.71
Low vegetation on riparian peatland	1	5	0.20	7	5	0.80
Low vegetation on shallow peatland	18	12	0.75	17	12	0.75

Table C- 31: Distribution of Moose Signs in Habitats on Generation Outlet Transmission Line Ground Tracking Transects Summer 2009

	Visit 1			Visits 2 and 3		
Habitat	Number of Signs	Number of Transects Surveyed	Proportion of Transects With Signs	Number of Signs	Number of Transects Surveyed	Proportion of Transects With Signs
Low vegetation on wet peatland	7	2	1.00	11	2	1.00
Off-system marsh	1	1	1.00	0	1	-
Shallow water	0	1	-	1	1	-
Tall shrub on mineral or thin peatland	3	3	0.67	0	3	-
Tall shrub on riparian peatland	4	2	-	1	2	0.50
Tamarack- black spruce mixture on riparian peatland	0	2	-	2	2	-
Tamarack- black spruce mixture on wet peatland	2	1	1.00	0	1	-
Tamarack treed on shallow peatland	1	2	0.50	5	2	1.00

Table C- 32: Distribution of Caribou Signs in Habitats on Generation Outlet Transmission Line Ground Tracking Transects Over Three Visits Summer 2009

Habitat	Number of Signs	Number of Transects Surveyed	Proportion of Transects With Signs
Black spruce mixedwood on mineral or thin peatland	3	2	0.50
Black spruce treed on mineral soil	58	16	0.44
Black spruce treed on riparian peatland	1	6	0.17
Black spruce treed on shallow peatland	3	20	0.10
Black spruce treed on thin peatland	46	24	0.33
Black spruce treed on wet peatland	5	8	0.25
Black spruce treed thin peatland	2	6	0.17
Broadleaf treed on all ecosites	10	1	1.00
Human infrastructure	0	1	-
Jack pine treed on mineral or thin peatland	7	12	0.17
Low vegetation on mineral or thin peatland	17	14	0.50
Low vegetation on riparian peatland	0	5	-
Low vegetation on shallow peatland	10	12	0.33
Low vegetation on wet peatland	0	2	-
Off-system marsh	0	1	-
Shallow water	0	1	-
Tall shrub on mineral or thin peatland	0	3	-
Tall shrub on riparian peatland	0	2	-
Tamarack- black spruce mixture on riparian peatland	0	2	-
Tamarack- black spruce mixture on wet peatland	0	1	-
Tamarack treed on shallow peatland	1	2	0.50

Table C- 33: Distribution of Caribou Signs in Habitats on Generation Outlet Transmission Line Ground Tracking Transects by Visit Summer 2009

	Visit 1			Visits 2 and 3		
Habitat	Number of Signs	Number of Transects Surveyed	Proportion of Transects With Sign	Number of Signs	Number of Transects Surveyed	Proportion of Transects With Sign
Black spruce mixedwood on mineral or thin peatland	3	2	0.50	0	2	-
Black spruce treed on mineral soil	52	16	0.31	6	16	0.19
Black spruce treed on riparian peatland	0	6	-	1	6	0.17
Black spruce treed on shallow peatland	1	20	0.05	2	20	0.05
Black spruce treed on thin peatland	45	24	0.29	1	24	0.04
Black spruce treed on wet peatland	5	8	0.25	0	8	-
Black spruce treed thin peatland	2	6	0.17	0	6	-
Broadleaf treed on all ecosites	10	1	1.00	0	1	-
Human infrastructure	0	1	-	0	1	-
Jack pine treed on mineral or thin peatland	6	12	0.08	1	12	0.08
Low vegetation on mineral or thin peatland	16	14	0.43	1	14	0.07
Low vegetation on riparian peatland	0	5	-	0	5	-
Low vegetation on shallow peatland	10	12	0.33	0	12	-
Low vegetation on wet peatland	0	2	-	0	2	-
Off-system marsh	0	1	-	0	1	-

Table C- 33: Distribution of Caribou Signs in Habitats on Generation Outlet Transmission Line Ground Tracking Transects by Visit Summer 2009

	Visit 1			Visits 2 and 3		
Habitat	Number of Signs	Number of Transects Surveyed	Proportion of Transects With Sign	Number of Signs	Number of Transects Surveyed	Proportion of Transects With Sign
Shallow water	0	1	-	0	1	-
Tall shrub on mineral or thin peatland	0	3	-	0	3	-
Tall shrub on riparian peatland	0	2	-	0	2	-
Tamarack- black spruce mixture on riparian peatland	0	2	-	0	2	-
Tamarack- black spruce mixture on wet peatland	0	1	-	0	1	-
Tamarack treed on shallow peatland	0	2	-	1	2	0.50

Table C- 34: Distribution of Caribou Photos and Tracking Data on Caribou Calving and Rearing Islands in Lakes and Peatland Complexes from the Keeyask Generating Station and Keeyask Infrastructure Project Monitoring Programs in the Project Study Area

Study	Year	Age of Caribou/Number of Islands Surveyed	Islands in Lakes	Islands in Peatland Complexes	Peatland Complexes
Trail Camera	2010	Adult	0	2	3
		Calf	0	0	0
		Total Surveyed	4	3	4
	2011	Adult	0	2	2
		Calf	0	0	0
		Total Surveyed	0	2	2
	All Years	Adult	0	3	3
		Calf	0	0	0
		Total Surveyed	4	4	4
Ground Tracking	2010	Adult	0	1	1
		Calf	0	0	0
		Total Surveyed	4	12	4
	2011	Adult	1	15	3
		Calf	1	5	2
		Total Surveyed	3	22	3
	All Years	Adult	1	15	4
		Calf	1	5	2
		Total Surveyed	4	29	5
All Studies	2010	Adult	0	3	3
		Calf	0	0	0
		Total Surveyed	4	12	4
	2011	Adult	1	15	3
		Calf	1	5	2
		Total Surveyed	3	22	3
	All Years	Adult	1	16	4
		Calf	1	5	2
		Total Surveyed	4	29	5

Table C- 35: Distribution of Moose Photos and Tracking Data on Caribou Calving and Rearing Islands in Lakes and Peatland Complexes from the Keeyask Generating Station and Keeyask Infrastructure Project Monitoring Programs in the Project Study Area

			Islands in Lakes	Islands in Peatland Complexes	Peatland Complexes
Trail Camera	2010	Moose Adult	3	1	2
		Moose Calf	1	0	0
		Total Surveyed	4	3	4
	2011	Moose Adult	0	0	2
		Moose Calf	0	0	1
		Total Surveyed	0	2	2
	All Years	Moose Adult	3	1	2
		Moose Calf	1	0	1
		Total Surveyed	4	4	4
Ground Tracking	2010	Moose Adult	2	1	1
		Moose Calf	2	1	1
		Total Surveyed	4	12	4
	2011	Moose Adult	2	15	3
		Moose Calf	1	7	2
		Total Surveyed	3	22	3
	All Years	Moose Adult	3	16	3
		Moose Calf	2	8	2
		Total Surveyed	4	29	5
All Studies	2010	Moose Adult	1	2	2
		Moose Calf	0	1	1
		Total Surveyed	4	12	4
	2011	Moose Adult	2	15	3
		Moose Calf	1	7	2
		Total Surveyed	3	22	3
	All Years	Moose Adult	4	17	3
		Moose Calf	2	8	2
		Total Surveyed	4	29	5

Table C- 36: Moose Browse Observed in Habitats on Construction Power Transmission Line Routes 1 and 2

Habitat Type	CP Route 1			CP Route 2		
	Number of Plots	Number of Observations of Browse	Proportion of Plots	Number of Plots	Number of Observations of Browse	Proportion of Plots
Black spruce mixedwood on mineral or thin peatland	0	0	-	4	1	0.25
Black spruce treed on mineral soil	3	0	-	1	1	1.00
Black spruce treed on riparian peatland	0	0	-	8	1	0.13
Black spruce treed on shallow peatland	69	2	0.03	13	3	0.23
Black spruce treed on thin peatland	55	6	0.11	26	6	0.23
Black spruce treed on wet peatland	3	0	-	2	1	0.50
Black spruce treed thin peatland	2	0	-	21	7	0.33
Broadleaf mixedwood on all ecosites	5	1	0.20	5	1	0.20
Broadleaf treed on all ecosites	0	0	-	5	2	0.40
Human infrastructure	49	1	0.02	0	0	-
Jack pine treed on mineral or thin peatland	18	0	-	9	5	0.56
Low vegetation on mineral or thin peatland	6	2	0.33	6	1	-
Low vegetation on riparian peatland	4	0	-	18	0	-
Low vegetation on shallow peatland	39	4	0.10	12	3	0.25
Low vegetation on wet peatland	5	0	-	5	3	0.60
Off-system marsh	0	0	-	0	0	-
Shallow water	1	0	-	0	0	-
Tall shrub on mineral or thin peatland	4	1	0.25	0	0	-
Tall shrub on riparian peatland	2	2	1.00	1	1	1.00
Tall shrub on shallow peatland	0	0	-	0	0	-
Tall shrub on wet peatland	3	1	0.33	0	0	-
Tamarack- black spruce mixture on riparian peatland	0	0	-	0	0	-
Tamarack- black spruce mixture on wet peatland	8	4	0.50	0	0	-
Tamarack treed on shallow peatland	18	2	0.11	3	1	0.33
Tamarack treed on wet peatland	7	1	0.14	0	0	-

Table C- 37: Moose Browse Observed in Habitats on Generation Outlet Transmission Line Route Alternative Options A, B, and C

Habitat Type	A			B			C		
	Number of Plots	Number of Observations of Browse	Proportion of Plots	Number of Plots	Number of Observations of Browse	Proportion of Plots	Number of Plots	Number of Observations of Browse	Proportion of Plots
Black spruce mixedwood on mineral or thin peatland	-	-	-	6	2	0.33	-	-	-
Black spruce treed on mineral soil	21	5	0.24	20	7	0.35	27	2	0.07
Black spruce treed on riparian peatland	1	-	-	-	-	-	1	1	1.00
Black spruce treed on shallow peatland	27	11	0.41	11	2	0.18	22	2	0.09
Black spruce treed on thin peatland	21	5	0.24	19	2	0.11	36	4	0.11
Black spruce treed on wet peatland	3	1	0.33	4	-	-	3	-	-
Black spruce treed thin peatland	-	-	-	10	-	-	10	3	0.30
Broadleaf treed on all ecosites	-	-	-	7	2	0.29	-	-	-
Human infrastructure	-	-	-	-	-	-	4	-	-
Jack pine treed on mineral or thin peatland	28	8	0.29	8	3	0.38	6	-	-
Low vegetation on	11	2	0.18	15	8	0.53	4	1	0.25

Table C- 37: Moose Browse Observed in Habitats on Generation Outlet Transmission Line Route Alternative Options A, B, and C

Habitat Type	A			B			C		
	Number of Plots	Number of Observations of Browse	Proportion of Plots	Number of Plots	Number of Observations of Browse	Proportion of Plots	Number of Plots	Number of Observations of Browse	Proportion of Plots
mineral or thin peatland									
Low vegetation on riparian peatland	-	-	-	7	1	0.14	6	-	-
Low vegetation on shallow peatland	15	-	-	5	-	-	3	1	0.33
Low vegetation on wet peatland	4	1	0.25	6	-	-	-	-	-
Off-system marsh	-	-	-	2	-	-	-	-	-
Shallow water	1	-	-	-	-	-	-	-	-
Tall shrub on mineral or thin peatland	1	-	-	1	1	1.00	3	1	0.33
Tall shrub on riparian peatland	1	-	-	2	-	-	-	-	-
Tall shrub on shallow peatland	-	-	-	1	-	-	-	-	-
Tamarack- black spruce mixture on riparian peatland	-	-	-	-	-	-	1	-	-
Tamarack- black spruce mixture on wet peatland	2	-	-	1	1	1.00	-	-	-