

4.0 EVALUATION OF ALTERNATIVE ROUTES AND OTHER INFRASTRUCTURE

4.1 ALTERNATIVE ROUTE EVALUATION

An evaluation of two options for Construction Power transmission line (CP) alternative routes (with the Keyask Construction Power Station and Unit Transmission lines) and four options for Generation Outlet Transmission lines (GOT) route alternative options (with the Keyask Switching Station and Radisson Converter Station upgrade) was completed by comparing route options and Project infrastructure locations with potentially sensitive mammal habitats. Table 4-1 compares the most sensitive site measures, which are calving islands and stream crossings associated with each of the proposed alternative routes and infrastructure. The potential to affect movements is also characterized.

Table 4-1: Matrix Table of Sensitive Sites and Other Factors Associated With Infrastructure Planned For the Construction Power and Transmission Lines and Associated Structures

Transmission Line	Option/ Structure	Stream Crossings	Calving and Rearing Islands Intersected	Calving and Rearing Islands within 1 km	Calving and Rearing Islands within 1 to 2 km	Calving and Rearing Islands within 2 km	Potential to Affect Movements
Construction Power	CP Route 1	5	0	9	17	26	Low
	CP Route 2	10	5	11	10	21	Low
	Keyask Construction Power Station	NA	0	1	12	13	Negligible
	Unit Transmission Lines	2	0	6	16	22	Low
Generation Outlet	GOT Route Alternative Option A	10	0	13	12	25	Low
	GOT Route Alternative Option B	14	0	15	11	26	Low

Table 4-1: Matrix Table of Sensitive Sites and Other Factors Associated With Infrastructure Planned For the Construction Power and Transmission Lines and Associated Structures

Transmission Line	Option/ Structure	Stream Crossings	Calving and Rearing Islands Intersected	Calving and Rearing Islands within 1 km	Calving and Rearing Islands within 1 to 2 km	Calving and Rearing Islands within 2 km	Potential to Affect Movements
Generation Outlet	GOT Route Alternative Option C	7	0	13	12	25	Low
	GOT Route Alternative Option D	8	0	3	21	34	Low
	Switching Station	NA	0	1	2	3	Negligible
	Radisson Converter Station	NA	0	0	0	0	None

4.1.1 Construction Power Transmission Line

The Construction Power transmission line would be built to tap the existing 138 kV line (KN 36) to feed the proposed Keyask Construction Power Station. The approximately 21 km-long line (see Map 1-1) would cross several streams and either black spruce treed on shallow peatland, black spruce treed on thin peatland, and low vegetation on mineral or thin peatland (Terrestrial Habitat, Ecosystems and Plants Technical Report), three common habitats in the Project Study Area. When comparing alternative routes, CP Route 1 would be approximately 20.5 km in length and would cross 5 streams or riparian areas while CP Route 2 would span approximately 21.5 km and would cross 10 streams or riparian areas.

4.1.1.1 Small Mammals

Riparian areas are typically more productive for small mammals and CP Route 2, which has more stream crossings, is expected to have a greater diversity of small mammal species. To minimize potential effects on small mammals, CP Route 1 is preferred. No little brown myotis hibernacula or roosting areas were observed along either route.

4.1.1.2 Aquatic Furbearers

More beaver lodges and muskrat push-ups were observed on CP Route 2 than CP Route 1 during aerial surveys for aquatic furbearers, indicating that the habitat along CP Route 2 could support a greater number of aquatic furbearers due to the greater number of stream crossings along CP Route 2 than along CP Route 1. To minimize potential effects on aquatic furbearers, CP Route 1 is preferred.

4.1.1.3 Terrestrial Furbearers

While no specific studies were done to assess the presence and abundance of terrestrial furbearer species in the Project Study Area, a number of species were detected during winter tracking studies. Signs of American marten, lynx, red squirrel, snowshoe hare, weasel, and fox (species unknown) activity were observed near both Construction Power transmission line alternative routes; neither route is preferred. Additionally, both routes would likely fall within the home range of a single wolverine. Due to the larger number of stream crossings on CP Route 2, CP Route 1 is slightly preferred to reduce potential Project-related effects on terrestrial furbearers.

4.1.1.4 Large Carnivores

Signs of gray wolf and black bear activity were found along both Construction Power transmission line routes; however, more gray wolf signs were found along CP Route 1. Given the large home ranges of both gray wolves and black bears, it is likely that the same individuals would be affected by either route, and therefore, neither route is preferred over the other.

4.1.1.5 Ungulates

Both ungulate species in the Project Study Area are VECs and are considered in Section 4.1.1.6 below.

4.1.1.6 Valued Environmental Components

Moose

In addition to lake and river shorelines, moose use islands in lakes and occasionally in peatland complexes in the Project Study Area for calving and rearing. Adults may also use these habitats for predator protection or summer thermal cover. Some of the potential calving and rearing islands within 2 km of CP Routes 1 and 2 were surveyed for moose presence (see Table 2-1). Not all of the potential habitat was occupied. Adult moose were found on two of the five potential calving and rearing islands bisected by CP Route 2 during field studies in the area. No islands are bisected by CP Route 1, and no moose activity was recorded in the calving and rearing complex traversed by this route. Nine islands are within 1 km of CP Route 1, two of which were

occupied by adult moose. Seventeen more islands are within 1 to 2 km of CP Route 1, one of which was occupied by adult moose. Ten islands are within 1 to 2 km of CP Route 2; moose adults and calves were observed on one.

Abundant signs of moose activity were found along CP Route 1 and CP Route 2. Either route is likely to enhance hunter and predator access to moose habitat and improve the line of sight when it is cleared. Because CP Route 1 will cross the fewest streams and calving and rearing islands, it is preferred to minimize potential effects on moose.

Caribou

Summer resident caribou use islands in lakes and in peatland complexes for calving and rearing. No islands are bisected by CP Route 1. Some of the calving and rearing islands within 2 km of CP Routes 1 and 2 were surveyed for caribou presence (see Table 2-1). Not all of the potential habitat was occupied. Nine islands are within 1 km of CP Route 1; caribou adults and calves were documented on one of these islands and adults were documented on another during field studies in the area. Two of the islands within 1 to 2 km of CP Route 1 were occupied by adult caribou. Signs of caribou adults and calves were observed on two of the islands bisected by CP Route 2, and an adult was photographed on another. Additionally, an adult caribou occupied one of the islands within 1 km of CP Route 2.

Signs of caribou activity were found along both routes during field studies. Caribou movements would likely be equally affected by either route based on their proximity to each other and their north-south orientation. Either route is likely to enhance hunter and predator access to caribou habitat and improve the line of sight when it is cleared. Caribou are widespread and few animals are expected to occur along either route. As such, neither is more likely than the other to affect caribou movements and mortality. Because CP Route 1 will cross the fewest calving and rearing islands, it is likely a better option to minimize potential effects on caribou.

4.1.1.7 Construction Power Transmission Line Preference for Mammals

Based on field studies, mapping, literature, and professional judgment, CP Route 1 is preferred from a mammal's perspective. CP Route 1 is marginally preferred for moose because potential moose habitat loss would be lower and there would be less fragmentation along the slightly shorter route. CP Route 1 is highly preferred from a caribou perspective because it would not cross any potential calving and islands compared with five islands on CP Route 2. Neither alternative is preferred for listed species; no site-specific habitat differences were observed for little brown myotis or wolverine. Wolverine tend to occupy large home ranges, and because the separation distance between the proposed alternatives is so small geographically, the alternate placement of CP Route 1 or 2 would make little difference concerning habitat or fragmentation effects. CP Route 1 is also the slightly preferred option for other mammals because it has fewer potential fragmentation effects as it is the shorter route, and because potential habitat loss and

access effects would be slightly less on CP Route 1 than on CP Route 2 because the diversity of mammals is somewhat lower and less riparian habitat would be crossed on CP Route 1 than on CP Route 2.

4.1.2 Keyask Construction Power Station

The proposed new 138 to 12.47 kV permanent wood-pole/steel transformer station will be located on the north side of the Nelson River (see Map 1–1) in a mostly burned area containing 1 to 2 m-high regenerated conifers. The transformer station will be built on a 2 ha site that will accommodate three transformer banks to supply the necessary power for construction of the Keyask Generating Station.

The site of the Keyask Construction Power Station is in a common habitat type and does not affect uncommon habitats, minimizing potential effects on small mammals, furbearers, large carnivores, moose, and caribou. No calving and rearing islands are in the immediate area. As the proposed power station site is limited in scope and scale and does not intersect any streams, it will not likely affect caribou movements. Because the site will likely have a small effect on mammals and their habitat, no alternative locations were assessed.

4.1.3 Unit Transmission Lines

Four 138 kV AC Unit Transmission lines will transmit power from the seven generators at the Keyask Generating Station to the Keyask Switching Station. The four lines, each approximately 4 km long, will be within a single corridor (see Map 1–1) and will form a 260 m-wide ROW. No alternative routes were identified for the Unit Transmission lines. Most of the affected habitat is black spruce treed on shallow peatland and black spruce treed on thin peatland, which are common in the Project Study Area (Terrestrial Habitat, Ecosystems and Plants Technical Report). It is anticipated that because the Unit Transmission lines will occur in the immediate area of the Keyask Generating Station, effects on mammal species will be negligible compared to those of the nearby generating station. Traffic on the south access road, which will connect the generating station with the community of Gillam, will also affect mammals in the footprint of the Unit Transmission lines.

4.1.4 Keyask Switching Station

A switching station is proposed south of the Nelson River to accommodate the new transmission lines (see Map 1–1). Power from the proposed Keyask Generating Station will be delivered to the Keyask Switching Station by four 138 kV Generation Outlet Transmission lines with steel-lattice towers (Keyask Transmission Project Environmental Assessment Report Section 2). Habitat at the site is predominantly needleleaf treed on peatland, which is common in the Project Study Area (Terrestrial Habitat, Ecosystems and Plants Technical Report) and areas near the site have been described as good moose habitat (Manitoba Hydro and Fox Lake

Cree Nation Core Elder and Resource User Group Keeyask Transmission Project Workshop June 13, 2012). No streams run through the site. There is one calving and rearing complex approximately 1 km northeast of the site, and a second calving area within 2 km. Because the site is about 1 km away from the nearest potential calving and rearing complex, its use by moose or caribou will not likely be affected. Because the switching station site itself is limited in scope and scale, it is highly unlikely to affect caribou movements in the area. As the site does not overlap uncommon habitat or calving and rearing habitat, potential effects on mammals will be minimal. As such, there is no need to assess an alternative switching station site.

4.1.5 Generation Outlet Transmission Lines

Manitoba Hydro is proposing to construct Generation Outlet Transmission lines from the Radisson Converter Station to the Keeyask Construction Power Station, as a source of backup power during construction of the Keeyask Generating Station (see Map 1–1). Once the generating station is complete, a portion of the KR1 from near the proposed Keeyask Switching Station to the Keeyask Construction Power Station will be salvaged, and KR1 will terminate at the Keeyask Switching Station. Two additional 138 kV transmission lines (KR2 and KR3) will be built from Radisson Converter Station to the new Keeyask Switching Station (Keeyask Transmission Project Environmental Assessment Report Section 2).

Habitat in the areas of the four GOT Route Alternative Options (A, B, C, and D) consists primarily of black spruce treed on thin peatland, black spruce treed on shallow peatland, and black spruce treed on mineral soil, which are all common in the Project Study Area (Terrestrial Habitat, Ecosystems and Plants Technical Report). Uncommon habitats include broadleaf treed on mineral soil, broadleaf treed on peatland, and tall shrub or low vegetation on mineral soil. GOT Route Alternative Option A crosses the most ($n = 14$) streams and GOT Route Alternative Option C crosses the fewest ($n = 7$; see Table 4-1). GOT Route Alternative Options B and C are the shortest of the four routes. No clear determination of a preferred route could be made based on results of field studies. Identification of the preferred Generation Outlet Transmission lines route was based on habitat characteristics in the Project Study Area and their importance to mammal communities.

4.1.5.1 Small Mammals

While no studies were conducted for small mammals along the proposed routes, incidental observations of small mammal signs were recorded opportunistically with winter mammal tracking surveys. No little brown myotis hibernacula or roosting areas were observed along either route. Riparian areas are typically more productive for small mammals and the route with more stream crossings may support larger small mammal communities. Based on the number of stream crossings, GOT Route Alternative Option C or D is marginally preferred for small mammals.

4.1.5.2 Aquatic Furbearers

Aerial surveys for aquatic furbearers indicated that beavers were most numerous along GOT Route Alternative Options A, B, and C, in descending order. In spring, the most muskrat push-ups were counted on GOT Route Alternative Option C and the fewest on GOT Route Alternative Option A. Signs of river otter activity were observed on GOT Route Alternative Options A, B, and C during ground tracking surveys. GOT Route Alternative C or D, with the fewest stream crossings, would likely have the smallest effect on river otter habitat. Because GOT Route Alternative Options C and D cross the fewest streams, they are slightly preferred for aquatic furbearers.

4.1.5.3 Terrestrial Furbearers

During ground tracking surveys, a greater diversity of terrestrial mammal species was observed on GOT Route Alternative Option C than on GOT Route Alternative Options A and B. As the shortest routes, GOT Route Alternative Options B and C would likely affect less terrestrial furbearer habitat than GOT Route Alternative Options A and D. The entire Project Study Area would likely fall within the home range of one or a few wolverine. GOT Route Alternative Options B and C are slightly preferred for wolverine, largely because the routes are shorter and follow existing human features. Based on species diversity and the length of the route, GOT Route Alternative Option B would be preferred from a terrestrial furbearer perspective.

4.1.5.4 Large Carnivores

Gray wolf and black bear activity was recorded on GOT Route Alternative Options A, B, and C during ground tracking surveys. The level of large carnivore activity was generally similar on each route, with one exception. More gray wolf signs were observed on GOT Route Alternative Option A than on GOT Route Alternative Options B and C in summer. Because large carnivores are wide-ranging and do not appear to favour particular habitat types, none of the routes are preferred.

4.1.5.5 Valued Environmental Components

Moose

Ground tracking surveys indicated varying levels of moose activity on the three alternative routes surveyed. The most moose signs were recorded on GOT Route Alternative Option C and the fewest on GOT Route Alternative Option A during summer ground tracking surveys. In winter, the reverse was true.

In addition to lake and river shorelines, moose use islands in lakes and occasionally, peatland complexes in the Project Study Area for calving and rearing. Adults may also use these habitats for predator protection or summer thermal cover. None of the four alternative routes intersects

potential calving and rearing islands. Some of the calving and rearing islands within 2 km of GOT Route Alternatives A through D were surveyed for moose presence (see Table 2-1). Adult moose were found on 1 of the calving and rearing islands within 1 km of GOT Route Alternative A during field studies in the area. Adult moose were observed on one of the islands within 1 km of GOT Route Alternative Option B and on one of the islands within 1 km of GOT Route Alternative Option C. Of the islands within 1 km of GOT Route Alternative D, adult moose were observed on two. Adult moose were observed on one of the islands within 1 to 2 km of GOT Route Alternative Option A, on one of the islands within 1 to 2 km of GOT Route Alternative Option B, on one of the islands within 1 to 2 km of GOT Route Option C, and in the peatland complex of 21 islands within 1 to 2 km of GOT Route Alternative Option D.

Recorded signs of moose activity appeared to be distributed evenly among the routes sampled. It is expected therefore, that all proposed routes will increase hunter and predator access to moose in the Project Study Area to some degree along the cleared ROW. However, GOT Route Alternative Option D follows pre-existing linear features including KN36, so new access would be minimized. GOT Route Alternative Options B and C will closely parallel the south access road and will therefore not create new access. GOT Route Alternative Option A is the only route that would create new access in a previously remote area. GOT Route Alternative Option D intersects one calving and rearing complex, in which moose have been observed. GOT Alternative Route D is slightly less preferred over Routes B and C because of the marginally wider sight-line created by this route that is expected to increase hunting opportunities. While none of the options would likely lead to large alterations in the distribution and abundance of local moose populations, GOT Route Alternative Options B and C are shortest, and are the preferred routes.

Caribou

Ground tracking surveys indicated varying levels of caribou activity on the three alternative routes surveyed. The most caribou signs were recorded on GOT Route Alternative Option C and the fewest on GOT Route Alternative Option A.

Summer resident caribou use islands in lakes and in peatland complexes for calving and rearing. None of the four routes intersects potential calving and rearing islands. Some of the calving and rearing islands within 2 km of GOT Route Alternatives A through D were surveyed for caribou presence (see Table 2-1) Adult caribou were found on two of the islands within 1 km of GOT Route Alternative A during field studies in the area. Adult caribou were observed on one of the islands within 1 km of GOT Route Alternative Option B and on one of the islands within 1 km of GOT Route Alternative Option C. Of the islands within 1 km of GOT Route Alternative D, adult caribou were observed on two. Adult moose were observed on one of the islands within 1 to 2 km of GOT Route Alternative Option A, on one of the 11 islands within 1 to 2 km of GOT Route Alternative Option B, on one of the 12 islands within 1 to 2 km of GOT Route Option C, and none were observed on the 21 islands within 1 to 2 km of GOT Route Alternative Option D.

Potential caribou migration corridors are generally widespread in the Keeyask region. However, GOT Route Alternative Option D, which is farthest south, would likely intersect the greatest number of migrating Pen Islands caribou most frequently. Although caribou would be distributed relatively equally by all of the routes, GOT Route Alternative Option D is the slightly less preferred option for this reason. All of the routes will increase hunter and predator access into the Project Study Area through the creation of cleared linear corridors. However, GOT Route Alternative Option D would marginally increase access along pre-existing linear features, GOT Route Alternative Options B or C would marginally increase access along the south access road, and GOT Route Alternative Option A would create new access in an area that does not have pre-existing linear features. The construction of an additional ROW adjacent to KN36 may increase available hunter sightlines such that the placement of this route could lead to proportionally higher numbers of migrating caribou being successfully hunted. GOT Route Alternative Options B and C will closely parallel the south access road and will therefore not create a new corridor for hunter and predator access. Hunting restrictions would apply adjacent to the road. For all of the above listed reasons, GOT Route Alternative Options B and C are the preferred routing options for caribou.

4.1.5.6 Generation Outlet Transmission Lines Preference for Mammals

Based on field studies, mapping, literature, and professional judgement, GOT Route Alternative Option B or C is moderately preferred over GOT Route Alternative Options A and D from a mammal's perspective because GOT Route Alternative Option B or C would have the fewest adverse Project effects on caribou and moose. GOT Route Alternative Options C and D, with the fewest stream crossings, are slightly preferred from an aquatic furbearer perspective. GOT Route Alternative Options B and C are moderately preferred from a caribou perspective because these shorter routes would disturb fewer caribou calving islands and result in the lowest habitat loss. GOT Route Alternative Options B and C are slightly preferred from a moose perspective because potential habitat loss and fragmentation effects would be lower on these shorter routes. Route Alternative Options B and C are slightly preferred for wolverine, largely because the routes are shorter and follow existing human features. No substantial little brown myotis habitat differences are apparent on any of the routes. GOT Route Alternative Options B and C are also the slightly preferred options for other mammals because they are the shorter routes, and potential habitat loss and access effects would be slightly less than on the other routes.

4.1.6 Radisson Converter Station Upgrades

The selected site for the Radisson Converter Station upgrades is currently located next to the Radisson Converter Station. Alternative sites were not provided for assessment. The Radisson Converter Station expansion is relatively small and appears to be contained within a previously

fenced-in and disturbed area. As such, only small and incremental mammal habitat effects are anticipated at this location.

4.1.7 Summary of Inputs

The construction of project components associated with the Keeyask Transmission Project is anticipated to only have minor potential impacts on local mammal populations, regardless of the location selected. However, where alternative routing options were available for specific project components, it was determined that CP Route 1 was preferred as it is most likely to minimize potential projects effects for moose and caribou. Similarly for the GOT Route Alternative Options, GOT Route Alternative Options B and C are considered as equally viable for mammal species including moose and caribou, when considering the alternate General Outlet Transmission Line routing options.

No options were considered for the Keeyask Switching Station, Keeyask Construction Power Station, Unit Transmission lines, and the Radisson Converter Station upgrades. These project components are relatively small compared to routing options considered for Construction Power and General Outlet transmission lines and are anticipated to have only minor effects on mammal species in the Project Study Area.

5.0 EFFECTS AND MITIGATION

5.1 OVERVIEW

This section considers potential effects of the Project based on the final preferred sites for each Project component. The selection process that resulted in the final preferred sites is described in Chapter 6 of the Keeyask Transmission Project Environmental Assessment Report. CP Route 1 was selected for the Construction Power transmission line. The preferred route for the Generation Outlet Transmission line followed GOT Route Alternative Option B for most of the approximately 14 km of line extending eastward from the Keeyask Switching Station; the remainder of the line extending to the Radisson Converter Station followed GOT Route Alternative Option C.

A range of effects on mammal species can be associated with the development of infrastructure related to the Project. Changes in species diversity and abundance occur through the anthropogenic development of habitat areas such that these areas are no longer able to sustain some species. Changes in habitat composition can also lead to increases in the abundance of other species, such as increases in white-tailed deer populations in southern Manitoba, which can lead to increased competition for resources between wildlife species where none existed before. Construction of Project components can lead to sensory disturbance and discourage species' use of habitats. Operation of Project components can lead to increased opportunities for harvesting species by hunting, trapping, and poaching. While these activities can occur in a sustainable manner with regulation or enforcement, if done in excess they can lead to local and potentially regional declines in some mammal populations.

In this assessment, particular attention was given to the potential effects of the Project on VECs. However, effects are also anticipated for non-VEC species. Species of cultural and economic importance, including beaver and muskrat, could be affected by the construction and operation of Project components if riparian habitat is affected or if considerably improved access leads to an increase in trapping. Potential effects on these species were mitigated by selecting transmission line routes to minimize the number of stream crossings and to avoid areas that have not yet been altered through large-scale anthropogenic development. Reducing access to previously undisturbed areas and minimizing effects on sensitive habitat areas will also likely reduce potential Project effects on mammal species, including VECs considered in more detail below.

Clearing, construction, operation, and maintenance of the Construction Power transmission line, Generation Outlet Transmission lines, Unit Transmission lines, Keeyask Construction Power Station, Keeyask Switching Station, and the Radisson Converter Station upgrades could affect moose and caribou directly and indirectly in three primary ways:

- Habitat loss and alteration;
- Sensory disturbance, disruption of movement, and habitat fragmentation; and
- Mortality.

Mammals are expected to experience a loss of habitat and change in habitat structure and composition through the clearing and construction of transmission lines and associated Project infrastructure. The effects of habitat alteration could have more pronounced effects on some species, such as caribou, than others, such as large carnivores.

Sensory disturbance and habitat fragmentation will likely affect mammals in the Project Study Area, and could result in disruption of movements. Sensory disturbance will likely be due to construction activities and traffic. Such disturbances could decrease the amount of effective habitat available for various species, as individuals disturbed by construction activities will avoid active construction zones. Avoidance of the area by wildlife is a concern for FLCN Members (Manitoba Hydro and Fox Lake Cree Nation Core Elder and Resource User Group Keeyask Transmission Project Workshop September 6, 2012). Sensory disturbance could also be due to transmission line maintenance during operation. Transmission line rights-of-way and access trails contribute to habitat fragmentation, which reduces core area size for mammals requiring large, undisturbed blocks of habitat. Fragmentation also influences ecosystem processes and species. Fragmentation effects are discussed in detail in the Terrestrial Habitat Ecosystem and Plants Technical Report. Sensory disturbance and habitat fragmentation could result in avoidance of the Project Study Area by mammals, disrupting their movements. Such disruptions could occur temporarily during construction or over a longer term due to the presence of transmission line rights-of-way and Project infrastructure.

Mammal mortality could occur as a result of improved access to the Project Study Area by hunters, trappers, and predators, and via accidents such as collisions with vehicles. Linear features including roads and transmission lines act as movement corridors for predators such as red fox and gray wolf, and improve access to formerly remote areas by resource users. Increased mortality of prey species and harvested animals could result from increased access to the Project Study Area. Improved hunting efficiency could benefit some predator species.

A literature review for potential effects related to general transmission line construction, operation, and maintenance activities was conducted, and where information was limited, information from similar projects and activities has been provided. Benchmarks and thresholds that were used to evaluate residual environmental effects were the same as for the Keeyask Generation Project EIS (Keeyask Hydropower Limited Partnership 2012).

Because the SSEA process was used to determine the ideal locations for Project infrastructure, it is expected that many potential negative effects will have been mitigated entirely or minimized for mammals including small mammals, aquatic furbearers, terrestrial furbearers, large

carnivores, and ungulates. In addition, clearing and construction activities will be limited to the winter months, reducing some environmental effects but potentially increasing others. Generally, construction-related effects should be minimal, as Manitoba Hydro's current fire protection practices, oil containment, and materials handling/spill response practices will be applied throughout the construction and operation phases (Environmental Protection Plan). Mitigation for accidents and malfunctions includes planned measures such as training in fire response protocols, and the presence of fire suppression equipment on site will reduce the extent of fire damage. Spill response programs and equipment will be in place for spillage or leaks of any oils or contaminants. All material will be stored and handled in accordance with established policies and regulations. Legislation and regulations will be followed for the transportation of dangerous goods, and on-site emergency response teams will receive training with respect to fuel spill containment, cleanup, and other emergency measures.

5.2 VALUED ENVIRONMENTAL COMPONENTS

5.2.1 Moose

5.2.1.1 Construction

Habitat loss and alteration is expected along the ROWs from the clearing of vegetation and construction of the Generation Outlet Transmission lines, Construction Power transmission line, and Unit Transmission lines. Moose will likely take advantage of the new forage regenerating on the ROW (Peek *et al.* 1976; Banfield 1987; Rempel *et al.* 1997; Coady 1982; Pattie and Hoffman 1990; Peek 2007), but winter and summer **thermal and snow interception cover** may be reduced in areas where trees are removed (Coady 1974; Peek *et al.* 1976; Demarchi and Bunnell 1993; Osko and Hilz 2004). Habitat loss is expected within the Keeyask Construction Power Station and Keeyask Switching Station footprints because moose will be excluded from the infrastructure.

Based on the results of a desktop habitat modelling exercise, the Construction Power transmission line footprint consists of 4.1% primary moose habitat and 83.2% secondary moose habitat (Table 5-1, Map 5-1). Because the footprint only encompasses an area of 755 ha, the amount of moose habitat lost is expected to be small.

Table 5-1: Moose Habitat (ha) Overlapped by Components of the Keeyask Transmission Project

	Coarse Habitat	CP Route 1	Unit Transmission Lines	GOT Route Alternative Option B	Keeyask Switching Station	Total
Primary Moose Habitat	Broadleaf mixedwood on all ecosites	0	0	4	0	4
	Broadleaf treed on all ecosites	0	0	11	0	11
	Jack pine mixedwood on mineral or thin peatland	0	0	8	0	8
	Jack pine treed on mineral or thin peatland	6	0	41	0	47
	Jack pine treed on shallow peatland	0	0	0	0	0
	Low vegetation on mineral or thin peatland	19	0	126	0.1	145
	Tall shrub on mineral or thin peatland	1	0.1	6	0	7
	Tall shrub on shallow peatland	0	0.1	1	0	1
	Tall shrub on wet peatland	5	0	3	0	8
	Total Primary Habitat	31	1.4	200	0.1	226
	Total Terrestrial Area	755	86	1,583	68	2,492
	Habitat: Terrestrial	4.1%	0.1%	14.1%	0.1%	10.2%
	Secondary Moose Habitat	Black spruce mixedwood on mineral or thin peatland	0	0	10	0
Black spruce treed on mineral soil		19	0.3	102	9	130
Black spruce treed on shallow peatland		311	46.0	339	35.3	731
Black spruce treed on thin peatland		181	21.1	501	21.6	725

Table 5-1: Moose Habitat (ha) Overlapped by Components of the Keeyask Transmission Project

	Coarse Habitat	CP Route 1	Unit Transmission Lines	GOT Route Alternative Option B	Keeyask Switching Station	Total
Secondary Moose Habitat	Black spruce treed on wet peatland	17	0	52	0	69
	Low vegetation on shallow peatland	85	4.4	164	1.7	255
	Low vegetation on wet peatland	15	0	47	0	62
	Total Secondary Habitat	628	71.8	1,215	67.6	1,978
	Total Terrestrial Area	755	86	1,583	68	2,492
	Habitat: Terrestrial	83.2%	83.5%	76.8%	99.4%	79.4%
	Total Moose Habitat	Total Secondary Habitat	659	67.4	1,415	67.6
Total Terrestrial Area		755	86	1,583	68	2,492
Habitat: Terrestrial		87.3%	78.5%	89.4%	99.6%	89.6%

The Keeyask Construction Power Station overlaps pre-existing human infrastructure and clearing associated with the construction of the north access road, thus no additional moose habitat will be lost.

The Unit Transmission lines footprint consists of 0.1% primary moose habitat and 83.5% secondary moose habitat. Because the footprint only encompasses an area of 86 ha, the amount of moose habitat altered is expected to be small.

The Generation Outlet Transmission lines footprint consists of 14.1% of primary moose habitat and 76.8% secondary moose habitat. Because the footprint only encompasses an area of 1,583 ha, the amount of moose habitat altered is expected to be small.

The Keeyask Switching Station footprint consists of 0.1% of primary moose habitat and 99.4% secondary moose habitat. Because the footprint only encompasses an area of 68 ha, the amount of moose habitat lost is expected to be small.

The Radisson Converter Station upgrades overlap pre-existing human infrastructure and clearing associated with current Radisson Converter Station site and consequently no moose habitat will be lost during construction.

Based on the overall results of habitat modelling, the Keeyask Transmission Project footprint consists of 10.2% of primary moose habitat and 79.4% secondary moose habitat. The total physical moose habitat altered or lost for all Project components encompasses an area of 2,492 ha, or approximately 4% of the Project Study Area. The effect of habitat loss (~0.5%) is expected to be small, compared with the amount of primary moose habitat available in the Moose Regional Study Area (465,018 ha).

Sensory disturbances (e.g., traffic, machinery) could result in a loss of effective habitat, temporary abandonment of calving habitat, and disruption of movements. Moose will be scared off by the activity (Manitoba Hydro and Fox Lake Cree Nation Core Elder and Resource User Group Keeyask Transmission Project Workshop June 13, 2012). Moose exhibit a high level of calving site fidelity and do not easily abandon suitable areas (RRCS 1994); often returning once the disturbance ends (Colescott and Gillingham 1998). Moose cows and calves were often reported by workers during the construction of the Wuskwatim Generating Station, and overall moose activity levels during construction remained high throughout the access road construction period, indicating that construction activity does not affect all moose (Wuskwatim Power Limited Partnership 2011). Disruption of moose movements could occur through the avoidance of the Construction Power transmission line, Keeyask Construction Power Station, Unit Transmission lines, Keeyask Switching Station, and Generation Outlet Transmission lines sites during construction. Moose occasionally move across or along linear features, even during construction (Wuskwatim Power Limited Partnership 2011). Because moose do not easily abandon habitat due to sensory disturbance, and are likely to return when the disturbance ends, the effects of sensory disturbance and disruption of movements on moose in the Project Study Area are expected to be negligible to small.

Other Project effects on moose could include increased mortality hunting and predation, as the newly created ROW will allow for additional access into areas not previously accessible, possibly resulting in the reduction of a population (Coady 1982). Hunters include workers and local resource users. Increased site lines especially on wider ROWs such as the Generation Outlet Transmission lines, and more efficient movement of predators such as gray wolves could also contribute to moose mortality (Jalkotzy 1997). Gray wolves use cleared linear corridors as transportation routes and in order to hunt more efficiently (James and Stuart-Smith 2000). Similarly, potential effects will likely be reduced due to sensory disturbances by people, construction, and traffic during construction. With mitigation and the regulation and monitoring of moose harvest by Manitoba Conservation and Water Stewardship, the moose harvest will not likely exceed sustainable limits and is expected to have a negligible effect on the regional moose population.

Potential Project effects on moose also include mortality due to wildlife-vehicle collisions. The number of collisions with vehicles could increase due to increased traffic levels during construction. Wildlife-vehicle collisions can be influenced by adjacent habitats (Dussault *et al.* 2007; Christie and Nason 2004) as moose use certain habitats more than others. Due to the

existing terrain along the ROW and cautionary speed limits, the risk of collisions is very low. While vehicles may occasionally collide with moose, particularly on the south access road, due to increased local construction traffic, such events are uncommon and will likely have a negligible effect on the regional moose population.

Mitigation measures for moose during construction include:

- An Access Management Plan will be developed for the Keeyask Transmission Project to reduce the effects of moose mortality from increased access and harvest in the Project Study Area;
- Vegetation buffers will be established on the transmission line ROWs as practicable to reduce the line of sight between hunters and moose;
- Firearms will be prohibited in camps and at work sites to reduce mortality due to hunting during construction; and
- Information about wildlife awareness will be provided for workers to reduce vehicle speeds and the risk of wildlife-vehicle collisions.

5.2.1.2 Operation

Potential Project effects on moose during operation include habitat alteration. No additional loss of moose habitat is expected during operation; however, vegetation on the ROW is expected to stabilize into low-growth plant communities over time. Periodically, these ROWs will require vegetation maintenance to maintain the low-growth plant communities, and this will alter habitat. Shrubland habitat types are favourable to moose for foraging (Richard and Doucet 1999) and moose will likely take advantage of the regenerating forage on the ROW (Peek *et al.* 1976; Banfield 1987; Rempel *et al.* 1997; Coady 1982; Pattie and Hoffman 1990; Peek 2007). This could result in a small increase in moose feeding habitat along the ROW (see Map 5–1); however, thermal cover could be reduced in some areas (Osکو and Hilz 2004) over the long-term. The overall quality of moose habitat in the Project Study Area is not anticipated to change.

Potential Project effects on moose during operation also include sensory disturbance, disruption of movements, and habitat fragmentation. Annual inspections of the Construction Power transmission line, Unit Transmission Lines, and the Generation Outlet Transmission lines by ground or by air could disturb moose; however, such events will be brief and infrequent. Maintenance activities follow well-established guidelines (Keeyask Transmission Project Environmental Assessment Report Section 2), and effects of sensory disturbance on the regional moose population are expected to be negligible. Moose movements in the area could be disrupted due to habitat fragmentation and the presence of Project infrastructure. Moose are resilient to development features on the landscape (Laurian *et al.* 2008) and often use edge habitat (Dussault *et al.* 2005). As such, disruption of moose movements by the transmission line ROWs will likely be negligible.

Other Project effects on moose could include increased mortality. The cleared transmission line ROWs will likely increase hunter and predator access into the Project Study Area, which can result in increased moose mortality. Species such as gray wolves have been shown to use cleared linear corridors as transportation routes and in order to hunt more efficiently (James and Stuart-Smith 2000). Similarly, hunters can use clearings to access areas that were previously inaccessible. With mitigation, including the continued regulation and monitoring of moose harvest by Manitoba Conservation and Water Stewardship, the moose harvest will not likely exceed sustainable levels and is expected to have a negligible effect on the regional moose population. Collisions with vehicles could increase if moose are attracted to the Generation Outlet Transmission lines ROW adjacent to the south access road. While vehicles may occasionally collide with moose, such events are uncommon and will likely have a negligible effect on the local moose population.

Mitigation measures for moose during operation include:

- ROW access trails will be decommissioned, unless required for on-going maintenance, to minimize access-related effects from harvest and predation;
- If moose mortality is greater than anticipated, warning signs will be placed along the south access road near high-quality moose habitats to reduce the potential of wildlife-vehicle collisions; and
- The use of helicopters for maintenance activities on the transmission lines will be avoided near calving habitat from May 15 to June 30, to reduce effects of sensory disturbance on calving females and their young.

5.2.2 Caribou

5.2.2.1 Construction

Potential Project effects on caribou during construction include habitat loss or alteration (Table 5-2, Map 5–2). Based on the results of a desktop habitat modelling exercise, the Construction Power transmission line footprint consists of 74% caribou winter habitat. As the footprint only encompasses an area of 755 ha, the actual amount of winter habitat lost is expected to be small. No potential calving and rearing islands will be intersected by the Construction Power transmission line ROW (see Section 4.1.1.6).

Table 5-2: Caribou Winter Habitat (ha) Overlapped by Components of the Keeyask Transmission Project

Coarse Habitat	CP Route 1	Unit Transmission Line	GOT Route Alternative Option B	Keeyask Switching Station	Total
Black spruce treed on mineral soil	19	0.3	102	9	130
Black spruce treed on shallow peatland	311	46.0	339	35.3	731
Black spruce treed on thin peatland	181	21.1	501	21.6	725
Black spruce treed on wet peatland	17	0	52	0	69
Jack pine treed on mineral or thin peatland	6	0	41	0	47
Jack pine treed on shallow peatland	0	0	0	0	0
Tamarack- black spruce mixture on wet peatland	3	0	15	0	18
Tamarack treed on shallow peatland	11	7.7	24	0.3	43
Tamarack treed on wet peatland	14	0	2	0	16
Total Winter Habitat	562	75.1	1,076	66	1,791
Total Terrestrial Area	755	86	1,583	68	2,492
Habitat:Terrestrial	74%	87%	68%	98%	71%

The Keeyask Construction Power Station overlaps pre-existing human infrastructure and clearing associated with the construction of the north access road, thus no additional caribou habitat will be lost.

The Unit Transmission lines footprint consists of 87% of caribou winter habitat. As the footprint only encompasses an area of 86 ha, the amount of caribou winter habitat lost is expected to be small. No calving and rearing complexes are intersected by the Unit Transmission lines ROW.

The Generation Outlet Transmission lines footprint consists of 68% caribou winter habitat. As the footprint only encompasses an area of 1,583 ha, the amount of caribou habitat lost is expected to be small. No calving and rearing islands are intersected by the Generation Outlet Transmission lines ROW.

The Keeyask Switching Station footprint consists of 98% caribou winter habitat. As the footprint only encompasses an area of 68 ha, the amount of caribou habitat lost is expected to be small. No calving and rearing islands are in the Keeyask Switching Station footprint.

The Radisson Converter Station upgrades overlap pre-existing human infrastructure associated with the current Radisson Converter Station site and consequently no caribou habitat will be lost during construction.

Based on the overall results of habitat modelling, the Keeyask Transmission Project footprint consists of 71% caribou winter habitat. The total physical caribou winter habitat altered or lost for all components of the Keeyask Transmission Project encompasses an area of 1,791 ha, or approximately 3% of the Project Study Area. The effect of habitat loss (~0.2%) is expected to be small, compared with the amount of caribou winter habitat available in Zone 5 (849,079 ha).

Sensory disturbances from traffic, machinery, and people will likely result in avoidance of some winter habitat by caribou and disruption of movements. Habitat avoidance or temporary abandonment could result near construction activity (Shideler *et al.* 1986; Dyer *et al.* 2001). Caribou activity will likely decline within 2 km of construction zones (Wuskwatim Power Limited Partnership 2011), resulting in a loss of effective habitat. Individuals that move away from affected winter habitat will most likely find suitable habitat elsewhere in the Caribou Regional Study Area (Shideler *et al.* 1986; Dyer *et al.* 2001), and the overall effect of sensory disturbance will likely be negligible to small. Because clearing and most construction activities for the Construction Power transmission line, Unit Transmission lines, and Generation Outlet Transmission lines are expected to occur in winter, caribou calving activities will not be affected. Some calving island disturbance is expected for three potential calving and rearing islands located within 2 km of the Keeyask Switching Station. Calving will not be affected by construction sensory disturbances at the Keeyask Construction Power Station or at the Radisson Converter Station upgrade site because there is no calving habitat nearby.

Caribou mortality can be caused by factors including hunting, predation, and collisions with vehicles. During construction of the Construction Power transmission lines, Keeyask Construction Power Station, Unit Transmission lines, Keeyask Switching Station, and Generation Outlet Transmission lines, temporary access to each site will be developed along winter roads on, or in some cases immediately adjacent to, construction sites, increasing winter access and traffic. Hunting and predation could increase in the Project Study Area, as the Project will allow for additional access into areas not previously accessible (Nellemann *et al.* 2001). Species such as gray wolves use linear features to travel and to hunt (James and Stuart-Smith 2000). Greater hunting efficiency and a potential influx of predators could increase caribou mortality, which is a threat to some caribou populations (Environment Canada 2011). Increased site lines, especially on wider ROWs such as the Generation Outlet Transmission lines, and efficient movement for predators such as wolves may also contribute to caribou mortality (James and Stuart-Smith 2000). However, data from the Bipole III Transmission

Project suggest that caribou mortality due to predation is more common in burned habitat than on transmission line ROWs, and that population growth rates in disturbed areas are similar to those in remote unfragmented areas (Manitoba Hydro 2012).

Effects of improved access to the area could also include increased mortality due to hunting. Hunters could use the transmission line ROWs to access areas that were previously inaccessible. However, the Project Study Area overlaps only a small portion of Game Hunting Area 3, the area where licensed caribou hunting is permitted, and the limited number of resident licences available for caribou harvest is managed by the Province. The potential increase in caribou mortality due to workers hunting will be managed and the overall effect will likely be neutral. Domestic harvest could occur during construction, although with disturbances in the area, these locations are unlikely used by either caribou or hunters.

During construction, there is the potential for caribou collisions with construction vehicles traveling along the south access road and the ROWs. Collisions with vehicles are not generally considered an important source of caribou mortality (Jalkotzy *et al.* 1997; Environment Canada 2011) and due to the existing terrain along the ROW and cautionary speed limits, the risk of collisions is very low. Effects of mortality due to collisions with vehicles on the regional caribou population will likely be small and should be negligible with mitigation.

Mitigation measures for caribou during construction include:

- Borrow areas will be sited to avoid calving and rearing complexes and reduce habitat loss;
- Access roads will be routed to avoid calving and rearing complexes and reduce loss of effective habitat;
- An Access Management Plan will be developed for the Keeyask Transmission Project to reduce the effects on caribou mortality from increased access and harvest in the Project Study Area;
- Firearms will be prohibited in camps and at work sites to reduce mortality due to hunting during construction; and
- Warning signs will be placed along the access roads near caribou travel corridors and high-quality habitats to reduce the potential of wildlife-vehicle collisions.

5.2.2.2 Operation

Potential Project effects on caribou during operation include habitat alteration. No additional caribou habitat loss is expected during operation; however, vegetation on the Construction Power transmission line, Unit Transmission lines, and Generation Outlet Transmission lines ROWs is expected to stabilize into low-growth plant communities over time. Periodically, these ROWs will require vegetation maintenance to maintain the low-growth plant communities, and this will alter habitat.

Potential Project effects on caribou during operation also include sensory disturbance, habitat fragmentation, and disruption of movements. Line maintenance activities in spring could disturb females and their young during the calving period. A total of 26 potential calving and rearing islands occur with 1 km of the Construction Power transmission line, Unit Transmission lines, and Generation Outlet Transmission lines ROWs and an additional 39 islands occur within 1 to 2 km of them. Because line maintenance activities will be infrequent and short-term, effects of sensory disturbance on caribou will likely be negligible. Habitat fragmentation can affect the quality of caribou habitat and caribou movements throughout their ranges (Environment Canada 2011) (Map 5–3), particularly for summer residents and Pen Islands coastal caribou, which are the two main types of caribou found in the Project Study Area. Human developments can create barriers to caribou movements (Smith *et al.* 2000; Dyer *et al.* 2001; Sorenson *et al.* 2008). However, past projects including the Wuskwatim Transmission Line have had minimal to no effect on caribou movements or their use of core areas (Manitoba Hydro 2012). It is likely that caribou will continue to cross the ROWs in the long-term, but a small loss of effective habitat near the Construction Power transmission line, Keeyask Construction Power Station, Unit Transmission lines, Keeyask Switching Station, and the Generation Outlet Transmission lines is expected as a result of Project operations.

The cleared linear corridor will likely increase hunter and predator access into the Project Study Area, which could result in increased caribou mortality. Species such as gray wolves use cleared linear corridors for more efficient transportation and hunting (James and Stuart-Smith 2000). Similarly, hunters can use clearings to access areas that were previously inaccessible. Periodic influxes of coastal caribou into the area would likely result in a greater harvest. With mitigation, including the continued regulation and monitoring of caribou harvest by Manitoba Conservation and Water Stewardship, the caribou harvest will not likely exceed sustainable levels and is expected to have a negligible effect on the regional caribou population.

Mitigation measures for caribou during operation include:

- ROW access trails will be decommissioned, unless required for on-going maintenance, to minimize access-related effects from harvest and predation;
- Manitoba Hydro will work with Manitoba Conservation and Water Stewardship to maintain previously developed access control and hunter related signage in order to prevent excessive hunting;
- The use of helicopters for maintenance activities on the transmission lines will be avoided near calving habitat from May 15 to June 30, to reduce effects of sensory disturbance on calving females and their young; and,

- A plan is being developed to coordinate caribou mitigation and monitoring activities among Manitoba Hydro's northern developments, as well as with government authorities and existing caribou committees and management boards.

5.3 OTHER MAMMALS

5.3.1 SMALL MAMMALS

Small mammals are expected to experience limited habitat loss from clearing and sensory disturbance during construction, including roosting habitat for little brown myotis. Some roosting habitat may be created in temporary buildings set up for construction. Small mammals are expected to find suitable habitat throughout the Small Mammals Regional Study Area. Some small mammal mortality could occur during clearing of the rights-of-way.

During operation, no additional habitat will be lost. As vegetation regenerates along the Construction Power transmission line, Unit Transmission lines, and Generation Outlet Transmission lines ROWs, new habitats will be created and used by small mammals. New small mammal communities will develop on the ROWs and along edges. Habitats with low-growth vegetation will be dominated by species that do not require forest canopy cover (e.g., meadow vole). No additional roosting opportunities are expected to be created for little brown myotis; however, edge habitat along the ROW may allow for increased feeding opportunities.

Mitigation measures for small mammals include:

- Organic material removed from temporarily cleared areas will be replaced to encourage re-growth of native vegetation and reduce habitat loss; and
- Construction camps and marshalling yards will be kept clean and free of garbage so as to not attract wildlife to the site.

5.3.2 AQUATIC FURBEARERS

Aquatic furbearers are expected to experience minor habitat loss from clearing and sensory disturbance during construction, as relatively few streams will be crossed by the Construction Power transmission line, Unit Transmission lines, and Generation Outlet Transmission lines ROWs. Additionally, some beaver may be removed from dammed stream crossings to facilitate clearing and construction. Aquatic furbearers are expected to find suitable habitat throughout the Furbearers Regional Study Area.

During operation, no additional habitat loss is expected. As vegetation regenerates along the ROWs, new browse is likely to be created for beaver. While some new access may be created for trappers, trapping pressure is not expected to increase substantially, as a limited number of

registered traplines overlap the Project Study Area. The effects of trapping on aquatic furbearers are expected to be small in magnitude.

Mitigation measures for aquatic furbearers include:

- A 100 m buffer will be retained, where practical, around lakes, wetland, and creeks to minimize habitat loss for aquatic furbearers.

5.3.3 TERRESTRIAL FURBEARERS

As with moose and caribou, terrestrial furbearers are expected to experience some habitat loss and sensory disturbance during construction. Terrestrial furbearers are expected to find suitable habitat throughout the Furbearers Regional Study Area. In addition, some terrestrial furbearers such as red fox and arctic fox could become habituated to people if food and garbage are not properly managed. These potential effects are likely manageable with mitigation. Given the large home range of a single wolverine, it is unlikely that construction will have a measureable effect on the wolverine population.

During operation, no additional habitat loss is expected. As vegetation regenerates along the ROW, hunting opportunities may be created as small mammal populations begin to use habitat along the ROW. While some new access may be created for trappers, it is unlikely that trapping pressure will increase in any considerable amount because a limited number of registered traplines overlap the Local Study Area. The effects of trapping on terrestrial furbearers are expected to be small in magnitude. Finally, given the large home range as a single wolverine, it is unlikely that operation of the Project will have a measureable effect on wolverine.

Mitigation measures for terrestrial furbearers include:

- ROW access trails will be decommissioned where practical to minimize access-related effects such as harvest; and,
- Construction camps and marshalling yards will be kept clean and free of garbage so as to not attract wildlife to the site.

5.3.4 LARGE CARNIVORES

Large carnivores are expected to experience some habitat loss and sensory disturbance during construction, possibly at black bear and gray wolf dens. Large carnivores are expected to find suitable habitat throughout the Large Carnivores Regional Study Area. Other effects during construction include the potential for black bear to become habituated to people if food and garbage are not properly managed.

During operation, no additional habitat loss is expected. The creation of new linear corridors could facilitate movement and increase hunting efficiency for gray wolves, although

decommissioning access trails where feasible will reduce this effect. Predator movements could become more frequent if snowmobiles are used on the Construction Power transmission line, Unit Transmission lines, and Generation Outlet Transmission lines ROWs for travel. The density of gray wolves in the Project Study Area is not expected to change because there is likely not enough caribou and moose biomass in the Project Study Area to support a dense predator population (Keeyask Hydropower Limited Partnership 2012). Because large carnivores occupy large home ranges, it is unlikely that operation of the Project will have a measureable effect on their populations.

Mitigation measures for large carnivores include:

- ROW access trails will be decommissioned where practical to minimize access-related effects;
- Firearms will be prohibited in camps and at work sites to reduce large carnivore mortality due to hunting during construction;
- Construction camps and marshalling yards will be kept clean and free of garbage so as to not attract wildlife to the site; and,
- Where possible, 100 m buffers will be established around active gray wolf and black bear dens within the project footprint to minimize the disturbance of animals during sensitive periods.

5.3.5 UNGULATES

Moose and caribou are the only ungulates in the Project Study Area. Effects for these VECs are described in Sections 5.2.1 and 5.2.2.

5.4 RESIDUAL EFFECTS

After mitigation, the Project is not expected to have significant adverse residual effects on mammal populations or their habitats. Predicted long-term residual effects include the following:

- Small alteration of habitat for caribou and moose along the Construction Power transmission line, Unit Transmission lines, Generation Outlet Transmission lines, and a small, long-term loss of habitat at the Keeyask Construction Power Station and Keeyask Switching Station;
- Small avoidance of Project infrastructure by caribou resulting in a loss of effective habitat;
- Periodic sensory disturbance effects to caribou and moose during operation resulting in small behavioural changes; and
- A small increase in regional access for predators and hunters resulting in a small increase in moose and caribou mortality.

These effects can be observed during the construction and operations phases of the Project. It is expected that Project activities will be reversible, as over time, biophysical disturbances due to the Project will be reversed by the natural succession of vegetation. Residual effects are expected to be of small magnitude after applying mitigation measures.

Table 5-3: Residual Effects of Keeyask Transmission Project Components

Potential Effect	Project Phase	Mitigation	Residual Effect	Assessment Characteristics
Moose				
Habitat loss and alteration	Construction & Operation	-routing of project components -rehabilitation of affected areas where possible	Decreased moose population in the Project Study Area for two or more generations due to reduced habitat and increased mortality	Step 1: Direction: Adverse Magnitude: Small Geographic Extent: Small Duration: Long-term
Sensory disturbance, disruption of movement, and habitat fragmentation	Construction & Operation	-construction activities to occur in winter to avoid calving	Altered movements due to sensory disturbance	Step 2: Not Required
Mortality due to predation, hunting and wildlife-vehicle collisions	Construction & Operation	-vegetation buffers on the ROW -prohibition of firearms in camp -warning signs along roadsides -decommissioning of trails used during construction		
Caribou				
Habitat loss and alteration	Construction & Operation	-routing of project components -rehabilitation of affected areas where possible	Decreased caribou population in the Project Study Area for two or more generations due to habitat alteration and increased mortality	Step 1: Direction: Adverse Magnitude: Small Geographic Extent: Small Duration: Long-term
Sensory disturbance, disruption of movement, and fragmentation	Construction & Operation	-construction activities to occur in winter to avoid calving	Altered movements and distributional shifts due to sensory disturbance	Step 2: Not Required
Mortality due to predation, hunting and wildlife-vehicle collisions	Construction & Operation	-prohibition of firearms in camp -warning signs along roadsides -decommissioning of trails used during construction		

Table 5-4: Residual Effects of the Keeyask Transmission Project by Project Component

VEC	Project Component	Phase	Residual Effects	Assessment
Moose	Construction Power and General Outlet Transmission	Operation	Increased hunter and predator access along cleared ROWs	Direction: Adverse Magnitude: Small Geographic Extent: Small Duration: Long-term
	All project components	Construction & Operation	Increased potential for animal-vehicle collisions based on higher traffic levels	Direction: Adverse Magnitude: Small Geographic Extent: Small Duration: Long-term
	All project components	Construction & Operation	Decline in moose population in the Project Study Area for two or more generations due to reduced habitat and ongoing habitat disturbances	Direction: Adverse Magnitude: Small Geographic Extent: Small Duration: Short-term
	All project components	Construction	Altered movements and distributional shifts within the Project Study Area due to sensory disturbances	Direction: Adverse Magnitude: Small Geographic Extent: Small Duration: Short-term
Caribou	Construction Power and General Outlet Transmission	Operation	Increased hunter and predator access along cleared ROWs	Direction: Adverse Magnitude: Small Geographic Extent: Small Duration: Long-term
	All project components	Construction & Operation	Increased potential for animal-vehicle collisions based on higher traffic levels	Direction: Adverse Magnitude: Small Geographic Extent: Small Duration: Long-term

Table 5-4: Residual Effects of the Keeyask Transmission Project by Project Component

VEC	Project Component	Phase	Residual Effects	Assessment
Caribou	All project components	Construction & Operation	Decline in caribou population in the Project Study Area for two or more generations due to reduced habitat and ongoing habitat disturbances	Direction: Adverse Magnitude: Small Geographic Extent: Small Duration: Short-term
	All project components	Construction	Altered movements and distributional shifts within the Project Study Area due to sensory disturbances	Direction: Adverse Magnitude: Small Geographic Extent: Small Duration: Short-term

5.5 INTERACTIONS WITH OTHER PROJECTS

The assessment of cumulative effects requires that adverse residual effects resulting from the Keeyask Transmission Project be evaluated for interactions with reasonably foreseeable future projects and human activities. The effects past and current projects and activities were described in part in the preceding sections as a component of the residual effects assessment for each VEC, and are evaluated further in this section.

Future projects that are considered in evaluating the residual effects of the Keeyask Transmission Project include:

- Development of the Keeyask Generation Project
- Development of the Bipole III Transmission Project
- Development of the Conawapa Generation Project and;
- Gillam Redevelopment.

5.5.1 Moose

5.5.1.1 Effects of Past and Current Projects and Activities

Effects of past and present projects on moose include habitat alteration and increased mortality from resource harvesting and predator access along existing linear features including roads,

railway lines and trails. Prior to hydroelectric development, moose occurred between Split Lake and what is now Stephens Lake. Shoreline habitat loss and fluctuating water levels resulted in a decrease in the number of moose present, resulting in resource users tending to travel further during harvest. At present, moose appear to be common, widely distributed, and clustered in the Project Study Area, and the regional population appears to be increasing. Concerns have been expressed about the sustainability of moose populations, and as part of the Keeyask Generation Project TCN is preparing a Moose Harvest Sustainability Plan to guide the management of their Adverse Effects Agreement Access Program.

5.5.1.2 Cumulative Effects of the Project with Past and Current Projects and Activities

The main residual effects of the Project on moose in combination with past and current projects are a decreased population and altered movements. Moose abundance, distribution, and movements are likely to change during construction, primarily as a result of sensory disturbance from construction. It is highly likely that Project effects on moose will be negligible to small in the Project Study Area. Small changes in habitat are expected given the small footprint of the project and that moose will use the ROW to move and forage. Reduced habitat and increased mortality from increased hunter and predator access are expected to result in a minor decrease in the moose population in the Project Study Area for two or more generations. Gray wolf numbers are expected to change in response to changes in the moose population. Finally, a small change in cumulative effects measures, including intactness and fragmentation, is expected as a result of the Project. As part of the Keeyask Generation Project, TCN has prepared a Moose Harvest Sustainability Plan to guide the management of their Adverse Effects Agreement Access Program to ensure the sustainability of the moose population in the Split Lake Resource Management Area. The province is responsible for managing licensed harvest while recognizing the priority of Aboriginal harvesting rights. Therefore, only a small cumulative effect is anticipated for the regional moose population.

5.5.1.3 Cumulative Effects of the Project with Future Projects and Activities

Residual Project effects on moose are expected to overlap with the effects of reasonably foreseeable future projects including the Conawapa Generation Project, Bipole III Transmission Project, Keeyask Generation Project, and Gillam redevelopment. Although the Split Lake Resource Management Area moose population appears to be secure, recent declines in the abundance of moose in western and eastern Manitoba have occurred, where it is thought that access and harvesting are the main issues affecting these moose. Although minor changes including habitat alteration are likely to occur with each project, access issues and sustainable moose harvest are of particular concern. As part of the Keeyask Generation Project, TCN is preparing a Moose Harvest Sustainability Plan to guide the management of their Adverse Effects Agreement Access Program to ensure the sustainability of the moose population in the

Split Lake Resource Management Area. The province is responsible for managing licensed harvest while recognizing the priority of Aboriginal harvesting rights.

5.5.2 Caribou

5.5.2.1 Effects of Past and Current Projects and Activities

Effects of past and present projects on caribou include habitat alteration and increased mortality from resource harvesting and predator access along linear features. Habitat alteration and access effects from past and present developments (e.g., hydroelectric development, linear developments) can depress populations that are periodically in decline from increased predation, and potentially from harvest over the entire migratory caribou range. Concerns have been expressed about the disappearance of large caribou herds in the region since the 1950s, and the limited return of caribou beginning in about the early 1990s and continuing today. Recent declines in migratory caribou and the sustainability of their populations are of further scientific concern.

Caribou have recently returned to the area and occasionally mix in the Project Study Area. Local First Nations distinguish a small group of woodland caribou from migratory barren-ground and coastal caribou herds in the Project Study Area. Summer resident caribou remain in the Project Study Area to calve, and are conservatively estimated to number 20 to 50 individuals in an area slightly broader than the Project Study Area that includes island habitat in Stephens Lake, however the long-term trend of this group of animals is unclear. The Qamanirjuaq barren-ground caribou population, which infrequently migrates into the Project Study Area, has declined since the 1980s (e.g., Beverly and Qamanirjuaq Caribou Management Board 2002; Campbell *et al.* 2010; Beverly and Qamanirjuaq Management Board 2011), while the Cape Churchill coastal caribou herd has increased in size since 2007 (e.g., Abraham *et al.* 2012b; Manitoba Hydro 2012). The Pen Islands coastal caribou herd increased from the late 1970s to the mid-1990s, when it was estimated at 10,800 individuals (Abraham and Thompson 1998), and has since declined to approximately 10,000 individuals (Manitoba Conservation and Water Stewardship 2012c). Local First Nations are concerned about past and present habitat loss, fragmentation, predation, harvest, changes in movement patterns, and accidental mortality of summer resident caribou attributed to development.

5.5.2.2 Cumulative Effects of the Project with Past and Current Projects and Activities

Past and current project effects have resulted in regional habitat loss and alteration but most of these changes are limited to habitat affected by flooding along the Nelson River. The main residual effects of the Project on migratory caribou in combination with past and current projects are localized altered movements due to habitat fragmentation and sensory disturbance, and decreased populations due to increased mortality. Given the large ranges of migratory caribou

that only periodically occur in Keeyask region, the effects of altered movements and mortality on these animals are considered negligible to small. Most effects of the Project will be negligible to small and affect two or more generations.

Summer resident caribou abundance, distribution, and movements are likely to be altered by the Project during construction and operation, primarily because of sensory disturbance near calving and rearing complexes. Small changes in habitat are expected compared to its regional availability and use by caribou. Predator hunting efficacy is predicted to change slightly as predators move along new linear features. Resource harvesting is not expected to change as there are currently numerous access corridors in the Project Study Area, and where the transmission lines are not expected to contribute substantially to access effects. Therefore, only a negligible to small cumulative effect for local caribou populations is anticipated from the Project in combination with past and present projects.

Scientific uncertainty exists where human disturbance could exacerbate long-term natural changes in populations and habitat, and where these on-going effects could be affected by climate change, could reduce habitat availability and limit abundance in caribou ranges. Local First Nations predict that with more development, caribou will most likely disappear from the area and not return for a very long time. There is further concern that caribou may not return at all.

5.5.2.3 Cumulative Effects of the Project with Future Projects and Activities

Residual Project effects on caribou are expected to overlap with the effects of reasonably foreseeable future projects including the Conawapa Generation Project, Bipole III Transmission Project, Keeyask Generation Project, and Gillam redevelopment.

Incremental habitat fragmentation effects for summer resident caribou from the Project in combination with future projects are a concern within the Project Study Area because of the scientific uncertainty associated with abundance and range use of these animals. For summer residents, the effect of cumulative habitat fragmentation will be small and is highly unlikely to result in a measurable change to the population.

Existing human and fire disturbance in the Project Study Area is already large, and may not support a non-migratory caribou population. The density of predators, however, is not expected to increase with a small increase in fragmentation because there is likely not enough caribou and moose biomass in the Project Study Area to support a dense predator population. As such, incremental habitat fragmentation effects from future projects are more likely to have a small effect on the summer resident caribou population, whether they are coastal caribou, boreal woodland caribou, or both.

The management of access to and harvest of migratory caribou in the lower Nelson River area has a high scientific and social concern. Infrequent but potentially high harvest events, coupled with incremental habitat effects over a broad region, could result in a decrease and prolonged decline of coastal caribou populations in particular. All Project-related caribou mortality in association with other effects will be monitored to decrease the risk of cumulative effects. A plan is being developed to coordinate caribou monitoring activities among northern hydroelectric developments, as well as with government authorities and existing caribou committees and management boards.

5.6 MONITORING

In order to verify the short-term and long-term effects of the Project on moose and caribou, the effectiveness of mitigation measures, and where there is higher uncertainty in predicting Project effects, monitoring will be required. Manitoba Hydro is responsible for ensuring that the mitigation measures prescribed in this report are implemented and verified through follow-up inspections, monitoring, and reporting.

Table 5-5: Monitoring for Mammals

VEC	Issue/Rationale	Monitoring	Timelines
Caribou	<ul style="list-style-type: none"> To verify the predicted effects of habitat alteration and disturbance during operation. 	<ul style="list-style-type: none"> Measure habitat alteration and use calving and rearing islands near the project Footprint. 	Periodically during operation depending on the degree of effects.
		<ul style="list-style-type: none"> Measure movements across the widest rights-of-way. 	Periodically during operation depending on the degree of effects.
	<ul style="list-style-type: none"> To verify the predicted effects of mortality during operation. 	<ul style="list-style-type: none"> Monitor harvest and predation effects associated with access. 	Periodically during operation depending on the degree of effects.
Moose	<ul style="list-style-type: none"> To verify the predicted effects of mortality during operation. 	<ul style="list-style-type: none"> Monitor harvest and predation effects associated with access. 	Periodically during operation depending on the degree of effects.

Keyask Transmission Project

Project Infrastructure

- Route Alternative Option A
- Route Alternative Option B
- Route Alternative Option C
- Route Alternative Option D
- Construction Power Line (KN36) Option 1 and 2
- - - Construction Power Line (Temporary)
- Unit Lines
- 3 Construction Power Station
- 3 Switching Station
- Project Study Area

Infrastructure

- X Converter Station
- Generating Station (Proposed)
- Generating Station
- Bipole I and II (Existing 500 kV DC Line)
- Transmission Line
- - - South Access Road (Proposed)
- Access Road

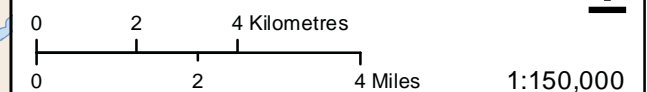
Moose Habitat Quality

- Primary habitat
- Secondary habitat

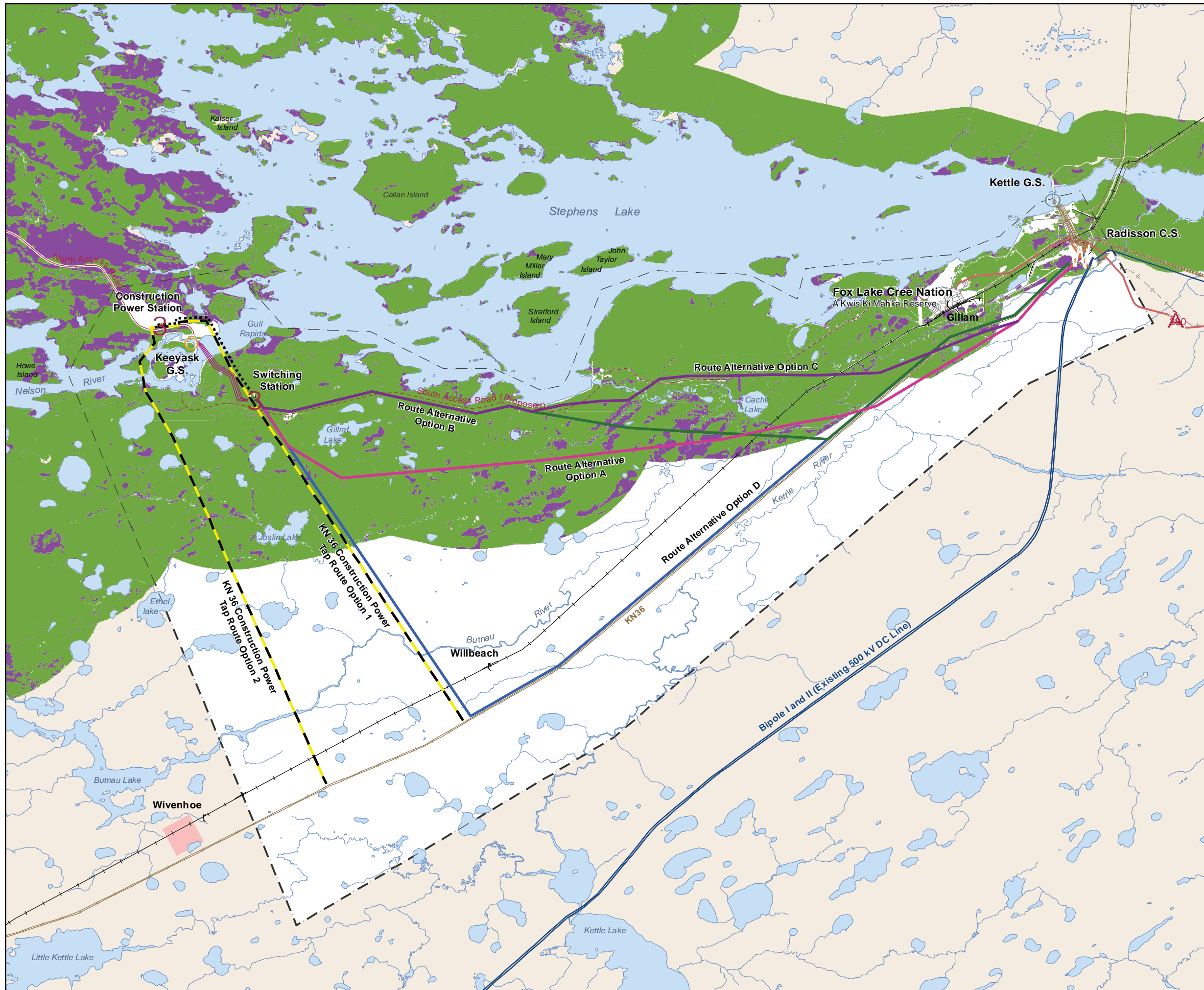
Landbase

- ⌵ Community
- Provincial Road
- Municipal Road
- Active Railway
- - - Abandoned Railway
- Watercourse
- Waterbody

Coordinate System: UTM Zone 15N NAD83
 Data Source: MBHydro, ProvMB, NRCAN
 Date Created: September 24, 2012



Moose Habitat Quality



Keeyask Transmission Project

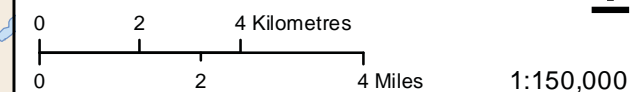
- Project Infrastructure**
- Route Alternative Option A
 - Route Alternative Option B
 - Route Alternative Option C
 - Route Alternative Option D
 - Construction Power Line (KN36) Option 1 and 2
 - Unit Lines
 - Construction Power Station
 - Switching Station
 - Project Study Area

- Infrastructure**
- Converter Station
 - Generating Station (Proposed)
 - Generating Station
 - Bipole I and II (Existing 500 kV DC Line)
 - Transmission Line
 - South Access Road (Proposed)
 - Access Road

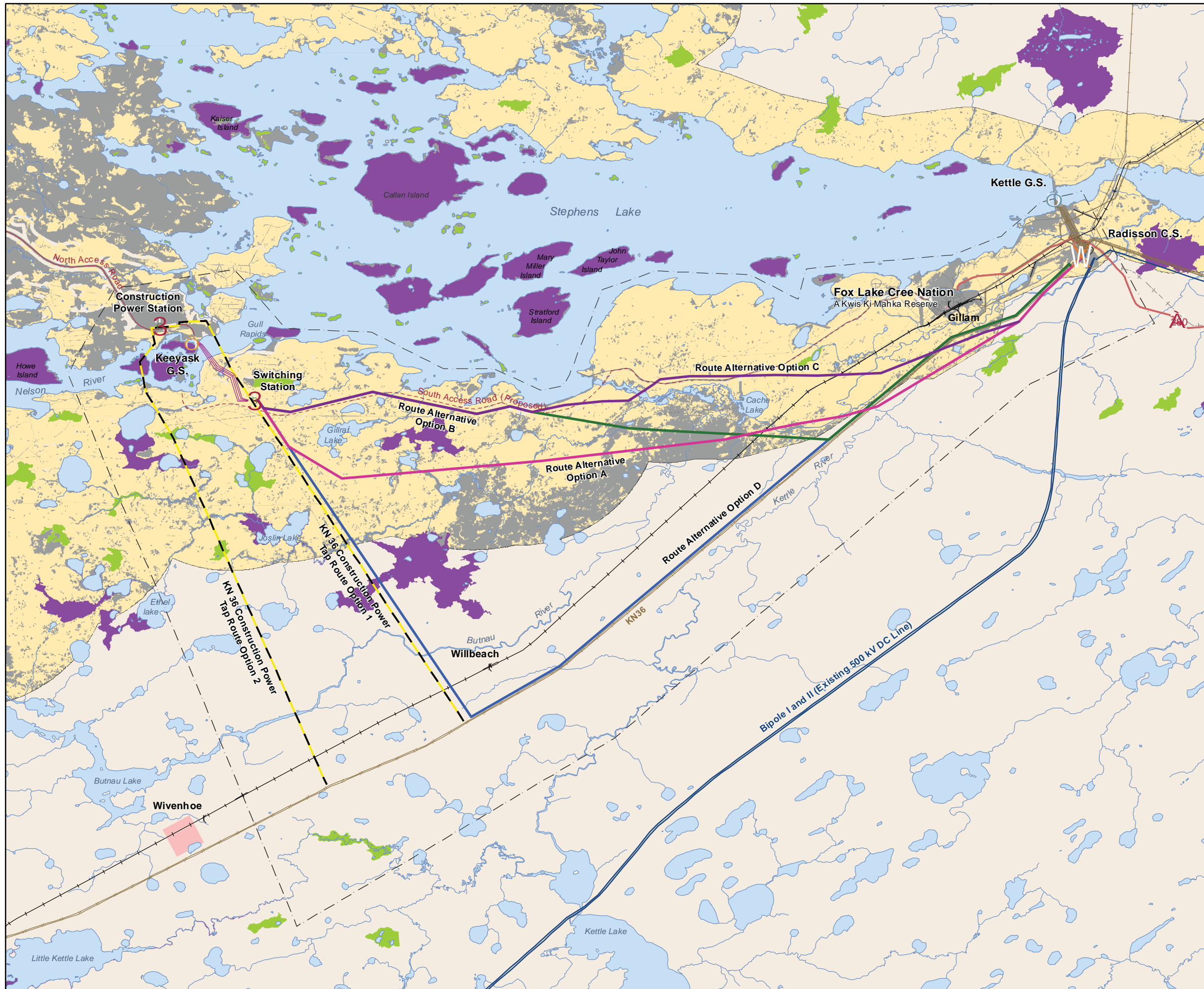
- Caribou Habitat Quality**
- Primary Calving Habitat
 - Secondary Calving Habitat
 - Winter Habitat
 - Unsuitable Habitat

- Landbase**
- Community
 - Provincial Road
 - Municipal Road
 - Active Railway
 - Abandoned Railway
 - Watercourse
 - Waterbody
 - Caribou Local Study Area

Coordinate System: UTM Zone 15N NAD83
 Data Source: MBHydro, ProvMB, NRCAN
 Date Created: September 24, 2012



Caribou Habitat Quality



Keeyask Transmission Project

Project Infrastructure

- Route Alternative Option A
- Route Alternative Option B
- Route Alternative Option C
- Route Alternative Option D
- Construction Power Line (KN36) Option 1 and 2
- - - - Construction Power Line (Temporary)
- Unit Lines

- Construction Power Station
- Switching Station
- Project Study Area

Infrastructure

- Converter Station
- Generating Station (Proposed)
- Generating Station
- Bipole I and II (Existing 500 kV DC Line)
- Transmission Line
- North Access Road
- - - - Proposed Access Road

Caribou Habitat

- Undisturbed caribou habitat
- Disturbed caribou habitat

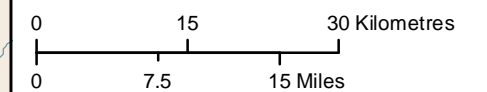
Study Area

- Zone 5
- Caribou Regional Study Area

Landbase

- Community
- Provincial Road
- Provincial Highway
- Municipal Road
- Active Railway
- Abandoned Railway
- Watercourse
- Waterbody
- First Nation

Coordinate System: UTM Zone 15N NAD83
 Data Source: MBHydro, ProvMB, NRCAN
 Date Created: Tuesday, September 25, 2012



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Intact Caribou Habitat

