FINAL REPORT

WILDLIFE AND WILDLIFE HABITAT STUDIES ALONG THE TALTSON EXPANSION PROJECT

Submitted to:

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06-1328-002

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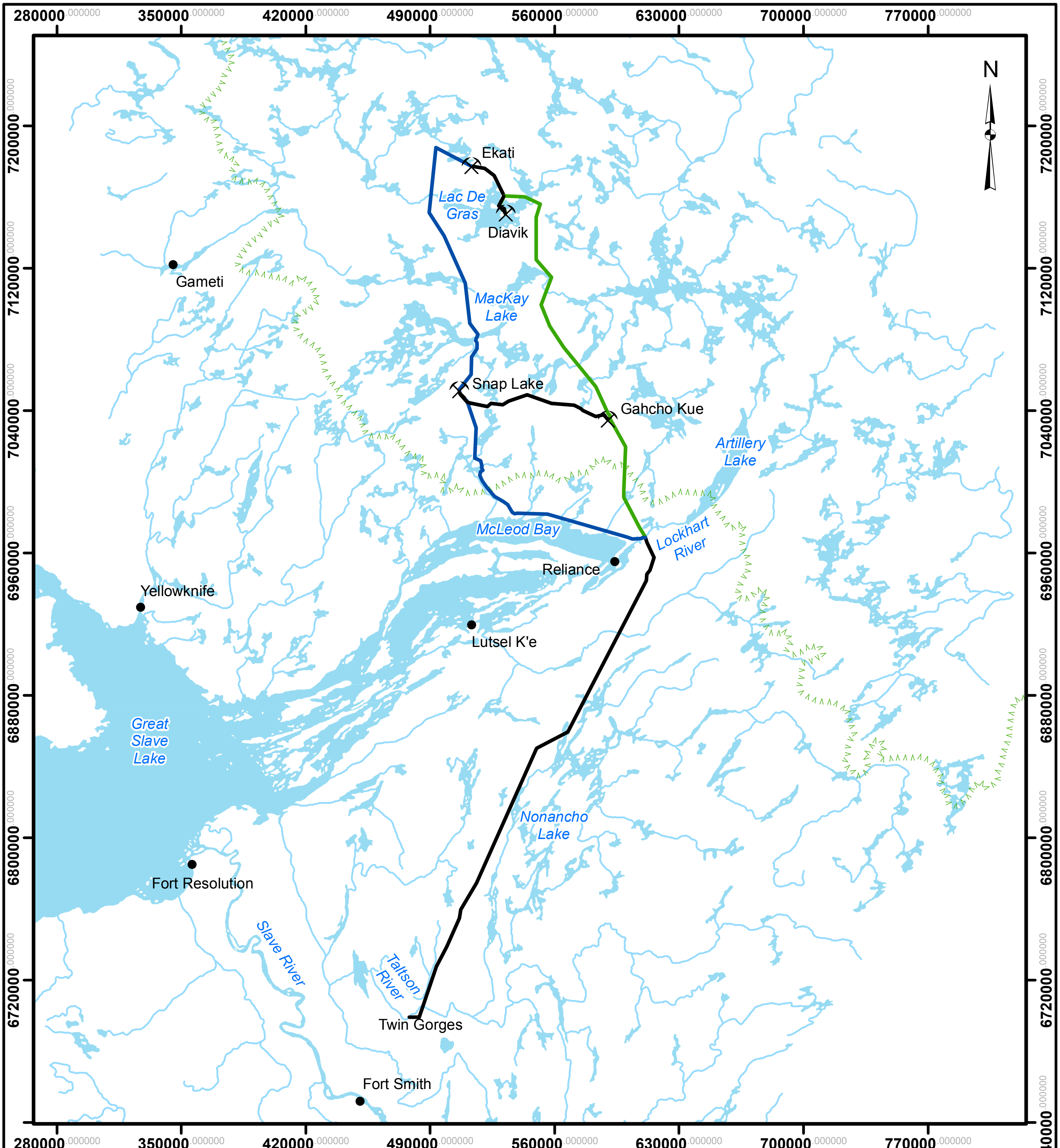
1.0 INTRODUCTION

This document describes aerial surveys and desktop studies of wildlife and wildlife habitat conducted between February and April 2006, along the route of the proposed Taltson Expansion Project. The original scope of the proposed Taltson Expansion Project was to construct a transmission line from the Twin Gorges hydroelectric station on the Taltson River to the Snap Lake Project using the corridor now described as Option 2a. Since then, the proposed Taltson Expansion Project has been augmented with the intent of supplying power to all four proposed or existing diamond mines (Ekati, Diavik, Snap Lake, and Gahcho Kue). Two routing options are currently being investigated, and further wildlife studies were required along these new sections of proposed transmission line.

Permitting of this development will require an assessment of the possible impacts to wildlife and wildlife habitat. Wildlife studies began in 2003 with the identification of Valued Ecosystem Component (VEC) species for the project. The VECs selected were ungulates, carnivores, waterfowl and raptors. Field studies were also initiated in 2003, from Taltson River to Snap Lake, and included summer and winter aerial surveys from July 2003 to March 2004 for the VEC species.

A single route has been proposed for the transmission line from Twin Gorges to the Lockart River. North of the Lockhart River to the diamond mines, the proposed route currently has two alternate alignment options, described as Option 1 and Option 2a (Figure 1-1). The objective of this report was to add to the existing information which seeks to identify wildlife and sensitive wildlife habitats which may be affected by the construction and operation of the Taltson transmission line, and to determine if there was a clear advantage to using either Option 1 or Option 2a to minimize impacts to wildlife and wildlife habitat. To address these questions, several approaches were used to identify existing information and collect new information. These included aerial surveys, analysis of the movements of collared caribou, a literature review, and the analysis of existing land cover classification. Each of these four tasks are summarized below.



LEGEND

- DIAMOND MINE
- APPROXIMATE TREELINE
- WATER

Transmission Line Options

- OPTION 1
- OPTION 2A
- SECTIONS COMMON TO BOTH OPTIONS

SCALE 1:3,000,000 — 50 0 50 100 KILOMETRES

REFERENCE

Datum: NAD 83 Projection: Transverse Mercator Coordinate System: UTM Zone 12

PROJECT
NORTHWEST TERRITORIES ENERGY CORPORATION

TITLE
TALTSON EXPANSION PROJECT TRANSMISSION LINE ALIGNMENT OPTIONS

Golder Associates
Yellowknife, Northwest Territories

PROJECT No. 06-1328-002. 5000		SCALE AS SHOWN	REV. 0
DESIGN	DP	28 Mar. 2006	**FIGURE: 1-1**
GIS	KB	28 Mar. 2006	
CHECK	DP	20 Apr. 2006	
REVIEW	JV	22 Apr. 2006	

Project: N:\Active\GIS\06-1328-002 NTEC\Final Figures\PDF\Figure 1-1

Task 1 Aerial Survey for Ungulates and Carnivores

Those sections of the transmission line alignment which fall below the treeline (the area usually selected by barren-ground caribou in winter) were surveyed by helicopter to document caribou presence, abundance, habitat associations, behaviour, and location. Caribou snow tracks were also documented to record activity levels along this section of the alignment. Two aerial surveys were conducted, one in mid-February, and one in mid-March, 2006.

Task 2 Review of Satellite Collared Caribou Data

For the purposes of monitoring caribou, the Government of Nunavut and the Government of the Northwest Territories have deployed collars on female caribou of the Bathurst and Ahiak herds, the ranges of which both overlap with the proposed transmission line (Department of Environment and Natural Resources [ENR] 2006). Locations of satellite-collared Bathurst caribou from 1996 to 2005 were analyzed using a Geographic Information System (GIS) to investigate historical use of the proposed transmission line alignment by these herds. Key questions addressed by the analysis included:

- have there been any spatial patterns of caribou presence along the alignment (are some areas used more than others?);
- have there been any temporal patterns of caribou presence along the alignment (does caribou presence change with seasons and years?); and,
- have there been any patterns in exposure time (did caribou tend to stay in some areas longer than others?).

Task 3 Literature Review

The literature review included information from three sources; the scientific literature, industry-sponsored monitoring at existing mines, and Traditional Ecological Knowledge (TEK) studies. A review of the scientific literature pertaining to impacts of linear disturbances (such as seismic and transmission lines) to wildlife was conducted. The relative impacts of a linear disturbance both above and below the treeline were considered, where information was available, as visual and audible disturbances appear to extend further in treeless environments. Wildlife monitoring reports are available from Snap Lake, Diavik and Ekati, all of which lie along the route of the proposed transmission line. The study areas of each of these projects contain portions of the transmission line alignment. Reports are available which document Inuit, Dene and Chipeywan TEK of caribou and other wildlife movements and habitat associations (such as Kendrick *et al.* 2005 and Parlee *et al.* 2005). A literature review was conducted to identify relevant reports, and summarize their findings in the context of the proposed transmission line.

Task 4 Review of Existing Land Cover Information

Land cover (which includes both vegetation and abiotic features such as lakes, eskers, and rock) maps or classifications can be used to understand the impacts of development on wildlife habitat. The existing land cover classifications available of the Slave Geological Province (SGP) and of forested areas of the Northwest Territories compiled by the Government of Northwest Territories (GNWT) were used to describe land cover types along the proposed alignment. The areas and proportions of each land cover type were overlaid by the transmission line and documented. Particular attention was paid to sensitive habitats (such as wetlands and eskers) and areas where tall vegetation may require clearing.

1.1 Project Description

The Northwest Territories Energy Corporation proposes to run a transmission line from the Twin Gorges generating station to existing and proposed diamond mines north of Great Slave Lake. The proposed project includes the construction of an additional hydroelectric generating station in the vicinity of the existing Twin Gorges Generation Station on the Taltson River, the construction of a 161 kV transmission line from Twin Gorges to either Snap Lake or Gahcho Kue, and several further sections of either 161 kV or 69 kV line to connect Snap Lake, Gahcho Kue, Diavik and Ekati. Two options are currently proposed, described as Option 1, which would see a sub-station near Gahcho Kue and a total length of 690 km, and Option 2a, which would place a substation near Snap Lake and a total length of 755 km (Northwest Territories Power Corporation [NTPC] 2005, Figure 1-1).

During construction the Twin Gorges area would be accessed by winter road from Fort Smith (the winter road currently exists, but has not been maintained). Upgrading and expansion of the facilities at Twin Gorges will be required, including the construction of a second generating station to provide the required 52 MW. Existing facilities at Twin Gorges are capable of generating 18 MW. At Nonacho Lake, approximately 150 km northeast of Twin Gorges, the existing control dam will require modifications to allow up to 170 m^3/s of continuous flow, and to maintain at least 14 m^3/s of flow during low lake inflows. A small generating plant may be incorporated at Nonacho Lake to provide power for gate operation, heat, light, and communication.

Construction of the transmission line will be supported through a combination of existing winter roads, helicopters, and barges on Great Slave Lake. Helicopters will be used to stage buiding materials and crews, install foundations, set towers and string conductor line. Barges on Great Slave Lake will also be used to stage materials. North of Great Slave Lake, the existing winter roads used to supply the mines (*i.e.* the Tibbitt to Contwoyto Winter Road and its spurs to the individual mines) will be extended to support construction, including the establishment of additional lay-down yards. Construction is expected to require two to four years, after which the winter road from Fort Smith will not be maintained. The towers will be constructed from 'Y' or 'T' configured steel lattice or pipe, and each tower will be guyed. The transmission line right-of-way will be approximately 30 m wide. Clearing will be required for the forested areas of the transmission line, between Twin Gorges (km 0 of the proposed transmission line) and approximately km 400. Underbrush and vegetation less than 3 m tall will be undisturbed.

1.2 Sensitive Wildlife Areas

The proposed transmission line intersects the proposed East Arm National Park at its narrowest point, over the Lockhart River. The boundaries of this park are similar to an International Biological Program (IBP) site on the East Arm, which was identified for it's wide cross section of flora and fauna of the boreal forest and eastern Arctic. It also provides scenery, unique geomorphology, and moreover is of historical and archaeological interest (Beckel 1975). Twin Gorges is also approximately 70 km northeast of the Plains Southwest of Grand Detour IBP site (Beckel 1975). This site is at the northern limit of extensive prairie-like grass sedge meadows. Bison and wolves are abundant here in a relatively undisturbed state.

Other parks in the area of the proposed transmission lines include the Wood Buffalo National Park, 75 km southwest of the Twin Gorges Power generating plant; and the Thelon Wildlife Sanctuary which is 200 km east of the Lockhart River to Gahcho Kue segment of the transmission line.

Approximately 130 km north of Twin Gorges the Taltson River flows into the Slave River Delta, which has been identified by the Canadian Wildlife Service (CWS) as an important staging area for thousands of water birds in spring and fall (Alexander *et al.* 1991). The Slave River Delta is also an area of interest to the Northwest Territories Protected Areas Secretariat (2005).

The proposed transmission line that will run from Lockhart River to Gahcho Kue will pass within 40 km of the western border of the Waters of Desnedhe Che, which is an area of interest to the Northwest Territories Protected Areas Secretariat (2005). No wildlife areas of special interest to the Department of Renewable Resources (Ferguson 1987) were identified in the vicinity of the proposed transmission line.

1.3 Species At Risk

Terrestrial wildlife species (including mammals, birds, reptiles and amphibians) present in the study area were compared against three species at risk lists: Schedule 1 of the Species At Risk Act (SARA, Government of Canada 2005), the Committee on the Status of Endangered Wildlife in Canada (COSEWIC, Government of Canada 2005) and the NWT Species Infobase (ENR 2006). The purpose of these lists is to highlight species which may be at risk of extinction or extirpation.

The proposed Taltson Expansion Project falls within, or adjacent to, the habitat ranges of 39 species named under at least one of these three lists (Table 1-1). Schedule 1 of SARA contains the species for which protection under SARA applies. Species on Schedules 2 and 3 require assessment to determine if they should be placed on Schedule 1, but do not receive protection under SARA. Species with SARA protection and with ranges that overlap the proposed transmission line are the Eskimo curlew, the anatum (boreal) peregrine falcon, and the whooping crane. Other species of note include the tundra peregrine falcon (listed as vulnerable under COSEWIC).

Table 1-1
Species At Risk in the Vicinity of the Proposed Taltson Expansion Project

Common Name	Scientific Name	COSEWIC 2005 Status	SARA Status	NWT Species 2005 Status
Fisher	*Martes pennanti*		-	Sensitive
Grizzly Bear	*Ursus arctos*	Special Concern	-	Sensitive
Wolverine	*Gulo gulo*	Special Concern	-	Secure
Little Brown Myotis (bat)	*Myotis lucifugus*	-	-	Sensitive
Red-sided Garter Snake	*Thamnophis sirtalis*	-	-	May be at Risk
Western Toad	*Bufo boreas*	Special Concern	-	May Be At Risk
Northern Leopard Frog	*Rana pipiens*	Special Concern	-	Sensitive
Canadian Toad	*Bufo hemiophrys*	Not at Risk	-	May Be At Risk
Northern Pintail	*Anas acuta*	-	-	Sensitive
Long-tailed duck (Oldsquaw)	*Clangula hyemalis*	-	-	Sensitive
White-winged Scoter	*Melanitta fusca*	-	-	Sensitive
Surf Scoter	*Melanitta perspicillata*	-	-	Sensitive
Lesser Scaup	*Aythya affinis*	-	-	Sensitive
Lesser Yellowlegs	*Tringa flavipes*	-	-	Sensitive
American Golden-Plover	*Pluvialis dominica*	-	-	Sensitive
Caspian Tern	*Sterna caspia*	Not at Risk	-	Sensitive
Hudsonian Godwit	*Limosa haemastica*	-	-	Sensitive

Table 1-1
Species At Risk in the Vicinity of the Proposed Taltson Expansion Project Continued

Common Name	Scientific Name	COSEWIC 2005 Status	SARA Status	NWT Species 2005 Status
Red-necked Phalarope	*Phalaropus lobatus*	-	-	Sensitive
Black Tern	*Chlidonias niger*	Not At Risk	-	Sensitive
Eskimo Curlew	*Numenius borealis*	Endangered	Schedule 1 Endangered	At Risk
Least Sandpiper	*Calidris minutilla*	-	-	Sensitive
Semipalmated Sandpiper	*Calidris pusilla*	-	-	Sensitive
American Bittern	*Botaurus lentiginosus*	-	-	Sensitive
Tundra Peregrine Falcon	*Falco peregrinus tundrius*	Vulnerable	Schedule 3 Special Concern	Sensitive
Anatum Peregrine Falcon	*Falco peregrinus anatum*	Threatened	Schedule 1 Threatened	Sensitive
Whooping Crane	*Grus americana*	Endangered	Schedule 1 Endangered	At Risk
Yellow Rail	*Coturnicops noveboracensis*	Special Concern	-	May Be At Risk
Harris's Sparrow	*Zonotrichia querula*	-	-	Sensitive
White-throated Sparrow	*Zonotrichia albicollis*	-	-	Sensitive
Barn Swallow	*Hirundo rustica*	-	-	Sensitive
American Tree Sparrow	*Spizella arborea*	-	-	Sensitive
Boreal Chickadee	*Poecile hudsonica*	-	-	Sensitive
Rusty Blackbird	*Euphagus carolinus*	-	-	May Be At Risk
Blackpoll Warbler	*Dendroica striata*	-	-	Sensitive
Olive-sided Flycatcher	*Contopus cooperi*	-	-	Sensitive
American Pipit (Water Pipit)	*Anthus rubescens*	-	-	Sensitive
American White Pelican	*Pelecanus erythrorhynchos*	Delisted	-	May Be At Risk
Pied-billed Grebe	*Podilymbus podiceps*	-	-	Sensitive
Short-eared Owl	*Asio flammeus*	Special Concern	-	Sensitive

2.0 UNGULATE AND CARNIVORE WINTER AERIAL SURVEYS

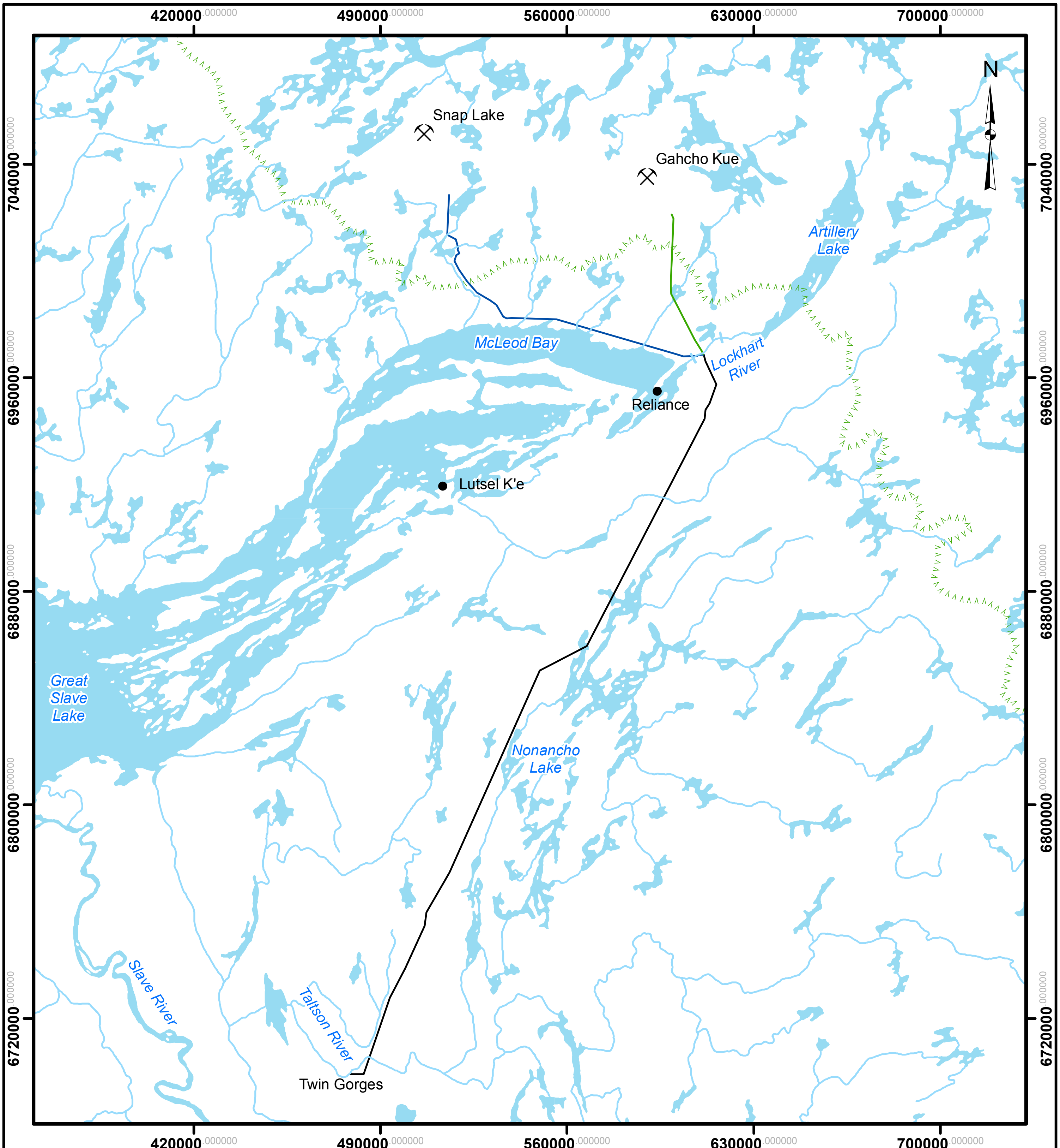
To gather information on the presence and distribution of ungulates and carnivores along the proposed transmission line corridor during the winter, two aerial surveys of the proposed transmission line were conducted. As caribou were the primary species of interest, the aerial surveys included all sections of the proposed transmission line (Options 1 and 2a and common sections, Figure 1-1) south of the tree line. Caribou of the Bathurst herd are predominantly found below the treeline during the winter months (Gunn *et al.* 2001). Figure 2-1 shows the sections of the transmission line flown during these surveys.

2.1 Methods

Aerial surveys were conducted on February 14 and March 7, 2006. Surveying conditions were excellent on both occasions, with clear skies and 100 percent snow cover. A GPS unit with the proposed alignment waypoints and topographic maps with the proposed alignments were used to maximize adherence to the proposed route. Observations of wildlife and wildlife sign were made from the center line of the proposed alignment by an observer in the front seat, and up to 200 m on either side of the helicopter by two observers in the back seats. Both surveys included one Lutsel K'e representative with previous experience conducting aerial wildlife surveys.

Surveys were conducted by helicopter, flying at approximately 120 m above ground level, at speeds of 80 km/h to 120 km/h. The speed was varied to obtain the best possible observations, and to account for daylight and fuel limitations (*i.e.*, slower speed over closed forests or areas of heavy wildlife activity, increased speed over unforested areas or areas with little wildlife activity).

The location and nature of all ungulates, carnivores, and their sign were recorded. When an observation was made, a GPS coordinate was recorded and the species, dominant behaviour, dominant land cover type and group size were noted where possible. Habitat types were classified as bedrock, open pine forest, closed pine forest, open spruce forest, open mixedwood forest, lake (ice) and heath tundra. More specific classifications of habitat type were avoided due to snow cover. Sign from arctic and red fox, both of which are known to occur along the proposed transmission line, were not differentiated as they could not be distinguished from the air. Observers were in continuous communication to avoid recording the same observation twice. In addition, continuous monitoring of caribou snow track abundance was conducted to determine areas that caribou had been present and their relative level of activity prior to the survey. Every two minutes, the two observers in the rear of the helicopter made instantaneous observations of caribou snow track abundance, according to the qualitative measures of "none" (no caribou sign),



LEGEND

- DIAMOND MINE
- LOCKHART RIVER TO GAHCHO KUE (OPTION 1)
- LOCKHART RIVER TO SNAP LAKE (OPTION 2A)
- TWIN GORGES TO LOCKHART RIVER
- APPROXIMATE TREELINE
- WATER

REFERENCE

Datum: NAD 83 Projection: Transverse Mercator Coordinate System: UTM Zone 12

50 0 50

SCALE 1:2,000,000 KILOMETRES

PROJECT

NORTHWEST TERRITORIES ENERGY CORPORATION

TITLE

ROUTE OF WINTER SURVEYS OF THE PROPOSED TRANSMISSION LINE

Golder Associates
Yellowknife, Northwest Territories

PROJECT No. 06-1328-002. 5000			SCALE AS SHOWN	REV. 0
DESIGN	DP	28 Mar. 2006	**FIGURE: 2-1**	
GIS	KB	28 Mar. 2006		
CHECK	DP	20 Apr. 2006		
REVIEW	JV	22 Apr. 2006		

Project: N:\Active\GIS\06-1328-002 NTEC\Final Figures\PDF\Figure 2-1

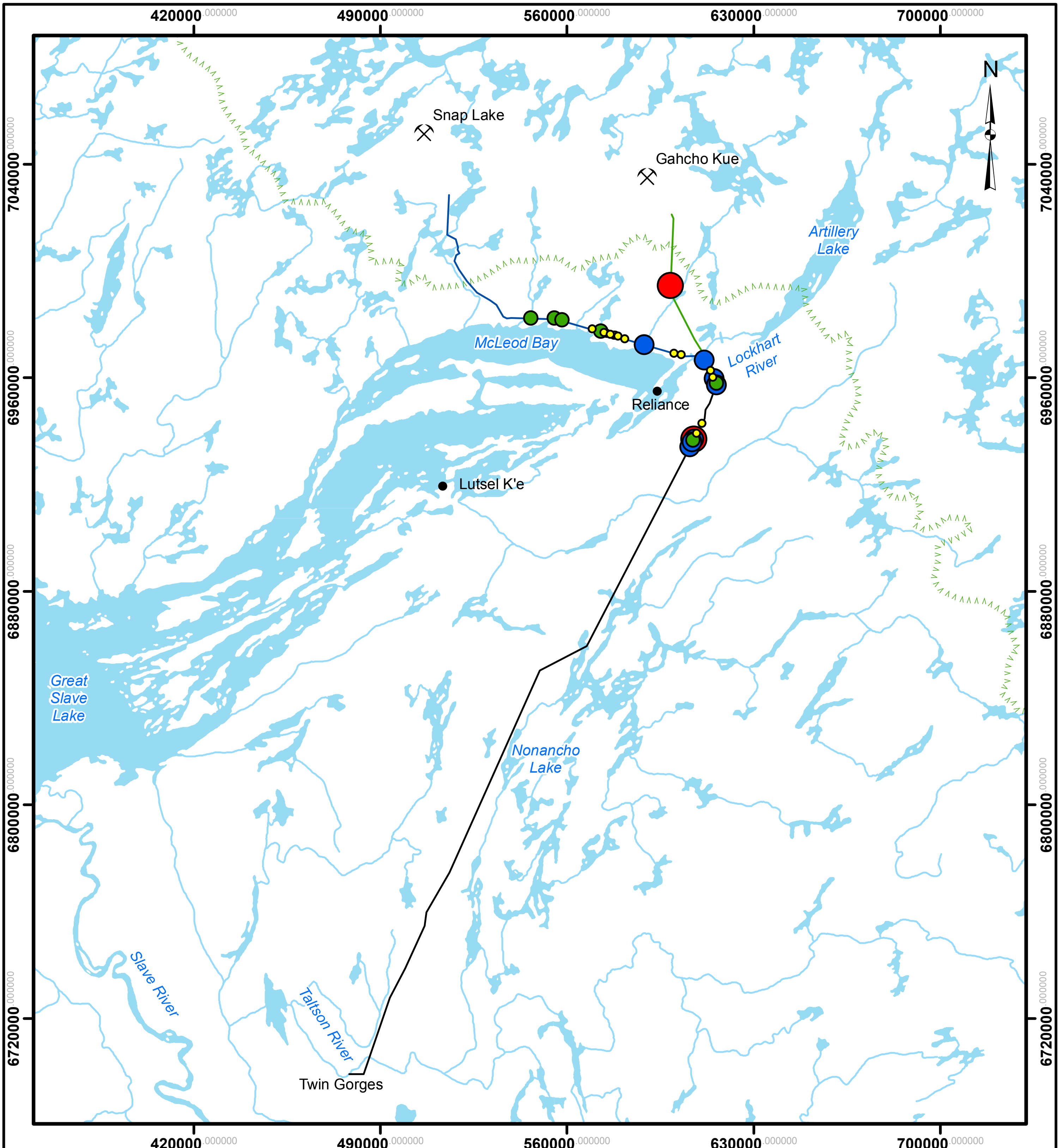
"low" (some individual caribou tracks), "medium" (caribou trails present) or "high" (continuous tracks or a network of trails). A GPS coordinate was also collected for each track abundance observation.

2.2 Results

Two aerial surveys recorded a total of 29 caribou groups. Fifty-five percent of the groups had less than 10 individuals, 38 percent had 10 to 20 individuals and 7 percent had greater than 75 individuals. There were no observations of group sized ranging from 21 to 74 caribou. Twelve groups with a total of 261 individuals were observed during the February survey and 17 groups with a total of 159 individuals were observed during the March survey. The median group size (and associated 25th and 75th quartiles) was eight (5 and 20).

During the survey, caribou were predominantly located along the Lockhart River and Snap Lake section (Option 2a) along the north shore of McLeod Bay, Lockhart River, and up to 40 km south of the Lockhart River (Figure 2-2). This distribution was confirmed by the caribou snow track index observations (Figure 2-3). The snow track index data also identified the presence of caribou in two other areas, approximately 100 km south of the Lockhart River (Figure 2-3) where no animals were observed.

Caribou behaviour and habitat were recorded during the 2006 aerial surveys. Caribou behaviour was described in the field, and later categorized into resting (bedded or standing), feeding and moving (walking or running) behaviours. Sixty-seven percent of the groups were resting, ten percent of the caribou groups were observed feeding and 24% were observed moving (Figure 2-4). Sixty-eight percent of the 25 caribou groups were observed on frozen lakes, while 28% were observed in open spruce forest (N=25, Figure 2-5). Among the groups observed resting, Seventy-nine percent (N=14) were on frozen lakes and 50% (N=6) were in the open spruce forest (Figure 2-6). Two groups were observed feeding, both in open spruce forest.



LEGEND

DIAMOND MINE

CARIBOU NUMBER

- 2 - 7
- 8 - 14
- 15 - 20
- 21 - 80

LOCKHART RIVER TO GAHCHO KUE (OPTION 1)

LOCKHART RIVER TO SNAP LAKE (OPTION 2A)

TWIN GORGES TO LOCKHART RIVER

APPROXIMATE TREELINE

WATER

50 0 50

SCALE 1:2,000,000 KILOMETRES

REFERENCE

Datum: NAD 83 Projection: Transverse Mercator Coordinate System: UTM Zone 12

PROJECT

NORTHWEST TERRITORIES ENERGY CORPORATION

TITLE

CARIBOU GROUP OBSERVATIONS

Golder Associates

Yellowknife, Northwest Territories

PROJECT No. 06-1328-002. 5000			SCALE AS SHOWN	REV. 0
DESIGN	DP	28 Mar. 2006	FIGURE: 2-2	
GIS	KB	28 Mar. 2006		
CHECK	DP	20 Apr. 2006		
REVIEW	JV	20 Apr. 2006		

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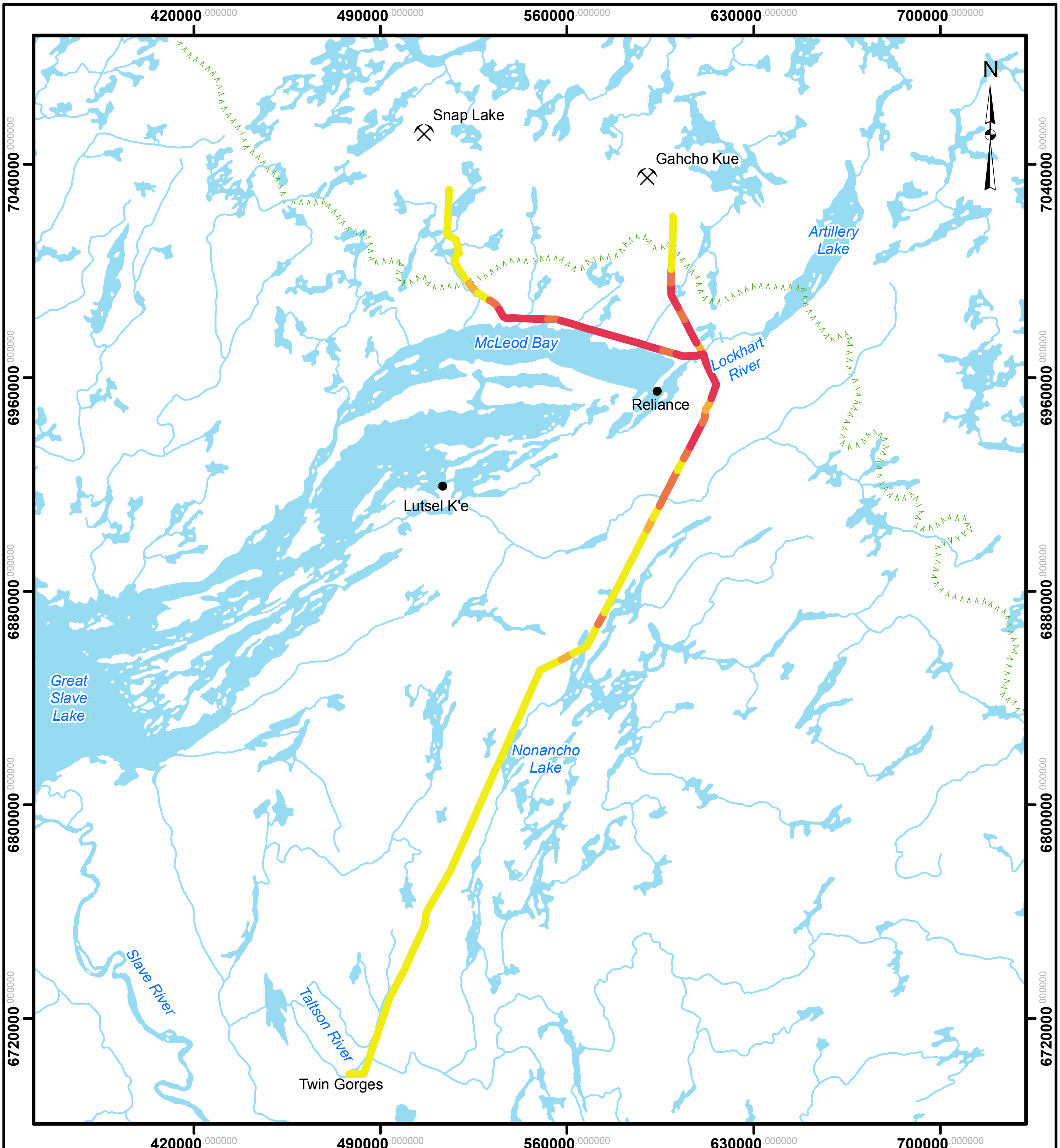

LEGEND

DIAMOND MINE

APPROXIMATE TREELINE

WATER

CARIBOU TRACK INDEX

- NONE
- LOW
- MEDIUM
- HIGH

50 0 50

SCALE 1:2,000,000 KILOMETRES

REFERENCE

Datum: NAD 83 Projection: Transverse Mercator Coordinate System: UTM Zone 12

PROJECT

NORTHWEST TERRITORIES ENERGY CORPORATION

TITLE

CARIBOU TRACK INDEX OBSERVATIONS

Golder Associates

Yellowknife, Northwest Territories

PROJECT No. 06-1328-002. 5000			SCALE AS SHOWN	REV. 0
DESIGN	DP	28 Mar. 2006	**FIGURE: 2-3**	
GIS	KB	28 Mar. 2006		
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Figure 2-4 Percent of Caribou Groups (N = 29) Displaying Feeding, Resting and Moving Behaviour

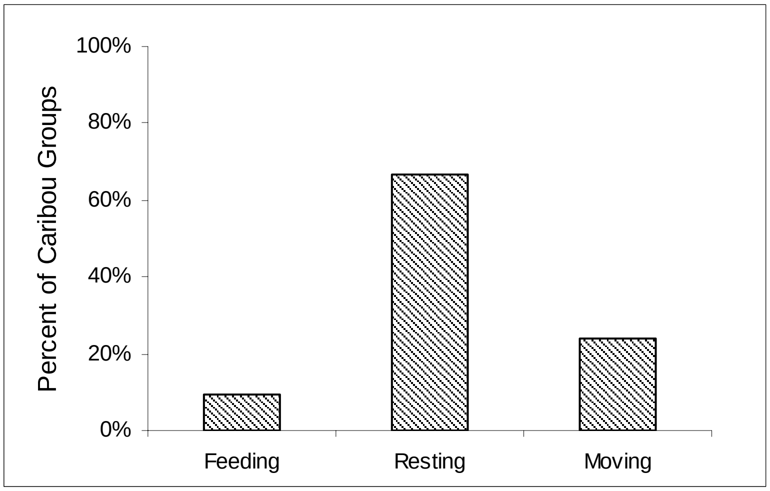


Figure 2-5 Percent of Caribou Groups (N = 29) Observed in Different Habitat Types

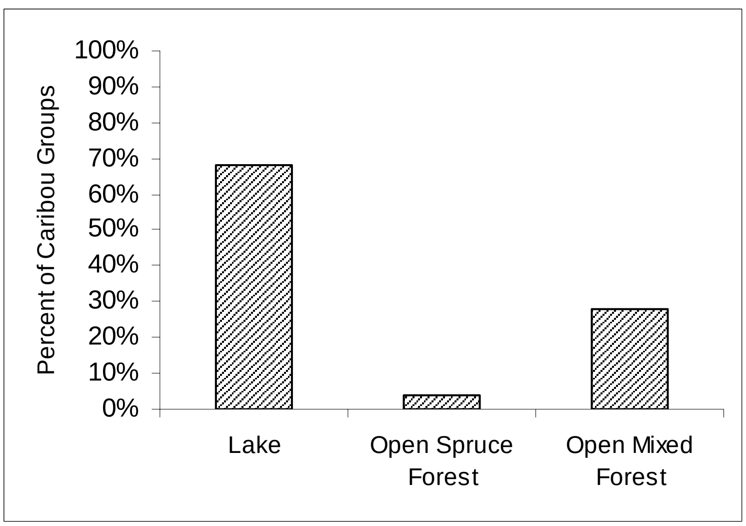
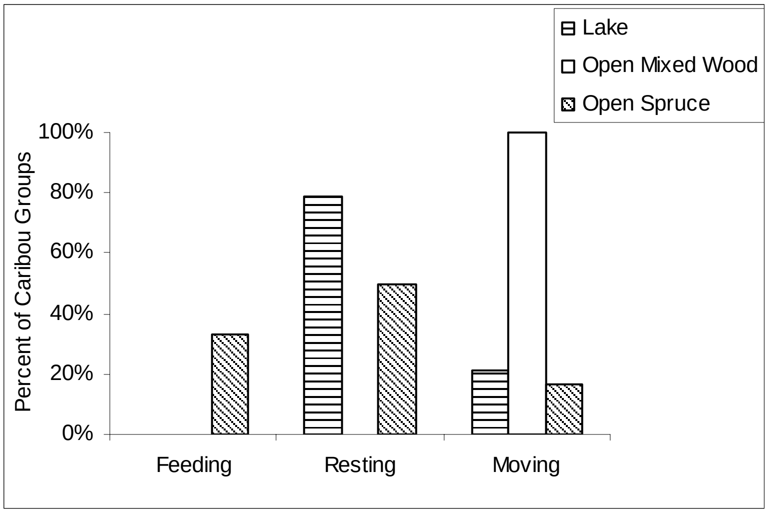


Figure 2-6 Percent of Caribou Behavioural Observations in Each Habitat Type

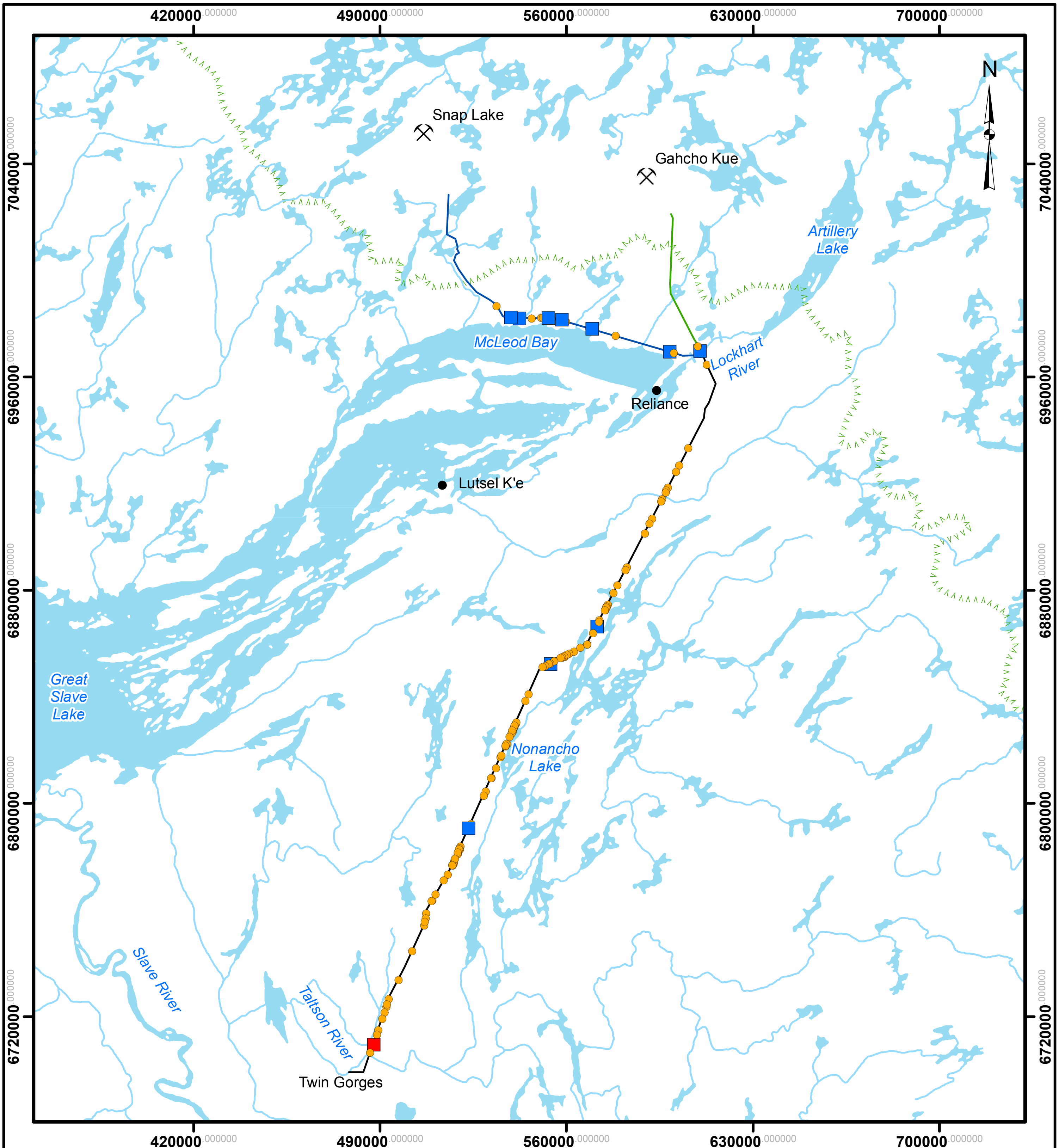


2.2.1 Moose

Aerial surveys recorded a total of 11 moose groups (one pair [female and calf] and ten lone individuals). During the February survey, eight individual moose were observed, while four individuals were observed during the March survey. Based on the observation of their sign, moose were most abundant south of the Lockhart River, but were also more easily observed in the open forests on the north shore of McLeod Bay (Figure 2-7). Moose were observed within open spruce, closed pine, mixed forests, bedrock, and frozen lakes.

2.2.2 Carnivores

Carnivore tracks, including wolverine, fisher, marten, otter, fox, and wolf were observed during both aerial surveys. Three wolverines were seen during the February survey, and were the only carnivores directly observed.



LEGEND

- DIAMOND MINE
- MOOSE TRACK
- ONE MOOSE
- TWO MOOSE
- LOCKHART RIVER TO GAHCHO KUE (OPTION 1)
- LOCKHART RIVER TO SNAP LAKE (OPTION 2A)
- TWIN GORGES TO LOCKHART RIVER
- APPROXIMATE TREELINE
- WATER

50 0 50

SCALE 1:2,000,000 KILOMETRES

REFERENCE

Datum: NAD 83 Projection: Transverse Mercator Coordinate System: UTM Zone 12

PROJECT

NORTHWEST TERRITORIES
ENERGY CORPORATION

TITLE

MOOSE AND MOOSE TRACK OBSERVATIONS

Golder Associates
Yellowknife, Northwest Territories

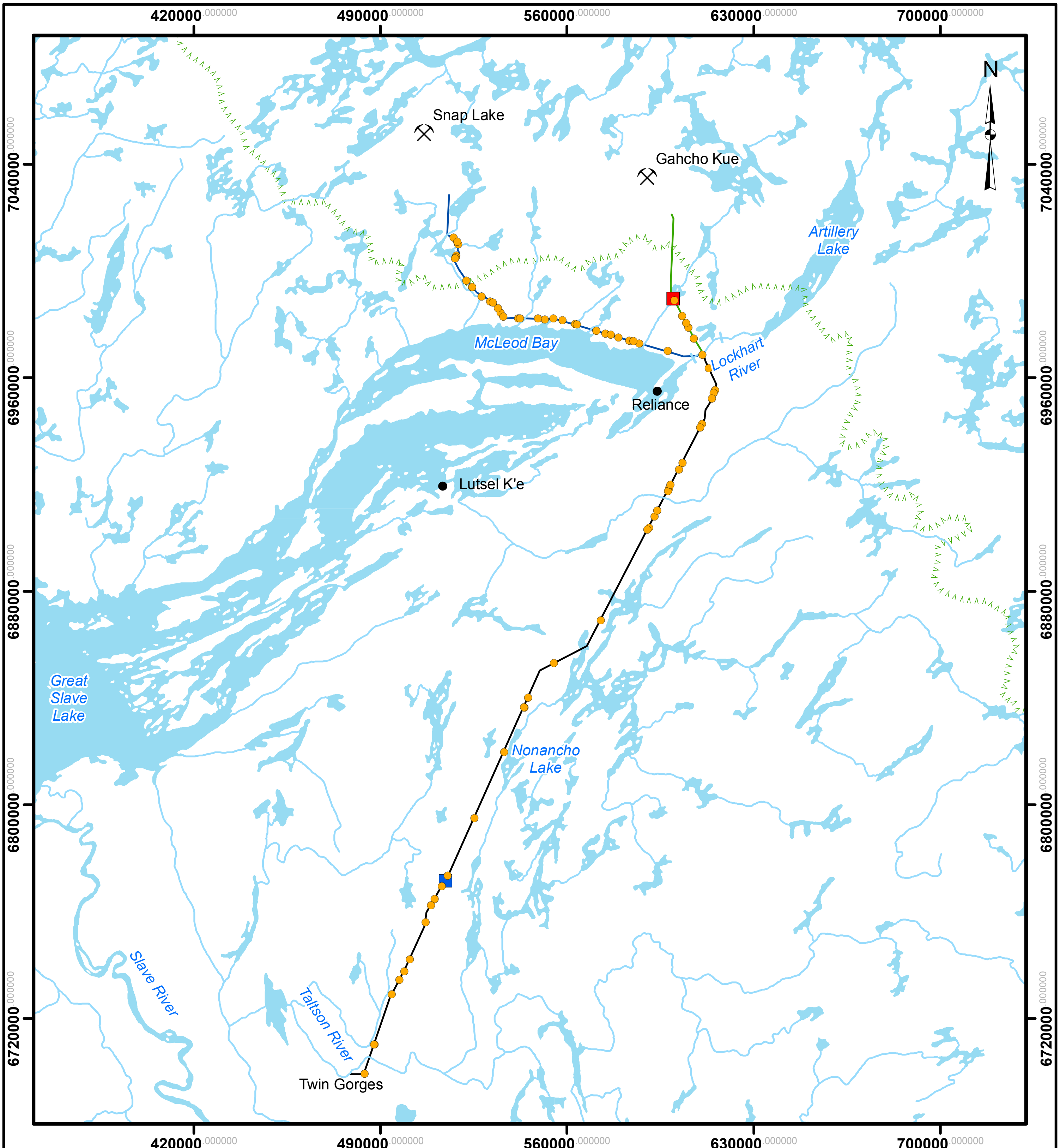
PROJECT No. 06-1328-002. 5000			SCALE AS SHOWN	REV. 0
DESIGN	DP	28 Mar. 2006	**FIGURE: 2-7**	
GIS	KB	28 Mar. 2006		
CHECK	DP	20 Apr. 2006		
REVIEW	JV	22 Apr. 2006		

Project: N:\Active\GIS\06-1328-002 NTEC\Final Figures\PDF\Figure 2-7

Wolverine tracks were observed along all sections of the transmission line surveyed, but appeared to be most prevalent near McLeod Bay and the Lockhart River (Figure 2-8). Fisher tracks were identified along the southern end of the Twin Gorges to Lockart River section of the transmission line alignment (Figure 2-9). From Twin Gorges, fisher tracks extended approximately 60 km towards the Lockhart River. Marten tracks were observed along the Lockhart River to Snap Lake section, and the Lockhart River to Gahcho Kue section, but the highest density was along the Twin Gorges to Lockhart River section (Figure 2-9). Otter tracks were identified along the lower 180 km of the Twin Gorges to Lockhart River section of the transmission line route, although a lone otter track was observed along the Lockhart River to Snap Lake section immediately north of McLeod Bay (Figure 2-9). Fox tracks were observed along all sections of the transmission line and appeared to be evenly distributed (Figure 2-10), whereas lynx tracks were identified only within boreal areas, and appeared to be more prevalent in the areas south of Nonacho Lake. Wolf tracks were also seen consistently along all sections of the transmission line route (Figure 2-11).

2.3 Discussion

The transmission line alignment from approximately north of Nonacho Lake to it's northern extent lies within the home range of the Bathurst and Ahiak caribou herds (ENR 2006). However, as these barren-ground caribou are migratory, not all of this home range is used throughout the year. Rather, specific areas within their home range are used at different times, such as the calving grounds in June and forested areas from approximately November to May. These caribou also display a high degree of variation in their use of their home range from year to year, so the area used as wintering grounds in one year may not have caribou present in the next year (Gunn *et al.* 2002).



LEGEND

- DIAMOND MINE
- WOLVERINE TRACK
- 1 WOLVERINE
- 2 WOLVERINE
- LOCKHART RIVER TO GAHCHO KUE (OPTION 1)
- LOCKHART RIVER TO SNAP LAKE (OPTION 2A)
- TWIN GORGES TO LOCKHART RIVER
- APPROXIMATE TREELINE
- WATER

50 0 50
SCALE 1:2,000,000 KILOMETRES

REFERENCE

Datum: NAD 83 Projection: Transverse Mercator Coordinate System: UTM Zone 12

PROJECT

NORTHWEST TERRITORIES ENERGY CORPORATION

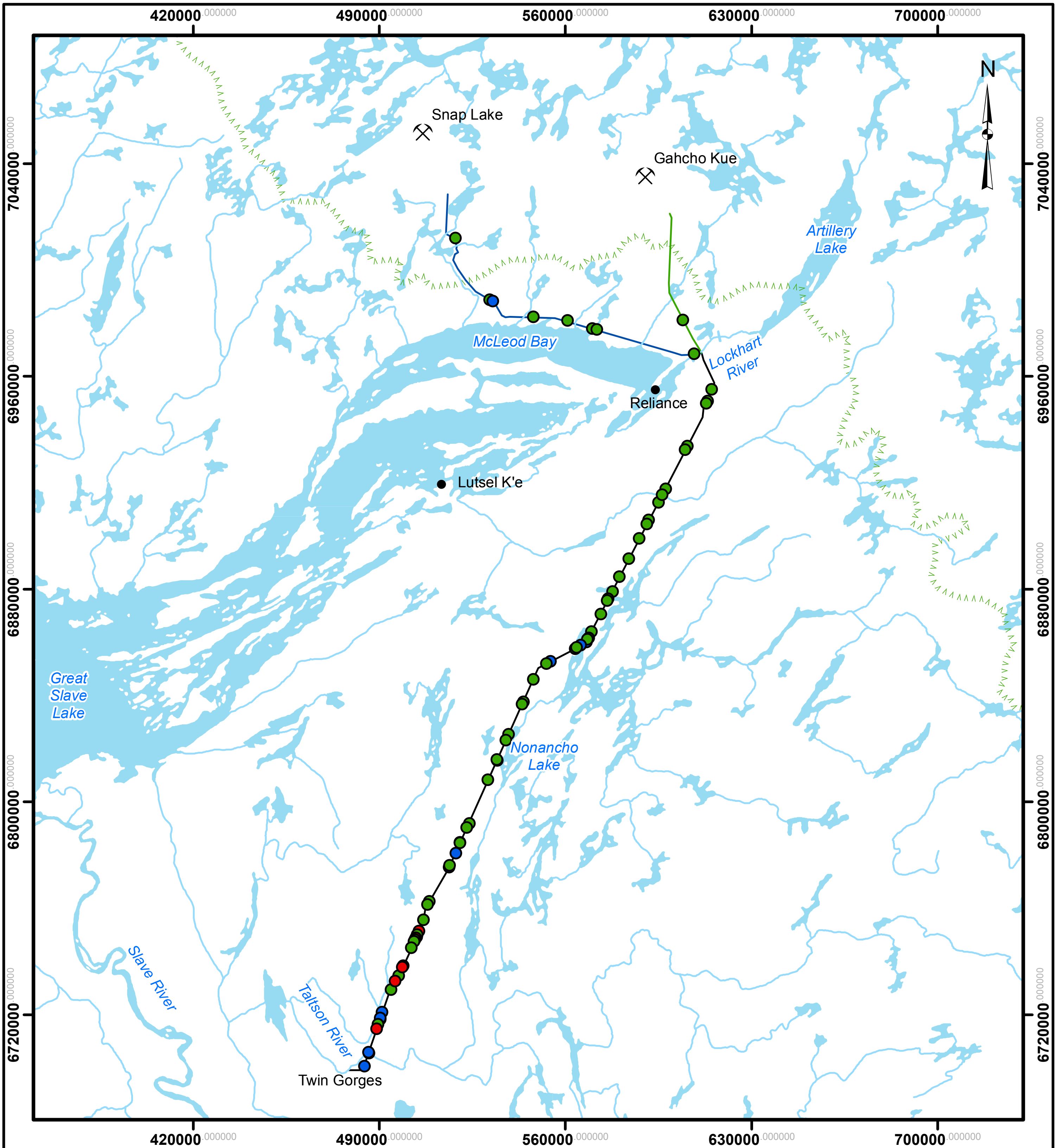
TITLE

WOLVERINE AND WOLVERINE TRACK OBSERVATIONS

Golder Associates
Yellowknife, Northwest Territories

PROJECT No. 06-1328-002.5000			SCALE AS SHOWN	REV. 0
DESIGN	DP	28 Mar. 2006	**FIGURE: 2-8**	
GIS	KB	28 Mar. 2006		
CHECK	DP	20 Apr. 2006		
REVIEW	JV	22 Apr. 2006		

Project: N:\Active\GIS\06-1328-002 NTEC\Final Figures\PDF\Figure 2-8



LEGEND

- DIAMOND MINE
- FISHER TRACK
- OTTER TRACK
- MARTEN TRACK
- LOCKHART RIVER TO GAHCHO KUE (OPTION 1)
- LOCKHART RIVER TO SNAP LAKE (OPTION 2A)
- TWIN GORGES TO LOCKHART RIVER
- APPROXIMATE TREELINE
- WATER

50 0 50

SCALE 1:2,000,000 KILOMETRES

REFERENCE

Datum: NAD 83 Projection: Transverse Mercator Coordinate System: UTM Zone 12

PROJECT

NORTHWEST TERRITORIES
ENERGY CORPORATION

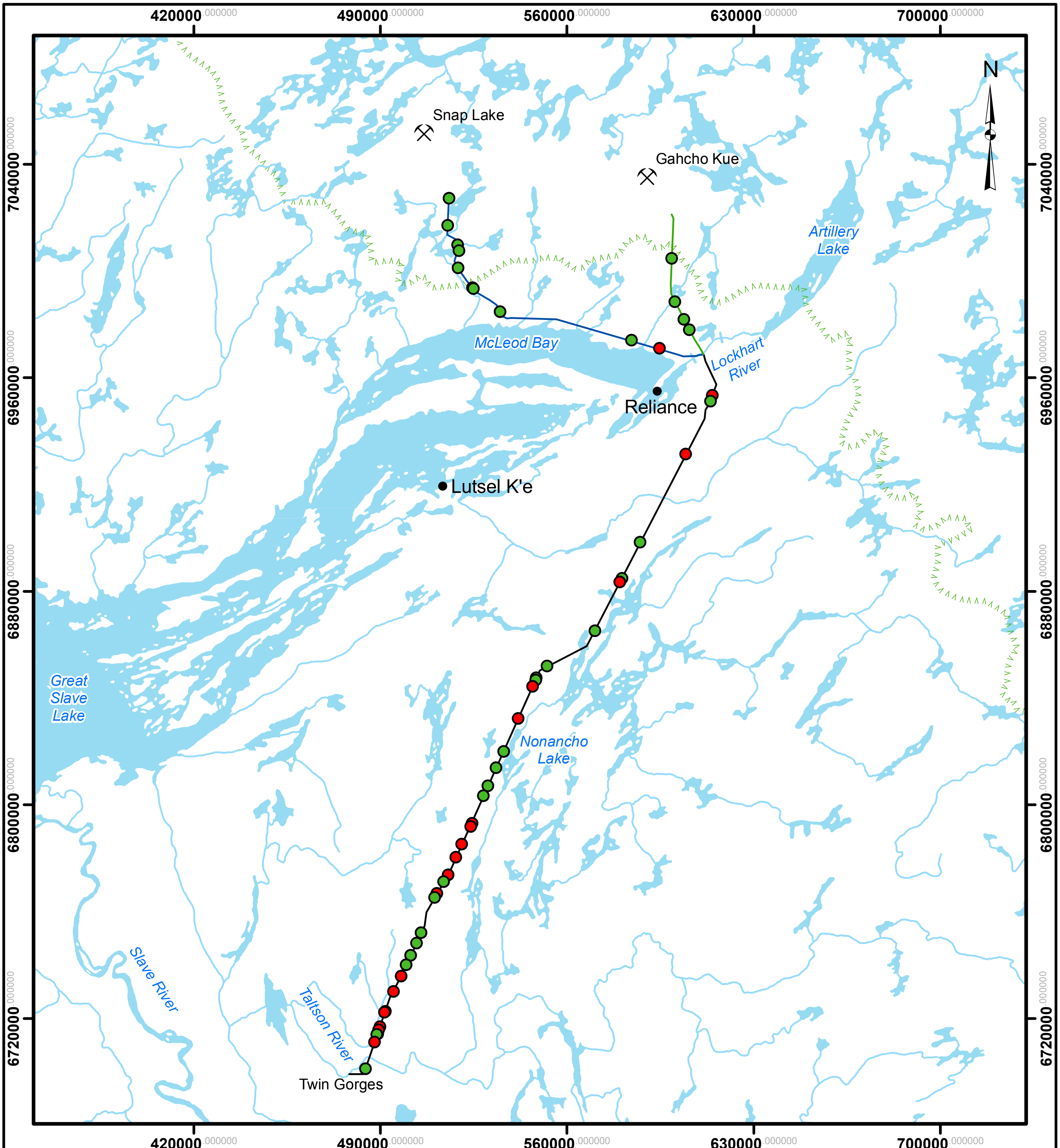
TITLE

FISHER, MARTEN AND RIVER OTTER TRACK OBSERVATIONS

Golder Associates
Yellowknife, Northwest Territories

PROJECT No. 06-1328-002. 5000			SCALE AS SHOWN	REV. 0
DESIGN	DP	28 Mar. 2006	FIGURE: 2-9	
GIS	KB	28 Mar. 2006		
CHECK	DP	20 Apr. 2006		
REVIEW	JV	22 Apr. 2006		

Project: N:\Active\GIS\06-1328-002 NTEC\Final Figures\PDF\Figure 2-9



LEGEND

- DIAMOND MINE
- LYNX TRACK
- FOX TRACK
- LOCKHART RIVER TO GAHCHO KUE (OPTION 1)
- LOCKHART RIVER TO SNAP LAKE (OPTION 2A)
- TWIN GORGES TO LOCKHART RIVER
- APPROXIMATE TREELINE
- WATER

50 0 50

SCALE 1:2,000,000 KILOMETRES

REFERENCE

Datum: NAD 83 Projection: Transverse Mercator Coordinate System: UTM Zone 12

PROJECT

NORTHWEST TERRITORIES
ENERGY CORPORATION

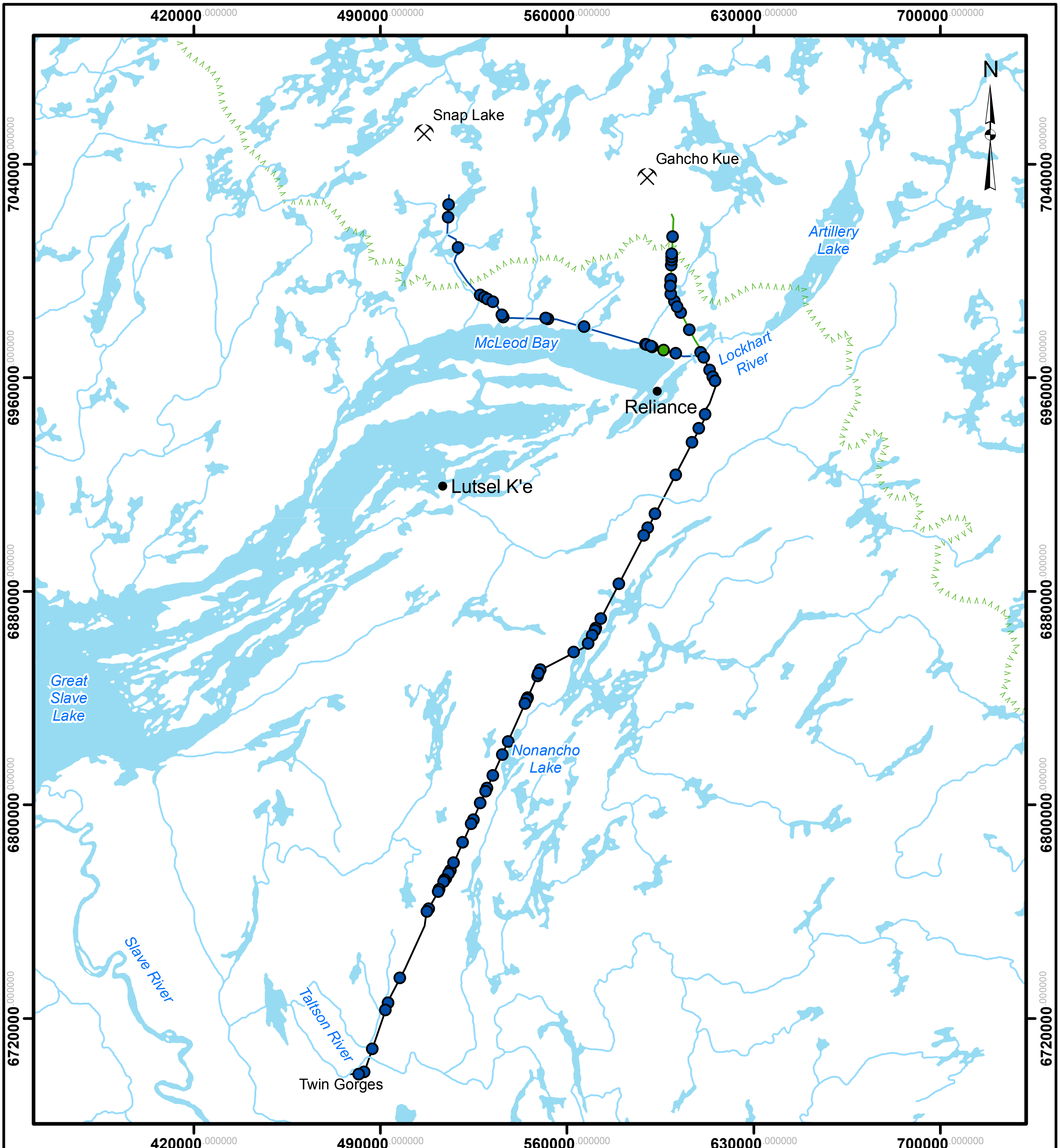
TITLE

FOX AND LYNX TRACK OBSERVATIONS

Golder Associates
Yellowknife, Northwest Territories

PROJECT No. 06-1328-002. 5000			SCALE AS SHOWN	REV. 0
DESIGN	DP	28 Mar. 2006	**FIGURE: 2-10**	
GIS	KB	28 Mar. 2006		
CHECK	DP	20 Apr. 2006		
REVIEW	JV	22 Apr. 2006		

Project: N:\Active\GIS\06-1328-002 NTEC\Final Figures\PDF\Figure 2-10



LEGEND

- DIAMOND MINE
- WOLF TRACK
- WOLF TRAIL
- LOCKHART RIVER TO GAHCHO KUE (OPTION 1)
- LOCKHART RIVER TO SNAP LAKE (OPTION 2A)
- TWIN GORGES TO LOCKHART RIVER
- APPROXIMATE TREELINE
- WATER

50 0 50

SCALE 1:2,000,000 KILOMETRES

REFERENCE

Datum: NAD 83 Projection: Transverse Mercator Coordinate System: UTM Zone 12

PROJECT

NORTHWEST TERRITORIES
ENERGY CORPORATION

TITLE

WOLF TRACK OBSERVATIONS

Golder Associates
Yellowknife, Northwest Territories

PROJECT No. 06-1328-002. 5000			SCALE AS SHOWN	REV. 0
DESIGN	DP	28 Mar. 2006	**FIGURE: 2-11**	
GIS	KB	28 Mar. 2006		
CHECK	DP	20 Apr. 2006		
REVIEW	JV	22 Apr. 2006		

Project: N:\Active\GIS\06-1328-002 NTEC\Final Figures\PDF\Figure 2-11

The winter (November 1 to February 28) home range of collared Bathurst caribou observed between 1996 and 2001 has ranged from 43,000 km^2 to 87,000 km^2, or 14 percent of the total annual range, but has been almost exclusively located south of the treeline (Gunn *et al.* 2002). Annual overlap of caribou winter range with the proposed transmission line has varied from 0% to 75%. The winter home range has overlapped with some sections of the proposed transmission line alignment below the tree line during all winters from 1996 to 2001, with the exception of the winter of 1999/2000 (Gunn *et al.* 2002). Caribou may be and have been present along the transmission line corridor below the tree line during the winter, as confirmed by the aerial surveys in February and March of 2006. But the large area of winter home range, and the variability in the overlap of winter range between successive years, generates a low level of confidence in predicting their presence along a particular section of the transmission line. Small changes in the wintering areas and migration routes could lead to a large change in the number of caribou observed along the proposed transmission line. Further, the average minimum weekly movement rates of Bathurst caribou during the winter has ranged from 2 km/day to 17 km/day (Gunn *et al.* 2002), and is at it's lowest between February and April. This indicates that the exposure time of the caribou (*i.e.* the amount of time spent within the zone of influence of the transmission line) is also unpredictable, as slower movement rates would likely lead to longer exposure.

Moose tend to be found in young forests, recent burns, and riparian areas. They can also range far out into the tundra, particularly in summer (Banfield 1974). Along the proposed transmission line, moose were most numerous south of the Lockhart River, although similar surveys by Rescan (2004) along the transmission line alignment found the greatest densities south of Nonacho Lake. Muskox are most commonly found on the tundra, but may be also found below the treeline, particularly on non-forested slopes (ENR 2006). Muskox were not observed during the 2006 aerial surveys, although they have been documented in the area, and their range is reported to be increasing (ENR 2006). In 2003 and 2004, Rescan (2004) documented a total of 36 muskox in seven groups near the alignment. Muskox are common around Artillery Lake (Enzo, personal communication), and are harvested in this area. Muskox have also been observed occasionally at Snap Lake (De Beers 2006).

The distributions of fisher, fox, marten, otter, wolf and wolverine made during the surveys correspond with those documented in Banfield (1974). Otter, fisher and marten are all boreal forest species, and as such their sign was not observed above the tree line (with the exception of a single observations of otter sign south of Snap Lake). In contrast, wolves and wolverine are found above and below the tree line, and their sign was also observed in these areas during the two aerial surveys.

It was not possible to distinguish arctic fox and red fox tracks from the helicopter though it is likely that both species were encountered. Red fox are commonly found in boreal areas, while the smaller arctic fox are a tundra species. The distributions of arctic and red fox (Banfield 1974) overlap along the Lockhart River to Snap Lake, and Lockhart River to Gahcho Kue sections of the proposed transmission line corridor. It is therefore likely that both species made some of the tracks recorded, but most were likely red fox as the surveys were focused on forested areas of the transmission line alignment.

Wolves in the Northwest Territories are either resident to areas within the treeline or follow the migrating caribou herds (Banfield 1974), and den in the spring on the tundra. Similar to wolf sign, the high incident of wolverine tracks along the Lockhart River to Snap Lake section corresponds to the high index of caribou tracks in that area. Wolves are very mobile, and their distribution is influenced by caribou, their main prey species.

3.0 ANALYSIS OF COLLARED CARIBOU DATA

The purpose of this assessment was to estimate the spatial and temporal use of the transmission line alignments (Option 1 and Option 2a, Figure 1-1) by Bathurst caribou, and if there is a difference in the probability of interaction between caribou and the two options. Specifically, key questions addressed by the analysis included:

- have there been any spatial patterns of caribou presence along the alignment (are some areas used more than others?); and,
- have there been any temporal patterns of caribou presence along the alignment (does caribou presence change with seasons and years?).

Since 1996, ENR has been monitoring the migratory movements of Bathurst caribou cows with the aid of satellite collars (Gunn *et al.* 2002). Between six and 19 cows have been monitored at any one time between 1996 and 2005, for a total of 81 cows. Most collars transmitted locations at five to seven day intervals, although this was increased to daily locations during the calving period of 1996 and 1997 (Gunn *et al.* 2002). The accuracy of the locations ranged from less than 150 m to 1000 m. The advantage of using collared caribou data is that it includes information on caribou locations throughout the year, and throughout the entire range of the Bathurst herd. The limitations of these data are that only six to 19 caribou have been collared at any one time, which is not a representative sample of a herd estimated at 186,000 (ENR 2006). Further, it cannot provide an estimate of the number, group size or behaviour of caribou present in an area, information which can be only acquired through aerial surveys.

Caribou of the Ahiak herd, which calve on the southern coast of the Queen Maud Gulf, have a winter range which overlaps with that of the Bathurst caribou herd (ENR 2006). However, caribou of the Ahiak herd have not been as extensively collared as the Bathurst. Within 30 km of the proposed transmission line alignments (the maximum distance caribou travel within one day, Gunn *et al.* 2002), only 44 locations representing nine collared Ahiak caribou were identified over three years (2001, 2002, and 2005). This was not considered sufficient to conduct an analysis of their potential interactions with the transmission line, and therefore the Ahiak collared caribou data was excluded from the analysis. Caribou of the Beverly and Quamanirjuaq barren-ground herds may be present along the transmission line between Twin Gorges and MacKay Lake from early November to mid-March as determined by aerial surveys, but none of the collared caribou from these two herds has overlapped the transmission line (Beverly and Quamanirjuaq Caribou Management Board [BQCMB] 2006).

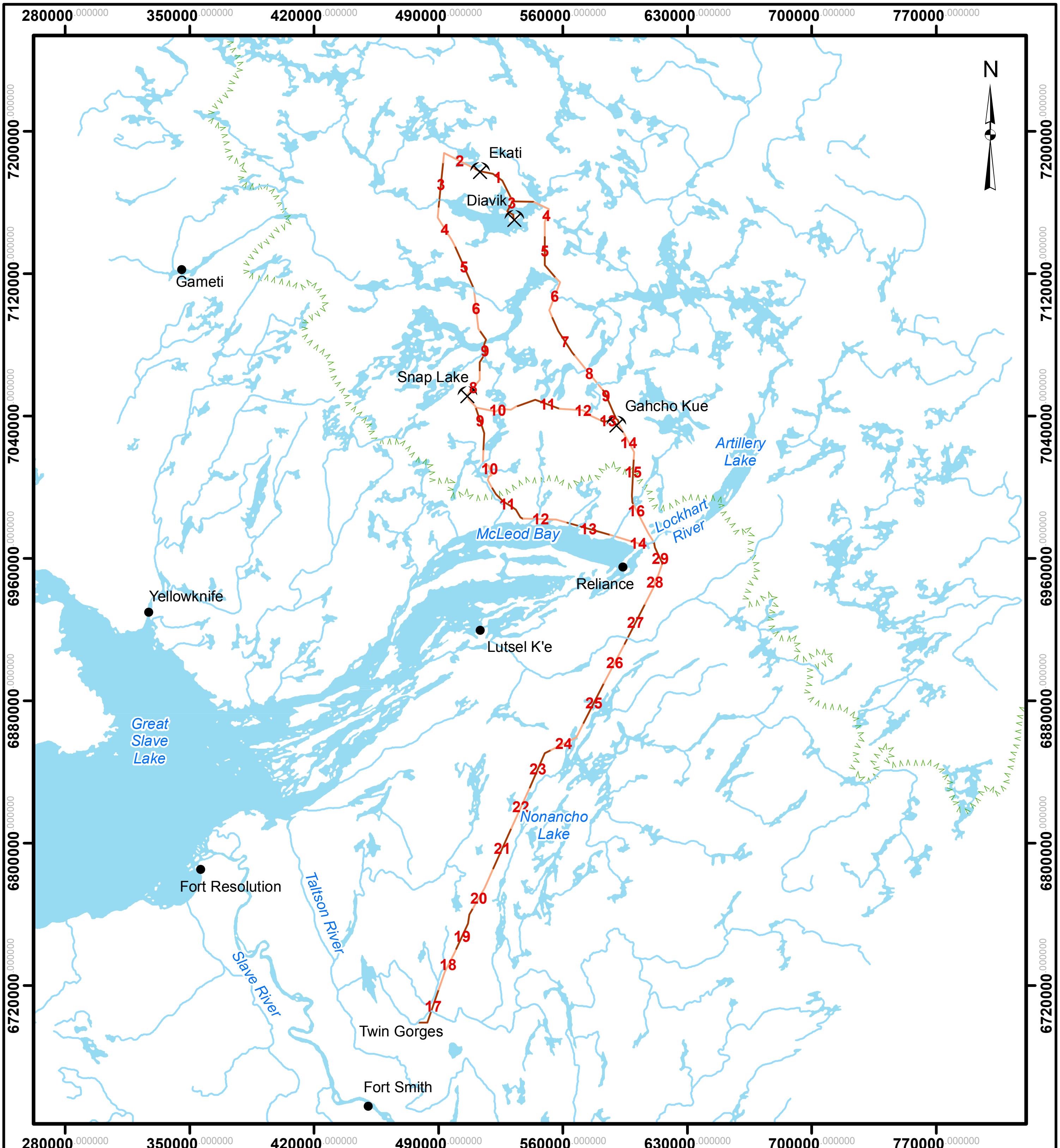
3.1 Methods

The transmission line options (Option 1 and Option 2a) were divided into 25 km segments and each segment was individually numbered (Figure 3-1). The 25 km segments were chosen because that distance is about equal to the greatest distance a caribou moves per day during peak migration (Gunn *et al.* 2002), and provides an indication of which area of the transmission line is most likely to be encountered by the caribou. Option 1 has 13 segments and Option 2a has 15 segments (Figure 3-1). Each segment represented a sampling unit.

Caribou display distinctive seasonal patterns of behaviour, range use and movement rates. As such, the data from satellite collared caribou were divided into a series of biological seasons (Gunn *et al.* 2002). For the purposes of this analysis, biological seasons included the northern migration, calving period, post-calving migration, fall rut, and winter (Table 3-1). Collar locations were grouped within a season accordingly.

Table 3-1
Calendar Dates for the Caribou Biological Seasons

Season	Calendar Dates	Duration (days)
Winter	November 1- April 14	165
Northern Migration	April 15 - May 31	47
Calving	June 1 - June 15	15
Post-Calving	June 16 - August 31	77
Fall Rut	September 1 - October 31	61



LEGEND

DIAMOND MINE

TRANSMISSION LINE SEGMENTS

APPROXIMATE TREELINE

Water

50 0 50 100

SCALE 1:3,000,000 KILOMETRES

REFERENCE

Datum: NAD 83 Projection: Transverse Mercator Coordinate System: UTM Zone 12

PROJECT

NORTHWEST TERRITORIES ENERGY CORPORATION

TITLE

TRANSMISSION LINE OPTION 1 AND 2A WITH 25 KM SEGMENTS

Golder Associates

Yellowknife, Northwest Territories

PROJECT No. 06-1328-002. 5000			SCALE AS SHOWN / REV. 0
DESIGN	DP	28 Mar. 2006	**FIGURE: 3-1**
GIS	KB	28 Mar. 2006	
CHECK	DP	20 Apr. 2006	
REVIEW	JV	22 Apr. 2006	

Project: N:\Active\GIS\06-1328-002 NTEC\Final Figures\PDF\Figure 3-1

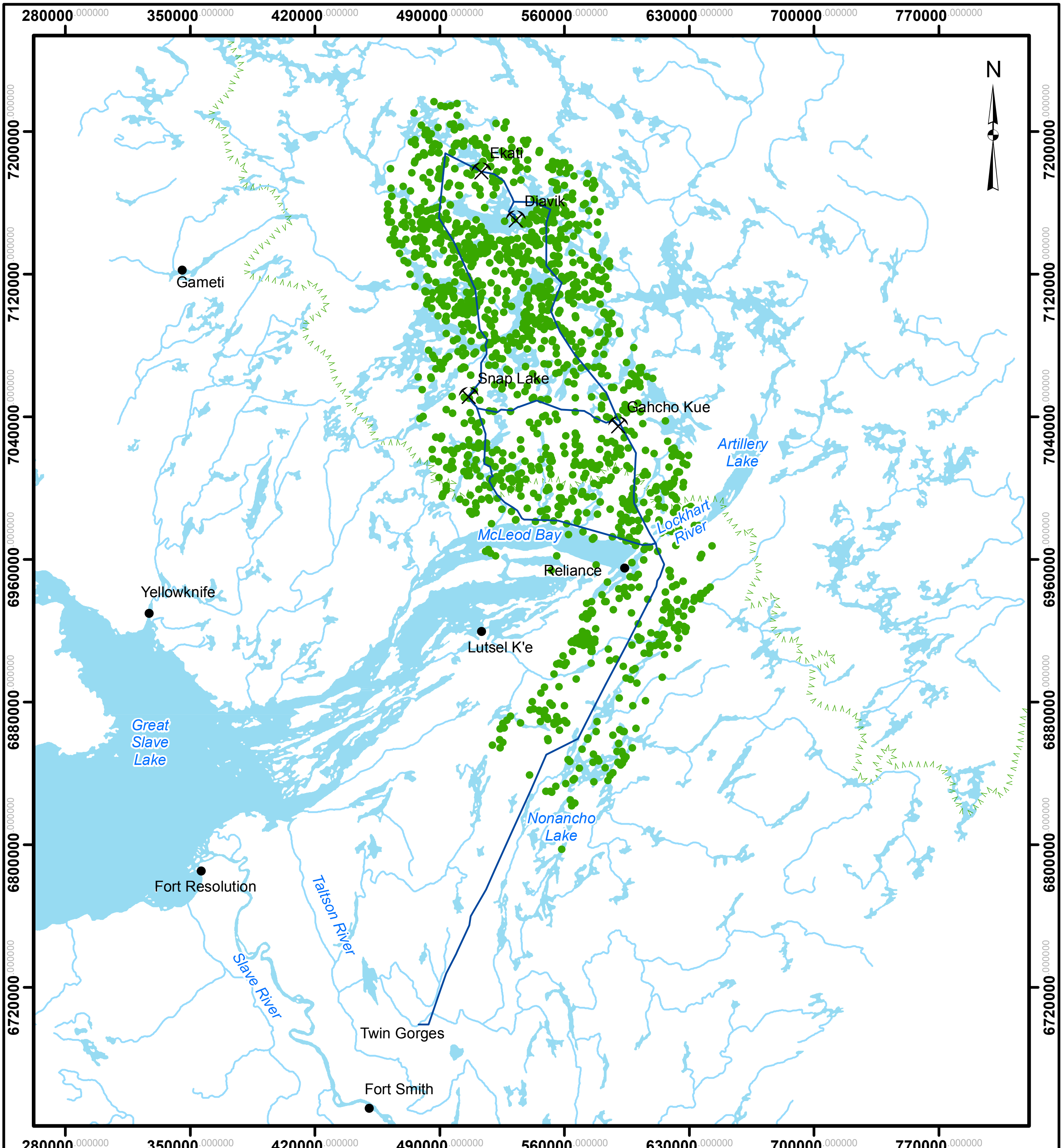
All Bathurst herd caribou collar locations within 30 km of the transmission line options were retained for analysis (Figure 3-2). This distance was chosen to select all caribou within approximately a one day walk from the transmission line, as estimated by their peak daily movement rate (Gunn *et al.* 2002). This distance likely represents a catchment area beyond the zone of influence of the transmission line and likely over-estimates the number of possible interactions per segment, but was selected in the interest of providing a sufficient sample size and a conservative estimate of caribou interactions with the proposed transmission line. In some cases there were multiple locations from a single collar within the same year and season. However, each location within 30 km meant the animal was in the area and it was therefore considered as a possible interaction with the transmission line route. Thus the frequency in which each segment is most likely to interact with caribou was the number of collar locations within each segment. The information used with each location included: the date, biological season, identification number of the nearest segment, and the distance to that segment. The number of locations per segment, mean distance to segment, standard error, and minimum and maximum distance was summarized (Appendix I and Appendix II).

Data were separated into Option 1 or 2a (Figure 3-1) and categorized by caribou (biological) season. Data were then summarized into the number of collar locations for each segment. The number of collar locations per segment divided by the total number of collar locations during that season represented the observed proportion used in comparisons. Only segments with greater than five collar locations were used in the statistical analysis to avoid false conclusions from sparse data. Three segments were less than 25 km in length but were included in analysis if they had greater than 5 collar locations, these segments were 1 and 15 in Option 2a, and segment 2 in Option 1.

A statistical analysis was completed to test for differences in the distribution of collar locations. The χ^2 (Chi square) tests determined whether locations were equally distributed among segments of the transmission line and among seasons between Option 1 and Option 2a. The equality of observed frequency was tested against the expected frequency (number of locations were equally distributed among the segments for each option).

The analyses and results are described in reference to four sections of the proposed transmission line:

- the common section of the two options from Twin Gorges to the Lockhart River (segments 17-29);
- the routing of Option 1 from the Lockhart River to Ekati (segments 1- 9, 14-16);
- the routing of Option 2a from Lockhart River to Ekati (segments1-15); and,
- the section between Snap Lake and Gahcho Kue (segments 10-13).



LEGEND

- DIAMOND MINE
- COLLARED BATHURST CARIBOU LOCATION
- APPROXIMATE TREELINE
- WATER

50 0 50 100

SCALE 1:3,000,000 KILOMETRES

REFERENCE

Datum: NAD 83 Projection: Transverse Mercator Coordinate System: UTM Zone 12

PROJECT

NORTHWEST TERRITORIES
ENERGY CORPORATION

TITLE **COLLARED BATHURST CARIBOU LOCATIONS (1996-2005) WITHIN 30 KM OF THE TRANSMISSION LINE (OPTION 1 AND 2A)**

Golder Associates
Yellowknife, Northwest Territories

PROJECT No. 06-1328-002. 5000			SCALE AS SHOWN	REV. 0
DESIGN	DP	28 Mar. 2006	**FIGURE: 3-2**	
GIS	KB	28 Mar. 2006		
CHECK	DP	20 Apr. 2006		
REVIEW	JV	22 Apr. 2006		

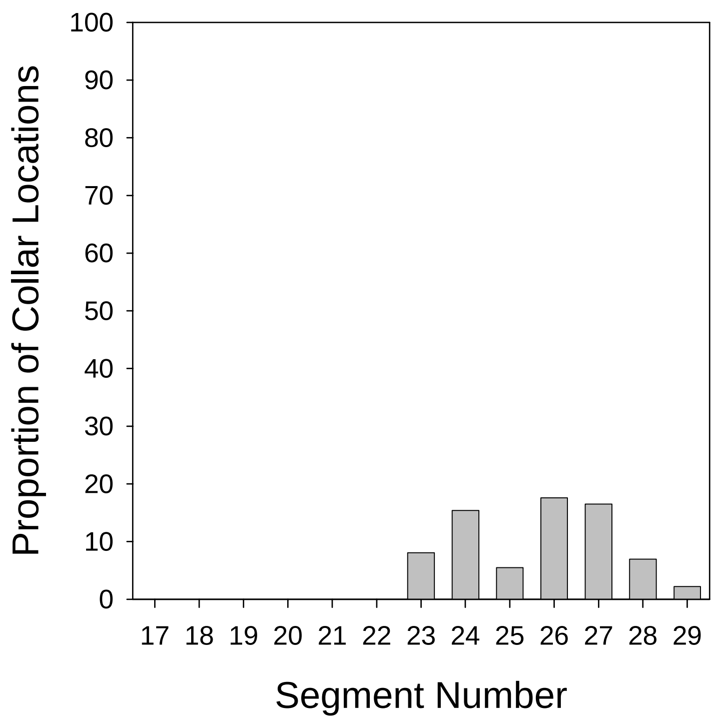
The segments with higher potential caribou interactions within each of these sections were identified. Comparisons to determine which option is least likely to interact with the seasonal ranges of the Bathurst caribou herd were made between two northern routing sections of Option 1 (segments 1-9 and 14-16) and Option 2a (segments 1-15) (Figure 3-1).

3.2 Results

3.2.1 Twin Gorges to Lockhart River

This section includes segments 17 to 29 and is located southeast of Great Slave Lake below the treeline (Figure 3-1). Most of the collar locations recorded along this section occurred during the winter season with the exception of six locations that occurred at segment 26 during the northern migration season. Otherwise, there were seven segments with greater than 5 collar locations during the winter season (segments 23 - 29); whereas, segments 17 to 22 had less than five collar locations. There was evidence the proportion of collar locations occurred unequally among segments 23 to 29 ($\chi^2 = 63.9$, $df = 6$, $P < 0.01$; Figure 3-3). The 95% confidence intervals were proportionately higher for segments 24, 26, and 27 than the expected value of 14.3%. Collectively, the three segments 24, 26 and 27, had 69% of the winter locations (Figure 3-3).

Figure 3-3 The Proportion of Caribou Locations During the Winter Between Twin Gorges and the Lockhart River



3.2.2 Snap Lake to Gahcho Kue

Caribou activity occurred along segments 10 to 12, and not 13, although the likelihood of detecting collared animals adjacent to segment 13 was lower because is was shorter than the other segments (Figure 3-2). The timing of the activity was primarily during the post-calving and fall rut seasons. Five percent of locations during the post-calving season occurred near segments 10 and 11. During the fall rut season about 23% of the caribou locations were observed along segments 10 to 12.

3.2.3 Lockhart River to Ekati via Gahcho Kue and Diavik (Option 1)

The northern section of Option 1 includes segments 1 to 9 and 14 to 16 (Figure 3-1). Most of the collar locations were distributed along the northern segments during the northern migration and post-calving seasons (Figure 3-4). Six of 12 segments had more than 5 collar locations during the northern migration. There was evidence that collar locations occurred unequally during the northern migration among these six segments (χ^2 = 15.3, df = 5, P < 0.01). The observed proportion and its associated 95% confidence interval were higher for segment 1 than the expected value (Table 3-2).

There was evidence that collar locations occurred unequally among segments during the post-calving (χ^2 = 142.7, df = 8, P<0.01) and fall rut seasons (χ^2 =28.5, df = 9, P<0.01) (Figure 3-4). There were two segments identified to have a proportionately higher frequency of locations during the post-calving and fall rut seasons (Table 3-2). Only two segments (14 and 15) had more than 5 locations during the winter season and there was evidence of no difference in distribution between the two (χ^2 = 3.7, df = 1, P>0.05). The observed proportions and their associated 95% confidence intervals were not proportionately higher than the expected value.

Figure 3-4 The Proportion of Caribou Locations as a Function of the Nearest Segment, Lockhart River to Ekati via Gahcho Kue (Option 1)

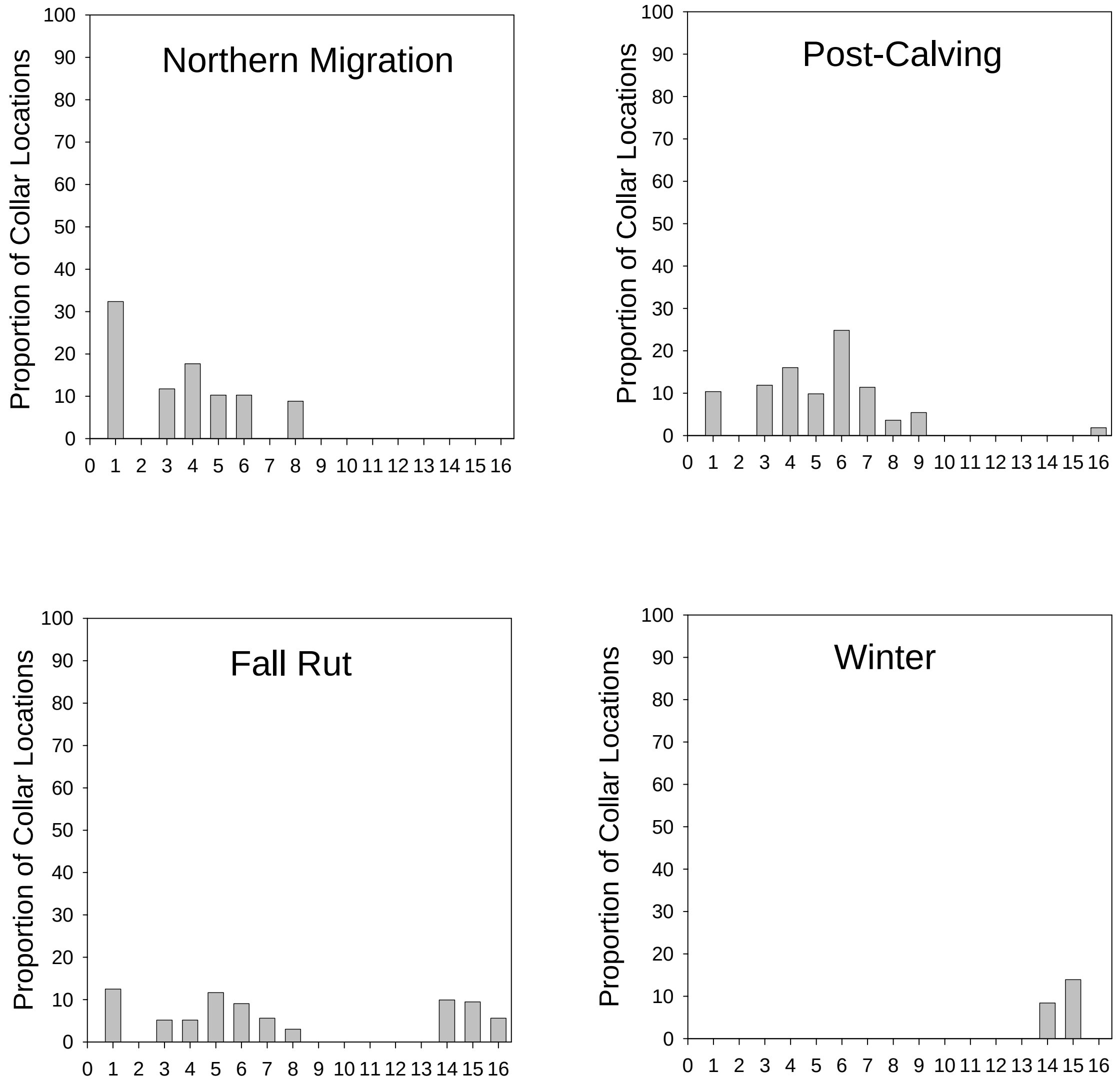


Table 3-2
Segments with the Potential for a Higher Proportion of Caribou Interactions, Lockhart River to Ekati via Gahcho Kue

Caribou Season	Number of Collar Locations	Number of Segments with >5 Collar Locations (N = 12 Segments)	Segment[(a)]	Expected Proportion of Collar Locations[(b)]	Observed Proportion of Collar Locations	95% Confidence Interval	P - value
Northern Migration	62	6	1	17%	36%	25-48%	0.009
Post-Calving	368	9	4	11%	17%	13-21%	0.001
			6	11%	26%	22-31%	
Fall-Rut	179	10	1	10%	16%	12-22%	0.001
			5	10%	15%	11-21%	

Note: a = Only the segments with an unequally higher proportion of collar locations are shown.
b = Only segments with >5 collar locations were tested for equal distribution.
Winter was not included as there were no segments with >5 collar locations

3.2.4 Lockhart River to Ekati via Snap Lake (Option 2a)

Option 2a includes segments 1-15 and is located from the Ekati mine south through the Snap Lake mine to the Lockhart River (Figure 3-1). Most of the collar locations were distributed along the northern segments during the northern migration and post-calving seasons (Figure 3-5). There was evidence that collar locations occurred in an equal distribution during the northern migration among six segments ($\chi^2 = 7.7$, $df = 5$, $P>0.05$). However, segment two had an observed proportion of 28% and associated 95% confidence interval that was greater than the expected value (Table 3-3).

There was evidence that collar locations occurred unequally among segments during the post-calving ($\chi^2 = 115$, $df = 7$, $P<0.01$) and fall rut seasons ($\chi^2 = 74.5$, $df = 13$, $P<0.01$) (Figure 3-5). There were four segments identified to have a proportionately higher frequency of locations during the post-calving season (Table 3-3). Although 14 of 15 segments had more than 5 collar locations during the fall rut, only three segments had a higher proportion of the locations relative to the expected proportion.

Unlike Option 1, seven segments in Option 2a had more than five caribou locations during the winter season. These locations were primarily along the southern segments where Option 2a is located along the north shore of McLeod Bay (Figure 3-1). There was evidence of a difference in distribution among these seven segments ($\chi^2 = 33.4$, $df = 6$, $P<0.01$; Figure 3-5). Specifically at segments 10 and 14, where the observed proportions and their associated 95% confidence intervals were proportionately higher than the expected value (Table 3-3).

Figure 3-5 The Proportion of Caribou Locations as a Function of the Nearest Segment, Lockhart River to Ekati via Snap Lake (Option 2a)

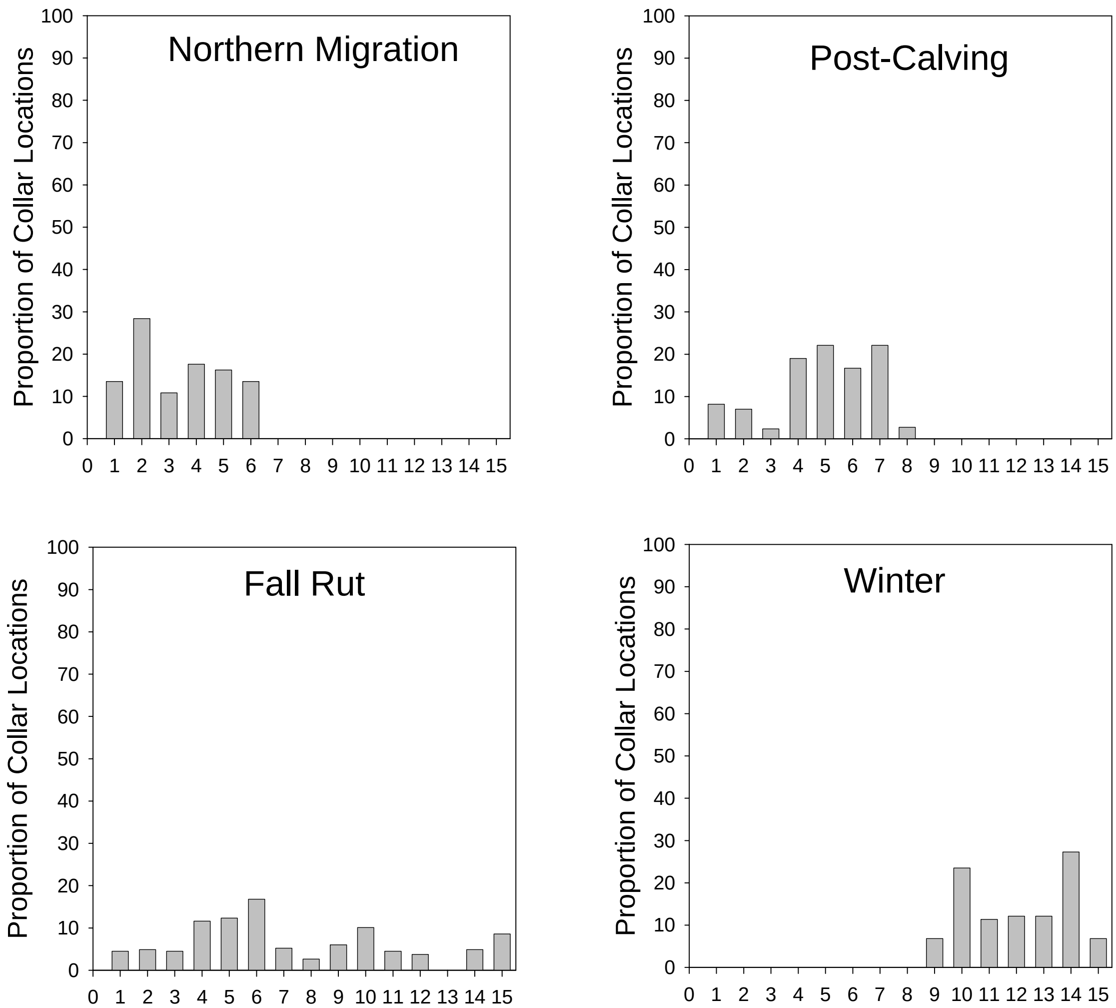


Table 3-3
Segments with the Potential for a Higher Proportion of Caribou Interactions, Lockhart River to Ekati via Snap Lake

Caribou Season	Number of Collar Locations	Number of Segments with >5 Collar Locations (N = 15 Segments)	Segment[(a)]	Expected Proportion of Collar Locations[(b)]	Observed Proportion of Collar Locations	95% Confidence Interval	P - value
Northern Migration	74	6	2	17%	28%	19-40%	0.171
Post-Calving	258	8	4	13%	19%	15-24%	0.001
			5	13%	22%	17-28%	
			6	13%	17%	13-22%	
			7	13%	22%	17-28%	
Fall-Rut	268	14	4	7%	12%	8-16%	0.001
			5	7%	12%	9-17%	
			6	7%	17%	13-22%	
Winter	132	7	10	14%	23%	17-31%	0.001
			14	14%	27%	20-35%	

Note: a = Only the segments with an unequally higher proportion of collar locations are shown.
b = Only segments with >5 collar locations were tested for equal distribution.

3.2.5 Comparison of Option 1 and Option 2a

Option 1 had 27 of 48 segments (56%) with five or more collar locations during the northern migration, post-calving season, fall rut, and winter. Option 2a had caribou activity near 35 of 60 segments (58%) during the same four seasons. For both options, the likelihood of caribou interacting with the transmission line corridor was highest during the post-calving and fall rut seasons (Table 3-4). Eighty-two percent and 72% of the caribou locations occurred during the post-calving and fall rut seasons along Option 1 and Option 2a, respectively. There were no segments with greater than five collar locations during the calving season.

There were statistical differences in the proportion of collar locations within seasons between the two Options ($\chi^2 = 62.3$, $df = 3$, $P<0.01$). The greatest difference between options occurred during the post-calving, fall rut, and winter seasons (Table 3-4). Option 1 had a higher proportion of locations than Option 2a during the post-calving season. Option 2a had more collar locations during the fall rut and winter seasons. During the northern migration, the proportion of observations was similar for the two options (Table 3-4)

Table 3-4
Comparison of Segments in Option 1 and 2a
Identified to Have Potential Interactions with Caribou

Option 1 (Segments 1-9, 14-16)[(a)]				**Option 2a (Segments 1 – 15)**		
Caribou Season	**Number of Collar Locations**	**Number of Segments with >5 Collar Locations**	**Segments Identification Number**	**Number of Collar Locations**	**Number of Segments with >5 Collar Locations**	**Segments Identification Number**
Northern Migration	62 (9%)[(b)]	6 (50%)[(c)]	1, 3-6	74 (10%)	6 (40%)	1-6
Post-Calving	368 (55%)	9 (75%)	1, 3-9, 16	258 (35%)	8 (53%)	1-8
Fall Rut	179 (27%)	10 (83%)	1, 3-8, 14-16	268 (37%)	14 (93%)	1-12, 14, 15
Winter	61 (9%)	2 (17%)	14, 15	132 (18%)	7 (47%)	9-15

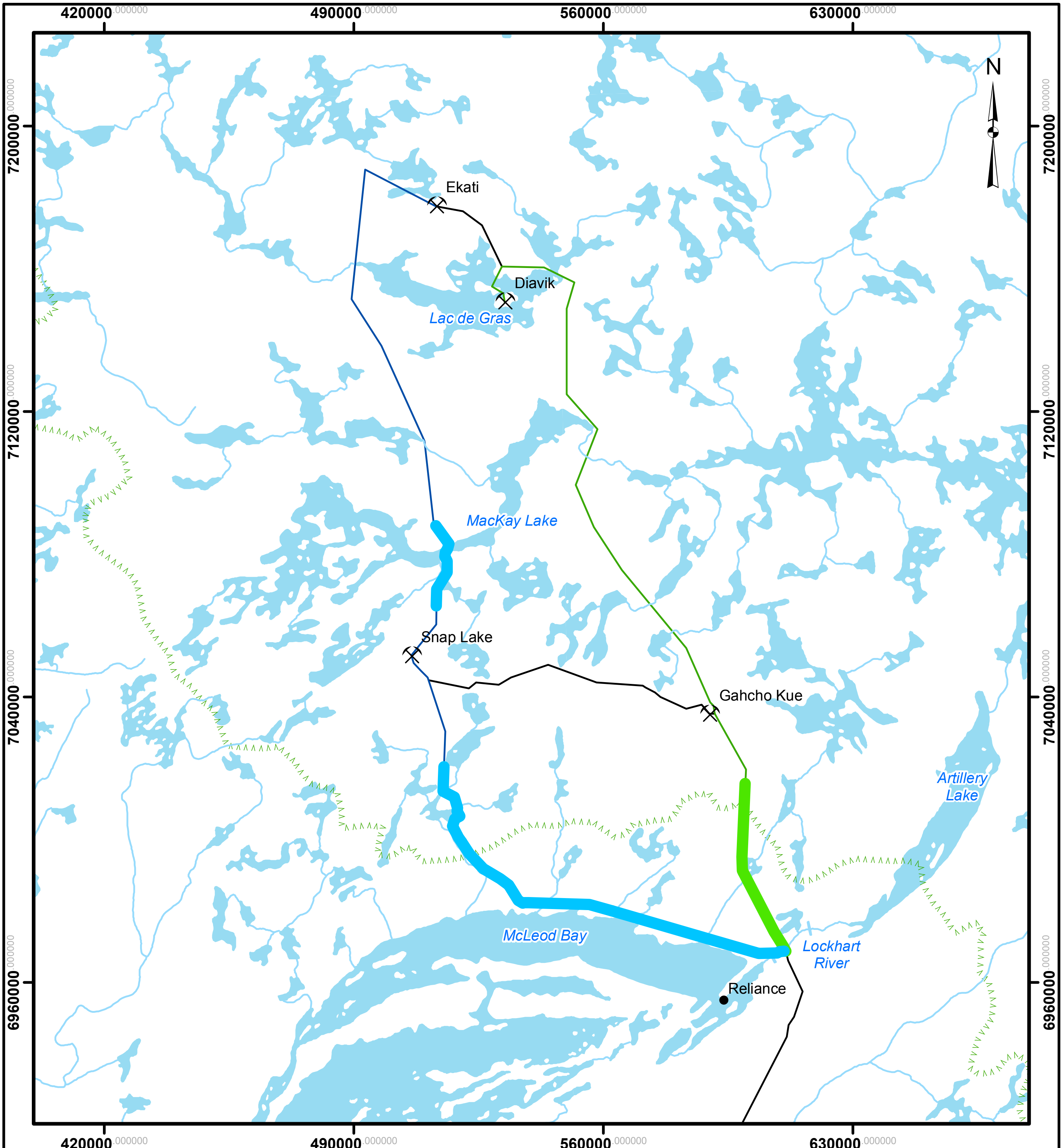
Note: a = Only segments 1-9 and 14-16 were compared with Option 2a.
b = The number of collar locations during a season divided by the total number collar locations for each option.
c = The number of segments with > 5 collar locations divided by the total number of segments in Option 1 and 2a.

There were also within seasonal differences in the number of segments with caribou activity between the two options, particularly during the post-calving and winter seasons (Table 3-4). For example, during the post-calving season, Option 1 had 75% of segments with more than five locations whereas 53% of the segments in Option 2a had similar levels of caribou activity. During the winter, Option 2a had 47% of segments with greater than five locations, while 17% of the segments along Option 1 exhibited similar levels of caribou activity.

The segments identified in Table 3-4 as having a greater potential for interactions with caribou are illustrated geographically in Figure 3-6 through Figure 3-9. Segments with a greater potential for interactions with caribou are highlighted over the two transmission line options. Option 2a had a greater proportion of segments with caribou activity during the fall rut and winter months, but as Figure 3-6 and Figure 3-9 illustrate, the latitudinal distribution of these segments with higher activity was similar for both options, with the exception of the segments crossing MacKay Lake on Option 2a.

3.3 Discussion

The common section of Option 1 and Option 2a from the Twin Gorges to the Lockhart River had seven of 13 segments (23-29) with more than 5 collar locations during the winter season from 1996 through 2005. Three of those seven segments (24, 26, and 27) had higher proportions of locations, and therefore, would likely have the most interactions with caribou during the winter season.



LEGEND

- DIAMOND MINE
- APPROXIMATE TREELINE
- OPTION 1
- WATER
- OPTION 2A
- SECTIONS COMMON TO BOTH OPTIONS

SEGMENTS WITH HIGHER POTENTIAL OF CARIBOU

- SEGMENTS IN OPTION 1
- SEGMENTS IN OPTION 2A

50 0 50

SCALE 1:1,500,000 KILOMETRES

REFERENCE

Datum: NAD 83 Projection: Transverse Mercator Coordinate System: UTM Zone 12

PROJECT

NORTHWEST TERRITORIES
ENERGY CORPORATION

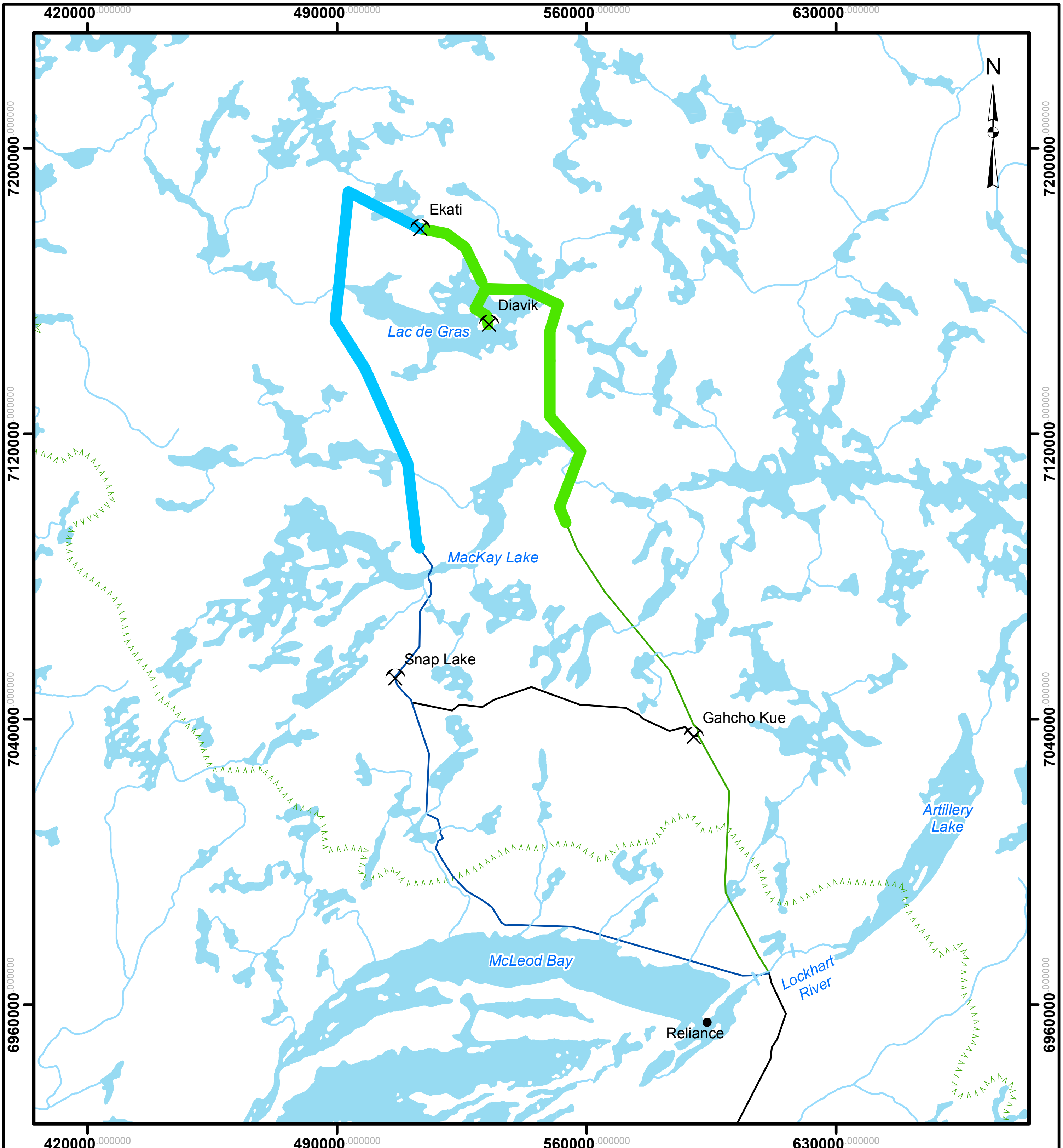
TITLE

SEGMENTS WITH POTENTIAL FOR HIGHER PROPORTION OF CARIBOU WINTER SEASON

PROJECT No. 06-1328-002. 5000			SCALE AS SHOWN	REV. 0
DESIGN	DP	28 Mar. 2006	**FIGURE: 3-6**	
GIS	KB	28 Mar. 2006		
CHECK	DP	20 Apr. 2006		
REVIEW	JV	22 Apr. 2006		

Golder Associates
Yellowknife, Northwest Territories

Project: N:\Active\GIS\06-1328-002 NTEC\Final Figures\PDF\Figure 3-7



LEGEND

DIAMOND MINE
APPROXIMATE TREELINE
OPTION 1
WATER
OPTION 2A
SECTIONS COMMON TO BOTH OPTIONS

SEGMENTS WITH HIGHER POTENTIAL OF CARIBOU

SEGMENTS IN OPTION 1
SEGMENTS IN OPTION 2A

REFERENCE

Datum: NAD 83 Projection: Transverse Mercator Coordinate System: UTM Zone 12

50 0 50
SCALE 1:1,500,000 KILOMETRES

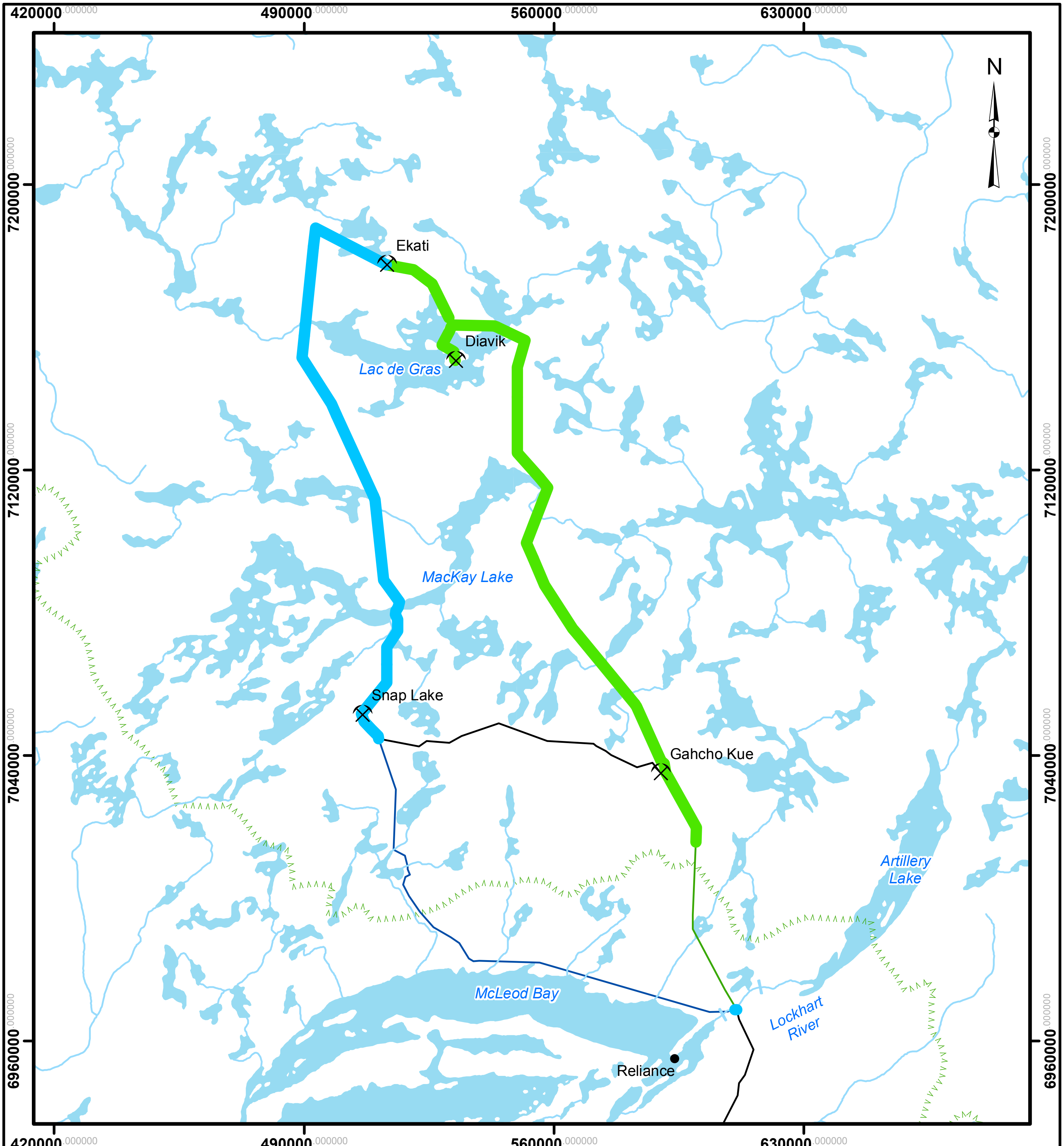
PROJECT
NORTHWEST TERRITORIES ENERGY CORPORATION

TITLE
SEGMENTS WITH POTENTIAL FOR HIGHER PROPORTION OF CARIBOU NORTHERN MIGRATION

Golder Associates
Yellowknife, Northwest Territories

PROJECT No. 06-1328-002. 5000			SCALE AS SHOWN	REV. 0
DESIGN	DP	28 Mar. 2006	**FIGURE: 3-7**	
GIS	KB	28 Mar. 2006		
CHECK	DP	20 Apr. 2006		
REVIEW	JV	22 Apr. 2006		

Project: N:\Active\GIS\06-1328-002 NTEC\Final Figures\PDF\Figure 3-8



LEGEND

- DIAMOND MINE
- APPROXIMATE TREELINE
- OPTION 1
- WATER
- OPTION 2A
- SECTIONS COMMON TO BOTH OPTIONS

SEGMENTS WITH HIGHER POTENTIAL OF CARIBOU

- SEGMENTS IN OPTION 1
- SEGMENTS IN OPTION 2A

REFERENCE

Datum: NAD 83 Projection: Transverse Mercator Coordinate System: UTM Zone 12

50 0 50

SCALE 1:1,500,000 KILOMETRES

PROJECT

NORTHWEST TERRITORIES
ENERGY CORPORATION

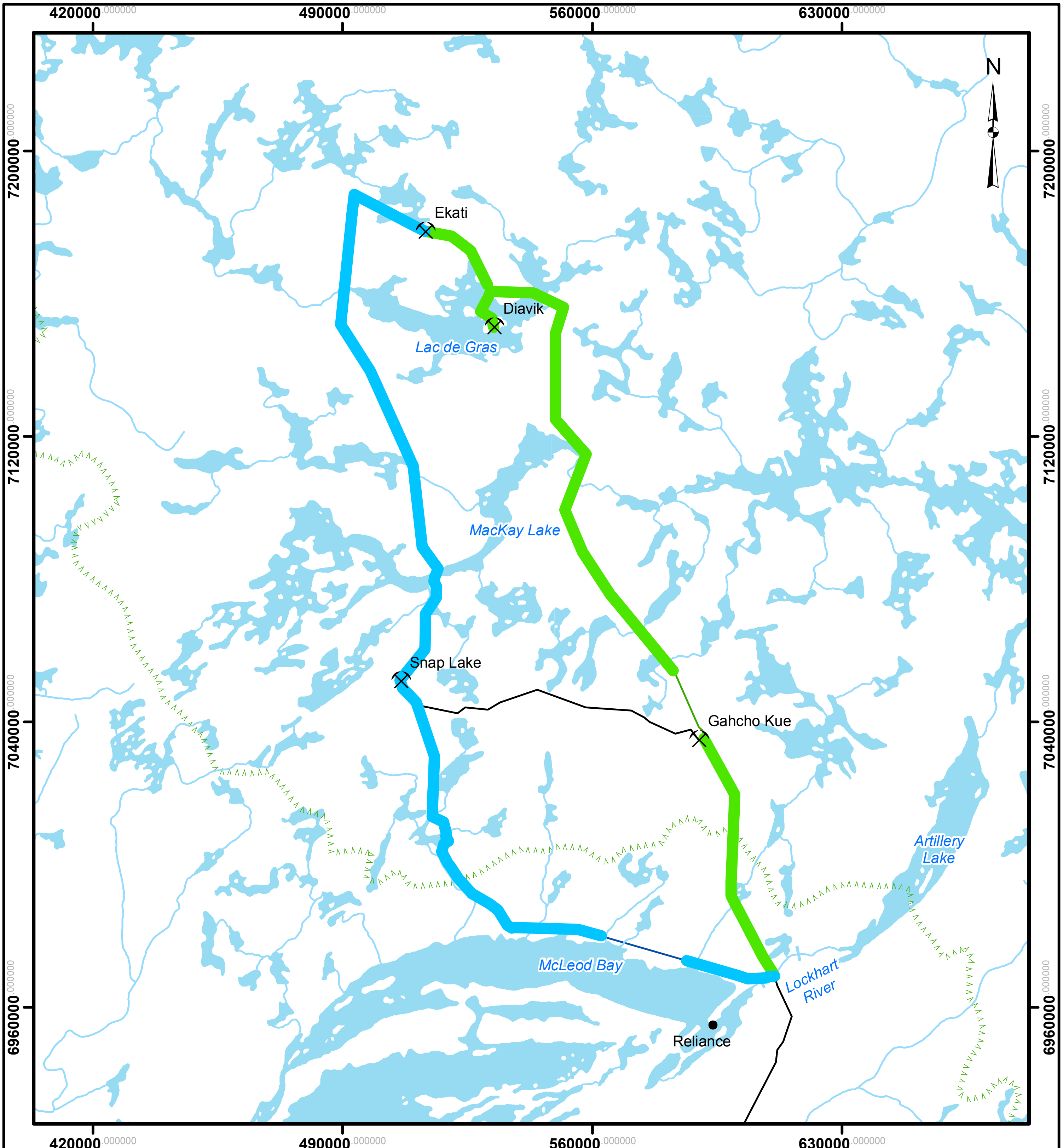
TITLE

SEGMENTS WITH POTENTIAL FOR HIGHER PROPORTION OF CARIBOU POST-CALVING MIGRATION

Golder Associates
Yellowknife, Northwest Territories

PROJECT No. 06-1328-002. 5000			SCALE AS SHOWN	REV. 0
DESIGN	DP	28 Mar. 2006	**FIGURE: 3-8**	
GIS	KB	28 Mar. 2006		
CHECK	DP	20 Apr. 2006		
REVIEW	JV	22 Apr. 2006		

Project: N:\Active\GIS\06-1328-002 NTEC\Final Figures\PDF\Figure 3-9



LEGEND

- DIAMOND MINE
- APPROXIMATE TREELINE
- OPTION 1
- WATER
- OPTION 2A
- SECTIONS COMMON TO BOTH OPTIONS

SEGMENTS WITH HIGHER POTENTIAL OF CARIBOU

- SEGMENTS IN OPTION 1
- SEGMENTS IN OPTION 2A

50 0 50

SCALE 1:2,000,000 KILOMETRES

REFERENCE

Datum: NAD 83 Projection: Transverse Mercator Coordinate System: UTM Zone 12

PROJECT

NORTHWEST TERRITORIES
ENERGY CORPORATION

TITLE

SEGMENTS WITH POTENTIAL FOR HIGHER PROPORTION OF CARIBOU FALL RUT SEASON

Golder Associates
Yellowknife, Northwest Territories

PROJECT No. 06-1328-002. 5000			SCALE AS SHOWN	REV. 0
DESIGN	DP	28 Mar. 2006	**FIGURE: 3-9**	
GIS	KB	28 Mar. 2006		
CHECK	DP	20 Apr. 2006		
REVIEW	JV	22 Apr. 2006		

Project: N:\Active\GIS\06-1328-002 NTEC\Final Figures\PDF\Figure 3-10

The northern section of Option 1 between the Lockhart River and Ekati (via Gahcho Kue) had most collar locations along segments 1 to 9 between Gahcho Kue and Diavik during the northern migration and post-calving seasons. Fall rut activity was spread out among almost all segments. The only winter activity was located in segments 14 and 15.

Option 2a (Lockhart River to Ekati via Snap Lake) had all northern migration and post-calving locations between Snap Lake and Ekati. Fall rut was dispersed across all segments except 13. There were also significant winter season locations along segments 9 to 15 that are located along McLeod Bay.

3.3.1 Comparison Between Option 1 and 2a

There was a statistical difference in the proportion of locations within seasons between the two Options. Based on the total number of locations, Option 1 had a higher proportion of locations during post-calving season, and Option 2a had a higher proportion during fall rut and winter seasons. No difference was found in the number of locations between the two Options during the northern migration.

The largest difference detected was during the winter season between the two Options. Segments 9 to 15 of Option 2a are evidently in a wintering area for caribou, whereas only two segments of Option 1 (14 and 15) appear to have a similar level of activity. As the winter biological season is significantly longer than all other seasons (165 days vs. 77 days for the next longest biological season, post-calving [Table 3-1]), and the average daily movement rate is also lowest during the winter season (Gunn *et al.* 2002), it is likely that areas of the transmission line passing through winter range of the Bathurst caribou would have longer exposure times for caribou.

4.0 LITERATURE REVIEW

A literature review was conducted to determine the possible impacts of the proposed transmission line on wildlife and wildlife habitat. Information was derived from three bodies of information: the scientific literature, reports from wildlife monitoring at the existing diamond mines to be serviced by the transmission line, and TEK.

4.1 Search Methods

Scientific knowledge regarding the impacts of transmission lines was identified through searches of the Environment and Natural Resources, the University of Guelph, and the Golder Associates Ltd. (Golder) Libraries. Search keywords included 'wildlife' or 'bird' or 'caribou' in combination with 'cutline' or 'transmission [line]' or 'power [line]'. Further literature regarding the impacts of cutlines and habitat changes on bird communities was provided by the Canadian Wildlife Service (Machtans, personal communication). Industry reports documenting wildlife monitoring at the three existing diamond mines (Diavik, Ekati, and Snap Lake) were available in the Golder library.

The available literature documenting Dene and Chipewyan TEK in the region of the proposed transmission line was selected by determining if it could contribute to the understanding of the possible impacts of a transmission line in the taiga forest or barren-grounds. TEK was identified through a previous review of TEK conducted by Brockman and Legat (1995) and Sadownik and Harris (1995), and through a search of documents available in the Golder library. Information sources documenting ethnography, stories and legends, and unpublished proprietary TEK were not included in the review.

4.2 Scientific Literature

According to Jakimchuck *et al.*(1983), caribou may be impacted by linear disturbances such as transmission line cutlines in several different ways, including; obstructions to movement, disturbance, improved access by hunters and predators, vehicle collisions, and changes to habitat. These five possible impacts were used as the basis to organize the findings of the literature review, and will be applied to all wildlife species. However, as the only road associated with the transmission line will be winter roads associated with construction (short duration), vehicle collisions were not considered. Unlike Jakimuchuck *et al.* (1983), these categories were applied to all VEC species, though not all were relevant to all species and information was not available for all species.

4.2.1 Obstructions to Movement

Crossing frequencies of elevated pipelines by caribou in the treeless northern coast of Alaska were studied by Curatolo and Murphy (1986). These pipelines were elevated from the ground to at least 1.5 m, specifically to mitigate any barrier effect the pipeline may have to caribou. Caribou did not appear to avoid crossing under these elevated pipelines; only pipelines coupled with roads and traffic affected crossing frequency. However, caribou behaviour while crossing the pipeline was affected; up to 12 percent of the caribou passing under the elevated pipelines were running. The results also indicated that environmental factors (particularly biting insects such as mosquitoes) play a role in the caribou's decision to cross roads and pipelines.

Crossing frequencies of roads and 7 m to 9 m wide seismic lines through forest by woodland caribou in northern Alberta were studied by Dyer *et al.* (2002). No difference could be detected between the crossing frequency of seismic lines and control areas during any of the five biological seasons examined (*e.g.,* late winter, calving, summer, and rut).

4.2.2 Changes to Access

Use of linear corridors for travel by wildlife has been reported by both caribou and moose, and their main predator, wolves. As suggested by Dyer *et al.* (2001), the impacts of a cutline would be difficult to determine from this perspective. Jakimchuk *et al.* (1983) reported that caribou tend to follow linear corridors which do not deviate significantly from their intended course. The cutline may therefore facilitate caribou migrations by providing a travel corridor, but it may also increases the ability of wolves and humans to access the caribou (Horejsi 1979; James and Stuart-Smith 2000). Caribou mortalities attributed to wolf predation were closer to linear corridors than expected, and there were indications that caribou were also more likely to be hunted by humans when near a corridor (James and Stuart-Smith 2000), although the study area (northern Alberta) contained denser forest than that usually found within the Taiga Shield, thorough which the proposed transmission line will be positioned.

4.2.3 Noise

Jakimchuk *et al.* (1983) reported that the noise associated with transmission lines was observed to frighten wild reindeer, but noise was not generally considered to be a significant source of disturbance. No other information regarding the effects of noise from transmission lines were identified.

4.2.4 Habitat Changes

As the transmission line will not require any clearing of trees above the treeline, no direct habitat alteration will take place in this area, with the exception of the footing of the transmission towers (the towers will have a single foot per tower, not including guyline anchors). Below the treeline, all vegetation over 3 metres in height will be cut to create a 30 m wide corridor. As caribou often travel along linear disturbances and graze on the vegetation which develops in these cleared areas, Jakimchuck *et al.* (1983) did not consider habitat disturbance along a cutline to be significant. However, research by Dyer *et al.* (2001) did detect avoidance of seismic lines by woodland caribou throughout the year, at distances of up to 250 m in the late winter.

Use of transmission line towers by raptors and ravens as nesting platforms has been well documented (see review by Lehman 2001). Raptors are apparently attracted to transmission towers by the wide field of view for hunting, and easy takeoff (Boeker and Nickerson 1975, Harness and Wilson 2001). For example, raptors and ravens began to nest along the towers within a year of construction of an electrical transmission line in southern Idaho and Oregon (Steenhof *et al.* 1993). Steenhof *et al.* (1993) also found that ravens in the Mojave Desert nested more frequently along transmission lines than other nesting habitats. In the same study it was found that red-tailed hawks also nest more frequently along transmission lines and used the transmission towers as perch sites. Similarly, Knight and Kawashima (1993) found that red-tailed hawks and ravens selected transmission lines as nests and perches.

4.2.5 Other Effects

The effect of electromagnetic fields on wildlife is not well understood. It has been proposed that the electromagnetic field associated with a transmission line was the most likely cause of a decline in reproductive success of tree swallows (Doherty and Grubb 1998), but no other information on the effects of electromagnetic fields could be identified.

Because raptors are attracted to the nesting and perching habitat provided by transmission lines, the incidence of electrocution can be quite high. For instance, it has been estimated that electrocution is the second highest cause of mortality among golden eagles in North America (Harness and Wilson 2001). Mortalities are usually more numerous among larger species (such as eagles) than small species (such as falcons), which are more likely to span the distance between electrically charged and grounded structures. Further, juveniles tend to more susceptible to electrocution than adults, possibly due to a lack the flight experience (Harness and Wilson 2001).

Since the 1970's and 1980's, considerable efforts have been made to improve the structure of power lines (Lehman 2001). Studies have been conducted to identify the most dangerous transmission line structures and configurations (O'Neil 1988, Harness and Wilson 2001), and practices have been suggested to minimize the number of raptor electrocutions (see Olendorff *et al.* 1981).

In the Northwest Territories, along a total distance of 190 km of transmission line operated by the Northwest Territories Power Corporation (the Snare River and Bluefish transmission lines), there were three raven electrocutions between 2002 and 2005, or 0.4 electrocutions per year per 100 km of line. No other species were recorded to have been electrocuted during this time (Dies, personal communication).

4.2.6 Discussion

As noted by Dyer *et al.* (2002), the barrier effects from development may be more pronounced to non-migratory woodland caribou than to the migratory barren-ground caribou present along the proposed transmission line corridor. Woodland caribou are not present in the region of the proposed transmission line (ENR 2006).

The evidence suggests that caribou occasionally follow cutlines that do not deviate significantly from their intended direction of travel. This may be relevant to caribou migrating through the forested areas of the Taltson transmission line, which will be cleared to a width of 30 m during construction. However, the low degree of tree cover (*i.e.,* open canopies and frequent exposed bedrock) observed during aerial surveys for most of the proposed alignment may limit such an effect.

The cutline could also produce some localized changes to caribou behaviour. Such changes have been detected at distances of up to 250 m from the cutline in studies of woodland caribou. This suggests that a narrow cutline may result in a functional loss of habitat that is larger than the area that is physically cleared.

Access to prey species by humans and predators (particularly wolves, which are highly mobile) may be improved by the 30 m wide clearing for the transmission line (in the forested areas of the proposed transmission line), and during the construction phase when a winter road will be opened from Twin Gorges, northeast for approximately 260 km. However, this improved access may be limited to the winter months when the winter road is operational and only for the two to four year construction period, after which time it is not expected to be maintained. Further, it is unlikely that a cutline cleared of trees over 3 m in height, but not of trees or shrubs below this height, will provide improved snowmobile access over already existing snowmobile trails.

Bird electrocutions as a result of the proposed transmission line will likely occur, but records from two other major transmission lines in the Northwest Territories has shown that these electrocutions are both rare, and apparently limited to ravens. Any noise created from the transmission line (either from wind or the electricity) may cause disturbance to wildlife, and this has been observed to occur. However, the low decibel, constant noise would lend itself to habituation and may have less impact than infrequent and unpredictable noises.

4.3 Information from Mine Wildlife Monitoring Programs

There are currently two operating diamond mines in the Northwest Territories (Diavik and Ekati), one in construction (Snap Lake), and one which has recently entered the permitting phase (Gahcho Kue). The permitting of these mines included requirements for the monitoring of effects to wildlife resulting from the mine, within a regional study area.

Monitoring of wildlife at the diamond mines has been focused on VECs, which are species or groups of species which are considered to have significant cultural or ecological value. VECs common to all environmental assessments and monitoring programs of Northwest Territories diamond mines include caribou, wolverine, grizzly bear, wolves, falcons, and wildlife habitat. Other VECs occasionally used include upland birds, loons, fox, and waterfowl.

For the purposes of this review, the relevant wildlife effect monitoring program reports from the three diamond mines (Diavik, Snap Lake, and Ekati) were reviewed to identify any information in these reports relevant to the placement of the proposed transmission line.

Extensive and multi-year monitoring at these sites has provided a large amount of information regarding wildlife presence and movements in the study areas. Documents reviewed to determine wildlife presence, distribution and identify sensitive wildlife areas at the Diavik, Ekati, and Snap Lake mines included Diavik (2005), BHPB (2004), and Golder (2006), all of which included historical information from previous years of wildlife monitoring at each respective site. Although wildlife baseline studies have been initiated at the Gahcho Kue project, this project is currently in the early stages of environmental assessment, and no documents detailing the results of wildlife studies have yet been made public (Mackenzie Valley Environmental Impact Review Board [MVEIRB] 2006).

Wildlife monitoring at the Diavik, Ekati and Snap Lake diamond mines has consisted of a combination of surveys within a regional study area to determine large-scale impacts, and more surveys within the mine footprint to document wildlife interactions with the mine. Information gathered during the regional study area surveys are applicable to determining if the proposed transmission line will cross any sensitive wildlife areas in the vicinity of the mines.

4.3.1.1 Diavik and Ekati

The Diavik and Ekati mines are within 30 km of one another, and the northern boundary of the Diavik regional study area is shared with the southern boundary of the Ekati study area. These two projects will be considered a single entity for the purpose of this summary. The Ekati mine became operational in 1998, while the Diavik mine became operational in 2001.

The Ekati study area is composed predominantly of heath tundra (including heath tundra with bedrock and boulder), which constitutes 42% of the 1,600 km^2 study area, and water constitutes a further 34%. A large esker system runs east-west roughly from the Exeter Lake to the north coast of Lac du Sauvage and from Ursula Lake to the Lac du Sauvage narrows and beyond. The Diavik regional study area is 1,200 km^2. Proportions of land cover types for the Diavik study area were not available, but it is predominantly composed of heath tundra and water, with several esker systems along the south coast of Lac de Gras, oriented in a northwest-southeast direction (BHPB 2004).

4.3.1.2 Caribou

Weekly aerial surveys between April and October at the Diavik and Ekati mines have shown that the two study areas lie within the northern and post-calving migratory routes of the Bathurst herd. Caribou have regularly appeared in this region in May during their northern migration to the calving grounds, and again, although less predictably, in July as they return from the calving grounds (BHPB 2004; and Diavik 2005). A third peak in caribou numbers occurs between July and October, although this movement again has not been predictable from year to year (BHPB 2004 and Diavik 2005). Caribou are observed only occasionally outside of these two migratory seasons, and no caribou-specific monitoring is conducted outside of these seasons. Information from the Ahiak herd is limited (due to fewer satellite collars), but the data indicates that Ahiak caribou are also not abundant in the Diavik or Ekati study areas during the winter, and appear to be absent during all other seasons.

During the northern migration, caribou have generally been most abundant to the west of the Ekati and Diavik study areas. This has not been the case every year, and appears to depend upon the wintering location of individual caribou. Caribou wintering to the north and west of Great Slave Lake have generally migrated to the west of the Ekati and Diavik study areas, while caribou wintering to the south and east of Great Slave Lake have generally migrated to the east of the Ekati and Diavik study areas during the northern migration (Diavik 2005).

Post-calving migration routes appear to be more variable than northern migration routes (Diavik 2005). In most years, a clear migration corridor has been evident from the movements of collared caribou, but in some years a migration corridor was either not apparent or wide enough to encompass both study areas (Diavik 2005).

There are some geographic features which appear to cause ‘bottlenecks’ to migration during the post-calving migration. One such area of particular relevance to the proposed transmission line includes the narrows between Lac de Gras and Lac du Sauvage (near the Misery pit) which would be crossed by the proposed alignment for Option 1. This area has been observed to act as a bottleneck for south-bound caribou during their post-calving migration, and large groups of caribou have also been observed along the southeast shore of Lac de Gras (Diavik 2005). This area is also actively hunted by sport hunters from the Lac de Gras outfitting camp (operated by Courageous Lake Caribou Camps), located on the south shore of Lac de Gras near these narrows.

Habitat selection appears to occur within the Diavik and Ekati study areas. During aerial surveys, caribou were more frequently observed in heath tundra, heath tundra/boulder/bedrock, riparian shrub and tussock-hummock habitats than on frozen lakes (during the northern migration) or water (during the post-calving migration, Diavik 2005). Behaviour is influenced by habitat type; during the northern migration caribou on frozen lakes tended to be moving more than caribou groups on other habitat types, while during the post-calving migration caribou in riparian shrub tended to be feeding or resting more than caribou groups in other habitats (Diavik 2005). Avoidance of the mine and behavioural changes has also been detected by aerial and ground surveys, although the relationship has not been detectable every year (Diavik 2005 and BHPB 2004).

4.3.1.3 Carnivores

At Diavik and Ekati, wolverine, wolves and grizzly bears are monitored under the wildlife effects monitoring programs. Wolverines are known to be active around Diavik and Ekati, and they are detected throughout the wildlife study areas annually through snow track counts. Wolverine dens have been identified within 4 km of the Lac de Gras and Lac du Sauvage narrows and within 1 km of the Ekati to Misery road (BHPB 2004 and Diavik 2005). Wolves are also present in the area; 10 historic wolf dens have been identified within the Ekati wildlife study area, of which up to three have been occupied in any one year. Grizzly bears are also common in the Lac de Gras region, as confirmed by the mine wildlife monitoring programs (BHPB 2004 and Diavik 2005). It has been estimated that a minimum of four adult females (not including cubs) are present in the Ekati and Diavik study areas (McLoughlin and Messier 2001).

4.3.1.4 Falcons

Falcons, including peregrine falcons and gyrfalcons, are present in the study area, and are monitored by visiting the cliffs they nest upon. A total of 16 falcon nest sites have been identified within the Ekati and Diavik study areas, all associated with rocky cliffs. Most of these nests are occupied by falcons each spring, although the numbers that successfully reproduce young is more variable (Diavik 2005). Rough-legged hawks and ravens also occasionally use these nest sites.

4.3.2 Snap Lake

At the Snap Lake Project, wildlife is monitored within a 31 km radius study area. Monitoring began in this study area in 1999. VEC species currently monitored are caribou, grizzly bears, wolverine, wolves, and falcons. Although the study area is above the continuous treeline, there are large areas of open forest, and many boreal wildlife species, such as snowshoe hare, red squirrel, black bear and moose, have been observed in the study area. Similar to the Ekati and Diavik study areas, the Snap Lake regional study area is predominantly heath tundra and heath tundra/boulder (49%) and water (36%). Unlike Ekati and Diavik, there are also areas of spruce forest (6.5%, De Beers 2002). There are four esker systems in the study area, each running roughly east-west, and comprising 0.2% of the study area. All eskers continue beyond the boundaries of the study area in both directions.

4.3.2.1 Caribou

Caribou are predominantly present in the Snap Lake wildlife study area during their northern (April and May) and post-calving (July to October) migrations and group size tends to be small (Lutsel K'e Dene Elders 2001, Golder 2006). Caribou appear to be evenly distributed throughout the study area during the northern migration when there is snow cover and lakes are frozen, but during the post-calving migration caribou are less common in the portion of the study area to the east of the Snap Lake Project. This finding was also supported by traditional knowledge, which points out that caribou avoid boulder fields and rocky tundra (Lutsel K'e Dene Elders 2001) common to the east of the Project. A further observation from wildlife monitoring is the historic post-calving migration routes and trails along the south shore of MacKay Lake, and between MacKay Lake and Camsell Lake. Large groups of caribou have been observed in this area during the post-calving migrations (Golder 2006).

4.3.2.2 Carnivores

Among carnivores, wildlife monitoring at Snap Lake has focused on wolverine, wolves, grizzly bears and black bears. Wolverines have been confirmed in the study area, and are monitored through annual surveys for their sign. Two wolverine dens were identified in 2003 (Golder 2006). There are seven wolf dens within the Snap Lake wildlife study area, at least two of which have been occupied in all years except for 2004. However, this does not appear to be a highly productive region, as dens are often abandoned by the summer and very few pups have been observed at these dens, when compared to wolf dens near Ekati (Golder 2006). Both grizzly bears and black bears have been regularly observed in the study area. No grizzly bear or black bear dens have yet been found.

4.3.2.3 Falcons

Twelve falcon's nests have been identified since 1999, and at least five of these have been occupied each spring. Peregrine falcons appear to be the more common of the two falcon species present, but at least one gyrfalcon nest has been occupied each year from 1999 through 2004 (Golder 2006).

4.3.3 Discussion

Several features to be crossed by at least one of the proposed transmission line options have been identified which may have large numbers of caribou on a seasonal basis. Historic caribou migration routes are present within the study areas of Ekati, Diavik and Snap Lake. Further, some areas, such as the narrows between Lac de Gras, Lac du Sauvage, and MacKay Lake, appear to act as geographic bottlenecks to caribou movement, producing high concentrations of caribou during the migratory periods, albeit for a short period. Wolverine, bears, wolves and falcons are present in the Ekati, Diavik and Snap Lake study areas, as confirmed by wildlife monitoring. Sensitive areas to these species are also present, particularly cliffs and eskers, which provide nesting and denning habitat for falcons and wolves, respectively.

Although wolves, wolverine and grizzly bears require sites with specific characteristics (such as sand which can be dug into without collapsing), they do not necessarily utilize the same denning site year after year. For example, Walton *et al.* (2001) found that although wolves may re-use a particular den, they show fidelity not to a den but to a denning area, probably on the order of 20 km to 30 km radius, which contains several dens. Grizzly bears were not found to reuse dens (McLoughlin 2000), which were most commonly situated in heath tundra habitats, usually on south-facing slopes with ample dwarf birch cover. Disturbance to den sites for these species can likely be absorbed, provided suitable substrate is available elsewhere. By contrast, falcons do re-use the same nest, or at least the same cliff, year after year. Falcon monitoring at Ekati has shown that at least 70 percent of known nest sites are occupied each year (BHPB 2004), indicating the importance of cliffs to these species.

The environment departments of each of these respective projects (Diavik, Ekati, Snap Lake, and Gahcho Kue) should be consulted prior to construction of the proposed transmission line, so that disturbance to features such as cliffs, eskers, and known wolf dens by the proposed transmission line are minimized.

4.4 TEK

TEK, defined as a body of knowledge built up by a group of people through generations of living in close contact with nature (Brockman and Legat 1995) has become an accepted, and often required source of information for decision making in the Northwest Territories (Brockman and Legat 1995, MVEIRB 2005). However, significant barriers still exist, preventing its full implementation and utilization (Ellis 2005). Although significant advances have been made, very little traditional knowledge has been documented in the Northwest Territories (Brockman and Legat 1995). No TEK was identified which was directly applicable to a electrical transmission line.

4.4.1 Caribou

The area around the Ekati mine has been documented as a caribou migration route during both spring and fall (Legat and Zoe 1995). Barren-ground caribou are also present in the fall, winter and spring in the forested sections of the proposed transmission line (Kendrick *et al.* 2005). Important caribou migration routes used during the spring and fall migrations is documented by TEK along the north and south shorelines of McLeod Bay, the Lockhart River, and from Artillery Lake to Lutesel K'e. The Chipewyan of the area had many seasonal hunting camps in these areas to take advantage of these hunting opportunities. Important caribou migration routes are also noted between Lac de Gras and MacKay Lake (Lutsel K'e Dene Elders 2001, Weledeh Yellowknives Dene 1997). Specific to Snap Lake, TEK has identified that caribou are predominantly in the area during their northern (April and May) and post-calving (July to October) migrations. Group size tends to be small, and during the post-calving migration caribou are less common in the portion of the study area to the east of the Snap Lake Project as caribou avoid boulder fields and rocky tundra common to the east of the Project. Historic post-calving migration routes and trails were identified along the south coast of MacKay Lake, and between MacKay Lake and Camsell Lake (Lutsel K'e Dene Elders 2001, Weledeh Yellowknives Dene 1997).

Kendrick *et al.* (2005) indicated that caribou from the Beverly herd may occasionally be present along the proposed transmission line alignment approximately south of the treeline during the winter months, and many hunters from Lutsel K'e can often distinguish between herds by hide colour, size, body shape, and the direction of migration. The year-to-year changes in caribou migratory routes and seasonal home ranges make it difficult to predict where the caribou will be, although long-term trends and cycles appear to be present (Kendrick *et al.* 2005).

4.4.2 Habitat

Caribou avoid areas where forest fires have occurred, both as a feeding area and as a migratory route (Kendrick *et al.* 2005, Parlee *et al.* 2005). When the caribou do migrate through burned areas, they apparently do not stop to feed. Caribou are also noted to avoid rocky areas and boulder fields, some of which are found along sections of the proposed transmission line alignment north of the treeline (Kendrick *et al.* 2005).

4.4.3 Discussion

No specific information on the possible impacts of power transmission lines or cut lines on wildlife was identified through the documented traditional ecological knowledge. As stated by Sly *et al.* (1999), the documentation of TEK is an emerging field, and it is not surprising that little has been documented to date, particularly in regards to a project-specific question. Priorities for TEK documentation to date have been in response to the emergence of the diamond mining industry. The reports reviewed make the case that any anthropogenic-caused changes to the environment will have some repercussions. However, in the words of one hunter and resident of Lutsel K'e, operation of the proposed transmission line "would be better than burning diesel (to generate electricity at the mines)" (Enzo, personal communication).

5.0 EXISTING LAND COVER

Existing land cover maps were analysed to document the amount and types of habitat to be crossed by the proposed transmission line. These digital files are essentially maps of the land cover, including the vegetation, rock and water, produced through the analysis of satellite imagery. Two such large-scale land cover maps exist for the areas to be crossed by the proposed transmission line, that produced of the West Kitikmeot/Slave Study (WKSS) Region (covering most of the above-treeline sections of the transmission line alignment (Matthews *et al.* 2001), and that produced of the forested regions of the Northwest Territories (ENR).

The WKSS Region classification was completed using Landsat Thematic Mapper satellite imagery, with pixel dimensions of 25 m by 25 m (Matthews *et al.* 2001). The forested region of the Northwest Territories was classified by the Department of Environment and Natural Resources, GNWT using Landsat 5 and 7 images, and has a pixel dimension of 30 m by 30 m (Croft, personal communication). The similarity in the scale of the proposed transmission line corridor (30 m) and the resolution of the land cover map (25 m by 25 m pixels) indicates that the accuracy of the predicted land cover types to be overlaid by the proposed transmission line is likely to be poor.

Further, the original WKSS maps have user accuracies (the probability that a sample from land cover map actually matches what is on the ground) as low as 64 percent for the scenes which overlap the proposed transmission line (Matthews *et al.* 2001) No user accuracies were provided with the forest cover map. A detailed description of the location of each habitat type to be disturbed or overlaid was therefore considered to be beyond the capabilities of the data. However, the data can still be used to provide a gross description of the amount and type of habitat types expected to be disturbed by the proposed transmission corridors.

5.1 Methods

Using a Geographical Information System (GIS) platform, the proposed transmission line alignment was buffered by 15 m on each side to produce the 30 m alignment which is expected to be cleared. A 30 m alignment is used to allow enough space for guy wires and so that trees do not present a hazard to the transmission line towers or guy wires (Grabke, personal communication). The 30 m alignment was also used for the areas above the treeline for consistency. Although there will be no clearing in areas above the treeline, guy wires will still be used. This area (a 30 m buffer down the length of the proposed transmission line alignment) was then clipped from the two different land cover maps to determine the total area of each land cover type expected to be disturbed by the proposed transmission line. A description of the WKSS classifications are presented in Appendix III, the descriptions of the forestry cover classifications were not available.

Unclassified areas include those pixeled areas within the land cover maps which could not be categorized. These unclassified areas were not included in the summaries below, but are presented in Table 5-1 and Table 5-2. Existing land cover maps only partially covered the Gahcho Kue to Snap Lake, Lockhart River to Gahcho Kue, and Lockhart River to Snap Lake sections, at 66 percent, 64 percent, and 74 percent coverage respectively. Figure 5-1 shows the sections of the proposed transmission line for which land cover information was available.

5.2 GNWT Forest Cover Map

As stated above, only vegetation over 3 m in height will be cleared within the 30 m cut line for the proposed transmission line. As such, there are several land cover types which are expected to remain relatively undisturbed during the erection of the transmission line. This includes the land cover types of herbaceous, lichen dominant, low shrubland (where the average shrub height is less than 2 m), non-vegetated, sphagnum moss, water, and wetlands (see Appendix IV).

Within the area of existing land classification, roughly half of the proposed transmission line between Twin Gorges to Lockhart River will overlie the spruce-lichen boreal forest (24%) or the tall shrubland open/immature deciduous forest and/or immature conifers open (25%) land cover categories. A large section will also overlie an area of burned forest (15%) and water (9%). Almost no wetland was identified (<1%, Table 5-1).

Between the Lockhart River and Snap Lake (Option 2a), the transmission line will span 160 km (NTPC 2005), of which approximately 119.5 km (74%) have been classified. This section will span the treeline (see Figure 5-1). A large proportion of this section of the proposed transmission line would lie over low shrubland (47%), and smaller areas of spruce-lichen boreal forest (11%) and fire regeneration (9%). Only 4% would be water, and 2% wetland (Table 5-1).

Between the Lockhart River and Gahcho Kue (Option 1), approximately 46.6 km of the total length of 73 km (64%) for this section of the transmission line has existing land cover information. Common habitat types along this stretch include spruce-lichen boreal forest (22%), and lichen dominant and low shrubland, each at 20%. Water accounts for 15% of the land cover, although wetlands are uncommon (<0.1%).

Table 5-1
Approximate Area of Land Cover Types
Underlying the Proposed Transmission Line in Forested Areas (hectares)

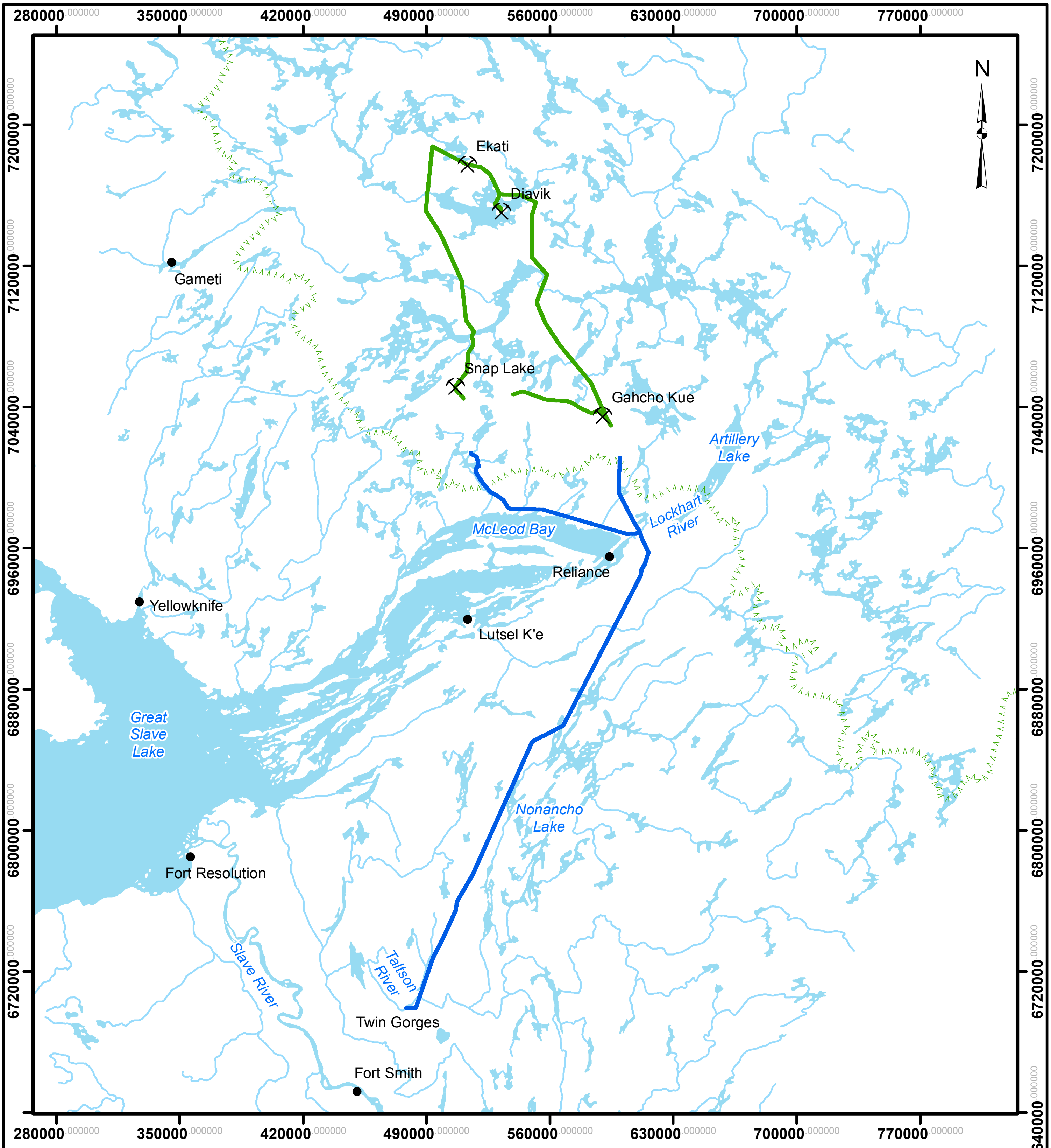
Land Cover Type	TG to LR	LR to SL (Option 2a)	LR to GK (Option 1)
Cloud or rock shadow	0.9	0.4	2.1
Clouds or smoke or ice	0.0	2.0	0.0
Deciduous	11.5	1.6	0.0
Fire regeneration/low shrubland open	136.5	20.8	13.3
Fire regeneration/sparsely vegetated	0.0	12.0	0.0
Herbaceous	9.5	0.0	0.0
Jackpine	62.6	0.0	0.0
Lichen dominant	44.9	25.1	27.0
Low shrubland	40.6	165.1	26.8
Mixed forest	12.6	0.5	0.0
Non-vegetated	0.9	14.6	0.0
Scattered conifers on bedrock	57.0	23.1	0.0
Sphagnum moss	1.6	3.7	0.0
Spruce-lichen boreal forest	215.8	38.9	29.6
Tall shrubland open/immature deciduous and/or immature conifers open	230.0	22.7	14.0
Water	84.0	15.4	19.2
Wetlands	0.2	5.1	0.0
White spruce	5.0	0.0	0.0
Total	**913.3**	**350.8**	**132.0**
Unclassified	0.5	92.4	23.6

Note: TG = Twin Gorges
LR = Lockhart River
SL = Snap Lake
GK = Gahcho Kue

Table 5-2
Approximate Area of Land Cover Types
Underlying the Proposed Transmission Line in the Slave Geological Province (hectares)

Land Cover Type	DK to EK	GK to DK (Option 1)	GK to SL	SL to EK (Option 2a)
Lichen Veneer	0.1	10.4	24.0	14.8
Deep Water	10.7	58.9	28.6	48.4
Esker Complex	0.0	0.0	0.0	0.8
Wetland (Sedge Meadow)	1.2	6.2	0.9	16.4
Shallow Water	8.8	55.3	22.6	45.2
Tussock/Hummock	0.8	23.0	0.7	12.4
Heath Tundra	11.9	160.8	40.2	155.9
Spruce Forest	0.0	4.2	1.1	7.0
Ice And Snow	0.0	0.0	0.0	0.0
Bedrock Association	1.9	0.7	0.3	1.0
Tall Shrub	0.0	0.7	0.0	3.7
Birch Seep	0.0	1.6	0.0	6.0
Heath/Boulder	20.1	113.1	22.6	85.9
Heath/Bedrock	8.1	10.5	4.0	15.3
Boulder Association	2.2	1.6	0.1	5.9
Bare Ground	0.0	0.0	0.0	0.0
Low Shrub	0.0	0.0	0.0	0.0
Gravel Deposit	0.0	0.0	0.0	0.0
Peat Bog	0.1	0.6	0.0	7.5
Mixed Forest	0.0	0.0	0.0	0.0
Old Burns	0.0	0.0	0.0	0.3
Young Burns	0.0	0.0	0.0	0.9
Total	**65.8**	**447.6**	**145.0**	**427.2**
Unclassified	9.2	34.1	105.5	71.9

Note: TG = Twin Gorges
LR = Lockhart River
SL = Snap Lake
GK = Gahcho Kue
EK = Ekati
DK = Diavik



LEGEND

- DIAMOND MINE
- FOREST LAND COVER MAP
- SLAVE GEOLOGICAL PROVINCE LAND COVER MAP
- APPROXIMATE TREELINE
- WATER

50 0 50 100

SCALE 1:3,000,000 KILOMETRES

REFERENCE

Datum: NAD 83 Projection: Transverse Mercator Coordinate System: UTM Zone 12

PROJECT

NORTHWEST TERRITORIES ENERGY CORPORATION

TITLE

AREA OF TRANSMISSION LINE WITH EXISTING LAND COVER MAPS

Golder Associates
Yellowknife, Northwest Territories

PROJECT No. 06-1328-002. 5000			SCALE AS SHOWN	REV. 0
DESIGN	DP	28 Mar. 2006	**FIGURE: 5-1**	
GIS	KB	28 Mar. 2006		
CHECK	DP	20 Apr. 2006		
REVIEW	JV	22 Apr. 2006		

Project: N:\Active\GIS\06-1328-002 NTEC\Final Figures\PDF\Figure 5-1

5.3 WKSS Region Land Cover Map

Although the 30 m wide swath was used to determine the approximate areas and proportions of land cover types to be intercepted by the proposed transmission line alignment, few of the land cover types within this swath would actually be directly disturbed by the transmission line. According to Matthews *et al.* (2001), only three of the land cover types in the Slave Geological Province have vegetation over 3 m in height; these are spruce forest, mixed forest, and tall shrub (containing birch, willow and alder). Spruce forest and tall shrub were identified along the proposed transmission line route, but mixed forest was not present.

The section from Diavik to Ekati (part of both Option 1 and Option 2a) had land cover classification for the entire 40 km of proposed transmission line. Using the 30 m wide swath for the transmission line as the area to be cleared, almost two-thirds of this was classified as either heath/boulder (31%) or water (30%). Based on the land cover classification, no clearing of vegetation is expected along this section. Heath tundra (18%) heath bedrock (12%) were also common (Table 5-2). The section from Gahcho Kue to Diavik (171 km length, Option 1), was predominantly heath tundra (36%), heath/boulder (25%) and water (26%). Clearing may be required for approximately 1% of this section of the proposed transmission line alignment, as spruce forest and tall shrub vegetation types were identified.

The Gahcho Kue to Snap Lake (part of both Option 1 and Option 2a) section had land cover information for 63 km (66 percent) of its total distance of 96 km. Among the classified areas, dominant land cover types along included water (35%), heath tundra (28%) and heath/boulder (16%). A large proportion of lichen veneer (17%) was also identified. Less than 1% of the classified areas of this section contained spruce forest, which may require some clearing.

The Snap Lake to Ekati section (part of Option 2a) is approximately 149 km in length (NTPC 2005). The most common land cover types along this length were heath tundra (37%), water (22%) and heath/boulder (20%). Wetland (4%) were also identified over this route (Table 5-2). Vegetation types which may require clearing, spruce forest and tall shrub, were identified, and constituted 2.5% of this section. A short section of the Lockhart River to Gahcho Kue alignment (5.2 km) falls under the WKSS land cover map, but this short section was not considered sufficient to describe the land cover types present in this area.

5.4 Discussion

Overall, there does not appear to be any large differences between the various alignment options. Therefore, the most appropriate alignment option (*i.e.,* Option 1 vs. Option 2a) from the perspective of minimizing impacts to vegetation and sensitive habitats is probably the shorter. However, the difference in total length of each option is slight (the longer route, Option 2a, is only 65 km or 9 percent longer than Option 1). Some land cover features appear have been too small to be reliably detected by the classification such as eskers, which were only detected between Snap Lake and Ekati but probably occur more frequently, and low shrub which is also known to occur but was not detected through the analysis of the land cover maps.

6.0 CLOSURE

We trust the above meets your present requirements. If you have any questions or require additional details, please contact the undersigned.

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APPENDIX I

MEAN, STANDARD ERROR, MINIMUM AND MAXIMUM DISTANCE (METRES) OF CARIBOU LOCATIONS TO THE NEAREST SEGMENT OF OPTION 1 BY SEASON

MEAN, STANDARD ERROR, MINIMUM AND MAXIMUM DISTANCE (METRES) OF CARIBOU LOCATIONS TO THE NEAREST SEGMENT OF OPTION 1 BY SEASON.

Season	Segment[(a)]	Number of Collar Locations[(b)]	Mean Distance to Segment	Standard Error	Minimum	Maximum
Fall-Rut	1	29	15770	1471	1341	28898
Fall-Rut	3	12	18441	2107	1599	27621
Fall-Rut	4	12	13421	3115	668	29104
Fall-Rut	5	27	13738	1221	3273	26159
Fall-Rut	6	21	15357	1534	2158	27835
Fall-Rut	7	13	12773	2530	1573	27134
Fall-Rut	8	7	11467	3219	1144	28119
Fall-Rut	10	25	16576	1864	97	29752
Fall-Rut	11	16	16284	2667	1264	29876
Fall-Rut	12	12	16806	2569	695	29453
Fall-Rut	14	23	14408	1662	2399	28203
Fall-Rut	15	22	15392	2170	104	29049
Fall-Rut	16	13	10488	1763	1080	24383
Northern	1	22	16695	2040	1604	29761
Northern	3	8	21604	2681	5531	29567
Northern	4	12	14340	1744	3434	22951
Northern	5	7	9524	1720	5711	18140
Northern	6	7	10247	3092	423	23720
Northern	8	6	8580	1843	3795	17009
Northern	26	6	21560	1326	15043	23928
Post-calving	1	40	16570	1272	2446	29972
Post-calving	3	46	19622	1044	236	29935
Post-calving	4	62	12053	1214	6	29330
Post-calving	5	38	7668	948	158	28293
Post-calving	6	96	11378	746	510	29455
Post-calving	7	44	13617	1377	454	29919
Post-calving	8	14	12624	2416	1721	27655
Post-calving	9	21	11388	1483	658	22236
Post-calving	10	11	25648	1039	18660	29486
Post-calving	11	8	11381	3062	2477	28356
Post-calving	16	7	20106	3205	2301	29900
Winter	10	15	22366	1546	9103	29605
Winter	14	23	9002	1097	1175	20077
Winter	15	38	16295	1408	279	29101
Winter	23	22	22100	1678	3782	29689
Winter	24	42	18196	1223	5061	29940
Winter	25	15	21439	1911	5550	29864
Winter	26	48	19562	962	1132	28395
Winter	27	45	17590	1133	855	29977
Winter	28	19	14037	1354	714	24867
Winter	29	6	9491	3127	207	20729

Note: a = The segment number is the identification number assigned to each 25 km segment of the proposed transmission line.

b = Collared caribou locations detected within 30 km of the nearest segment. Only segments with >5 collar hits were included in the table.

APPENDIX II

MEAN, STANDARD ERROR, MINIMUM AND MAXIMUM DISTANCE (METRES) OF CARIBOU LOCATIONS TO THE NEAREST SEGMENT OF OPTION 2A BY SEASON

MEAN, STANDARD ERROR, MINIMUM AND MAXIMUM DISTANCE (METRES) OF CARIBOU LOCATIONS TO THE NEAREST SEGMENT OF OPTION 2A BY SEASON.

Season	Segment[a]	Number of Collar Locations[b]	Mean Distance to Segment	Standard Error	Minimum	Maximum
Fall-Rut	9	16	10618	2357	276	29277
Fall-Rut	10	27	13332	1827	178	29434
Fall-Rut	11	12	10361	2086	1385	25898
Fall-Rut	12	10	10184	3145	640	28614
Fall-Rut	14	13	18387	2662	152	28812
Fall-Rut	15	23	21229	1384	9766	28793
Fall-Rut	8	7	13971	4356	176	27492
Fall-Rut	7	14	11801	2484	630	28520
Fall-Rut	6	45	12295	1242	547	29479
Fall-Rut	5	33	13030	1879	45	29819
Fall-Rut	4	31	15042	1867	169	29133
Fall-Rut	3	12	7786	2509	435	28015
Fall-Rut	2	13	12553	1963	790	28206
Fall-Rut	1	12	14125	1467	5486	22335
Northern	6	10	10514	2632	764	23852
Northern	5	12	15435	2081	4452	29940
Northern	4	13	17030	1612	9052	28152
Northern	3	8	10575	2144	1991	17363
Northern	2	21	14896	1671	3362	29159
Northern	1	10	14602	3140	374	27643
Post-calving	8	7	21085	2679	5597	26414
Post-calving	7	57	16773	1173	970	29984
Post-calving	6	43	12203	1524	125	29754
Post-calving	5	57	14925	1130	430	29902
Post-calving	4	49	10983	1168	16	29839
Post-calving	3	6	13076	4475	1531	29440
Post-calving	2	18	12671	1886	500	28374
Post-calving	1	21	16974	1685	3519	29742
Winter	9	9	10199	3326	837	27388
Winter	10	31	14345	1499	683	28996
Winter	11	15	14061	1686	5205	27455
Winter	12	16	11755	1839	582	26624
Winter	13	16	15833	2399	2021	29604
Winter	14	36	12259	1493	32	29108
Winter	15	9	21244	3154	4806	29718

Note: a = The segment number is the identification number assigned to each 25 km segments of the proposed transmission line.

b = Collared caribou locations detected within 30 km of the nearest segment. Only segments with >5 collar hits were included in the table.

APPENDIX III

DESCRIPTIONS OF THE SLAVE GEOLOGICAL PROVINCE LAND COVER CLASSESS

APPENDIX IV

KEY TO THE FORESTRY LAND COVER CLASSIFICATION