Ducks Unlimited Canada

KAKISA (K 'ÁGEE TU) PHASE 1 ECOLOGICAL ASSESSMENT
K 'ÁGEE TU AREA OF INTEREST, DEHCHO
NORTHWEST TERRITORIES

1740209

March 2007

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PLAIN LANUAGE SUMMARY

The K 'ágee Tu First Nation, the federal and territorial governments, and non-governmental organizations are partners in the K 'ágee Tu Area of Interest initiative through the Northwest Territories Protected Areas Strategy (NWT – PAS). This ecological assessment requires a review of ecological components of the K 'ágee Tu Area of Interest, and further evaluation of how the area meets federal and territorial protected area criteria. This ecological assessment focuses on three important qualities of the Area of Interest, including preserving cultural integrity, supporting species with special conservation status, and maintaining regional biodiversity. These three categories play critical roles in the establishment of federally and territorially protected areas, and are specific to legislative criteria.

Through extensive consultation with the K 'ágee Tu First Nation members, areas considered important to preserve the cultural integrity of the K 'ágee Tu First Nation were identified and reported within the Area of Interest. These areas consist of important travel routes, harvest sites (for plants, animals, including fish), camp sites, and other significant cultural areas. Areas considered most critical to protect the cultural integrity of the area were concentrated around Kakisa, Muskeg, and Cameron rivers, Kakisa, Tathlina, and Beaver lakes, and an area called Etaáhdlįį, along the upper Kakisa River.

The Area of Interest is also considered important for preserving populations with special conservation status. A survey of available literature indicated that there are two species of fish, six species of bird, one amphibian, and two species of mammals occurring within the K 'ágee Tu Area of Interest that are considered to have either federal and/or territorial special conservation status. Two species of fish with special conservation status that may occur within the Study Area include Shortjaw Cisco and Inconnu. Birds with special federal and/or territorial conservation status that may occur within the Study Area include Whooping Cranes, Peregrine Falcons, Yellow Rails, American White Pelicans, Rusty Blackbirds, and Short-eared Owls. Northern Leopard Frogs may occur within the Study Area, and is considered the only frog species of special conservation status within the Study Area. Two mammal species with special conservation status, including boreal woodland caribou and wolverine also occur in the Study Area. Wood bison, listed as Threatened under the federal Species at Risk Act, may infrequently occur within the Area of Interest; however, the Area of Interest lies within a Bison Control Zone to ensure diseased bison from Wood Buffalo National Park (located approximately 50 km east of the Study Area) do not migrate and infect other disease-free herds in the Mackenzie Bison Sanctuary. Since the Area of Interest lies within a Bison Control Zone (all bison within the Area of Interest are removed), wood bison are not discussed further within this report.

In concert with supporting species with special conservation status, the Area of Interest maintains a rich biodiversity that contributes to the regional area. Large numbers of waterfowl and waterbirds are known to occupy the Study Area, particularly during spring and fall migrations, most notably Beaver Lake. In addition, woodland caribou, moose, beaver, muskrat, passerines, raptors, and fish populations are sustained by various upland and lowland habitat types represented within the Area of Interest.

In summary, the ecological significance of the proposed K 'ágee Tu Area of Interest is described by a number of factors:

1. It supports several Species at Risk, as listed under the Species at Risk Act (SARA), the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), and the NWT Wildlife Act. The presence of these species have been confirmed, or are potential residents in the area on a year round basis, or occur there as migrants. Boreal woodland caribou, a species listed as Threatened under SARA, occur in the Area of Interest. Wolverines are also year round residents (COSEWIC listed Special Concern). The Peregrine Falcon (Threatened) and the Short-eared Owl (Special Concern) occur in the Area of Interest as migrants, and the latter species may breed there. The Yellow Rail is believed to be breeding within the Area of Interest, as it is a known breeder southwest of the Town of Hay River along Highway #1.
2. The Area of Interest contains two International Biological Program Sites (Kakisa River, and the southern limits of Beaver Lake). These sites were identified because of they are considered important wildlife habitat.
3. Beaver Lake is a body of water that is considered a Key Migratory Bird Terrestrial Habitat Site and an Important Bird Area in the NWT. Beaver Lake has been known to support over 1 % of the national population for a number of migratory bird populations including the Tundra Swans and Canvasbacks. Only the southern portion of Beaver Lake is included with the existing Area of Interest boundaries.
4. The K 'ágee Tu Area of Interest appears to represent the ecoregion fairly well.
5. Based on criteria established under the NWT – PAS and the Canada Wildlife Act for establishment of a National Wildlife Area (NWA), EBA recommends expansion of the presently proposed boundaries to include:
    a. Extension of the northern boundary to include the northern shoreline of Beaver Lake and Mackenzie River near Fort Providence in order to further protect waterfowl/waterbird, amphibian, fish, moose, and woodland caribou critical habitat. This recommendation meets the National Wildlife Areas' (NWA) criteria 1 (*supports a concentrated population during any part of their lifecycle)*, as well as criteria 2 (*supports at least 1 % of the Canada population of migratory birds (i.e. waterfowl)).*
    b. Extension of the eastern boundary to include the Heart Lake IBP site to further protect unique and uncommon landscapes and rare plant species. This recommendation meets NWA criteria 4 *(supports an appreciable assemblage of individual rare, endangered, threatened, or vulnerable plant species)*, as well as criteria 5 and 6 (*area has special importance for maintaining ecological diversity of the region, and is considered to include rare or unusual habitat within the region, respectively*).

c. Extension of the eastern boundary along the northern shoreline of Hay River to the south of Highway #1. This portion is recommended since an abundance of collared woodland caribou have been documented to occur throughout this entire area. This recommendation meets NWA criteria 4 (*supports an appreciable assemblage of individual rare, endangered, threatened, or vulnerable animal species*).

d. Extension of the southern boundary to include the mature white spruce and aspen communities along the eastern slope of Cameron Hills, as they are uncommon habitats in the Dehcho area. This recommendation meets NWA criteria 5 and 6 *(the area has special importance for maintaining ecological diversity of the region, and the area is considered to include rare or unusual wildlife habitat within the region, respectively*).

e. Extension of the southwest corner of the Area of Interest to help reduce the perimeter to area ratio, as well as include areas known to be utilized by woodland caribou (as per collared caribou data from the South Cameron Hills project (ENR 2006c)). This recommendation meets the NWA criteria 4 (*supports an appreciable assemblage of individual rare, endangered, threatened, or vulnerable animal species),* as well as criteria 5 (*special importance for maintaining the genetic and ecological diversity of the region).*

Based on these features, the K 'ágee Tu Area of Interest could be adopted as a National Wildlife Area, and receive the appropriate federal protection.

PAGE

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TABLES

FIGURES

* Figures located in Appendix B

APPENDICES

1.0 INTRODUCTION

Interests in a K 'ágee Tu candidate protected area in the Dehcho Region (herein the Dehcho Region refers to the proposed land claim area) of the southwest Northwest Territories (NWT) (Figure 1) arose in January 2006 when the community of Kakisa proposed a NWT Protected Areas Strategy (NWT - PAS) Area of Interest (referred herein as the Area of Interest). Its lands and waters are reported to be rich in wildlife, plants, and fish that have sustained the K 'ágee Tu First Nation (KTFN) people since time immemorial, representing an important traditional harvesting area. Recently the Area of Interest was incorporated into the Final Draft Dehcho Land Use Plan as a Conservation Zone with only tourism and traditional harvesting as permitted activities (Dehcho Land Use Planning Committee 2006a). The KTFN wishes permanent protection of the K 'ágee Tu watershed, critical fish and wildlife habitat, and core traditional land use areas (K 'ágee Tu First Nation 2006).

The KTFN band council passed a resolution in support of pursuing protection for this Area of Interest through the NWT - PAS, and in February 2006 the K 'ágee Tu Area of Interest was formally advanced through the NWT protected area process.

The NWT - PAS process is a multi-level approach in which an area's ecological, cultural, and economic values are identified and evaluated prior to the establishment of a designated protected area. EBA Engineering Consultants Ltd. (EBA) has been retained to complete a Phase I Ecological Assessment (EA) for the K 'ágee Tu Area of Interest as part of the NWT - PAS process.

KTFN (2006) have prepared a report introducing the Area of Interest; documenting traditional knowledge of cultural, abiotic, biotic, and economic values of the area with supporting scientific information. A Phase I Ecological Assessment (EA) of the K 'ágee Tu Area of Interest is also required that will build upon already existing information to provide recommendations for protected area designations and future research needs. This report will follow NWT - PAS EA Guidelines (NWT – PAS Ecological Working Group 2002).

1.1 OBJECTIVES

The objectives of this Phase I EA are to describe the ecological value of the Area of Interest, determine whether the Area of Interest meets NWT - PAS criteria (NWT – PAS Ecological Working Group ND), and whether or not the Area of Interest possesses the necessary ecological characteristics to pass through federal or territorial protected areas legislation (most specifically as a National Wildlife Area or a Wilderness Conservation Area). These objectives are achieved, in accordance with the NWT – PAS guidelines, by identifying ecologically representative areas, compiling and evaluating available existing ecological data, and determining deficiencies in existing ecological information. In association with this, territorial and federal protected area legislation and establishment criteria were identified, and the Area of Interest's ecological components were evaluated in relation to established protected area criteria. Data deficiencies and further research

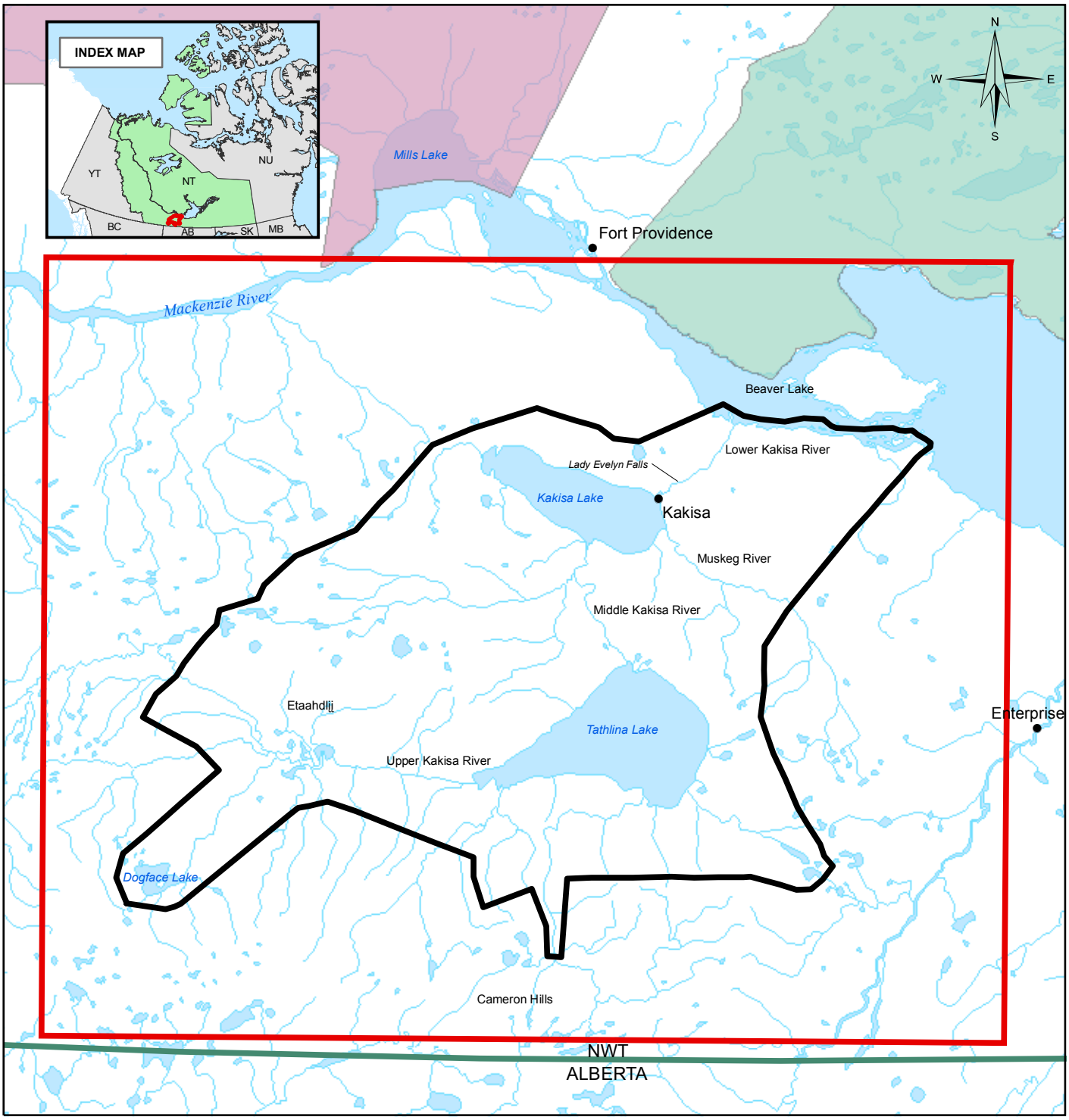
required to efficiently meet federal and territorial protected area criteria was recommended for a NWT – PAS Phase II program, as well as possible boundary changes to effectively protect critical species, cultural integrity, and biodiversity in the Area of Interest based on current information.

The analysis of ecological representation and detailed accounts of Valued Ecosystem Components (VECs), are provided in Appendix A and B, respectively, and were used as the foundation during the evaluation process of the Area of Interest.

2.0 K 'ÁGEE TU STUDY AREA

The K 'ágee Tu Area of Interest is closely centred around Kakisa and Tathlina lakes, and covers approximately 8,636 km^2 (Figure 1). Through numerous consultations, the KTFN have delineated the boundaries of the Area of Interest, which are considered to be a compromise between protecting the entire Kakisa watershed and a large enough area to ensure biophysical integrity, while still permitting controlled non-renewable resource development (KTFN 2006).

For this project, a larger Study Area (25,752 km^2) was used which included the Area of Interest plus a buffer zone extending beyond its delineated boundaries (Figure 1). The larger buffer zone was included to intentionally capture areas of importance or influence that may lie outside of the Area of Interest. Areas of importance include Beaver Lake and Mackenzie River to the north, Caribou Hills to the south, Heart Lake International Biological Program Site to the east, and the Kakisa watershed and Northern Alberta Upland ecoregion (although some of the Kakisa watershed and Northern Alberta Upland ecoregion still remains outside the Study Area).



LEGEND

- Kakisa Area of Interest
- Kakisa Study Area
- Community
- Territorial - Provincial Border
- Watercourse
- Waterbody
- Mackenzie Bison Sanctuary
- Edehzhie Candidate Protected Area

NOTES

Base data source: WWF Canada (2002)

KAKISA PHASE 1 ECOLOGICAL ASSESSMENT
K 'AGEE TU AREA OF INTEREST, DEHCHO, NWT

Site Location Map of Kakisa Area of Interest, Dehcho, NWT

PROJECTION	DATUM
UTM Zone 11	NAD83

Scale: 1:1,060,000

20 10 0 20

Kilometres

FILE NO.: 1740209_Site_Location_Map001.mxd

PROJECT NO.	DWN	CKD	REV
1740209	KDA	SM/KL	1

OFFICE	DATE
EBA-YEL	March 22, 2007

EBA Engineering Consultants Ltd.

Figure 1

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2.1 ECOLOGICAL BACKGROUND

The Study Area lies within the Taiga Plains ecozone[1], which is further subdivided into 18 distinctive ecoregions[2]. Of these 18 ecoregions, two occupy the Study Area: the Hay River Lowland and Northern Alberta Upland (Figure 2) (Ecological Stratification Working Group 1996).

The Hay River Lowland ecoregion is a relatively large ecoregion, covering the majority (99 %) of the Area of Interest. This lowland plain drains into the Fort Nelson and Liard rivers in northeastern British Columbia, the Hay River in northwestern Alberta, and ultimately the Mackenzie River in the Northwest Territories. This ecoregion is characterized by short, warm summers and long, cold winters. The mean annual temperature is approximately -2.5 degrees Celsius (°C). The mean summer temperature is 13 °C and the mean winter temperature is -19 °C. The mean annual precipitation ranges from 350 - 450 millimeters (mm). As a result, this ecoregion is classified as having a subhumid mid-boreal ecoclimate. It is characterized by closed mixed stands of trembling aspen, balsam poplar, white spruce, balsam fir, and black spruce. Approximately 30 % of the ecoregion includes low lying poorly drained fen and bog wetlands. The ecoregion is composed of low-relief, flat-lying Palaeozoic geology near Great Slave Lake, and Cretaceous shale in its western portion. Surface deposits are predominantly peat-covered clayey lacustrine and glacial till on nearly level to gently rolling topography. Characteristic wildlife includes woodland caribou (boreal ecotype), moose, black bear, wolf, beaver, and snowshoe hare. The most species-rich habitats within the Taiga Plains are the mixed woods and shrublands associated with fens, bogs, ponds, streams, and lakes (Ecological Stratification Working Group 1996).

The Northern Alberta Upland ecoregion occurs in the extreme southern portion of the Study Area (covers approximately 1 % of the entire Area of Interest) along the NWT/Alberta border, in an area known as the Cameron Hills (Figure 2). Particularly within the Area of Interest, the Cameron Hills includes flat-topped uplands that rise some 400-500 meters (m) above the surrounding lowlands, and have steep scarps on the north, west, and eastern sides. These side slopes support mixedwood forests comprising of white spruce, balsam fir, and aspen.

[1] An ecozone represents a large generalized unit at the top of an ecological hierarchy as defined by the Canada Committee on Ecological Land Classification (Ecological Stratification Working Group 1996).

[2] An ecoregion is part of an ecozone and is characterized by distinctive regional factors, including climate, physiography, vegetation, soil, water, fauna, and land use (Ecological Stratification Working Group 1996).

LEGEND

- Kakisa Area of Interest
- Kakisa Study Area
- Territorial - Provincial Border
- Watercourse
- Waterbody

Ecoregions

- Great Slave Lake Plain
- Hay River Lowland
- Northern Alberta Uplands

NOTES

Base data source: WWF Canada (2002)

KAKISA PHASE 1 ECOLOGICAL ASSESSMENT
K 'AGEE TU AREA OF INTEREST, DEHCHO, NWT

Ecoregions in the Study Area

PROJECTION	DATUM
UTM Zone 11	NAD83

Scale: 1:1,060,000

20 10 0 20

Kilometres

EBA Engineering Consultants Ltd.

FILE NO.			
1740209_Ecoregions_Map002.mxd			
PROJECT NO.	DWN	CKD	REV
1740209	KDA	SM/KL	0
OFFICE	DATE		
EBA-YEL	October 22, 2006		

Figure 2

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3.0 ECOLOGICAL REPRESENTIVITY

The goals of the NWT – PAS are to protect core representative areas within each ecoregion as well as special natural and cultural areas. To help meet these goals, the NWT – PAS Ecological Working Group (2006) modelled ecological representation within the Mackenzie Valley and Mackenzie Mountain ecoregions based on three abiotic and biotic datasets: vegetation type, landscape units (*i.e.* type of rock, soil, and terrain), and physiographic units (*i.e.* elevation, climate, slope, aspect, and landforms) (NWT – PAS Ecological Working Group 2006). A summary of the ecological representation analysis prepared by the NWT – PAS Ecological Working Group (2006) is provided in Appendix A, and is summarized below.

Based on this analysis, the Area of Interest was evaluated to determine if it adequately represents ecological features of the Hay River Lowland ecoregion. These three broad scale (or coarse filter) datasets were chosen to represent common, unique, and important areas within an ecoregion. A network of areas that adequately represent an ecoregion have all or most vegetation types, landscape units, and physiographic units that are present in an ecoregion, as well as uncommon or unique areas. Core representative areas should contain a wide variety of common and unique landscape features to help support the protection of biodiversity.

Two scenarios were run during the analysis (using the program Marxan): an "open" scenario with all parts of the ecoregion having equal chance of being included in the results, and a "closed" scenario with all existing and proposed protected areas "locked in" (including both the Kakisa and Sambaa K'e Areas of Interest, which lie within the Hay River Lowland ecoregion) (NWT – PAS Ecological Working Group 2006). Except, key development areas were locked out of the closed scenario (NWT – PAS Ecological Working Group 2006). Therefore, once the Areas of Interest are locked in, Marxan will identify any additional areas outside of the Areas of Interest that would be required to meet the representation goals for each ecoregion (NWT – PAS Ecological Working Group 2006). Marxan was run 100 times to identify the most representative (common and unique) areas within the ecoregion. Based on the results obtained from the closed scenario, the combination of both Areas of Interest (Kakisa and Sambaa K'e Areas of Interest) appear to represent the ecoregion fairly well (NWT – PAS Ecological Working Group 2006). However, these results may differ with the exclusion of Sambaa K'e Area of Interest. In the closed scenario, a few areas along the southern border of the Area of Interest have been identified by Marxan as unique to the ecoregion that is only represented to a small degree by the Area of Interest boundaries, as well as a small area in the western portion of the Study area, south of Dogface Lake, and in the Heart Lake area (refer to Appendix A).

Although this coarse filter approach is a well-accepted method used to determine core representative areas, it does have limitations. Determining the ecological representation of the Area of Interest is the first step in protected area design (Schneider 2002); however, adequate ecological representation of ecosystems and important ecological features does not

ensure that all natural processes will be maintained and species populations will survive (Schneider 2002). Ideally, coarse filter targets are combined with fine filter targets for focal species and other special ecological components in order to provide a balanced approach to conservation planning; therefore, valuable ecosystem components and their interactions have been also identified in Section 4.0 and further assessed in Appendix B to support the protection of core representative areas.

4.0 VALUED ECOSYSTEM COMPONENTS

4.1 INTRODUCTION

The objectives of this report were to conduct a Phase I Ecological Assessment on K 'ágee Tu Area of Interest following the NWT - PAS guidelines, and evaluate the ecological value of the Area of Interest in relation to NWT – PAS criteria, as well as federal and territorial protected area establishment criteria. Part of this process involved evaluating Valued Ecosystem Components (VECs) within the Study Area. Ecological resources that possess high inherent conservation values, and those that stakeholders and researchers consider important, are referred to as VECs. VECs can include abiotic and biotic environmental components that possess special importance.

Fundamental requirements to delineate protected area boundaries and evaluate the suitability as a protected area includes: determining adequate representation of broad scale landscape features within an ecoregion (Section 3.0); and, a finer scale evaluation of ecosystem components (*i.e.* VECs) and ecological processes. Determining the ecological representation of the Areas of Interest is the first step in protected area design (Schneider 2002). Although the Area of Interest is considered to adequately represent ecological conditions within the region, this does not ensure natural processes will be maintained and species populations will survive (Schneider 2002). Therefore, ecosystem components (*i.e.* VECs) and their interactions were identified below, described in Appendix B, and further evaluated as they relate to federal and territorial protected area suitability in Section 5.0.

4.2 DETERMINATION OF VALUED ECOSYSTEMS COMPONENTS

Beanlands and Duinker (1983) stated it is impossible for an analysis to address all potential environmental components. Therefore, an essential step at the beginning of any project is the selection of ecological components with high conservation values. This process requires selecting cultural and ecological components, such as indicator species or indicator habitats that are regarded as being valuable to stakeholders (*i.e.* Aboriginal groups, researchers, governments, and the public) to serve as VECs. VECs can be defined as "the environmental attributes or components identified as a result of a social scoping exercise as having legal, scientific, cultural, economic, or aesthetic value" (Sadar 1994). Hydrology, permafrost, and water quality are a few such environmental attributes that are important landscape components and were identified as important to the stakeholders. These specific attributes have been typically excluded as VECs in past regional work; however, since these

attributes have been identified as being important to the stakeholders of the K 'ágee Tu Area of Interest, they have been included as VECs for this project.

VECs selected for this project possess inherently high conservation values for KTFN. The selection of plant and animal species were based on species or species groups that have been previously identified as being important in other northern studies, important harvestable species, and species with special conservation status. Information on the distributional range of species was determined from available reports and the scientific literature.

For this document, VECs were selected based on the following six attributes:

- Ecological components considered traditionally and culturally important (*e.g.* important harvestable species);
- Ecological components that are common in the Study Area, and/or representative of the region;
- Ecological components identified as important by federal and territorial protected area legislation and associated regulations and policies;
- Ecological components considered sensitive to disturbance;
- Ecological components with special conservation status; and
- Areas identified as being biologically important such as International Biological Programme Sites (IBP sites), Important Bird Areas (IBA), and Key Migratory Bird Terrestrial Habitat sites.

Not all species and habitats selected as potential VECs encompass all six criteria; some were selected on the basis of only one attribute. Ecological resources recognised in this report as a VEC are outlined in Table 1, and are discussed as they relate to the suitability of the Area of Interest as a protected area designation, as well as in a future NWT – PAS Phase II program. Detailed accounts of each of the VECs were compiled and are provided in Appendix B, and were used as the foundation for assessing and evaluating the ecological value of the Area of Interest.

There is an exception within this report. Wood bison, a species with special conservation status (listed as Threatened under the federal Species at Risk Act), may infrequently occur within the Area of Interest, but is not considered a VEC within this report. The Area of Interest lies within a Bison Control Zone to ensure diseased bison from Wood Buffalo National Park (located approximately 50 km east of the Study Area) do not migrate and infect other disease-free herds in the Mackenzie Bison Sanctuary. Since the Area of Interest lies within a Bison Control Zone (all bison within the Area of Interest are removed), wood bison are not discussed within this report.

TABLE 1. VALUED ECOSYSTEM COMPONENTS

Environmental Components	Valued Ecosystem Components
Culture and Tradition	Cultural and Traditional Sites
Hydrology	Hydrology and Water Quality
Geology	Permafrost
Habitat	Vegetation (including rare vascular plants)
Ungulates	Woodland Caribou (boreal ecotype)[1]
	Moose
Furbearers	Wolverine
	Black Bear
	Wolf
	Marten
	Beaver and Muskrat
Birds	General Passerine Species
	General Waterfowl Species
	General Waterbird Species
	Whooping Crane
	American White Pelican
	Yellow Rail
	Rusty Blackbird
	General Raptors
	Peregrine Falcon
	Short-eared Owl
Amphibians	General Amphibian Species
	Northern Leopard Frog
Fish	General Fish Species
	Shortjaw Cisco
	Inconnu
	Walleye
Important Conservation Areas	Important Bird Areas (IBA) International Biological Programme (IBP) sites Key Migratory Bird Terrestrial Habitat Sites

[1] Only woodland caribou of the boreal ecotype occur within the Study Area, and are referred to as woodland caribou throughout this report.

5.0 PROTECTED AREAS LEGISLATION

5.1 INTRODUCTION

Valued Ecosystem Components, ecologically representative habitats, and special natural and cultural areas within the NWT can be protected through both federal and territorial legislation. Table 2 outlines available protected area designations that are available for important areas in the NWT.

A total of ten applicable federal and territorial protected area designations were reviewed and briefly considered for the Area of Interest. These ten potentially suitable protected area designations are managed by Parks Canada, Canadian Wildlife Service (CWS), NWT Department of Industry, Tourism and Investment, and the NWT Department of Environment and Natural Resources (ENR) (previously named Resources, Wildlife and Economic Development (RWED)) through a number of legislations and policies. In this report, legislation establishing these ten protected areas (such as the Canada National Parks Act, Migratory Birds Convention Act, Territorial Parks Act, and the NWT Wildlife Act) is referred to as Enabling Legislation. Each of these Acts, and associated Regulations, set out criteria for selecting new protected area sites. Based on these criteria, ecological components considered important within the Study Area are evaluated (Appendix B), and the protected area designations considered most suitable for the Area of Interest is determined.

Of these ten potentially suitable protected areas, only the most relevant to the Area of Interest are discussed in detail; the remaining protected areas are only briefly described. Other pieces of legislation, such as the Canadian Species at Risk Act (SARA) and the NWT Species at Risk Act (currently in development) also support the development and management of protected areas. These legislations are briefly discussed in Section 5.4.

Species and habitats may also be protected under other area designations, such as Ramsar sites, Federal Policy on Wetland Conservation, Canadian Biodiversity Strategy, Western Hemisphere Shorebird Reserve Network sites, North American Waterfowl Management Plan areas, and Canadian Biosphere Reserves. Although sites designated under these programs are not formally protected by legislation, they may benefit from protection through other programs (Rubec and Turner 2003).

TABLE 2. TERRITORIAL AND FEDERAL PROTECTED AREA DESIGNATIONS CONSIDERED FOR THE STUDY AREA

Responsible Agency	Protected Area Designations	Enabling Legislation and Regulations
Parks Canada Agency	National Parks and Reserves	Canada National Parks Act and National Parks General Regulations and other associated Regulations
	National Historic Sites	Canada National Parks Act and National Historic Parks General Regulations
Canadian Wildlife Service	Migratory Bird Sanctuaries	Migratory Birds Convention Act and Migratory Bird Sanctuary Regulations
	National Wildlife Areas	Canada Wildlife Act and Wildlife Area Regulations
NWT Department of Industry, Tourism and Investment	Natural Environment Parks	Territorial Parks Act, Territorial Parks Regulation, and Heritage Parks, Natural Environment Parks, and Recreation Parks Regulations
	Heritage Park	Territorial Parks Act, Territorial Parks Regulation, and Heritage Parks, Natural Environment Parks, and Recreation Parks Regulations
	Recreation Park	Territorial Parks Act, Territorial Parks Regulation, and Heritage Parks, Natural Environment Parks, and Recreation Parks Regulations
NWT Department of Environment and Natural Resources	Critical Wildlife Areas	Territorial Wildlife Act and Critical Wildlife Area Regulations
	Wildlife Preserves	Territorial Wildlife Act and Wildlife Preserves Regulations
	Wildlife Sanctuaries	Territorial Wildlife Act and Wildlife Sanctuaries Regulations

5.2 PROTECTED AREA DESIGNATIONS MOST SUITABLE FOR THE AREA OF INTEREST

The KTFN delineated the Area of Interest boundaries to represent an area considered most important for the protection of the Kakisa watershed and biophysical characteristics of the area (KTFN 2006). Within the Dehcho Land Use Plan, the Area of Interest was listed as a Conservation Zone (Dehcho Land Use Planning Committee 2006a). As a Conservation Zone, new renewable and/or non-renewable resource developments are not permitted within its boundaries; however, traditional harvesting and low level tourism are permitted (Dehcho Land Use Planning Committee 2006a).

According to these values of the KTFN, a National Wildlife Area or a Wilderness Conservation Area designation is considered most appropriate for the Area of Interest. The ecological attributes of the Area of Interest that meets the set criteria outlined for both a National Wildlife Area and a Wilderness Conservation Area are discussed below.

Other protected area designations considered less suitable for the Area of Interest are briefly discussed in Section 5.3.

5.2.1 Canada Wildlife Act and National Wildlife Areas

The Canada Wildlife Act establishes and manages National Wildlife Areas. Areas considered culturally important to Aboriginal communities are protected under the Act as eco - cultural areas (Canada Wildlife Act R.S., 1985, c. W-9, s. 1; 1994, c. 23). Eco - cultural areas were described by the CWS as a means to protect culturally important areas that support the full range of regional biodiversity (Latour pers. comm. 2006). Criteria to establish eco-cultural areas within the NWT are similar to criteria outlined for the establishment of National Wildlife Areas, and are discussed synonymously as a single term "National Wildlife Areas" in this report.

The establishment of National Wildlife Areas (NWAs) is considered the strongest form of habitat protection available to the Canadian Wildlife Service (CWS) (Canadian Nature Federation 2002). The main goal of NWAs is to protect wildlife and wildlife habitat, particularly for migratory species, species at risk and their habitats, and species and their habitats under development pressures continent wide (Rubec and Turner 2003). NWAs are established for the purposes of conservation, research, and/or education.

In 1989, CWS developed a minimum set of criteria for selecting new NWA sites. An area is said to meet minimum requirements if at least one of the following six criteria are met with respect to migratory birds, wild flora and fauna, and unique wildlife habitat:

Migratory Birds:

1. The area supports a concentrated population of species, subspecies, or a group of species for any part of their lifecycle (*e.g.* migration, nesting, feeding, and wintering);
2. The area supports at least 1 % of the Canadian population of a species, subspecies, or a group of species for any portion of the year (where data is available);
3. The area has a high potential for habitat restoration or enhancement so that migratory bird populations could increase to Canadian population targets, such as those established under the North American Waterfowl Management Plan[3], Canadian Landbird Conservation Strategy, North American Bird Conservation Initiative, Committee on the Status of Endangered Wildlife in Canada (COSEWIC), or recovery of nationally endangered wildlife programs.

[3] For example, the goal of the North American Waterfowl Management Plan (NAWMP) is to restore waterfowl populations back to average 1970s levels through the conservation of wetland and upland habitat (NAWMP 2004).

Wild Flora and Fauna:

4. The area supports an appreciable assemblage (sufficient to warrant conservation action) or number (determined on a case-by-case basis; however, it may include 1 % of the national population) of individual rare, endangered, threatened, or vulnerable plant and animal species or subspecies;
5. The area has special importance for maintaining the genetic and ecological diversity of the region because of the quality or uniqueness of its flora and fauna; and

Unique Wildlife Habitat:

6. The area is considered to include rare or unusual wildlife habitat within the region.

Although National Wildlife Areas can be established to protect representative ecosystems, the majority of NWAs established to date have been based on unique or special wildlife habitats (Rubec and Turner 2003).

Based on the set criteria outlined in the Canada Wildlife Act and by compiling and evaluating VECs within the Area of Interest (Appendix B), the Area of Interest has the potential to be designated as a National Wildlife Area based on the following:

The Area of Interest *supports a concentrated population of migratory birds during any part of their life cycle.*

- Little detailed information exists on migratory bird populations within the Area of Interest; however, waterfowl populations at Beaver Lake were estimated in the early 1970s. Beaver Lake was estimated to support approximately 10,000 ducks during fall migration and approximately 5,000 ducks during spring migration (Appendix B, Section 8.2) (Salter 1974; Bird Studies Canada *et al.* 2004).

The Area of Interest *supports at least 1 % of the Canadian population of a migratory bird.*

- Beaver Lake has been previously documented to support a significant concentration of migratory bird species, particularly waterfowl during spring and fall migration (refer to Appendix B Section 8.2). Tundra Swan densities recorded at Beaver Lake during the 1972 fall migration were estimated at approximately 2 % of the total North American Tundra Swan population at that time; while, Canvasback densities during the 1975 fall migration were estimated at approximately 1 % of the total global population at that time (Salter 1974; Bird Studies Canada *et al.* 2004).

The Area of Interest *supports an appreciable assemblage of individual rare, endangered, threatened, or vulnerable animal species.*

- The Area of Interest supports an appreciable population of woodland caribou (boreal ecotype), a species listed as Threatened under SARA. Population densities of woodland caribou are unknown within the Area of Interest; however, ENR has recently begun placing radio collars on caribou and tracking them within the NWT including the Area of Interest. Woodland caribou are known to occur within the

Area of Interest throughout the year, including during calving. Further details of woodland caribou occurrences within the Area of Interest are presented in Appendix B Section 6.1.

- The Area of Interest may support populations of additional species with special conservation status, including Whooping Crane, American White Pelican, Yellow Rail, Rusty Blackbird, Peregrine Falcon, Short-eared Owl, Northern Leopard Frog, wolverine, Inconnu, Shortjaw Cisco, and vascular plants. Accounts of each of these hypothetically occurring species is provided in their respective sections in Appendix B.

The Area of Interest *has special importance for maintaining the genetic and ecological diversity of the region.*

- The Area of Interest lies within the Taiga Plains ecozone, which supports the majority of the woodland caribou population occurring in the NWT. The Area of Interest covers approximately 2 % of the entire Taiga Plains ecozone in the NWT.

- Based on scientific information gathered in the Dehcho area, EBA (2003) mapped areas considered to have special conservation qualities, for example important calving, nesting, denning, spawning, and staging areas, which are critical in maintaining ecological diversity of the area. EBA (2003) recognized Beaver Lake, Etaáhdlı̨, and a few other smaller areas along upper and middle Kakisa River as very high conservation areas. Other areas were also recognized as having a high conservation value, including an area along the middle and lower Kakisa River (EBA 2003).

Although the Wildlife Act does not specifically identify culturally important areas as principle characteristics for the establishment of protected area, areas culturally important to Aboriginal communities are protected under the Act.

- The Area of Interest has supported Aboriginal traditional lifestyles for time immemorial. Hunting, gathering, and fishing activities occurred throughout the Dehcho region; however, areas such as lakes, rivers, wetlands, and wetland complexes (most notably an area called Etaáhdlı̨, which has been identified by residents as an important wildlife area) were critical to the survival of the KTFN (K 'ágee Tu First Nation 2006). The majority of the Area of Interest has been mapped as areas of very high and high importance to wildlife by the KTFN. Areas surrounding Beaver, Kakisa, and Tathlina lakes, as well as the upper and lower Kakisa River, Etaáhdlı̨ (a small lake complex along the upper Kakisa River with associated floodplains and mature spruce forests, also listed as an IBP site), as well as an area in the extreme southeast corner of the Area of Interest, and another area adjacent to Etaáhdlı̨ (K 'ágee Tu First Nation 2006). Refer to Appendix B Section 2.0 for further details on the cultural importance of the Area of Interest.

5.2.2 Territorial Parks Act and Wilderness Conservation Areas

The Territorial Parks Act establishes the formation of several types of Territorial Parks and Conservation Areas, including Wilderness Conservation Areas (WCAs) (other protected area designations under the Territorial Parks Act are described in Section 5.3.3). This Act is administered by the Department of Industry, Tourism and Investment. Hunting is permitted in Wilderness Conservation Areas for Aboriginals and hunting license holders; however, industrial activity is prohibited under the Act to the full extent of the NWT government power. Under the Territorial Parks Act, an area of interest can be considered a Conservation Area if it is established to protect core representative areas that contribute to regional biodiversity (such as landforms, watersheds, or wildlife habitat). In addition, prior to the establishment of a Conservation Area, the Minister must consult with affected or interested bodies, and an Area of Interest may become a Wilderness Conservation Area if affected or interested bodies are in agreement and the Minister assents the establishment.

Based on WCA criterion (*i.e. the Areas of Interest must protect core representative areas that contribute to regional biodiversity*), the Area of Interest, or portions of, have the potential to be designated a Wildlife Conservation Area. The Area of Interest is known to support regional biodiversity, particularly unique habitat types such as an IBP site, and inland floodplain (refer to appropriate sections in Appendix B). Based on the current Marxan analysis discussed in Section 3.0, the Area of Interest appears to adequately represent the ecoregion and encompasses most areas that are considered unique and uncommon in the region. Both common and uncommon landscape features incorporated in a protected area promotes greatest biological biodiversity.

5.3 OTHER PROTECTED AREA DESIGNATIONS LESS SUITABLE FOR THE AREA OF INTEREST

5.3.1 Canada National Parks Act and National Parks and National Historic Sites

The Canada National Parks Act establishes National Parks and Reserves[4], and National Historic Sites. Parks Canada is the responsible agency managing these protected areas. The Canada National Parks Act recognizes Aboriginal land claims, and allows traditional resource harvesting within any area of the park, including hunting, trapping, and carving stone removal activities. Public enjoyment and recreation is also permitted.

The main goal of the National Parks system is to protect areas representative of Canada's different natural regions. As of 2005, 38 National Parks and Reserves protected 24 different natural regions (resulting in over 60 % of the natural regions being protected) (Canadian Heritage – Parks Canada 2005). Since the primary mandate of National Parks and Reserves is to represent each of the natural regions, efforts towards the creation of new National Parks and Reserves focus on natural regions currently not represented. In addition, areas considered for a new National Park or Reserve, must be representative of

[4] Within the National Parks Act, areas considered Park Reserves are areas proposed as National Parks that are currently under negotiation of land claim agreements, such as Aboriginal Land Claims.

the environmental characteristics of a given area, and provide opportunities for public education and enjoyment (Canadian Heritage – Parks Canada 2005). Based on the criteria set out in the National Parks Act, a National Park/Reserve is less appropriate for the protection of the Area of Interest since the natural region, which the Area of Interest lies within, is currently represented by Wood Buffalo National Park (Canadian Heritage – Parks Canada 2005).

National Historic Sites may be established to commemorate a historical event, site or person of national importance, or protect a historic landmark or any other object of historic, prehistoric, and/or scientific interest of national importance. As part of the National Historic Sites General Regulations, no person is allowed to disturb, damage, or destroy any archaeological site, historical resource, or natural resource within the designated Site unless authorized. Based on the criteria set out in the National Parks Act, limited portions of the Area of Interest may be suitable for a National Historic Site. Further assessment may be required.

5.3.2 Migratory Birds Convention Act and Migratory Bird Sanctuaries

The Migratory Birds Convention Act is an accord between Canada and the United States of America to protect and conserve migratory birds, sustain healthy populations, provide for and protect habitat, and restore depleted populations of migratory birds (Migratory Birds Convention Act 1994 c-22). Canadian Wildlife Service is responsible for administering the Migratory Birds Convention Act. The Migratory Birds Convention Act establishes Migratory Bird Sanctuaries to be set up and managed to protect migratory birds and their nests.

There are five Migratory Bird Sanctuaries located within the NWT that protect critical areas for migrating birds. Within Migratory Bird Sanctuaries, it is prohibited to hunt, destroy, disturb or be in possession a migratory bird (including its body parts), egg, or its nest without a permit, except for Aboriginals (Migratory Bird Sanctuary Regulations CRC c.1036/1994).

It is recommended Migratory Bird Sanctuaries be reviewed every five years to determine if the protected area still meets Migratory Bird Sanctuary criteria. Areas are considered appropriate for a Migratory Bird Sanctuary if the area meets at least one of the following criteria (Rubec and Turner 2003):

- The area supports populations of migratory birds that are concentrated for any portion of the year in order to meet at least one life requirement, and that are vulnerable to site-specific threats;
- The area supports populations of migratory birds that occupy habitats of restricted distributions within the region and are vulnerable to human disturbance;
- The area regularly supports at least 1 % of a population of a species or subspecies; and

- The site supports the management of regional populations of migratory birds and/or has high capability for educational or interpretive purposes.

Numerous migratory bird species occur within the Area of Interest as breeders, migrants, and year-round residents. Based on criteria outlined for the establishment of Migratory Bird Sanctuaries, only Beaver Lake within the Area of Interest has the potential to be designated a Migratory Bird Sanctuary. However, current waterfowl surveys are required for confirmation. Refer to Appendix B Sections 8.2, 11.1 and 11.3 for details on Beaver Lake.

5.3.3 Territorial Parks Act and Natural Environment Parks, Heritage Parks, and Recreation Parks

In addition to establishing Wilderness Conservation Areas, the Territorial Parks Act sets up the formation of three other protected areas, including Natural Environment Parks, Heritage Parks, and Recreation Parks.

Natural Environment Parks are set up to preserve and protect unique, representative, or aesthetically important natural areas, and can be developed to promote natural park environmental appreciation. Lady Evelyn Falls Natural Environment Park occurs within the Area of Interest (Figure 1).

Heritage Parks are set up to protect significant cultural or historical natural areas, physical features, or built environments. In addition, Recreation Parks are established to encourage or provide recreational activities and the appreciation of natural environments. Service infrastructure, recreation, and interpretation facilities may be developed within both these parks; permits may be issued for businesses to provide services and activities that are in agreement with park mandates. Under the Territorial Parks Act, portions of the Area of Interest may be considered as a Heritage Park or a Recreation Park; however, this protected area designation may not be appropriate to meet values set by the KTFN.

Based on the above criteria, the Area of Interest, or portions of, have the potential to be protected as a Natural Environment Park, Heritage Park, and Recreation Park if under full agreement with KTFN, other affected parties, and the Minister.

5.3.4 NWT Wildlife Act and Critical Wildlife Areas, Wildlife Preserves, and Wildlife Sanctuaries

The existing NWT Wildlife Act enables the establishment of Critical Wildlife Areas, Wildlife Preserves, and Wildlife Sanctuaries, and provides power to the Commissioner to create associated Regulations respecting the preservation, maintenance, and restoration of habitats (Wildlife Act R.S.N.W.T. 1988, c.W-4, including amendments). Critical Wildlife Areas, Wildlife Preserves, and Wildlife Sanctuaries are areas set aside for the purpose of conservation; however, the Act and associated regulations do not formally define criteria for establishing these three protected areas. To date, existing Critical Wildlife Areas in the NWT solely protect the calving grounds of the Bluenose West and Bluenose East barren-ground caribou herds (Critical Wildlife Areas Regulations R.R.N.W.T. 1990, c.W-3).

In addition, a total of two Wildlife Sanctuaries (including the Mackenzie Bison and Thelon Wildlife sanctuaries) are recognized within the NWT (Wildlife Sanctuaries Regulations R.R.N.W.T. 1990, c.W-20).

Under the NWT Wildlife Act, these three protected areas may be established under the recommendation of the Minister, Aboriginal communities, and other impacted individuals/agencies. There are no set criteria required for the establishment of these three protected areas.

Based on this limited criteria, the Area of Interest has the potential to be protected as a Critical Wildlife Area, Wildlife Preserve, or a Wildlife Sanctuary if under full agreement with KTFN, other affected parties, and the Commissioner.

The existing NWT Wildlife Act is currently being revamped to provide tools to effectively manage and conserve wildlife within the NWT. The proposed Wildlife Act will apply to all vertebrate and invertebrate animals within the NWT, unlike the existing Wildlife Act that only applies to vertebrates (RWED 2003a). The proposed Wildlife Act may also outline the establishment of conservation areas (Yonge pers. comm. 2006).

5.4 SUPPORTING LEGISLATION AND POLICIES

Numerous federal and territorial legislation and policies help support the creation and management of protected areas, including the Canada Forest Accord, Federal Policy on Wetland Conservation, North American Waterfowl Management Plan, RAMSAR Convention on Wetlands of International Importance, Biosphere Reserve Network, North American Bird Conservation Initiative, CWS Habitat Conservation Program, Canadian Species at Risk Act, and the NWT Species at Risk Act. However, for this report, only the Canadian Species at Risk Act and the proposed NWT Species at Risk Act are discussed.

5.4.1 Canada Species At Risk Act

The Species At Risk Act is a federal legislation to protect species at risk and their habitats in Canada. Key objectives of the Act are to prevent species extinction, and support species at risk recovery efforts. The Species at Risk Act supports the protection of species at risk habitats, as well as encourages the management of other species to prevent them from becoming at risk (Species at Risk Act 2002 cH-24-29; Rubec and Turner 2003).

A species is protected under SARA if it is listed under Schedule 1 as Extirpated, Endangered, or Threatened. Once protected under SARA, a mandatory Recovery Plan is required within one to two years after being listed. Species listed as Special Concern under Schedule 1 are classified as at risk; however, they do not benefit from full legal protection under the Act. Under SARA, a Management Plan must be developed within 3 years for species considered as Special Concern under Schedule 1, and measures to ensure the conservation of the species and its habitat are set.

Under SARA, species listed under Schedules 2 and 3 require assessment (or reassessment) by COSEWIC and are not yet protected under SARA. Species listed under Schedules 2 and

3 may have been designated at risk by previous COSEWIC assessments (prior to the standardization of protocols); however, a reassessment is required of these species following standardized international protocols. Therefore, species listed under Schedules 2 and 3 may be protected under SARA in the future, following COSEWIC reassessment; consequently, they have been identified within this report.

Species within the Study Area that are listed under SARA are provided in Table 3, and are organized based on their conservation status. Detailed accounts on species with special conservation status are provided in their respective sections in Appendix B.

There are a total of five species recognized under SARA (Whooping Crane, woodland caribou (boreal ecotype), Peregrine Falcon (*anatum*), Yellow Rail, and Northern Leopard Frog) that hypothetically occur within the Study Area (Table 3). Of these five species listed, one species, the Whooping Crane, is considered Endangered, two listed as Threatened (woodland caribou (boreal ecotype), and Peregrine Falcon (*anatum*), and two considered Special Concern (Yellow Rail and Northern Leopard Frog). To date, there are no Recovery or Management Plans developed for these species. However, a Recovery Plan is expected for Whopping Crane, woodland caribou (boreal population), and Peregrine Falcon (*anatum*) in 2007.

TABLE 3. SPECIES HYPOTHETICALLY OCCURRING IN THE STUDY AREA WITH SPECIAL FEDERAL CONSERVATION STATUS[1]

Species	SARA Designation[2]			COSEWIC[3] Designation (last COSEWIC assessment)
	Schedule 1	Schedule 2	Schedule 3	
Whooping Crane	Endangered	-	-	Endangered (2000)
Woodland Caribou	Threatened	-	-	Threatened (2002)
Peregrine Falcon (anatum)	Threatened	-	-	Threatened (2000)
Yellow Rail	Special Concern	-	-	Special Concern (2001)
Northern Leopard Frog	Special Concern	-	-	Special Concern (2002)
Short-eared Owl	-	-	Special Concern	Special Concern (1994)
Shortjaw Cisco	No Status	No Status	No Status	Threatened (2003)
Wolverine	No status	No status	No status	Special Concern (2003)
Rusty Blackbird	No status	No status	No status	Special Concern (2006)

[1] Vascular plants with special conservation status are provided in Appendix B Section 5.2.
[2] (SARA 2006).
[3] (COSEWIC 2006)

As mandated under the Recovery and Management Plans, critical habitats of each species will be identified to the extent possible and research and management activities that are needed for the protection of the species will be recommended. For this report, the identification of critical habitat under the Recovery and/or Management Plans is important for the application of the Area of Interest as a protected area. Identification of critical habitat for species listed under SARA may benefit the application of the Area of Interest into a protected area depending on the amount of critical habitat present within the Study Area compared to elsewhere in the species national range.

5.4.2 NWT Species At Risk Act

The proposed NWT Species at Risk Act will apply to most wildlife and plant species naturally occurring in the NWT, except fish and migratory birds since they are managed by federal policies and legislations. The objectives and goals of the proposed NWT Species at Risk Act are similar to the federal Species at Risk Act, and include: assessing species risk levels, registering species on the NWT List of Species at Risk, protect endangered and threatened species, plan and implement endangered and threatened species recoveries, and

reassess species status every 3 to 5 years (RWED 2003b). Once listed under the Act, species will benefit from full territorial legislation against the killing, harming, harassing, capturing of individuals and damaging of dens, nests, or homes of a member of that species. This protection would apply to everyone, including Aboriginal harvesters.

As part of protecting species at risk, the proposed NWT Species at Risk Act will allow for the management and protection of listed species habitat. Under the proposed Act, the Minister would have the authority to create Species at Risk Conservation Areas (RWED 2003b). To date, criteria for the establishment of Species at Risk Conservation Areas have not been outlined; consequently, it is difficult to determine if the Area of Interest would be a candidate site for a species at risk conservation area.

The general status ranks of native NWT species have been identified by ENR in order to ensure proper species management and conservation. Species were ranked based on their population size, occurrences, distribution, population trends, population distribution, and threats. Species with special conservation status were placed into several ranking categories, including: At Risk[5], May Be At Risk[6], and Sensitive[7] (Working Group on General Status of NWT Species 2006). Table 4 lists the status of species considered At Risk and May Be At Risk that hypothetically occur within the Study Area, and are organized based on their conservation status. Species accounts are provided in their respective sections in Appendix B.

TABLE 4. SPECIES HYPOTHETICALLY OCCURRING IN THE STUDY AREA WITH SPECIAL TERRITORIAL CONSERVATION STATUS [1]

Species	NWT Designation (2006)	COSEWIC Designation
Whooping Crane	At Risk	Endangered (2000)
Shortjaw Cisco	May Be At Risk	Threatened (2003)
Rusty Blackbird	May Be At Risk	Special Concern (2006)
Yellow Rail	May Be At Risk	Special Concern (2001)
American White Pelican	May Be At Risk	Not At Risk (1987)
Inconnu	May Be At Risk	Not Determined

[1] Vascular plants with special conservation status are provided in Appendix B Section 5.2.

[5] At Risk Species = Species which are considered Endangered or Threatened by COSEWIC or other jurisdictional status reports.
[6] May Be At Risk Species = Species that may be at risk of extinction or extirpation and are ranked with the highest priority for a detailed assessment by COSEWIC or a jurisdiction.
[7] Sensitive Species = Species that are not at risk of extinction or extirpation, but may require special management or protection to prevent population decline.

6.0 CURRENT AND FUTURE RESEARCH OBJECTIVES IN THE STUDY AREA

A number of researchers and research agencies have been completing biophysical studies in the Study Area for a number of years, including the Department of Fisheries and Oceans (DFO), ENR, Ducks Unlimited, as well as a number of universities.

In order to determine data deficiencies and to recommend future research priorities, current and future research in the area was identified and provided in Table 5 below. Research programs listed in Table 5 represents only current (in the last year) and future research known to have occurred or expected to occur within the Study Area. Previous research and subsequent findings within the Study Area are discussed in each relevant section in Appendix B.

To date, it is evident current and future research within the Study Area has focussed mainly on water quality, land cover classification, woodland caribou, and Walleye populations. Little other research is occurring or proposed to occur to asses the remaining VECs outlined in this report.

TABLE 5. CURRENT AND FUTURE RESEARCH IN THE STUDY AREA

Valued Ecosystem Components	Current Research	Future Research
Cultural and Traditional Sites	• KTFN – K ‘ágee Tu NWT Protected Areas Strategy Step 1/2 Report: Identifying and Documenting the Area of Interest (KTFN 2006).	None known to date
Hydrology and Water Quality	• DIAND - Kakisa River Basic Water Quality sampling. Objectives are to continue sampling background conditions and report trend analysis for water quality conditions within the lower Kakisa River.	• DIAND - Kakisa River Basic Water Quality sampling will continue. Objectives will be to continue sampling background conditions and report trend analysis for water quality conditions within the lower Kakisa River. Sampling will continue for an undetermined amount of time.
Permafrost	• Geological Survey of Canada – Active layer and permafrost temperature monitoring. Objectives are to monitor permafrost conditions with climate change at numerous sites, including the Kakisa River immediately outside the Study Area (Aurora Research Institute 2006).	• Geological Survey of Canada – continued monitoring of the active layer and permafrost temperatures as they relate to climate change. Anticipated end dates are not known; however, assumed to be a long-term project within the Canadian Permafrost Monitoring Network (Natural Resources Canada 2006).
Vegetation	• ENR – Establishing Permanent Monitoring Plots for Growth and Yield, National Forest Inventory and Cumulative Impact Monitoring. This research was conducted throughout the Dehcho Region and Sahtu Settlement Area, and data will be used to determine forest growth rates under disturbed and undisturbed conditions, potential yield volumes, status of the NWT forests and trends over time, and Cumulative Impact Monitoring (ENR 2006a; GNWT 2007a). Three permanent plots were established within the Area of Interest, although detailed vegetation data was unavailable (GNWT 2007a). • ENR – Ecosystem Classification and Mapping of the Northwest Territories – Taiga Plains. Objectives of this project were to refine and revise existing boundaries of the National Ecological Framework of Canada (1996) NWT for the Taiga Plains. Final mapping, technical report, and educational poster are being prepared for the Taiga Plains, including the Study Area, and should be available late March 2007 (Decker pers. comm. 2006).	• ENR – Establishing Permanent Monitoring Plots for Growth and Yield, National Forest Inventory and Cumulative Impact Monitoring program will continue. Several hundred additional permanent monitoring plots will be established over the next 5 – 10 years throughout the Taiga and Boreal Plains ecozones (ENR 2006a). • ENR – Ecosystem Classification and Mapping of the Northwest Territories – Taiga Plains project will continue. Mid-to-long term objectives within the Taiga Plains include: reclassifying smaller scale sub-regions and ecosites, publishing an educational field guide, and possible revision of the classification system in 5 to 10 years (ENR 2006a).
Vegetation (rare species)	• Ontario Natural Heritage Information Centre – Survey of Rare and Exotic Plants in the NWT. Objectives included documenting rare and alien plant species along roads in the Dehcho and North and South Slave Areas (Aurora Research Institute 2006). It is unknown if survey plots were located within the Study Area.	• None known to date – Data deficiency.
Woodland Caribou (boreal ecotype)	• ENR – Boreal Caribou Fitness and Habitat Use in the North Cameron Hills Area of the Dehcho, NWT. This research occurred within the Area of Interest. Research objectives are to monitor collared female caribou fitness, calf recruitment and production, population trend, diseases, and document seasonal range use, home range use, and calving site fidelity (ENR 2006a; 2006b). This research began in 2003 and continues annually. • ENR – Boreal Caribou Fitness and Habitat Use in the South Cameron Hills Area of the Dehcho, NWT. This survey area lies within the southern portion of the Study Area, but outside the Area of Interest. Research began to monitor collared females, calf recruitment and production, population trends, and presence of disease, as well as document seasonal distribution in relation to human developments (ENR 2006a;	• ENR – Boreal Caribou Fitness and Habitat Use in the North Cameron Hills Area of the Dehcho, NWT will continue. Future research objectives include long-term population dynamics of boreal caribou and natural variation of environmental conditions (ENR 2006b). • ENR – Boreal Caribou Fitness and Habitat Use in the South Cameron Hills Area of the Dehcho, NWT will continue into the future for an undetermined amount of time. Future objectives include monitoring of environmental conditions (ENR 2006c). • ENR – Seasonal Range Use and Movement Patterns of Boreal Caribou Inhabiting Areas of Limited Human Disturbance will continue. Objectives are to continue

Valued Ecosystem Components	Current Research	Future Research
	2006c). • ENR – Seasonal Range Use and Movement Patterns of Boreal Caribou Inhabiting Areas of Limited Human Disturbance. This research program occurs immediately outside the Study Area to the west near Trout Lake; however, data may be of consequence to the Study Area. Objectives include seasonal range use and movement (including calving areas), population dynamics between adult females and calves, disease, gene flow, and habitat (ENR 2006a).	monitoring collared caribou, as well as to collar additional caribou (ENR 2006). Exact timing objectives are unknown.
Moose	• ENR - Dehcho Moose Population Monitoring Program. This research program is situated to the west and north of the Study Area. Objectives include baseline moose density estimates in the Dehcho, establish a community based monitoring program, conduct annual small scale moose surveys (outside the Study Area), and monitor moose health including heavy metal and other contaminants (ENR 2006a).	• ENR – Dehcho Moose Population Monitoring Program (outside the Study Area) will continue until 2009. The aerial monitoring component will occur from 2007/2008, biological sampling and analysis (including contaminant assessment) will be completed by 2007/2008, and a large scale moose survey will be conducted 2008/2009 (ENR 2006a).
Wolverine	None known to date – Data deficiency.	None known to date – Data deficiency.
All other Furbearers	None known to date – Data deficiency.	None known to date – Data deficiency.
Whooping Crane	None known to date – Data deficiency.	None known to date – Data deficiency.
American White Pelican	None known to date – Data deficiency.	None known to date – Data deficiency.
Yellow Rail and Rusty Blackbird	None known to date. CWS completed Rusty Blackbird surveys in the NWT, but not within the Study Area (this data is not available until early 2007 (Machtans pers. comm. 2006)).	None known to date – Data deficiency.
Peregrine Falcon	• None known to date (ENR Peregrine Falcon surveys along the Mackenzie River do not cover the Study Area).	None known to date – Data deficiency.
Short-eared Owl	None known to date – Data deficiency.	None known to date – Data deficiency.
All other Birds	None known to date – Data deficiency.	None known to date – Data deficiency.
Northern Leopard Frog	None known to date – Data deficiency.	None known to date – Data deficiency.
Shortjaw Cisco and Inconnu	None known to date – Data deficiency.	None known to date – Data deficiency.
All other Fish	• Department of Fisheries and Oceans - Walleye stocks at Kakisa and Tathlina lakes will continue to be monitored on a regular basis. Walleye population structures are currently being assessed at Tathlina Lake (Smith pers. comm. 2006).	• Department of Fisheries and Oceans - Walleye population structures will continue to be monitored at both Tathlina and Kakisa lakes. Walleye at Kakisa Lake will be surveyed in the fall of 2007, and aging structures will continue to be determined from fish harvested by the commercial fishery at Kakisa Lake (R. Smith pers. comm. 2006).
Important Areas	None known to date – Data deficiency.	None known to date – Data deficiency.

6.1 DEFICIENCIES IN SCIENTIFIC INFORMATION

As shown above in Table 5, little to no current or future scientific studies have been completed or are anticipated to assess many of the species occurring or potentially occurring within the Study Area. In addition, past research has been limited. Most particularly, little scientific information exists with regards to species with special conservation status within the Study Area. In addition, scientific information on the general biodiversity of the Study Area, including populations, distribution, and species richness within the Area of Interest is limited. This lack of scientific information can be generally categorized across the NWT, and particularly within the Study Area, but does not reflect insignificance of the areas or their flora and fauna, but rather logistical and cost constraints. The NWT is a large and relatively unpopulated area, and possesses numerous cost and logistical constraints while conducting research.

A few studies have been conducted within the Study Area, including waterfowl, woodland caribou, fish (particularly for commercial and sport fish), and vegetation (see Appendix B for detailed accounts). However, comprehensive surveys for a number of VECs outlined in this report have not been completed, including vegetation (including rare vascular plants), moose, wolverine and other furbearers, passerines, waterfowl, waterbirds, raptors, amphibians, and most fish species (particularly Shortjaw Cisco and Inconnu). In addition there is little current research at areas considered Important Bird Areas, International Biological Programme Sites, and Key Migratory Bird Terrestrial Habitat Sites. Ecosystem classification and mapping has also been updated to include climate – vegetation relationships within the Study Area (refer to Appendix B, Section 5.0); however, this information was not available while preparing this report. As a result, the revised ecosystem classification and mapping data is considered a significant information deficiency.

Of particular importance to the establishment of a protected area, little to no information is available for the occurrence and/or distribution of species with special conservation status and their critical habitat. SARA requires Recovery and Management Plans to be developed and critical habitat to be identified for all species currently listed as Endangered, Threatened, and Special Concern under Schedule 1, which involves the identification of species distributions, critical habitat, and threats. To date, a Recovery Plan has been proposed to SARA for the recovery of Whooping Cranes; however, it is currently unavailable to the public. No other species within the Study Area have Recovery or Management Plans. Critical habitat and species distributions identified within the Recovery and Management Plans of SARA listed species are of importance to this report.

Species considered At Risk and May Be At Risk by the territorial government (such as the Whooping Crane, Yellow Rail, American White Pelican, Inconnu, and Shortjaw Cisco) require more detailed assessments to be completed within the NWT. In doing so, the territorial government is required to identify species distributions and critical habitat within the NWT. To date, the territorial government has not completed any detailed assessments on any species within the Area of Interest.

Gunn *et al.* (2004) conducted a winter aerial caribou survey throughout a large segment of the Mackenzie Valley, including the Area of Interest, and mapped areas considered to have a high potential of caribou occurrence. However, further research is required on areas considered high, medium, and low potential for caribou occurrence to enhance and test Gunn *et al.* (2004) winter habitat modeling (Larter *et al.* (2006). In addition, areas considered to have high winter occupancy potential should be surveyed in the summer to refine specific habitat qualities at a finer scale (Larter *et al.* 2006).

Although a reconnaissance survey has been completed on waterfowl in the last few years within the Study Area (DUC 2003), species distribution and habitats most critical during spring and fall migration, staging, and breeding pair formation within the Study Area requires further study, particularly at Beaver Lake.

7.0 RECOMMENDATIONS

By evaluating the ecological components of the Study Area in accordance to KTFN wishes to permanently protect fish, wildlife, and their habitats within the Area of Interest, and to exclude resource development (except for traditional use and tourism), it was determined the most suitable protected area designation for the Study Area may be a National Wildlife Area or Wilderness Conservation Area. These two protected areas were also chosen as they have the strongest form of habitat protection afforded under federal and territorial legislation, and appear to complement the wishes of the KTFN, and are considered the best fit for the ecological environment within the Area of Interest. However, in order for the Area of Interest to be considered for a protected area designation, deficiencies in ecological knowledge must be addressed (refer to Section 5.1).

7.1 RECOMMENDED RESEARCH FOR FURTHER CONSIDERATION OF A PROTECTED AREA

A good scientific base is required to determine suitability for a protected Area. To meet the set criteria, a sound scientific base of research, inventory, and monitoring is required for the establishment of a National Wildlife Area and Wilderness Conservation Area. Recommended research provided in this report is focussed on critical research required within the next two years.

To contribute to the application of a National Wildlife Area or Wilderness Conservation Area and substantiate boundaries of the Area of Interest, a number of the data deficiencies must be addressed. Based on known scientific information, and current and future research objectives in the study area by other agencies, a few ecological deficiencies are considered most critical to answer. Priority field research (to be conducted within the next two years) should focus on the presence of species with special conservation status (including rare plants) as well as migratory birds, unique or uncommon habitats, general biodiversity, and critical wildlife areas. Field research recommended within the Areas of Interest include systematic plot sampling proportional to available habitat types, as well as breeding bird surveys, waterfowl surveys, and rare plant surveys. It is important for survey data to provide quantitative indicators of biodiversity.

Systematic plot sampling represents the best efficiencies for gathering the greatest breath of species' information over a large area, in a limited timeframe and budget, still covering the broadest range of taxa. It is important to sample plots proportional to habitat types within the Area of Interest, including uncommon habitats such as at IBP sites and alvars. At each sampling plot, baseline ecological information should be collected including general landscapes (*i.e.* slope, aspect, and landforms), vegetation, and species presence (including all visual and auditory observations, pellets, scat, nests, tracks, dens, and trails). Due to the size of the Area of Interest, plot sampling is considered the most effective solution for documenting basic habitat data, and may provide an estimate of the biodiversity of the area. Information collected from the plot samples, may also reveal key wildlife and high use areas, presence of species with special conservation status, and uncommon habitats. Two years of plot sampling is recommended in order to acquire a large sampling size of each habitat type within the Area of Interest. The ecological classification of the Study Area has been updated which incorporates climate and vegetation relationships (refer to Appendix B, Section 5.0); however, this new ecological classification scheme was unavailable during the preparation of this report. It is recommended this new ecological classification scheme be used as the foundation in identifying habitat types within the Area of Interest.

In addition, breeding bird point-count surveys proportional to available habitat types within the Areas of Interest are recommended. These surveys should follow appropriate breeding bird protocols and continue for two field seasons. Breeding bird data can help to describe the general biodiversity of the area, as well as document the presence, distribution, and a rough estimate of relative bird abundance for each community type surveyed, including for those species with special conservation status (*e.g.* Rusty Blackbird and Short-eared Owl). These surveys can be completed in association with systematic baseline plot sampling during breeding bird season (*i.e.* June).

Waterfowl surveys are also recommended at Beaver, Kakisa, Tathlina, and Dogface lakes, as well as, at wetland complexes (including Etaáhdlı̨,) (proportional to habitat types) throughout the Area of Interest. Waterfowl surveys should follow methodology and protocols of previous waterfowl surveys completed in the area, wherever possible, to allow for general comparisons. Surveys should be conducted during peak spring and fall migration, and during summer breeding for two years. Information collected from the waterfowl surveys may also reveal the presence of species with special conservation status (*e.g.* Whooping Crane and American White Pelican), and may provide an estimate of the general biodiversity of the area.

Rare plant surveys are also recommended to be carried out for two field seasons within the Areas of Interest, including uncommon and unique habitats (*e.g.* alvars and IBP sites). Rare plant surveys not only provide information on species at risk, but they can provide additional species diversity, which is also important. These surveys can be completed in association with the systematic plot surveys.

Other VECs are important to document; however, are not as critical for meeting NWT – PAS, NWA, and WCA establishment criteria. Other VECs such as hydrology, moose, furbearers, waterfowl, raptors, and fish are important to the basic ecological function, biodiversity, and productivity of an area; however, a full understanding of these VECs within the Area of Interest is not as critical for the application of a protected area under the two year timeframe for field research. For instance, the hydrology of the Area of Interest is considered to be relatively pristine and sensitive to natural and human disturbances, particularly Tathlina Lake. However, all land use developments outside the Area of Interest that may impact hydrology (both quality and quantity) are regulated under the Mackenzie Valley Land and Water Board, and developments with the potential to significantly impact hydrology must conduct, at a minimum, baseline water quality data prior to, during, and following development, and must not exceed appropriate federal Canadian water quality standards. However, Special Management Conditions may be required outside the Area of Interest to help protect water quality and quantity at the headwaters of the Kakisa watershed.

As well, moose are considered an important harvestable species; however, population surveys are not recommended at this time for the Area of Interest. Population densities of moose within the Area of Interest are not considered a priority for the establishment of a protected area under appropriate federal or territorial criteria.

In addition, fish surveys are not recommended in the Area of Interest at this time. Although two fish species of special conservation status hypothetically occur in Beaver Lake (Shortjaw Cisco and Inconnu), surveys to document the presence of rare species is not recommended. To adequately determine species presence and possible distribution and abundance of rare fish species is considered beyond the timeframe and monetary funds for this project.

7.2 RECOMMENDED BOUNDARY CHANGES

Protected areas succeed best in association with other management and/or protected areas in the region rather than in isolation. Large protected areas or a number of smaller protected areas together, provide greater ecological protection against pollution, isolation and fragmentation, and natural and human disturbances (including fire regimes). The Study Area is located adjacent Edéhzhíe, which is a proposed "Wildlife Area" (as per Latour pers. comm. 2006). Collectively, Edéhzhíe and the Area of Interest can contribute to the protection of regional landscapes and biodiversity conservation.

Boundaries of protected areas should reflect habitat and ecosystem needs (Rubec and Turner 2003). It has been suggested, 1,000 ha is the minimum area required for a National Wildlife Area or Migratory Bird Sanctuary to maintain ecological integrity (Rubec and Turner 2003). Protected areas of this size have the ability to accommodate natural disasters, (such as fire), contain numerous habitat types to preserve biological diversity, productivity, and health of an area, and protect sensitive species and their habitats.

As stated in the NWT - PAS guidelines, protected areas should ideally include a large enough area to:

- Contain numerous habitat types in various stages of succession;
- Accommodate natural disturbances, such as fire;
- Preserve areas that are biologically diverse and productive;
- Allow the natural renewal of healthy land and water systems; and
- Protect sensitive species and their life requirements (*i.e.* key habitats).

Based on the size alone, the Area of Interest supports a diverse assemblage of flora and fauna, and is considered to protect species and habitat diversity. Existing boundaries and the size of the Area of Interest are considered adequate to protect valuable ecosystem components, particularly regional biodiversity and species with special conservation status. The Area of Interest encompasses approximately 50 % of the Kakisa watershed, a number of habitat types, and covers a sizable area (863,600 ha). A number of unique habitats exist within the Area of Interest including the Kakisa River IBP site (also referred to as Etaáhdlįį (see Appendix B, Section 11.0)) and the southern shoreline of Beaver Lake. All of these communities vary in successional stage, particularly those in areas where fire has occurred, and within flood zones.

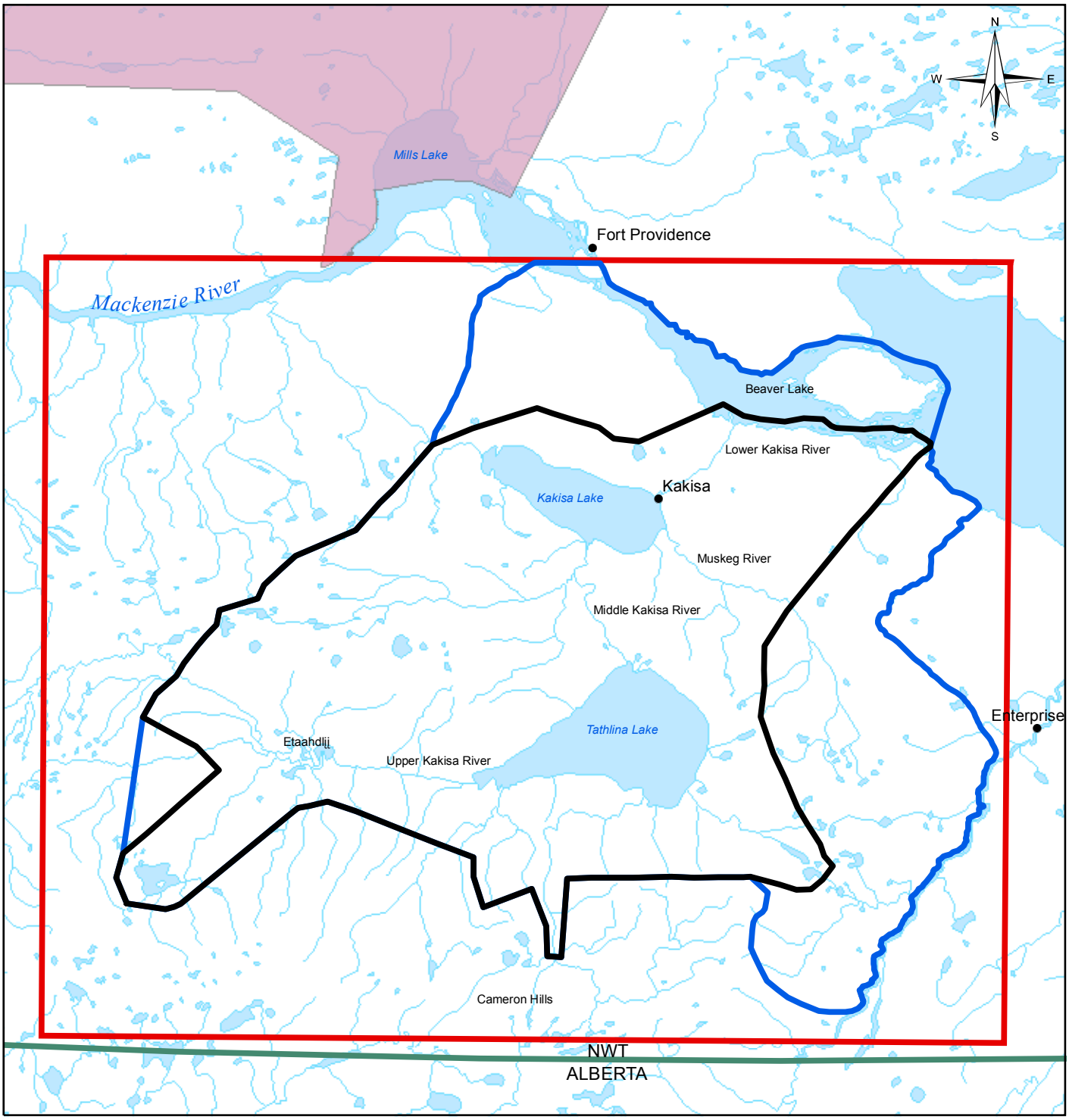
A protected area must be an appreciable size to accommodate natural disturbances (in this case fire is the dominant disturbance within the Study Area). Fire history has been mapped for the study area[8], and based on known historical records, fires have occurred throughout the entire Area of Interest. The largest fire within the Area of Interest occurred between Kakisa and Tathlina lakes in 1980 (GNWT 2007b). Smaller fires have also occurred at Etaáhdlįį, Dogface Lake, south of Tathlina Lake, and the southern shoreline of Beaver Lake. Although fire intensities are not known, the largest documented fire within the Area of Interest was approximately 1,234.618 km^2 (of which 638.571 km^2 completely within the Area of Interest) (GNWT 2007b). Approximately 2,476.698 km^2 of the Area of Interest has been burned (GNWT 2007b).

The protection of the Kakisa watershed was a major factor for establishing the boundaries of the Area of Interest. Boundaries of the Area of Interest cover approximately 50 % of the entire Kakisa watershed, principally the middle and lower reaches. Based on known information from the Area of Interest, the Kakisa watershed is assumed to be relatively pristine and fully functioning (*i.e.* no anthropogenic impacts or practices have altered water quality or flow). Although, by protecting the headwaters, aquatic systems are better able to sustain natural processes and, therefore, accommodate change. The existing boundaries of the Area of Interest were considered to be a compromise between protecting the entire Kakisa watershed, while still permitting controlled non-renewable resource development

[8] The GNWT makes no guarantees, representations, or warranties respecting the fire history data used.

(KTFN 2006). Special Management Conditions may be required outside the Area of Interest to help protect water quality and quantity at the headwaters of the Kakisa watershed.

Although existing boundaries and the size of the Area of Interest is considered sufficient to protect valuable ecosystem components, a few boundary changes have been recommended to enhance the protection for regional biodiversity and species at risk (Figure 15). Boundary recommendations are based on information collected within this report, and extensions are focused solely on ecological conditions and do not factor in possible land use limitations.



LEGEND

- Kakisa Area of Interest
- Kakisa Study Area
- Territorial - Provincial Border
- Community
- Watercourse
- Waterbody
- Edehzhie Candidate Protected Area
- Recommended Boundary Extensions

NOTES

Base data source: WWF Canada (2002)

KAKISA PHASE 1 ECOLOGICAL ASSESSMENT
K 'AGEE TU AREA OF INTEREST, DEHCHO, NWT

Recommended Boundary Extensions of Kakisa Area of Interest, Dehcho, NWT

PROJECTION	DATUM
UTM Zone 11	NAD83

Scale: 1:1,060,000

20 10 0 20

Kilometres

EBA Engineering Consultants Ltd.

FILE NO.			
1740209_New_Boundary_Map026.mxd			
PROJECT NO.	DWN	CKD	REV
1740209	KDA	SM/KL	2
OFFICE	DATE		
EBA-YEL	March 22, 2007		

Figure 15

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Recommended boundary extensions are as follows:

- Extension of the northern boundary to include the northern shoreline of Beaver Lake and Mackenzie River near Fort Providence in order to further protect waterfowl/waterbird, amphibian, fish, moose, and woodland caribou critical habitat (Figure 15). Beaver Lake in particular has been identified as an Important Bird Area, Key Migratory Bird Terrestrial Habitat Site, and an Important Biological Programme Site. Beaver Lake (and its islands) has the potential to support a number of species with special conservation status (including woodland caribou, Whooping Crane, American White Pelican, Yellow Rail, Rusty Blackbird, Northern Leopard Frog, Inconnu, and Shortjaw Cisco). As well, Beaver Lake helps support regional biodiversity in the area, and has been identified as an important traditional harvesting area for fish, moose, woodland caribou, and waterfowl. This extension meets NWA criteria 1 (*supports a concentrated population during any part of their lifecycle)*, as well as criteria 2 (*supports at least 1 % of the Canada population of migratory birds (i.e. waterfowl)).*
- An extension of the eastern boundary to include the Heart Lake IBP site to further protect unique and uncommon landscapes and rare plant species is recommended (Figure 15). In the past, Heart Lake IBP site has been an important site for conducting scientific research. The Heart Lake area includes a multitude of habitat types, particularly unique landscapes and landscapes uncommon in the regional area such as alvars, escarpments, canyons, ancient coral reef outcrops, and talus slopes. This multitude of habitat types within the Heart Lake area would benefit regional biodiversity and is known to support rare plants and possibly rare wildlife species. This recommended extension meets NWA criteria 4 *(supports an appreciable assemblage of individual rare, endangered, threatened, or vulnerable plant species)*, as well as criteria 5 and 6 (*area has special importance for maintaining ecological diversity of the region, and is considered to include rare or unusual habitat within the region, respectively*).
- Further extension of the eastern boundary along the northern shoreline of Hay River to Highway 1 (Figure 15). This portion is recommended based on known concentration of collared woodland caribou, a federally protected species, throughout this area (ENR 2006b) (refer to Section 6.1 in Appendix B for further details). In addition, this extension includes the headwaters of the Muskeg River (included as part of the Kakisa watershed). This recommended portion meets NWA criteria 4 (*supports an appreciable assemblage of individual rare, endangered, threatened, or vulnerable animal species*).
- Extension of the southern boundary to include the mature white spruce and aspen communities along the eastern slope of Cameron Hills (Figure 15) (Appendix B, Section 5.1). Incorporation of the mature forests along the eastern slopes of Cameron Hills into the Area of Interest is recommended as these habitat types are considered uncommon within the Area of Interest. These mature upland habitats would also aid in regional biodiversity, since the majority of the Area of Interest is dominated by lowland spruce. Of particular importance, the mature aspen forests along the eastern slopes of the

Cameron Hills are uncommon in the Dehcho area (PACTeam Canada 2003; Decker pers. comm. 2006). The closest mature aspen forests to those found along the eastern slopes of Cameron Hills occur in the Liard Valley. This southern boundary extension meets NWA criteria 5 and 6 *(the area has special importance for maintaining ecological diversity of the region, and the area is considered to include rare or unusual wildlife habitat within the region, respectively*).

- Extension of the southwest corner of the Area of Interest to help reduce the perimeter to area ratio, as well as include areas known to be utilized by woodland caribou (as per collared caribou data from the South Cameron Hills project (ENR 2006c)) (Figure 15). This recommendation meets the NWA criteria 4 (*supports an appreciable assemblage of individual rare, endangered, threatened, or vulnerable animal species),* as well as criteria 5 (*special importance for maintaining the genetic and ecological diversity of the region).*

The proposed boundary changes increase the Area of Interest to a total of 1,307,881.4 ha (13,078.8 km^2), and slightly increases the protection of the Kakisa watershed. The existing Area of Interest boundaries includes 49.8 % of the total Kakisa watershed; however, the recommended boundary extensions include 56.7 % of the Kakisa watershed.

8.0 CLOSURE

We trust this report meets your present requirements. Should you have any questions or comments, please contact the undersigned at your convenience.

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APPENDIX

APPENDIX A ECOLOGICAL REPRESENTATION ANALYSIS

Northwest Territories
Protected Areas Strategy

Ecological Representation in the Northwest Territories: K'ágee Tu Area of Interest

December 29, 2006

Prepared by the Northwest Territories Protected Areas Strategy Ecological Working Group

One of the goals of the Northwest Territories Protected Areas Strategy (NWT-PAS) is "to protect representative core areas within each ecoregion"[1]. The following is a brief summary of K'ágee Tu's contribution to this goal.

Each of the NWT's ecoregions has a unique combination of living things, landscapes and habitats. The NWT-PAS wants to protect samples of all of those things in each ecoregion – this is called **ecological representation**. The *most* ecologically representative areas in a region are called **core representative areas**.

The NWT-PAS is completing an analysis to identify options for core representative areas within NWT ecoregions. Well-accepted systematic conservation planning methods were employed, and a full technical report will soon be available.

1. Data Used

The NWT-PAS used data on three different conservation features to identify core representative areas within each ecoregion. The assumption is that these three abiotic and biotic datasets are good surrogates for biodiversity and ecological integrity:

- **Vegetation Types** (e.g. spruce, tall shrubs, emergent (wetland) vegetation, etc)
- **Landscape Units** (areas with a particular type of rock, soil and terrain)
- **Physiographic Units** (areas with similar elevation, climate, slope, aspect, and landforms)

2. Goal and Targets

The goal of the analysis is to protect a representative portion of all conservation features within each ecoregion. Proportional representation targets were set for individual conservation features, based on their total area (size) within each ecoregion. Proportional representation targets range from 10% to 25% for most features, and 100% for rare features. Computer modeling software was used to run the analysis and select areas that most efficiently meet the representation targets. The analysis was run on all of the Mackenzie Valley and Mackenzie Mountain ecoregions.

The assumption is that protecting representative portions of all enduring conservation features will help to protect a functional, resilient, ecologically representative sample of each ecoregion.

[1] The Northwest Territories Protected Areas Strategy Advisory Committee. 1999. Northwest Territories Protected Areas Strategy: A balanced approach to establishing protected areas in the Northwest Territories. (http://www.nwtwildlife.com/pas/pdf/stratsupp.pdf)

3. Results

It is important to note that the results presented here only show one configuration of areas that strive to meet all of the representation targets. There may be other configurations that will meet the targets, although perhaps not as efficiently as those presented here.

Conversely, there may be instances when no configuration can meet all of the targets in the analysis because some conservation features are distributed so patchily throughout the study area that entire ecoregions would need to be protected to capture them all. There will need to be a balance between finding the highest-value areas, and protecting a realistic proportion of the landbase.

The maps (Figures 1 and 2) show which areas are highly representative or unique (dark green), and likely cannot be found elsewhere; other areas (light green) contain more common features and can probably be found elsewhere in the study area.

- In other words, dark areas indicate the locations of features that are most **irreplaceable**. However, protecting only those irreplaceable features does not guarantee capturing representative portions of the more common features.
- The core representative area boundaries indicate how much of both irreplaceable and common features are required to fully meet the representation targets, in the most efficient way possible.

Two different scenarios describe the ecological representation of K'ágee Tu. The open and closed scenarios should be looked at side-by-side to get a better idea of how the information can be used:

1) In an **OPEN scenario (Figure 1)**, all parts of the study area have equal chances of being included in the solution[2].

- This scenario shows a theoretical result, indicating the most ecologically-representative areas within the study area, regardless of the potential locations of proposed protected areas.

- This scenario shows which areas **within** K'agee Tu are the most ecologically-representative, and may require special management measures. For example, those areas may be designated as *benchmark* areas, which are development-free. Benchmarks serve as reference sites which are monitored over time, and compared to similar areas where development occurs. They increase our knowledge of local natural systems, and can tell us whether changes in the environment are natural, or perhaps related to development activities.

[2] Exception: Existing Protected Areas (Nahanni National Park Reserve and Wood Buffalo National Park) were locked into the analysis, so they would automatically be included in the core representative areas.

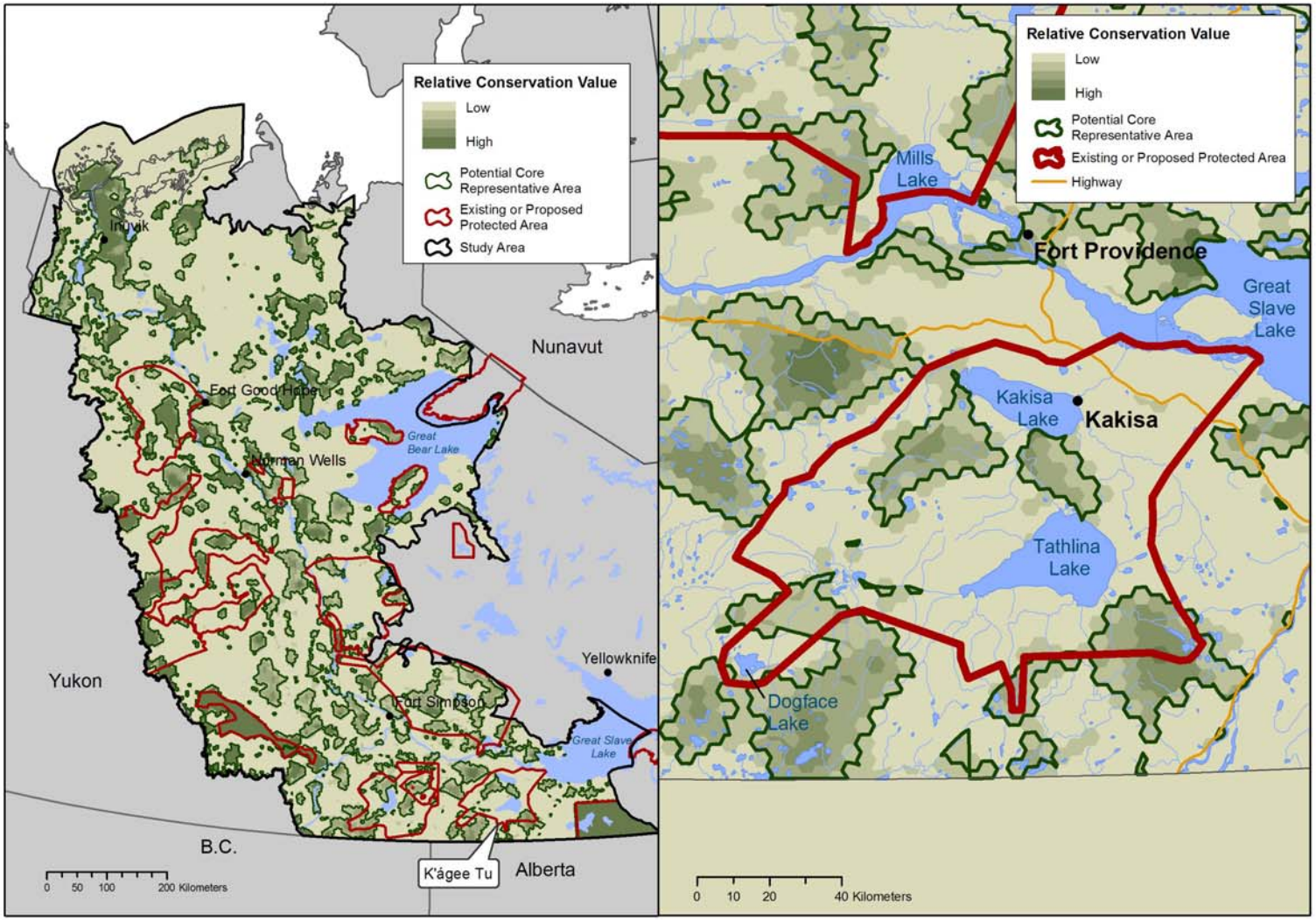


Figure 1. Left: Open scenario results for the Mackenzie Valley and Mackenzie Mountain ecoregions. Right: Open scenario results for K'ágee Tu.

2) NWT communities have already identified several special natural and cultural areas for protection. Those areas innately begin to meet the goal of ecological representation.

In a **CLOSED scenario (Figure 2)**, all existing and proposed protected areas that fall within the study area are "locked in" to the analysis. In other words, K'ágee Tu *must* be considered a part of the solution, and areas outside of K'ágee Tu will only be selected if they contain conservation features that cannot be found within K'ágee Tu.

Additionally, key development areas have been "locked out" of the closed scenario analysis. The 1 km-wide proposed Mackenzie Gas Project corridor, oil and gas production licences, and significant discovery licences were excluded from the analysis, so that areas of imminent high commercial value would not be part of the solution.

- This scenario shows how ecologically-representative K'ágee Tu is, compared to the areas **around** it. The fewer areas that the model needs to select outside of K'ágee Tu, the more representative it is. This can be seen as a kind of "gap analysis".

- However, all existing and proposed protected areas together contribute to meeting representation targets, so decisions made about one protected area may affect decisions on another one nearby. For example, if Sambaa K'e, a proposed protected area west of K'ágee Tu, were removed, it would no longer contribute to ecological representation. K'ágee Tu alone then might not be enough to meet the representation targets for the ecoregions that it shares with Sambaa K'e.

- Compared to the open scenario, few areas to the northwest and southwest of K'ágee Tu are required to meet representation targets. This indicates that K'ágee Tu is likely doing a good job of representing the conservation features in that region.

- Some areas along the southern border of K'ágee Tu appear as potential core representative areas in both the open and closed scenarios. If boundary modification were desired, these areas would be the most practical to consider including as part of the proposed K'ágee Tu protected area.

- Locking out development areas has little impact on the results for K'ágee Tu.

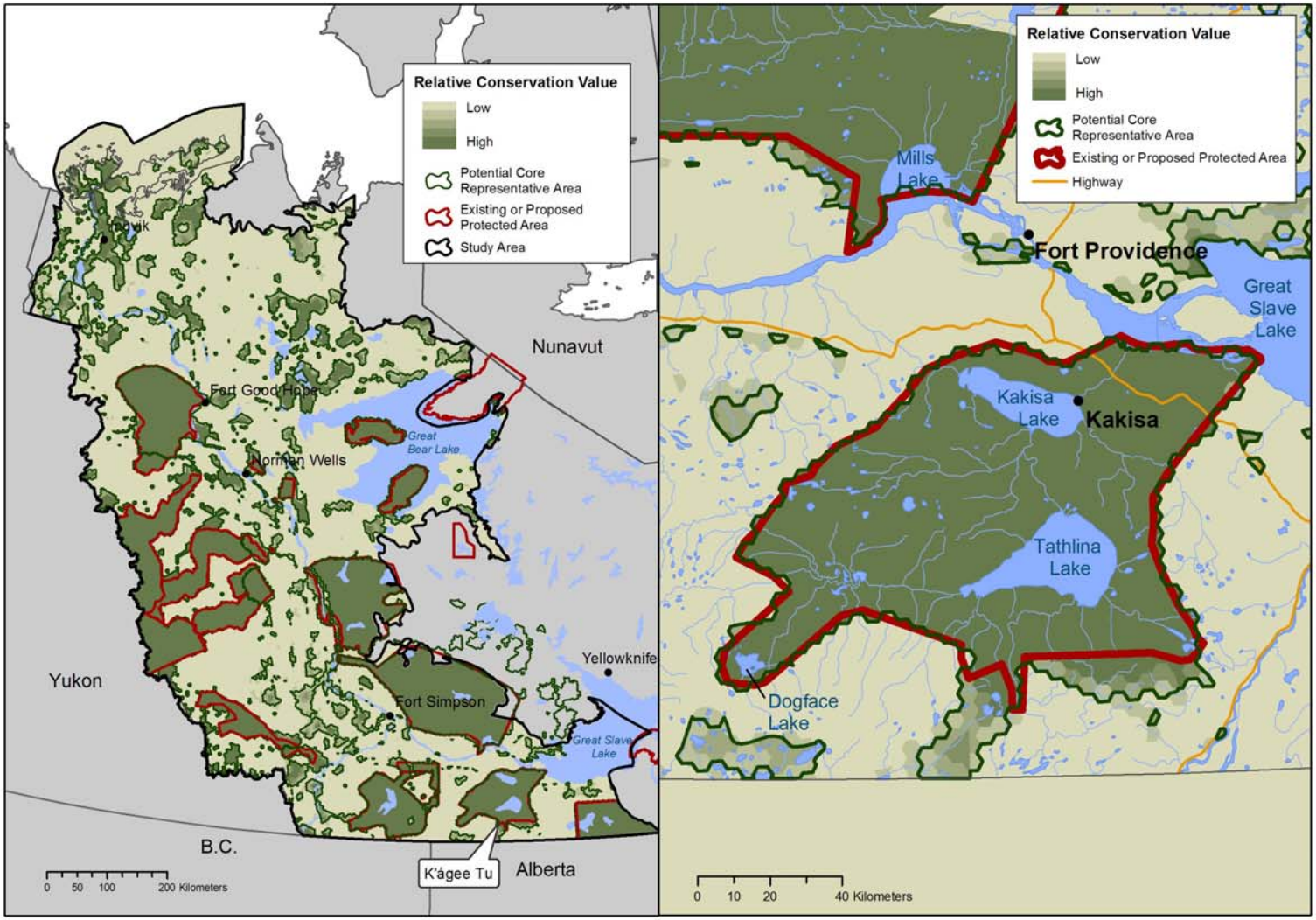


Figure 2. Left: Closed scenario results for the Mackenzie Valley and Mackenzie Mountain ecoregions. Right: Closed scenario results for K'ágee Tu

4. Next Steps

Further representation analyses
As stated earlier, there is no one perfect or "right" set of ecologically-representative core areas. The results presented here illustrate one option; they indicate locations of unique features or combinations of features in the most efficient manner possible.

Results can change based on other information that is locked into or locked out of the analysis. For example, the closed scenario analysis can be redone if communities would like other potential development areas locked out, to see if and where representation goals can still be met. It can be a tool to help make decisions about boundary modifications, if desired. The analysis can be redone to see how theoretical revised boundaries would change K'ágee Tu's contribution to ecological representation.

The results can also be scrutinized further, to help identify *which* conservation features (i.e. specific landscape units, physiographic units, or vegetation classes) are well-represented, and which are not (i.e. as a more in-depth gap analysis).

Further analysis is completed by the NWT-PAS by request and may change the core representative areas that were initially identified.

Adding Additional Information
While the NWT-PAS calls for protecting core representative areas as part of a protected areas network, it also states that other ecological information should be incorporated. The ecological representation analysis gives us a good starting point for locating high-value areas, but protecting only those core areas might not be enough to ensure that all natural processes and species will persist over time throughout the NWT. The NWT-PAS is working to provide information about several additional factors that conservation scientists consider when designing a protected areas network, including:

1. Special and unique habitats and features on the landscape
2. How climate change may impact the NWT
3. How big or small protected areas should be and which ones should be used to monitor change over time (benchmarks)
4. How to best connect protected areas in a network across the landscape

When a proposed protected area goes through the NWT-PAS process, some of these factors are addressed to a certain extent by the Non-renewable Resource Assessment, Renewable Resource Assessment, and Ecological Assessment.

Communities and land use planners will be consulted about additional information that can be used to refine a potential core representative area (e.g. information on freshwater, special features and species, how big an area should be, or other values they feel are important).

APPENDIX

APPENDIX B DETAILED ACCOUNTS OF VALUED ECOSYSTEM COMPONENTS

PAGE

PAGE

TABLES

FIGURES

Figures 1, 2, and 15 are located within the main body of the report.

1.0 VALUABLE ECOSYSTEM COMPONENTS

1.1 INTRODUCTION

Biological resources that possess high inherent conservation values, and those that stakeholders and researchers consider to be important, are called Valued Ecosystem Components (VECs). VECs can include abiotic and biotic environmental components that possess special cultural, ecological, economic, social, or legal importance. The approach for determining valued ecosystem components were discussed in the main body of the report (Section 4.2 *Determination of Valued Ecosystem Components*).

Ecological resources recognised in this report as a VEC are outlined in Table 1. Detailed accounts of each of the VECs are provided below, and were used as the foundation in assessing and evaluating the ecological value of the Area of Interest for advancing the site through the NWT - PAS.

Common names of species have been used where possible. For those species that do not have common names Latin nomenclature was used. Plant species nomenclature follows Porsild and Cody (1980) and Cody (2000). By convention, the common names of bird and fish species typically begin with capital letters (as outlined in ornithological journals such as Wilson Journal of Ornithology, as well as the Department of Fisheries and Oceans), whereas mammals often begin with lower case letters (as outlined in appropriate wildlife journals such as The Wildlife Society). These conventions were followed in this report.

TABLE 1. VALUED ECOSYSTEM COMPONENTS

Environmental Components	Valued Ecosystem Components
Culture and Tradition	Cultural and Traditional Sites
Hydrology	Hydrology and Water Quality
Geology	Permafrost
Habitat	Vegetation (including rare vascular plants)
Ungulates	Woodland Caribou (Boreal ecotype)
	Moose
Furbearers	Wolverine
	Black Bear
	Wolf
	Marten
	Beaver and Muskrat
Birds	General Passerine Species
	General Waterfowl Species
	General Waterbird Species
	Whooping Crane
	American White Pelican
	Yellow Rail
	Rusty Blackbird
	General Raptors
	Peregrine Falcon
	Short-eared Owl
Amphibians	General Amphibian Species
	Northern Leopard Frog
Fish	General Fish Species
	Shortjaw Cisco
	Inconnu
	Walleye
Important Conservation Areas	Important Bird Areas (IBA) International Biological Programme (IBP) sites Key Migratory Bird Terrestrial Habitat Sites

2.0 CULTURE AND TRADITION

The K 'ágee Tu Area of Interest was proposed through the Northwest Territories Protected Areas Strategy (NWT - PAS) since it represents an important traditional harvesting area for fish, wildlife, and plants, and holds significant cultural and traditional value. Through extensive consultations with its members, particularly elders, the boundaries of the Area of Interest were delineated to encompass an area most important for permanent protection of the watershed, critical fish and wildlife habitat, and core traditional land use areas (K 'ágee Tu First Nation 2006).

Traditional place names were documented throughout the Area of Interest (K 'ágee Tu First Nation 2006). Areas most concentrated with important harvesting, cultural, and camping sites were located along the Kakisa, Muskeg, and Cameron rivers, and surrounding Etaáhdlįį, Kakisa, Tathlina, and Beaver lakes (K 'ágee Tu First Nation 2006). These named areas represent high use areas of traditional importance.

Etaáhdlįį is located along the upper Kakisa River, and has been designated as an important wildlife area by the KTFN people for being rich in beaver, muskrat, waterfowl, fish, and moose (K 'ágee Tu First Nation 2006). In addition, Kakisa, Tathlina, and Beaver lakes are important for fish, waterfowl, moose, woodland caribou, furbearers, and plants (K 'ágee Tu First Nation 2006).

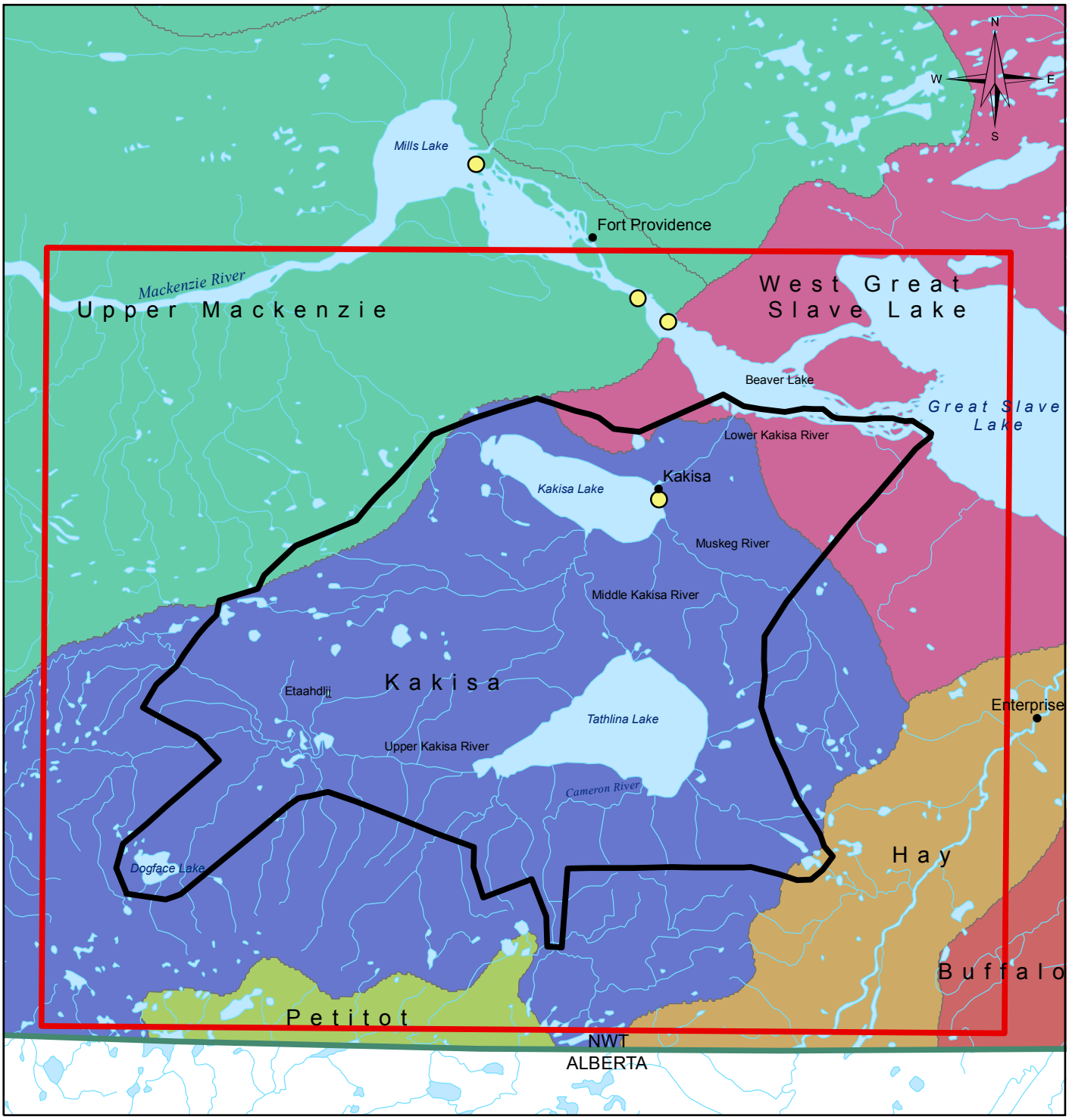
Beaver Lake is considered spiritually important for the people of KTFN, and was used as a harvest area typically for waterfowl and fish (K 'ágee Tu First Nation 2006). In addition, Tathlina Lake holds significant cultural value, and was the original settlement of the KTFN and is considered an important traditional land use area (K 'ágee Tu First Nation 2006).

3.0 HYDROLOGY

The Dehcho people have indicated the areas' water resources are critical for sustaining the land, people, and wildlife (Dehcho Land Use Planning Committee 2006). Water connects all life, and is considered a sacred gift (Dehcho First Nations 2006). Approximately 11.8 % of the Area of Interest is represented by water (as represented by landscape units described in K 'ágee Tu First Nation 2006).

Various environmental conditions affect the hydrological regime of an area including the geology, topography, climate, permafrost, characteristics of the drainage area, and vegetation cover (Kokelj 2001). Within the Taiga ecozone, a large number of lakes, ponds, and wetlands act to store water and buffer stream flow during spring runoff (Faria 2002). Spring runoff from snow melt is the primary source of water within the Study Area (Faria 2002).

The Area of Interest covers a total of four watersheds: Kakisa, West Great Slave Lake, Hay, and Upper Mackenzie (Figure 3).



LEGEND

- Community
- Kakisa Area of Interest
- Kakisa Study Area
- Territorial - Provincial Border
- Watercourse
- Waterbody
- Hydrometric Stations

Watersheds

- Buffalo
- Hay
- Petitot
- Upper Mackenzie
- West Great Slave Lake
- Kakisa

NOTES
Base data source: WWF Canada (2002)
Reference: WWF Canada (2002)

KAKISA PHASE 1 ECOLOGICAL ASSESSMENT
K 'AGEE TU AREA OF INTEREST, DEHCHO, NWT

Watersheds and Hydrometric Stations within the Study Area

PROJECTION	DATUM
UTM Zone 11	NAD83

Scale: 1:1,060,000
20 10 0 20
Kilometres

FILE NO.
1740209_Water_Map021.mxd

PROJECT NO.	DWN	CKD	REV
1740209	KDA	SM/KL	1

OFFICE	DATE
EBA-YEL	March 22, 2007

EBA Engineering Consultants Ltd.

Figure 3

C:\Krista Amey\DU - Kakisa\1740209_Water_Map021.mxd

The majority of the Area of Interest occurs within the Kakisa watershed (90 %), and only minor portions of the northwestern boundary lies within the Upper Mackenzie, and the southeastern corner in the Hay watershed (Table 2).

TABLE 2. SUMMARY OF WATERSHEDS WITHIN THE AREA OF INTEREST

Drainage Basin	Watershed	Represented by the Area of Interest (%)
Great Slave Lake	Kakisa	90.0
Great Slave Lake	West Great Slave Lake	7.5
Great Slave Lake	Buffalo*	0.0
Great Slave Lake	Hay	0.3
Liard	Petitot*	0.0
Mackenzie River – Great Bear Lake	Upper Mackenzie	2.2

* Although the Study Area includes the Buffalo and Petitot watersheds, the Area of Interest does not.

However, the Study Area also includes small portions of the Buffalo and Petitot watersheds (Figure 3). The Kakisa, Hay, Buffalo, and West Great Slave Lake watersheds are a part of the greater Great Slave Lake drainage basin; and the Upper Mackenzie watershed is part of the greater Mackenzie River – Great Bear Lake drainage basin (SENES Consultants Limited 2005). The Petitot watershed is included within the greater Liard drainage basin (SENES Consultants Limited 2005).

3.1 KAKISA WATERSHED

The Area of Interest lies predominantly within the Kakisa watershed, and is drained by the Kakisa River and its associated smaller tributaries (Figure 3). The Kakisa River drains an area approximately 15,600 km^2 (Environment Canada 2006b) through wetland complexes and lakes. Approximately 49.8 % of the entire Kakisa watershed is included within the Area of Interest.

The Area of Interest includes two large lakes: Kakisa and Tathlina lakes, as well as numerous other smaller lakes, ponds, and wetlands. Both Kakisa and Tathlina lakes are drained by the Kakisa River.

The upper Kakisa River is described as low lying with an average stream gradient of approximately 25 meters/kilometer (m/km) (Imperial Oil Resources Ventures Limited 2004). Beaver activity is assumed to play a critical role in the general hydrology and annual flow regimes of the upper Kakisa River (particularly the upper Kakisa River) and its tributaries. The upper Kakisa River is composed of the occasional small rapid and riffle areas (Roberge *et al.* 1986; Roberge *et al.* 1988); however, the river slows and deepens to 3 m prior to reaching the west end of Tathlina Lake (Roberge *et al.* 1986). Once entered into the west end of Tathlina Lake, Kakisa River (mid Kakisa River) continues flowing through a series of large rapids until entering into the south end of Kakisa Lake (Roberge *et al.* 1986; Roberge *et al.* 1988).

The lower Kakisa River flows through Kakisa Lake and eventually into Beaver Lake. At the outlet of Kakisa Lake, the River becomes shallow and widens, and often has extensive aquatic vegetation throughout the channel (Roberge *et al.* 1986; Roberge *et al.*1988).

The lower Kakisa River is characterized by swiftly flowing water with many rapids, and flows over Lady Evelyn Falls (15 m height). Bottom substrate of the lower Kakisa River was described as coarse gravel and bedrock, gravel bars, with small islands (Moshenko and Low 1983).

A hydrometric station at the outflow of Kakisa Lake has recorded flow data within the Area of Interest from 1962 to 1990. The mean annual flow calculated at the Kakisa Lake outflow hydrometric station was 41.1 cubic meters per second (m^3/s), and the total basin yield was 83.1 millimeters per year (mm/y) (Faria 2002; Environment Canada 2006b). The maximum average flow was typically observed in June and July, with the lowest average flow occurring in March and April (Environment Canada 2006b). Numerous wetlands, ponds, and lakes within the watershed acted as excess water storage areas and buffered spring runoff and high water events along the Kakisa River. This acted to suppress (but not prevent altogether) high flow and flood events along the Kakisa River. Because of this buffering effect, spring runoff and high water events were recorded at the hydrometric station as reduced and delayed flow and compared to the upper Kakisa River (Faria 2002).

A second hydrometric station was located on Kakisa Lake near the community of Kakisa. This hydrometric station has recorded water levels on a discontinuous basis for a year (a total of five water level records exist) (Environment Canada 2006b). Based on only five water level records, water levels were highest in June (3.57 m) and lowest in April (2.02 m) (Environment Canada 2006b).

Of particular interest, Etaáhdlı̨, located along the Kakisa River, is frequently flooded during spring runoff. This inland flood delta is unique to the Study Area; however, no hydrological data has been collected at Etaáhdlı̨. Flood frequencies and magnitudes affect local vegetation communities as well as floodplain channels (Salmo Consulting Inc. *et al.* 2004). Traditional knowledge indicates water levels at Etaáhdlı̨ begin to fall after ice break-up, leaving Etaáhdlı̨ shallow throughout the remaining of the year (K 'ágee Tu First Nation 2006).

3.2 OTHER WATERSHEDS

The Study Area encompasses four other watersheds, which are represented by the Mackenzie River – Great Bear Lake drainage basin, the Great Slave Lake and Liard drainage basins. The Upper Mackenzie watershed is a part of the Mackenzie River – Great Bear Lake drainage basin. This drainage basin covers 475,000 km^2 and lies almost entirely within the NWT (SENES Consultants Limited 2005). Within the Study Area, a total of two hydrometric stations were historically in operation in the Upper Mackenzie watershed. A hydrometric station was installed in Beaver Lake in 1971, and recorded water depths during the months of August (average water depth 153.23 m) and September (153.09 m) (Environment Canada 2006b).

In addition, a second hydrometric station was installed along the Mackenzie River, just west of the Beaver Lake station. This hydrometric station had been in discontinuous operation from 1958 to 1999 and limited data is available (Environment Canada 2006b). Flow reported at this hydrometric station averaged 4,580 m^3/sec throughout the year, and was highest in June and July (6,940 and 6,880 m^3/sec, respectively) and lowest in February and March (2000 and 1910 m^3/sec, respectively) (Environment Canada 2006b). The average annual water levels at the hydrometric station were 151.23 m, and remained relatively similar throughout the year (ranging from 151.99 m in June (highest) to 151.02 m in November (lowest) (Environment Canada 2006b).

Great Slave Lake's drainage basin covers 379,000 km^2 and includes watersheds in both Alberta and the NWT (SENES Consultants Limited 2005). This drainage basin receives water from a number of sources; however, 77 % of the water is received from the Slave River (SENES Consultants Limited 2005). The Liard drainage basin covers 275,000 km^2 (SENES Consultants Limited 2005). This drainage basin lies within the Yukon, British Columbia, and the NWT where it drains into the Mackenzie River.

3.3 WATER QUALITY

Geological characteristics of the Study Area affect river sediment loads and the associated water quality characteristics. Sedimentary rock and glacial till (which characterize the geology of the Study Area) erode as a result of runoff, and impact sediment loads of a river or stream particularly in spring and following summer rains. Conversely, in winter, water levels are at their lowest, and there is less water to dilute metals, salts, and other water quality parameters. However, these high sediment loads provide a rich supply of nutrients for plants, invertebrates, and subsequently higher order species (Mackenzie River Basin Board 2004). The headwaters of the Kakisa River flow through low lying wetlands and pick up tannins from organic soils, turning the water a reddish brown in colour. Roberge *et al.* (1986 and 1988), describes the Kakisa River as being a transparent brown colour.

In addition, the water quality of rivers, lakes, and wetlands that receive input from groundwater commonly reflect high mineral loads from the parent rock of underlying soils (Mackenzie River Basin Board 2004). The KTFN considers the Kakisa watershed to be pristine (K 'ágee Tu First Nation 2006).

In general, the water quality of the Great Slave, Liard, and Mackenzie River – Great Bear drainage basins are considered good (Mackenzie River Basin Board 2004). Although, metals such as aluminum, copper, iron, zinc, and other metals, as well as turbidity, regularly exceed the Canadian Council of Ministers of the Environment (CCME) guidelines for protecting freshwater aquatic life in all three drainage basins (Mackenzie River Basin Board 2004). This can be attributed to natural levels as a result of high sediment load during runoff from erodable material (such as glacial till which dominates the Study Area) (Mackenzie River Basin Board 2004). Therefore, the Mackenzie River Basin Board (2004) suggests these metal concentrations have probably been high for thousands of years, and as a result, the local flora and fauna have likely adapted to such conditions.

Water temperature also plays a critical role in water quality. Water temperatures naturally fluctuate with seasons; however, un-seasonal temperature changes have the potential to affect fish and other aquatic flora and fauna populations. In August 1989, Arctic Grayling stocks in the upper Mackenzie River, Beaver Lake, and Providence Rapids were killed as a result of a natural, un-seasonal increase in water temperatures; and, consequently, water pathogens increased and fish were weakened, which eventually led to a fish die-off (Stewart and Low 2000). This natural change in water temperatures in the upper Mackenzie River, Beaver Lake, and Providence Rapids also indirectly affected Arctic Grayling populations in the lower Kakisa River (Stewart and Low 2000).

Water quality was surveyed as part of baseline conditions for a potential hydro-electric development at Lady Evelyn Falls (Lamoureux 1973). In general, Kakisa Lake was considered productive for similar lakes at this latitude (Lamoureux 1973). Lamoureux (1973) reported Kakisa Lake was relatively turbid during spring runoff and early summer, but turbidity decreased in the fall and winter. In addition, summer water temperatures at Kakisa Lake ranged between 18 – 20 °C (lake considered isothermal), near eutrophic (rich in minerals and organic nutrients), and high in dissolved oxygen (near saturation year round) (Lamoureux 1973). Summer water temperatures at Kakisa Lake were closely correlated to ambient air temperatures and had little lag time (Fuller and Lamoureux 1973). High dissolved oxygen and high summer water temperatures were primarily in response to lake morphology (shallow with a large aerial extent), high wind exposure, and long solar radiation during summer months (Fuller and Lamoureux 1973).

In addition, the Department of Indian Affairs and Northern Development (DIAND) has collected basic water quality data on the Kakisa River (approximately 100 m downstream from the Kakisa River Bridge) from 1982 to 2006. Basic water quality data collected during this program includes physical properties (such as pH, conductivity, and turbidity), major ions, nutrients, and metals. Water parameter averages from 1982 to 2002 were available for this report, and are summarized in Table 3 summaries (Sanderson 2006).

Of most importance from the data collected on Kakisa River are the concentrations of four different metals commonly occurring above CCME guidelines for Freshwater Aquatic Life, including cadmium, mercury, iron, and chromium (Table 3). This is likely representative of natural conditions as a result of high sediment loads (Mackenzie River Basin Board 2004).

TABLE 3. SUMMARY OF WATER QUALITY DATA ON KAKISA RIVER FROM 1982 - 2002[1]

Water Parameter (unit)	Average (1982 – 2002)	CCME Freshwater Aquatic Guideline
pH	8.02	6.5 – 9
Conductivity (µs/cm)	244.35	-
Turbidity (NTU)	18.40	-
Colour (CU)	38.75	-
Suspended Solids	23.50	-
Calcium (mg/L)	38.73	-
Magnesium (mg/L)	8.06	-
Hardness (mg/L)	129.69	-
Sodium (mg/L)	4.69	-
Potassium (mg/L)	1.40	-
Alkalinity (mg/L)	110.01	-
Chloride (mg/L)	1.91	-
Sulphate (mg/L)	19.72	-
Ammonia (N) (mg/L)	0.023	-
Nitrate – Nitrite (mg/L)	0.030	-
Total Kjeldahl (N) (mg/L)	0.426	-
Total Phosphorous (P) (mg/L)	0.037	-
Total Arsenic (ug/L)	1.164	5.000
Total Cadmium (ug/L)	**0.304**	0.017
Total Copper (ug/L)	3.025	2.0
Total Iron (ug/L)	**659.64**	300.00
Total Manganese (ug/L)	32.717	-
Total Lead (ug/L)	1.545	1.0
Total Mercury (ug/L)	**0.151**	0.026
Total Nickel (ug/L)	3.947	25
Total Zinc (ug/L)	11.711	30
Total Chromium (ug/L)	**2.202**	1.000
Total Cobalt (ug/L)	0.609	-

[1] Data provided by Sanderson (2006).

- No recommended guideline (CCME 2006).

BOLD = Water parameter above CCME Aquatic Life guideline.

4.0 GEOLOGY

4.1 PERMAFROST

The presence, distribution, and extent of permafrost in an area can have an affect on plant and wildlife distributions and, therefore, influence the location of traditional harvest areas. Permafrost occurs when ground (either rock or soil) temperatures remain at or below zero degrees Celsius (°C) for at least two years. Permafrost distribution within the Study Area is considered sporadic discontinuous with low ice content (Ecological Stratification Working Group 1996; Geological Survey of Canada and Natural Resources Canada 2006). Soil moisture in permafrost occurs in the form of ground ice, which can occur in different forms, such as ice wedges, ice sheets, and pingos. The occurrence of ground ice depends on a number of factors, including the soil type. Fine textured and organic soils typically have more ground ice, compared to course textured soils (sands and gravels). The Area of Interest is dominated by low lying wetlands with organic soils.

5.0 HABITAT

The Study Area lies predominantly within the Hay River Lowland ecoregion, except for the southwestern portion which covers the Northern Alberta Uplands (Figure 2). Vegetation communities differ slightly between these two ecoregions in response to geology, permafrost, and climate.

In the Hay River Lowland ecoregion, upland vegetation communities are dominated by closed mixed stands of trembling aspen, balsam poplar, white spruce, and black spruce. Sporadic discontinuous permafrost leads to large areas being waterlogged, creating a patchwork of wetland complexes that cover approximately 30 % of the ecoregion (Ecological Stratification Working Group 1996). Tamarack and black spruce are common tree species within these wetlands.

Little over half of the Northern Alberta Upland ecoregion is covered by fen and bog wetlands (50-70 %) that support open stands of stunted black spruce, birch, and other shrubs. In upland habitats, vegetation communities are characterized by white spruce and aspen mixed-wood forests (Ecological Stratification Working Group 1996).

New ecosystem classifications have been completed within the Taiga Plains ecozone, including the Study Area; however, this information is currently unavailable to the public until at least late March 2007 (Decker pers. comm. 2006). In order to map new ecological classifications, landforms, soils, and vegetation were field surveyed; however, this information is currently unavailable as well (Decker pers. comm. 2006). According to Decker (pers. comm. 2006), the new land cover classifications are significantly different from existing Hay River Lowland and Northern Alberta Upland ecoregion classifications, and have included climate as an abiotic factor affecting plant associations.

5.1 PLANT COMMUNITIES

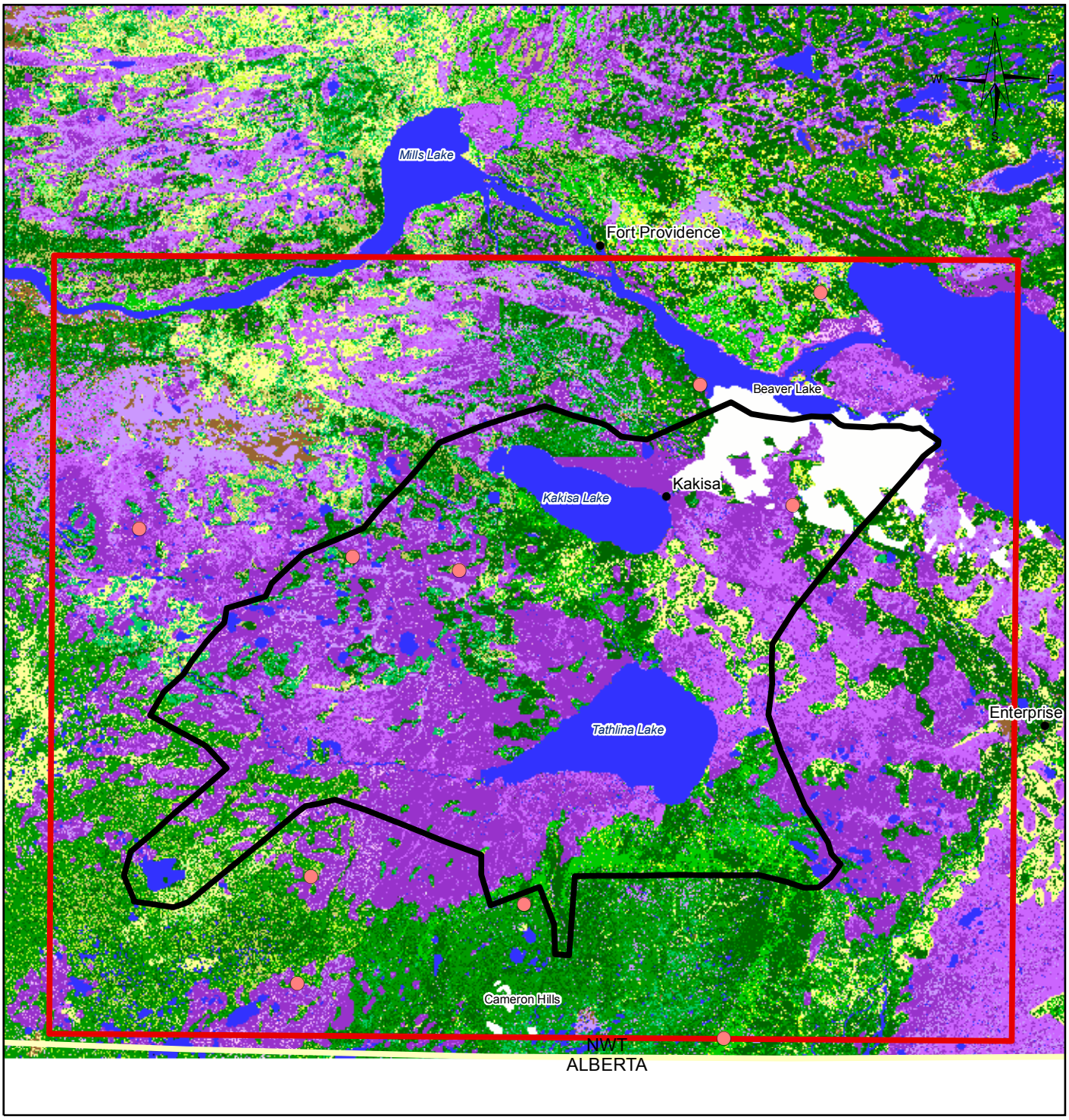
Information on existing plant communities within the Study Area is limited mainly to land cover classifications using satellite imagery; however, this data has not been field confirmed.

The territorial Government has classified land covers throughout the entire Dehcho, including the Study Area using satellite imagery at a 1 kilometre (km) resolution (Northwest Territory Land Cover Classification 2002), as well, Natural Resources Canada has classified land cover from satellite imagery (Earth Observation for Sustainable Development (EOSD)) (Canadian Forest Service 2005) (Figure 4). Ducks Unlimited has also completed earth cover classification mapping; however, this does not encompass the entire Study Area.

Needleleaf forest communities, such as spruce, pine, and tamarack dominate approximately 45 % of the Dehcho territory (Dehcho Land Use Planning Committee 2006). Tall and low shrub dominated communities account for 18 % of the total Dehcho territory, and barren lands account for 11 % (Dehcho Land Use Planning Committee 2006). A number of other land cover types were reported within the Dehcho territory, including areas dominated by broadleaf (7 % total coverage), herbaceous (6 % total coverage), and lichen (5 % total coverage) communities (Dehcho Land Use Planning Committee 2006). Broadleaf forests occurred primarily along the Liard and South Nahanni river valleys. It is important to recognize that percent cover of various communities throughout the Dehcho territory are fundamental in describing the general habitat of the area; however, it is essential to remember that these percent covers are based on satellite imagery at a large spatial scale. As a result, small vegetation communities are not represented since they are combined within much larger community types.

In comparison to the Dehcho territory, the Area of Interest is dominated by wetlands, including treed (dominated by black spruce and/or tamarack), shrub, and herb communities (Figure 4) (Canadian Forest Service 2005). A limited amount of shrub (both tall and low shrub) dominated habitats occur within the Area of Interest, principally along Muskeg River (Figure 4) (Canadian Forest Service 2005). Areas dominated by broadleaf forests (aspen and/or balsam poplar) also occur in the Area of Interest, particularly south of Tathlina Lake along the north and east slopes of Cameron Hills, and a small area along the southern shore of Kakisa Lake (Figure 4) (Dehcho Land Use Planning Committee 2006; Canadian Forest Service 2005).

Although landcover has been classified for the entire Study Area using satellite imagery, little field data exists to confirm imagery interpretation. Vegetation communities occurring in a single area along the upper Kakisa River banks (outside the Study Area) were described during geological surveys (Geological Survey of Canada and Natural Resources Canada 2006). Vegetation communities at these sites were described as dense, tall black spruce, upland Jack pine, Labrador-tea, and mountain cranberry (Geological Survey of Canada and Natural Resources Canada 2006). Vegetation community types within bog and fen habitats in the headwaters of Kakisa River were dominated by black spruce, birch, leatherleaf, lichen, peat moss, and shrubs (Geological Survey of Canada and Natural Resources Canada 2006). Although the field data was recorded outside the Study Area, it is reasonable to assume that similar vegetation communities and species composition occur within the Study Area.



LEGEND

- Kakisa Area of Interest
- Kakisa_Study_Area
- Territorial - Provincial Border
- No Data
- Cloud
- Shadow
- Water
- Snow/Ice
- Rock/Rubble
- Exposed Land
- Bryoids
- Shrub Tall
- Shrub Low
- Wetland-Treed
- Wetland-Shrub
- Wetland-Herb
- Herb
- Conifer. Dense
- Conifer. Open
- Conifer. Sparse
- Broadleaf Dense
- Broadleaf Open
- Broadleaf Sparse
- Mixedwood Dense
- Mixedwood Open
- Mixedwood Sparse
- Permanent Forest Inventory Plots

NOTES

Base data source: Canadian Forest Service 2005
Reference: GNWT (2007)

KAKISA PHASE 1 ECOLOGICAL ASSESSMENT
K 'AGEE TU AREA OF INTEREST, DEHCHO, NWT

Dominant Plant Communities within the Study Area

PROJECTION	DATUM
UTM Zone 11	NAD83

Scale: 1:1,060,000

20 10 0 20

Kilometres

EBA Engineering Consultants Ltd.

FILE NO.: 1740209_Dominant_Plant_Map003.mxd

PROJECT NO.	DWN	CKD	REV
1740209	KDA	SM/KL	1

OFFICE	DATE
EBA-YEL	February 26, 2007

Figure 4

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Large fires have occurred within the Study Area, particularly between Kakisa and Tathlina lakes, along the Mackenzie River in the northwest portion of the Study Area, and in the extreme southeastern corner of the Study Area (Dehcho Land Use Planning Committee 2006). Based on fire history data, more than 10 % of the Area of Interest was burned in 1980, and approximately 1.5 % of the Area of Interest was burnt in 1983 and again in 1996 (K 'ágee Tu First Nation 2006).

Timber potential within the Study Area has also been determined in 2003 (PACTeam Canada 2003). Although timber potentials are beyond the scope of work for this report, timber data provides useful baseline information regarding plant communities and successional stage. The majority of the Study Area is considered to have none to low timber potential for saw logs (PACTeam Canada 2003), which indicates communities within the Study Area are either young (early successional stage) or trees that are stunted as a result of poor growing conditions (as found in wetlands or areas with exposed or reduced substrates). Areas with high log timber potential included mature upland white spruce and aspen forests[1] located along the north and east slopes of Cameron Hills as well as north of Kakisa Lake up to the Mackenzie River (PACTeam Canada 2003). These mature aspen stands located along the north and east slopes of Cameron Hills (within the Study Area) are considered uncommon within the Dehcho. Aspen forest stands that meet timber potentials are only found in the Cameron Hills and Liard Valley within the entire Dehcho (PACTeam 2003).

In addition to plant community surveys, a total of ten National Forest Inventory (NFI) Permanent Monitoring Plots have been established within the Study Area (three within the Area of Interest) in 2005 and 2006 (Figure 4) (GNWT 2007). To date, field data regarding dominant species, forest health, successional stage, and community complexity at these sites are not available (Cassidy pers. comm. 2007). However, future monitoring of each Permanent Monitoring Plot is expected every five to ten years (Cassidy pers. comm. 2007).

[1] As defined within the PACTeam Canada (2003) report, potential white spruce log timber stands are recognized to be at least 15 m tall and 80 years old. As well, potential aspen log timber stands are 15 m in height.

5.2 RARE VASCULAR PLANTS

Areas supporting flora with special conservation status commonly represent unique landscapes and illustrate the diversity of an area. Due to the vastness and remoteness of the NWT, limited knowledge exists on plant distributions, particularly rare species. Rare vascular plants were reported by McJannet *et al.* (1995) and Porslid and Cody (1980) throughout the NWT; however, little to no work has been published on rare lichens, mosses, and other non-vascular flora. Within the NWT, approximately one third of the rare plants are known to occur in the boreal zone, particularly within the Southern Boreal Province, which includes the Study Area (McJannet *et al.* 1995). The biological diversity of plants has become increasingly important to researchers and Canadians in general. Species listed below are rare flora listed in *Rare Plants of Northwest Territories* (McJannet *et al.* 1995; Working Group on General Status of NWT Species 2006). Based on McJannet *et al.* (1995), World Wildlife Fund (2000), and the Working Group on General Status of NWT Species (2006), a total of 14 rare vascular plants occur, or hypothetically occur, within the Study Area (Table 4). Typical habitats supporting these rare plants are provided in Table 4 below.

As defined by McJannet *et al.* (1995), a rare species is one that has particular biological characteristics, or occurs at the edge of its main range, or for some other reason, exists in low numbers or in restricted distributions in the region of consideration.

The Ontario Natural Heritage Information Centre has recently completed a rare and exotic plant survey along Highways in the NWT (Aurora Research Institute 2006). Objectives of this study were to document rare and alien plant species along roads in the Dehcho, and North and South Slave Areas (Aurora Research Institute 2006). It is unknown if survey sites were located within the Study Area or if rare or exotic species were recorded.

Other plant surveys have been completed in the Heart Lake IBP area by the University of Alberta and others. Of the rare plants identified in the Heart Lake IBP, only three are currently listed as rare (At Risk or May Be At Risk under the 2006 NWT status list) (Table 4) (World Wildlife Fund 2000; Working Group on General Status of NWT Species 2006).

TABLE 4. RARE VASCULAR PLANTS HYPOTHETICALLY WITHIN THE STUDY AREA

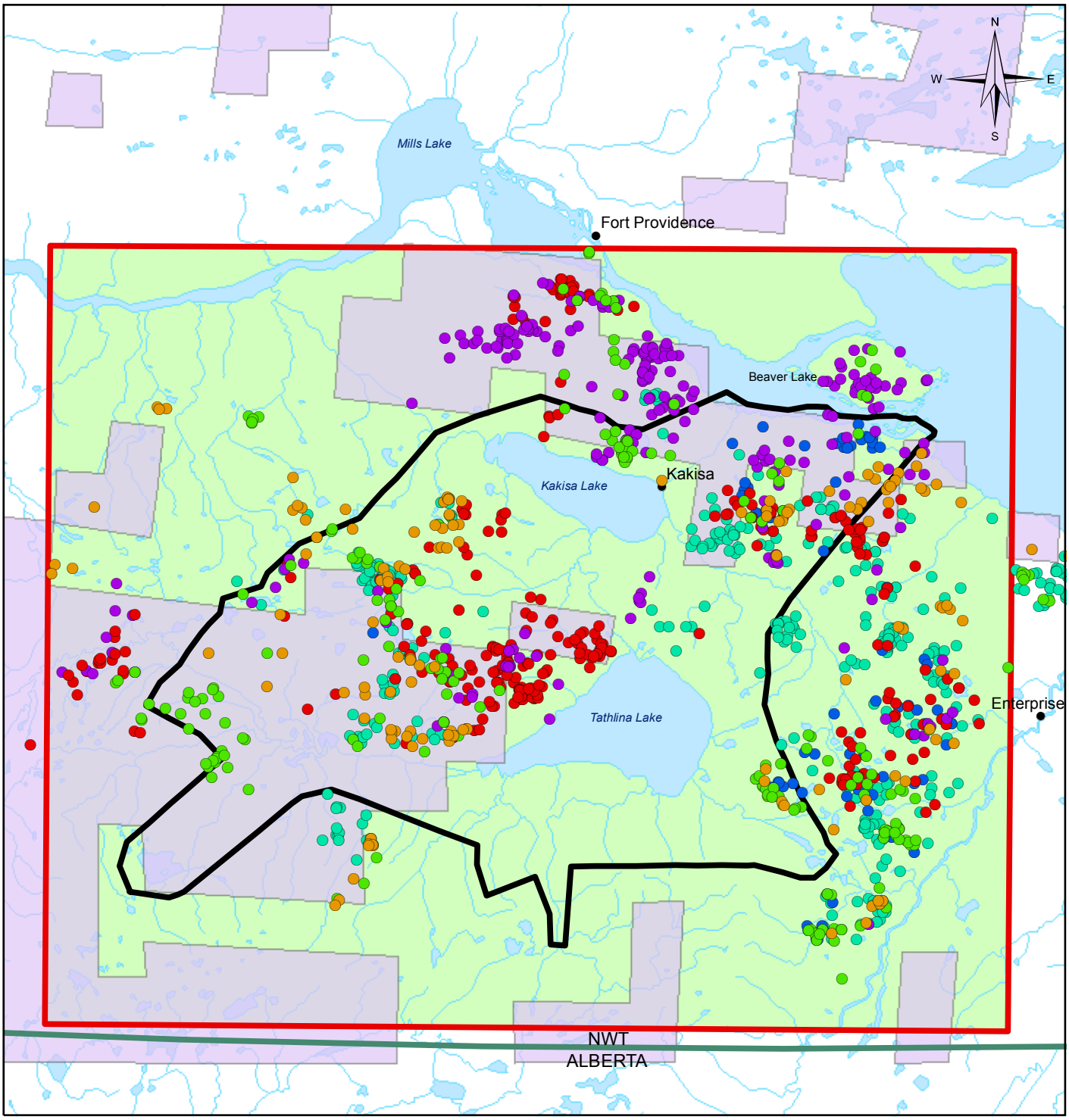
Common Name (Scientific Name)	Habitat	NWT Status (2006)
Clasping-Leaf Dogbane (*Apocynum cannabinum*)	Exposed river banks	May Be At Risk
Green Spleenwort spp (*Asplenium trichomanes – ramosum*)	Moist rocky slopes and crevices	May Be At Risk
Canadian Milk Vetch (*Astragalus canadensis*)	River banks and moist open woods	May Be At Risk
Hooker's Alpine Oat Grass (*Avenula hookeri*)	Dry grasslands	May Be At Risk
Carex species (*Carex duriuscula*)	Dry grasslands and slough edges	May Be At Risk
Prairie Sedge (*Carex prairea*)	Bogs	May Be At Risk
Retorse Sedge (*Carex retrorsa*)	Woodland marshes	May Be At Risk
Slender Spike Rush (*Eleocharis elliptica*)*	Calcareous sandy and muddy shores	May Be At Risk
Linear-Leaved Willow Herb (*Epilobium leptophyllum*)	Marshes, bogs, and sedge meadows	May Be At Risk
Macoun's Gentian (*Gentianopsis macounii*)	Gravelly beaches and marshy shores	May Be At Risk
Richardson Alumroot (*Heuchera richardsonii*)	Woodland meadows	May Be At Risk
Muskeg Lousewort(*Pedicularis macrodonta*)*	Bogs and marshes	May Be At Risk
Illinois Pondweed (*Potamogeton illinoensis*)	Still waters	May Be At Risk
White Beakrush (*Rhynchospora alba*)*	Fens and bogs	May Be At Risk

* Species recorded at Heart Lake IBP site (WWF 2000).

6.0 UNGULATES

6.1 WOODLAND CARIBOU (BOREAL ECOTYPE)

Status: Woodland caribou in the NWT are divided into two ecotypes, the Boreal and the Northern Mountain ecotypes. Only the boreal ecotype occurs within the Study Area (Figure 5); consequently, all reference to woodland caribou refers to the boreal ecotype. Environment and Natural Resources (ENR) (formerly known as Resources, Wildlife and Economic Development (RWED)) lists the boreal ecotype as Sensitive (Working Group on General Status of NWT Species 2006), and SARA recognizes the boreal ecotype as Threatened (SARA 2006). In addition, woodland caribou are an important harvestable species.



LEGEND

- Kakisa Area of Interest
- Kakisa Study Area
- Territorial - Provincial Border
- Waterbody
- Watercourse
- Potential Distribution
- High Probability of Occurrence*

Monthly Caribou Locations (03 - 06)

- Calving (1 May - 14 June)
- Early Winter (1 Nov - 31 Dec)
- Fall (1 Sep - 31 Oct)
- Late Winter (1 Jan - 31 Mar)
- Spring (1 - 30 Apr)
- Summer (15 Jun - 31 Aug)

NOTES
Base data source: WWF Canada (2002)
Reference: ENR (2006b); Gunn et al. (2004)
*Based on preliminary habitat modelling

KAKISA PHASE 1 ECOLOGICAL ASSESSMENT
K 'AGEE TU AREA OF INTEREST, DEHCHO, NWT

Woodland Caribou (Boreal Ecotype) Distribution within the Study Area

PROJECTION	DATUM
UTM Zone 11	NAD83

Scale: 1:1,060,000
20 10 0 20
Kilometres

FILE NO.			
1740209_Caribou_Map006.mxd			
PROJECT NO.	DWN	CKD	REV
1740209	KDA	SM/KL	1
OFFICE	DATE		
EBA-YEL	March 27, 2007		

EBA Engineering Consultants Ltd.

Figure 5

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Woodland caribou are distributed throughout the Taiga Plains ecozone in the NWT and Alberta. Of particular interest, 40 % of the entire Taiga Plains ecozone in the NWT lies within the Dehcho Settlement Area (Gunn *et al.* 2004). In addition, 99 % of the Area of Interest is represented by the Taiga Plains ecozone.

Limited scientific information exists on populations, life requisites, and habitat use of woodland caribou within the Dehcho, particularly within the Study Area. Traditional knowledge indicates winter habitat for woodland caribou occurs south of Tathlina Lake and in the southwest corner of the Area of Interest, while summer habitat can be found in the Cameron Hills (K 'ágee Tu First Nation 2006). In addition, traditional knowledge suggests that spruce – lichen forests south of Beaver Lake may be important caribou habitat (K 'ágee Tu First Nation 2006).

Woodland caribou occur throughout the entire Area of Interest; however, traditional knowledge reports the main population of caribou occur between Kakisa Lake and Etaáhdlı̨i, and further south (K 'ágee Tu First Nation 2006). Caribou are also known to occur along the shore of Beaver Lake (K 'ágee Tu First Nation 2006).

Woodland caribou have been surveyed within the Study Area, including the entire Area of Interest. ENR has collared 40 female woodland caribou within the North Cameron Hills Area, including the Study Area from 2003 to 2006 and were relocated by fixed wing aircraft on a regular basis throughout the year (ENR 2006b). Monthly relocations indicate boreal caribou occupy much of the Area of Interest throughout the year (Figure 5) (ENR 2006b). Concentrations of collared caribou occur between Kakisa and Tathlina lakes, as well as between Kakisa and Beaver lakes (Figure 5) (ENR 2006b). Caribou concentrations were observed along the southern shoreline of Mackenzie River to Kakisa Lake particularly during the summer and fall (although a few caribou occurred here during calving) (Figure 5) (ENR 2006b). Caribou were also concentrated northwest of Tathlina Lake particularly during early and late winter and during calving season (Figure 5) (ENR 2006b). The eastern portion of the Study Area including east of Kakisa Lake appear to support concentrations of collared caribou particularly during late winter, spring, calving, and fall seasons (Figure 5) (ENR 2006b). Preliminary results from 2003 to 2006 indicate calf production (or pregnancy rates) varied from 87 to 95 % during this time, and eleven mortalities were reported (seven from wolf predation, two from black bear predation, one human harvest, and one unknown mortality) (ENR 2006b). The rate of increase, based on modeled recruitment rates and female mortality rates was estimated at 0.84 to 0.99 from 2003 - 2006 (ENR 2006b). From monthly fixed-wing location flights, collared caribou appeared to occur throughout the Area of Interest during the entire year (ENR 2006b). Based on known collared caribou occurrences, the area between Kakisa and Tathlina lakes appeared to be important woodland caribou habitat, as well as the area between Kakisa and Beaver lakes (ENR 2006b). Caribou were also known to occur outside the Area of Interest, particularly near Highway 1 and northeast of Cameron Hills along the north shore of Hay River (ENR 2006b). Home range size averaged 619 km^2 during 2003/2004 season to 985 km^2 in 2004/2005 season (ENR 2006b). From collared caribou locations, female woodland caribou appeared to calve throughout the Area of Interest (ENR 2006b).

ENR has also collared female woodland caribou on the Cameron Hills (immediately south of the Area of Interest) (ENR 2006c). Results from this research indicate caribou appear to occupy Cameron Hills throughout the entire year, but are known to occur near Dogface Lake in the southwest corner of the Area of Interest (ENR 2006c) (this data is not mapped in Figure 5). Woodland caribou that occur on the Cameron Hills were not observed to occupy the Area of Interest, except for a small area near Dogface Lake.

In addition, 33 female woodland caribou were outfitted with radio collars near Ebbutt Hills and Trout Lake, approximately 160 km northwest and 100 km west of the Study Area, respectively. Based on collared caribou, a number of important behavioural attributes and habitat use were confirmed. Female woodland caribou from both survey locations (Ebbutt Hills and Trout Lake) were observed to calve and summer over larger home ranges than compared to wintering areas (Larter and Allaire 2006a; Larter and Allaire 2006b). Unlike barren-ground caribou, woodland caribou do not gather to calve on a common calving area (Larter and Allaire 2006a; Larter and Allaire 2006b; ENR 2006b). During the calving period (May 1 – June 15), collared woodland caribou females were in small groups of one to two individuals, and were widely dispersed throughout the area (Larter and Allaire 2006a; Larter and Allaire 2006b).

Initial results have shown some individual fidelity to calving areas (Larter and Allaire 2006a; Larter and Allaire 2006b). Caribou are known to calve on small prairies within the Mackenzie Bison Sanctuary, and it is probable that caribou inhabiting the Study Area use similar areas for calving (Gray and Panegyuk 1989). Within the Dehcho Land Use Plan Background Report (Dehcho Land Use Planning Committee 2006), the Kakisa and Tathlina lakes area was identified as an important woodland caribou calving area.

During the summer (June 16 – August 31), female woodland caribou remained in small groups, sometimes in a different area than the calving and post calving area. During the calving and summer period, female caribou limited their movements (the distance between three day locations were limited) (Larter and Allaire 2006a; Larter and Allaire 2006b). However, group size and movements increased during the fall and rut period (September 1 – October 15). Group size and movements (both distance and direction) were the greatest during winter months (October 16 – April 30) (Larter and Allaire 2006a; Larter and Allaire 2006b). Mean annual home range size was 1,339 km^2 and 1,410 km^2 at Trout Lake and Ebbutt Hills, respectively (Larter and Allaire 2006a; Larter and Allaire 2006b).

Woodland caribou prefer mature or old growth coniferous forests associated with bogs, lakes, and rivers. Veitch (2001) states that these caribou select old coniferous forests greater than 100 years old; as these forests offer high concentrations of ground and tree lichens. In addition, preliminary reports from Gunn *et al.* (2004) indicate the presence of woodland caribou is associated with black spruce - lichen habitat in both upland and lowland sites within the Dehcho Settlement Area, including the Study Area. In winter, woodland caribou are said to favour uplands, treed fens and bogs, and south facing slopes where the snow is not as deep. Their winter diet consists of up to 80 % ground and tree lichens. In summer, they prefer areas such as forest edges, marshes and meadows that provide the fresh green growth of flowering plants, sedges, and grasses.

Gunn *et al.* (2004) mapped winter caribou distribution and potential winter habitats within the Study Area based on a preliminary modelling exercise that incorporated Landsat imagery (for forest cover types), traditional knowledge (life time harvest sites), aerial survey results (in March 2002), and caribou data collected during the Bison Control Program. This preliminary modelling exercise reported a few areas within the Study Area to have a high probability of caribou occurrence during the winter including the area between Kakisa Lake and Beaver Lake, as well as west of Tathlina Lake (Gunn *et al.* 2004). However, Larter *et al* (2006) completed aerial surveys immediately north of the Study Area, near Mills Lake and Edéhzhíe, and recorded caribou in areas Gunn *et al.* (2004) predicted to have low and moderate winter caribou occupancy. Although the area between Kakisa Lake and Beaver Lake, and the area west of Tathlina Lakes were mapped as having high winter potential for caribou occupancy by Gunn *et al.* (2004), caribou may also utilize other areas within the Study Area previously mapped as low to moderate potential. Larter *et al.* (2006) reported the majority of caribou observations were in areas that have not been recently burned; however, a few caribou were also recorded in areas burned from 1991 to 2000.

The NWT woodland caribou (boreal ecotype) population is estimated at 7,070 individuals (Gau 2006). Population densities in the Dehcho are estimated at approximately 2 per 1,000 km^2 (Larter 2005).

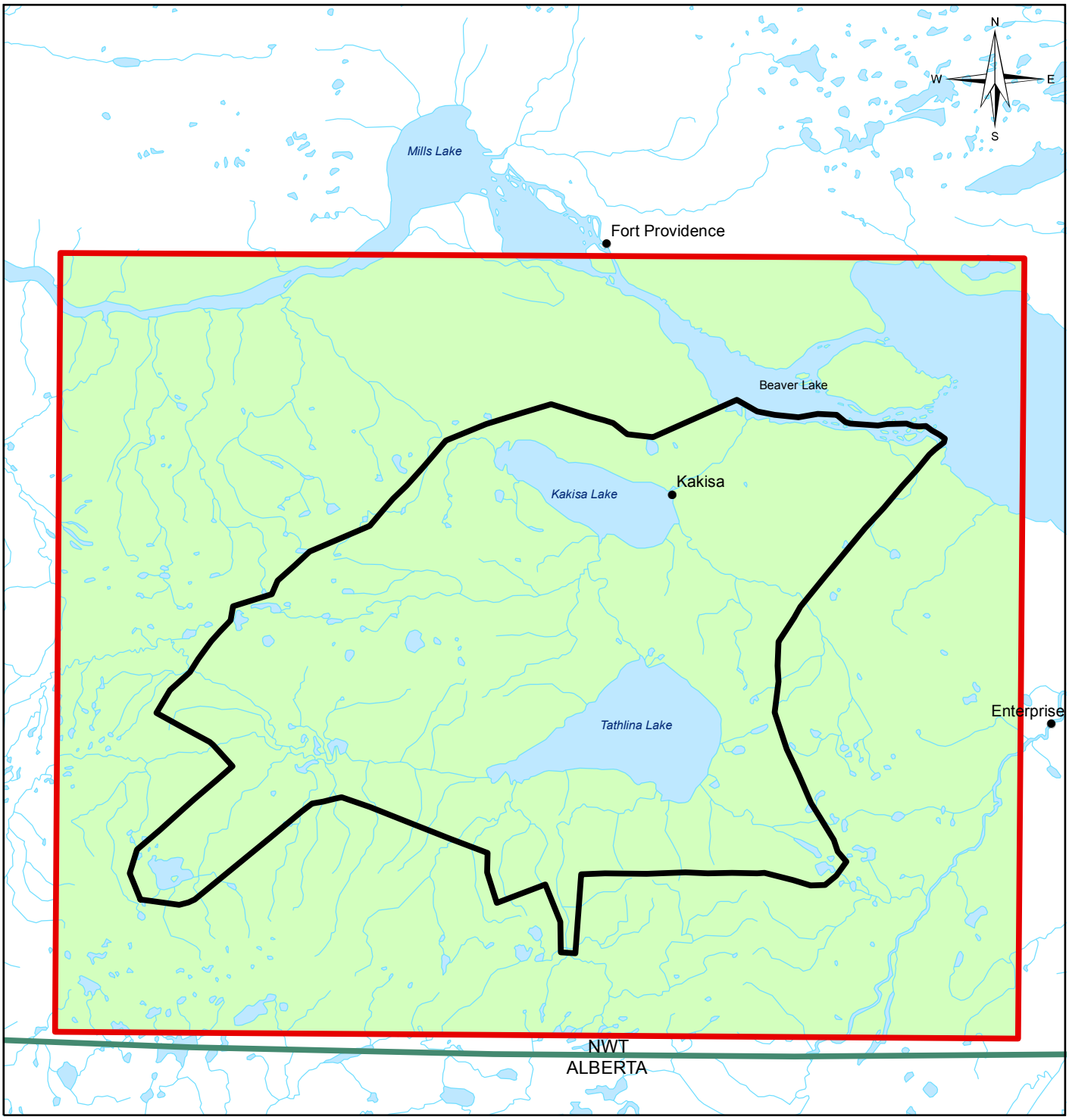
The KTFN report caribou populations in the Area of Interest have been recently declining; however, this trend is not predicted to continue (K 'ágee Tu First Nation 2006).

Threats to the population include potential over-hunting, habitat loss, predation, disease, and human activity.

6.2 MOOSE

Status: Moose are considered Secure throughout their range in Canada, including the NWT (Working Group on General Status of NWT Species 2006; Canadian Endangered Species Conservation Committee 2006). In addition, they are an important harvestable species to stakeholders.

Moose occur throughout the boreal-forested zone of the NWT, including the Study Area (Figure 6). Riparian willow communities that have high shrub cover are used throughout the year and appear to be a major factor in determining moose distribution. These riparian willow communities typically occur along seepage areas, streams, rivers, and wetlands as small inclusions within larger vegetation communities. The KTFN have indicated that moose occur throughout the entire Area of Interest, particularly west of Tathlina Lake to Etaáhdlı̨ and further upstream of Kakisa River, as well as along the northern slopes of Cameron Hills and the shoreline of Beaver Lake (K 'ágee Tu First Nation 2006). Smaller islands within Beaver Lake have been reported to include a high coverage of willow and alder (Falk and Gillman 1980); which would provide important moose habitat. Traditional knowledge also supports this claim (Johnson and Ruttan 1993).



LEGEND

- Kakisa Area of Interest
- Kakisa Study Area
- Territorial - Provincial Border
- Watercourse
- Waterbody
- Potential Distribution

NOTES
Base data source: WWF Canada (2002)

KAKISA PHASE 1 ECOLOGICAL ASSESSMENT
K 'AGEE TU AREA OF INTEREST, DEHCHO, NWT

Moose Distribution within the Study Area

PROJECTION	DATUM
UTM Zone 11	NAD83

Scale: 1:1,060,000
20 10 0 20
Kilometres

FILE NO.
1740209_Moose_Map004.mxd

PROJECT NO.	DWN	CKD	REV
1740209	KDA	SM/KL	1

OFFICE	DATE
EBA-YEL	March 22, 2007

EBA Engineering Consultants Ltd.

Figure 6

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Ruttan (1972) reported significant moose observations in the lowland spruce/willow/birch habitat south of Kakisa River and Tathlina Lake, as well as near Dogface Lake. In addition, Ruttan (1972) reported small numbers of moose utilized the muskeg areas north and east of Tathlina Lake. Moose density surveys within the Area of Interest have not been conducted.

A winter moose survey in the Liard Valley in February 1978 revealed densities of 1 to 24 individuals per 100 km^2 (Decker and Mackenzie 1980). In addition, Shank (1992) conducted moose surveys in 1991 north of the Study Area at Mills and Mink lakes, and estimated moose densities at Falaise Lake based on a correction factor from the Mills and Mink lake data. These surveys completed by Shank (1992) estimated moose densities at 13 individuals per 100 km^2, 25 per 100 km^2, and 12 per 100 km^2 at Mills, Mink, and Falaise lake, respectively (Shank 1992). The Mills Lake and Mink Lake survey areas were re-censused in 1994 (although the survey area between the two years differed by 157.2 km^2), and reported moose densities to be 7 individuals per 100 km^2 (Bradley *et al.* 1998). Bradley *et al.* (1998) recalculated Shank's 1991 moose density estimate in relation to a single study area (rather than at Mills Lake, Mink Lake, and Falaise Lake) and reported moose densities averaged 17 individuals per 100 km^2 for the larger area. By combining into a single study area, Bradley *et al.* (1998) was then able to recalculate the 1994 moose densities based solely within the area previously surveyed in 1991 to allow for a direct comparison between survey years. As a result, moose densities for the Mills Lake and Mink Lake areas in 1991 was reported as 17 individuals per 100 km^2, while 1994 surveys efforts generated moose densities of 8 individuals per 100 km^2 (Bradley *et al.* 1998). In 1997, Bradley and Johnson (2000) resurveyed Mills and Mink lakes area and reported moose densities had continued to decline to 3 individuals per 100 km^2. In addition to declining moose densities, there were significant declines in calf to cow ratios between 1991 and 1994, and again from 1994 to 1997 for the Mills Lake and Mink Lake areas (Bradley and Johnson 2000).

Moose are known to favour areas previously burned, that include early successional plant species, such as willow. Larter *et al.* (2006) completed winter aerial surveys in the Mills Lake and Edéhzhíe areas (north of the Study Area), and reported the majority of moose observations were located in habitats that have been recently burned (at least seven years prior); however, some moose were also observed in areas that have not been burned since the 1970s.

Moose are generally associated with early successional forests, and they respond positively to uplands that have been recently burned. The optimal successional stage for browse production in the boreal forest occurs between 11 and 30 years post-fire, and generally peaks at around 15 years (Franzmann 2000), although these values are probably regionally variable (LeResche and Davis 1973). Moose densities often increase substantially following fires (Peek 1998). Moose are assumed to utilize the entire Study Area throughout the year (Figure 6). The Northern Land Use Information Series (NLUIS) mapped important fall and winter moose habitat at the west end of Tathlina Lake and at Etaáhdlįį; in addition, year round moose habitat was also mapped throughout the western half of the Area of Interest (WWF 2002).

Moose are primarily browsers and require abundant food supplies close to security cover. Food items include willow, aspen, balsam poplar, saskatoon berry, red-osier dogwood, chokecherry, hazelnut, buffalo berry, rose, bush cranberry, and gooseberry (Romito *et al.* 1999).

Moose have been regularly observed throughout the Study Area while conducting woodland caribou surveys and aerial reconnaissance for the Bison Control Program. Moose recorded by Gunn *et al.* (2004) during the winter of 2002 were located throughout the Study Area; however, moose observations were primarily within the southern three-quarters of the Study Area. From January to March 2004, 69 moose were recorded during the Mackenzie River shoreline patrols for the Bison Control Program (Bidwell *et al.* 2004). Most of these moose observations were located near the south shore of Mills Lake, as well as the south shore of Beaver Lake (Bidwell *et al.* 2004).

The KTFN have indicated wildlife populations, including moose within the Area of Interest are healthy and have been generally increasing in numbers, except near Beaver Lake (K 'ágee Tu First Nation 2006). Traditional knowledge reports moose densities along Beaver Lake have decreased in the past three decades as a result of increased human disturbances (*i.e.* barging, sport fishing, and hunting from other communities) (K 'ágee Tu First Nation 2006).

The NWT moose population is estimated at approximately 30,000 – 40,000 individuals with average density estimates ranging from 5 to 15 per 100 km^2 (although recent evidence suggests densities average 5 moose per 100 km^2 (Larter pers. comm. 2007)) (Resources, Wildlife and Economic Development and Lakusta 2004). Moose are on the edge of their northern range in the NWT; therefore, their density is quite low compared to other areas in Canada.

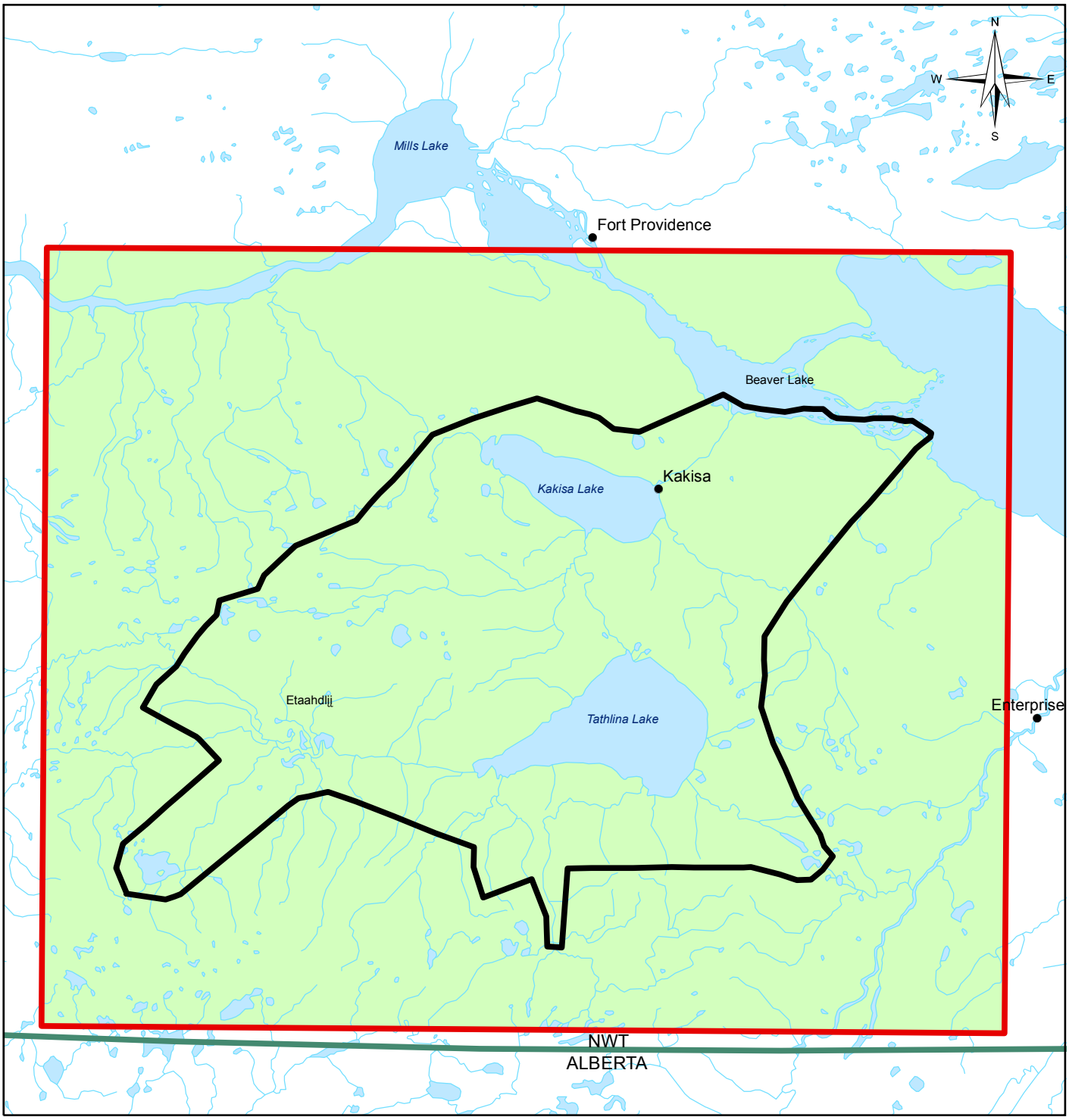
7.0 FURBEARERS

A number of furbearers occur within the Study Area, including wolverine, black bear, wolf, marten, beaver, and muskrat (Figure 7). These species are considered valuable to traditional harvesters and the people of K 'ágee Tu, and in particular, wolverines have been listed by COSEWIC as a species of Special Concern. Although other furbearers, such as snowshoe hare, red squirrel, mink, otter, and lynx occur within the Study Area, only the wolverine, black bear, wolf, marten, beaver, and muskrat are discussed below.

7.1 WOLVERINE

Status: Wolverines in the NWT are considered Sensitive by the territorial Government (Working Group on General Status of NWT Species 2006), and the western population is considered Special Concern by COSEWIC (2003) (however, wolverines are not listed under SARA).

Wolverines range throughout most of northern and western Canada, including the Study Area (Figure 7). They occur in large, sparsely inhabited wilderness areas with adequate year-round food supplies (large ungulates and carrion) (ENR 2006).



LEGEND

- Kakisa Area of Interest
- Kakisa Study Area
- Territorial - Provincial Border
- Community
- Watercourse
- Waterbody
- Potential Distribution for Black Bear, Wolf, Wolverine, Marten, Beaver and Muskrat

NOTES

Base data source: WWF Canada (2002)

KAKISA PHASE 1 ECOLOGICAL ASSESSMENT
K 'AGEE TU AREA OF INTEREST, DEHCHO, NWT

Furbearer Distribution within the Study Area

PROJECTION	DATUM
UTM Zone 11	NAD83

Scale: 1:1,060,000

20 10 0 20

Kilometres

FILE NO.
1740209_Furbearers_Map009.mxd

PROJECT NO.	DWN	CKD	REV
1740209	KDA	SM/KL	0

OFFICE	DATE
EBA-YEL	November 29, 2006

EBA Engineering Consultants Ltd.

Figure 7

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Wolverines are difficult to locate during snow-free periods, lead a largely solitary lifestyle, and live at low population density even under optimal conditions (Banci 1994). Reproductive rates are low and sexual maturity is delayed, in comparison with some (or most) other carnivores. As a result, little is known regarding their population size in the NWT.

Wolverine populations in the NWT are likely between 2,100 to 4,000 individuals (ENR 2006). Wolverine density is estimated to be 1.6 to 3.7 per 1,000 km^2 (food availability dependent) for males, and smaller for females (ENR 2006). Wolverine populations are unknown, but are thought to be currently stable.

Resource development in the NWT is increasing and may be potentially threatening wolverine populations. As a result of the future increase in non-renewable resource development and the development of roads and seismic lines, loss of wolverine habitat is expected to increase (ENR 2006).

7.2 BLACK BEAR

Status: Black bears in the NWT are considered Secure (Working Group on General Status of NWT Species 2006) and Not At Risk by COSEWIC (2006). In addition, they are considered a harvestable species by the KTFN.

Black bears occur throughout treed portions of the NWT. Based on available habitats within the Study Area and traditional knowledge of black bear occurrences, black bears occur throughout the entire Study Area and neighbouring properties (Figure 7) (K 'ágee Tu First Nation 2006). It has been reported home ranges and core areas overlap between both sexes of black bears (Laviviere 2001).

Black bear habitat quality is primarily related to the abundance of seasonally important food items. Disturbed habitats are also known to provide good black bear habitat, for example, bears benefit most from sites that have been burned at least 20 years prior (Laviviere 2001; Snyder 1991). Forests regenerating from fires commonly provide black bear summer and fall feeding habitat as berry producing vegetation regenerates and ants invade downed and burned trees. Black bears are omnivores. In most areas, their diet is dominated in all seasons by vegetation. However, meat, especially winter-killed ungulates during spring, insects during summer, and possibly fish, can be locally important.

Black bear movements change seasonally and annually depending on the availability of foods. In the spring, bears gravitate towards areas with early-emerging vegetation such as roadsides and wetlands dominated by sedges, cottongrass, grasses, and horsetails, and may be found in sites such as meadows with over-wintered berries (Chatalain 1950; Hatler 1972). Winter-killed ungulate carcasses can also be important, but are usually scarce and may not be predictably available. In summer, bears typically consume a variety of species of grasses, sedges, horsetails, and forbs (Hatler 1972; Pelton 2000). Insect activity peaks during summer, and black bears feed heavily on colonies of ants, bees, and wasps. By fall time, their diet shifts as the nutritional quality of many plants decline and berries become ripe and

available. Major berry-producing species, such as blueberry, crowberry, bearberry, and cloudberry are important black bear food items.

Black bears typically dig dens in till material available on eskers or drumlins, stream banks, or in natural cavities such as an upturned tree root. Black bear denning habitat may occur throughout the Study Area, including on the various drumlins which are known to occur west of Tathlina Lake. Decker (pers. comm. 2006) has suggested that some of these drumlins may be alvars, an area with thin soils overlying limestone or marble rock, in which case these would not be considered good black bear denning habitat. In addition, approximately 80 % of the Area of Interest is underlain by glacial till ranging from one to several hundred metres in thickness (K 'ágee Tu First Nation 2006). As a result, denning habitat for black bears may occur throughout much of the entire Area of Interest.

There have been no surveys or formal attempts to estimate black bear densities within the Dehcho or the Study Area. In addition, the number of black bears in the NWT is not known but is estimated to about 10,000 individuals (considered a conservative estimate) (Anonymous 2000). Population densities are relatively unknown but are believed to be highest along the Mackenzie River and Great Slave Lake (Clarkson 1985; Department of Renewable Resources 1990). The population trend is unknown but thought to be healthy across its entire range.

7.3 WOLF

Status: The wolf is listed as Secure within the NWT (Working Group on General Status of NWT Species 2006), and COSEWIC (2002) has assigned a designation of Not At Risk. Wolves are considered a harvestable species to the KTFN.

Wolves were once distributed throughout much of Canada. They are found throughout the Study Area and occupy most terrestrial habitat types (Figure 7). In the NWT three different groups of wolves can be distinguished based on their behaviour and distribution: timber wolves, arctic wolves, and tundra wolves. Timber wolves live below the treeline or in the mountains and rely mostly on non-migratory prey like moose, woodland caribou (boreal ecotype), and wood bison, and occur throughout the Study Area.

Wolves are habitat generalists, and their strongest affinity is for habitats occupied by their prey. The KTFN report wolf densities have increased in recent years within the Area of Interest, particularly at Etaáhdlį and Cameron Hills (K 'ágee Tu First Nation 2006). Wolves have specific requirements for denning habitat; and, within the Slave Geological Province (SGP), nearly all den sites that have been found where located on eskers or in other glacial deposits (EBA 2003). Glacial till deposits, called drumlins, occur within the Area of Interest, west of Tathlina Lake. Decker (pers. comm. 2006) has suggested that some of these drumlins may be alvars, an area with thin soils over limestone or marble rock, in which case they would not be considered good wolf denning habitat. However, approximately 80 % of the Area of Interest is underlain by glacial till ranging from one to several hundred metres in depth (K 'ágee Tu First Nation 2006); and therefore, wolf denning habitat may occur throughout the entire Area of Interest.

There have not been any formal wolf studies conducted in the Study Area; however, wolf densities in the Dehcho, particularly areas near Trout and Celibeta lakes are considered to have relatively high wolf densities (Larter 2000). Wolf densities in the boreal forest zone of the NWT are estimated at one individual per 101 km^2 (Van Zyll de Jong and Carbyn 2000). The population trend appears to be stable, with some populations increasing. During the Bison Control Program, conducted during the winters along the shoreline of the Mackenzie River (on a weekly basis) as well as a comprehensive survey (one survey a year) in the eastern two-thirds of the Study Area, all wolves observed were recorded (Bidwell *et al.* 2004). For instance, during the 2004 Bison Control Program, a total of nine wolves were observed during the shoreline patrols, and one was observed during the semi-comprehensive (Bidwell *et al.* 2004).

7.4 MARTEN

Status: Martens are considered Secure in the NWT and throughout the majority of southern Canada (Working Group on General Status of NWT Species 2006; Canadian Endangered Species Conservation Committee 2006). They are considered an important harvestable species for the KTFN.

Within the NWT, martens are restricted to the northern boreal forest, and are known to occur throughout the Study Area (Figure 7). The KTFN report martens occur throughout the Area of Interest and their populations are considered high (K 'ágee Tu First Nation 2006). Little scientific information is known about population densities within the NWT, particularly within the Study Area.

Throughout their range marten are closely associated with mature stands of mesic (areas with well drained soils such as those found in upland sites) coniferous forests; however, they are also found in other forest types including sparse open forests (as seen in treed wetlands) especially those with complex physical structure near the ground (Allen 1984; Clark *et al.* 1987; RWED 1995). Physical structure refers to the vertical and horizontal complexity created by a diversity of tree sizes and shapes, light gaps, dead and downed wood, varied shrub understory and layers of overhead cover. Based on known vegetation communities within the Study Area, forests most suited for marten occur along the north and east slopes of Cameron Hills, as well as north of Kakisa Lake. Sparse open coniferous forests, such as those in treed wetlands, occur throughout the Study Area.

7.5 BEAVER AND MUSKRAT

Status: In the NWT, beaver and muskrat populations are considered to be Secure (Working Group on General Status of NWT Species 2006). COSEWIC (2006) has listed both species as secure throughout their Canadian range (except beaver populations in Nunavut, which are undetermined). Both species, in particular beaver, are considered important harvestable species to the KTFN.

Beavers and muskrats are common throughout the Study Area (K 'ágee Tu First Nation 2006), wherever appropriate aquatic habitat is found such as slow-flowing streams, lakes, rivers, and marshes, most especially in the area of Tathlina Lake, Etaáhdlį, and Kakisa River

headwaters (Figure 7). Traditional knowledge also indicates faster flowing rivers are also used (Johnson and Ruttan 1993). Beaver and muskrat densities are highly variable and dependent upon habitat quality. The NLUIS reported important beaver habitat all around Tathlina Lake and along the upper Kakisa River to Etaáhdlı̨ı̨ (WWF 2002). In addition, important muskrat habitat was mapped along the most western perimeter of the Study Area (outside the Area of Interest) (WWF 2002).

A beaver lodge survey was conducted near Kakisa and thirteen other areas in western NWT in the fall of 1989 (Poole and Croft 1990). The average density of active beaver lodges in lakes, ponds, and wetlands throughout the western NWT was recorded at 0.26 lodges per square kilometre (km^2), with an average density in rivers of 0.43 lodges/km^2 (Poole and Croft 1990). Active beaver lodge densities near Kakisa and along Kakisa River were reported at 1.0/km^2 and 0.45/km^2, respectively (Poole and Croft 1990). The KTFN reported up to three beaver lodges occurring on smaller lakes around Tathlina Lake and Etaáhdlı̨ı̨ (K 'ágee Tu First Nation 2006). In addition, a beaver aerial survey was conducted in the upper reaches of Kakisa River (portions within the Study Area) in 1972 (Wooley 1974). Results from this 1972 aerial survey recorded 164 occupied beaver colonies in 412.3 km survey area (total density was 0.40 individuals/km) (Wooley 1974). Wooley (1974) also reported beavers in the Kakisa River area travel considerable distances, even up steep banks, to access aspen trees.

Muskrat densities have not been estimated within the north, including the Study Area. However, the KTFN has reported muskrat populations in the Area of Interest appear to be slowly declining (K 'ágee Tu First Nation 2006). In contrast, traditional knowledge indicates beaver populations appear to be increasing in the Area of Interest (K 'ágee Tu First Nation 2006).

Beavers forage on leaves, twigs, and bark of most terrestrial woody plant species, as well as herbaceous and aquatic plants (Jenkins and Busher 1979). Willow, birch, and poplar are cut and stored in the fall near the lodge entrance to sustain them during winter months (Johnson and Ruttan 1993). Muskrats have been known to forage on most aquatic plants occurring near their lodges (Willner *et al.* 1980).

8.0 BIRDS

A variety of bird species occur throughout the entire Study Area, including passerines, waterfowl, waterbirds, and raptors. The majority of birds occurring in the NWT are seasonal migrants. Many of these birds migrate to the NWT to breed in various habitats including the boreal forest and tundra. However, winters in the NWT can be cold and harsh, and many of the birds migrate south to more advantageous weather and abundant food supplies. Only a few bird species within the NWT have adapted to the northern climate and are year round residents. Some adaptive strategies year round residents employ include food stashing and burrowing under the snow (Canadian Endangered Species Conservation Committee 2006).

Although the NWT provides breeding habitat for a number of bird species, species richness in the NWT is considered lower than compared to southern Canada (Canadian Endangered Species Conservation Committee 2006).

Because of the large number of birds and their respective diversity, species were grouped into general VECs such as passerines, waterfowl, waterbirds, and raptors. However, those species with special conservation designations were separated out and are discussed separately below. For this report general passerines include those species typically considered in the "Passeriformes" order; general waterfowl include swans, geese, ducks, loons and grebes; general waterbirds include pelicans, cranes, and shorebirds; and general raptors include eagles, hawks, ospreys, falcons, and owls. Species that have been separated out and addressed separately based on special conservation designations include Whooping Crane, American White Pelican, Yellow Rail, Rusty Blackbird, Peregrine Falcon, and Short-eared Owl. This was intentionally done for ease of presentation.

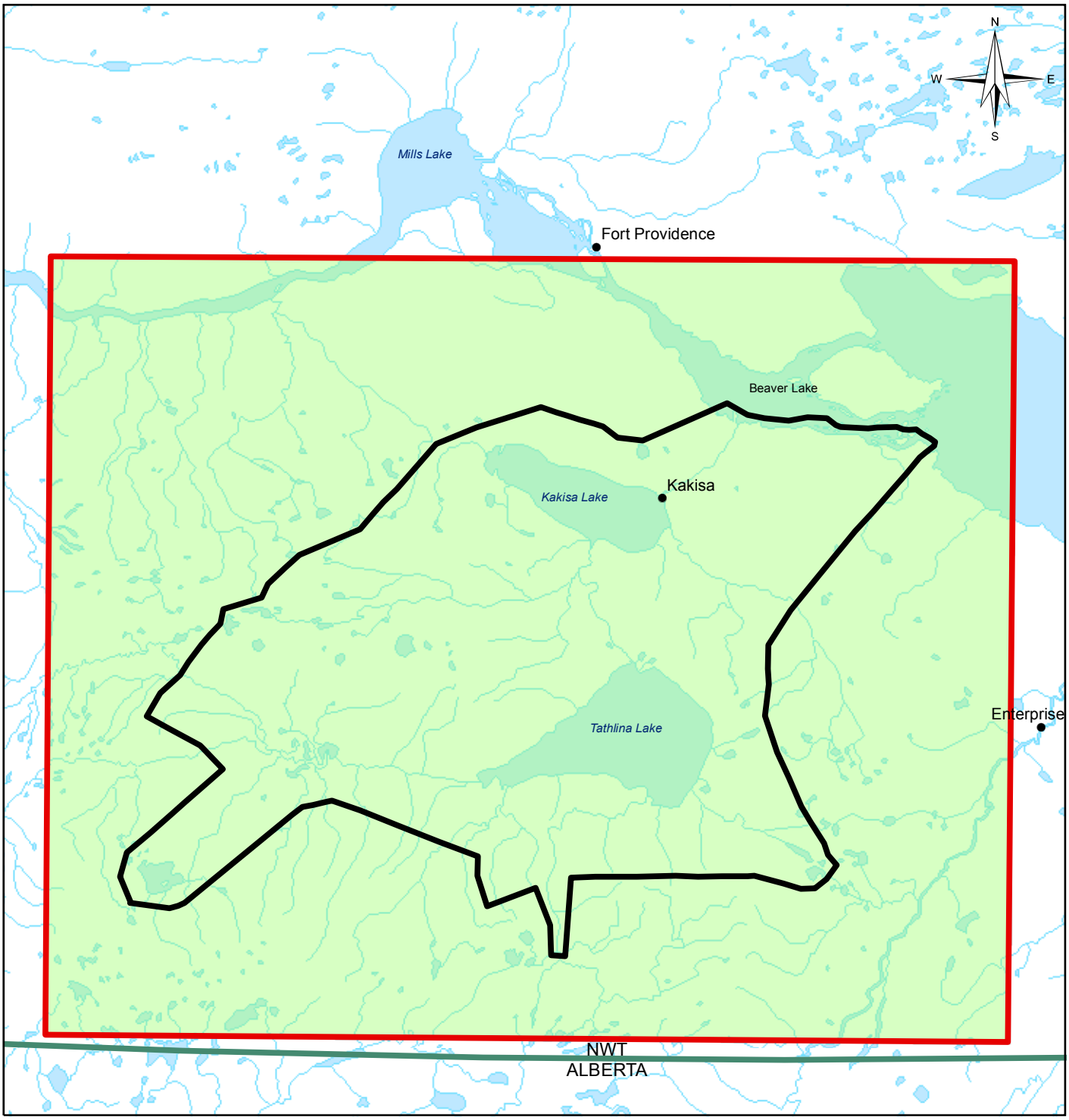
8.1 PASSERINES

Passerines, also known as "Perching" birds, make up the largest and most diverse group of birds occurring in the Dehcho. Passerines occurring in the NWT are widely distributed throughout the boreal forest, alpine, and tundra.

Passerines occur throughout all terrestrial habitat types in the Study Area (Figure 8); however, little is known about passerine populations within the NWT, including the Area of Interest. Some species are year-round residents while the majority are migratory and are present only during their reproductive phase, and are common throughout the Study Area during spring, summer, and fall.

Passeriformes represent a large and diverse group of birds and, consequently, their food habits are also varied. Most upland nesting birds are omnivores, eating a variety of items that shifts as the availability of food changes over the course of a year. In general, dietary items can include wild fruits and seeds, and insects. Foraging occurs in all habitat types and includes aerial feeding by swallows over water and ground and canopy feeding by sparrows and warblers, respectively. Upland birds nest in all terrestrial habitat types including deciduous forests, coniferous forests, mixed forests, shrub stands, habitats of different seral stages (such as burned areas), dry uplands to wet lowlands, and vegetated to sparsely vegetated sites.

Some generalized patterns of habitat use in boreal forests have been made. Typically, fewer species and individuals occur in forests dominated by pine and black spruce than compared to deciduous, mixed, or white spruce dominated communities (Machtans and Latour 2003). Similarly, fewer species and individuals occur in mature forests than compared to similar habitats in younger forests (Machtans and Latour 2003). In the Liard Valley, Machtans and Latour (2003) reported highest species richness in mixedwood forests (this may also be true for the mixedwood forests along the north and east slopes of Cameron Hills). In addition, wooded bogs, as seen throughout the Area of Interest were found to have unique species assemblages (Machtans and Latour 2003).



LEGEND

- Kakisa Area of Interest
- Kakisa Study Area
- Territorial - Provincial Border
- Community
- Watercourse
- Waterbody
- Potential Passerine Distribution

NOTES

Base data source: WWF Canada (2002)

KAKISA PHASE 1 ECOLOGICAL ASSESSMENT
K 'AGEE TU AREA OF INTEREST, DEHCHO, NWT

Passerine Distribution within the Study Area

PROJECTION	DATUM
UTM Zone 11	NAD83

Scale: 1:1,060,000

20 10 0 20

Kilometres

FILE NO.: 1740209_Birds_Map027.mxd

PROJECT NO.	DWN	CKD	REV
1740209	KDA	SM/KL	0

OFFICE	DATE
EBA-YEL	November 28, 2006

EBA Engineering Consultants Ltd.

Figure 8

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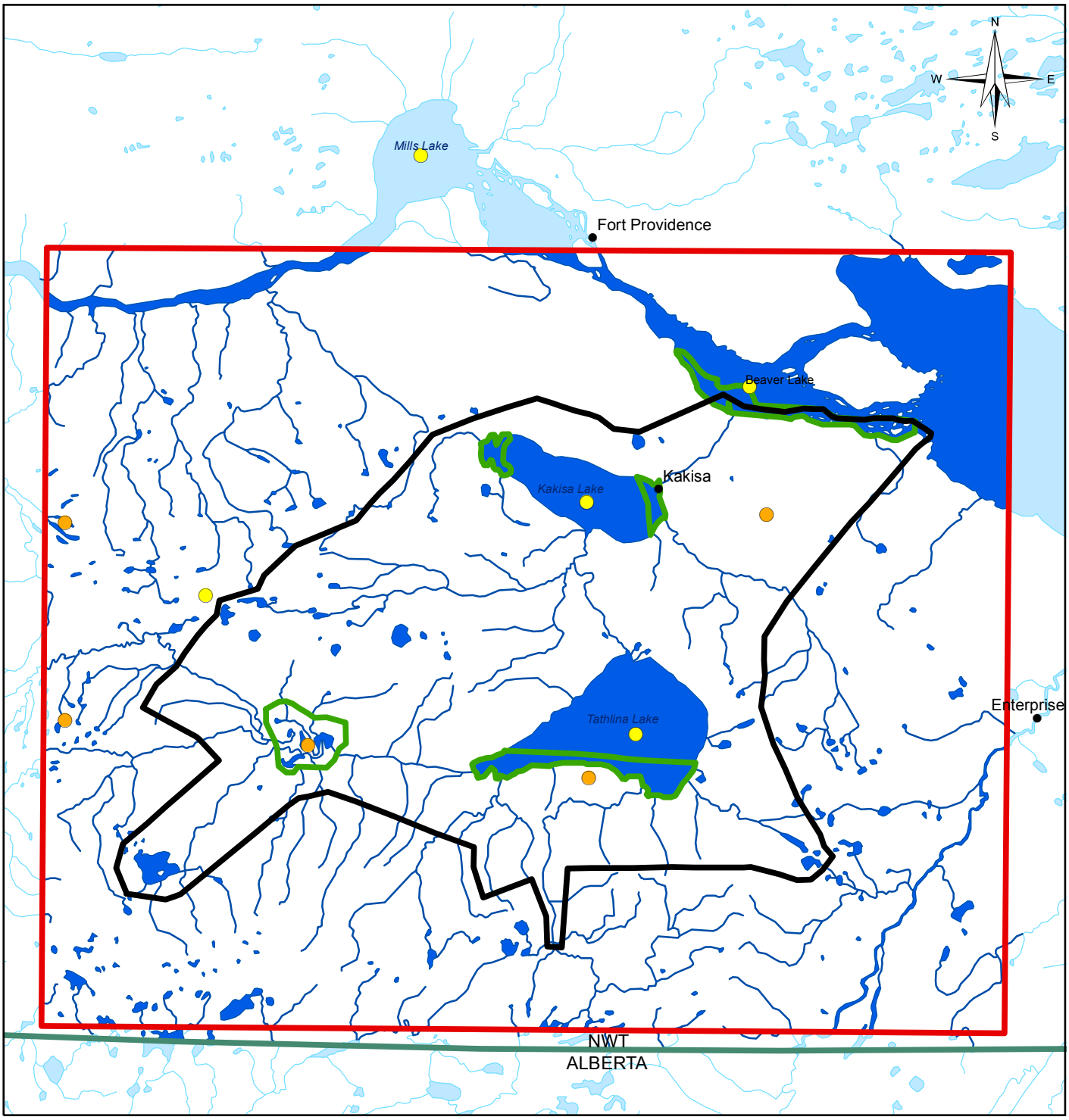
8.2 WATERFOWL

The term waterfowl is used in a general sense; and species are grouped together and treated collectively. The term waterfowl is typically used in the context of swans, geese and ducks, however, for this report it also includes loons and grebes.

Waterfowl breed throughout much of Canada's boreal forests with select areas attracting high breeding densities, including the NWT. Waterfowl are common throughout the Study Area during spring, summer, and fall (Figure 9). Waterfowl commonly arrive to the NWT and the Study Area in late April - early May, and depart from the Study Area by approximately mid-October. Waterfowl are typically not present in the NWT during winter. However, KTFN have reported some diving ducks, such as Mergansers have been known to over-winter in sections of the Kakisa River that do not freeze over (K 'ágee Tu First Nation 2006). Traditional knowledge indicates Etaáhdlı̨ı̨ is particularly important for waterfowl during spring staging, and the mouth of Cameron River and the southern shoreline of Beaver Lake are considered important staging and nesting areas within the Study Area (K 'ágee Tu First Nation 2006).

Aquatic vegetation accounts for approximately three-quarters of the diet for waterfowl, with aquatic invertebrates and minnows providing the balance (Lamoureux 1970). In general, the majority of waterfowl exploit food resources found in the shallow water of lakes, ponds, marshes, sedge meadows, and bogs. Shallow bays containing emergent and submergent vegetation are important feeding areas. These habitats can be found particularly at the outlet and west ends of Kakisa Lake (Lamoureux 1973), as well as at all stream inlets (except Kakisa River) (Lamoureux 1973). Pondweeds comprise the largest single forage component (many researchers believe that pondweeds are the single most important component in the diet of waterfowl in North America), followed by bulrushes and smartweeds (Lamoureux 1970).

Traditional knowledge reports the dominant waterfowl species that stage within the Area of Interest during spring and fall migrations include Geese, Snowgeese, Swan, Sandhill Crane, and Long-tailed Duck (K 'ágee Tu First Nation 2006). Important geese and duck nesting areas include Tathlina Lake, the outlet of Cameron River, Etaáhdlı̨ı̨, and Beaver Lake (K 'ágee Tu First Nation 2006).



LEGEND

- Kakisa Area of Interest
- Kakisa Study Area
- Territorial - Provincial Border
- Community
- Watercourse
- Waterbody
- Breeding Pair Survey Sites*
- Staging Survey Sites*
- Potential Waterfowl Distribution**
- Potential Waterfowl Distribution**
- Known Waterfowl Nesting and Staging Sites

NOTES

Base data source: WWF Canada (2002)
Reference: KTFN 2006; Bird Studies Canada et al. 2004; DUC 2003; Salter 1974
*These points represent the approximate locations of the surveyed areas (please refer to text for further details)
**Waterfowl potentially occur in all watercourses and waterbodies throughout the study area, including those not mapped on this figure.

KAKISA PHASE 1 ECOLOGICAL ASSESSMENT
K 'AGEE TU AREA OF INTEREST, DEHCHO, NWT

Waterfowl Distribution within the Study Area

PROJECTION	DATUM
UTM Zone 11	NAD83

Scale: 1:1,060,000

20 10 0 20

Kilometres

FILE NO.: 1740209_Waterfowl_Map010.mxd

PROJECT NO.	DWN	CKD	REV
1740209	KDA	SM/KL	1

OFFICE	DATE
EBA-YEL	March 22, 2007

EBA Engineering Consultants Ltd.

Figure 9

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Reconnaissance waterfowl surveys have been completed in the Study Area in 1972 (Salter 1974) and again in 2003 (DUC 2003). Both of these surveys were preliminary in nature, but are provided below to attain general knowledge of waterfowl distribution and abundance within the area.

Aerial fall migration surveys were completed in 1972 at Mills and Beaver lakes from mid September to early October (Salter 1974). Salter (1974) reported Beaver Lake was favoured by Tundra Swans and duck species, whereas, Mills Lake was favoured by geese and duck species. Beaver Lake was said to support a significant number of waterfowl particularly during spring and fall migration (Bird Studies Canada *et al.* 2004; Salter 1974). Of particular importance, Tundra Swan densities at Beaver Lake were estimated at approximately 4,470 during the fall migration in 1972 (Salter 1974), which accounted for approximately 2 % of the North American population, and Canvasback densities at Beaver Lake were approximately 8,000 (or approximately 1 % of the global population) in 1975 (Bird Studies Canada *et al.* 2004). Beaver Lake was also estimated to support approximately 10,000 ducks during fall migration and approximately 5,000 ducks during spring migration (Bird Studies Canada *et al.* 2004; Salter 1974).

At the same time as surveying Mills and Beaver lakes, a single aerial survey was completed at Kakisa and Tathlina lakes (on September 20, 1972). Based on this single survey, a total of 65 Tundra Swans, 400 geese species (including both Canada and Greater White-fronted), and 200 ducks (mostly scaup species) occupied Kakisa Lake (Salter 1974). In comparison, 35 Tundra Swans, 355 geese species (predominantly Canada geese), and six Common Goldeneye ducks occupied Tathlina Lake (Salter 1974).

The most current waterfowl data available for the Study Area includes a preliminary reconnaissance completed by Ducks Unlimited Canada (DUC) in 2003. At this time, preliminary breeding pair and staging waterfowl surveys were conducted within the Study Area and neighbouring properties (Falaise Lake in the Mackenzie Bison Sanctuary) (Figure 9). In general, waterfowl densities within the Area of Interest were relatively low. Breeding pair surveys (June 18 - 19) were completed at five different areas within the Study Area boundary, three within the Area of Interest including the south shore of Tathlina Lake, Etaáhdlı̨i, and east of Kakisa Lake (Figure 9). The two remaining areas surveyed, within the Study Area, were located within wetland complexes in the Kakisa watershed (west of Etaáhdlı̨i) and the Upper Mackenzie watershed (northwest of Etaáhdlı̨i) (Figure 9). Only a small portion of the Upper Mackenzie watershed survey site occurs within the Study Area.

Of the five different areas surveyed within the Study Area, Tathlina Lake survey area supported the highest density of waterfowl, followed by Etaáhdlı̨i, area east of Kakisa Lake, and the wetland complex within the Kakisa watershed (DUC 2003). Of the areas surveyed, the most productive areas for breeding waterfowl were Falaise Lake (northeast of the Study Area) and the south shore of Tathlina Lake (DUC 2003). During the preliminary breeding pair survey, DUC reported Scaup and Mallard were the most prevalent duck species occurring within the Study Area, followed by Ring-necked Duck, American Wigeon, Green-winged Teal, Northern Shoveler, and Bufflehead (DUC 2003).

DUC also completed a staging survey in September during fall migration at three different locations within the Study Area, including Tathlina Lake, Kakisa Lake, and a wetland complex northwest of Etaáhdlı̨ı̨ (in both the Kakisa and Upper Mackenzie watersheds) (Figure 9). During the fall staging survey, Falaise Lake (outside the Study Area in the Mackenzie Bison Sanctuary) had the highest densities of waterfowl, followed by the wetland complex northwest of Etaáhdlı̨ı̨, Tathlina Lake, and Kakisa Lake, respectively (DUC 2003). Scaup species were the dominant duck observed during the staging survey; however, Mallard, Bufflehead, Canvasback, and White-winged Scoter were also reported (DUC 2003).

8.3 WATERBIRDS

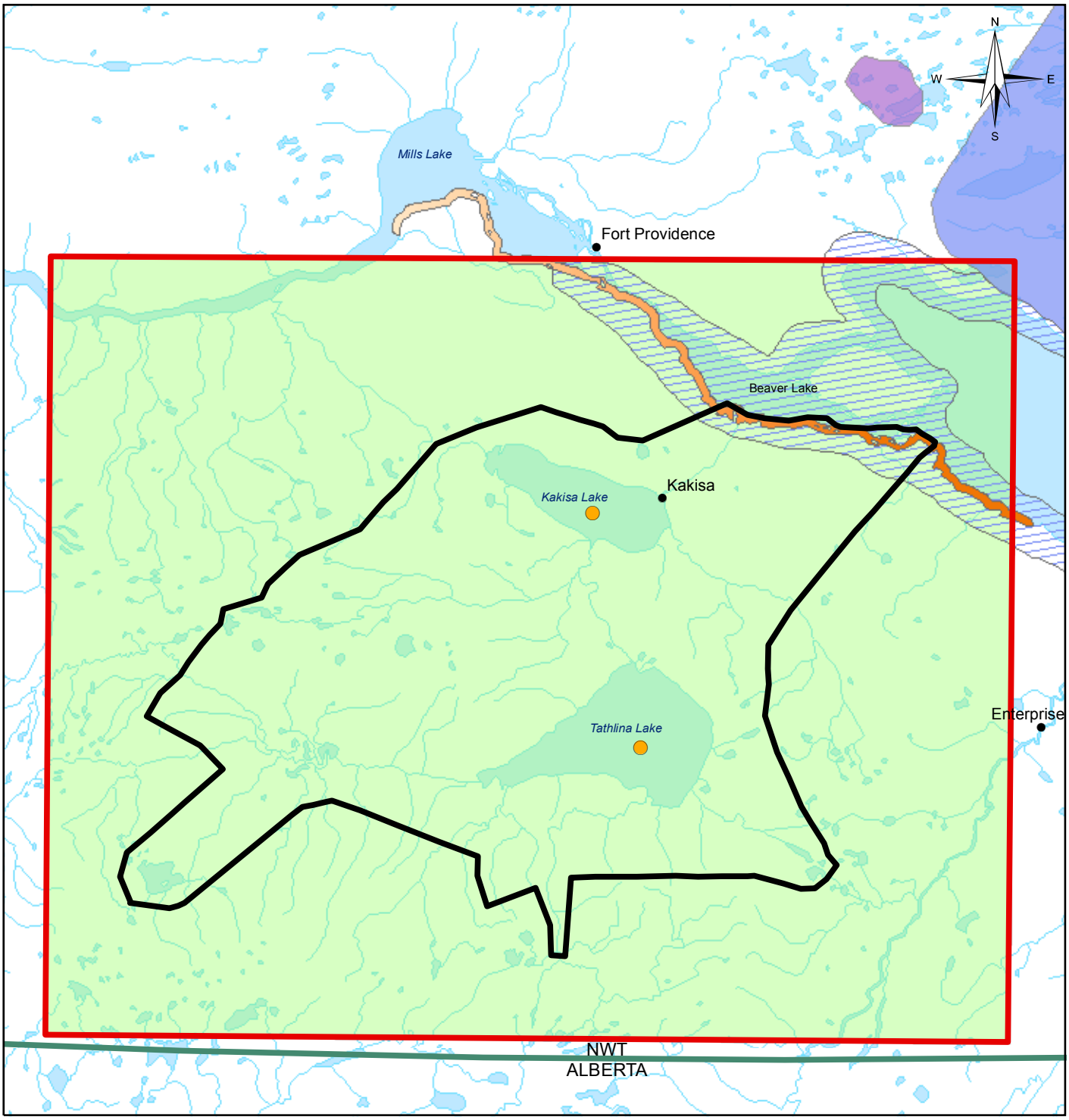
A number of bird species did not fit into passerines, waterfowl, or raptors and, consequently, they were grouped as waterbirds. This term is used in a general sense; select species have been grouped together and treated collectively. For this report, the term waterbirds include pelicans, cranes, and shorebirds.

8.3.1 Whooping Crane

Status: Whooping Cranes in the NWT are considered At Risk by the territorial Government (Working Group on General Status of NWT Species 2006), and Endangered by SARA (SARA 2006).

Whooping Cranes have a restricted distribution in the NWT, and are limited to summer breeding grounds along the Sass River area of northern Wood Buffalo National Park (WBNP). WBNP is the only nesting area for Whooping Cranes in the NWT. However, non-breeding cranes have been documented in the Dieppe Lake region of Mackenzie Bison Sanctuary, which lies immediately north of the Study Area (Figure 10). This area is considered critical habitat for the non-breeding segment of the Whooping Crane population (Decker pers. comm. 2003; Anonymous 1972).

The nesting grounds within WBNP are located in poorly drained areas where muskeg and boreal forest intermix (NPRC 2006 and references therein). Here they typically build an open nest with a shallow depression for the eggs, approximately 1 metre in diameter (SARA 2005). The nest is usually located in a stand of emergent vegetation, either built up from the bottom of the pond or floating. On their southern migration, cranes stop in the prairies where they feed on grain around sloughs and marshes. On their winter range, cranes can be found on inland tidal marshes and tidal mud flats in the Aranas National Wildlife Refuge, United States.



LEGEND

- Kakisa Area of Interest
- Kakisa Study Area
- Territorial - Provincial Border
- Community
- Watercourse
- Waterbody

Known Distribution

- Whooping Crane
- Yellow Rail

Potential Distribution

- American White Pelican
- Rusty Blackbird, Whooping Crane & Other Waterbirds
- Yellow Rail

NOTES
Base data source: WWF Canada (2002)
Reference: CWS (2004); Sibley (2003); Birds of North America (2006); KTFN (2006)

KAKISA PHASE 1 ECOLOGICAL ASSESSMENT
K 'AGEE TU AREA OF INTEREST, DEHCHO, NWT

Waterbird Distribution within the Study Area

PROJECTION	DATUM
UTM Zone 11	NAD83

Scale: 1:1,060,000
20 10 0 20
Kilometres

EBA Engineering Consultants Ltd.

FILE NO.			
1740209_Aquatic_Birds_Map020.mxd			
PROJECT NO.	DWN	CKD	REV
1740209	KDA	SM/KL	0
OFFICE	DATE		
EBA-YEL	October 23, 2006		

Figure 10

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As of 1998 - 1999, the total wild population of Whooping Cranes was 260 individuals, of which 183 were members of the Wood Buffalo National Park/Aransas National Wildlife Refuge flock. This flock has increased by approximately 35 % over the past 10 years, attributing to about 3.7 % population growth per year (SARA 2005). Since approximately 70 % of the world's population is restricted to a small breeding area in the Wood Buffalo National Park, a single event could affect most or all individuals. Whooping Crane density averages 1 pair per 0.9 km radius (Johns *et al.* 2000). In the summer of 2005, a total of 58 successful nests hatched 62 chicks; only 31 fledglings were observed in mid-August (Johns *et al.* 2000).

Despite their slow reproductive potential and small clutch size, population numbers are slowly increasing from near extinction (SARA 2005). Present threats to the population include natural mortality, shooting during migration, collision with power lines, predation at nest sites, pollution and destruction of wintering habitat. Threats to population most likely to occur during migration and on wintering grounds, but they are also vulnerable on their breeding grounds (SARA 2005).

8.3.2 American White Pelican

Status: American White Pelicans are considered May Be At Risk territorially (Working Group on General Status of NWT Species 2006), but are not listed by COSEWIC.

In Canada, American White Pelicans are found in the southern NWT, south-central British Columbia, northern Alberta, northeast Saskatchewan, central Manitoba, and southwestern Ontario (BNA 2006). They are known to breed in the region of Fort Smith, east of the Study Area; however, non-breeders may be expected to frequent the shore of Great Slave Lake, including Beaver Lake (Figure 10). According to Sirois *et al.* (2000) non-breeders also regularly occur in other areas in the NWT. Population trends of the Pelican in the NWT indicate an increase in numbers, and possible extension of breeding distribution may be expected (Fournier 2000).

Within the Dehcho Land Use Plan Background Report, American White Pelicans were said to frequent Kakisa and Tathlina lakes on a regular basis during the summer months (Figure 10) (Dehcho Land Use Planning Committee 2006). Traditional knowledge also recalls in the past, pelicans were said to nest around Kakisa Lake; however, they now nest around Wrigley Harbour at the east end of Beaver Lake (K 'ágee Tu First Nation 2006).

American White Pelicans typically breed on isolated islands in freshwater lakes, and forage at inland marshes, lakes, or rivers, favouring shallow waters. They are habitat generalists, and will occupy waters ranging from oligotrophic to eutrophic and shorelines ranging from mud, sand, gravel, and rock (BNA 2006).

Breeding Bird Survey data indicates the continental population of American White Pelicans have increased steadily and rapidly at rate of 3.9 % a year from 1980 to 2003 (BNA 2006). This increase appears driven by expanding populations in the United States.

8.3.3 Yellow Rail

Status: Yellow Rails are considered May Be At Risk by the NWT (Working Group on General Status of NWT Species 2006), and SARA lists Yellow Rails as Special Concern (Schedule 1) (SARA 2006).

The breeding distribution of the Yellow Rail is not well known. Typical breeding habitat varies locally from fresh to brackish water wetlands, swampy meadows, and occasionally wet, cut-over hay fields. The Canadian breeding range includes the southern NWT, as well as parts of Alberta, Saskatchewan, Manitoba, Ontario, Quebec, and all of New Brunswick and Nova Scotia (SARA 2006). Known breeding Yellow Rail distribution extends to just outside the Study Area, to the north and east (Figure 10) (Canadian Wildlife Service 2004). However, Yellow Rails may potentially occur at Beaver Lake (Figure 10).

Yellow Rails typically nest in marshes dominated by sedges, true grasses, and rushes, where there is little or no standing water (generally 0 - 12 cm water depth), but where the substrate remains saturated throughout the summer (SARA 2006).

The most recent population estimate of the Yellow Rail is approximately a few thousand pairs breeding in the Hudson/James Bay region, and approximately another 2,000 pairs in the rest of Canada (1998 estimates) (SARA 2006). It is estimated approximately 20 – 100 breeding pairs occur in the NWT; at a density of 1 breeding male per 25 to 86 ha (Anonymous 2000).

Threats to the population include effects of human activity and loss of habitat (BNA 2006). Some Yellow Rails are lost to machinery during hay cutting and baling on wintering grounds, and some strike TV towers or other structures during nocturnal migration. However, loss of wetlands to human activity is probably the most serious factor affecting Yellow Rail populations. Drainage of marshes may explain why southern boundary of breeding areas have moved northward in the twentieth century (BNA 2006 and references therein). Due to their relatively small population, and secretive nature, further population decline could go relatively undetected (COSEWIC 2006).

8.3.4 Rusty Blackbird

Status: Rusty Blackbirds in the NWT are considered May Be At Risk by the territorial Government (Working Group on General Status of NWT Species 2006) and are considered Special Concern by COSEWIC (2006) (at present, Rusty Blackbirds are not listed under SARA). Rusty Blackbird populations have experienced significant declines throughout the rest of their range; however, populations in the NWT are unknown.

Rusty Blackbirds breed north to the tree line in wet forests of Alaska, Canada, and the northeastern United States (BNA 2006). This species typically nests along bogs, muskeg swamps, beaver ponds, and streams and have been recorded within the Study Area, and the Area of Interest (Figure 10) (Bird Studies Canada *et al.* 2006). Rusty Blackbirds arrive in the NWT in early April and depart by mid-October (Bird Studies Canada *et al.* 2006).

Rusty Blackbird habitat occurs throughout the Study Area (Figure 10). Typical habitat consists of wet coniferous and mixed forests. Fens, bogs, muskegs, beaver ponds, and other openings in the forest such as swampy shores along lakes and streams are frequented by Rusty Blackbirds (BNA 2006).

Rusty Blackbirds were listed as Special Concern by COSEWIC since populations have experienced ongoing declines throughout the rest of their range in Canada, and there is no evidence to suggest this declining trend will be reversed. There are currently no population estimates of Rusty Blackbirds breeding in the NWT; however, CWS has completed Rusty Blackbird surveys within the NWT last year; but this information is currently unavailable. Although surveys were conducted in the NWT, surveys were not completed within the Study Area (Machtans pers. comm. 2006).

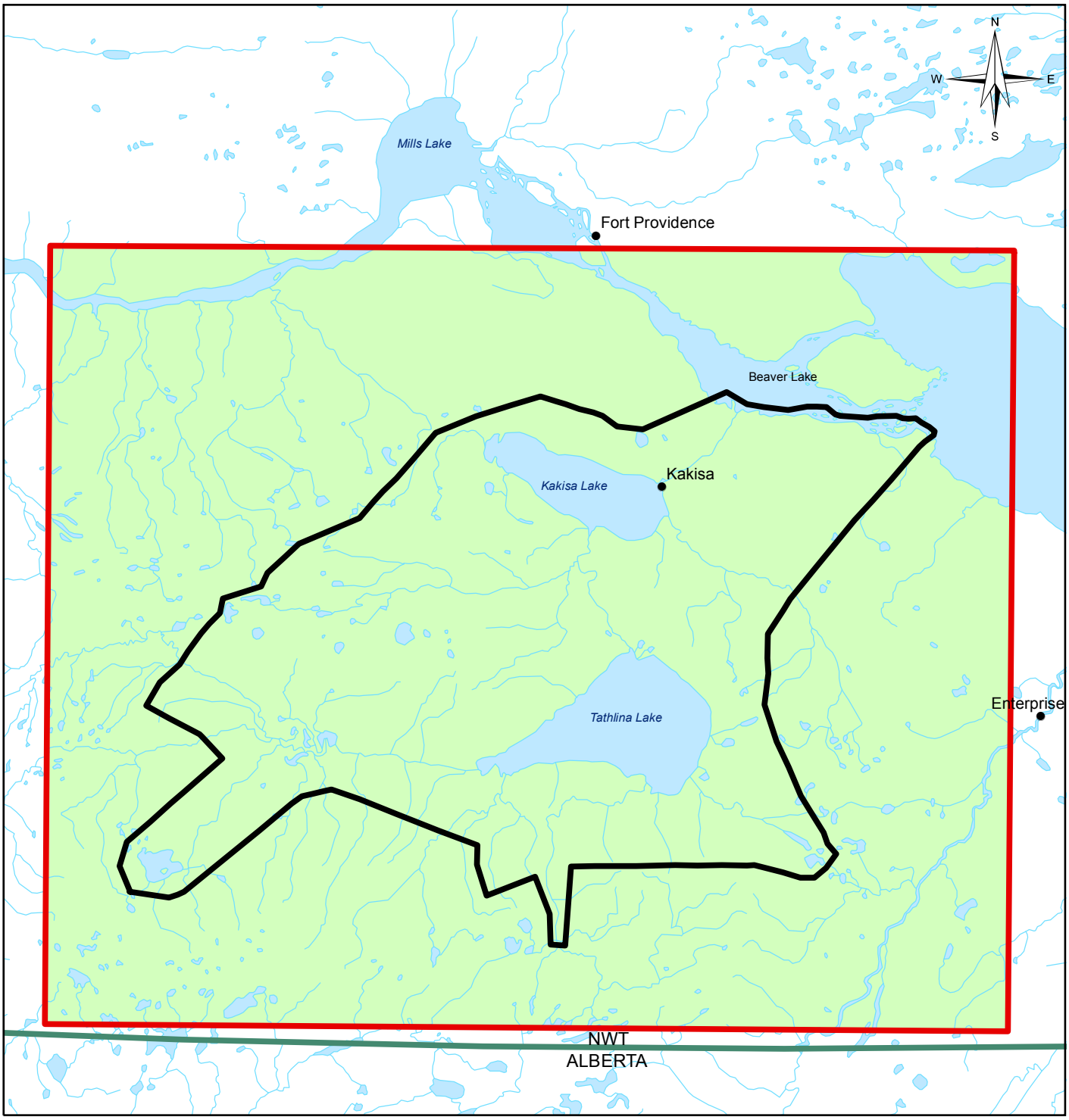
Threats to the population include effects of human activity and loss of habitat (BNA 2006). On the winter grounds, Rusty Blackbirds form mixed-species flocks/roosts with starlings and other blackbirds. Such winter aggregations in southern United States regularly exceed 1 million birds and have been subjected to lethal control to reduce nuisance, health, and crop-damage problems (BNA 2006 and references therein).

8.4 RAPTORS

Raptors, also known as "Birds of Prey," make up a small but important group of birds occurring in the Study Area (Figure 11). Although this group covers a small number of species, it is diverse and includes eagles, hawks, ospreys, falcons, and owls. Species will be reported collectively in a general group. This approach has been adopted because of the variety of species life requisites, habitat requirements, and general behaviour.

Raptors are known to breed throughout the Study Area, in all habitat types that meet breeding habitat requirements (Figure 11). Traditional knowledge indicates a number of eagles nest in the Area of Interest (the species of eagle was not reported), most particularly along the lower Kakisa River (K 'ágee Tu First Nation 2006). However, only a single Bald Eagle nest has been scientifically recorded within the Study Area (Carriere pers. comm. 2006). Raptors within the Study Area nest on various substrates including, cliff faces, mature trees, snags, on the ground, and on human structures in various habitat types including wetlands, uplands, slopes, and near water.

Many raptor species defend breeding territories, and may or may not defend a larger hunting territory. Little is known about the population status of individual species, particularly within the Study Area; however, seasonally and locally raptors can be common to abundant. Some are migratory, appearing as early as mid-April and departing in October, while others over-winter in the region. Traditional knowledge reports eagles arrive at the Area of Interest in March (the first migratory bird to arrive in the spring) and are one of the last to depart (K 'ágee Tu First Nation 2006).



LEGEND

- Kakisa Area of Interest
- Kakisa Study Area
- Territorial - Provincial Border
- Community
- Waterbody
- Watercourse
- Potential Raptor Distribution* (Including Peregrine Falcon and Short-eared Owl)

NOTES

Base data source: WWF Canada (2002)
Reference: Sibley (2003)
* Nesting habitat for cliff nesting raptors, such as Peregrine Falcons, is assumed to be suboptimal within the study area. However, all raptors (including non-breeding and migrating cliff nesting raptors) have the potential to occur throughout the study area.

KAKISA PHASE 1 ECOLOGICAL ASSESSMENT
K 'AGEE TU AREA OF INTEREST, DEHCHO, NWT

Raptor Distribution within the Study Area

PROJECTION	DATUM
UTM Zone 11	NAD83

Scale: 1:1,060,000

20 10 0 20

Kilometres

FILE NO.
1740209_Raptor_Map015.mxd

PROJECT NO.	DWN	CKD	REV
1740209	KDA	SM/KL	0

OFFICE	DATE
EBA-YEL	October 23, 2006

EBA Engineering Consultants Ltd.

Figure 11

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8.4.1 Peregrine Falcon

Status: Peregrine Falcons (*anatum*) in the NWT are considered At Risk by the NWT government (Working Group on General Status of NWT Species 2006), and Threatened by SARA (SARA 2006). This Peregrine Falcon subspecies is one of three subspecies occurring in Canada. The *anatum* subspecies occurs below the treeline and is the only breeding subspecies in the Study Area.

Peregrines have two main habitat requirements. They need proper nesting sites, usually on cliff ledges near water and access to prey. Peregrines do not defend home ranges but they do hunt within them. The home range overlaps the nesting range and can extend up to 27 km from the nest. Peregrines mainly hunt other birds in the air; so open tundra, grasslands, prairies and waterways are important habitats.

There are over 220 documented breeding pairs of Peregrine Falcons in northern Canada (NWT, Yukon, Nunavut, and northern Quebec) (Johnstone 1997). In the past, periodic Peregrine surveys along the Mackenzie Valley (outside the Study Area) have documented 83 nests on a linear 600 km transect along the Mackenzie River (Shank 1996). There has been an increasing trend in Peregrine Falcon numbers since 1980 (Shank 1996; Johnstone 1997). To date, no known Peregrine Falcon nests have been recorded in the Study Area; however, their populations are increasing (Carriere pers. comm. 2006). No Peregrine Falcon reports have been scientifically documented in the Study Area (Bird Studies Canada *et al.* 2006).

Historically, the use of agricultural pesticides, particularly organochlorides, was a major threat to Peregrine Falcon populations. Currently, the small population size, human interference at nest sites, habitat alteration, and habitat loss threaten populations (SARA 2004a). Present threats are limited in the NWT due to the remoteness of the country (Shank 1996; Johnstone 1997).

8.4.2 Short-eared Owl

Status: Short-eared Owls in the NWT are considered Sensitive by the territorial Government (Working Group on General Status of NWT Species 2006) and are listed as Special Concern under SARA Schedule 3 (SARA 2006).

Although many field guides indicate Short-eared Owls are summer residents in the regional area (Sibley 2003) and probably breed in the region, they are considered partial migrants[2] and some individual Short-eared Owls may remain in the region year-round (Wiggins 2006). Short-eared Owls have been recorded as year-round residents in northern Alberta including Caribou Mountains, Claire Lake, Wood Buffalo National Park, as well as Fort Vermillion (Clayton 2000).

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[2] Some individual Short-eared Owls do not migrate. Current research indicates a tendency of individual Short-eared Owls occupying the northern part of their species range (*i.e.* the NWT) to migrate south more frequently than individuals occupying the southern part of the species range (*i.e.* southern Alberta) (Wiggins 2006).

Some Short-eared Owls may also occupy the Study Area during winter months. Short-eared Owl habitat is present within the Study Area. Figure 11 shows the potential distribution of Short-eared Owls in the Study Area.

Open habitats, including marshes, prairies, and tundra, which Short-eared Owls prefer for nesting and hunting, are threatened throughout much of their range by urban expansion, human development and operations (particularly agriculture), and wetland drainage (SARA 2004a). Although these threats to Short-eared Owls are limited in the NWT, they occur on winter ranges.

The NWT population status of these owls is difficult to assess because individuals are nomadic and prone to annual fluctuations in numbers. Populations have declined throughout much of Canada; however, population trends in northern Canada still need to be confirmed.

9.0 AMPHIBIANS

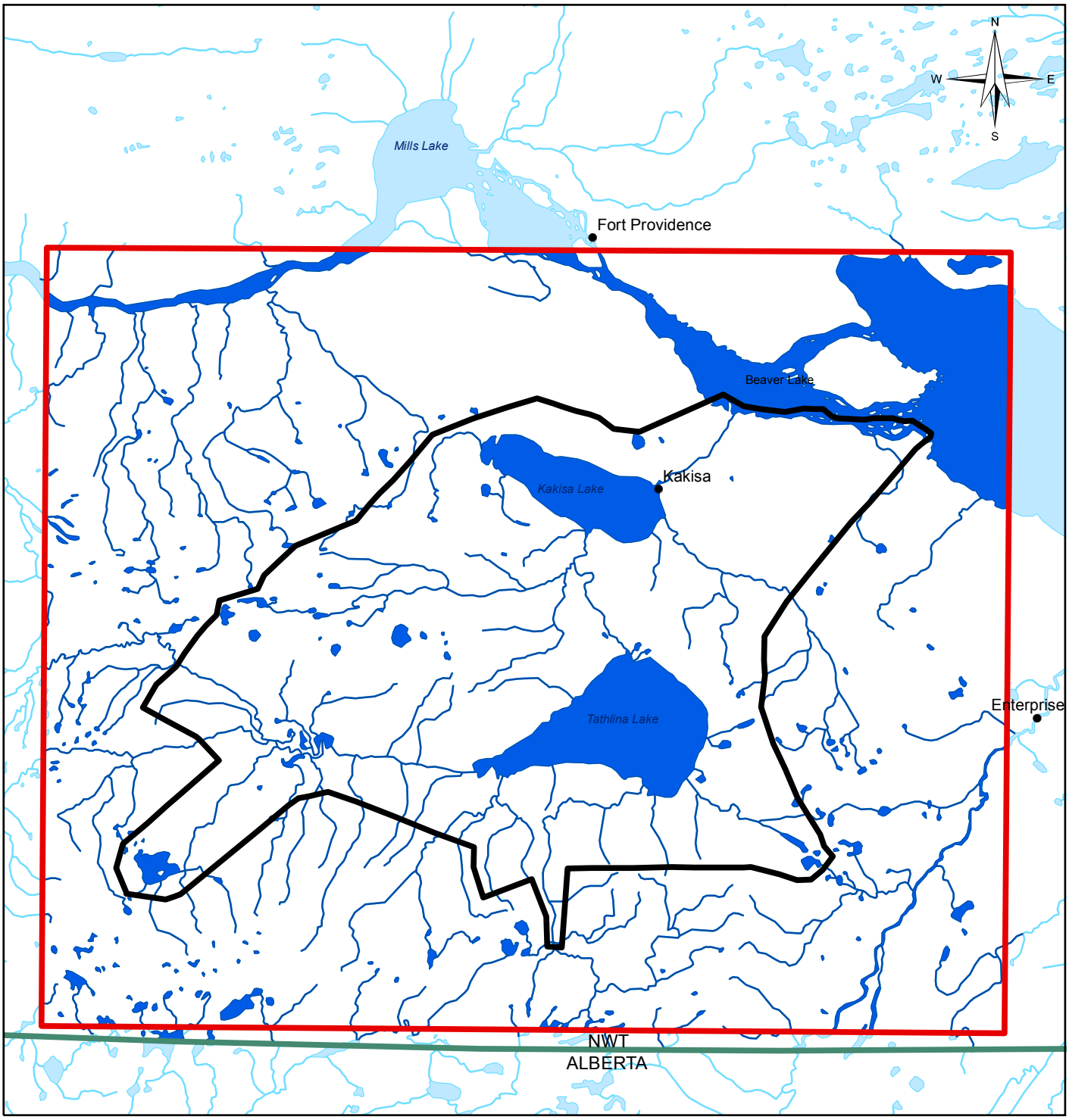
The NWT lies in the extreme northern limit of amphibian species ranges. Northern distributions are limited by winter temperatures and species tolerance to cold. Three amphibian species may potentially occur within the Area of Interest: Boreal Chorus, Wood, and Northern Leopard frog (Figure 12). Wood Frogs are highly adaptive to cold temperatures, and are able to survive freezing during winter hibernation (Canadian Endangered Species Conservation Committee 2006). As a result, they are known to have the largest distribution within the NWT.

Throughout much of the world, amphibian populations have been in decline or have disappeared due to habitat loss, pollution of aquatic environments, other human disturbances, or other unknown causes. Little information currently exists on amphibian populations within the NWT; however, there is particular interest in Northern Leopard Frog populations due to their uncommon occurrence and restricted distributions within the NWT and southern Canada.

9.1 NORTHERN LEOPARD FROG

Status: Northern Leopard Frogs are classified as a species of Special Concern by SARA (Schedule 1) (SARA 2006) and Sensitive in the NWT (Working Group on General Status of NWT Species 2006).

Populations have declined throughout much of western Canada, however, they are presumed stable in the NWT (Fournier 1997; Fournier 2000). Northern Leopard Frogs are known to occur at nine sites within the NWT, most of which are located between the Alberta border and Great Slave Lake (Seburn and Seburn 1998), but possibly more widely distributed than indicated since data is limited in the north (Figure 12) (Fournier 2000).



LEGEND

- Kakisa Area of Interest
- Kakisa Study Area
- Territorial - Provincial Border
- Community
- Watercourse
- Waterbody
- Potential Amphibian Distribution*
- Potential Amphibian Distribution*

NOTES

Base data source: WWF Canada (2002)
Reference: WWF Canada (2002)
*Amphibians potentially occur in all watercourses and waterbodies throughout the study area, including those not mapped on this figure.

KAKISA PHASE 1 ECOLOGICAL ASSESSMENT
K 'AGEE TU AREA OF INTEREST, DEHCHO, NWT

Amphibian Distribution within the Study Area

PROJECTION	DATUM
UTM Zone 11	NAD83

Scale: 1:1,060,000
20 10 0 20
Kilometres

EBA Engineering Consultants Ltd.

FILE NO.			
1740209_Amphibian_Map023.mxd			
PROJECT NO.	DWN	CKD	REV
1740209	KDA	SM/KL	0
OFFICE	DATE		
EBA-YEL	November 29, 2006		

Figure 12

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Northern Leopard Frogs use various habitat types throughout their life history, and are predominantly found in or near permanent waterbodies including lakes, rivers, streams, and wetlands, although they can be found a long distance from water, particularly after a rain. After hibernating at the bottom of ponds, Northern Leopard Frogs emerge and begin mating in early spring; some years prior to complete ice-melt. In Alberta, breeding may occur from early April to early June (Sustainable Resource Development 2005).

Diet varies among different age classes, for instance tadpoles rely solely on algae for 9 – 12 weeks prior to metamorphosing into adults (Canadian Endangered Species Conservation Committee 2006).

Northern Leopard Frogs have been documented along the Slave River near Fort Resolution, NWT (Ecology North ND). Northern Leopard Frogs may occur throughout the Study Area, in lakes, ponds, wetlands, rivers, and streams (Figure 12). Upland habitats may also be used.

Northern Leopard Frog populations are threatened by un-seasonal or unusual weather changes (*e.g.* drought, fluctuating winter temperatures, freezing rain, low snow cover), disease, alteration or destruction of habitat, and collection for laboratory demonstration material (Fournier 1997; Fournier 2000).

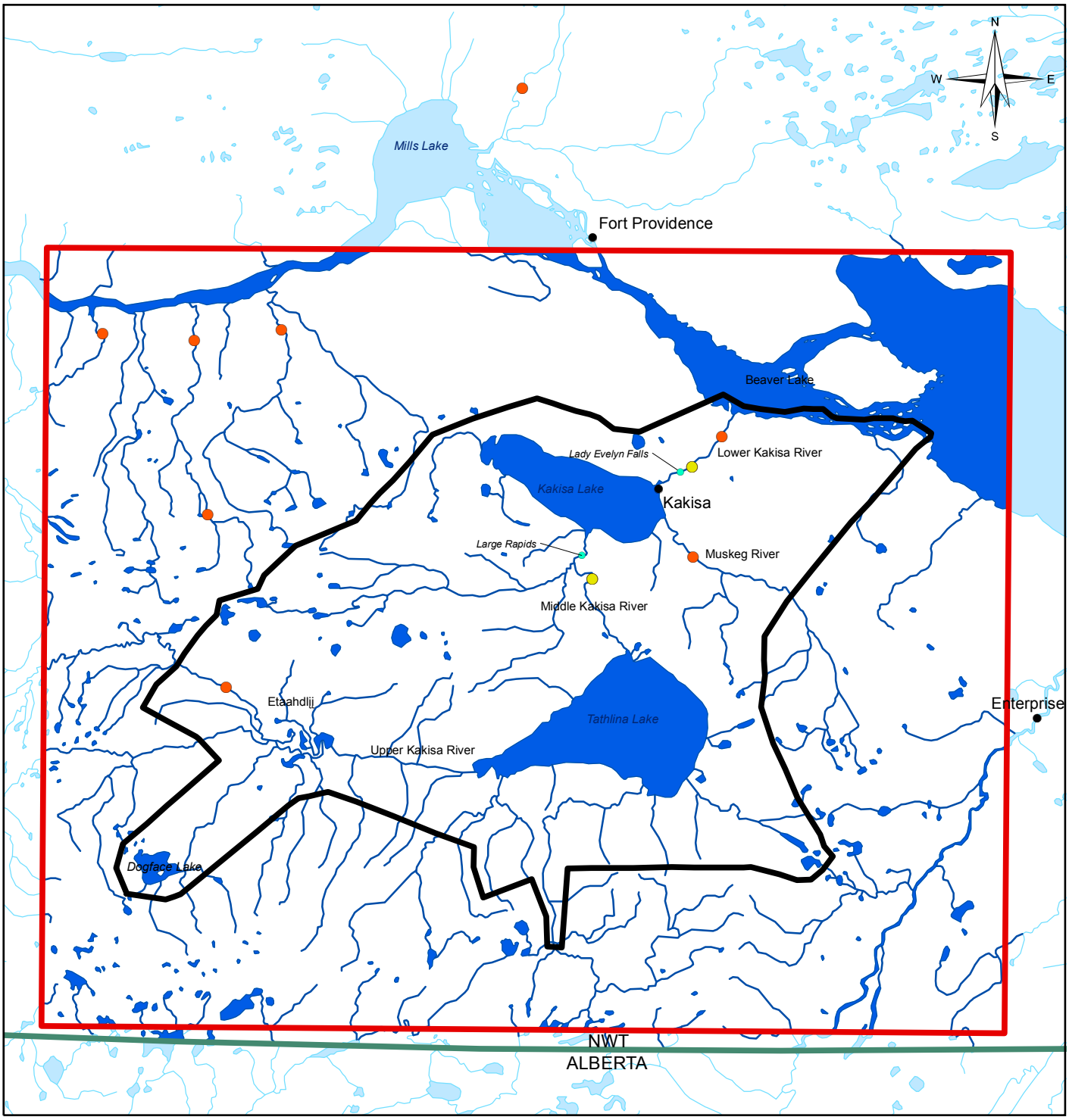
10.0 FISH

Three fish species in the NWT have special conservation status: Shortjaw Cisco, Inconnu (Upper Mackenzie River population), and Bull Trout. Of these three fish species, only the Shortjaw Cisco and Inconnu occur or hypothetically occur within the Study Area (Figure 13).

Fish make up a diverse group of species. Species represented within the NWT is considered less diverse than compared to southern Canada; however, many of the fish species occurring in the north are coldwater species with little to no distribution within southern Canada (Canadian Endangered Species Conservation Council (CESCC) 2006). Within this group of species, a variety of food items, habitat types, reproductive behaviour, and adaptations can be observed.

Fish eat a variety of food items such as algae, vascular plants, invertebrates, amphibians, and other fishes.

Diet among fish species typically changes with different age classes. Similar to changing diets at different age classes, most fish use several different habitat types throughout their life cycle. Fish can be expected to occur in most lakes and rivers within the Study Area that are deep enough to provide a good supply of oxygenated water, either on a permanent or semi-permanent basis (Figure 13). Fish are expected to over-winter in areas where ice does not freeze down to the substrate and in pools and rivers that remain open. KTFN (2006) indicated the outlets of Dogface Lake, Tathlina Lake, and Kakisa Lake remains open through the winter months. Fish occur throughout most of the aquatic habitat in the Study Area.



LEGEND

- Kakisa Study Area
- Kakisa Area of Interest
- Territorial - Provincial Border
- Community
- Watercourse
- Waterbody
- Known Spawning Sites*
- Known Migration Sites
- Known Fish Barriers
- Potential Fish Distribution
- Potential Fish Distribution

NOTES

Base data source: WWF Canada (2002)
Reference: NLUIS (1972 in WWF Canada (2002))
* Only exact locations of known spawning sites are depicted on map. Other general spawning areas are not shown (please refer to text for general locations).

KAKISA PHASE 1 ECOLOGICAL ASSESSMENT
K 'AGEE TU AREA OF INTEREST, DEHCHO, NWT

Fish Distribution within the Study Area

PROJECTION	DATUM
UTM Zone 11	NAD83

Scale: 1:1,060,000

20 10 0 20

Kilometres

EBA Engineering Consultants Ltd.

FILE NO.			
1740209_Fish_Map024.mxd			
PROJECT NO.	**DWN**	**CKD**	**REV**
1740209	KDA	SM/KL	0
OFFICE	**DATE**		
EBA-YEL	November 29, 2006		

Figure 13

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Limited information exists on fish habitat within the Study Area. Roberge *et al.* (1986) and Lamoureux (1973) described shoreline and bottom substrate at Kakisa Lake. Kakisa Lake (331.26 km^2) reaches a maximum depth of 7 m and is dominated by silty bottom substrate, except at the western end of the lake that is dominated by black organic material (Roberge *et al.* 1986; Lamoureux 1973). Shoreline habitat includes boulder, gravel, and sand to water depths of 2 – 4 m (Roberge *et al.* 1986). Aquatic vegetation dominated the west and east ends of Kakisa Lake, covering approximately 13 % of the entire lake surface (Lamoureux 1973). Dense aquatic vegetation was also reported in all inlet streams (six in total, including Muskeg River), except Kakisa River (Lamoureux 1973). These vegetated areas supported greater diversity and abundance of fauna than compared to silt-bottomed areas (Lamoureux 1973).

The Kakisa and Cameron rivers, as well as other small tributaries enter Tathlina Lake. Fish habitat within Tathlina Lake (573 km^2 area) was also described by Roberge *et al.* (1988) as generally shallow water levels (between 1.5 – 3 m depth), with a bottom substrate of silt and black organic matter. Since Tathlina Lake is relatively shallow, winterkill can occur periodically. In fact, winterkill was reported in Tathlina Lake during the winter of 1942 - 1943; however, no further reports of winterkill have been identified to date (Stewart and Low 2000). No limnological data is available on winter conditions in Tathlina Lake; however, limnological conditions during the winter depend on winter temperatures, water depth, and snow cover (Stewart and Low 2000). In addition, traditional knowledge reported a major fish die-off in 1942 as a result of a major forest fire in the area contaminating the water (K 'ágee Tu First Nation 2006). Traditional knowledge indicates Tathlina Lake is highly susceptible to water contamination from both human and natural disturbances due to its shallow depth (K 'ágee Tu First Nation 2006).

Fish habitat along Kakisa River is described in Section 3.1 (*Kakisa Watershed*). Known important fish habitat within the Area of Interest includes three known spawning sites (located in the upper Kakisa River, lower Kakisa River, and Muskeg River), two known migration areas (middle and lower Kakisa River), and two potential fish barriers (rapids along the middle Kakisa River and Lady Evelyn Falls) (Figure 13). Known fish spawning and migration areas are described below in Section 10.3 and 10.4.

Lady Evelyn Falls is a significant barrier to fish migration upstream from Beaver Lake (Figure 13) (Roberge *et al.* 1986; Roberge *et al.*1988). Species such as Arctic Grayling and Inconnu are only known in the lower Kakisa River up to Lady Evelyn Falls. In addition, a series of rapids occur in the middle Kakisa River (approximately 4 km upstream of Kakisa Lake) (Figure 13). This series of rapids were described by Roberge *et al.* (1988) as violent and the majority of fish movement between the two lakes may be inhibited (Figure 13).

Kakisa and Tathlina lakes have supported commercial Walleye and Whitefish fisheries since the late 1940s and 1954, respectively, and also a domestic fishery (Roberge *et al.* 1986; Roberge *et al.* 1988; KTFN 2006). In addition, Kakisa River and Beaver Lake are considered sport fishing areas for species such as Arctic Grayling, Walleye, Northern Pike, Inconnu, and Lake Cisco. Sport fishing along the Kakisa River is focussed primarily downstream of Lady Evelyn Falls to the Kakisa River Bridge (Highway 3), and targets

mainly Arctic Grayling. In addition, a sport fishing lodge operates on Brabant Island (Brabant Island Lodge) within Beaver Lake, and at Dogface Lake. Brabant Island is a relatively large island along the south channel of Beaver Lake. Many fish species are harvested by guests of the Brabant Island Lodge; however, species most targeted include Arctic Grayling and Northern Pike (Falk and Gillman 1980). A sport fishery for trophy sized Walleye also exists at Dogface Lake, and a commercial fishery once operated in the 1960s and early 1970s (Stewart and Low 2000). Other fish species targeted by sport harvesters at Dogface Lake include Lake Whitefish and Northern Pike (Stewart and Low 2000).

Fish habitat near Brabant Island within Beaver Lake has been described by Falk and Gillman (1980). Water depth and current vary throughout the area; however, near Brabant Island, the water is considered swift flowing with deep (2 – 4 m) (Falk and Gillman 1980). Bottom substrates are dominated by medium to large sized rocks, and gravel bars; little aquatic vegetation is present (Falk and Gillman 1980). This area near Brabant Island (as well as other islands of similar habitat attributes within Beaver Lake) is considered good Arctic Grayling habitat (Stewart and Low 2000). Stewart and Low (2000) report Arctic Grayling spawn near some of the islands in the eastern part of Beaver Lake. Unlike the main channel, shallow bays along Brabant Island, as well as along Mills Lake shoreline, are characteristic of slower moving water, silty/clayey bottom substrates, and an abundance of aquatic vegetation (Falk and Gillman 1980). This slower moving water with an abundance of aquatic vegetation is considered important habitat for a number of fish species (of all age classes), particularly Northern Pike. Falk and Gillman (1980) reported environmental conditions and habitat attributes at Mills Lake is conducive to the higher than average growth of Arctic Grayling and Northern Pike. Arctic Grayling in the area are considered to have the fastest growths reported in North America for Grayling, and the growth of Northern Pike is considered faster than reported growths throughout the NWT (Falk and Gillman 1980).

Known fish spawning sites and migration areas are mapped in Figure 13. Other fish spawning sites are present within the Study Area; however, exact locations are unknown and, consequently, are not depicted in the figure.

10.1 SHORTJAW CISCO

Status: The territorial Government lists the Shortjaw Cisco in the NWT as At Risk (Working Group on General Status of NWT Species 2006); and COSEWIC lists this species as Threatened (COSEWIC 2006).

The Shortjaw Cisco species range across Canada is generally unknown. Within the NWT, Shortjaw Cisco has been reported in Great Slave Lake, Great Bear Lake, and Tazin River (Figure 13) (Scott and Crossman 1973; McPhail and Lindsey 1970; Todd 2003). Although Shortjaw Ciscoes have only been reported in three areas in the NWT, other occurrences may be possible (Todd 2003). The Shortjaw Cisco may occur within the Study Area, most particularly within Beaver Lake (Figure 13).

This species is typically a deep water fish (55 – 144 m) and requires spawning habitat characteristic of shallower water (35 – 75 m depth) with clay bottom substrate (Scott and Crossman 1973). Spawning habitat may be present in Beaver Lake. Spawning is thought to occur during the fall; however, specific spawning periods varied from lake to lake in Ontario (Scott and Crossman 1973). Although seasonal movement from the deepest water depths in the spring to shallower depths in summer and winter were reported in Lake Superior, Ontario (Scott and Crossman 1973). Preferred habitats in smaller lakes are relatively unknown; however, Shortjaw Ciscoes were found in the deepest parts of the smaller lakes in Manitoba and Ontario. Except at a single lake in Alberta, Shortjaw Ciscoes were reported at depths ranging from 2 – 16 m (Todd 2003). Since Shortjaw Ciscoes occur at deeper water depths, crustacea (*i.e.* copepods) and benthic invertebrates make up the majority of their diet (Todd 2003).

10.2 INCONNU

Status: Inconnu (Coney) (Upper Mackenzie River and Great Slave Lake) in the NWT are listed as May Be At Risk (Working Group on General Status of NWT Species 2006); however, Inconnu has not been evaluated by COSEWIC (2006) and are considered secure in other jurisdictions.

Inconnu are distributed throughout northwest Canada, and are present in the Mackenzie River and Great Slave Lake (Figure 13). Inconnu populations in the NWT are divided into anadromous[3] Upper Mackenzie River populations, and a non-anadromous population in the Lower Mackenzie River/Great Slave Lake. Little mixing of anadromous and non-anadromous Inconnu occur.

The Inconnu subpopulation that occurs in the Study Area are considered non-anadromous and reside in Great Slave Lake to feed and over-winter and migrate short distances up the Buffalo, Little Buffalo, Slave, Hay, and Taltson rivers to spawn immediately prior to freeze up (Evans *et al.* 2002). Inconnu may occupy areas in the Study Area during summer feeding.

Young Inconnu may remain in the river systems for approximately two years before migrating to Great Slave Lake. Tallman *et al.* (1995), used gillnets and radio-telemetry to investigate Inconnu movements in the lower Slave River. This investigation revealed Inconnu migrate up river systems during August and September, and peak spawning occurs in mid-October. After spawning, Inconnu migrate back to Great Slave Lake within a two week period at the end of October (Tallman *et al.* 1995).

Population densities for Inconnu present within the Study Area are not known; however, densities are assumed to be limited.

Potential threats to Inconnu populations include forestry and mining, climate change, and habitat alteration, disturbance, and destruction (Day *et al.* 2000).

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[3] Anadromous populations refer to fish that occur in marine environments and return to freshwater rivers to spawn.

10.3 WALLEYE

Status: Yellow Walleye are considered Sensitive within the NWT (Working Group on General Status of NWT Species 2006); however, they are not listed under COSEWIC (2006).

In the NWT, Walleye occur at their northern most range, and are known to occur throughout the majority of the Mackenzie River system (McPhail and Lindsey 1970), including Great Slave Lake, Mackenzie River, and both Kakisa and Tathlina lakes (Figure 13).

This species typically occurs in loose schools and typically have separate spawning and summering habitats (Scott and Crossman 1973). Preferred habitat for adult Walleye includes a variety of habitats, including large, shallow, turbid lakes, and large, deep, turbid rivers. Spawning begins shortly after ice break-up in rocky habitats including below water falls (including Lady Evelyn Falls) and/or in boulder and coarse gravel shoals in lakes (Scott and Crossman 1973). However, in the NWT, spawning may not occur some years as a result of unfavourable temperature, wind, and stream flow conditions (Scott and Crossman 1973).

In addition, northern Walleye populations have a slower growth rate than compared to populations in southern Canada (Scott and Crossman 1973; Roberge *et al.* 1986). This slower growth rate may be attributable to temperature, forage/prey abundance, and population density (Roberge *et al.* 1986). Diet varies considerably, particularly between age classes, and includes invertebrates, copepods, and any species of fish available to them.

Based on seasonal commercial fishing efforts throughout the lake and tag recapture survey locations, Walleye habitat selections within Tathlina and Kakisa lakes can be assumed. Commercial Walleye fishing operations in Tathlina Lake focus their efforts at and near the inlet of Kakisa River during the spring spawning migrations, as well as in July when Walleye are feeding (Roberge *et al.* 1988). From August to October commercial fishing has typically concentrated in the deeper waters at the west end of Tathlina Lake (Roberge *et al.* 1988). Tag returns indicated Walleye were over-wintering in Kakisa River near the outlet into Tathlina Lake (Roberge *et al.* 1988; Stewart and Low 2000). This seasonal trend in habitat utilization was supported by fish recaptures at the west end of Kakisa Lake and within Kakisa River (Roberge *et al.* 1988). Walleye are known to spawn in Kakisa River between Kakisa and Tathlina lakes, and also congregate during post-spawning to feed on spawning Trout Perch and White Suckers (Stewart and Low 2000). In addition, Walleye were recaptured near Cameron River in June and July (Roberge *et al.* 1988).

Area-specific commercial fishing effort was also seen at Kakisa Lake. Roberge *et al.* (1986), reported fishing is primarily concentrated at the mouth of Kakisa River (mid Kakisa River flowing from Tathlina Lake) throughout the year, particularly during spring (Walleye spawning and post-spawning times).

Based on tag recoveries, Stewart and Low (2000) reported Walleye occurring at Kakisa, Tathlina, and Beaver lakes do not intermix. This was attributed to large rapids along Kakisa

River (mid Kakisa River) between Kakisa and Tathlina lakes, as well as the impassable Lady Evelyn Falls between Kakisa and Beaver lakes.

Known Walleye spawning areas include Kakisa River between Beaver Lake and Lady Evelyn Falls, mid-Kakisa River between Kakisa and Tathlina lakes, mid-Kakisa River tributaries, upper Kakisa River upstream of Tathlina Lake, and Muskeg River (Stewart and Low 2000; KTFN 2006; Lamoureux 1973). Walleye stocks that spawn between Beaver Lake and Lady Evelyn Falls, return to Beaver Lake after spawning, and remain along the lake shore and river outlets (Stewart and Low 2000). Spawning is thought to occur from mid-May to the end of June (K 'ágee Tu First Nation 2006).

10.4 OTHER FISH

Numerous other fish species occur within the Study Area; however, only those species that have known spawning locations within the Study Area are discussed below. Known spawning locations include Muskeg River, Kakisa River, and Kakisa Lake.

Northern Pike, Trout Perch, White Sucker are known to spawn in the spring along the Muskeg and Kakisa rivers between May and early June (Stewart and Low 2000). As well, White Suckers are also known to spawn along the northern shore of Kakisa Lake, while Lake Cisco and Lake Whitefish spawn near the south and east shores of Kakisa Lake in the fall (Stewart and Low 2000).

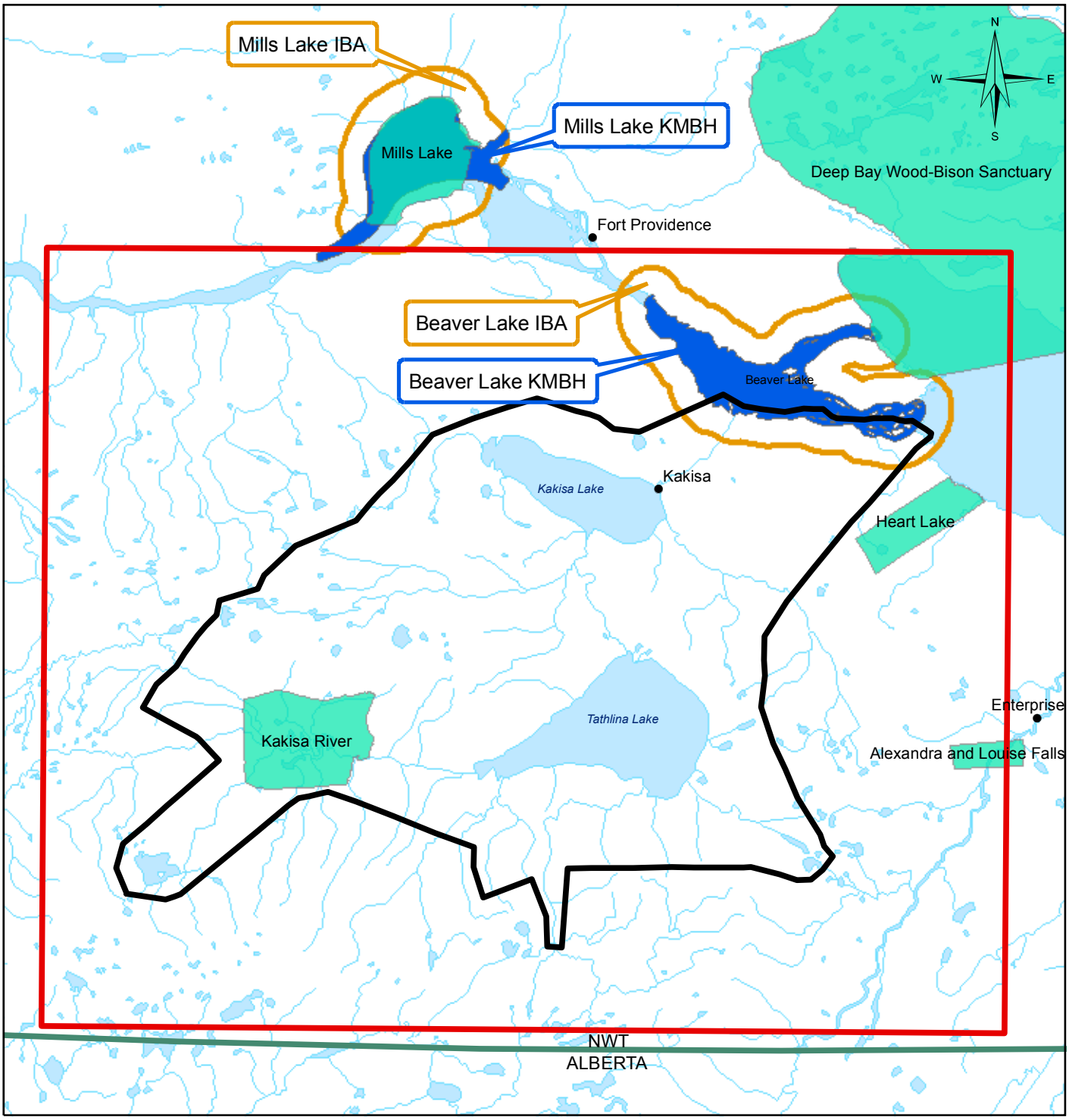
Kakisa River, between Beaver Lake and Lady Evelyn Falls is also a known Arctic Grayling, Northern Pike, Longnose Sucker, and Lake Whitefish spawning area (Stewart and Low 2000; KTFN 2006). Stewart and Low (2000) report Arctic Grayling spawn at various locations along Kakisa River from Beaver Lake to Lady Evelyn Falls in early to mid-May (Stewart and Low 2000). Arctic Grayling then migrate back to Beaver Lake during post-spawning and remain for the remainder of the year (Stewart and Low 2000).

Lake Whitefish and White Suckers have been reported to spawn along upper Kakisa River, between Tathlina Lake and Etaáhdlı̨ı̨ (K 'ágee Tu First Nation 2006).

Lake Whitefish and Northern Pike have also been recorded in Dogface Lake. No spawning habitat has been reported near Dogface Lake.

11.0 IMPORTANT CONSERVATION AREAS

Three designated conservation areas occur within the study area including Important Bird Areas, International Biological Programme Sites, and Key Migratory Bird Terrestrial Habitat Sites. Five different areas within the Study Area have been designated under at least one of these conservation area designations, and are detailed below in appropriate sections (Figure 14). Table 5 outlines the important conservation areas within the Study Area.



LEGEND

- Kakisa Area of Interest
- Kakisa Study Area
- Terr. - Prov. Border
- Community
- Waterbody
- Watercourse
- Key Migratory Bird Habitat (KMBH)
- International Biological Programme (IBP)
- Important Bird Areas (IBA)

NOTES
Base data source: WWF Canada (2002)
Reference: WWF Canada (2002)

KAKISA PHASE 1 ECOLOGICAL ASSESSMENT
K 'AGEE TU AREA OF INTEREST, DEHCHO, NWT

Known Important Conservation Areas within the Study Area

PROJECTION	DATUM
UTM Zone 11	NAD83

Scale: 1:1,060,000
20 10 0 20
Kilometres

EBA Engineering Consultants Ltd.

FILE NO.			
1740209_Key_Sites_Map018.mxd			
PROJECT NO.	DWN	CKD	REV
1740209	KDA	SM/KL	0
OFFICE	DATE		
EBA-YEL	October 25, 2006		

Figure 14

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TABLE 5. IMPORTANT CONSERVATION AREAS WITHIN THE STUDY AREA

Important Conservation Area Designation	Important Area
Important Bird Area	Beaver Lake
International Biological Programme Sites	Kakisa River
	Deep Bay Wood – Bison Sanctuary
	Heart Lake
	Alexandra and Louise Falls
Key Migratory Bird Terrestrial Habitat Site	Beaver Lake

11.1 IMPORTANT BIRD AREAS

Although Important Bird Areas are not protected by legislation, their mandates are to identify and conserve habitats necessary for the long-term viability of bird populations (Bird Studies Canada *et al.* 2004).

Areas are designated as an Important Bird Area if:

- Large numbers of threatened species occur in the area;
- Numerous species of restricted distribution occur in the area;
- Area includes restricted bird habitats, or represent North American breeding bird habitats; and
- High concentrations of birds during one or more seasons congregate for breeding, wintering, or migrating (Bird Studies Canada *et al.* 2004).

Sites are further categorized at global and national levels based on the assemblage of birds using a given area.

11.1.1 Beaver Lake

Beaver Lake has been designated as an area both globally and nationally significant for migratory birds and has been listed as an Important Bird Area (Figure 14). Beaver Lake is designated as a significant area since it supports a large congregation of waterfowl during their spring and fall migrations (Bird Studies Canada *et al.* 2004). Tundra Swans and several other waterfowl species, including Canvasbacks, American Wigeons, Mallards, and Scaup species were the most commonly observed species at Beaver Lake in the early 1970s. Tundra Swan densities observed at Beaver Lake during fall migration in 1972 was estimated at approximately 2 % of the North American population during that time (Bird Studies Canada *et al.* 2004). In addition, densities of duck species occurring at Beaver Lake during fall and spring migration were estimated at 10,000 and 5,000, respectively (Bird Studies Canada *et al.* 2004). In 1975, approximately 8,000 Canvasbacks (or approximately 1 % of the global population) were observed in the north channel of Beaver Lake (Bird Studies Canada *et al.* 2004).

An additional Important Bird Area, Mills Lake, lies immediately north of the Study Area, along the Mackenzie River. Mills Lake is considered both globally and continentally significant due to the large numbers of waterfowl that congregate, particularly during fall migration (Bird Studies Canada *et al.* 2004). Waterfowl favour the extensive marshes, floating sedge mats, and other emergent and submergent aquatic vegetation that surround the shallow shoreline of Mills Lake.

11.2 INTERNATIONAL BIOLOGICAL PROGRAMME SITES

International Biological Programme (IBP) Sites were established through an agreement with the International Council of Scientific Unions, of which Canada participated in from 1964 to 1974. During this ten year period, 120 sites considered important to migratory birds, as well as considered to have archaeological, and geomorphology value and/or unique flora and fauna were identified across Canada. Many areas listed as an IBP contained features such as relict or endangered populations, unique plant associations, breeding areas, critical range for wildlife, pristine lakes, and mineral springs.

Although IBP sites do not benefit from legislative protection, their designation serves to highlight the ecological importance of particular areas. There are four IBP sites within the Study Area, one which is included in the Area of Interest (Figure 14). In addition, Mills Lake, immediately north the Study Area is also considered an IBP site. Mills Lake was listed as an IBP site since it supports large congregations of waterfowl, particularly during migration, aquatic vegetation, and fish (Beckel 1975).

11.2.1 Kakisa River

A portion of the upper Kakisa River and its associated floodplain is categorized as an IBP site. Local KTFN have also recognized the Kakisa River IBP as an important wildlife area, and named it Etaáhdlı̨. This IBP site is approximately 365 km^2 and is located approximately 24 km west of Tathlina Lake (Figure 14) (Beckel 1975). This area includes broad active floodplains that are dominated by sedge-scrub birch and tamarack plant communities (Beckel 1975). Mature spruce forests dominate the surrounding uplands. The active floodplains include floating bogs and numerous shallow lakes and ponds, and is considered important habitat for waterfowl, beavers, muskrat, and moose (Beckel 1975).

11.2.2 Deep Bay Wood – Bison Sanctuary

The Deep Bay Wood – Bison Sanctuary is located within the northeastern corner of the Study Area, but is not included within the Area of Interest (Figure 14). This IBP site is a relatively large site (approximately 4,168 km^2), and is situated along the western shoreline of Great Slave Lake (Beckel 1975). Characteristic vegetation communities consist of white spruce – tamarack, ground birch – willow, Labrador tea – lichen, black spruce, and white birch – white spruce (Beckel 1975). Ephemeral lakes and wetlands are also common within this IBP site. This site was chosen as an IBP site since wood bison and Whooping Cranes (both species with special conservation status, refer to Section 6.2 and 8.2.1, respectively) are known to occupy the numerous upland and lowland habitats within this important area

(Beckel 1975). As well, the area possesses interesting limnology in numerous lakes (Beckel 1975). This area is also known as an important waterfowl staging area, and habitat for woodland caribou, wolves, and lynx.

11.2.3 Heart Lake

Heart Lake IBP site is a small area of land (approximately 130 km^2) located immediately outside the Area of Interest, but along the eastern portion of the Study Area (Figure 14). This IBP site has also been proposed as a NWT - PAS protected area by the KTFN (World Wildlife Fund 2000). The area of interest includes Heart Lake and follows an escarpment towards the Great Slave Lake shoreline. Based on biological studies in the area, this area was considered as an IBP site and subsequently proposed as a NWT - PAS protected area in response to interesting plant associations, rare plant species, unique landscapes, rich and diverse habitats and flora and fauna, representivity of the region, and a valuable traditional knowledge and scientific learning area (Beckel 1975; Eng *et al.* 1989; World Wildlife Fund 2000).

This relatively small area encompasses a multitude of various landscape features, including a variety of wetland types, uplands including ancient beach ridges, limestone escarpments and canyons, talus slopes, ancient coral reef outcrops along the escarpment, and alvars[4] (World Wildlife Fund 2000). Alvars, in particular are known to support rare plant species (World Wildlife Fund 2000).

The University of Alberta and a few others utilized Heart Lake as a research site for biological research. A number of researchers (mainly universities) have completed small mammal, bird, and plant surveys at Heart Lake.

Based on research conducted at Heart Lake, the area is known to support 28 % of the entire continental NWT plants (World Wildlife Fund 2000). Heart Lake area is considered a rich and diverse habitat, and is known to support 316 vascular plants, 136 mosses, and 85 lichen species (Carpenter 2000). A total of 13 rare vascular plants were originally reported within the Heart Lake IBP sites; however, based on the 2006 species ranks (Working Group on General Status of NWT Species 2006), only three are now considered May Be At Risk, five considered Sensitive, and five considered Secure. A total of rare mosses and lichens were also originally recorded within the Heart Lake IBP site.

11.2.4 Alexandra and Louise Falls

The IBP documents entitled, *IBP ecological sites in subarctic Canada* (Beckel 1975) and *A Review of international biological programme sites in the Northwest Territories* (Eng *et al.* 1989) have left out material describing Alexandra and Louise falls. Consequently, little information is available for these two sites.

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[4] Alvars are defined as areas with thin soils over limestone or marble rock with naturally little vegetation cover (World Wildife Fund 2000).

11.3 KEY MIGRATORY BIRD TERRESTRIAL HABITAT SITES

Key Migratory Bird Terrestrial Habitat Sites were identified based primarily on important breeding, staging and nesting habitat across Canada. One Key Migratory Bird Terrestrial Habitat site occurs within the Study Area, Beaver Lake. However, Mills Lake, immediately north of the Study Area, has also been designated as a Key Migratory Bird Terrestrial Habitat site due to significant waterfowl populations utilizing Mills Lake during fall migration (Figure 14). Areas considered for Migratory Bird Terrestrial Habitat Sites support at least 1 % of the Canadian population of at least one migratory bird (Latour *et al.* 2006).

11.3.1 Beaver Lake

Beaver Lake is a widening at the head of the Mackenzie River that is separated into two channels by a large island, both included within the Key Migratory Bird Terrestrial Habitat Site (approximately 461 km^2). Habitat within the southern channel (located within the Area of Interest) is characterized predominately by upland spruce – poplar mixed forest, and habitat along the North Channel is generally low and marshy (Figure 14) (Latour *et al.* 2006). This marshy area along the northern shoreline contains large areas of sedge – grass marshes, which are favored staging areas for waterfowl and waterbirds, including Tundra Swans. Beaver Lake lies within the major migratory corridor, and waterfowl migrate through in May and again in September and October. During survey events in the spring and fall, approximately 6 % of the national population of Tundra Swans has been recorded at Beaver Lake. Tundra Swan densities observed at Beaver Lake during fall migration in 1972 was estimated at approximately 2 % of the North American population during that time (Bird Studies Canada *et al.* 2004; Salter 1974). In addition, duck densities occurring at Beaver Lake during spring and fall migration were approximately 5,000 and 10,000, respectively (Bird Studies Canada *et al.* 2004; Salter 1974). In 1975, approximately 8,000 Canvasbacks (or approximately 1 % of the global population) were observed in the north channel of Beaver Lake (Bird Studies Canada *et al.* 2004). This lake was designated as a Key Migratory Bird Terrestrial Habitat Site since it provides important life requisites for many bird species; and is considered a critical spring and fall staging area for a number of waterfowl (Latour *et al.* 2006).

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