Acho Dene Koe First Nation
Boreal Caribou Traditional Knowledge and Cumulative Impacts Qualitative Assessment

Non-Confidential Final Report

Submitted to:
Julian Kanigan
Manager, Cumulative Impact Monitoring Program
Environment and Natural Resources
Government of the Northwest Territories
Box 1320, Yellowknife NT X1A 2L9
Email: Julian_kanigan@gov.nt.ca

Mackenzie Valley Environmental Impact Review Board
Conference of Management Authorities

Submitted by:
Acho Dene Koe First Nation

Prepared by:
Landmark Resource Management Ltd.

ADKFN Contact: Boyd Clark, Operations Manager
Email: administration@adkfirstnation.ca

LRM Contact: Julie Swinscoe, Project Director
Email: julie@landmarkrm.com

Re-submitted to CIMP: October 2018

Table of Contents

List of Images

List of Tables:

List of Figures

A Guide to Acronyms

ADKFN	Acho Dene Koe First Nation
AiP	Agreement in Principle
BC	British Columbia
CI	Cumulative Impacts
CIMP	Northwest Territories Cumulative Impact Monitoring Program
CMA	Northwest Territories Conference of Management Authorities
GNWT	Government of Northwest Territories
KH	Knowledge Holder
LUP	Land Use Plan
NWT	Northwest Territories
SARA	*Species at Risk Act*
TEK	Traditional Ecological Knowledge
TK	Traditional Knowledge
TLU	Traditional Land Use
VC	Valued Component
VEC	Valued Ecosystem Component
WG	Working Group

Abstract

This report documents the purpose, methodology, results, and conclusions of a traditional knowledge and cumulative impact qualitative assessment regarding boreal caribou undertaken collaboratively by Acho Dene Koe First Nation and Landmark Resource Management Ltd. ("the Study"). The purpose of the Study was to examine the natural and industrial impacts to boreal caribou within Acho Dene Koe First Nation's traditional territory. For the purposes of the Study, analysis was limited to the portion of Acho Dene Koe First Nation's traditional territory in the Northwest Territories ("the Study Area"). The Study was conducted under the Northwest Territories Cumulative Impact Monitoring Program to supplement the program's goals of better understanding and mitigating the cumulative impacts and environmental trends affecting caribou, water, and fish in the region.

Boreal caribou have a longstanding cultural and economic importance to Acho Dene Koe First Nation, forming part of the basis of the Nation's traditional economy and figuring prominently in the Nation's body of traditional knowledge. Boreal caribou are also a species at risk in Canada, and have been identified as a "threatened" species under the Government of Canada's *Species at Risk Act* in need of special management actions in response to declining populations.

Preliminary scoping for the Study began in January 2017, and desktop research was initiated in October 2017. Information for the Study was drawn from traditional knowledge interviews with Acho Dene Koe First Nation members which took place over the week of January 16, 2018, as well as from literature review and from geospatial analysis of existing datasets held by the Governments of Northwest Territories and British Columbia. Categories under consideration included those ecological components that are vital to the continued survival of the species in the Study Area (habitat, migration routes, calving areas, food sources, water sources), and those aspects of Acho Dene Koe First Nation culture that risk being lost to future generations should adverse impacts to caribou continue (hunting, transportation routes, habitation and gathering areas, historic and named places). The Study found that although some herds of healthy caribou individuals exist within Acho Dene Koe First Nation traditional territory, boreal caribou face a range of disturbance threats from natural and human-caused sources including human development, contaminated sites, forest fires, vegetation clearing, and linear features. Linear disturbance features, such as pipelines, seismic lines, and roads, pose a particularly significant risk, as they afford predators easy access throughout the caribou's habitat, thereby increasing predation on the caribou. Geospatial analysis found that direct disturbance has reached levels of 1.45% of the Study Area, and that together with indirect disturbance, total disturbance equals approximately 47%.

These threats to boreal caribou in turn threaten the intergenerational transmission of traditional cultural practices and values surrounding the caribou. Despite the longstanding importance of caribou in the traditional diet and cultural activities, Acho Dene Koe First Nation has responded to the concern around caribou population by targeting other non-threatened species for big game hunting, such as moose and deer, thereby demonstrating their stewardship over their traditional territory. It is imperative that Acho Dene Koe First Nation be recognized as full participants in caribou management, and that governments fulfil their constitutional duty to consult and accommodate Acho Dene Koe First Nation's treaty-protected rights in regards to hunting caribou.

Key Messages

Key messages from the Study are:

- Acho Dene Koe First Nation is a signatory to Treaty 11. Treaty 11 protects Acho Dene Koe First Nation's vocation of hunting, trapping and fishing. Boreal caribou are, and have always been, an integral part of Acho Dene Koe First Nation's hunting vocation. Boreal caribou traditionally hold a prominent and important role in Acho Dene Koe First Nation culture and subsistence practices. This longstanding importance has led to the transmission of cultural practices, teachings, values, and Traditional Ecological Knowledge
- A land use plan has not yet been established through the First Nation's past relationship with the Dehcho Process or through its own treaty land claim to date.

- Past economic development initiatives (in particular related to oil and gas) within the area under consideration located in the southwestern Northwest Territories has led to serious disturbance of the boreal caribou's habitat which threatens the species' survival. Forest fires and linear anthropogenic (human-caused) disturbance features are particularly harmful to the caribou as they destroy habitat and increase predation, respectively.
- In response to a perceived vulnerability of the species, and despite the caribou's longstanding cultural importance for Acho Dene Koe First Nation, the Nation's members have largely altered their hunting practices, instead targeting other large ungulates which have become increasingly common in recent years. However, the hunting of caribou does continue among the members of the Nation, with particular emphasis placed on utilizing every part of the animal and sharing of harvest among the members.
- Should boreal caribou populations continue to decline in Acho Dene Koe First Nation's traditional territory, the species, the natural environment, and the Nation's Traditional Land Use and Traditional Ecological Knowledge surrounding boreal caribou will be threatened. The mismanagement of caribou herds has a direct adverse impact on ADKFN's treaty protected right to hunting, aboriginal rights and Acho Dene Koe First Nation's inter-generational transmission of cultural knowledge. Decision-makers must take into account the cumulative effects of development and land alterations on caribou when considering applications for future land-disturbing activities, and must fulfil their constitutional duty to consult and accommodate Acho Dene Koe First Nation's treaty protected rights.

1 Introduction

In January 2017, Landmark Resource Management Ltd. (Landmark) began the preliminary scoping of a traditional knowledge (TK) and cumulative impact (CI) qualitative assessment for Acho Dene Koe First Nation (ADKFN).

The intent of this collaboration was to examine the natural and industrial impacts to boreal caribou within ADKFN's traditional territory ("the Study").

The Study's plan was finalized in October 2017, and desktop research began on November 8, 2017. This was followed by ADKFN member-based interviews during the week of January 16, 2018.

Information provided in this report was gathered from a literature review, geospatial analysis of existing datasets held by the Government of Northwest Territories (GNWT), the Province of British Columbia (BC), and ADKFN, in addition to ADKFN member-based TK interviews information gathered during Phase 1 activities related to ADKFN's Land Use Planning (prepared for and submitted to the Government of Canada as part of the land claim agreement negotiations between ADKFN, Canada and the GNWT).

Information was collected within the portion of ADKFN's traditional territory in the Northwest Territories (NWT) that is currently subject to ADKFN's land use planning ("the Study Area"). Reports containing additional information regarding the movements of boreal caribou elsewhere in Canada were also consulted, to better understand the boreal caribou migration routes and how those routes are being impacted by development.

1.1 Purpose and Overview of Study

Boreal caribou (*Rangifer tarandus caribou*) are traditionally a highly significant species to ADKFN and the species is currently listed as 'threatened' under Canada's *Species at Risk Act* (SARA). As a keystone indicator species both culturally and ecologically, boreal caribou are the focal point of the Study and form the basis of the analysis of the cumulative impacts of both human and natural disturbances occurring in ADKFN territory.

The Study is being conducted under the Northwest Territories Cumulative Impact Monitoring Program (CIMP) to supplement the program's goals of better understanding and mitigating the cumulative impacts and environmental trends affecting caribou, water, and fish in the region. Under CIMP, the GNWT and ADKFN have entered into a contribution agreement regarding capacity funding for the Study. The Study intends to be mutually beneficial to CIMP and ADKFN, and seeks to provide meaningful information on the cumulative impacts on boreal caribou within ADKFN's traditional territory, and how the incorporation of ADKFN TK on this topic can aid in regulatory decisions and mitigations.

The Study has several objectives and specific research questions, aimed to determine:

- Past and present traditional land use (TLU) of the Study Area as it relates to boreal caribou, and how that TLU has changed with development of the land;
- The potential effects of continued land and resource development on boreal caribou habitat range in the Study Area;
- How the land and ecological features in the Study Area have been impacted by past and present natural disturbances and industrial development;
- What the past, current, and reasonably foreseeable cumulative impacts may be on the ecological features and boreal caribou within the Study Area; and
- What the potential cumulative impacts on ADKFN boreal caribou harvesting activities may be in the Study Area.

2 Acho Dene Koe First Nation

2.1 Ethnohistory

ADKFN are descendants of the Dene people, and speak an Athapaskan language belonging to the Na-Dene family called Slavey. ADKFN ancestors occupied their traditional territory for thousands of years, sustaining their livelihood on a traditional economy of moose and caribou hunting, fishing, trapping, and plant gathering. Resource procurement followed a seasonal pattern based on their time and location of availability (the seasonal round). A rich material culture developed among Acho Dene Koe using the territory's resources, and items produced included knives and traps for hunting; moose-hide boats, sleds, and canoes for transportation; scrapers and fleshers for leather preparation; animal hide clothing, which often featured intricate beading decoration; and weapons for combat (DCMS 2012). Resource procurement according to the seasonal round necessitated a mobile lifestyle and an intimate knowledge of the region, its resources, and the uses of these resources in Acho Dene Koe culture. Many traditional resource procurement activities continue to be practiced by contemporary ADKFN members.

Contact with European settlers was established in the 18th century, and European presence increased with Alexander Mackenzie's exploration of the region. Trade between Europeans and the Acho Dene Koe people was facilitated by the Northwest Company and Hudson Bay Company trading post at Francois Lake, BC, which was later relocated to Fort Liard (Chief Gene Hope, pers. comm.). 1859 saw the foundation of the Fort Liard Mission by oblate missionary Father Zephirin Gascon, and the presence of the missionaries and Grey Nuns is reflected in the iconography of contemporary material works. ADKFN are Signatory to Treaty No. 11 (Treaty 11).

Treaty 11 protected Indigenous signatories' right to hunt, and these rights are enshrined in the *Constitutional Act,* 1982. Prior to entering into Treaty 11, signatories expressed their fear that their liberty to hunt, trap and fish would be taken away or curtailed, but were assured by Canada's representatives that this would not be the case (Cloutier, 1921). Treaty 11 explicitly protects their Indigenous signatories "right to pursue their usual vocations of hunting, trapping and fishing throughout the tract surrendered" subject to regulation and the alienation of certain lands. In addition to an established Treaty right to hunt, ADKFN asserts an Aboriginal right to hunt throughout its traditional territory, including in the Northwest Territories.

2.2 Traditional Territory

ADKFN's traditional territory spans the southwest portion of the Northwest Territories, northeast British Columbia, and southeast Yukon (Figure 1). Due to funding and jurisdictional restraints, the focus of the Study and this report is the portion of ADKFN's traditional territory located solely within the Northwest Territories.

The southwestern NWT is a significant region to ADKFN. The hamlet of Fort Liard is currently the principal residence for the majority of ADKFN members who reside in NWT. Several waterways and overland trails converge at the hamlet, and the Liard River is an important transportation route for ADKFN members; the river is travelled via dog during the winter freeze months, and via boat during the rest of the year. The region's lakes, including Fisherman Lake, Lede'h Ke'h (Bovie Lake), and Celebita Lake are important sites for resource procurement and for their cultural significance to ADKFN (DCMS 2012). Fish are caught in the lakes, and ADKFN has historically used these locations for habitation, hunting and trapping cabins, tool manufacture, plant gathering, spiritual and ceremonial purposes, and burials (DCMS 2012).

YUKON TERRITORY

NORTHWEST TERRITORIES

BRITISH COLUMBIA

N

7

97

Toobally Lakes

Fantasque Lake

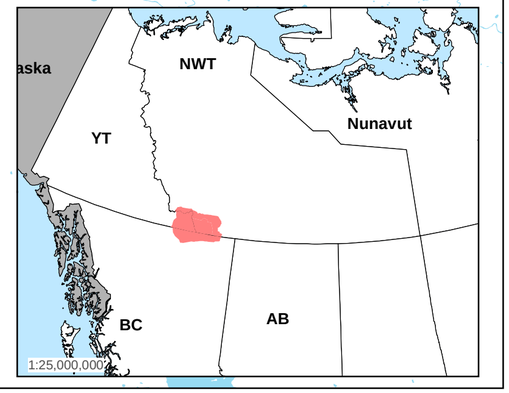
Fisherman Lake

Liard River

Fort Liard

Trout Lake

Maxhamish Lake



NAHENDEH

Landmark RESOURCE MANAGEMENT LTD.

Date Produced: 2018-02-15
Coordinate System: Deh Cho Lambert Conformal
Data Source: GeoBC, NRCan, ADK, GEOGratis

Figure 1: Acho Dene Koe First Nation Traditional Territory

Treaty 8 and 11 Boundary
Acho Dene Koe Traditional Territory
Major Highway
Major Waterbody

0 5 10 15 20 Km

1:750,000

2.3 Study Involvement

The contributions of ADKFN members and leadership representatives were essential for the successful completion of the Study, and took place at various stages throughout the course of the Study.

The development of a proposal to the NWT CIMP for a TK and CI Qualitative Assessment began in mid-2016. In 2017 Landmark was retained as an external contractor to superintend ADKFN's Lands and Resources department, and to provide assistance to both comprehensive land claim negotiations and project delivery support for various initiatives in NWT, BC, and YT. The CIMP proposal was accepted by ADKFN Chief and Council in September 2017.

Information regarding TK and TLU was gathered from nine (9) ADKFN Knowledge Holders (KHs) interviewed in January 2018. Capacity building took place during the Study in the form of training an ADKFN member in TK interviewing techniques and data collection; the ADKFN member was present throughout the interviews, and assisted the team lead in the collection of data in each interview.

ADKFN leadership chose the Knowledge Holders, worked with the Landmark representative during the week of the interviews, reviewed the draft report, and provided input into the final report.

3 Boreal Caribou

Boreal caribou are a specific population of the greater woodland caribou sub-species of caribou within Canada. Boreal caribou are distinguished from their woodland caribou cousins by the habitat they use; boreal caribou range is limited to forests (preferably old growth boreal) and they are specifically found within the forests east of the Mackenzie Mountains (Conference of Management Authorities, 2017). Boreal caribou are notably cautious and startle easily; as a result, any disturbance to their habitat can significantly impact their movements and overall population. Boreal caribou differ from other types of caribou found in western and northern Canada primarily because they do not seek refuge from predators by migrating to mountainous areas. Rather, boreal caribou prefer to live in forested areas year-round and spread out during calving, further opening them up to the risks of predation. To this end, boreal caribou require large tracts of contiguous forest in order to establish sufficient space, or buffer zones, between them and various predators such as wolves, wolverines, bear, and human harvesters.

Sub-Sections 3.1–3.4 describe current observations of impacts to boreal caribou from ADKFN, federal, provincial, and territorial perspectives, respectively.

3.1 Cultural and Subsistence Significance to ADKFN

Caribou, known as *mbedzih* in South Slavey, figure prominently in the traditional lifestyle of the Acho Dene Koe people. Big game hunting, together with trapping, fishing, and plant gathering, formed the basis of Acho Dene Koe traditional economy (DMCS 2012a). The animals continue to be harvested by contemporary ADKFN members, and make up a significant portion of the traditional diet, alongside other food sources such as moose, deer, bear, and grouse (Quicksilver 2013). Because of this longstanding cultural and economic importance, ADKFN members are acutely aware of caribou habitat locations within their traditional territory, including mineral licks and calving areas, and are attuned to their patterns of behaviour (Quicksilver 2013).

The historical importance of caribou in Acho Dene Koe culture and economy was reiterated by Knowledge Holders interviewed during the Study's 2018 interviews. Traditional techniques of caribou hunting, preparation, and utilization have been passed down through generations, with particular emphasis on utilizing every part of the animal, including meat, bones, hides, and internal organs (KH02, KH03, KH04, KH06, January 2018 Interviews). ADKFN hunters demonstrate stewardship through their hunting practices by avoiding female caribou during calving and avoiding the species altogether when populations are low (KH03, KH06, January 2018 Interviews). Cultural importance is also placed on communal sharing of harvested caribou, especially with ADKFN elders (KH06, January 2018 Interviews).

ADKFN representatives gathered in the hamlet of Fort Liard with the Government of Northwest Territories Department of Environment and Natural Resources (ENR) facilitators, James Hodson (Wildlife Biologist), Nic Larter (Wildlife Biologist), and Angus Smith (Wildlife Intern) on May 27, 2015 with the goal of compiling relevant data surrounding traditional ecological knowledge (TEK), including local observations and experiences, regarding boreal caribou in ADKFN traditional territory.

At the function, ADKFN participants conveyed their concerns regarding boreal caribou population levels, wolf and bear population levels, and the impacts of human activity including roads, seismic lines, sumps, ponds, and other small bodies of water created by oil and gas development, as well as the impact of hunting on boreal caribou populations (Hodson, Larter, Smith, 2015).

Central to the ADKFN members' observations and concerns is that fact that wolf and bear populations are historically higher than previously observed in recent memory. The increased bear population was noted as a significant concern regarding the safety of land harvesters in the area. As such, ADKFN members attribute the significant growth in bear and wolf populations to have resulted in a marked and significant decline in the boreal caribou population. This is evidenced further by the number of boreal caribou which ADKFN members not only see, but are capable of harvesting (Hodson, Larter, Smith, 2015).

ADKFN leaders also voiced their concerns with people from outside the region coming in to hunt in ADKFN territory. As stated during the consultation meeting, ADKFN members are concerned that they are able to

monitor neither what animals are being hunted, nor the means by which they are being hunted, by visitors from outside the Dehcho region and those outside of the NWT. At the meeting, it was conveyed to ENR that a notification system should be designed and implemented to help ADKFN members gauge what, if any, impacts non-resident harvesting has on local boreal caribou and other species (Hodson, Larter, Smith, 2015)

Lastly, ADKFN members stated that increased predation from wolves and bears has had a detrimental impact on boreal caribou and moose populations. ADKFN members asserted that more data on wolves must be collected for future implementation of the boreal caribou recovery plan.

3.2 A Species at Risk

The last two decades have seen the health of boreal caribou herds markedly declining. The species is recognized to be threatened at the federal, provincial, and territorial levels. Under the Government of Canada's *Species at Risk Act* (SARA), boreal caribou have been identified as 'threatened' and in need of special management actions in response to declining populations (Environment Canada, 2012). Of the fifty-one (51) local populations of boreal caribou in Canada, fourteen (14) are believed to be self-sustaining (Environment Canada, 2012). The Committee on the Status of Endangered Wildlife in Canada designates the threatened status to be due to habitat disturbance and predation in Alberta, British Columbia, Northwest Territories, and Yukon (COSEWIC, 2002). Additionally, the British Columbia Conservation Data Centre 'Blue-Listed' boreal caribou due to observed low calf recruitment, loss of habitat, and declining population numbers (Culling and Culling, 2006). Further justifying that listing, the Province of British Columbia 'Red-Listed' Boreal Caribou in 2010, illuminating the full extent to which the species have been adversely impacted by various environment and anthropogenic factors.

The primary habitat of boreal caribou in western and northern Canada is rich in natural resources such as minerals, oil, gas, and timber. As resource development increases, the total area of undisturbed critical habitat for boreal caribou is reduced; additionally, boreal caribou are notably shy and easily disturbed. In conjunction with a decrease in absolute square kilometers of habitat, Nagy has noted that boreal caribou avoid linear features (such as seismic lines) by 400 m (2011). In Alberta, Dyer determined that female caribou maintained a 1 km distance from oil and gas well sites, and avoided areas within 250 m of roads and seismic lines (Dyer et al., 2001). Avoidance was more pronounced during the winter and least pronounced in the summer. Consequently, boreal caribou in northeastern Alberta displayed a predilection for unused secondary linear features during winter while avoiding primary roads (Boulanger et al., 2012). In effect, research findings indicate that increased habitat disturbance with regard to resource development directly impacts the capacity of the species to effectively utilize the environment around them for sustenance. Moreover, such development exacerbates their ability to avoid harmful encounters with predators, namely wolves, who in turn are afforded additional routes and paths into boreal caribou areas.

Wittmer and others found that boreal caribou avoidance of linear features was related to predation risk (2005). It is believed that seismic lines and roads may be used by wolves for access into boreal caribou habitat. Computer models suggest that wolf-caribou interactions increased with the density of linear disturbances in caribou habitat (McCutchen, 2007; Whittington et al., 2011). Canada's National Recovery Strategy for the species defined 'disturbed habitat' as a habitat showing:

1. Anthropogenic disturbance visible on Landsat at scale of 1:50,000, including habitat within a 500 m buffer of the anthropogenic disturbance; and/or
2. Fire disturbance in the last 40 years, as identified in data from each province and territorial jurisdiction (Environment Canada, 2008, 2012).

3.3 Province of British Columbia's Strategy to Conserve Boreal Caribou

As per the National Recovery Strategy, provinces, territories, and First Nations communities have been tasked with developing their own guidelines and strategic action plans to mitigate and avoid adverse impacts on boreal caribou populations in British Columbia, Alberta, Northwest Territories, and Yukon (Environment Canada, 2012).

Enumerated below are the Province of British Columbia's recommendations for caribou management for industrial project developments (BC FLNRO, 2014):

1. Identify caribou habitat and historic and current caribou use of those habitats within the proposed project footprint and its area of influence.
2. Identify caribou indicators within the project area by caribou ecotype.
3. Identify the impacts of proposed activities on caribou population and habitat.
4. Avoid or minimize new disturbance to, or loss of, important habitats.
5. Avoid increasing the density of linear disturbances within or in proximity to caribou habitat.
6. Avoid displacing caribou and minimize direct and indirect mortality on caribou populations.
7. Avoid increasing the predation risk for caribou populations.
8. Avoid contaminating caribou habitat.
9. Restore habitats to a condition that provides a similar level of functional caribou habitat to that of an area absent of all industrial activity.
10. Develop a monitoring and adaptive management plan to monitor the effectiveness of measures to avoid, minimize, and restore boreal caribou habitat.
11. Follow Least Risk timing windows for caribou.

Due to the pressure from First Nations and environmental groups, as well as litigation, the Province of British Columbia requires that proponents whose development projects will adversely impact caribou herds provide species management plans using provincial guidelines as a blueprint.

3.4 Northwest Territories Strategy to Conserve Boreal Caribou

Under the NWT *Species at Risk Act*, boreal caribou have been identified as 'Threatened.' The Act stipulates that this designation is defined as a species that is likely to become endangered in NWT if action is not taken to reverse the causal factors related to extirpation or extinction. The Act affirms that a comprehensive recovery plan must be implemented for a Threatened species within two years after the designation is accepted to the NWT list of species at risk.

Northwest Territories Conference of Management Authorities (CMA) was established under the Act and is comprised of wildlife co-management boards and governments in the NWT that share responsibility for the conservation and recovery of species at risk. The CMA has outlined a recovery strategy for mitigating the factors which have led to boreal caribou decline, as well as reversing and improving the status and natural habitat of the species. In collaboration with various First Nations communities (e.g., Tłı̨chǫ Government, Wek'èezhìi Renewable Resources Board, Sahtú Renewable Resources Board, Gwich'in Renewable Resources Board) and the Wildlife Management Advisory Council of the NWT, the CMA has developed and submitted a comprehensive recovery plan to be approved by the territorial government (Conference of Management Authorities, 2017).

The CMA has laid forth seven core objectives it its recovery plan (Conference of Management Authorities, 2017):

1. Ensure there is adequate habitat across the NWT range to maintain a healthy and sustainable population of boreal caribou.
2. Ensure that harvest of boreal caribou is sustainable.
3. Obtain information to inform sound management decisions, including boreal caribou ecology, key habitat and population indicators, and cumulative effects.
4. Manage boreal caribou collaboratively, using adaptive management practices and the best available information.

5. Exchange information with NWT members of ADKFN about boreal caribou in all regions.
6. Further to the national recovery strategy, ensure recovery obligations for protecting critical habitat and maintaining a self-sustaining population are met or exceeded in NWT.

Analysis by Environment Canada suggests that boreal caribou require habitat that has less than 35% disturbance (or a minimum of 65% undisturbed habitat), and a minimum 60% probability of maintaining a stable or increasing population trend over 20 years is necessary (Conference of Management Authorities, 2017). As of 2014, approximately 67% of boreal caribou range is classified as undisturbed in the NWT (Conference of Management Authorities, 2017). Per recent communication with the CMA, boreal caribou range has already reached the mandated 65% of undisturbed critical habitat as of the end of 2017; therefore, the necessity for the swift implementation of a comprehensive recovery plan has become critical (Conference of Management Authorities, 2018).

In response to this rapid decline of undisturbed critical habitat, an Agreement in Principle (AiP) is being developed by the CMA concurrently to the Study, with the goal of recommendations and mitigations to be submitted to the Canada's Governor in Council in the spring of 2018. The recommendations and mitigations will focus on reversing and significantly improving the current trends of declining critical habitat and populations. The CMA intends to use its recovery plan as the starting point for its AiP, in addition to supplementing with additional data from stewardship partners from provincial, territorial, and Indigenous governments and communities.

Currently, human activity and naturally occurring fires cause the greatest habitat disturbance for boreal caribou in the NWT; both of these disturbances have been linked to increased levels of predation. In 2014, severe fires in the NWT resulted in the loss of approximately 2.6 million hectares of forest within the North Slave region, with a further loss of 3.3 million hectares throughout the rest of the NWT (Conference of Management Authorities, 2017). It is estimated that the 2014 fires reduced the percentage of undisturbed habitat from 69% to 67%.

There are a number of gaps in wildlife ecologists' and governments' understanding of the relationships between boreal caribou, disturbance, and predation in the NWT. However, the links between habitat disturbance, predation and boreal caribou decline are well studied in many other parts of Canada. The weight of evidence from scientific studies and TK indicates that increased predation linked to habitat disturbance is the main cause of declining populations across Canada (Environment Canada, 2012).

4 Methods

The following methodology was used as the framework to carry out the Study.

4.1 Intellectual Property

The information provided during the Study is the intellectual property of ADKFN; the information gathered during the TK interviews belongs to the Knowledge Holders interviewed during the Study and ADKFN, collectively. The Study was designed in collaboration with and was subject to the approval of ADKFN. Any recorded information (including notes, photographs, or audio, whether on tape, transcribed, or electronic form) is considered the property of ADKFN and will be returned to ADKFN upon completion of the Study, unless ADKFN requests that Landmark keep a copy of the information. Information has been provided by ADKFN with the understanding that the Boreal Caribou TK and CI Qualitative Assessment is intended for the use of ADKFN and the CIMP, as it informs future regulatory decisions and mitigations as they impact boreal caribou within ADKFN traditional territory.

Knowledge Holders were advised that information provided would be summarized in a report and presented to ADKFN review of accuracy and suitability prior to its submission to the GNWT. In order to obtain prior informed consent of Knowledge Holders, the purpose and goals of the Study, as well as the nature and intentions of the CIMP were explained during the first meeting with ADKFN study team members and prior to the commencement of each interview. The discussion also included options and implications for sharing confidential information (e.g., presenting information to the appropriate level of detail to protect the information and implications for not sharing the information at all).

ADKFN, the GNWT's ENR, and Landmark have entered into a Data Sharing Agreement to clarify and formalize a framework for sharing TK throughout the Study.

The agreement includes the following principles:

1. To work together in the spirit of mutual respect and understanding.
2. TK Holders and ADKFN hold the intellectual property rights for the TK information shared.
3. Use of TK in the submission of the Study's results is established through permission of ADKFN. It is understood that site-specific information necessary for resource management planning will be made publicly available to government agencies to inform future decisions and mitigations. As a result, no information collected from the Study that is deemed confidential in nature will be made available to any government agencies or the general public; all information shared will be subject to ADKFN approval.
4. It is understood by the Parties that the GNWT will share the results of the non-confidential report as described in the agreement with regulatory authorities, as appropriate.

TK information is being shared with the CIMP to inform and improve future regulatory decisions and mitigations related to industry and natural impacts to boreal caribou and ADKFN land use; to allow the information to inform future regulatory decisions and mitigations, the non-confidential information may be provided to the public by CIMP following ADKFN's review.

4.2 Scoping Process

Due to the cultural and ecological significance of the boreal caribou to ADKFN, the research goals of CIMP were identified as an opportunity to contribute meaningful TK regarding the species. In January 2017, ADKFN approached Landmark to collaboratively conduct a TK-focused study on the cumulative impacts to boreal caribou habitat range in its traditional territory within the NWT. Landmark subsequently began the preliminary scoping for the Study in collaboration with ADKFN, with a focus on the LUP priorities related to the species and its preservation, and ADKFN's traditional harvesting rights. Following feedback from the GNWT, the Study's plan was solidified in October 2017.

4.2.1 Types of Aboriginal Knowledge

Indigenous people in Canada have a connection to the natural environments that sustained preceding generations, and continue to sustain a distinct way of life. These environments support personal and collective histories and identities, and are frequently the foundation for spiritual practices. Indigenous people who have lived on the land have vivid and detailed memories and sensory perceptions, and this information constitutes the basis for traditional knowledge. This knowledge:

> is generally grounded in specific uses of particular ecosystems. It is inseparable from landforms, environmental quality, survival of particular species, and subsistence activities. Knowledge is taught, learned, tested and expanded through traveling and using a specific territory. Modifying the landscape, biodiversity or human ecology jeopardizes knowledge (Battiste and Youngblood Henderson, 2000).

By incorporating TK into cumulative impact assessments, the information base considered in environmental assessments is broadened and provides an understanding about the potential effects of industrial and natural impacts on Indigenous people's lands, waters, resources, and activities. The consideration of potential effects of past, current, and future developments, as well as natural impacts on traditional lands and activities, and the environmental components within it is of cultural, environmental, and ultimately, socio-economic relevance because it pertains to the social and physical well-being of the affected Indigenous community. It should be noted, however, that TK is lived knowledge, and therefore is not always conducive to being recorded via interview format or documenting in a written report; for this reason, this report should be considered one of many steps in the incorporation of TK in decision-making processes, but ongoing dialogue is necessary in order to realize the full reconciliation and recognition of ADKFN's rights.

TK is passed on orally, from generation to generation, and current observations often have very old origins. Information shared by Aboriginal participants is primarily qualitative and is based on sensory experience, oral traditions, and cultural norms and values.

The Study considers two types of TK: TLU information and TEK. Here, TLU information focuses on activities as well as sites, areas, and locales of cultural significance within traditional lands and territories. While Landmark typically classifies TLU sites according to nine categories during a TK study, the focus of the Study was limited to four relevant categories:

- Habitation and Gathering Areas (e.g., cabins, camps, and teaching areas)
- Subsistence/Hunting Areas
- Transportation Routes (e.g., travel routes, trails, trade routes, and canoe portages)
- Historic and Names Places; Landforms (e.g., battle sites, lookouts, culturally significant landforms, and Indigenous named sites)

TEK is the wisdom and understanding of the natural and cultural environment that has accumulated over countless generations. Ideally, TEK is shared with practitioners of technical scientific disciplines to provide an alternative perspective for establishing baseline conditions and assessing project effects. TEK is relevant to various project components (e.g., design, safety, aesthetic considerations, closure, and reclamation), the biophysical environment (e.g., wildlife, vegetation, fisheries and aquatic resources, hydrogeology, geology and terrain, climate, soils, palaeontology, noise, and air), and the human or socio-cultural environment (e.g., Aboriginal culture, health, socio-economics, TLU, archaeology, and heritage). TEK also relates to the cumulative effects of past and existing activities on both culture and the environment. The sharing of TLU information and TEK can lead to the development of strategies to avoid, reduce, or mitigate potential effects of proposed projects on sensitive cultural areas.

TEK sites identified during the Study are classified according to five categories:

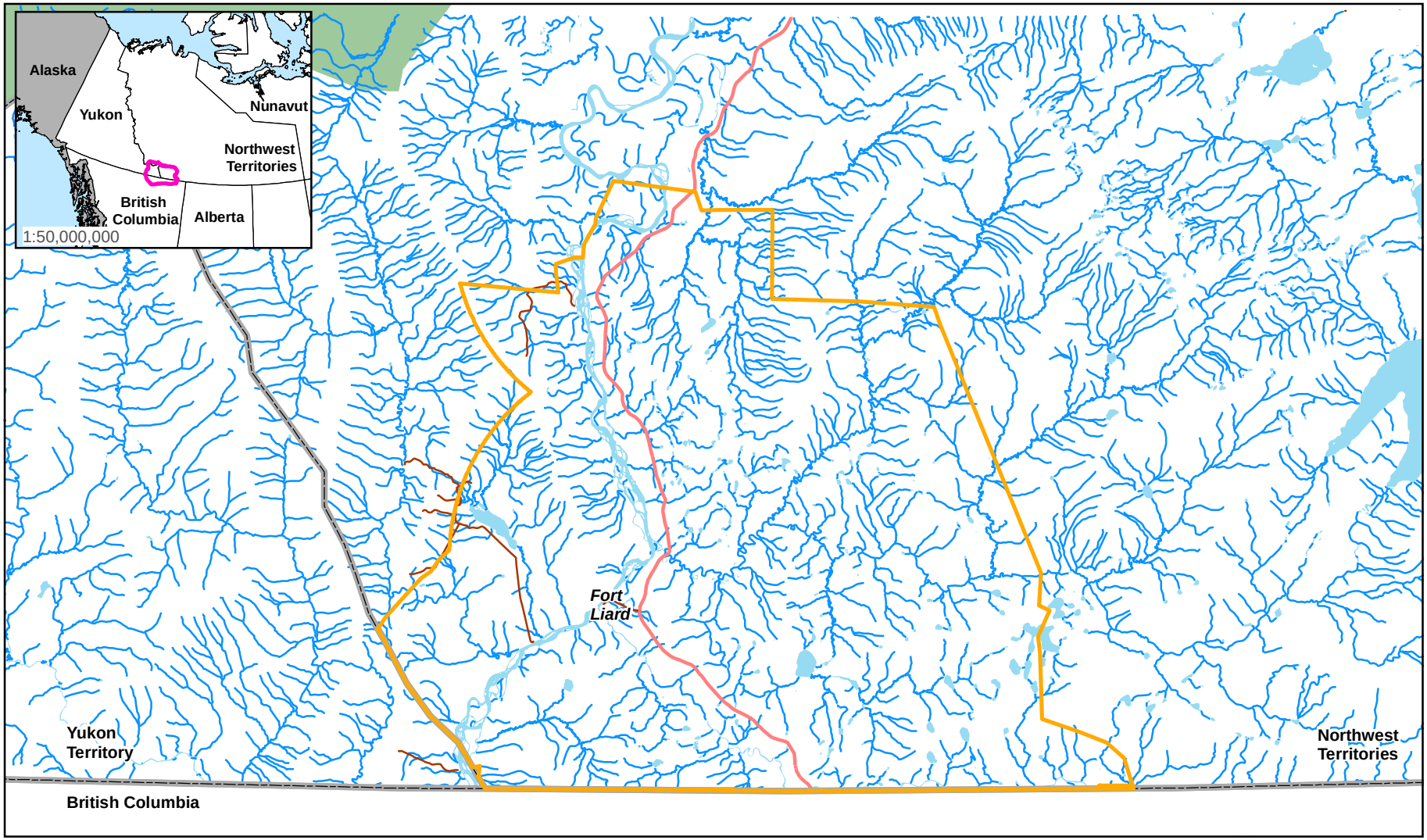
- Habitat Areas (e.g. known habitat sites, caribou sightings, and forest fire sites—which indicate areas of habitat loss)

- Migration Routes
- Calving Areas
- Food Sources (e.g., vegetation, muskegs, and mineral licks)
- Water Sources

4.2.2 Spatial Boundaries

ADKFN's traditional territory spans southwestern Northwest Territories, northeastern British Columbia, and southeastern Yukon; boreal caribou habitat range spans a vast portion of Canada, from the Yukon and into Newfoundland and Labrador. In order to provide a manageable qualitative analysis that is applicable to ADKFN's and CIMP's interests, the spatial boundaries considered by the Study were limited to the boreal caribou habitat range found within the portion of ADKFN territory in the NWT (Figure 2). The expanse of the Study Area comprises approximately 618,596 ha.

Information collected during the ADKFN member-based TK interviews focused on the Study Area described above; however, information from areas outside of the Study Area was also consulted during the literature review and geospatial analysis portions of the Study in order to better understand the movements of boreal caribou, as they are not limited to the boundaries of ADKFN's LUP.



Study Area
ADK Traditional Territory
Major Highway
Limited Use Road
River
Provincial Boundary
Waterbody

Figure 2: Study Area

Date Produced: 2018-02-28
Coordinate System: NAD 1983 UTM Zone 10N
Data Source: GeoBC

Landmark RESOURCE MANAGEMENT LTD.

N

1:850,000
0 5 10 15 20
Kilometres

4.2.3 Valued Component, Effects, Areas of Interest, and Measurable Analysis Parameters

The Study assesses the effects of natural and industrial impacts to boreal caribou (the valued component, or VC) within ADKFN's traditional territory (TEK), and the subsequent (TLU). Areas of interest have also been identified based on their ecological and cultural interaction with boreal caribou. These areas of interest and measurable analysis parameters are provided in Table 1 below.

Table 1: VC, Effects, Areas of Interest and Measurable Analysis Parameters

Valued Component	Effect	Areas of Interest	Measurable Analysis Parameter
Boreal caribou	Natural and industrial impacts to boreal caribou within ADKFN's traditional territory	Habitat	• Availability of undisturbed habitat • Level of direct disturbances impacting habitat
		Migration routes	• Contiguousness of migration routes (routes not fragmented) • Level of direct disturbances impacting routes
		Calving areas	• Availability of safe calving areas • Level of direct disturbances impacting calving areas
		Food sources	• Changes to food sources • Level of direct disturbances impacting food sources
		Water sources	• Changes to water sources • Level of direct disturbances impacting water sources
	Changes to ADKFN's culture and subsistence practices	Hunting	• Observed presence of boreal caribou • Quantity and quality/health of boreal caribou • Access to hunting areas • ADKFN perceptions regarding viability of caribou hunting • Travel distance to caribou hunting areas
		Trails	• Access to routes • Viability of harvesting sites to which routes lead
		Habitation and gathering areas	• Access to sites/areas • Viability of sites (e.g., harvesting resource availability)
		Historic and named places	• Access to sites

4.3 Study Phases

Once scoping was completed, the Study proceeded according to the phases outlined in sub-Sections 4.3.1–4.3.5 below.

4.3.1 Literature and Geospatial Review

During this stage, relevant existing TK studies within ADKFN's traditional territory in the NWT were reviewed and analyzed. This analysis took place in November and December 2017. Existing environmental literature was also reviewed to develop a baseline understanding of the conditions and changes of boreal caribou

population and habitat range, as well as the conditions and recent changes impacting the other VECs identified in the Study.

Landmark reviewed various geospatial datasets to develop a baseline understanding of the existing impacts to the environment within the Study Area. This included information on climate change and wildfire damage, wildlife migration routes, and industrial development such as roads, seismic development and registered contaminated sites. To better understand impacts to the Study Area, information from surrounding regions was also reviewed and considered, including data from northern BC, northern Alberta, and the Yukon.

4.3.2 Acho Dene Koe First Nation Member Interviews

ÄDKFN member interviews created an opportunity for Knowledge Holders to share TLU information and TEK relevant to boreal caribou within the Study Area, and to explore and clarify members' issues and concerns regarding the anticipated cumulative impacts to the species and ADKFN's traditional lands and activities. During the course of these discussions, recommendations for mitigation measures made by ADKFN were also recorded. Individual interviews were conducted by the study team lead Jodi Carlow of Landmark, in collaboration with an ADKFN member. The local member was trained in TK interviewing and data collection, and assisted the team lead in the collection of data in each interview.

ADKFN leadership provided guidance and approval of the interview questions, as well as a list of Knowledge Holders known to possess information regarding caribou. The interviews were semi-structured using a questionnaire to keep focus; however, Knowledge Holders were encouraged to expand on topics that they felt were important. In addition to the interview questions, maps of the Study Area were reviewed with the Knowledge Holders so areas of interest could be marked on the map to document ADKFN's TEK and harvesting areas.

Each interview (which consisted of one Knowledge Holder) used a clean copy of the interview map so that no other sites identified by other Knowledge Holders were visible. Each of the completed maps, consisting of all the TK sites identified during the interview, are termed a "map biography" (also known as a "mark-up map").

Each Knowledge Holder interviewed was given a unique identifier code that is used throughout this report. This system allows ADKFN to use and/or or share components of the report without compromising the privacy of individual Knowledge Holders. The identifier codes are represented by numbers ranging from 1–9, inclusive. The full confidential list of Knowledge Holders who provided consent to participate in the Study has been provided separately from this report to ADKFN.

4.3.3 Analysis and Reporting

Information collected from geospatial analysis, literature review, interviews, and the ADKFN member verification meeting was analyzed and amalgamated into this report. The Study results, including observed changes and trends to the boreal caribou population and habitat range, were compared and analyzed alongside the anticipated cumulative impacts to determine potential mitigative options and recommendations for future regulatory decisions and policies affecting the species.

ADKFN reviewed the report in draft form and provided comments and suggestions to incorporate into the finalized version. After discussion with ADKFN, recommendations and mitigations, and anticipated cumulative impacts from both the ADKFN members and Landmark, were analyzed and incorporated into this report.

See Section 5 Study Results for more information on analysis and methods.

4.3.4 Acho Dene Koe First Nation Member Review

The draft maps and draft report were displayed and discussed with ADKFN leadership in the hamlet of Fort Liard on April 10, 2018. Results of ADKFN's comments discussed during the review with leadership are incorporated into the remainder of this report, as appropriate.

4.3.5 Report Finalization

ADKFN's requested edits were incorporated into the final version of this report, prior to its submission to the GNWT for the CIMP. The final report will be used to supplement the CIMP's goals of providing current information on boreal caribou habitat range that incorporates TK; the final report will be used to inform future regulatory decisions regarding the maintenance, recovery, and protection of the boreal caribou population and its critical habitat range. Two reports will be returned to ADKFN for final review and approval:

- A confidential version for ADKFN only; and,
- A non-confidential version for CIMP and regulator use.

5 Study Results

The Study's results were informed by geospatial analysis, literature review, and TLU and TEK regarding boreal caribou gathered during ADKFN member interviews.

The ADKFN member-based interviews provided information on land use and TEK sites. A confidential map depicting composite study results has been provided to ADKFN. The following table summarizes the sites identified during the January 2018 interviews by categories of interest to ADKFN.

Table 2: Summary of Cumulative Impact Qualitative Analysis

Areas of Interest	Number of Sites
Traditional Ecological Knowledge	
Habitat	27
Migration routes	2
Calving areas	1
Food sources (vegetation, muskeg)	13
Water sources	5
Traditional Land Use	
Hunting	33
Transportation routes	16
Habitation and gathering areas	8
Historic and named places	6

Note that some of the sites identified may contain information on woodland caribou that are not of the boreal population; however, because both species reside within the Study Area, the chance that sites capturing information on the separate caribou species could not be definitively confirmed or negated. It is our understanding that the margin for error here is very small and may only have affected a few of the TK sites in our results.

5.1 Traditional Ecological Knowledge

ADKFN have resided in their traditional territory for thousands of years, and their continued remoteness has resulted in a wealth of TEK regarding the lands and resources throughout the region. ADKFN is situated within the boreal forest, and ultimately a vital portion of the boreal caribou's critical habitat range. As a result, ADKFN's TEK provides valuable insights into the VECs that are interrelated with the vulnerable boreal caribou species.

Sub-Sections 5.1.1–5.1.5 below summarize ADKFN's TEK regarding the VECs identified for the Study, including information on past and present ecological conditions, and the related observed changes to those conditions.

5.1.1 Habitat

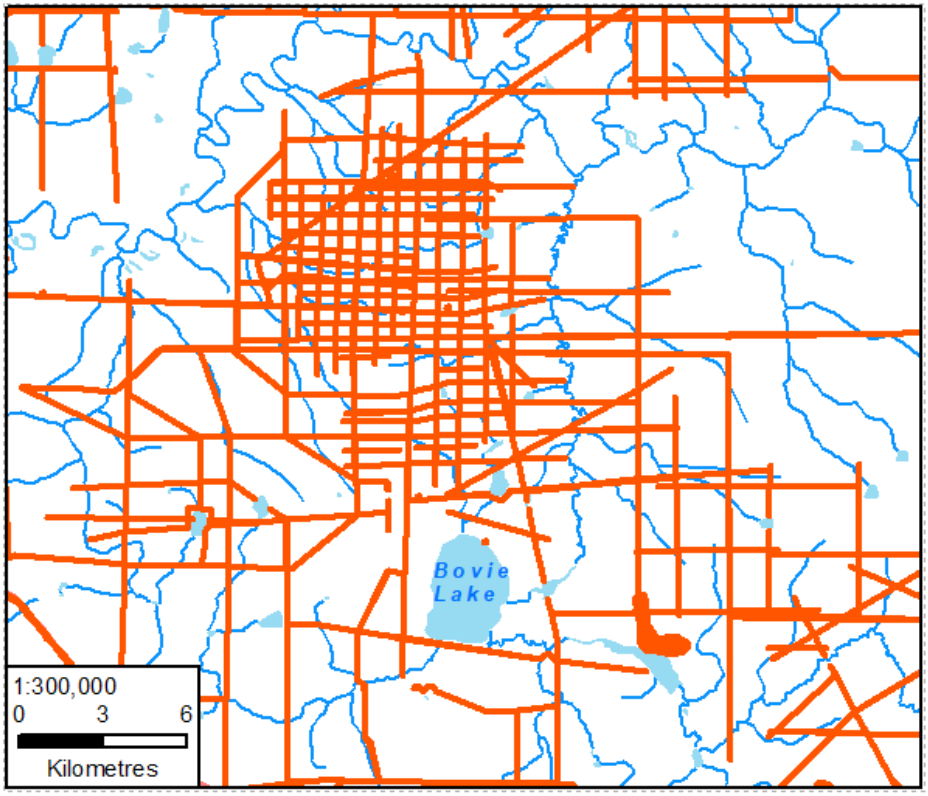
Boreal caribou dwell in the boreal forests east of the Mackenzie Mountains and, unlike the related woodland caribou, are generally sedentary and do not undertake large-scale migrations. The caribou avoid predators by remaining in small groups and spreading widely across the landscape. The ideal habitat for this population is large expanses of contiguous old growth pine or spruce forest with abundant ground and tree lichens (Conference of Management Authorities, 2017). Other terrain features, including muskegs and bogs with available lichen, also form part of the boreal caribou range.

Twenty-seven sites representing caribou sightings and areas of caribou habitat were identified by ADKFN Knowledge Holders interviewed in 2018. Evidence of caribou presence at these sites included observed

tracks, known locations of important vegetation, and oral reports from other ADKFN members. Knowledge Holders reported the presence of caribou at locations such as east of Hook Lake and surrounding the Arrowhead River. Knowledge Holders also commented on former caribou habitat sites where the species is no longer seen: one Knowledge Holder stated that Bovie Lake once showed signs of caribou habitation but no longer does, and recent forest fires which destroyed caribou vegetation were reported in the south-eastern portion of the Study Area, located southwest of TooChoo (Celibeta) Lake.

The Knowledge Holders explained that some boreal caribou found within the Study Area appear to belong to healthy populations, and noted that a substantial portion of their habitat range is undisturbed. However, it should be noted that due to the caribou's patterns of behaviour, it may appear that some boreal caribou groups are healthy while the species itself is at risk. Boreal caribou remain relatively stationery in their habitat, living in small sub-groups. A healthy herd may be subject to relatively little predation and disturbance, while a nearby herd may suffer from significant nearby development. Knowledge Holder comments above suggest that Bovie Lake is such an area which is no longer hospitable to caribou; this information aligns with the development footprint of Bovie Lake, which shows it is a highly disturbed area (see Image 1 below). Finally, it is also possible that Knowledge Holders' comments regarding healthy caribou groups may refer to animals belonging to the mountain woodland population.

Image 1: Development near Bovie Lake



5.1.2 Migration Routes

Boreal caribou do not migrate vast distances, but rather follow routine migration routes within a certain habitat range per each herd. The 2018 interviews identified two migration routes used by boreal caribou within the Study Area. One migration route was identified between Bovie Lake and the Arrowhead River, connecting the NWT to BC; this route is based on the species' pursuit of food resources. If food resources are lost, the migration routes used by the boreal caribou within the Study Area may be impacted. Knowledge Holders further explained that predator populations and movements—wolves in particular—have an impact on the movements of caribou.

5.1.3 Calving Areas

Boreal caribou rely on vast tracts of thick forest cover to safely engage in calving activities. Female caribou spread out into the remote areas of their habitat range during the calving periods between May and July (Quicksilver 2013). This behavior makes the animals more vulnerable to predators, such as wolves. The January 2018 interviews identified a possible calving area near TooChoo (Celibeta) Lake, noting there to be lots of young caribou observable there.

ADKFN's recognition of the importance of calving times is reflected in their hunting practices; KH06 explained that female caribou are generally not targeted in the spring, so as to allow their young the highest chance of survival (January 2018 Interviews).

5.1.4 Food Sources

A variety of vegetation species native to ADKFN traditional territory make up the diet of the boreal caribou; these include willow, tree buds, lichens, shrubs, grasses, sedges, and mushrooms (Conference of Management Authorities, 2017). Mineral licks, or natural deposits of salts and other minerals, also represent significant features for boreal caribou as sources of essential dietary nutrients, and muskegs are important ecological features providing nutrients to the boreal caribou. ADKFN is attuned to the food sources of caribou in their traditional territory not only because of the caribou's significance in traditional cultural and subsistence practices, but also due to ADKFN's TEK about vegetation in their traditional territory. Many plant species have cultural significance to ADKFN, some of which are also consumed by caribou, and knowledge about their locations, seasons of growth, and uses in ADKFN culture have been passed down through generations.

Thirteen (13) sites identified by ADKFN Knowledge Holders represented areas of known or potential caribou food sources; these include areas vegetated by plants preferred by caribou, muskegs, and two mineral licks. An important vegetated area containing caribou food sources, such as "old man's beard" lichen and spruce trees, was identified along a trail running from Bovie Lake to TooChoo (Celibeta) Lake. TooChoo Lake was also noted for the good grass it provides to caribou; other plants eaten by caribou were noted, including willow trees and a particular grass called geese grass, referred to in Slavey as *Xahdoú.* Muskegs were identified throughout the Study Area, particularly surrounding the lakes and rivers in the southeastern portion of the Study Area, and were emphasized for their suitability as caribou habitat.

5.1.5 Water Sources

ADKFN's TEK regarding the water sources in the Study Area are closely tied to their cultural traditions. Four of the named places (see sub-Section 5.2.4) identified during the 2018 interviews refer to lakes found within the Study Area. These lakes are considered to be of good quality; however, an ADKFN Knowledge Holder raised concerns over the health of Fisherman Lake. KH05 spoke of a past acid spill near the airport which impacted a nearby creek, and the Knowledge Holder is concerned that the contamination may have reached Fisherman Lake, which is of cultural significance to ADKFN (January 2018 Interviews). GIS analysis for the Study also found that approximately 87 ha within the Study Area are subject to disturbance from well sites.

The ADKFN member engagements undertaken during the Phase 1 Activities of ADKFN's LUP identified Fisherman, Bovie, and Celebita Lakes, and along the Liard, Muskeg, and Petitot rivers as water sources considered to have ecological significance to ADKFN ranging from "medium" to "very high" (Landmark and ADKFN 2017). These water sources are found within the Study Area and are likely sources of sustenance for the resident boreal caribou. A previous study found that prominent hunting areas used by ADKFN include areas near water sources including the Petitot River (DMCS 2012b), thereby demonstrating the importance of clean water sources to wildlife such as the boreal caribou. It is important for boreal caribou to have access to clean water sources in order to maintain the health of the population found within the Study Area.

5.2 Traditional Land Use

The following sections describe ADKFN's past, present, and intended future land use in the Study Area in relation to the boreal caribou. Note that as part of ADKFN's land claim negotiations the Nation is continuing

to develop a comprehensive land use plan for the entire traditional territory of ADKFN beyond the boundaries of the Study Area.

5.2.1 Hunting

The results of the Phase 1 activities of ADKFN's LUP found that the remoteness of ADKFN lands has allowed traditional activities, such as hunting, to be continually practiced and passed on to younger generations. As a result, the protection of traditional hunting sites was stressed by many ADKFN members during the engagement sessions (Landmark and ADKFN 2017).

The 2018 interviews identified thirty-three (33) caribou hunting sites within the Study Area; however, a portion of these sites pertain to the mountain woodland population rather than the boreal population. Boreal caribou hold strong cultural significance to ADKFN, and traditionally were a prominent source of food and material production via their hides (DMCS 2012a). Knowledge Holders interviewed described traditional techniques of processing the animal into tools, clothing, drum skins, and dried meat, stressing the importance of using the entire animal—including intestines, hide, and bones—and minimizing waste (KH02, KH04, January 2018 Interviews). Sharing harvested meat among the entire Fort Liard-based ADKFN membership, especially with elders, is an important value in ADKFN culture (KH01, KH02, KH06, January 2018 Interviews).

The 2018 interviews found that although the boreal caribou continue to be hunted by the Nation, ADKFN members have largely shifted their focus to other caribou populations and moose in recent years. This shift in focus demonstrates ADKFN members' ecological knowledge and understanding of the vulnerability of boreal caribou and their stewardship over the species. Stewardship was further demonstrated by Knowledge Holders' statements that female caribou are not harvested during springtime, to allow them to raise their calves.

5.2.2 Transportation Routes

Sixteen (16) sites representing trails were identified during the 2018 interviews. These trails crisscross the traditional territory of ADKFN, some following lake shorelines or traversing frozen lakes, and provide access to the territory's waterbodies, members' cabins, and the western Mackenzie Mountains. Several trails converge at the hamlet of Fort Liard, which is the principal residence of the majority of ADKFN's members who reside in the NWT. These routes are travelled by a variety of means, including via dog sled, snowmobile, ATV, and on foot, and are used by ADKFN members for various purposes, such as facilitating access to hunting areas where caribou and other animals are targeted. One identified trail also represents a named site, the Dene Trail, which leads from Skinny Lake to ADKFN members' cabins near the NWT/BC border.

Several trails utilized by ADKFN make use of the region's development cut lines, some of which are several decades old and have since been maintained by ADKFN members as transportation routes. Knowledge Holders interviewed in 2018 also remarked on wildlife use of human transportation routes; caribou have been observed by ADKFN members walking along pipelines, and wolves are known to use snowmobile trails because of the access it affords them to hunting areas. Increased wolf populations in the Study Area and the threat they pose to caribou, exacerbated by increased access from anthropogenic linear features, were commonly cited concerns among ADKFN Knowledge Holders interviewed.

5.2.3 Habitation and Gathering Areas

ADKFN's longstanding use and occupation of its traditional territory has resulted in campsites, cabins, and teaching areas within the region. Knowledge Holders interviewed in 2018 identified eight (8) such sites, which include ADKFN members' cabins, campsites utilized during multi-day caribou hunts, and teaching areas. Caribou hunting campsites were mainly framed as a past land use activity, but several Knowledge Holders interviewed recalled learning caribou hunting techniques from elder family members at specific sites within the Study Area. Teaching cultural practices to younger generations was identified as a priority during Phase 1 activities of ADKFN's LUP, and that study's working group recognized a member-wide consensus regarding the protection of cultural sites for future knowledge transmission (Landmark and ADKFN, 2017).

5.2.4 Historic and Named Places

ADKFN's longstanding connection to its traditional territory is evident in the close connection of oral history and named places to the ecological features of the land. Five named places were identified during the 2018 interviews, including lakes referred to in Slavey, named trails tied to ADKFN's history, and an area known as /me-ta-toe-the-nay/ (or, "people talk to each other in the spruce") which demonstrates the site's connection to the vegetation and oral history.

In addition to named places, a storied place was also identified during the Study. An area located near a small lake east of Grass Mountain holds the oral history of an ADKFN member landing a plane in the mountains, who then had to walk back to Fort Liard over three days; the member hunted caribou along the way, demonstrating the continued connection between the land, caribou, and ADKFN's oral traditions.

5.3 Cumulative Impacts

As a known species at risk, the boreal caribou's populations and habitat are highly sensitive to any changes to the environment within its range. Natural and anthropogenic impacts within the Study Area may result in changes to the environment, as well as impacts to ADKFN's cultural practices and activities, or traditional sites and areas.

Within the Study Area, approximately 8,983 ha contain direct disturbance, which represents 1.45% of the portion of the boreal caribou habitat range within the Study Area (Figure 3). An additional 280,182 ha of the habitat range is subject to indirect disturbance; therefore, the total area impacted by some degree of disturbance (direct or indirect) is 289,165 ha, or 47% (Figure 4). Analysis of direct disturbance features was informed by digital spatial data and imagery retrieved from various sources; these include the GNWT, Natural Resource Canada's GeoGratis, Landsat imagery, and Canada and Earthstar Imagery.

Direct disturbance features within the Study Area include:

- Buildings;
- Contaminated sites;
- Forest fires;
- Pipeline right-of-ways;
- Residential areas;
- Roads; including:
    - Major roads and highways (i.e., the Liard Highway)
    - Intermediate roads
    - Access roads
- Seismic lines; and
- Forestry cut blocks.

Direct disturbances may further be differentiated by the severity of their anticipated impact on caribou vitality. For the purposes of the Study, sources of direct impact were assigned impact ratings of High, Medium, and Low:

- High: lands impacted by these disturbance types are permanently changed and, unless remediation is undertaken, will never regenerate to old growth forest.
- Medium: lands impacted by these disturbance types are altered in a semi-permanent way, and will eventually regenerate to suitable habitat due to their moderate use.
- Low: lands impacted by these disturbance types are minimally altered and will likely regenerate to a state that approximates growth forest.

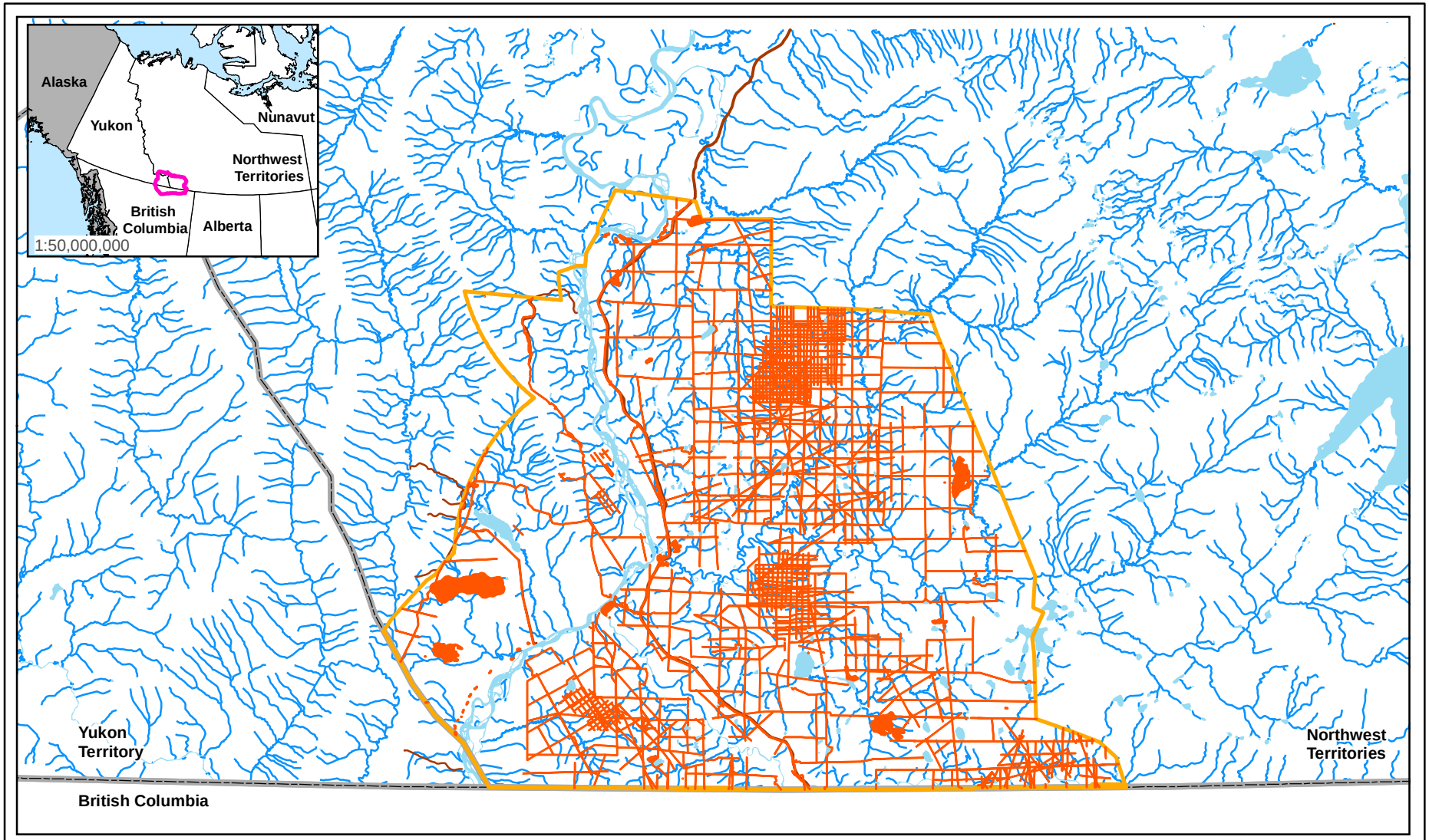
The total areas within the Study Area subject to the various disturbance sources, together with their impact ratings, are detailed in the following table. For areas where multiple disturbance features overlapped, the area was attributed to the disturbance type with the highest impact rating.

Table 3: Direct Disturbances Impacting Boreal Caribou in the Study Area

Disturbance Feature	Impact Rating	Area (ha)
Well Sites	High	87
Buildings	High	3
Residential Areas	High	202
Liard Highway	High	659
Intermediate Roads	Medium	60
Pipeline Right-of-Ways	Medium	132
Forest Fires	Medium	5,963
Cut Blocks	Medium	445
Access Roads	Low	115
Seismic Lines	Low	1,318
Total		**8,983**

The area subject to indirect disturbance was calculated by applying a buffer of 500 m around the edges of anthropogenic direct disturbance features. Considering indirect disturbance is a recognition of the complex and multi-faceted ways in which boreal caribou respond to disturbance, and the ways in which disturbance limits the caribou's effective use of the surrounding lands. Most importantly, it aims to approximate caribou's avoidance of lands subject to direct disturbance, and the increased risk of predation to which they are exposed in areas adjacent to disturbances (Canadian Boreal Forest Agreement, 2016). The National Recovery Strategy for Woodland Caribou undertook a scientific comparison of buffers on human disturbances ranging from 100–4,000 m, finally adopting 500 m as the best approximator of caribou vulnerability and avoidance of disturbed areas (Environment Canada, 2012).

Sections 5.3.1 and 5.3.2 describe qualitative analysis of the observed and anticipated cumulative impacts resulting from these direct and indirect disturbances on boreal caribou, the relevant VECs, and the cultural interests of ADKFN.



Disturbed Area
Study Area
ADK Traditional Territory
Major Highway
Limited Use Road
Provincial Boundary
River
Waterbody

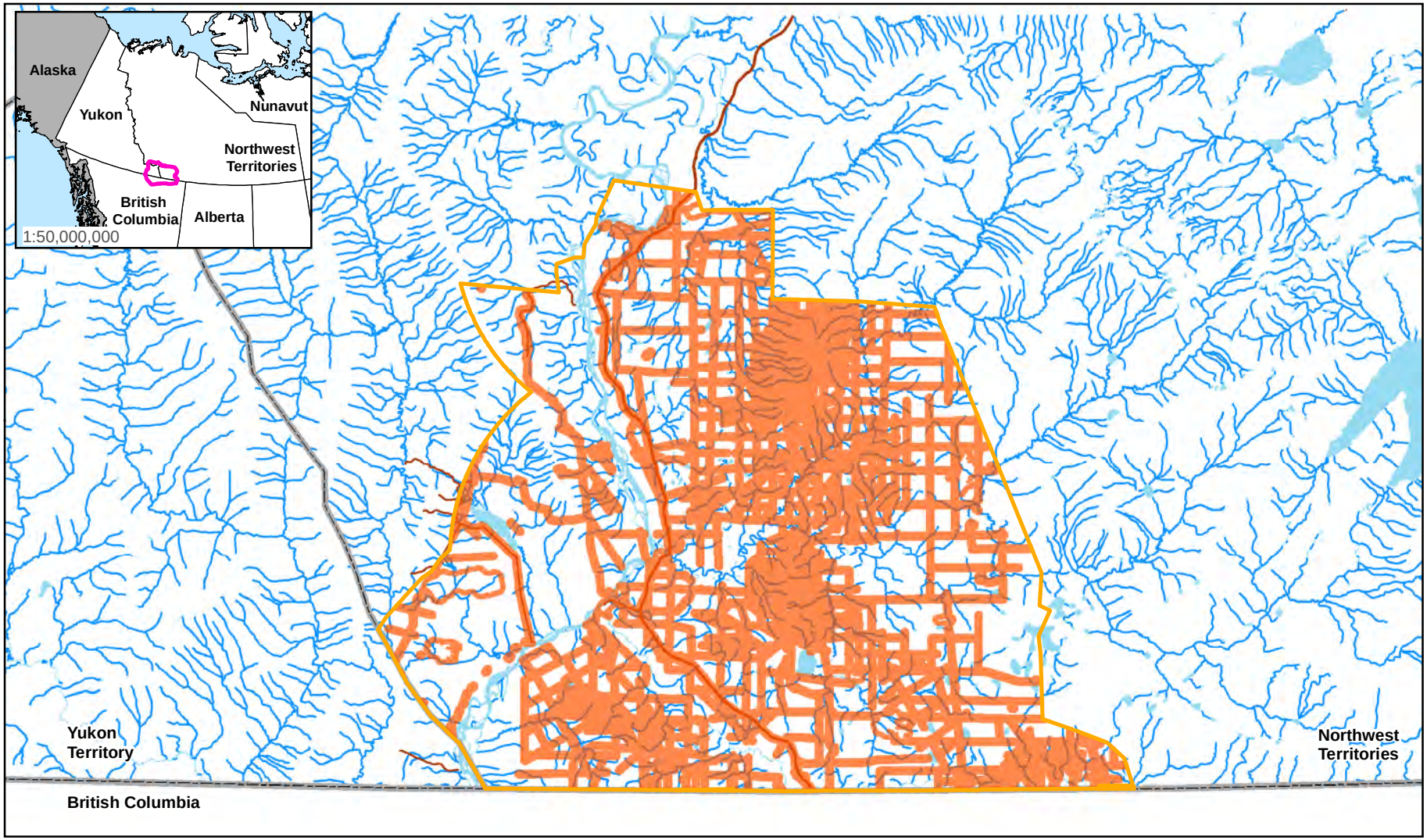
Figure 3: Direct Disturbance within the Study Area

Date Produced: 2018-04-27
Coordinate System: NAD 1983 UTM Zone 10N
Data Source: GeoBC

Landmark RESOURCE MANAGEMENT LTD.

N

1:850,000
0 5 10 15 20
Kilometres



Indirect Disturbance
Study Area
ADK Traditional Territory
Major Highway
Limited Use Road
Provincial Boundary
River
Waterbody

Figure 4: Indirect Disturbance within the Study Area

Date Produced: 2018-04-27
Coordinate System: NAD 1983 UTM Zone 10N
Data Source: GeoBC

Landmark RESOURCE MANAGEMENT LTD.

N

1:850,000
0 5 10 15 20
Kilometres

5.3.1 Traditional Ecological Knowledge

5.3.1.1 Habitat

Availability of undisturbed habitat is the most important factor for the viability of boreal caribou's continued self-sustenance (Conference of Management Authorities, 2017). Due especially to the boreal caribou's relatively stationary lifestyle, and their reliance on vast expanses of old-growth boreal forest for predator avoidance, the caribou are extremely vulnerable to changes in the landscape (and subsequent changes to predator and prey populations and behaviours) from natural and anthropogenic causes. For this reason, Canada's National Recovery Strategy has identified a minimum threshold of 65% undisturbed habitat (maximum 35% disturbance) across a caribou range to ensure a 60% chance of stable or growing boreal caribou population over time.

Linear features, namely seismic lines and roads, are a significant cause of disturbance to caribou within the Study Area. Analysis conducted to inform the National Recovery Strategy found that although caribou response to non-linear forms of disturbance (such as well sites, clearings, and cut blocks) was subject to regional variation, linear disturbance consistently had a strong negative impact on boreal caribou across all regions of Canada (Canadian Boreal Forest Agreement, 2016). Although some of these features, such as seismic lines, serve functions to ADKFN as transportation routes and hunting trails, linear features are known to influence the behaviour of caribou and their interrelationships with other species. The effective disturbance from linear features on caribou habitat extends beyond the actual disturbance footprint, as boreal caribou in the NWT have been shown to use areas located within 400 m of anthropogenic linear features less than other available habitat areas, and have been observed to travel more quickly when linear features are encountered (Nagy, 2011). Furthermore, predators make use of linear disturbance features as travel corridors; as cut lines have accumulated in the Study Area over decades of industrial activity, predators are offered a network of efficient movement throughout boreal caribou habitat, resulting in increased predation on the caribou (Canadian Boreal Forest Agreement, 2016). These scientific findings are corroborated by the traditional knowledge offered by ADKFN Knowledge Holders interviewed, several of whom cited increased numbers and movements of predators—particularly wolves—as a significant concern vis-à-vis the boreal caribou (KH03, KH08, January 2018 Interviews). KH03 cautioned that additional linear disturbance in the region from access roads will further increase wolf predation and put pressure on the boreal caribou population (January 2018 Interviews). Vegetation clearing for seismic activity and pipelines leaves a persistent impact on the natural environment, and it has been shown that cleared areas may not recover to woody vegetation for more than a century (Ray 2014). It should also be taken into consideration that industrial development, and therefore human-caused linear disturbances, are expected to increase in the NWT over the coming years (Conference of Management Authorities, 2017).

A holistic understanding of disturbance impacts on caribou habitat should also consider habitat changes which benefit other prey species, which may indirectly harm boreal caribou. Disturbances which create younger forest habitat, such as forestry cut blocks and forest fires, are conducive to rises in moose and deer, and therefore increase predator populations which also prey on caribou (Conference of Management Authorities, 2017). Higher predator populations are then exacerbated by increased access offered by linear disturbances, resulting in increased predation. Increases in alternative prey are reflected in the hunting activities of ADKFN who, despite the longstanding traditional significance of caribou, have largely switched to targeting moose as the preferred big game species for a variety of reasons as described elsewhere in this report (January 2018 Interviews).

Forest fires further pose a further threat to boreal caribou habitat availability. The Study's analysis of spatial data dated up to and including 2016 estimates that 5,963 ha within the Study Area have been impacted by forest fire within the last 40 years, which represents approximately 0.98% of the area under consideration (making it the largest single category of direct impact). Disturbance from fire is projected to increase in the NWT due to climate change, as warmer, drier summer seasons increase the likelihood of fire frequency and severity (Conference of Management Authorities, 2017). Continued impacts from forest fires are supported by information gathered from ADKFN Knowledge Holders, one of whom identified four sizeable sites of forest fire damage in the southeastern portion of the Study Area from fires which burned within the last two years. Knowledge Holders discussed the fires' negative impacts on vegetation important to local caribou herds, and the subsequent impacts on food availability (KH03, January 2018 Interviews). This

information is consistent with reports from Environment Canada discussing severe fires during the 2014–2015 seasons, which are believed to have reduced total available undisturbed habitat in the NWT range from to 69% to 67% (Conference of Management Authorities, 2017).

Considering the results of the Study's spatial analysis, the ratio of disturbed to undisturbed lands in the Study Area is greater than the prescribed 35% threshold (see sub-Section 3.4). It should be noted, however, that the National Recovery Strategy applies a disturbance threshold to the entirety of the caribou herd range, while the Study examined a delineated area in the southwest corner of NWT. Despite a relatively high level of disturbance, ADKFN Knowledge Holders indicated during TK interviews that healthy caribou populations consisting of healthy individuals still exist within their traditional territory, suggesting that caribou have managed to make effective use of the region for habitat. For this reason, it is imperative that future land management decisions consider cumulative impacts to existing caribou habitat, so as not to jeopardize what appears to be a healthy population of boreal caribou among many declining populations in other regions of Canada.

5.3.1.2 Migration Routes

A 2013 study regarding the Fortune Creek Gas Plant development shows that ADKFN has previously expressed significant concern over the fragmentation of migration routes used by wildlife, in particular caribou, from industrial development (Quicksilver, 2013). Although boreal caribou do not migrate as widely as their mountain cousins, the ability to migrate between contiguous habitat spaces is essential for the herd's survival; seasonal migration allows caribou to search more widely for food in times of scarcity, and renders caribou less vulnerable to disturbance to particular habitat areas (Environment Canada, 2012). Knowledge Holders from ADKFN identified the importance of the migration route leading from TooChoo (Celibeta) Lake north toward Arrowhead River, in particular emphasizing its role in providing food for caribou.

Linear disturbance features especially have the ability to compromise caribou movements throughout their habitat; for example, roads have been shown to act as semipermeable barriers to caribou movements in Alberta, especially in late winter (Dyer et al., 2002). Particularly in light of projected increased disturbance from climate change and industrial activity in the Northwest Territories, migration routes, such as those identified by ADKFN Knowledge Holders, should be considered in land management decisions to avoid habitat fragmentation and bolster the ability of herds to respond to current and future disturbance.

5.3.1.3 Calving Areas

The strategy employed by female caribou during calving season is to remain separate from the herds and spread across forest habitat, thereby reducing the risk of predation (Conference of Management Authorities, 2017). Therefore, the risks posed to caribou habitat generally from disturbance features, such as increased predation and habitat fragmentation via linear features, apply to calving sites as well. Calves are even more vulnerable to predation than adult caribou, and calf mortality can be as high as 50% in the first six weeks of life (Bergerud, 1974). This vulnerability is recognized by ADKFN harvesters, who actively avoid harvesting female caribou during calving seasons to ensure as high a chance as possible for calves to reach maturity and become part of the adult caribou population (KH06, January 2018 Interviews).

5.3.1.4 Food Sources

Food sources within the Study Area include a variety of vegetation species as well as mineral licks; these food sources risk being compromised by reduced availability, contamination, and proximity to disturbance features.

Changes to caribou food sources are expected to result from climate change in the region. Permafrost thaw is already causing vegetation mortality on peat plateaus, as well as changes from forest to bog-fen habitat (Conference of Management Authorities, 2017). The caribou's ability to forage for food is also being compromised by climate change, as rain on snow and freeze-thaw events become increasingly common and foraging becomes more difficult for caribou. Finally, increased forest fire disturbance which is projected to occur from hotter, dryer summers will further reduce vegetation available for caribou food. Fire has a pervasive effect on caribou food resources, and caribou have been found to generally avoid burned forest

areas because of the lack of lichen biomass (Sorenson et. al., 2008). Impacts on caribou vegetation from forest fires were acknowledged by ADKFN Knowledge Holders, and four sites where vegetation has recently burned were identified during interviews (KH03, January 2018 Interviews). In addition to climate change, contamination and proximity of food sources to anthropogenic disturbances also limit the caribou's ability to benefit from food in their habitat.

Despite these risks to caribou food availability, sources acknowledge that food availability alone is unlikely to limit boreal caribou populations, and increased predation most likely limits caribou population levels below their habitat's carrying capacity (Conference of Management Authorities, 2017). Therefore, those processes which encourage predation on caribou—including linear disturbances and changes to caribou habitat which are conducive to the rise of alternative prey species—should be of particular focus for regulatory decision-makers.

5.3.1.5 Water Sources

Sources of clean water are vital for the survival of boreal caribou, and water bodies are important features in the boreal caribou habitat. Boreal caribou in the Taiga Plain ecozone, which encompasses the NWT herd's habitat, generally prefer bogs over fens, and seek out areas of standing and flowing water (e.g., muskegs, marshes, lakes, rivers) especially during calving and post-calving life stages (Environment Canada, 2012). Ten (10) muskeg areas used by boreal caribou within the Study Area were identified by Knowledge Holders interviewed in January 2018. These muskeg locations were scattered throughout the Study Area, but were especially frequent in the southern and eastern portions. Furthermore, a large area was identified surrounding the numerous lakes in the south-east portion of the Study Area, including TooChoo (Celibeta) Lake, and was described as significant caribou habitat containing favourable vegetation, where mature and young caribou have historically been sighted by the community (KH01, KH02, KH03, KH07, January 2018 Interviews)

ADKFN has previously expressed significant concern over water extraction and contamination from industrial activity in their traditional territory, as documented in a 2013 assessment of lands in northern British Columbia; in this assessment, ADKFN members commented that water extraction for industrial projects is an important concern for ADKFN, and that water levels in nearby lakes and streams (in addition to the health of resident wildlife species) may be impacted from industrial water extraction (Quicksilver, 2013). Contamination from industry has also been cited as a concern for ADKFN members; during the same 2013 assessment, ADKFN noted water contamination impacting wildlife health as a major concern for development, and members suspect that water contaminated by industry has recently killed wildlife in that area (Quicksilver, 2013). In a similar way, industrial activity in the southwestern NWT has the ability to impact caribou health via water contamination. The Study identified 87 ha of disturbed lands within the Study Area attributable to disturbance from well sites. Contamination from well sites has the ability to extend beyond the site into nearby water bodies and groundwater, thereby impacting downstream vegetation and the wildlife which feed on it. Furthermore, one specific contaminated area located near Fisherman Lake was identified during interviews, further illustrating ADKFN members' concerns over contaminated water (KH05, January 2018 Interviews). In light of these concerns, governments, including the GNWT, should recognize their constitutional duty to consult and accommodate ADKFN's treaty protected rights, and in ADKFN's view, the GNWT's consultation efforts have not been adequate with respect to potential effects of development in its territory.

Climate change is another important consideration for the cumulative impacts on boreal caribou's access to viable water sources. Warmer average temperatures are causing permafrost melt in the region, which in turn causes increased ground absorption of water and a reduction in standing water on the land's surface (Conference of Management Authorities, 2017). As previously noted, muskegs and other areas of standing water are important habitat features for the boreal caribou, especially during and post-calving, and the diminishment of these areas due to climate change could significantly impact viable habitat areas and calf mortality. Furthermore, freeze-thaw events and rain on snow are increasingly common as a result of climate change, which compromise the boreal caribou's ability to travel, forage, and avoid predators in throughout their habitat (Conference of Management Authorities, 2017).

5.3.2 Traditional Land Use

Considering the caribou-related TK sites identified by ADKFN Knowledge Holders together with the spatial layer showing direct and indirect disturbance areas, all of the TK sites identified during the January 2018 Interviews are subject to some type of disturbance. Therefore, all of these culturally significant sites—hunting areas, transportation routes, habitation/gathering places, and historic/named places—have the potential to be impacted by changes to caribou caused by past and future development in the region.

Potential impacts to each of the TLU sites categories can be measured as follows:

- Hunting
  - Observed presence of boreal caribou
  - Quantity and quality/health of boreal caribou
  - Access to hunting areas
  - ADKFN member perceptions regarding viability of caribou hunting
  - Travel distance to caribou hunting areas
- Trails
  - Access to routes
  - Viability of harvesting sites to which routes lead
- Habitation and gathering areas
  - Access to sites/areas
  - Viability of sites (e.g., harvesting resource availability)
- Historic and named places
  - Access to sites

The 2018 interviews clearly show that natural and anthropogenic disturbances in the Study Area have been observed by the members of ADKFN and that impacts from these disturbances have been reflected in the members' cultural practices. ADKFN is aware of the ways in which these disturbances threaten boreal caribou in their traditional territory, and subsequently ADKFN's ability to continue their traditional practices and use traditional use sites. Disturbances observed by Knowledge Holders which threaten boreal caribou include: sites of recent forest fires which have burned caribou vegetation, thereby limiting its availability as food; contamination of water bodies; and increased predation on caribou by wolves, facilitated by linear disturbance features, including pipelines, industrial roads and seismic lines (KH03, KH04, KH05, January 2018 Interviews).

Many Knowledge Holders identified ways in which caribou harvesting, preparation, and other related cultural activities have already been impacted by declining populations. Once an extremely prevalent cultural activity among ADKFN members, hunting caribou is less common than it was in the past because of declining populations, and because of ADKFN members' intentional avoidance of the animal due to its vulnerability (KH02, KH03, January 2018 Interviews). Some traditional sites identified by ADKFN members have changed from present use to past use within the span of the Knowledge Holders' lifetime, as a result of declines in caribou availability. If caribou numbers continue to decline, traditional knowledge surrounding caribou hunting techniques, techniques of processing the animal into tools, clothing, and food, together with the values and stories infused in the caribou harvest, risk being lost for future generations. Trails may cease to be used as routes to access caribou harvesting areas, and teaching and gathering sites may lose some of their traditional significance regarding caribou. The consequences of this situation is significant: as a result of declining caribou populations ADKFN members are not able to practice their traditional vocation of hunting caribou, which is contrary to their Treaty 11 right. The loss of ADKFN's hunting practice is leading to an increasing erosion of ADKFN's traditional way of life and transmission of cultural practices to current and future generations.

It should be noted that the majority of TLU sites identified during the January 2018 interviews are located in the southeast portion of the Study Area, which is also an area of significant oil and gas exploration). Future disturbance in this region, in the form of increased oil and gas activity or other industrial activities, will most likely affect the viability of these sites. KH08 was optimistic regarding caribou numbers, stating that reduced seismic activity in recent years has allowed the return of boreal caribou in the area, but KH03 warned that additional linear disturbance from roads, seismic lines, and pipelines will increase wolf predation and further threaten the caribou (January 2018 Interviews).

6 Resource Management Implications

Some implications of the Study's results for northerners, including environmental regulators, Indigenous organizations, ADKFN and ADKFN members, are itemized below:

- The boreal caribou is a highly significant species for the members of ADKFN, and has historically occupied a prominent position in ADKFN's resource procurement and cultural activities. This traditional significance should be affirmed by resource management policies, such as hunting policies, where preferential treatment of ADKFN individuals over non-Indigenous hunters is warranted.
- While ADKFN and its economic development corporation entities recognize the necessity of balancing economic development against environmental protection, future applications for land-disturbing activities should be evaluated in a holistic way based on their risk to the boreal caribou and all their VECs in the NWT (habitat, migration routes, calving areas, food sources, and water sources). Impacts to boreal caribou which are likely to take place due to climate change (independently of future anthropogenic disturbance), such as increased forest fire disturbance, reduction of water bodies used during and after calving, changes to caribou food sources, and changes to caribou travel, foraging, and predator avoidance, should also be taken into consideration before development approvals are issued.
- Boreal caribou range has already reached the NWT Recovery Strategy's mandated 65% of undisturbed critical habitat as of the end of 2017; therefore, the necessity for the swift implementation of a comprehensive recovery plan has become critical (Conference of Management Authorities, 2018). Reclamation priorities should be jointly developed between the GNWT and ADKFN in order to ensure that development can continue over the coming years without surpassing the mandated 35% disturbance level, and ADKFN should be involved in the priority-setting process. In addition, all policy direction and decisions that affect or impact caribou habitat or populations should include deep consultation with ADKFN.
- Consideration of cumulative impacts to boreal caribou must be taken into consideration during ADKFN and GNWT land use planning and final agreement land selection negotiations by ADKFN and the GNWT.
- ADKFN members may need to continue to place self-imposed restrictions on boreal caribou hunting as a result of the GNWT failure to properly manage caribou populations. ADKFN's treaty rights are being detrimentally affected because of the actions or inactions taken by the GNWT.

7 Project Linkages

The draft results of the Study were presented to ADKFN leadership (Chief and Council) on April 10, 2018. Leadership determined that the results would be discussed with the members of ADKFN during Phase 2 of the ADKFN LUP as this process is occurring concurrently. Leadership's input was incorporated into this final draft report. Once submitted, NWT decision-makers will have the opportunity to review the draft report before being finalized.

The results of the Study are intended to inform SARA's current Section 11 development regarding the recovery strategy of boreal caribou, which are scheduled to be presented to the Governor in Council in April 2018. This information will also provide valuable TK perspectives on boreal caribou and help to inform future regulatory decisions made by the ENR and MVEIRB.

8 Discussion

The boreal caribou play an important role in ADKFN culture, and the Study's results show that ADKFN holds a wealth of knowledge about the caribou, their habitat, needs, and behaviour. This knowledge is dynamic, and allows the members of ADKFN to make observations about changes to the species over time.

Although Knowledge Holders' observations indicate that some herds of healthy individuals exist within their traditional territory, the members acknowledges cumulative impact threats posed to the species from industry, increased predation, and climate change. Caribou habitat, migration routes, calving areas, food sources, and water sources all threaten to be compromised by natural and anthropogenic disturbances including human development (buildings, residential areas), contaminated sites, forest fires, vegetation clearing, and linear features (pipelines, seismic lines, roads). Linear disturbance features pose a particularly significant risk, as they afford predators easy access throughout the caribou's habitat, thereby increasing predation on the caribou. Direct disturbance has reached levels of 1.45% of the Study Area; together with indirect disturbance, total disturbance equals approximately 47%.

These threats to the species in turn threaten the transmission of traditional cultural practices and values surrounding the caribou from one generation of ADKFN members to the next. Hunting practices, transportation routes, habitation and gathering areas, and historic and named places all feature within the identified Study Area, and are all threatened by changes to caribou populations. Despite the longstanding importance of caribou in the traditional diet and cultural activities, ADKFN has responded to the current state of affairs by targeting other non-threatened species for big game hunting, such as moose and deer, thereby demonstrating their stewardship over their traditional territory.

Table 4 provides a summary of the cumulative effects rating for each area of interest, based on an assessment of the measurable analysis parameters. The criteria rating is based on low, medium and high thresholds as follows:

1. Natural and industrial impacts to boreal caribou within ADKFN's traditional territory (based on the established 35% threshold):
    - Low: limited disturbance (estimated at less than 10%) to areas or features vital to the survival of caribou has occurred, or is expected to occur in the near future (within the next 50 years) unless immediate and sustained action is taken to preserve boreal caribou habitat and populations.
    - Medium: moderate disturbance (estimated at between 11-20%) to areas or features vital to the survival of caribou has occurred, or is expected to occur in the near future (within the next 50 years) unless immediate and sustained action is taken to preserve boreal caribou habitat and populations.
    - High: extreme disturbance (estimated at between 21-35%) to areas or features vital to the survival of caribou has occurred, or is expected to occur in the near future (within the next 50 years) unless immediate and sustained action is taken to preserve boreal caribou habitat and populations.
2. Changes to ADKFN's culture and subsistence:
    - Low: limited disturbance (estimated at less than 10%) to TLU practises has occurred, or is expected to occur in the near future (within the next 50 years) unless immediate and sustained action is taken to preserve boreal caribou habitat and populations, and TLU areas associated with caribou.
    - Medium: Moderate disturbance (estimated at between 11-49%) to TLU practises has occurred, or is expected to occur in the near future (within the next 50 years) unless immediate and sustained action is taken to preserve boreal caribou habitat and populations, and TLU areas associated with caribou.

- High: Extreme disturbance (estimated at over 50%) to TLU practises has occurred, or is expected to occur in the near future (within the next 50 years) unless immediate and sustained action is taken to preserve boreal caribou habitat and populations, and TLU areas associated with caribou.

Table 4: Cumulative Effects Analysis

Valued Component	Effect	Areas of Interest	Measurable Analysis Parameter	Cumulative Effects Rating
Boreal caribou	Natural and industrial impacts to boreal caribou within ADKFN's traditional territory	Habitat	• Availability of undisturbed habitat • Level of direct disturbances impacting habitat	High
		Migration routes	• Contiguousness of migration routes (routes not fragmented) • Level of direct disturbances impacting routes	Medium
		Calving areas	• Availability of safe calving areas • Level of direct disturbances impacting calving areas	High
		Food sources	• Changes to food sources • Level of direct disturbances impacting food sources	High
		Water sources	• Changes to water sources • Level of direct disturbances impacting water sources	High
	Changes to ADKFN's culture and subsistence practices	Hunting	• Observed presence of boreal caribou • Quantity and quality/health of boreal caribou • Access to hunting areas • ADKFN member perceptions regarding viability of caribou hunting • Travel distance to caribou hunting areas	High
		Trails	• Access to routes • Viability of harvesting sites to which routes lead	Moderate
		Habitation and gathering areas	• Access to sites/areas • Viability of sites (e.g., harvesting resource availability	Moderate
		Historic and named places	• Access to sites	Moderate

9 Recommendations

With a disturbance level of 47% within the Study Area, and reports of boreal caribou numbers declining, land-altering decisions should not be approved without the integration of ADKFN's views in the decision-making process. Caribou migration routes identified by ADKFN in particular should be protected, given that caribou are known to respond more robustly to habitat disturbance if they are afforded migration routes along which to travel for access to alternate resource-gathering areas. Not only do the boreal caribou require vast tracts of land to effectively use their habitat, these tracts of land should be strategically connected. Furthermore, linear disturbance in the Study Area should cease, which is particularly impactful to boreal caribou via increased predation. Proponents should be required to re-use existing linear features prior to constructing new access roads, thereby limiting negative impacts on caribou. Reclamation priorities should also be set in conjunction with ADKFN in order to ensure that development can continue over the coming years without surpassing the mandated 35% disturbance level, and ADKFN should be integrated in the priority-setting process.

Given ADKFN's longstanding use and intimate knowledge of the Study Area, ADKFN should be directly involved in the development, and be a joint decision-maker in relation to, remediation plans, designation of travel corridors, establishment of areas of future development and areas of future protection. Decisions must integrate ADKFN views, TLU, and TEK.

Finally, the Study offers opportunities for further research into cumulative impacts in ecosystems in the NWT, particularly with respect to forest fire modelling and predator-prey interactions given various types of disturbance. Increased predation is widely cited in the literature as the principal threat to caribou in the NWT, aided by increased access for predators along anthropogenic linear features and by increased populations of alternative prey species. However, these predator-prey interactions in the face of anthropogenic disturbance is not well understood, especially at a granular level. Understanding the ways in which human modifications of the landscape impact wildlife behaviours, especially with respect to linear disturbances and animal behaviour, will be crucial to effectively monitor and protect boreal caribou. In addition, forest fires are predicted to become increasingly frequent and impactful as effects from climate change are felt in the north, and regulators would benefit from a deeper understanding of future impacts of forest fires on boreal caribou, their habitat, and the northern ecosystem as a whole. These studies should be conducted with the knowledge of local Indigenous governments and with consideration for the TK which could benefit them.

10 Literature Cited

Battiste, M. and J. Youngblood Henderson. (2000). Protecting Indigenous Knowledge and Heritage. Purich Publishing Ltd., Saskatoon.

BC FLNRO. (2014). A Compendium of Wildlife Guidelines for Industrial Development Projects in the North Area, British Columbia. Interim Guidance Report November 19, 2014.

Bergerud, A. (1974). Decline of caribou in North America following settlement. Journal of Wildlife Management Vol. 38, No. 4: 757-770 pp.

Boulanger, J., K.G. Poole, A. Gunn, and J. Wierzchowski. (2012). Estimating the Zone of Influence of Industrial Developments on Wildlife: A Migratory Caribou *Rangifer tarandus groenlandicus* and Diamond Mine Case Study. Wildlife Biology 18: 164-179.

Canadian Boreal Forest Agreement (2016). Understanding Disturbance Thresholds and Opportunities to Achieve Better Outcomes for Boreal Caribou in Canada: a Primer.

Cloutier, Edmond, "REPORT OF THE COMMISSIONER FOR TREATY No. 11" in Treaty No. 11 (June 27, 1921) and Adhesion (July 17, 1922) with Reports, etc. (Ottawa: 1957) Queen's Printer and controller of Stationery.

Conference of Management Authorities (CMA). (2017). Recovery Strategy for the Boreal Caribou (*Rangifer tarandus caribou*) in the Northwest Territories. Management Plan and Recovery Strategy Series. June 3, 2016.

Conference of Management Authorities (CMA). (2018). Conference Call and PowerPoint Presentation regarding the NWT Species at Risk Act Section 11: Conservation Agreements for Boreal Caribou. Various attendees, January 22, 2018.

COSEWIC. (2002). Assessment and Update Status Report on the Woodland Caribou *Rangifer tarandus caribou* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 98 pp.

Culling, D. and B. Culling. (2006). Ecology and Seasonal Habitat Selection of Boreal Caribou in the Snake-Sahtaneh Watershed. Technical Report.

DM Cultural Services Ltd., Acho Dene Koe and Fort Liard Metis. (2012a). Acho Dene Koe and Fort Liard Metis Traditional Ecological Knowledge of Quicksilver Resources Canada Inc., Fortune Creek Project. Mill Bay, B.C.

DM Cultural Services Ltd., Acho Dene Koe and Fort Liard Metis. (2012b). ADK Traditional Land Use Summary for Quicksilver Resources Canada Inc. Mill Bay, B.C.

Dyer, S.J., J.P. O'Neill, S.M. Wasel, and S. Boutin. (2001). Avoidance of Industrial Development by Woodland Caribou. Journal of Wildlife Management 65: 531-542.

Environment Canada. (2008). Scientific Review for the Identification of Critical Habitat for Woodland Caribou (*Rangifer tarandus caribou*), Boreal Population, in Canada. E. Canada. Ottawa: 72 pp. plus 180 pp. Appendices.

Environment Canada. (2012). Recovery Strategy for the Woodland Caribou (*Rangifer tarandus caribou*), Boreal Population in Canada. Species at Risk Act Recovery Strategy Series. Ottawa, ON, Environment Canada, 138 p.

Hodson, J., Larter, N., Smith, A., (2015). Boreal Caribou Range Plan Meeting. Fort Liard, May 27, 2015

Landmark Resource Management Ltd. and Acho Dene Koe First Nation. (2017). Acho Dene Koe First Nation Land Use Plan: Phase I Activities Draft Final Report. Draft report submitted to Indigenous and Northern Affairs Canada in August 2017.

McCutchen, N. A. (2007). Factors Affecting Caribou Survival in Northern Alberta: the role of wolves, moose, and linear features. PhD Thesis. University of Alberta.

Nagy, J. (2011). Use of Space by Caribou in Northern Canada. Ph.D. Thesis. University of Alberta.

Ray, J. C. (2014). Defining Habitat Restoration for Boreal Caribou in the Context of National Recovery: A Discussion Paper. Prep. For Environment and Climate Change Canada. Prep. by Wildlife Conservation Society Canada, Toronto, ON.

Quicksilver Resources. (2013). Part B — Assessment of Potential Effects, Mitigation, and Significance of Residual Effects. Fortune Creek Gas Plant. British Columbia Environmental Assessment Certificate Application. Pursuant to the *British Columbia Environmental Assessment Act*. Final Report. Section 5: Assessment of Potential Environmental Effects: 115-176.

Part C — Aboriginal Information Requirements. Fortune Creek Gas Plant. British Columbia Environmental Assessment Certificate Application. Pursuant to the *British Columbia Environmental Assessment Act*. Final Report. Section 14: Other Interests of Treaty 8 First Nations Assessment: 1-22.

Sorensen, T., P. D. McLoughlin, D. Hervieux, E. Dzus, J. Nolan, B. Wynes and S. Boutin. (2008). Determining Sustainable Levels of Cumulative Effects for Boreal Caribou. Journal of Wildlife Management 72: 900-905.

Whittington, J., (and 6 co-authors). (2011). Caribou Encounters with Wolves Increase near Roads and a Time-to-Event Approach. Journal of Applied Ecology 48: 1535-1542.

Wittmer, H.U., B.N. McLellan, D.R. Seip, J.A.Young, T.A. Kinley, G.S. Watts, and D. Hamilton. (2005). Population Dynamics of the Endangered Mountain Ecotype of Woodland Caribou (*Rangifer tarandus caribou*) in British Columbia, Canada. Canadian Journal of Zoology 83: 367-418.

Appendix A NWT CIMP Project Information

NWT CIMP #	190
Project Title	ADKFN Boreal Caribou TK and CI Qualitative Assessment
Project length	1 year
Date Submitted	April 30, 2018
Author(s) & their organizations	Julie Swinscoe, Landmark Elizabeth Robertson, Landmark Brooke Barber, Landmark
Contact Information	ADKFN Contact: Boyd Clark, Operations Manager Acho Dene Koe First Nation General Delivery Fort Liard NT X0G 0A0 administration@adkfn.com 867-770-4571 adkfn.com Landmark contact: Julie Swinscoe, Project Director Landmark Resource Management Ltd. 303–45 Bastion Square Victoria BC V8W 1J1 julie@landmarkrm.com 250-590-9767 landmarkrm.com
Type of Research	☐ Science ☒ TK
Valued Component	☒ Caribou ☐ Fish ☐ Water ☐ Other
Geographic Area/Region	☐ Akaitcho ☒ Dehcho ☐ Sahtu ☐ Gwich'in ☐ ISR ☐ Wek'èezhii
Project Keywords (at least 4)	Acho Dene Koe First Nation, Boreal Caribou, Caribou, Cumulative Impacts, Traditional Ecological Knowledge, Traditional Knowledge, Traditional Land Use
Location in decimal degrees (dd.mmm)	Provide coordinates for the general study location; or if regional, provide 4 coordinates for the bounding box Southeast: -122.099, 60.012 Southwest: -123.786, 60.009 Northwest: -123.855, 60.653 Northeast: -122.613, 60.633
Consent	I agree to allow NWT CIMP to post this report on the NWT Discovery Portal for public access. ☒ I agree

Appendix B Contribution to Understanding

Outcomes of monitoring and research conducted during the project life are presented in the table below.

Table 5: Project Outcomes

Outcome	Description
☒ New or enhanced knowledge in the field of study	This study clarifies the traditional cultural importance of boreal caribou to Acho Dene Koe First Nation (ADKFN), the change in ADKFN's subsistence practices regarding caribou, and the state of caribou populations in the southwestern NWT from the perspective of the Nation's TEK.
☒ New or enhanced knowledge of cumulative effects	The geospatial data analyzed sheds light on the scale of impacts to caribou populations from development in the southwestern NWT. It offers a quantitative evaluation of the cumulative impact which decades of disturbance in the region have had.
☐ Directly impacted a current decision-making process (1)	
☒ Could contribute to a future decision-making process	Several recommendations flowed from the project lifecycle that could be adopted by decision makers and land managers. Examples include reclamation priorities, land protection planning, and suggestions for further study; these are discussed further in Section 9 of this report.
☐ Development of a standardized monitoring protocol(s)	
☐ Adoption of standardized monitoring protocol(s) by decision-maker	
☒ Responded to a community concern	ADKFN have expressed concern over the health of caribou populations for a number of years prior to the study's commencement. Several of the ADKFN Knowledge Holders interviewed for the study expressed concern about the decline of caribou in their traditional territory. This study contributed to the information-gathering process to aid in species management, while taking into account ADKFN's use of the land and cultural practices with respect to caribou.
☒ New or enhanced community capacity (2)	TK interviews with ADKFN community members were conducted collaboratively by the study team lead and an ADKFN member, who was trained in techniques of TK interviewing and data collection.
☐ New or enhanced analytical tool	
☐ New or enhanced modeling capacity	
☐ Other (please specify, insert rows as required)	