Government of Northwest Territories
Gouvernement des Territoires du Nord-Ouest

APR 12 2017

Mr. Simon Toogood
Environmental Assessment Officer
Mackenzie Valley Environmental Impact Review Board
200 Scotia Centre
5102 – 50th Ave
PO BOX 938
YELLOWKNIFE NT X1A 2N7

Dear Mr. Toogood:

Tłı̨chǫ All Season Road EA1617-01: GNWT response to the Mackenzie Valley Environmental Impact Review Board's TASR Adequacy Statement

Please find enclosed the Adequacy Statement Response (ASR) for the Tłı̨chǫ All-Season Road. The Government of the Northwest Territories (GNWT) submits this ASR in accordance with the Terms of Reference and Adequacy Statement issued on October 28, 2016 by the Mackenzie Valley Environmental Impact Review Board.

If you have any questions or comments, please contact me at (867) 767-9089 ext. 31194 or by email at Michael_Conway@gov.nt.ca at your earliest convenience.

Sincerely,

Michael Conway
Regional Superintendent
North Slave Region
Infrastructure

Enclosure

c. Ms. Laura Duncan, Tłı̨chǫ Executive Director
Tłı̨chǫ Government

ADEQUACY STATEMENT RESPONSE
for the

Tłįchǫ All-Season Road Project

EA1617-01
Prepared for the Government of the Northwest Territories
Prepared by Golder Associates Ltd.
April 2017

Submitted to:
Mackenzie Valley Environmental Impact Review Board
200 Scotia Centre
5102-50th Ave
Yellowknife, NT

13 April 2017

ADEQUACY STATEMENT RESPONSE
EA1617-01

Tłı̨chǫ All-Season Road Project

Submitted to:

Mackenzie Valley Environmental Impact Review Board
200 Scotia Centre
Box 938, 5102-50th Ave
Yellowknife, NT X1A 2N7

Report Number: 1665943

Distribution:

Mackenzie Valley Environmental Impact Review Board: 10 copies
Government of the Northwest Territories: 3 copies
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Plain Language Summary

Tłı̨chǫ Yatıı̨

March 31, 2016 k'e, Edzanèk'e ts'ǫ Government, dè k'e eghàlagìde ha Wek'èezhìı Dè eyıts'ǫ Tı wenàowo xogıhdı (WLWB) ha dè nı̨htł'è eyıts'ǫ tı nı̨htł'è sıì geàke, wet'à xoghà tı̨lıdeè Whatì ts'ǫ̀ nı̨ı̨ʔa agele ha, tı̨lıdeè 3 ts'ǫ adle ha, Tłıchǫ Xoghà Tı̨lı La wıìyeh (hanì-le dè TASR). Dıì TASR weghà Whatì ts'ǫ̀ tı̨lı nı̨ı̨ʔà adle ha.

Dıì TASR xoghà tı̨lıdeè hohłè ha sıì, behchı̨ı̨ nàke ełǫts'ǫhk'e eht'aìnàede ha ewa tı̨lı hohłè ha, 94 km haı̨doo, wexè dè gotł'a tı k'etł'o ha satsǫ̀we sıì whela agele ha eyıts'ǫ denelı̨ eyıts'ǫ dehtsòa teè dasąkah k'e behchı̨ı̨ nàke wek'e naàtł'oo ha. 70 km/h hanahtła zǫ behchı̨ı̨ k'edè ha eyıts'ǫ xoghà bechı̨ı̨ ası eht'ànàegìle wek'e aget'ı̨ ha eyıts'ǫ dǫne t'ala sıì tı̨lı k'e aget'ı̨ ha. Dzę̀ę tąt'e satsǫ̀ behchı̨ı̨ 20 40 ts'ǫ̀ tı̨lı k'e aget'ı̨ha gedı, eyıxè Whatì gà sǫǫ̀mbak'è hohłe ha gedı sıì ts'ǫ̀ behchı̨ı̨ eht'ànàeko ha.

July 21, 2016 k'e, dıì Mackenzie Valley Environmental Impact Review Board (la hazhǫ weghàgeda) dıì TASR la dè wegondı nàtsı̨ ha gedı t'à nàowo hòlı̨. GNWT nı̨htł'è agı̨tł'è tł'axǫǫ̀ gıghaı̨da t'à Dè Esawòdech'à gha Dè Xǫgıhdı gha Gehkw'e sıì weghà eghàlagìde gha nı̨htł'è weghà dıì hanì nàowo gehtsı̨, dè wexìıdı ha honı gedı xè dǫne kǫ̀ta nàdè sıì gıghǫ nànìdè gedı t'à dıì nı̨htł'è gehtsı̨:

- Whatì ts'ǫ̀ tı̨lı hòlı̨ dè ası łǫ ładı̨ ade ha gedı.
- Ası goxè ładı̨ at'ı̨ dè, edàanì goxè hòʔǫ sıì ładı̨ at'ı̨, nàedıch'ıı eyıts'ǫ kǫ̀tì netłǫ ade ha eyıts'ǫ dǫne sıì asıjıì k'alagede ade ha.
- Tı̨lı wegoò wet'à ekwǫ̀ wexìdı ha, dǫne netłǫgǫǫ̀ nàgezè ade ha, tıch'àadìı sıì netłǫ weghǫ nàgezè ade ha, satsǫ̀behchı̨ı̨ ekwǫ̀ t'akèa honı̨ eyıts'ǫ ekwǫ̀ sıì ładı̨ k'ehòeʔa ade ha hǫnı eyıts'ǫ edı̨ nàeʔa ı̨lè sıì, ładı̨ ade ha hǫnı.
- GNWT edàanì sìì dè wexııdı hale gha weghǫ nı̨htł'è gehtsı̨, edàanì dè senàgele ha wet'à dè sìì wexııdı hale gha nı̨htł'è gehtsı̨.

Dıì nı̨htł'è, dè weghǫgeda t'à ahsı̨ GNWT nezı̨ dè senàgele ha gedı t'à weghǫ nı̨htł'è deghà segı̨la nìì gha wek'agehta ha eyıts'ǫ edàanì senàgele xè wexòedı ha wet'à dè sìì ładı̨ ade haà-le. Tıch'àadìı teè nàdè weghǫ nànègìdè t'à ası taı wexòedı t'à weghǫ nı̨htł'è hòlı̨, dıì TASR edàanì dè wexòedı ha eyıts'ǫ edàanì senàdle ha:

- Łıwe eyıts'ǫ adı̨ teè nàdè
- Tıch'àadìı eyıts'ǫ adı̨ tıch'àadìı nàdè
- Edàanì dǫne kǫ̀ta nàdè gıxè ładı̨ ade ha eyıts'ǫ sǫǫ̀mba hohłè nàowo sıì dǫne gha wet'aʔà

Dıì dè wek'agehtǫ hò, dıì dzę̀ę edàgǫ̀ht'e sıì hazǫ gıghaı̨da eyıts'ǫ edàanì TASR t'à wexııdı ha hǫnı gedı t'à gıghaı̨da, eyıts'ǫ eyı la weghàlada ts'ǫ ı̨da gots'ǫ̀ edàanì hazǫ dè xıìdı ha hǫnı. Ası łǫ wedànàgeta, dıì hanı sıì, denı̨lı yìì łıwe k'eʔoò, tıch'àadìı gha dè ładı̨ ade ha, adı̨ tıch'àadìı nàdè ı̨lè sıì ładı̨ ade ha, tıch'àadìı ładı̨ ade ha eyıts'ǫ ası dè k'e łaìtł'ì ha hǫnı. Tı̨lı wegoò hòlı̨ dè edàanì Whatì gots'ǫ dǫne kǫ̀ta nàdè gıxìdı ha hǫnı nezı̨ nezı̨-le ehk'ę̀ weghǫ nànègìdè.

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Dıì la TASR wet'à asıı mǫhdaà dè k'e hagode ha hǫnı, edàanì senàdle ha eyıts'ǫ edàanì wexòedı nàowo wet'à, sìì hòtł'ò dè xıìdı haà-le. Hazǫ t'à, dıì la TASR wet'à dè ts'ǫ̀ asıı sìì hòtł'o ładı̨ ade haà-le, dıì hanı sıì, łıwe ts'ǫ̀, tıch'àadì hanì-le dè kǫ̀ta dǫne wet'à sǫ̀ǫmba hohłè nàowo hazǫ wek'eèzhìı dè k'e sìì wexıìdı haà-le.

Dıì dè wek'e eghàlagìde ha nı̨htł'è weghǫ̀geda ha sıì, nǫde ts'ǫ̀ dıì hanì nı̨htł'è gehtsı̨ ha eyıts'ǫ dǫne ładı̨ dıì la weghǫ nànègìdè sıì, nǫde ts'ǫ̀ edàanì dıì la TASR wet'à dè wexıìdı ha hǫnı gedı t'à nezı̨ gıghǫ nanìde t'à nàowo gehtsı̨ ha. Dıì dè weghǫgeda ha gehkw'e sıì, dıì la TASR sìì dè wexıìdı haà-le dè, wet'à GNWT achı̨ denı̨htł'è negele t'à gıla weghǫgeda t'à, la wexè hoewı ha ade ha.

English

On March 31, 2016, the Government of the Northwest Territories (GNWT) submitted applications for a Land Use Permit and Water Licence to the Wek'èezhìı Land and Water Board (WLWB) to construct an all-season road from Highway 3 to the community of Whatì, called the Tłı̨chǫ All-Season Road Project (the Project or TASR). The TASR would provide road access to Whatì throughout the year.

The proposed TASR is an all-season two-lane gravel road approximately 94 km in length, with culverts and double lane bridges over rivers and streams. The road will have a posted speed limit of 70 km/h, and will allow for year-round use by commercial and private vehicles. Traffic levels are estimated at 20 to 40 vehicles per day, including traffic from a proposed mine northeast of Whatì.

On July 21, 2016, the Mackenzie Valley Environmental Impact Review Board (the Review Board) decided to refer the TASR to environmental assessment. After reviewing the information prepared by the GNWT and comments from other parties, the Review Board provided a Terms of Reference that identified the following key areas of concern, which might result in a significant adverse impact on the environment or cause significant public concern:

- Changes to the community of Whatì from the improved access.
- Changes causing stresses on existing social services, related to possible increased drug and alcohol addictions and increased crime.
- Impacts on caribou from the new road, including increased harvesting, increased predation, increased vehicle collisions with caribou, and changes to caribou behaviour and migration.
- Concern about the effectiveness of the mitigation proposed by the GNWT to reduce these effects.

This document is the response to the Review Board's requests, and includes the developer's (GNWT's) assessment of Project effects and commitments for monitoring and mitigation to prevent or reduce these effects. There are three major sections to the Adequacy Statement Response, which consider the possible TASR environmental effects and mitigations to:

- fish and fish habitat
- wildlife and wildlife habitat
- the social and economic well-being of regional communities

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The assessment considered the existing environment and the effects of the TASR, as well as cumulative effects from previous and existing developments, and possible future developments. It considered a range of possible effects, such as new access to rivers for fishing, new access to wildlife areas for harvesting, effects of wildlife habitat loss, and spills. The assessment also considered both the positive and negative effects to the community of Whatì that may result from a new road.

While the TASR is expected to cause some adverse environmental effects, the proposed mitigation and monitoring will help to avoid and reduce these effects through adaptive management. Overall, the TASR is not expected to cause significant environmental effects to fish, wildlife, or socio-economics in the Wek'èezhìı Resource Management Area.

The Review Board will consider these conclusions, and any additional opinions provided by other interested parties, when making a final determination of the significance of environmental effects caused by the TASR. If the Review Board finds that the TASR will not cause any significant environmental effects, it would enable the GNWT to resubmit its applications for permits to start construction of the Project.

Français

Le 31 mars 2016, le gouvernement des Territoires du Nord-Ouest (GTNO) a présenté des demandes de permis d'utilisation des terres et des eaux auprès de l'Office des terres et des eaux de Wek'èezhìı en vue de construire la route toutes saisons de la région des Tłįchǫ permettant de relier la route 3 à la collectivité de Whatì. Cette route permettrait de se rendre à Whatì par la route toute l'année.

Le projet consiste à construire une route de gravier toutes saisons de 2 voies d'environ 94 km, ainsi que des ponceaux et des ponts à 2 voies pour franchir les rivières et les ruisseaux. La vitesse maximale autorisée affichée sera de 70 km/h, et des véhicules commerciaux et privés pourront emprunter la route toute l'année. On s'attend à une circulation de 20 à 40 véhicules par jour, provenant notamment d'un site minier proposé situé au nord-est de Whatì.

Le 21 juillet 2016, l'Office d'examen des répercussions environnementales de la vallée du Mackenzie (l'Office d'examen) a pris la décision de soumettre le projet de route toutes saisons de la région des Tłįchǫ à une évaluation environnementale. À l'issue de l'examen des renseignements produits par le GTNO et de commentaires d'autres parties, l'Office d'examen a présenté un cadre de référence précisant les principales préoccupations ci-dessous, qui pourraient avoir des répercussions négatives importantes sur l'environnement, ou entraîner de fortes inquiétudes de la part du public :

- Modifications de la collectivité de Whatì attribuables à l'accessibilité.
- Modifications entraînant des pressions sur les services sociaux actuels en raison de l'augmentation de la dépendance aux drogues et à l'alcool, et de la hausse de la criminalité.
- Conséquences de la nouvelle route pour le caribou, notamment l'augmentation de la chasse, de la prédation et des collisions avec des véhicules, et les modifications du comportement et des habitudes migratoires des animaux.
- Préoccupations liées à l'efficacité des mesures d'atténuation de ces répercussions proposées par le GTNO.

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Le présent document est la réponse aux demandes de l'Office d'examen. Il contient l'évaluation des répercussions du projet par le promoteur (le GTNO) et des engagements envers la surveillance et l'atténuation afin d'éviter ou de limiter ces répercussions. La réponse à l'énoncé d'adéquation comporte trois parties principales, qui tiennent compte des éventuels effets de la route toutes saisons de la région des Tłįchǫ sur l'environnement et des mesures d'atténuation possibles pour :

- Le poisson et son habitat.
- La faune et son habitat.
- Le mieux-être social et économique des collectivités régionales.

L'évaluation prenait en considération l'environnement actuel et les répercussions de la route toutes saisons de la région des Tłįchǫ, ainsi que les effets cumulatifs d'autres aménagements, notamment d'aménagements éventuels. Elle tenait compte d'une gamme d'effets possibles, par exemple un nouvel accès aux rivières pour la pêche et aux réserves d'espèces fauniques pour la chasse, ou les répercussions de la perte d'habitat faunique et des déversements. Elle examinait également les répercussions positives et négatives qui pourraient découler de la construction d'une route pour la collectivité de Whatì.

La route toutes saisons de la région des Tłįchǫ devrait avoir certains effets sur l'environnement, mais les mesures de surveillance et d'atténuation proposées permettront de réduire ces effets. Dans l'ensemble, l'impact environnemental de la route sur le poisson, la faune ou les aspects socio-économiques dans la région de Wek'èezhìı ne devrait pas être important.

Pour établir définitivement la gravité des répercussions de la route sur l'environnement, l'Office d'examen tiendra compte de ces conclusions et de tout autre avis émis par des parties intéressées. S'il juge que la route toutes saisons de la région des Tłįchǫ n'entraînera aucune conséquence majeure sur l'environnement, le GTNO pourra présenter de nouveau ses demandes de permis afin de commencer les travaux.

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Abbreviations and Units of Measure

Abbreviation	Definition
AGO	Aboriginal Government Organization
ARD	acid rock drainage
ASR	Adequacy Statement Response
ATV	all-terrain vehicle
BBS	breeding bird survey
BNE	Bluenose-East
CGW	Community Government of Whatì
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
DAR	Developer's Assessment Report
DDT	dichlorodiphenyltrichloroethane
DFO	Fisheries and Oceans Canada
DGGFN	Deh Gah Got'ie First Nations
DNA	deoxyribonucleic acid
EA	environmental assessment
ECCC	Environment and Climate Change Canada
GDP	Gross Domestic Product
GIS	Geographic Information System
GNWT	Government of the Northwest Territories
GNWT-DOT	Government of the Northwest Territories-Department of Transportation
GNWT-ECE	Government of the Northwest Territories-Department of Education, Culture and Employment
GNWT-ENR	Government of the Northwest Territories-Environment and Natural Resources
GNWTBS	Government of the Northwest Territories Bureau of Statistics
IR	Information Request
MACA	Department of Municipal and Community Affairs
MVEIRB, Review Board	Mackenzie Valley Environmental Impact Review Board
NSMA	North Slave Métis Alliance
NWT	Northwest Territories
PDR	Project Description Report
P3	public-private partnership
PR#	Public Registry Number (EA1617-01)
Project Co.	Preferred Proponent
Project, TASR	Tłįchǫ All-Season Road
RCMP	Royal Canadian Mounted Police
RFD	Reasonably Foreseeable Development
RFQ	Request for Qualifications
RLU	Rural Local Undivided
ROW	right-of-way

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Abbreviation	Definition
RSA	Regional Study Area
SARA	*Species At Risk Act*
SARC	Species at Risk Committee (NWT)
SEIA	Socio-Economic Impact Assessment
spp.	species
STI	Sexually Transmitted Infection
TCSA	Tłı̨chǫ Community Services Agency
TG	Tłı̨chǫ Government
TIC	Tłı̨chǫ Investment Corporation
TK	Traditional Knowledge
TOR	Terms of Reference
TREDWG	Tłı̨chǫ Regional Economic Development Working Group
VC	valued component
VSEC	valued socio-economic component
WLWB	Wek'èezhìı Land and Water Board
WRMA	Wek’èezhìı Resource Management Area
WMMP	Wildlife Management and Monitoring Plan
WNS	white-nose syndrome
WRRB	Wek'èezhìı Renewable Resource Board
YKDFN	Yellowknives Dene First Nation

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Unit	Defintion
%	percent
/	per
≤	less than or equal to
<	less than
≥	greater than or equal to
>	greater than
cm	centimetre
dB	decibel
ha	hectare
Hz	hertz
kHz	kilohertz
km	kilometre
km/h	kilometres per hour
km/km^2	kilometres per square kilometre
km^2	square kilometre
kPa	kilopascal
L	litre
m	metre
mm	millimetre
MW	megawatt

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1.0 INTRODUCTION

1.1 Background

On March 31, 2016, the Government of the Northwest Territories-Department of Transportation (GNWT-DOT) submitted applications for a Type A Land Use Permit (W2016E0004) and a Type B Water Licence (W2016L8-0001) to the Wek'èezhìı Land and Water Board (WLWB) to construct an all-season road from Highway 3 to the community of Whatì (Public Registry [PR]#16), referred to as the Tłįchǫ All-Season Road Project (the Project or TASR, Figure 1.1-1, 1.1-2). On July 21, 2016, the Review Board referred the Project to environmental assessment on its own motion. After initial review and consideration of materials on the WLWB public registry and the comments provided through the screening process, the Review Board identified the following key areas of concern that might result in a significant adverse impact on the environment or cause significant public concern.

- Change to access: new all-season access to the Community of Whatì.
- Changes causing stresses on existing social services: related to increased drug and alcohol addiction, and increased crime.
- Impacts on caribou: increased harvesting pressure, increased predation resulting from new access, increased road - induced mortality, and barrier effects to caribou – linear impediments, dust, noise, and reduced air quality.
- Uncertainty regarding the effectiveness of mitigation measures.

Following a review and comment period, the Review Board determined the scope of development, scope of assessment, and additional information requirements for the environmental assessment (EA) of the Project. The Review Board's decisions regarding the scope of development and scope of assessment for this EA are described in the Terms of Reference (TOR; PR#69) and requirements for further information are described in the Adequacy Statement (PR#70). This document constitutes the Adequacy Statement Response (ASR) for the MVEIRB environmental assessment EA1617-01. The ASR and Project Description Report (PDR) together constitute the Developer's Assessment Report (DAR).

To aid in comparison of this document with the TOR and Adequacy Statement (PR#69; PR#70), a Concordance Table has been prepared, which outlines the requirements in the TOR and Adequacy Statement with the corresponding location within the ASR where the developer's response is provided (Appendix A). To facilitate cross-referencing with the PDR and other relevant documents already submitted to the MVEIRB public registry for EA1617-01, this document refers to documents by their public registry number (i.e., the PDR is referred to as PR#7), and the full references are provided in Section 6.0. Likewise, ASR appendicies are referred to directly (i.e. Appendix A), while appendicies to the PDR are referred to after the public registry number, separated by a comma (i.e. PR#7, Appendix E).

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LEGEND

- EXISTING MINE
- POPULATED PLACE
- ALL-SEASON ROAD
- WINTER ROAD
- TREELINE
- WATERCOURSE
- PROVINCIAL/TERRITORIAL BOUNDARY
- TŁĮCHǪ LAND
- WATER BODY
- PROJECT FOOTPRINT
- WEK'ÈEZHÌI RESOURCE MANAGEMENT AREA

0 120 240

1:6,000,000 KILOMETRES

REFERENCE(S)

1. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
PROJECTION: CANADA LAMBERT CONFORMAL CONIC

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
TŁĮCHǪ ALL-SEASON ROAD

TITLE
LOCATION OF THE TŁĮCHǪ ALL-SEASON ROAD PROJECT

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-04-13
DESIGNED	DC
PREPARED	LMS
REVIEWED	DP
APPROVED	DP

PROJECT NO.	REV.	FIGURE
1665943	0	1.1-1

25mm

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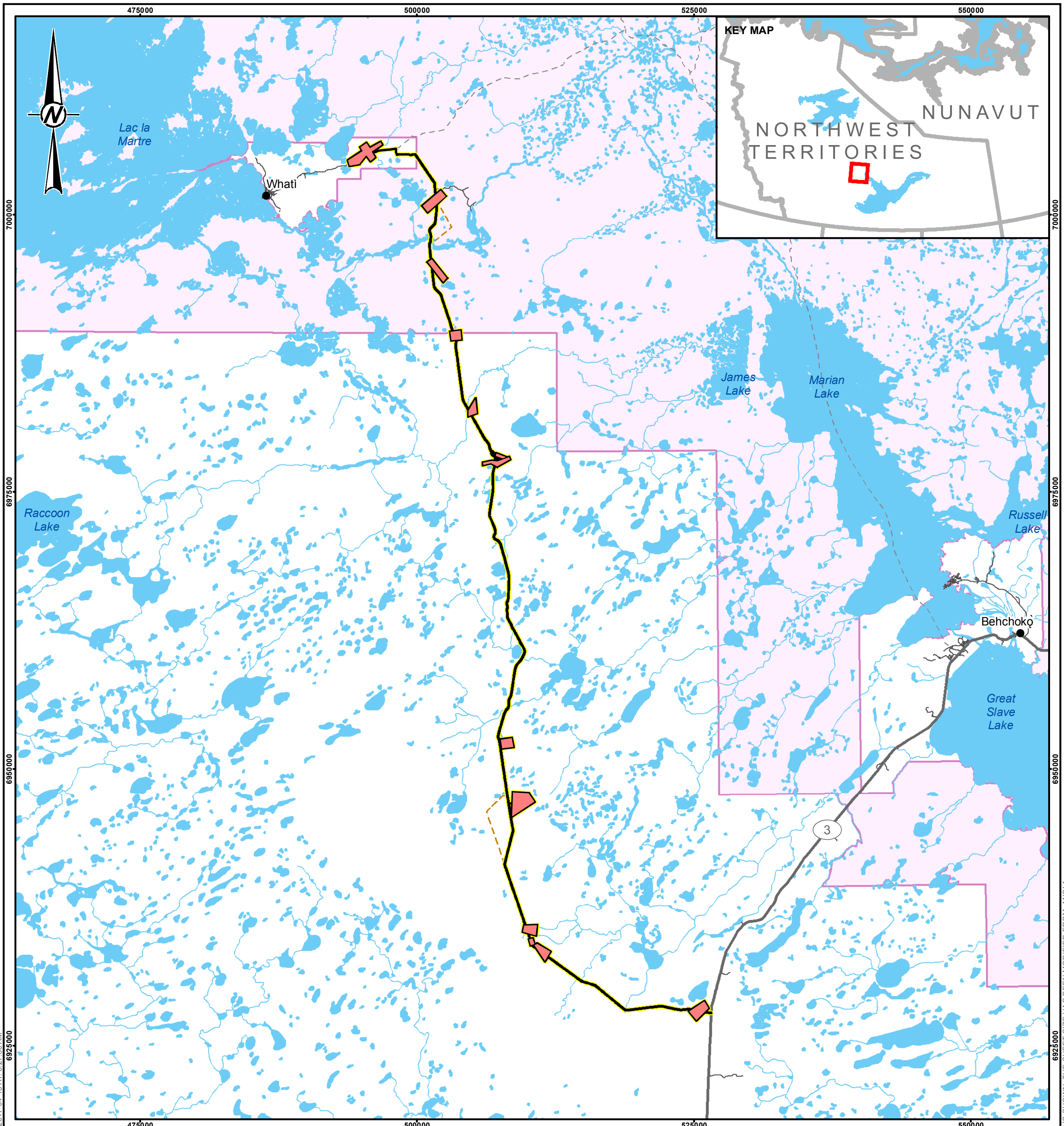

LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- OLD AIRPORT ROAD
- WATERCOURSE
- TŁĮCHǪ LAND
- WATER BODY
- PROJECT FOOTPRINT - BORROW SOURCE
- PROJECT FOOTPRINT - ROAD

0 10 20

1:500,000 KILOMETRES

REFERENCE(S)

1. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
TŁĮCHǪ ALL-SEASON ROAD

TITLE
PROPOSED TŁĮCHǪ ALL-SEASON ROAD PROJECT FOOTPRINT

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-04-13
DESIGNED	DP
PREPARED	LMS
REVIEWED	DP
APPROVED	DP

PROJECT NO.	REV.	FIGURE
1665943	0	1.1-2

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1.1.1 Purpose

The purpose of the DAR is to provide the developer's assessment of Project effects and commitments for monitoring and mitigation to detect and eliminate or reduce these effects, and to meet the TOR and Adequacy Statement. The DAR also provides the developers assessment of Project significance, which is required by the *Mackenzie Valley Resource Management Act*. Where there is discrepancy between the ASR and the PDR with respect to existing environment, mitigation or effects assessment, the ASR takes precedence.

1.1.2 Scope of Development

Section 117(1) of the *Mackenzie Valley Resource Management Act* requires that "every environmental assessment of a proposal for a development shall include a determination by the Review Board of the scope of the development, subject to any guidelines made under section 120". For this Project, the Review Board has determined that the scope of development includes construction, operation/use, and maintenance of the road, including borrow sources and construction camps, as well as any reclamation activities undertaken during the construction and operations phase. Further, the Review Board also stated that the scope of the EA is not limited by whatever may or may not be within the jurisdiction of regulators/screeners (see the Review Board Reasons for Decision, PR#71).

1.2 Project Overview

The GNWT and Tłįchǫ Government are proposing improved transportation to the Tłįchǫ region. In 2011, both governments became reengaged under the Tłįchǫ Roads Steering Committee in order to assess the feasibility, desirability and implications of realigning the Tłįchǫ Winter Road System to provide improved community access. As of May 2013, the vision of the Tłįchǫ Roads Steering Committee has been to pursue development of an all-season road. The route would end at the boundary of the community government of Whatì and predominantly follow 'Old Airport Road', an existing overland alignment that was used up until the late 1980s as an overland winter road.

The proposed TASR is defined as an all-season road approximately 94 km in length with a 60 m right-of-way (ROW), and a cleared driving surface of approximately 8.5 m in width in order to accommodate a two-lane gravel road with culverts and/or double lane bridges over water crossings as necessary (Figure 1.1-2 and PR#7, Appendix EE). This road is classified as a Rural Local Undivided (RLU) highway with a design speed of 80 km/h and a posted speed limit of 70 km/h. This design standard will allow for year-round use by commercial and private vehicles according to the size and weight limitations outlined in NWT regulations, such as the Large Vehicle Control Regulations. The TASR will be a RLU 80 road designed to handle up to 200 vehicles per day, but traffic levels for the proposed TASR are estimated at 20 to 40 vehicles per day. This estimate has taken into consideration any potential traffic volumes of a metals mine north-east of Whatì if it were to begin production and develop a road that meets the TASR. Additional details of the Project are provided in the development description section of the PDR (PR#7 and appendices). The Project footprint includes the preferred route with a 60 m ROW, laydown areas, construction camps, and borrow sites (with associated access roads with a 30 m ROW).

1.2.1 Additional Development Description Information

The development description is provided in the PDR (PR#7 Section 4). Additional details required by the Adequacy Statement (PR#70) are provided here. Activities during the operational phase of the TASR will be defined within a Highway Operations Manual, specific to the TASR. A preliminary TASR operations and maintenance activity list,

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which will form the basis of the Operations Manual, and a preliminary construction schedule, are provided in Appendix B.

Government of the Northwest Territories Departmental Changes

The GNWT Departments of Transportation and Public Works and Services were amalgamated into a single Department of Infrastructure effective April 1, 2017. This change supports the GNWT's fiscal strategy and will provide a more efficient and effective delivery of government programs and services. References to DOT that remain within the Adequacy Statement Response should now be read as referring to the Department of Infrastructure. An effort will be made for the remainder of the environmental assessment process to refer to the new department name where applicable; however, as this amalgamation occurred during the final review of the ASR, the change could not be fully incorporated into this document.

Procurement Update

Section 4.6 of the PDR (PR#7) briefly mentioned that the anticipated Project delivery methods were contingent upon the type of financing that would be secured for the Project. On January 11, 2017, conditional approval of federal funding for the construction of the TASR was announced. The federal government will provide up to 25% of eligible Project costs through the P3 Canada Fund. The GNWT will be seeking to enter into a contract with a qualified entity to design, build, finance, operate, and maintain a new all-season road between Highway 3 and Whatì referred to as the Tłįchǫ All-Season Road Project (the Project).

The contract for the Project will be procured using a public-private partnership (P3) approach. The contract will utilize a Design Build Finance Operate and Maintain model in order to take advantage of private sector innovation and expertise. The GNWT expects that a single private partner will provide these integrated services, assuming and sharing defined risks and participating in the financing of the Project. The GNWT believes that the Project is an opportunity for participants to form an experienced, highly qualified, multi-disciplinary team supported by the financial and corporate commitment, resources and experience necessary to undertake the Project.

A Request for Qualifications (RFQ) was issued by the GNWT on March 20, 2017. The RFQ is the first stage in a competitive selection process in the P3 procurement process, in accordance with the GNWT's Public-Private Partnership Policy. The RFQ invites interested parties to submit responses indicating their interest in, and qualifications for, the Project. This includes an assessment on the technical and financial capacity to undertake the Project. Based on the responses to the RFQ, the GNWT intends to select a shortlist of up to three proponents to be invited to participate in the next stage of the procurement process, the Request for Proposals (RFP) stage, pending a decision on the environmental assessment for the Project. Remaining procurement processes will depend upon the results of the environmental assessment; as such, RFP submissions are only expected to be due once the environmental assessment has been complete.

Once the procurement process is completed, a Project Agreement will require the Preferred Proponent (also known as ‘Project Co.’) to design, build, finance, operate and provide maintenance, repair (including life cycle), and provide other specified services for the TASR for a period of 25 years commencing from the date of construction completion.

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Whatì Community Access Road 3 km Upgrade

Three kilometres of all-season road within the Community Government of Whatì (CGW) boundary requires upgrading. Since construction equipment will already be in the area when the TASR is being constructed, the Project Agreement that GNWT enters into with Project Co. will identify that three kilometres of Whatì's access road should be upgraded at the same time. Because of these three extra kilometres, all procurement documents indicate that the TASR is 97 km versus the environmental assessment documents that indicate the TASR is 94 km. The minor community access road upgrades do not require WLWB approval but are being mentioned here in an effort to remain transparent and to help clarify why media documents reference two different road lengths. To provide conservative estimates of environmental impacts to the terrestrial environment, the analysis in this ASR includes the TASR sections within the CGW boundary (i.e., the assessment includes 97 km of road).

It is expected that the Whatì Chief and Council will provide GNWT with a letter confirming the community's agreement to allow the necessary portion of the community access road to be upgraded prior to GNWT signing the Project Agreement with Project Co.

Borrow Sources

Section 4.5 of the PDR (PR#7) indicated that a total of 39 granular and 21 bedrock prospects were identified along the proposed TASR corridor (Figure 1.1-2). These sources were identified through a desktop study and a preliminary aerial investigation in 2015. In the fall of 2016, GNWT engineers narrowed the list of prospects down to 13 prime sources. These sources were then selected for geotechnical and geochemical investigations. The results of the investigations, though not currently available, will identify the quality of the sources, determine whether the sources meet specific criteria, and will confirm the available quantity of material at each source location.

The PDR originally indicated that it was expected that only four to five borrow sources would be required to construct the all-season road. However, upon further review, GNWT has identified that it is no longer possible to limit the number of sources to four or five. As it is currently unknown how Project Co. intends to proceed with construction, it is unknown which and how many of the 13 sources would be developed. It is anticipated that the overall area of disturbance will vary little regardless of the number of sources developed as the amount of material required to construct the road will be the same regardless of the number of sources. In consideration of this possibility, all 13 borrow sources were included in the effects analysis so the disturbance of all sources being utilized has already been considered. Of the 13 sources identified, five were wholly impacted by the 2014 forest fires, two others were mostly, and an additional one on Tłįchǫ lands was partially impacted. Most of the sources also overlap the TASR alignment so disturbance of these areas are already expected.

The PDR also originally indicated that it was unlikely that sources would be developed on Tłįchǫ or Community Government of Whatì (CGW) lands; however, this too has changed and it is possible that Project Co. will want to develop sources on these non-public lands. Two sources and a portion of a third are within Tłįchǫ lands, while one source is located on CGW lands. Both governments have indicated that development of the sources would be possible. Whatì has indicated a willingness to enter into an agreement with Project Co. so that the material from the community gravel pit could be sold to Project Co.; however, these details would only be finalized once the P3 procurement process has been completed. Please see Section 1.4 of the ASR for further details on how the borrow sources located on Tłįchǫ lands conform to the Tłįchǫ Land Use Plan.

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Geotechnical Investigations

The GNWT proceeded with a land use permit application for design phase geotechnical investigations along the proposed TASR corridor in November 2016. This application was submitted in order to conduct geotechnical investigations at selected bridge and culvert locations and at specified locations along the centerline alignment of the proposed corridor. The investigations were considered part of the design phase of the Project and were considered exploratory in nature. The results from the investigations will benefit the overall TASR Project as they will provide a more accurate assessment of the subsurface conditions. On January 13, 2017, the WLWB issued the Land Use Permit (W2016S0009) and operations began in early February 2017. On March 7, 2017, a letter was emailed to the geotechnical permit distribution list informing the group of GNWT's intention to submit an amendment application so that geotechnical investigations could also be completed on the 13 proposed borrow sources. The amendment application was submitted on March 16, 2017 and a decision from WLWB is expected by May 8, 2017. Final laboratory results from the investigations are anticipated to be available in fall 2017.

Camp and Wastewater Amendments

Section 4.8 of the PDR (PR#7) indicated that two to three camps would be placed no more than 50 km apart to ensure a maximum driving distance of 25 km for Project workers and that only one camp would be operated at a time or if the construction schedule were shortened, two camps could operate at a time. The expected sizes of the construction camps were 150-person facilities which would be located within borrow source footprints to reduce the amount of disturbance. Camps were also expected to be only located on Territorial lands. Upon further review and because it is still unknown how Project Co. will proceed with construction of the TASR, the number and type of camps may increase.

Depending on final construction details, it is possible that Project Co. may use large camps within borrow sources on Tłįchǫ lands rather than being limited to borrow sources on Territorial lands. Project Co. will still be encouraged to not erect any form of camp within Whatì community lands.

It was originally anticipated that the 150-person camps would move as construction progressed to limit driving distance to 25 km for Project workers. Because of the costs associated with mobilizing and demobilizing a 150-person camp, it is possible that Project Co. may not want to move the camps; therefore, the driving distance between camp and the worksite may be greater than 25 km. Project Co. may also wish to use a number of smaller camps at any one time. The smaller camps would still be restricted to only using areas already planned to undergo disturbance, such as the ROW or borrow sources. These smaller camps may occur anywhere along the alignment; however, it is not expected that these camps will be located on Whatì community lands.

Section 4.11.2 of the PDR (PR#7) indicated that sewage and greywater from the 150-person camps would be collected in sewage holding tanks and would be transported to Behchokǫ̀ for appropriate disposal; however, in order for Project Co. to have more flexibility with construction delivery methods, additional methods for wastewater disposal are also being considered. Additional wastewater disposal methods include:

1) Greywater and sewage from smaller camps may be deposited into sumps or onto the land pending approval from an Inspector.

2) Greywater from the larger camps may use sumps pending approval from an Inspector. Grease traps on camp facilities will ensure greywater is suitable for sumps and setback distances from watercourses would be observed.

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3) Sewage from the larger camps is expected to be collected and transported to Behchokǫ̀ for appropriate disposal; however, depending on the progress of Whatì's sewage treatment facility, it may also be possible to dispose of some sewage in Whatì. The final disposal methods will be subject to permitting.

All waste disposal methods will be described in an updated Waste Management Plan that will undergo approvals during the final WLWB permitting process.

Detailed Construction Phase Schedule

The TASR PDR (PR#7) provided most of the development description details requested under Section 3.6 of the TOR (PR#69); however, as per Table 3-1 of the Adequacy Statement (PR#70), some activities required additional information. This section of the ASR provides the remaining details that were requested.

As indicated in Section 4.6 of the PDR (PR#7) and briefly discussed in a section above, the construction and Project delivery methods are contingent upon Project Co. so it is difficult to anticipate the detailed schedule of Project activities. A public-private partnership Design Build Finance Operate and Maintain model allows the GNWT to take advantage of private sector innovation and expertise so it is anticipated that Project Co. will use fiscally responsible best management practices when submitting their final Project design. GNWT engineers have drafted two possible construction schedules as examples (Appendix B), but the final construction schedule will depend upon the Project Co. proposal, the environmental assessment process and permitting.

Appendix B, Option 1 lists the activities and tentative start and end dates for a four-year construction schedule using one spread (i.e., the construction schedule would commence at Highway 3 and continue northward). This schedule anticipates only one large camp being constructed near Highway 3 because camp mobilization costs are expected to be cost prohibitive. Appendix B, Option 2 describes a two-spread approach, where construction occurs simultaneously from both the south and north ends. If the two-spread approach is used, camps would need to be constructed at either end of the Project. A four-year construction schedule is anticipated, although construction in two years is possible depending upon the capacity of Project Co.

Estimated Traffic Projections for the Tłı̨chǫ All-season Road

Please see Appendix C for an analysis of traffic for further clarification regarding how the GNWT TASR traffic projection was determined. After reanalysis of the data, the initial estimate of 20 to 40 vehicles per day remains unchanged.

1.2.2 Developer Information

The Adequacy Statement (PR#70) requests further information on GNWT-DOT regulatory compliance on previous construction Projects. The GNWT-DOT has a history of applying for and maintaining land use permits and water licences, responding to inspector concerns, and a strong commitment to environmental stewardship. A summary of inspector reports from the Deh Cho Bridge and Inuvik to Tuktoyaktuk Highway are presented as an example of the GNWT-DOT environmental performance record (Appendix D).

1.2.3 Existing Conditions

The PDR (PR#7 Section 4) includes details of route selection, road design parameters, borrow sources, construction, equipment, camps, fuel and oil storage, water use, waste management and reclamation.

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The PDR (PR#7 Section 6) also includes overviews of the existing conditions (including climate, air quality, climate change, terrain, permafrost and soils, vegetation, wildlife, hydrology and water quality, fish and fish habitat) and human environment (including cultural and heritage resources, communities, tourism and socio-economics). This ASR augments the environmental and human environment overview where necessary to provide sufficient information for the assessment.

1.2.4 Potential Environmental Impacts

The PDR (PR#7 Section 8) includes a summary of anticipated environmental impacts for air quality and emissions, noise, climate change, terrain, soil and permafrost, vegetation, hydrology, water quality, environmental effects of the Project. As per the Adequacy Statement (PR#70), the anticipated environmental impacts related to wildlife, fish and fish habitat and socio-economics (including communities, cultural and heritage resources) are considered in further detail in Sections 3.0, 4.0 and 5.0 of the ASR.

1.2.5 Ongoing Public Engagement

As a part of the preliminary screening process, the GNWT developed an Engagement Plan (PR#7, Appendix E) to meet the requirements outlined in MVLWB's Engagement and Consultation Policy (2013), and the guidelines presented in the MVLWB Engagement Guidelines for Applicants and Holders of Water Licenses and Land Use Permits (2014) (PR#7). In addition to this process, the GNWT also has a legal duty to consult and, where appropriate, accommodate an Aboriginal Government or organization whenever it considers carrying out a government action that has the potential to adversely affect an asserted or established Aboriginal and/or Treaty right (PR#7 Section 5.2). Under this duty to consult and as a part of the preliminary screening process, the Department of Aboriginal Affairs and Intergovernmental Relations instructed GNWT-DOT to consult with the following Aboriginal governments and organizations based on the location of the proposed TASR: Tłįchǫ Government, Acho Dene Koe First Nation, Mountain Island Métis, Dehcho First Nations, Northwest Territory Métis Nation, and the North Slave Métis Alliance (NSMA). The details of these consultations, up until March 31, 2016 are detailed in the the PDR (PR#7, Section 5, Appendix E).

Based on comments received during the preliminary screening process, Yellowknives Dene First Nation (YKDFN) were subsequently added to the consultation list. Once the project was referred to EA, the list was further expanded to include the Deninu K'ue First Nation, Łutsel K'e Dene First Nation, Mountain Island Métis, North Slave Métis Alliance, Northwest Territory Métis Nation, Fort Smith Métis Nation, Hay River Métis Council, Fort Resolution Métis Council, Tłįchǫ Government and Yellowknives Dene First Nation. Notification of EA letters were distributed (PR#49). YKDFN and the Akaitcho were not part of the original list because the proposed TASR Project area did not intersect their community asserted territory (Chief Drygeese) and the Akaitcho asserted territory. The YKDFN were included following a letter to the WLWB during the preliminary screening raising concerns about wildlife, archeological sites and consultation. Initially the Deh Gah Got'ie First Nation were not consulted separately from the Dehcho First Nations so were not notified directly. When the GNWT sent out letter to regional and community governments of Dehcho First Nations, the Deh Gah Got'ie First Nation indicated intent to participate. Of the newly added AGOs, the only additional AGO to respond to the notification of environmental assessment has been Deh Gah Got'ie First Nation. The GNWT will rely both on the consultative process of the Review Board and as the proponent for this Project, its bilateral consultation with AGOs, to fulfill the GNWT's duty to consult.

All additional consultation and engagement activities that have occurred during the environmental assessment to date have been captured in an updated consultation and engagement log that is provided (Appendix E). Any of

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the steps included in the log may be taken into account when assessing adequacy of section 35 consultation and accommodation.

1.3 Developer Commitments

The GNWT has made a range of commitments to mitigate environmental effects, described in the Pathways Tables in Sections 3.0, 4.0 and 5.0. The GNWT is the responsible authority for implementing this mitigation, unless otherwise noted. In addition to the mitigation listed in the Pathway Tables, supplementary GNWT commitments are listed in Appendix F. This list will be updated as the environmental assessment process continues.

The GNWT also commits to following or enforcing the following guidance in environmental management plans and mitigations throughout the construction and maintenance of the TASR.

Mackenzie Valley Land and Water Board

- Engagement and Consultation Policy
- Engagement Guidelines for Applicants and Holders of Water Licences and Land Use Permits
- Water and Effluent Quality Management Policy
- Guidelines for Developing a Waste Management Plan

Fisheries and Oceans Canada

- Protocols for Winter Water Withdrawal in the Northwest Territories
- Measures to Avoid Causing Harm to Fish and Fish Habitat Including Aquatic Species at Risk
- Indigenous and Northern Affairs Canada Guidelines for Spill Contingency Planning

Government of the Northwest Territories

- Draft Wildlife and Wildlife Habitat Protection Plan and Wildlife Effects Monitoring Program Guideline
- Guidelines for Dust Suppression
- Northern Land Use Guidelines: Camp and Support Facilities
- Northern Land Use Guidelines: Pits and Quarries
- Northern Land Use Guidelines: Access: Roads and Trails
- Guidelines for Developers for the Protection of Archaeological Sites in the Northwest Territories
- Forest Fire Prevention and Suppression Guidelines for Industrial Activities

1.4 Land Use Plans

As discussed in Section 3.1.1 of the PDR (PR#7), the GNWT and Tłı̨chǫ Government intend to exchange land so that the portion of the planned transportation corridor to be built on lands currently owned by the Tłı̨chǫ Government will rest upon Territorial land following its construction. When the exchange is completed, this 17 km

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portion of the TASR corridor will no longer be subject to the Tłı̨chǫ Land Use Plan. A GNWT Land Exchange Working Group has been created to complete the land exchange. The land exchange will be finalized after the highway is constructed, as legal surveys of the finished highway are required for Transfer documents that can be registered at the Northwest Territories' Land Titles Office. The Tłı̨chǫ Government and GNWT will enter into an agreement that provides for any required access, use of the highway lands, and the contemplated land exchange. A draft agreement has been prepared and reviewed by both governments, and the parties hope to have the agreement finalized by the end of April, 2017.

The GNWT, Tłı̨chǫ Government and other planning partners are developing a land use plan for public lands in the WRMA. However, as the planning process is in the early stages, the public lands plan will not affect the TASR.

1.5 List of Required Approvals

Section 3.5 of the Terms of Reference (PR#69) require an updated list of anticipated authorizations, permits licences and other approvals for the Project, including any authorizations required from the Tłı̨chǫ Government, Fisheries and Oceans Canada (DFO) or other responsible authorities that are not already covered in the PDR. The anticipated approvals are listed in Table 1.5-1.

Table 1.5-1: Approvals Required for TASR Construction and Operation

Process, Authorization, Permit, Licence, Approval	Act and/or Regulation	Board, Agency or Organization
Land		
Type A Land Use Permit (for construction, application W2016E0004)	*Mackenzie Valley Land Use Regulations*	Wek'èezhìı Land and Water Board (WLWB)
Type A Land Use Permit (for predesign geotechnical investigations, W2016S0009), already issued	*Mackenzie Valley Land Use Regulations*	WLWB
Land Use Permit (for routine operation and maintenance)	*Mackenzie Valley Land Use Regulations*	WLWB
Quarry Permit	*Quarrying Regulations* *Northwest Territories Lands Act/Regulations* *Northwest Territories Land Use Regulations*	GNWT Department of Lands
Explosives Permit	*Explosives Act/Regulations 2013* *Explosives Use Act/Regulations*	Natural Resources Canada Workers' Safety and Compensation Commission
Access Authorization (borrow sources, access roads and TASR corridor during construction)	*Tłı̨chǫ Lands Protection Amendment Law* *Tłı̨chǫ Land Use Plan Law*	Tłı̨chǫ Government
Approval to transport dangerous goods	*Transportation of Dangerous Goods Act/Regulations*	Transport Canada
Permit to Burn and Fire Preparedness Plan	*Forest Protection Act*	Forest Management Division, GNWT-ENR
Lands Reserve	*NWT Lands Act*	GNWT Department of Lands
Land Exchange	*Tłı̨chǫ Agreement*	Tłı̨chǫ Government - GNWT
Water		
Type B Water Licence (to span rivers, application W2016L8-0001)	*Waters Act/Regulations* *MVRMA*	WLWB
Navigable Waters Protection Act Approval	*Navigable Waters Protection Act*	Nav Canada
Fisheries Act Authorization	*Fisheries Act*	Fisheries and Oceans Canada

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Table 1.5-1: Approvals Required for TASR Construction and Operation

Process, Authorization, Permit, Licence, Approval	Act and/or Regulation	Board, Agency or Organization
Wildlife		
Research permit	*Scientists Act*	Aurora Research Institute
Wildlife permit	*Wildlife Act*	GNWT Environment and Natural Resources
Wildlife Management and Monitoring Plan	*Wildlife Act*	GNWT Environment and Natural Resources
Other		
Archaeology Permit	*Archaeological Sites Act/Regulations*	GNWT Education, Culture and Employment
Camp Sanitation Approval	*Public Health Act/Camp Sanitation Regulations*	Department of Health and Social Services
Waste Disposal Approval		Communities of Whatì and Behchokǫ̀

The use of solid waste facilities of Behchokǫ̀ and Whatì as well as Behchokǫ̀'s sewage treatment facilities (as indicated in the PDR) is one of several options only and alternate disposal options will be considered. The final disposal method will be subject to permitting.

1.6 Monitoring

Monitoring is proposed to deal with the uncertainties associated with the effect predictions and to assess the effectiveness of mitigation. Monitoring also is used to identify any unanticipated effects and guide the implementation of adaptive management to limit these effects. Typically, monitoring includes the following categories:

- **Compliance monitoring** confirms the implementation of approved design standards, mitigation, legal requirements and conditions of approval and proponent commitments (e.g., inspecting the installation of a silt fence, or monitoring water quality during instream works).
- **Follow-up monitoring** tests the accuracy of effects predictions, reduces/addresses uncertainties, determines the effectiveness of mitigation, and/or provides feedback for modifying or adopting new mitigation (e.g., wildlife effects monitoring and socio-economic monitoring). Results from these programs can be used to increase the certainty of effect predictions in future environmental assessments.
- **Regional cumulative effects monitoring** considers the overlapping effects from all development and natural environmental changes, but typically occurs at too large a scale to detect project-specific effects.

The monitoring may either be routine and regular (such as inspections), or triggered by events (such as a spill or habituated wildlife). If monitoring detects effects that are different from predicted effects, or the need for changes to mitigation, then adaptive management will be implemented. This may include increased monitoring, changes in monitoring plans, or additional mitigation.

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The environmental monitoring described in this document that is specific to the Project includes the Wildlife Management and Monitoring Plan, the In-Field Water Analysis Plan, and the Fish and Fish Habitat Protection Plan. Monitoring is also required or triggered by other GNWT documents including the Erosion and Sediment Control Manual and the Spill Contingency Plan. These documents will be updated and approved during the Project regulatory phase.

Environmental compliance and follow-up monitoring during Project construction will be implemented by dedicated Environmental Monitors. These individuals will have access to all Project construction workings, and will have the responsibility to advise construction staff, document observations, and report back to the relevant regulatory authorities. It is anticipated the Environmental Monitor will be a single full-time role (i.e., two individuals on rotation). Monitoring during the operational phase will be the responsibility of both the GNWT and Project Co. Further detail on compliance and follow-up monitoring relevant to the EA is provided in Sections 3.6, 4.7 and 5.6.

Regional cumulative effects monitoring is coordinated in the Northwest Territories by the GNWT Cumulative Impact Monitoring Program (CIMP). Descriptions of CIMP monitoring relevant to the Project area is described in NWT CIMP 2016a, 2016b and 2016c. The monitoring described in the ASR comprises compliance and follow-up monitoring, and the GNWT will continue to contribute to regional cumulative effects monitoring through CIMP.

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2.0 ASSESSMENT METHODS

2.1 Approach

The purpose of the ASR is to assess the potential Project effects, and to describe the proposed mitigation and monitoring to detect and reduce or avoid these effects. This is completed through a systematic approach, using standardized methods. The specific methods used here conform to guidance provided in the MVEIRB Environmental Impact Assessment Guidelines (MVEIRB 2004) and the Terms of Reference (PR#69).

2.2 Pathway Analysis

Pathway analysis identifies and assesses the linkages (or interactions) between the Project components and activities and the predicted changes to the environment that may affect Valued Components (VCs). A pathway analysis was used to refine the understanding of how the Project may affect VCs, to identify appropriate mitigation, and to help focus the assessment on key interactions between the Project and the environment. The pathway analysis involved the following steps:

1) identifying potential Project effect pathways
2) identifying mitigation that can be incorporated into the Project to avoid and minimize adverse effects
3) screening pathways to assess if, after incorporating mitigation, there is still potential for the change in the environment to cause or contribute to significant residual effects

The first step was to identify potential pathways and this was accomplished by:

- reviewing the proposed PDR (PR#7) and identifying potential effects by the environmental and engineering teams for the Project
- obtaining local and Traditional Knowledge (TK) from engagement with the communities and the Tłı̨chǫ TK Report (PR#28)
- understanding the existing conditions for the Project through field surveys, literature review, and scientific knowledge
- considering potential effects identified in the Adequacy Statement (PR#70) and TOR (PR#69)
- using scientific knowledge and experience with other road developments in the NWT

Project-environment interactions (or pathways) can generate multiple effects on VCs. For an effect to occur there has to be a source (Project component or activity) that results in a measurable change to the environment (pathway or measurement indicator) and a corresponding effect on the VC.

Project Activity → **Change in Environment** → **Effect on VC**

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The next step in the analysis was the application of mitigation that could be incorporated into the Project to avoid and/or minimize adverse effects to VCs. Mitigation may include Project design elements, environmental best practices, management policies and procedures. Mitigation was identified using the precautionary principle where the presence of an effect was uncertain. Uncertainty in the effectiveness of mitigation was also incorporated in the assessment.

After applying environmental design features and mitigation, a screening-level analysis was used to determine whether mitigation would remove potential effects pathways for the Project. This screening step is largely a qualitative assessment and is intended to focus the effects analysis on pathways that require a more comprehensive assessment of effects on VCs. Each potential pathway was assessed and described as follows, using scientific knowledge, TK (where available), logic, and experience with similar developments and effectiveness of environmental design features and mitigation:

- **No linkage** – analysis reveals that the pathway is removed (i.e., effect is avoided) by mitigation so that the Project would not be expected to result in a measurable environmental change relative to existing conditions (Base Case) and therefore would have no residual effect on the VC.
- **Secondary** – analysis reveals that the pathway could result in a measurable minor environmental change relative to existing conditions, but, after mitigation, would have a negligible residual effect on the VC and is not expected to contribute to effects of other past, previous or reasonably foreseeable developments (RFDs) to cause a significant effect.
- **Primary** – pathway is likely to result in an environmental change relative to existing conditions that could contribute to residual effects on the VC.

Pathways evaluated as no linkage (i.e., effects are avoided) or secondary (i.e., effects are minimized) were not assessed further because they were not expected to result in significant effects on self-sustaining or ecologically effective VCs, either individually or cumulatively. The rationale for these assessment decisions is presented for each pathway. Primary pathways require further evaluation through more detailed quantitative and qualitative effects analysis of the effects to the VC, which typically includes the classification of residual effects to support the determination of environmental significance.

2.3 Residual Effects Analysis

The residual effects analysis is based on the Project interactions that are determined to be primary in the pathway analysis.

The residual effects analysis is completed for the Application Case and the Reasonably Forseeable Development (RFD) Case, relative to the Base Case.

- **Base Case –** Represents existing (or baseline) conditions including cumulative changes from previous and existing developments and activities (Section 1.2). The Base Case describes the baseline conditions against which potential changes to VCs from the Project are compared and evaluated.
- **Application Case –** Represents predictions of the effects from the Base Case combined with the effects from the Project. This case is also used to identify the incremental changes from the Project that are predicted to occur between the Base Case and the Application Case.

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Reasonably Foreseeable Developments Case – Represents predictions of the cumulative effects of the Application Case, which includes the Base Case, plus Projects that are currently under application review or that have officially entered a regulatory application process, and are therefore, considered reasonably foreseeable. The following developments have the potential to overlap with VCs and were confirmed by the TOR include (PR#7):

- Fortune Minerals Ltd. NICO Mine
- Nailii Hydroelectric Project at La Martre River Falls
- Tłįchǫ/Whatì Park Area at La Martre Falls

The RFD Case also considers other disturbance factors such as climate change, which can influence VCs beyond the study area. The RFD Case for boreal caribou also includes the proposed Mackenzie Valley Highway and the Prairie Creek Mine Project.

The residual effects analysis for the Application Case is completed by predicting changes to VC measurement indicators. To be conservative, the regional study area (RSA) was used for the effects analysis instead of the Project footprint so that direct effects to VCs would not be underestimated. Similar to the Application Case, effects in the RFD Case were predicted using quantitative and qualitative changes in measurement indicators. Methods for effects classification and determination of significance use standardized criteria (direction, magnitude, geographic extent, duration, reversibility, frequency, timing and likelihood), and definitions relevant to the discipline are provided in each discipline section. Likewise, the approach for the determination of significance is provided in each discipline section.

2.3.1 Mitigation

The Adequacy Statement requires that the developer describe:

- the potential impacts (effects pathways) that may occur
- the Project components and/or activities that to which the effects pathway is linked
- how the proposed mitigation will reduce or avoid the effects pathway

The mitigation hierarchy will be used to describe how the proposed mitigation will avoid or minimize each pathway (BBOP 2017). The mitigation hierarchy is as follows.

1) **Avoidance:** measures taken to avoid creating impacts from the outset, such as careful spatial or temporal placement of elements of infrastructure, in order to completely avoid impacts on certain components of biodiversity.
2) **Minimization:** measures taken to reduce the duration, intensity and / or extent of impacts (including direct, indirect and cumulative impacts, as appropriate) that cannot be completely avoided, as far as is practically feasible.
3) **Rehabilitation/restoration:** measures taken to rehabilitate degraded ecosystems or restore cleared ecosystems following exposure to impacts that cannot be completely avoided and / or minimized.

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4) **Offset:** measures taken to compensate for any residual significant, adverse impacts that cannot be avoided, minimized and / or rehabilitated or restored, in order to achieve no net loss or a net gain of biodiversity. Offsets can take the form of positive management interventions such as restoration of degraded habitat, arrested degradation or averted risk, protecting areas where there is imminent or projected loss of biodiversity.

2.4 Incorporation of Traditional Knowledge

This summary explains how traditional knowledge (TK) has been incorporated into specific aspects of Project design; impact predictions; and potential mitigations. The Tłįchǫ Government, in its comments on the draft TOR, stated that the Tłįchǫ Government has been fully involved in carrying out TK research in the region, and the GNWT has integrated findings in a manner that is satisfactory (PR#76). Traditional knowledge was used throughout the ASR, and citations are provided to indicate where the available TK information was incorporated. Specific to the assessment of effects to fish and fish habitat (Section 3.0), TK was used to identify stream crossings for assessment, identify fish species present in the streams, and to estimate likely changes in use of these resources if access is improved. With regards to the assessment of effects to wildlife and wildlife habitat (Section 4.0), TK was used to identify VCs, define study areas for VCs, describe baseline conditions and traditional use, and estimate effects to VCs or changes in harvesting. Finally, TK was used in the assessment of effects to the socio-economic environment (Section 5.0) to describe current and historic land use, cultural values, and assess possible impacts that may result from the TASR.

2.4.1 Incorporation of Tłįchǫ Traditional Knowledge

The K'àgòo tįlıì Deè: Traditional Knowledge Study for the Proposed All-Season Road to Whatì (PR#28) was prepared and funded under a Memorandum of Understanding between the Tłįchǫ Government and GNWT. The study engaged the TK of 16 male Elders and harvesters in Whatì and Behchokǫ̀, each of whom had personal experience and knowledge surrounding the proposed TASR. The TK report outlines the importance of the Old Airport Road area to Tłįchǫ citizens. The Elders who contributed to the report identified several sacred places and culturally important sites in the vicinity of the TASR which were considered during route design in order to avoid these areas (PR#7 Section 7.1.2). Road design also considered the location of grave sites identified in the TK study.

The Elders also discussed the importance of the river crossings at Tsotìdeè (La Martre River) and Ɂehtł'ètìdeè (James River). These rivers are important sites for travel, hunting, fishing, and trapping. The Elders remarked that as long as bridges avoid contact with the rivers, the fish were unlikely to be disturbed. They noted that Tsotìdeè is near an important portage at T'oohdeèhoteè, and that a bridge should be built west of the portage to avoid potential disturbance to this site (PR#7 pg. 23). This TK and recommendations were considered in Project design by the GNWT; bridges will be constructed over the river crossings and will not come into contact with them, and the bridge at Tsotìdeè will be west of T'oohdeèhoteè to avoid any disturbance to this important cultural site.

Trails were identified as important means of travel for hunting, fishing and trapping on the land. Four main types of trails were identified that intersect with the TASR: Ɂelà etò (a canoe route), Whaàhdòò etò (the Ancestors trail), Màa tįlıì (a snowmobile trail), and K'àgòo tįlıì (the Old Airport Road) (PR#28 Map 4). The Elders noted that a road may increase safety risks to trail users where trails cross the TASR, particularly with large trucks traveling along the road. The GNWT has considered these concerns in the design of the road through the installation of suitable

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crossings, pullouts and signage (PR#7 pg. 5 & 6). A number of additional proposed mitigation measures are presented in the TK Study and are briefly discussed below.

During the summer of 2014, a ground-truthing trip was completed to identify traplines and cabins along the route. To avoid potential disturbance to cabins, it is expected that a 50 m buffer will be implemented at these sites (PR#7 Section 7.1.2). Two cabins were identified along the TASR route; however, both were burned down during the 2014 forest fires and traplines were subsequently relocated. During the ground-truthing trip, the Tłįchǫ Government Lands staff reviewed all river crossings, and gave specific guidance on the TASR route location and crossings. Further, all river crossings were photographed and the photos were subsequently shared with community members during meetings. Elders provided comments on the locations and discussed the crossings with the GNWT, and a helicopter flight over the TASR route provided the opportunity for one Elder to view the crossing locations and provide further feedback (PR#7).

2.4.2 Traditional Knowledge Study Mitigation Measures

The Tłįchǫ Government, CGW and GNWT have made a number of commitments to address the proposed mitigations presented in the TK Study (PR#28) based on community concerns related to TK, traditional use and culture from potential effects of the TASR. These commitments or mitigation measures were developed after review of the TK study, the Socio-Economic scoping study, and through ongoing discussions with community members and the GNWT and were accepted by Tłįchǫ Government.

It is the responsibility and authority of the Tłįchǫ Assembly and Chief's Executive Council to develop and implement new laws and regulations, including the existing Tłįchǫ Lands Protection Law. These authoritative powers include the right to establish specific restrictions and access provisions relating to Tłįchǫ lands and resources on or under those lands (although only a portion of the Project is on Tłįchǫ lands, see Figure 1.1-1). The overall authority for Tłįchǫ law-making powers derive from the *Tłįchǫ Agreement*. These legislative mechanisms will be developed and implemented as required, and at the discretion of the law maker, to mitigate any potential significant impacts to the environment and/or wildlife as a result of any potential development or activity on or impacting Tłįchǫ lands.

2.4.3 Tłįchǫ Government Information Requests

At the initiation of the environmental assessment process, the MVEIRB issued information requests to several parties, including the Tłįchǫ Government and the Community Government of Whatì (PR#73), which were later responded to by these two agencies (PR#95, #96, #97). These responses involved in-depth discussions and interviews with key Tłįchǫ Government personnel, service providers and agencies in Whatì, including with:

- the Senior Administrative Officer of the CGW and Behchokǫ̀
- the RCMP in Behchokǫ̀ and Whatì
- the authors of the TK Study (PR#28) and the Socio-economic Issues Scoping Study (PR#7)
- the Tłįchǫ Government staff
- Tłįchǫ Community Services Agency (TCSA) staff
- key service providers in Behchokǫ̀ and Whatì (i.e., education, housing, health and language specialists)

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- the Government of the Northwest Territories, Bureau of Statistics (GNWTBS)

The Tłįchǫ Lands Protection Department provided integral input to several IR responses and provided additional mapping analysis for the data collected during the TK Study (PR#28). These contributions to the TASR assessment are important to note as the collection and verification of data with community members and TK holders is an ongoing process. Elders, community members and TK holders played a pivotal role in the identification of the preferred all-season road route, and continue to provide ongoing guidance and feedback throughout the review process.

2.4.4 Additional AGO Information Requests

On December 21, 2016, NSMA responded to MVEIRB's Information Requests to describe and evaluate the potential adverse impacts to NSMA members' Aboriginal well-being and way of life as a result of the TASR (PR#99). The GNWT will consider NSMA's responses in Project planning and design, and will continue to engage with NSMA through the consultation process.

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3.0 ASSESSMENT OF EFFECTS TO FISH AND FISH HABITAT

3.1 Introduction

3.1.1 Background

The Tłı̨chǫ All-Season Road is proposed to be a 94 km long, two-lane gravel road connecting Highway 3 to the community government boundary of Whatì in the Northwest Territories (NWT). The proposed TASR alignment crosses 15 watercourses/drainages, including four crossings of larger, permanent watercourses, the Duport River, an unnamed watercourse at km 45.2 (crossing #9), James River, and La Martre River (Figure 3.1-1).

Additional information required by the Adequacy Statement (PR#70) for fish and fish habitat include describing the impacts to fish habitat and fish harvesting resulting from road construction and maintenance and from increased access to fish-bearing waters. Specific required information includes describing possible impacts to and mitigation for:

- fish population and water quality changes caused by the use of explosives during construction
- water quality and fish population changes caused by accidents, spills, and runoff during construction and operation
- fish habitat changes caused by sedimentation resulting from construction and operation
- fish habitat changes caused by changes to riparian zones and watercourse bed and banks during construction
- fish population changes caused by increased fishing pressure as a result of improved access

These and other pathways are considered in this section.

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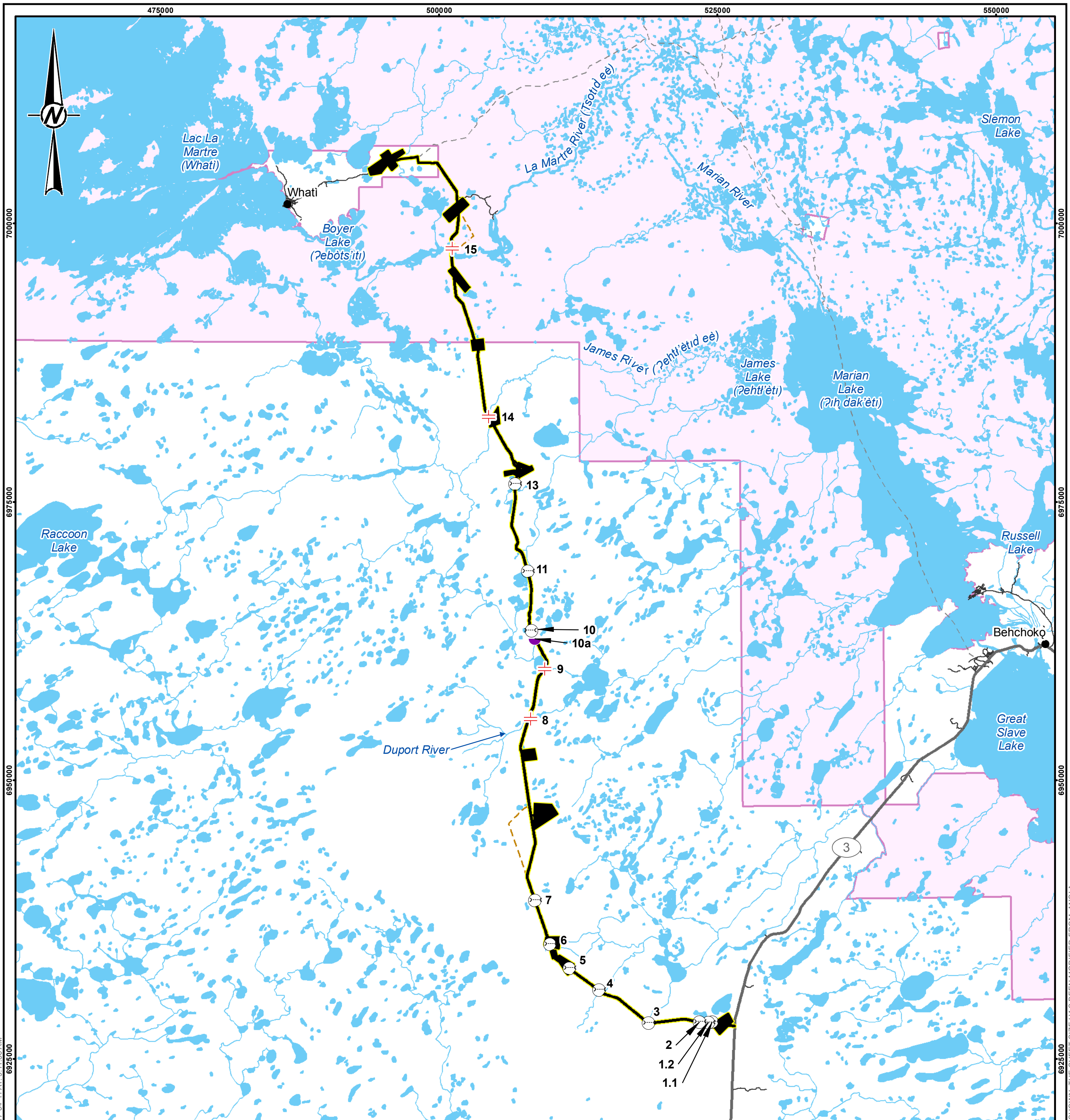

LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- OLD AIRPORT ROAD
- WATERCOURSE
- TŁĮCHǪ LAND
- WATER BODY

PROPOSED CROSSING STRUCTURES

- PROPOSED BRIDGE
- PROPOSED ARCHED (OPEN BOTTOM) CULVERT
- PROPOSED CLOSED BOTTOM CULVERT
- PROJECT FOOTPRINT

0 10 20

1:500,000 KILOMETRES

REFERENCE(S)

1. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
TŁĮCHǪ ALL-SEASON ROAD

TITLE
PROPOSED TASR ALIGNMENT AND WATER CROSSINGS

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-04-11
DESIGNED	KN
PREPARED	LMS
REVIEWED	DP
APPROVED	DP

PROJECT NO.	REV.	FIGURE
1665943	0	3.1-1

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3.1.2 Purpose and Scope

The purpose of this section of the report is to address the additional required information identified in the MVEIRB Adequacy Statement (PR#70) for fish and fish habitat and to meet the Terms of Reference (PR#69). This will be achieved by selecting VCs, defining the temporal and spatial boundaries for fish affected by the proposed TASR, and by completing an assessment of the effects of the proposed TASR construction and operation on fish and fish habitat.

3.1.3 Valued Components, Assessment Endpoints, and Measurement Indicators

VCs refer to environmental features that may be affected by a project and have been identified to be of concern by the proponent, scientists, government agencies, Aboriginal peoples, or the public (MVEIRB 2004).

The fish VCs identified for the Project are Arctic Grayling, Lake Trout, Northern Pike, Walleye, and Whitefish species (belonging to the subfamily Coregoninae, Table 3.1-1). These VCs represent species harvested by local Tłįchǫ fishers (PR#28; PR#97), as well as other Aboriginal or recreational fishers (DFO 2012), and represent a variety of habitats and seasons used throughout their respective life histories.

Table 3.1-1: Selected Fish VCs for the TASR and Rationale for Selection

Valued Component	Rationale for Selection
Arctic Grayling	■ Spring spawning species that primarily spawn in watercourse habitat with gravel substrates ■ Relatively common in watercourses in the RSA, especially the larger watercourses ■ Fished for traditional/subsistence use, and popular sport fish in NWT ■ Uses stream habitats for spawning and rearing, but overwinters in lakes ■ Feeds primarily on aquatic and terrestrial insects, as well as plankton
Lake Trout	■ Stringent habitat requirements (e.g., cold water lakes) and is sensitive to disturbance ■ Prevalent in the larger lakes and watercourses in the RSA ■ Fished for traditional/subsistence use; Lake Trout have been fished commercially in NWT at certain locations (e.g., Lac La Martre); popular sport fish in NWT ■ Fall spawning species that spawn in rocky shoal habitat in lakes ■ Completes most of its life history in lakes, with occasional movements into streams ■ Long-lived predatory species; primarily piscivorous
Northern Pike	■ Spring spawning species that spawn in slow moving watercourses and shallow areas of lakes with instream vegetation ■ Fished for traditional/subsistence use, and popular sport fish in NWT ■ Likely prevalent in a large proportion of lakes and watercourses in the RSA ■ Often a top predator in their ecosystem, they feed on fish, crustaceans, aquatic insects, and other animals (young muskrats or ducklings)
Walleye	■ Spring spawning species that spawn in lakes or larger watercourses with coarse substrates ■ Fished for traditional/subsistence use, with some sport fishing in NWT ■ Prevalent in lakes and watercourses in the RSA ■ Feed mostly on fish and aquatic invertebrates

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Table 3.1 1: Selected Fish VCs for the TASR and Rationale for Selection (continued)

Valued Component	Rationale for Selection
Whitefish (Coregonid) Species	■ Includes Round Whitefish, Lake Whitefish, Lake Cisco, and Inconnu ■ Fall spawning species that spawn primarily on gravel habitat in lakes or larger streams ■ Fished for traditional/subsistence use; Lake Whitefish has been fished commercially in NWT at certain locations (e.g., Lac La Martre) and continues to be a primary species targeted for subsistence fishing. ■ Complete much of their life history in lakes, with movements into streams or shallow bays for spawning and rearing ■ Whitefish and Cisco feed primarily on benthic organisms; Inconnu are primarily piscivorous. ■ Prevalent in the larger lakes and watercourses in the RSA (e.g., Lac La Martre, La Martre River, Marian River, James River)

Note: RSA defined in Section 3.1.4

The five fish species/groups were identified as VCs for fish and fish habitat, in part because they are species of value to communities, government agencies, and the public, and because they are representative harvested species. All VCs are fish species that can be part of a commercial, recreational, or Aboriginal fishery; therefore, including these species as criteria is consistent with DFO's legislation and policy (i.e., *Fisheries Act* [Government of Canada 1985] and Fisheries Protection Policy [DFO 2013]). Each of the VCs represent fish that are harvested from watercourses within the proposed TASR corridor and/or from watercourses and lakes where access might be improved by the TASR (PR#74).

The only fish species at risk in the Tłįchǫ region is the Shortjaw Cisco (*Coregonus zenithicus*), which is listed as 'Threatened' by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC; 2017) and under Schedule 2 of the *Species at Risk Act* (SARA 2017). Shortjaw Cisco are most commonly found in large lakes and the only confirmed presence within the Tłįchǫ region is in Great Slave Lake (COSEWIC 2003). Though it is present within the Tłįchǫ region, it is unlikely to exist within the area potentially affected by the Project and therefore will not be discussed further in this report.

Assessment endpoints represent the key properties of each VC that should be protected. Self-sustaining and ecologically effective populations and ongoing fisheries productivity represent the assessment endpoints for fish and fish habitat. The sustainability of the fish population(s) depends on the quantity and quality of the habitats required for each species and their respective life history stages. While recognizing that fish populations can fluctuate naturally, sustainable or self-sustaining populations are defined as those with the inherent capacity to be productive when their habitats and environmental conditions permit (Randall et al. 2013); in other words, the population is not affected to the point where future recruitment (i.e., organisms reaching a certain life history stage such as settlement or maturity) is diminished.

Indicators represent attributes of the environment that can be used to characterize changes to VCs and the assessment endpoint in a meaningful way. The indicators for fish and fish habitat are defined as follows:

- **Habitat availability:** includes habitat quantity (the amount of habitat available for aquatic organisms and various life history stages of fish) and habitat quality (the quality of habitat available for aquatic organisms and various life history stages of fish), which include both surface water quality and hydrology indicators.
- **Habitat distribution:** the spatial configuration and connectivity of habitats for aquatic organisms and fish in the study areas, and the spatial distribution and movement of fish.
- **Abundance:** the amount of fish in the population (i.e., based on survival and reproduction).

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3.1.4 Assessment Boundaries

3.1.4.1 Spatial Boundaries

The spatial boundaries selected for the fish assessment were defined to provide a description of existing conditions in sufficient detail to identify the Project VCs and identify and understand potential effects on VCs, including the contribution of the TASR and other developments to cumulative effects. The Project footprint, comprised of the preferred route, is approximately 94 km in length with a 60 m ROW, and includes laydown areas, construction camps, and borrow sites with associated access roads with a 30 m ROW. The Project footprint leads to direct physical disturbance and alteration of fish habitat at the proposed crossing locations within the 60 m ROW.

The Project footprint was then used to determine the Regional Study Area (RSA), which was defined as a portion of watercourses within 2 km on either side of the TASR alignment, as well as encompassing water bodies (i.e., lakes and ponds) with any portion within 2 km of the TASR alignment. The RSA also includes large watercourses and water bodies outside of the 2 km that were identified as fish harvesting locations within the Tłįchǫ region (i.e., Lac La Martre, the entire La Martre River up and downstream of the proposed TASR crossing, the Marian River downstream of La Martre River confluence, Boyer Lake; PR#74) (Figure 3.1-2). The RSA was intended to capture and assess the significance of incremental and cumulative effects on VCs from the Project and other previous, existing and RFDs.

3.1.4.2 Temporal Boundaries

The Project is planned to occur during two phases:

- **construction phase:** the period from the start of construction to the start of operation (approximately two to four years)
- **operation phase:** encompasses operation and maintenance activities throughout the life of the Project, which is anticipated to be indefinite (i.e., anticipated to be a public highway with indefinite operations).

The assessment of Project effects on fish and fish habitat considers effects that occur during the construction and operation phases. This timeframe is sufficient to capture the effects of the Project.

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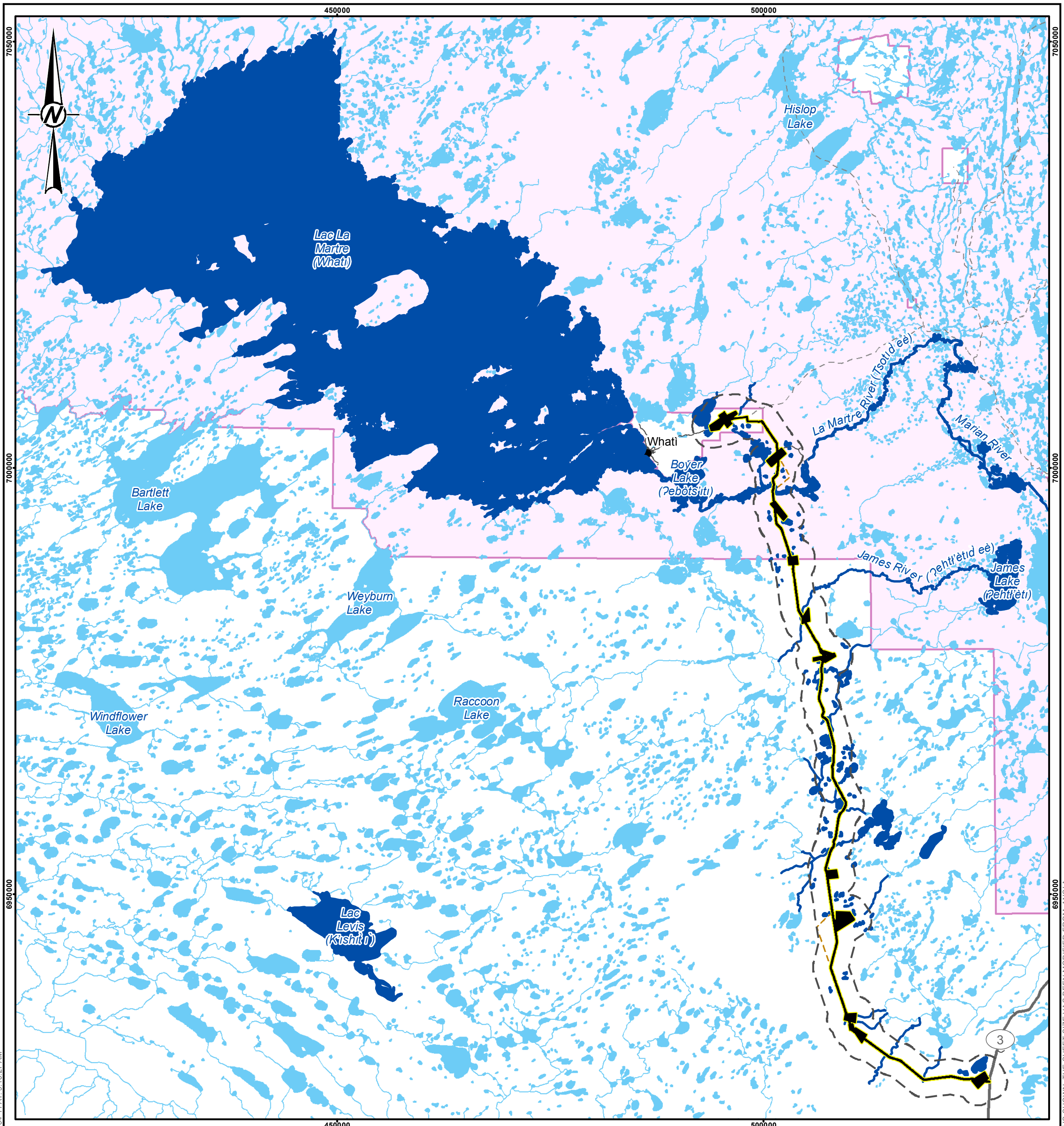

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LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- OLD AIRPORT ROAD
- WATERCOURSE
- TŁĮCHQ LAND
- WATER BODY
- 2 KM FROM EDGE OF PROJECT FOOTPRINT
- FISH REGIONAL STUDY AREA
- PROJECT FOOTPRINT

0 15 30

1:650,000 KILOMETRES

REFERENCE(S)

1. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
TŁĮCHQ ALL-SEASON ROAD

TITLE
REGIONAL STUDY AREA FOR FISHERIES

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-04-11
DESIGNED	KN
PREPARED	LMS
REVIEWED	DP
APPROVED	DP

PROJECT NO.	REV.	FIGURE
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3.1.5 Description of Existing Conditions (Base Case)

3.1.5.1 Methods

3.1.5.1.1 Desktop Analysis of Base Case Conditions

Base Case conditions for fish habitat, fish community, and fish harvesting pressures within the Project RSA were completed using a desktop analysis of existing data.

Fish habitat at the proposed TASR crossing locations was obtained from Project baseline reports where available (PR#7). Fish habitat assessments at the four major watercourse crossings (PR#7) and general channel and substrate information obtained during hydrological surveys (PR#7, Appendix R) were the basis for fish habitat information at each proposed crossing location. Hydroperiod at each crossing was determined from hydrological survey data (PR#7, Appendix R). Habitat connectivity, which was a ranking based on connection to overwintering habitat, and drainage basins were determined by using Geographic Information System (GIS) software to analyze a 1:50,000 Government of Canada topographic stream and lake database. Due to limited habitat data within the Project RSA, all lakes with areas of at least 10 ha and all permanent watercourses were assumed to provide overwintering habitat. Habitat functions for forage fish and for large-bodied fish were then determined for the watercourse at each proposed crossing location based on the habitat determined to be available, any habitat limitations, and life histories of the species found within the Project RSA.

The potential fish community within the WRMA was identified in Section 6.8.1 of the PDR (PR#7). This list was then compared to the Project RSA by first identifying the common drainage shared by each watercourse and lake within the Project RSA using a 1:50,000 Government of Canada topographic stream and lake database. By reviewing existing literature, a list of the documented species present in both the Project RSA and the common drainage basin was established, and a likely fish community within the Project RSA was determined. Trends were identified for lakes and watercourses where fish communities were documented both near and within the Project RSA, and these trends were then applied to unnamed watercourses and lakes within the Project RSA where no fish data was available.

Current fish harvesting pressures, consisting of both recreational and subsistence fisheries, were identified for watercourses and lakes within the Project RSA. Government reports (PR#91; Bond 1973; Chang-Kue 1987; DFO 2012) and Project specific reports and response documents (PR#7; PR#28; PR#97) were reviewed to determine which lakes and watercourses within the RSA are used for fish harvesting, which species are typically harvested at each, and what times of the year are harvests typically occurring.

3.1.6 Results

3.1.6.1 Fish Habitat

The proposed TASR is located in the Taiga Plains, with terrain dominated by a thin layer of glacial till over bedrock. The majority of watercourses proposed to be crossed by the TASR are small, shallow watercourses or undefined drainages with ephemeral or intermittent flow, substrate consisting of fines (sand, silt, and/or organics), and limited-to-no overwintering potential (Table 3.1-2). The remainder of the watercourses proposed to be crossed, specifically the Duport, James, and La Martre rivers and the unnamed watercourse at km 45.2 (crossing #9), contain high quality fish habitat, typically with substrate dominated by gravel and cobble, and access to overwintering habitat nearby. The proposed TASR alignment predominantly follows a winter road corridor originally constructed by the military in the 1950s which was in operation as a public winter road until the late 1980s. There is continued use of the corridor by Tłįchǫ community members and other NWT residents (i.e., via snowmobiles, dog sleds, ATVs, and

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trucks in certain parts). There are no crossing structures present, and as a result, there is an existing level of disturbance to bed and banks at smaller watercourses due to fording with ATVs or trucks during open water conditions.

Each watercourse/drainage proposed to be crossed by the TASR is part of the Great Slave Lake drainage, although all of the unnamed watercourses/drainages proposed to be crossed flow through at least one named watercourse or water body before reaching Great Slave Lake. Seven of the unnamed watercourses/drainages drain into Mosquito Lake/Mosquito Creek, two drain into the Duport River, and three drain into the James River. Mosquito Creek drains directly into Great Slave Lake; however, all other named watercourses/water bodies listed above drain through Marian Lake before reaching Great Slave Lake.

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Table 3.1-2: Fish Habitat and Likelihood of VC Presence at the Proposed TASR Watercourse Crossings

Water Crossing ID	Water Body Name	Crossing Location Substrate	Expected Hydroperiod[(a)]	Habitat Connectivity Evaluation[(b)]	Potential Species at Crossing[(c)]	Likelihood of Forage Fish Species at Crossing[(d)]	Likelihood of Large-Bodied Species at Crossing[(d)]	Potential Habitat Functions for Forage Fish Species[(e)]	Potential Habitat Functions for Large-Bodied Species[(e)]
1.1	Unnamed	Silt/sand	Ephemeral	Minimal	NNST	Unlikely	Unlikely	Minimal value	Minimal value
1.2	Unnamed	Silt/sand	Ephemeral	Minimal	NNST	Unlikely	Unlikely	Minimal value	Minimal value
2	Unnamed	Silt/sand	Ephemeral	Low	NNST	Low	Unlikely	Seasonal foraging, rearing, migration	Minimal value
3	Unnamed	Silt/sand	Ephemeral	Minimal	NNST	Low	Unlikely	Seasonal foraging, rearing, migration	Minimal value
4	Unnamed	Silt/sand	Ephemeral to Intermittent	Minimal	NNST	Low	Unlikely	Seasonal foraging, spawning, rearing, migration	Minimal value
5	Unnamed	Silt/sand	Ephemeral	Minimal	NNST	Low	Unlikely	Seasonal foraging, rearing, migration	Minimal value
6	Unnamed	Silt/sand	Ephemeral	Minimal	NNST	Low	Unlikely	Seasonal foraging, spawning, rearing, migration	Minimal value
7	Unnamed	Silt/sand	Ephemeral	Minimal	NNST	Unlikely	Unlikely	Minimal value	Minimal value
8	Duport River	Organics/silt	Perennial	High	**ARGR**, BURB, LNSC, **NRPK**, NNST, SLSC, WHSC	High	High	All habitat functions (overwintering uncertain)	Seasonal foraging, rearing, migration; **NRPK** spawning
9	Unnamed	Cobble/ gravel/sand/ silt	Intermittent	Moderate	**ARGR**, BURB, LNSC, **NRPK**, NNST, SLSC, WHSC	High	Moderate	Seasonal foraging, rearing, migration	Seasonal foraging, rearing, migration; **ARGR**/LNSC/**NRPK**/ WHSC spawning
10a	Unnamed	-	Intermittent	Moderate	**ARGR**, BURB, LNSC, **NRPK**, NNST, SLSC, WHSC	Moderate	Low	Seasonal foraging, spawning, rearing, migration	Seasonal foraging, rearing, migration; **ARGR**/LNSC/**NRPK**/ WHSC spawning
10	Unnamed	Organics/silt	Ephemeral	Minimal	NNST	Unlikely	Unlikely	Minimal value	Minimal value
11	Unnamed	Organics/silt	Ephemeral to intermittent	Low	NNST, **NRPK**, WHSC	Moderate	Low	Seasonal foraging, spawning, rearing, migration	Seasonal foraging, rearing, migration; **NRPK** spawning
13	Unnamed	Organics/silt	Ephemeral to intermittent	Low to moderate	NNST, **NRPK**, WHSC	Moderate	Low	Seasonal foraging, spawning, rearing, migration	Seasonal foraging, rearing, migration; **NRPK** spawning

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Table 3.1 2: Fish Habitat and Likelihood of VC Presence at the Proposed TASR Watercourse Crossings (continued)

Water Crossing ID	Water Body Name	Crossing Location Substrate	Expected Hydroperiod(a)	Habitat Connectivity Evaluation(b)	Potential Species at Crossing(c)	Likelihood of Forage Fish Species at Crossing(d)	Likelihood of Large-Bodied Species at Crossing(d)	Potential Habitat Functions for Forage Fish Species(e)	Potential Habitat Functions for Large-Bodied Species(e))
14	James River	Gravel/ cobble/sand/ silt	Perennial	High	**ARGR**, BURB, LNSC, **LKWH, NRPK,** NNST, **RNWH**, SLSC, WHSC	High	High	All habitat functions	Foraging, rearing, migration; **ARGR**/LNSC/**NRPK**/ WHSC spawning and overwintering
15	La Martre River	Boulder/ cobble/gravel	Perennial	High	**ARGR**, BURB, LKCH, **CISC**, **LKTR**, **LKWH**, LNSC, NNST, **NRPK**, **RNWH**, SLSC, **WALL**, WHSC	High	High	All habitat functions	All habitat functions

Note: **Bold** = Project VC species. Note: Crossing 1.1 and 1.2 are on the same watercourse; Crossing 10a and 10 are on the same watercourse. Crossing 12 eliminated through re-routing. See Figure 3.1-1 for locations.

Species codes: ARGR = Arctic Grayling, BURB = Burbot, LKCH = Lake Chub, CISC = Cisco, LKTR = Lake Trout, LKWH = Lake Whitefish, LNSC = Longnose Sucker, NNST = Ninespine Stickleback, NRPK = Northern Pike, RNWH = Round Whitefish, SLSC = Slimy Sculpin, WALL = Walleye, WHSC = White Sucker.

a) Hydroperiod defined based on habitat information provided in PR#7, Appendix R; "Intermittent streams" are assumed to support flowing water periods during the wet season (spring) but are normally dry during summer months; intermittent streams do not have continuous flowing water year-round; "ephemeral streams" have less flow than intermittent streams, are typically shallow, and have flowing water for a brief period in spring or in response to high precipitation events. Ephemeral streams are normally dry for most of the year. In contrast to an ephemeral or intermittent stream, a "perennial watercourse" is a stream or river (channel) that has continuous flow in parts of its stream bed all year round during years of normal rainfall.

b) General ranking approach for connectivity of crossing locations are as follows: minimal = ephemeral stream, greater than 1 km upstream of 10 ha lake, and not downstream of a 10 ha lake; low = ephemeral stream, less than 1 km upstream of 10 ha lake, and not downstream of 10 ha lake; moderate = intermittent stream, and downstream of 10 ha lake; and high = perennial stream. Lake sizes and stream distances calculated using a 1:50,000 Government of Canada topographic database for streams and lakes.

c) Potential species at crossing based on previously reported catch data where available (crossings 8, 14, and 15). If no catch data available, this column was populated based on the type of habitat available (PR#7, Appendix R), and the habitat requirements of species potentially in the area (PR#7, Table 6-13), which considered previously reported species distributions at the nearby NICO Project (Golder 2011).

d) High = Fish confirmed or expected to be present at watercourse location based on habitat characteristics and existing baseline data; moderate = watercourse location contains suitable habitat for fish on a seasonal basis and may be connected to a water body with the potential to support fish (i.e., to provide overwintering habitat); low = watercourse location contains habitat for occasional use of fish, but poor connectivity to overwintering habitat may preclude fish presence; unlikely = watercourse location contains marginal habitat for fish and lacks connectivity to overwintering habitat.

e) Forage species are defined as fish with adult fork lengths typically less than 200 mm (e.g., NNST, SLSC) and large-bodied species are defined as fish with adult fork lengths typically greater than 200 mm, specifically sport fish and sucker species.

'-' = no data available; ARGR = Arctic Grayling, BURB = Burbot, LKCH = Lake Chub, CISC = Cisco, LKTR = Lake Trout, LKWH = Lake Whitefish, LNSC = Longnose Sucker, NNST = Ninespine Stickleback, NRPK = Northern Pike, RNWH = Round Whitefish, SLSC = Slimy Sculpin, WALL = Walleye, WHSC = White Sucker.

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3.1.6.2 Fish Community

The fish community in the Project RSA consists entirely of species documented within Great Slave Lake (Table 3.1-3). The greatest diversity of fish species within the Project RSA are found in La Martre River below the falls and the Marian River between Marian Lake and La Martre River confluence (PR#91; Chang-Kue et al. 1987). Since the subset of Great Slave Lake species found within these two rivers also included all species documented within other lakes and watercourses within the Project RSA (PR#7; PR#28; PR#91; PR#97; Bond 1973; Chang-Kue et al. 1987; ARI 2012), this subset of species was determined to represent the entire fish community within the Project RSA. This list of 18 fish species was predominantly the same as the list identified in Section 6.8.1 of the PDR (PR#7), with only Emerald Shiner added following the literature review.

While the fish community for the RSA consists of 18 fish species, watercourse and lake-specific fish communities are likely to vary based on the habitats present. Based on fish capture data from the nearby proposed NICO Project (Golder 2011), forage species such as Ninespine Stickleback are likely prevalent in most watercourses within the Project RSA where overwintering habitat (maximum depths greater than 2 m) is present nearby. Several of these watercourses might also support large-bodied species such as Northern Pike and White Sucker on at least a seasonal basis (Golder 2011). Larger watercourses, such as the James, Duport, Marian, and La Martre rivers, likely hold the greatest variety of species, such as large coregonid species, Arctic Grayling, Northern Pike, Walleye, Burbot, sucker species, and numerous forage species. Larger lakes within the RSA (e.g., Lac La Martre, Marian Lake, Boyer Lake) hold Lake Trout, coregonid and sucker species, Burbot in deeper areas, and Northern Pike, Walleye, and forage species in shallower waters (PR#91; PR#97; Scott and Crossman 1998; Richardson et al. 2001). Habitat availability at each crossing location along the proposed TASR route, including connectivity to overwintering habitat, was assessed and a list of potential species present at each crossing was created (Table 3.1-3).

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Table 3.1-3: Documented Presence of Fish Species in Great Slave Lake and Named Watercourses/ Water bodies Within the Project RSA Watershed

Common Name	Latin Name	CRA Species?	Documented Presence in Named Water Body[a]							
			Great Slave Lake	Marian Lake	Lower La Martre River/ Marian River	Lac La Martre / Boyer Lake / Upper La Martre River	James Lake	Mosquito Lake/ Mosquito Creek	James River	Duport River
Arctic Grayling	*Thymallus arcticus*	Yes	X		X	X			X	
Arctic Lamprey	*Lethenteron camtschaticum*	Yes	X							
Burbot	*Lota lota*	Yes	X	X	X	X				
Chum Salmon	*Oncorhynchus keta*	Yes	X							
Deepwater Sculpin	*Myoxocephalus thompsonii*	No	X		X					
Emerald Shiner	*Notropis atherinoides*	No	X		X	X				
Flathead Chub	*Platygobio gracilis*	No	X							
Goldeye	*Hiodon alosoides*	Yes	X							
Inconnu	*Stenodus leucichthys*	Yes	X	X	X	X				
Lake Chub	*Couesius plumbeus*	No	X		X	X				
Lake Cisco	*Coregonus artedi*	Yes	X		X	X				
Lake Trout	*Salvelinus namaycush*	Yes	X	X	X	X	X		X	
Lake Whitefish	*Coregonus clupeaformis*	Yes	X	X	X	X			X	
Longnose Sucker	*Catostomus catostomus*	Yes	X	X	X	X		X		
Ninespine Stickleback	*Pungitius pungitius*	No	X		X	X				
Northern Pike	*Esox lucius*	Yes	X	X	X	X		X	X	
Round Whitefish	*Prosopium cylindraceum*	Yes	X	X	X	X		X	X	

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Table 3.1 3: Documented Presence of Fish Species in Great Slave Lake and Named Watercourses/ Water bodies Within the Project RSA Watershed (continued)

Common Name	Latin Name	CRA Species?	Documented Presence in Named Water Body[a]							
			Great Slave Lake	Marian Lake	Lower La Martre River/ Marian River[b]	Lac La Martre / Boyer Lake / Upper La Martre River[b]	James Lake	Mosquito Lake/ Mosquito Creek	James River	Duport River
Slimy Sculpin	*Cottus cognatus*	No	X		X	X				
Spoonhead Sculpin	*Cottus ricei*	No	X							
Spottail Shiner	*Notropis hudsonius*	No	X		X					
Trout Perch	*Percopsis omiscomaycus*	No	X		X					
Walleye	*Sander vitreus*	Yes	X	X	X	X		X		X
White Sucker	*Catostomus commersonii*	Yes	X	X	X	X		X		
Yellow Perch	*Perca flavescens*	Yes	X							

Note: Shaded cells = Project Valued Component species.

CRA = Fish species of Commercial, Recreational, and/or Aboriginal importance, as described in the *Fisheries Act* (Government of Canada 1985)

a) Species presence in each named water body summarizes the fish species documented in scientific, government, and/or Project-related literature only.

b) The fish community within the Project RSA was determined to consist of the 18 fish species with documented presence in the La Martre River, the Marian River, Boyer Lake, and/or Lac La Martre.

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3.1.6.3 Fish Harvesting

Local fish harvesters traditionally fish watercourses crossed by the Project, as well as lakes and watercourses near the Project alignment (PR#28; PR#91; PR#97). La Martre River is seen by local harvesters as a high quality fishery used for harvesting year round, with Arctic Grayling, Coregonids, Northern Pike, and suckers (*Catostomus* spp.) typically harvested there. The section of La Martre River between Whatì and the falls are specifically noted for their large populations of Arctic Grayling and Coregonids (PR#97), and the portage and the canoe route on La Martre River are key fishing locations for Tłįchǫ harvesters for catching Arctic Grayling, Coregonids, and sucker species (PR#97). Large numbers of Tłįchǫ people gather each year during the spring and summer at the numerous islands between Whatì and the falls to set fish nets and to prepare dry fish for use during the winter and while trapping (PR#28).

The James River is currently used for seasonal harvesting of Arctic Grayling, Coregonids, Lake Trout, and Northern Pike, though access is currently limited to travelling on trails and is further from La Martre River and therefore is fished less. The James River and James Lake are used by the Tłįchǫ people for trapping and travel routes, and fish (primarily Arctic Grayling) are captured for a food source while trapping (PR#28; PR#97).

Lac La Martre is heavily used by Whatì resident harvesters year-round, as well as by tourists who currently fly in to fish Lac La Martre in the summer (PR#97). Lac La Martre has a high abundance of Burbot, Coregonids, Lake Trout, Northern Pike, and Walleye (PR#91; PR#97). A commercial fishery existed on Lac La Martre from 1969 to 1973, and the lake is still used heavily for subsistence fishing by residents of Whatì, with Lake Whitefish and Lake Trout as the main species harvested (PR#91; PR#97; Bond 1973). A fishing lodge on Lac La Martre currently offers fly-in fishing excursions for a maximum of 150 visitors per year, primarily targeting trophy Lake Trout and Northern Pike (PR#97).

Boyer Lake is also fished heavily by Whatì residents due to proximity to the community and high abundance of Burbot, Coregonids, Lake Trout, Northern Pike, and Walleye. Boyer Lake is an important source of fish year-round for residents of Whatì. Islands on Boyer Lake are used by Tłįchǫ people for spring fishing and fish drying, with the islands offering protection from bears (PR#28; PR#91; PR#97).

The Marian River is used sometimes for fishing by local harvesters, specifically in the spring during Walleye spawning. Though access requires a boat and is more difficult, the Marian River is an important traditional canoe route and an active location for Tłįchǫ fishers (PR#97). Marian Lake is also used as a source of fish by Tłįchǫ people, with fish camps located along the northwestern shores (PR#28).

Lakes K'ıshıtì (Lac Levis) and Łıetı are traditionally known as good fishing sites by Tłįchǫ Elders, but not heavily fished due to their distance from Tłįchǫ communities. These lakes are primarily fished as a stable source of fresh food for harvesters when out trapping or hunting for long periods of time (PR#28; PR#97). The unnamed lakes to the east of proposed crossings #8 (Duport River) and #9 (unnamed watercourse at km 45.2) are along traditional winter trapping routes and fished as a food source for Tłįchǫ harvesters while trapping (PR#28).

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3.2 Pathway Analysis

3.2.1 Methods

Pathway analysis identifies and assesses the linkages (or interactions) between the Project components and activities and the predicted changes to the environment that may affect VCs. A pathway analysis was used to refine the understanding of how the Project may affect VCs, identify appropriate mitigation, and to help focus the assessment on key interactions between the Project and the environment. Methods for the pathways analysis are provided in Section 2.0.

3.2.2 Results

Project components and activities, effects pathways, and environmental design features and mitigation are summarized in Table 3.2-1. Classification of effects pathways (i.e., no linkage, secondary, and primary) to fish VCs are also summarized in Table 3.2-1 and detailed descriptions are provided in the subsequent sections.

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Table 3.2-1: Pathway Table for Fish and Fish Habitat VCs for the TASR

Tłįchǫ Road Project Component/Activity	Effect Pathways	Mitigation	Pathway Assessment
Construction of Stream Crossings	Sediment releases from installation of crossing structures can affect water quality, affecting fish and fish habitat.	■ DFO Measures to Avoid Causing Harm to Fish and Fish Habitat Including Aquatic Species at Risk (DFO 2016) will be followed as appropriate. ■ In-stream works where water is present will be conducted to avoid critical periods for spring-spawning fish, such as Arctic Grayling. In-stream work completed during the open water season will only take place between July 16 and September 14 as identified in the DFO Fish Timing Windows for the NWT to avoid impacting fish during critical life stages. In-stream works will be conducted when watercourses are dry or frozen to bed where possible. ■ Disturbance of fish and fish habitat below the high water mark will be minimized by using snow bridges/ice fills or temporary bridges (with no fill below the high water mark) as construction access and work platforms instead of fording (DFO 2016). ■ The effects of erosion will be minimized by implementing best management practices for erosion and sedimentation control (described in the GNWT-DOT Erosion and Sediment Control Manual, e.g., silt curtains, runoff management), where necessary. ■ Sediment releases into watercourses will be mitigated by using isolation methods when completing in-stream construction. Isolation methods will be used for work below the high water mark for streams with flowing water at the time of construction (DFO 2016). ■ Where isolations are required for construction in flowing watercourses, bypass pumps will pump water through or onto a diffuser to disperse the force of the pumped water and avoid scour of the watercourse bed and banks. Any grey water removed from the isolation will be pumped away from the watercourse and onto a vegetated area to prevent sediment from reaching the watercourse (DFO 2016). Where an adequate vegetated area is not available, grey water will be filtered before returning to the watercourse or pumped into a container and removed from site. ■ Additional erosion mitigation (i.e., rock reinforcement or armouring) will be applied at watercourse crossings where needed to minimize future erosion, as per the GNWT-DOT Erosion and Sediment Control Manual (PR#7, Appendix W). ■ Materials installed below the high water mark (i.e., riprap) will be clean to avoid adding deleterious substances to watercourses (DFO 2016). ■ Disturbed areas along the streambanks will be stabilized and allowed to re-vegetate upon completion of work to minimize future erosion (FFHPP 2016 [PR#7, Appendix X]). ■ Environmental Monitors will be onsite during construction to monitor the installation of crossing structures. Turbidity will be conducted at crossings with flowing water at the time of construction as per the In-Field Water Analysis Plan to meet regulatory requirements (PR#7, Appendix AA).	Secondary

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Table 3.2 1: Pathway Table for Fish and Fish Habitat VCs for the TASR (continued)

Tłįchǫ Road Project Component/Activity	Effect Pathways	Mitigation	Pathway Assessment
Construction of Stream Crossings (continued)	The crossing structure footprint can affect fish and fish habitat.	■ DFO Measures to Avoid Causing Harm to Fish and Fish Habitat Including Aquatic Species at Risk (DFO 2016) will be followed as appropriate. ■ Culverts will be embedded as appropriate to maintain species and habitat present, and will be installed parallel to the existing channel to minimize changes to channel morphology (PR#7). ■ Water crossing structures (e.g., culverts, bridges, ice bridges/snow fills) will be installed and maintained using best management practices (DFO 2016) and following environmental approval conditions to minimize impacts to fish and fish habitat. ■ Snow bridges/ice fills or temporary bridges will be used for construction access instead of fording to avoid impacting fish habitat (FFHPP 2016 [PR#7, Appendix X]). ■ Disturbed areas along the streambanks will be stabilized and allowed to re-vegetate upon completion of work to rehabilitate damage caused to fish habitat (DFO 2016). ■ Permanent bridges will not contact water bodies ;to minimize impacts below the ordinary high water mark, bridge abutment installation will span the active channel. Pier installation will be outside the active channel and within the floodplain (1 in 5 year flood) (PR#7).	Secondary
	Riparian vegetation removal/damage at crossing locations may lead to a loss of riparian fish habitat and an increase of erosion and sedimentation, affecting fish and fish habitat	■ Riparian areas will be maintained whenever possible to minimize erosion and impacts to fish habitat, with vegetation removal limited to the width of the ROW. At watercourse crossings, a riparian buffer will be maintained along the width of the ROW except at the actual crossing location (FFHPP 2016 [PR#7, Appendix X]). ■ Removed vegetation/debris will be removed from site to prevent them entering the watercourse, and grading of the stream banks at approaches will not occur (FFHPP 2016 [PR#7, Appendix X]). ■ Impacts to riparian vegetation at temporary crossings will be minimized by using structures such as snow fills and single-span bridges instead of fording, especially where banks are susceptible to erosion. Trees/shrubs removed at these crossings will be cut >10 cm above the ground level to maintain root structure and stability (FFHPP 2016 [PR#7, Appendix X]). ■ Disturbed areas along the streambanks will be stabilized upon completion of work to minimize erosion (GNWT-DOT Erosion and Sediment Control Manual, DFO 2016, Appendix W).	Secondary

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Table 3.2 1: Pathway Table for Fish and Fish Habitat VCs for the TASR (continued)

Tłı̨chǫ Road Project Component/Activity	Effect Pathways	Mitigation	Pathway Assessment
Construction of Stream Crossings (continued)	Water pumping for isolation bypass may cause temporary loss of fish habitat, fish entrainment, and/or fish impingement	■ Pumping rates will be matched to watercourse flow rates in order to maintain fish habitat upstream and downstream of isolations (DFO 2016). Backup pumps will be kept available to ensure flows and fish habitat are maintained in the event of a malfunction of the primary pump(s). ■ To avoid fish entrainment/impingement, fish screens on pumps will be designed according to DFO guidelines, kept clean and free of ice and debris, and inspected for damage prior to each withdrawal. A backup fish screen will be kept available to be used if the primary screen is frozen or damaged (DFO 1995, 2016).	No Linkage
	Crossing structures may alter stream hydraulics and geomorphology affecting passage for migratory fish	■ Permanent bridges at major crossings (crossings 8, 9, 14, and 15 in Table 3.1-2.) will minimize disturbance below the high water mark and maintain fish passage (FFHPP 2016 [PR#7, Appendix X]). ■ Culverts will be designed and installed to avoid creating fish movement barriers and to meet normal flow velocities for all seasons; culvert slopes will be optimized during construction to reduce velocities at the outlet (FFHPP 2016 [PR#7, Appendix X]). ■ Watercourses will be inspected upstream and downstream of the crossings for erosion, scour, and flow blockages during the spring freshet and through the open water season, as required (PR#7). Impacts will be minimized by culvert maintenance, including removal activities of debris (e.g., ice, beaver dams), following DFO's guidance (i.e., gradual removal such that flooding downstream, extreme flows downstream, release of suspended sediment, and fish stranding can be avoided). ■ Temporary snowfill/ice bridge crossings will be constructed to not restrict or block flow at any time to maintain fish habitat and ensure fish passage. Prior to spring break-up, ice bridges will be physically v-notched in the middle to allow it to melt from the centre (FFHPP 2016 [PR#7, Appendix X]). ■ Culverts will be embedded as appropriate to maintain species and habitat present, and will be installed parallel to the existing channel to minimize changes to channel morphology (PR#7).	Secondary
General Activities Related to the Construction and Operation of the Road	Use of explosives near fish-bearing water can cause injury or mortality to fish, which can affect fish populations	■ Blasting is not likely to be needed to clear the route. Should explosives be required for blasting within borrow sources or along the proposed corridor in close proximity to fish-bearing waters, blasting plans designed to avoid or minimize blasting impacts to fish and fish habitat will be provided to the appropriate authorities (PR#7). ■ Blasting operations will avoid or minimize impacts to fish by following DFO's Measures to Avoid Causing Harm to Fish and Fish Habitat Including Aquatic Species at Risk (DFO 2016) and DFO's Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters (Wright and Hopky 1998), including setback distances from fish-bearing water bodies and avoiding use of explosives in or near water. No explosive will be detonated in or near fish habitat that produces, or is likely to produce, an instantaneous pressure change greater than 50 kPa in fish-bearing water in efforts to avoid direct impacts to fish.	No Linkage

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Table 3.2 1: Pathway Table for Fish and Fish Habitat VCs for the TASR (continued)

Tłįchǫ Road Project Component/Activity	Effect Pathways	Mitigation	Pathway Assessment
General Activities Related to the Construction and Operation of the Road (continued)	Introduction of blasting residue (nitrogen compounds) to surface water can alter water quality, affecting fish habitat	■ Blasting is not likely to be needed to clear the route. Should explosives be required for blasting within borrow sources or along the proposed corridor in close proximity to fish-bearing waters, blasting plans designed to avoid or minimize blasting impacts to fish habitat will be provided to the appropriate authorities (PR#7). ■ To reduce the potential for introducing nutrients into water bodies or watercourses, ammonia management best practices will be implemented during storage and transport of ammonia explosives, should ammonium nitrate explosives be used (Requested by ECCC). ■ To reduce the potential for introducing blasting residue into fish habitat, only the required amount of explosive will be used as necessary for the amount of rock or borrow material to be blasted. The use of ammonium nitrate-fuel oil mixtures will not occur in or within 30 m of fish bearing water (FFHPP 2016 [PR#7, Appendix X]). ■ Drainage from quarries will not flow directly into any water bodies or watercourses and a minimum of 30 m of undisturbed land will be maintained between a quarry and any fish bearing water body to avoid impacts to fish habitat (FFHPP 2016 [PR#7, Appendix X]).	No Linkage
	Release of potential acid generating materials from quarry locations and from road building materials can alter water quality, affecting fish and fish habitat	■ Only non-acid generating material will be used for construction of the road and watercourse crossings to avoid impacting fish habitat with deleterious substances; testing will verify lack of acid rock drainage and metal leaching potential (PR#7). ■ Runoff from quarry areas will be directed away from fish habitat and sediment control measures will be installed. Where natural topography is modified for quarry areas, natural contours will be reconstructed and the area will be revegetated upon closure (PR#7).	No Linkage
	Introduction of dust/debris (from construction and traffic) can alter water quality and affect fish and fish habitat	■ Dust entering fish habitat will be minimized by enforcing speed and load limits to preserve the road bed, and regular road maintenance will be conducted to suppress dust production (as per the GNWT Guideline for Dust Suppression)(PR#7). ■ Snow will be plowed off of the road in such a manner that it melts into vegetated areas in the spring to filter out sediment, minimizing downstream sedimentation impacts to fish and fish habitat (FFHPP 2016 [PR#7, Appendix X]). ■ Debris and excess materials resulting from construction will be removed from the work site to prevent them reaching water bodies, as per the GNWT-DOT Erosion and Sediment Control Manual (PR#7, Appendix W). ■ To reduce potential for sediment release, areas for cleaning equipment will be a minimum of 30 m away from watercourses and will not drain into or toward watercourses (Requested by ECCC).	Secondary

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Table 3.2 1: Pathway Table for Fish and Fish Habitat VCs for the TASR (continued)

Tłįchǫ Road Project Component/Activity	Effect Pathways	Mitigation	Pathway Assessment
General Activities Related to the Construction and Operation of the Road (continued)	Introduction of new or invasive species to area water bodies can affect fish and fish habitat	Due to the relatively remote location, it is anticipated that most of the anglers/boaters using the TASR will be local.	Secondary
	Potential overexploitation of large-bodied fish populations due to improved road access	■ Project staff will not be allowed to hunt or fish during construction or operations while on their work rotation to minimize overexploitation of fish populations (PR#7). ■ The Tłįchǫ Government may control access to Tłįchǫ lands to conserve and protect areas used for harvesting by Tłįchǫ citizens to minimize overexploitation impacts (PR#74). ■ DFO will enforce the NWT's fishery regulations which are in place to prevent overfishing in any one area, including water bodies not within the proposed TASR corridor but accessed using the TASR (PR#7).	Primary
	Spills and leaks from construction equipment and spills and leaks from accidents can affect surface water and sediment quality, affecting fish, fish habitat and fish harvesting opportunities (construction phase)	■ Emergency Response Plan and Spill Contingency Plan (PR#7) will be developed and implemented, including ready access to an emergency spill clean-up kit for cleaning up any spills during construction or maintenance of the TASR. Drivers and construction crews on site will be familiar with the spill contingency plan and appropriately qualified to minimize impacts resulting from spills and leaks. ■ Fuels, lubricants and hydraulic fluids for equipment used will be carefully handled, properly secured against unauthorized access or vandalism, provided with spill containment and disposed of in accordance with the Waste Management Plan to avoid spillage impacts on fish and fish habitat. Fuel caches will be located on flat stable terrain or in natural depressions away from slopes to water bodies, and caches will be clearly marked and drums will be placed on their sides and spaced to facilitate inspections (FFHPP 2016 [PR#7, Appendix X]). ■ Construction equipment will be regularly maintained and inspected to ensure it is free of leaks (FFHPP 2016 [PR#7, Appendix X]). ■ Machinery used for work below the high water mark will use only biodegradable hydraulic fluid, and drip pans/trays will be placed under all equipment while not in use (FFHPP 2016 [PR#7, Appendix X]). ■ All fuel storage containers will have integrated 110% secondary containment, and refueling and servicing of machinery and storage of fuel and other materials for the machinery will occur a minimum of 30 m away from any water body, where possible, to avoid impacts to fish and fish habitat (FFHPP 2016 [PR#7, Appendix X]). ■ Equipment used in or near water will be clean and free of oil, grease or other deleterious substances. Vehicles travelling on the road will be properly loaded and loads appropriately covered where necessary (FFHPP 2016 [PR#7, Appendix X]). ■ Accidental spill impacts will be minimized by posting and enforcing speed limits on the road (PR#7). ■ Any spills will be reported immediately to the NWT Spill Line to minimize spillage impacts, as per the Spill Contingency Plan (FFHPP 2016 [PR#7, Appendix X]).	Secondary

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Table 3.2 1: Pathway Table for Fish and Fish Habitat VCs for the TASR (continued)

Tłı̨chǫ Road Project Component/Activity	Effect Pathways	Mitigation	Pathway Assessment
General Activities Related to the Construction and Operation of the Road (continued)	Spills and leaks from transport and maintenance equipment and spills and leaks from accidents can affect surface water and sediment quality, affecting fish, fish habitat, and fish harvesting opportunities (operation phase)	■ Emergency Response Plan and Spill Contingency Plan will be developed and implemented (PR#7), including ready access to an emergency spill clean-up kit for cleaning up any spills during construction or maintenance to minimize spillage impacts. Road maintenance crews and equipment operators on site will be familiar with the Spill Contingency Plan and appropriately qualified. ■ Road maintenance equipment will be regularly maintained and inspected to ensure it is free of leaks to avoid impacts to fish and fish habitat (FFHPP 2016 [PR#7, Appendix X]). ■ Accidental spill impacts will be minimized by posting and enforcing speed limits on the road (PR#7). ■ Other commercial operators using the road would have their own spill contingency plans in place. ■ Any spills will be reported immediately to the NWT Spill Line to minimize spillage impacts, as per the Spill Contingency Plan.	Secondary
	Sediment releases from road construction, and any land disturbances can affect surface water quality of nearby surface waters (e.g., increased total suspended solids loads and contaminants associated with sediments), affecting fish habitat	■ The effects of erosion will be minimized by implementing best management practices for erosion and sedimentation control (described in the GNWT-DOT Erosion and Sediment Control Manual, e.g., runoff management), where necessary. ■ Excess soils resulting from construction will be removed from the work site to prevent them reaching water bodies and impacting fish and fish habitat (PR#7). ■ Turbidity monitoring will be conducted at crossings with flowing water at the time of construction as per the In-Field Water Analysis Plan to meet regulatory requirements (PR#7, Appendix AA).	Secondary
	Water withdrawal for camps, construction, or dust suppression use may cause loss of fish habitat, fish entrainment, and/or fish impingement	■ Only water sources identified using DFO's *Protocol for Winter Water Withdrawal in the Northwest Territories* (DFO 2010) will be used for winter withdrawal to avoid impacts to fish and fish habitat. Withdrawal volumes and rates will not exceed guidelines in order to maintain fish habitat. ■ All water use will be monitored and tracked and, if required, regulated through a water license to avoid impacts to fish habitat (FFHPP 2016 [PR#7, Appendix X]). ■ To avoid fish entrainment/impingement, fish screens on pumps will be designed according to DFO guidelines, kept clean and free of ice and debris, and inspected for damage prior to each withdrawal. A backup fish screen will be kept available to be used if the primary screen is frozen or damaged (DFO 1995).	Secondary

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Table 3.2 1: Pathway Table for Fish and Fish Habitat VCs for the TASR (continued)

Tłįchǫ Road Project Component/Activity	Effect Pathways	Mitigation	Pathway Assessment
General Activities Related to the Construction and Operation of the Road (continued)	Wastewater, runoff, and waste/debris from temporary camps can affect surface water quality of nearby watercourses, affecting fish and fish habitat	■ Large (150 person) camps will be placed in selected borrow sources, and water and erosion structures will be installed where needed to avoid impacts to fish habitat (FFHPP 2016 [PR#7, Appendix X]). ■ Sewage waste generated from large (150 person) camp construction/use will be stored in a leak-free container before being transported to an approved disposal facility to avoid impacting fish and fish habitat (FFHPP 2016 [PR#7, Appendix X]). ■ All materials brought to camp sites will be removed at camp closure to avoid impacts to fish and fish habitat. Some materials may be incinerated (FFHPP 2016 [PR#7, Appendix X]).	Secondary

ECCC = Environment and Climate Change Canada.

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3.2.2.1 No Linkage Pathways

A pathway may have no linkage if the mitigation or environmental design features result in no measurable environmental change and, therefore, no residual effects to fish VCs. The pathways described in the following bullets are anticipated to have no linkage to fish and are not carried through the residual effects assessment.

- *Water pumping for isolation bypass may cause temporary loss of fish habitat, fish entrainment, and/or fish impingement.*

Where surface water exists at the time of construction, instream construction will be completed in isolation of flowing water. For isolations, temporary diversions may be used (i.e., isolation construction techniques such as flumes, instream diversions, or pumps) to divert the water flow around the isolated workspace. The use of intakes or pumps during instream construction can cause entrainment or impingement of fish. Entrainment occurs when a fish is drawn into a water intake and cannot escape. Impingement occurs when an entrapped fish is held in contact with the intake screen and is unable to free itself.

Where diversions are used, pumping will be monitored and adjusted as necessary to maintain downstream flow. Pumping rates will be matched to watercourse flow rates in order to maintain fish habitat upstream and downstream of isolations. Backup pumps will also be kept available to ensure flows are maintained in the event of a malfunction of the primary pump(s). Water intakes or pumps will be appropriately screened to prevent entrainment or impingement of fish (DFO 2016); measures for design and installation of intake end-of-pipe-fish screens will be followed to protect fish (DFO 1995, 2016). Fish screens will be kept clean and free of ice and debris, and inspected for damage prior to each withdrawal. A backup fish screen will be kept available to be used if the primary screen is frozen or damaged.

No measurable changes to fish habitat or fish abundance are expected from water pumping with the effective implementation of impact management measures. There is no anticipated effect from pumping for diversions on the maintenance of self-sustaining and ecologically effective populations of the VC fish species.

- *Use of explosives near fish-bearing water can cause injury or mortality to fish, which can affect fish populations.*

Pressure changes and vibrations caused by blasting during Project construction have potential to cause injury or mortality of fish in nearby water bodies. Post detonation compression shock waves caused by detonations of explosives in or near water can cause internal damage to the swim bladder and other soft organs of fish, and cause changes to fish behaviour (Wright 1982; Wright and Hopky 1998; Godard et al. 2008). The severity of effects is related to the type of explosive, method of detonation, distance away from fish, water depth, and the weight and pattern of the charge(s). The species, size, and life stage of fish also plays a role in the severity of effects of blasting. Fish eggs incubating in spawning beds near blasting zones can also be damaged by movement of the substrate in which eggs are embedded, causing mortality or disrupting development (Wright 1982; Faulkner et al. 2008). Peak particle velocities (i.e., vibrations) can increase mortality of incubating eggs close to blasting zones (Wright 1982).

It is expected that blasting will not be needed to clear the route. Should explosives be required for blasting within borrow sources or along the proposed corridor in close proximity to fish-bearing water, blasting plans designed to

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avoid or minimize blasting impacts to fish and fish habitat will be provided to the appropriate authorities, including DFO. There will be no blasting of rock in fish-bearing water.

Blasting operations will follow DFO's Measures to Avoid Causing Harm to Fish and Fish Habitat Including Aquatic Species at Risk (DFO 2016) and DFO's Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters (Wright and Hopky 1998), including setback distances from fish-bearing water bodies and avoiding use of explosives in or near water. Blasting will occur on land and with consideration of DFO's recommended setback distances from water bodies to avoid effects to fish and effects to incubating eggs. No explosive will be detonated in or near fish habitat that produces, or is likely to produce, an instantaneous pressure change greater than 50 kPa in fish-bearing water in efforts to avoid direct impacts to fish.

Blasting is expected to result in no measurable changes to fish habitat quantity and quality or fish abundance, with the effective implementation of mitigation measures, including setbacks. There is no anticipated effect on the maintenance of self-sustaining and ecologically effective populations of the VC fish species.

- *Introduction of blasting residue (nitrogen compounds) to surface water can alter water quality, affecting fish habitat.*

Residue from blasting operations can release nitrogen compounds (ammonia, nitrite, and nitrate) to nearby water bodies if not appropriately managed. Increased nutrients in water bodies that are particularly sensitive or vulnerable to changes in trophic status may result in eutrophication (enrichment of nutrients) and associated algal growth. At extremely high levels of nitrates or ammonia, toxicity may occur.

However, blasting is not likely to be needed to clear the route. Should explosives be required for blasting within borrow sources or along the proposed corridor in close proximity to fish-bearing waters, blasting plans will be developed and provided to the appropriate authorities. Only the required amount of explosive will be used as necessary for the amount of rock or borrow material to be blasted. The use of ammonium nitrate-fuel oil mixtures will not occur in or near fish-bearing water bodies. Drainage from quarries will not flow directly into any water bodies or watercourses and a minimum of 30 m of undisturbed land will be maintained between a quarry and any fish-bearing water body.

As a result, no measurable changes to water quality from blasting residue are expected with the effective implementation of mitigation measures, including setbacks, and as a result, no effects to fish habitat quantity and quality. There is no anticipated effect on the maintenance of self-sustaining and ecologically effective populations of the VC fish species.

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- *Release of potential acid generating materials from quarry locations and from road building materials can alter water quality, affecting fish and fish habitat.*

Acid rock drainage (ARD) is formed by the natural oxidation of relatively common sulphide minerals when they are exposed to water and air. ARD has the potential to introduce acidity and dissolved metals into water, which can change the water quality of receiving waters by lowering the pH and increasing the dissolved metal content and can be harmful to fish and aquatic life. The effects of ARD depends on the size and sensitivity of the water body affected, and the amount of neutralization and dilution that occurs.

As per the PDR, material utilized on the road will be screened for heavy metals and ARD potential during borrow source selection. Only non-acid generating material will be used for construction of the road and watercourse crossings; geochemical testing will verify lack of acid rock drainage and metal leaching potential. Runoff from quarry areas will be directed away from fish habitat and sediment control measures will be installed. Where natural topography is modified for quarry areas, natural contours will be reconstructed and the area will be revegetated upon closure.

As a result, no measurable changes to water quality from ARD are expected with the effective implementation of mitigation measures, and as a result, no effects to fish habitat quantity and quality. There is no anticipated effect on the maintenance of self-sustaining and ecologically effective populations of the VC fish species.

3.2.2.2 Secondary Pathways

In some cases, both a source and a pathway exist, but the change caused by the Project is anticipated to be minor and have a negligible residual effect on fish VCs. The pathways described in the following bullets are anticipated to be secondary for fish and are not carried through the residual effects assessment.

- *The crossing structure footprint can affect fish and fish habitat.*

Project construction has the potential to alter fish habitat quantity and quality in water bodies and watercourses crossed by the Project. Alteration of fish habitat can occur directly due to placement of crossing structures in water bodies and watercourses. The Project will require the installation of permanent water crossing structures at 15 water bodies crossed by the TASR (Table 3.2-2). Temporary crossing structures may also be required at some locations during the construction phase.

Disturbances that may affect fish habitat directly include: operation of construction equipment in the water; excavation of the stream bed and banks; and placement of crossing structures, fill, or rip rap in the water body or watercourse. Direct effects to fish habitat can include changes to the water body or watercourse bed and/or composition of bottom substrates; alteration of stream bank alignment and loss of riparian and instream vegetation. Alteration or loss of specific habitat features, such as pools, aquatic vegetation and bed materials may also cause impairment to existing habitat functions, such as overwintering, spawning, and rearing. This may include a loss of gravel spawning habitat for VC species such as Arctic Grayling or Walleye, a loss of shoal spawning habitat for VC species such as Lake Trout, or a loss of aquatic vegetation spawning habitat for VC species such as Northern Pike.

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Table 3.2-2: Conceptual Crossing Type, Mitigation for Work Below High Water Mark, and Restricted Activity Period

Water Crossing ID[a]	Water body Name	Crossing km	Conceptual Crossing Type	Construction Below High Water Mark[b]	Mitigation for Activities Below the High Water Mark[b]	Restricted Activity Timing Window[c]
1.1	Unnamed	2	1x900 corrugated steel pipe culvert	Yes	Use isolation techniques if flowing and install outside restricted timing windows. Use of ice bridge/snow fill or clear-span temporary bridges where needed for equipment crossings or work platforms.	April 1 to July 15
1.2	Unnamed	2.4	1x1200 corrugated steel pipe culvert	Yes	As above	April 1 to July 15
2	Unnamed	3.2	2x1400 corrugated steel pipe culvert	Yes	As above	April 1 to July 15
3	Unnamed	7.9	2x1400 corrugated steel pipe culvert	Yes	As above	April 1 to July 15
4	Unnamed	13.2	3x1400 corrugated steel pipe culvert	Yes	As above	April 1 to July 15
5	Unnamed	16.5	1x2430 structural plate corrugated steel pipe culvert	Yes	As above	April 1 to July 15
6	Unnamed	19.4	2x2430 structural plate corrugated steel pipe culvert	Yes	As above	April 1 to July 15
7	Unnamed	23.6	2x1400 corrugated steel pipe culvert	Yes	As above	April 1 to July 15
8	Duport River	40.4	48 m bridge	No	Construct bridge (including pier installation) during low-flow periods, where possible; use ice bridges/snow fill or clear-span temporary bridges for equipment crossings or work platforms. Install and maintain supplemental erosion and sediment control, as needed.	September 15 to July 15
9	Unnamed	45.2	24 m clear-span bridge	No	Construct bridge during low-flow periods, where possible; use ice bridges/snow fill or clear-span temporary bridges for equipment crossings or work platforms. Install and maintain supplemental control measures for erosion and sediment control, as needed.	September 15 to July 15
10a	Unnamed	48.2	3660x1910 arch culvert	Yes	Construct crossing during low-flow periods, where possible; use clear-span temporary bridges and/or ice bridges for equipment crossings. Install and maintain erosion and sediment control measures.	April 1 to July 15
10	Unnamed	48.3	1x1200 corrugated steel pipe culvert	Yes	Use isolation techniques if flowing and install outside restricted timing windows. Use ice bridge/snow fill or clear-span temporary bridges where needed for equipment crossings or work platforms.	April 1 to July 15
11	Unnamed	54.5	2x1400 corrugated steel pipe culvert	Yes	As above	April 1 to July 15
13	Unnamed	62.7	3x1400 corrugated steel pipe culvert	Yes	As above	April 1 to July 15
14	James River	68.7	80 m bridge	No	Construct bridge during low-flow periods, where possible; use ice bridges/snow fill or clear-span temporary bridges for equipment crossings or work platforms. Install and maintain supplemental control measures for erosion and sediment control, as needed.	September 15 to July 15
15	La Martre River	85.4	100 m bridge	No	Construct bridge (including pier installation) during low-flow periods, where possible; use ice bridges/snow fill or clear-span temporary bridges for equipment crossings or work platforms. Install and maintain supplemental erosion and sediment control, as needed.	September 15 to July 15

a) Crossing 1.1 and 1.2 are on the same watercourse; Crossing 10a and 10 are on the same watercourse; Crossing 12 was eliminated through re-routing; See Figure 3.1-1 for crossing locations.

b) Construction activities (including placement of temporary or permanent fill) below the High Water Mark was determined from the Major Bridge and Culvert Conceptual Designs 2016 (PR#7, Appendix I). Bridge piers and riprap are all above the 'edge' of water or active channel in figures, though some are within the 5-year floodplain.

c) Restricted activity timing window determined based on fish species likely to be present (Table 3.1-2) and NWT Zone 1 (DFO 2013).

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The effects depend on the types of habitat at the crossing site, the type of crossing structure used, and the timing of the construction. Bridges will be installed at four major crossings (Duport River, James River, La Martre River, and unnamed watercourse at km 45.2 [crossing #9]). Bridge abutment installation will span the active channel (i.e., no work will occur below the high water mark during construction or operation). Pier installation at the Duport and La Martre River bridges will be outside the active channel but within the floodplain (1 in 5 year flood).

The installation of culverts will require the placement of a structure below the high water mark, and therefore, would temporarily or permanently impact the section of fish habitat where the culvert is located. The extent of the footprint will be limited to a reasonably small area in each water body. Instream work will be completed in the shortest timeframe possible. Conceptual culvert selection considered site-specific conditions such as the width of the water body crossing, fish species presence, fish habitat characteristics, substrate type, and hydrologic characteristics of the water body.

All water body crossing structures will be constructed and operated following best management practices and environmental approval conditions, including DFO's *Measures to Avoid Causing Harm to Fish and Fish Habitat Including Aquatic Species at Risk* (DFO 2016). Environmental Monitors will be on-site during construction to monitor the installation of crossing structures. Culverts will be embedded as appropriate to maintain species and habitat present, and will be installed parallel to the existing channel to minimize changes to channel morphology. Rock aprons at culvert inlets and outlets, and bridge piers within the floodplain will provide erosion protection and prevent localized erosion from concentrated high velocity flows above the 1:10 year event.

Sediment and erosion control measures will be installed prior to commencing work. Following construction, disturbed areas along the streambanks will be stabilized and allowed to re-vegetate upon completion of work. For temporary construction access, snow bridges/ice fills or temporary bridges will be used instead of fording. For ice bridges/snow fills, any work below the high water mark will involve the placement of clean snow fill only. The temporary water body crossing structures will be removed following construction. Clearing of riparian vegetation will be limited to the extent practical, and to the requirement of the road width only.

Fish communities can be adversely affected by in-water work that occurs during certain periods in their life history or at certain life stages; for example, this can include movements to spawning areas, spawning and egg incubation, or eggs and newly hatched fry. Timing in-water work to avoid sensitive life history periods or life stages is an effective means of mitigating potential adverse effects. In NWT, restricted activity timing windows are applied to each water body to protect fish during spawning and incubation periods when spawning fish, eggs and fry are vulnerable to disturbance or sediment (DFO 2013). Restricted activity periods are determined on a case by case basis according to the species of fish in the water body, whether those fish spawn in the spring, summer, fall or winter, and where the water body is located. The applicable restricted activity timing windows for water bodies along the TASR are listed in Table 3.2-2. For any open-water activities with work below the high water mark, the restricted activity timing windows (Table 3.2-2) will be followed and any open-water season construction will adhere to the appropriate in-water timing window. If necessary based on the construction schedule for the Project, there is the potential that work may be completed during the restricted activity timing window if approval from DFO is obtained and the potential for adverse effects can be reduced or avoided.

All necessary permits and approvals will be acquired prior to crossing construction, with adherence to all terms and conditions. DFO's self-assessment and request for review process will be followed as required.

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Changes to fish habitat from permanent Project features (i.e., installation of culverts) are irreversible during the life of the operation; however, bridges will be installed at major crossings with high quality habitat. Due to the mitigation measures implemented, construction of the crossings is anticipated to result in minor and localized changes to fish habitat quality or quantity. However, as described in Section 3.2.2.1, Tłįchǫ community members and other NWT residents use the existing corridor for access and fording by ATVs and trucks causes ongoing disturbance to bed and banks at watercourse crossings; for some watercourses, there will be an improvement in fish habitat conditions due to the placement of a crossing structure.

This pathway was determined to have negligible effects on fish habitat quantity and quality. Given implementation of the mitigation measures described above, there is no anticipated effect from physical alteration of water bodies on the maintenance of self-sustaining and ecologically effective populations of the VC species.

- *Sediment releases from installation of crossing structures can affect water quality, affecting fish and fish habitat.*
- *Riparian vegetation removal/damage at crossing locations may lead to a loss of riparian fish habitat and an increase of erosion and sedimentation, affecting fish and fish habitat*
- *Sediment releases from road construction, and any land disturbances can affect surface water quality of nearby surface waters (e.g., increased total suspended solids loads and contaminants associated with sediments), affecting fish habitat.*

Increases in the concentration of suspended sediment can result directly from disturbance and resuspension of bed materials during construction of water body crossings or indirectly from site runoff. This could increase total suspended solids and turbidity in the downstream aquatic ecosystems and result in an adverse effect on surface water quality. Exposure to suspended sediment can affect the health of fish with effects ranging from minor physiological stress to mortality. The magnitude of the effect depends on a combination of the suspended sediment concentration and the duration of exposure.

Fine sediment can also result in downstream sediment deposition that alters substrate composition and modifies the suitability of habitat for spawning, overwintering, and rearing. Deposited sediments can modify the availability and suitability of fish habitat by (CCME 1999):

- smothering aquatic plants
- changing the bed conditions, which can reduce habitat suitability for the incubation of developing fish eggs
- infilling pools and reducing the size of riffle areas, consequently reducing the habitat available for juvenile and adult fish
- changing habitat conditions, reducing benthic invertebrate and forage fish populations and shifting fish species composition
- infilling interstitial spaces between gravel particles, which can prevent the emergence of fry

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Bridges and culverts are the proposed water body crossing methods (Table 3.2-2). Temporary clear-span bridges and ice bridge/snow fill (for winter construction) may be used for construction access.

All water body crossing structures will be constructed and operated following best management practices and environmental approval conditions, including DFO's *Measures to Avoid Causing Harm to Fish and Fish Habitat Including Aquatic Species at Risk* (DFO 2016). Culvert installation will follow DFO's advice on erosion and sediment control to avoid causing *serious harm to fish* (DFO 2016). Best management practices for erosion and sedimentation control (described in the GNWT-DOT Erosion and Sediment Control Manual) will be implemented (e.g., silt curtains, runoff management), where necessary for construction and for runoff management. Sediment and erosion control measures will be installed prior to commencing work. Sediment and erosion control measures will be installed, monitored, and managed as appropriate to prevent sediment from reaching a water body prior to and during construction. Materials installed below the high water mark (i.e., riprap) will be clean prior to installation. Effects from temporary crossings will be minimized by using structures such as snow fills and single-span bridges instead of fording, especially where banks are susceptible to erosion. The temporary water body crossing structures will be removed following completion of construction.

Where isolations are required for construction in flowing watercourses, bypass pumps will pump water through or onto a diffuser to disperse the force of the pumped water and avoid scour of the watercourse bed and banks. Any grey water removed from the isolation will be pumped away from the watercourse and onto a vegetated area to prevent sediment from reaching the watercourse (DFO 2016). Where an adequate vegetated area is not available, grey water will be filtered before returning to the watercourse or pumped into a container and removed from site.

Riparian areas will be maintained whenever possible to minimize erosion and impacts to fish habitat, with vegetation removal limited to the width of the ROW. At watercourse crossings, a riparian buffer will be maintained along the width of the ROW except at the actual crossing location. Removed vegetation/debris will be removed from site to prevent them entering the watercourse, and grading of the stream banks at approaches will not occur. Disturbed areas along the streambanks will be stabilized upon completion of work to minimize erosion (GNWT-DOT Erosion and Sediment Control Manual; DFO 2016).

The construction timing and preferred crossing methods will also minimize potential for sediment entrainment and deposition. To minimize downstream sediment effects, isolation methods will be used for work below the high water mark for streams with flowing water at the time of construction. Installation of water body crossing structures where work is completed below the high water mark (i.e., installation of a culvert or piers with fill or supports below the high water mark) will occur outside of the restricted activity timing windows (Table 3.2-2), unless approval from DFO is obtained. Construction will be completed during low-flow periods, where possible; if excessive flows or flood conditions are present, instream construction will be postponed until water levels have subsided.

Environmental Monitors will be onsite during construction to monitor the installation of crossing structures. Turbidity monitoring will be conducted at crossings with flowing water at the time of construction as per the In-Field Water Analysis Plan (PR#7, Appendix AA) to meet regulatory requirements. For example, during construction of bridges and culverts where flow is present, turbidity and total suspended solids sampling will be conducted approximately 50 m upstream and 100 m downstream of the construction area. Following construction, sampling will be conducted weekly for four weeks to confirm that the banks and structures have stabilized.

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Sediment effects on water bodies crossed by the TASR is expected to be minimal with effective implementation of the mitigation measures, and as a result, is expected to result in no measurable changes to fish habitat quantity or quality or fish abundance. Furthermore, the TASR may reduce sediment input at some watercourses compared to current conditions as the installation of crossing structures may minimize fording of the existing corridor by ATVs and trucks. There is no anticipated effect from sediment release into water bodies on the maintenance of self-sustaining and ecologically effective populations of the VC fish species.

- *Crossing structures may alter stream hydraulics and geomorphology affecting passage for migratory fish.*

During construction of the TASR, changes in channel morphology could potentially occur through alterations in the shape, stability and bank composition. Increased sediment inputs from erosion and bed and bank instabilities could upset the dynamic equilibrium in the channel's ability to transport water and sediment. The installation of culverts could also result in a constriction of the channel, which could affect flow velocities that could in turn affect channel geomorphology (e.g., bank-full width and depth, bed material composition, ratio of pools to riffles, composition of riparian vegetation). Placement of crossing structures in water bodies can also cause potential changes in fish accessibility to habitat (e.g., where the culvert forms a barrier to fish passage), which can cause habitat fragmentation. For example, a barrier between rearing and spawning habitat may remove access to habitat, resulting in loss of habitat, at the crossing location and a loss of access to habitat upstream from the crossing, which can ultimately, affect the stability of a self-sustaining population.

The water body crossings will be constructed or installed in a manner that follows the regulatory approvals or permits issued for the Project from the appropriate regulatory agencies, as required. The construction and operation of water body crossings will also follow best management practices and DFO's *Measures to Avoid Causing Harm to Fish and Fish Habitat Including Aquatic Species at Risk* (DFO 2016).

Bridges will be installed at four major crossings (Duport River, James River, La Martre River, and the unnamed watercourse at kilometre 45.2 [crossing #9]) which will minimize disturbance below the high water mark and maintain fish passage. Where culverts are used, the culvert will be appropriately designed for the water body and installed such that the channel is not constricted and to minimize potential for scour and erosion. Culverts will be designed and installed to allow fish movement and meet normal flow velocities for all seasons. Culvert slopes will be optimized during construction to reduce velocities at the outlet; culverts will be embedded, as appropriate, to maintain species and habitat present. Temporary snowfill/ice bridge crossings will be constructed to not restrict or block flow at any time. Prior to spring break-up, ice bridges will be physically v-notched in the middle to allow them to melt from the centre. Watercourses will be inspected upstream and downstream of the crossings for erosion, scour, and flow blockages during the spring freshet and through the open water season, as required. Where culverts are installed at fish-bearing water bodies, debris removal activities will follow DFO's guidance (i.e., gradual removal such that flooding downstream, extreme flows downstream, release of suspended sediment, and fish stranding can be avoided).

Sediment and erosion control measures will be implemented during water body crossing construction activities to minimize potential for changes in sediment yield. This includes stabilizing and re-vegetating banks and restoring the bed and banks of the water body to their original contour and gradient.

Effects on fish migration and access to habitats are expected to be negligible; as a result, effects to fish abundance and distribution are also expected to be negligible with effective implementation of the mitigation measures. There

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is no anticipated effect on the maintenance of self-sustaining and ecologically effective populations of the VC fish species.

- *Introduction of dust/debris (from construction and traffic) can alter water quality and affect fish and fish habitat.*

Dust and debris on the road surface and subsequent deposition into water bodies along the TASR may cause a change in water quality which could affect fish and fish habitat. However, speed and load limits will be enforced to preserve the road bed, and regular road maintenance will be conducted to suppress dust production (as per the GNWT Guideline for Dust Suppression). Snow will be plowed off of the road in such a manner that it melts into vegetated areas in the spring. Debris and excess materials resulting from construction will be removed from the work site to prevent them reaching water bodies.

Changes to water quality from dust and debris from construction and operation of the TASR are expected to result in negligible changes to fish habitat quantity and quality with the effective implementation of the mitigation measures. There is no anticipated effect on the maintenance of self-sustaining and ecologically effective populations of the VC fish species.

- *Introduction of new or invasive species to area water bodies can affect fish and fish habitat.*

Development of a road into a new area can allow for the introduction of new or invasive aquatic species (e.g., fish, invertebrates, mussels, aquatic plants). Boaters/anglers can transfer species through the use and transport of watercraft when organisms attach to or become lodged on the hull, motor, trailer or equipment, such as anchors and ropes, as well as from water that enters the watercraft during operations (e.g., bilge water). Fishing gear, such as nets and waders can also transfer organisms, as well as the use of live bait from other areas.

Due to the relatively remote location, it is anticipated that most of the anglers/boaters using the TASR will be local and there will not be transfer of new or invasive species from other areas of Canada. Therefore, the potential for the introduction of new or invasive species to water bodies crossed by the TASR is expected to be minimal, and as a result, is expected to result in no measurable changes to fish habitat quantity or quality. There is no anticipated effect on the maintenance of self-sustaining and ecologically effective populations of the VC fish species.

- *Spills and leaks from construction equipment and spills and leaks from accidents can affect surface water and sediment quality, affecting fish, fish habitat, and harvesting opportunities (construction phase).*

- *Spills and leaks from transport and maintenance equipment and spills and leaks from accidents can affect surface water and sediment quality, affecting fish, fish habitat, and harvesting opportunities (operation phase).*

Introduction of deleterious substances from spills of fuel or other hazardous materials during construction has the potential to adversely affect water quality. Spills that occur in high enough concentrations could contaminate runoff and surface water. Spills are generally preventable and local in nature.

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An emergency response and spill contingency plan will be developed and implemented for the construction and maintenance of the Project, including ready access to an emergency spill clean-up kit for cleaning up any spills. Drivers and construction crews on site will be familiar with the spill contingency plan and appropriately qualified. Fuels, lubricants and hydraulic fluids for equipment used will be carefully handled to avoid spillage, properly secured against unauthorized access or vandalism, provided with spill containment and disposed of in accordance with the Waste Management Plan. Fuel caches will be located on flat stable terrain or in natural depressions away from slopes to water bodies, and caches will be clearly marked and drums will be placed on their sides and spaced to facilitate inspections.

Construction equipment will be regularly maintained and inspected to ensure it is free of leaks. Equipment used in or near water will be clean and free of oil, grease or other deleterious substances. Machinery used for work below the high water mark will use only biodegradable hydraulic fluid, and drip pans/trays will be placed under all equipment while not in use. All fuel storage containers will have integrated 110% secondary containment, and refueling and servicing of machinery and storage of fuel and other materials for the machinery will occur a minimum of 30 m away from any water body, where possible. Any spills will be reported immediately to the NWT Spill Line.

During operations, speed limits will be posted and enforced. Transport Canada enforces the *Transportation of Dangerous Goods Act/Regulations*. Other commercial operators using the road would also have their own spill contingency plans in place.

Spills during construction and operation of the TASR are expected to result in negligible changes to fish habitat quantity and quality or fish abundance and distribution with the effective implementation of mitigation measures. There is no anticipated effect from spills on the maintenance of self-sustaining and ecologically effective populations of the VC fish species, and as a result, no anticipated effect on harvesting opportunities.

- *Water withdrawal for camps, construction, or dust suppression use may cause loss of fish habitat, fish entrainment, and/or fish impingement.*

Water supply needs for the Project may cause changes to water levels or flows in water bodies and streams, which can affect fish habitat. For camp operations, only water sources identified using DFO's *Protocol for Winter Water Withdrawal from Ice-covered Waterbodies in the Northwest Territories and Nunavut* (DFO 2010) will be used for winter withdrawal. This will include identification of suitable water withdrawal sources (lakes and stream), assessment of allowable withdrawal quantities per source, unique source identification, and water withdrawal volume tracking. All camp water use will be monitored and tracked and regulated through a water licence.

Fish screens on pumps will be designed according to DFO guidelines (DFO 1995, 2016), kept clean and free of ice and debris, and inspected for damage prior to each withdrawal. A backup fish screen will be kept available to be used if the primary screen is frozen or damaged.

The annual requirements of water from these water bodies to meet the water demand are expected to result in a small change to water level and the outflows of these lakes during winter (ice-cover) or open-water conditions. Withdrawal of water from source water bodies for water supply requirements may cause a minor, local change to water levels and outflows, but are expected to remain within natural variability. Negligible effects to fish habitat quantity and quality or fish abundance would be anticipated with the effective implementation of the mitigation

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measures, and no effect on the maintenance of self-sustaining and ecologically effective populations of the VC fish species.

- *Wastewater, runoff, and waste/debris from temporary camps can affect surface water quality of nearby watercourses, affecting fish and fish habitat.*

The discharge of camp wastewater can increase the concentration of nutrients such as nitrates and phosphates in receiving water bodies. Increased nutrients in water bodies that are particularly sensitive or vulnerable to changes in trophic status may result in eutrophication (enrichment of nutrients) and affect fish and fish habitat. Runoff and debris from camp locations can also affect water quality.

However, large (150 person) temporary work camps will be placed in selected borrow sources, and water and erosion structures will be installed at all temporary camps where needed. Sewage waste generated from large (150 person) camp construction/use will be stored in a leak-free container before being transported to an approved disposal facility. Sewage from small camps may be disposed in an approved sump. Grey water will be transported to an offsite facility or disposed of in an approved sump. Wastewater will not be disposed of into surface waters. All materials brought to camp sites will be removed at camp closure. Some materials may be incinerated.

As a result, no measurable changes to water quality from camp wastewater or runoff are expected with the effective implementation of setbacks and mitigation measures, and as a result, no effects to fish habitat quantity and quality. There is no anticipated effect on the maintenance of self-sustaining and ecologically effective populations of the VC fish species.

3.2.2.3 Primary Pathways

The only primary pathway identified for the Project is the potential overexploitation of large-bodied fish populations due to improved road access. This pathway is assessed in detail in the residual effects analysis.

3.3 Residual Effects Analysis

3.3.1 Approach and Methods

The residual effects analysis for impacts to fisheries generally followed the methods outlined in Section 2.0. The residual effects analysis is based on pathways determined to be primary in the pathway analysis (Section 3.2.2.3). The following primary pathway is analyzed and carried through the residual effects classification and determination of significance for the fish VCs (Arctic Grayling, Lake Trout, Northern Pike, Walleye and Whitefish [Coregonid] Species):

- *Potential overexploitation of large-bodied fish populations due to improved road access*

The residual effects analysis for this pathway is completed for the Application Case, relative to the Base Case. The Application Case represents predictions of the effects from the Base Case combined with the effects from the Project, and is also used to identify the incremental changes from the Project. As the primary pathway is related to harvesting effects on fish VCs, the residual effects analysis for the Application Case is completed by predicting changes to the measurement indicator of abundance; the analysis looked at the effects of harvest on the “fishery”, as the fishery considers a self-sustaining and ecologically effective fish population that can support harvesting practices.

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The residual effects analysis for the RSA was based on reviews of:

- the DFO and GNWT statistics related to fish harvesting and recreational fishing in Whatì, the Tłįchǫ region, the NWT, and/or Canada
- the population statistics from NWT and Canadian censuses
- government and scientific literature related to recreational fishing pressures, specifically in the presence of road access
- TK documents related to the Project, specifically those identifying subsistence fisheries within the RSA

The analysis of effects on VC abundance considered the overall fishery at specific watercourses and lakes within the RSA, and was based on the abundance of all VCs present at that location. Qualitative assessments were completed to compare harvesting and recreational fishing pressures between the Base Case and Application Case for each water body based on changes to the number of fishers and changes to the access to each water body. Potential harvesting locations were the focus of the residual effects analysis because:

- fish are often not specifically targeted to species during harvesting or recreational fishing activities, but fishing locations are targeted (especially locations with known high value fisheries)
- increases in harvest level from changes in access are likely linked to locations rather than to individual fish species
- while the proposed TASR will increase access to water bodies within the RSA, increases in access will not be equal between water bodies
- water bodies located on Tłįchǫ lands versus those solely on public lands may be regulated differently and therefore different mitigations may apply
- most or all of the VCs have documented presence at the major water bodies within the RSA (i.e., Lac La Martre, the La Martre and Marian Rivers, James River, and James Lake); however, documented fish data do not exist for most of the smaller, unnamed water bodies within the RSA
- effects to populations of individual fish species (VCs) at one water body are likely not linked to other populations of the same species in other water bodies

Following comparisons between Base Case and Application Case for each water body, the likely effects on the fishery at each water body was determined, where the fishery is defined as the abundance of all VCs present within each water body. The likely effects to the fishery at each water body were then rated based on the definitions below:

- **None**: No identifiable effects on VC abundance present and no effects on the fishery.
- **Negligible**: Effects on VC abundance may be present but not measurable; no detectable effects on the fishery.
- **Low**: Effects on VC abundance may occur such that there are minor measureable effects on VC populations in the water body and the associated fishery.

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- **Moderate**: Effects on VC abundance may occur such that there are measureable changes to the VC populations and the associated fishery and potential changes to fish community structure in the water body, but the VC populations remain self-sustaining and ecologically effective.
- **High**: Effects on VC abundance present such that there are measureable changes to the VC populations and the associated fishery such that one or more of the VC populations may no longer be self-sustaining and ecologically effective.

3.3.2 Application Case Results

The development of the TASR will provide all-season access for approximately 94 km in length from Highway 3 to Whatì, which might result in increased access to watercourses and water bodies in the RSA. Although there is currently some access along the existing corridor, the placement of an all-season road will increase access to these areas. Increased access has the potential to result in increased fishing pressure at new watercourse and water body access points. Increased fishing pressure has the potential to result in changes in fish abundance where increased fish harvest also occurs.

Fishing is an important subsistence and recreational activity in the NWT, with almost half of NWT residents age 15 years and older participating in hunting or fishing activities in 2014 (GNWTBS 2014). This proportion of people who fish is higher for people in the Tłı̨chǫ region and even higher still for residents of Whatì (Table 3.3-1). Subsistence fishing in the Tłı̨chǫ region is a culturally important activity (PR#28; PR#97), with only 9.2% of households surveyed throughout the region and 7.2% of households surveyed in Whatì reporting no meat or fish eaten that was obtained through hunting or fishing activities. Further, 62.8% of households surveyed in the Tłı̨chǫ region and 59.7% of households surveyed in Whatì obtained half or more of their eaten meat through hunting or fishing activities (GNWTBS 2014).

Table 3.3-1: Number of Fishers by Type and Region

Fisher Type	Percentage of Population Age 15 and Over That Fish[(a)]	Estimated Number of Fishers[(b)]
Whatì Resident	55.3%	225
Tłı̨chǫ Resident	46.0%	1,008
Non-Tłı̨chǫ, NWT Resident	44.7%	14,560
Non-NWT Resident Visitor	7.3%	4,623

a) NWT resident data obtained from 2014 NWT Community Survey, number represents people that hunt and/or fish (GNWTBS 2014, http://www.statsnwt.ca/). Non-NWT resident data obtained from GNWT Department of Industry, Tourism and Investment (http://www.iti.gov.nt.ca/en/tourism-research). Age of non-NWT resident fishers was not indicated, age 15 and over was assumed. Percentages include both subsistence and recreational fishers.

b) Number of fishers estimated by applying the percentage of population age 15 and over that fish to the GNWTBS July 1, 2016 population estimates by community and age group (GNWTBS 2016, http://www.statsnwt.ca/). Estimated numbers of fishers include both subsistence and recreational fishers.

Fishing is an important traditional activity for Tłı̨chǫ and other Aboriginal people (PR#28; PR#97; PR#98). The total Aboriginal population in the Tłı̨chǫ region is 2,871 individuals (all ages; GNWTBS 2016) resulting in a density of 0.07 aboriginal people per km^2 of Tłı̨chǫ lands and 0.02 Aboriginal people per km^2 of the WRMA. Expanded to include the entire NWT Aboriginal population (n=22,013), the resulting densities are 0.57 Aboriginal people per km^2 of Tłı̨chǫ lands and 0.15 Aboriginal people per km^2 of the WRMA. Expanded further to include the entire NWT population (both Aboriginal and non-Aboriginal; n=44,469), the resulting densities are 1.16 people per km^2

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of Tłı̨chǫ lands and 0.30 people per km^2 of the WRMA. By comparison, population density in Canada is one of the lowest in the world at 3.92 people per km^2 (Statistics Canada 2017).

Recreational fishing is one of the major components of the tourism industry in the NWT, with an average of 4,880 recreational fishing tourists per year over the past five years (GNWT Department of Industry, Tourism and Investment 2016). Recreational fishing in general (tourists and native NWT license holders) provides economic value in the NWT, with an estimated $12.76 million spent on recreational fishing in general and an estimated $5.59 million spent on guided fishing packages in 2010 (DFO 2012). An estimated $9.7 million was spent by non-NWT residents on fishing in 2015, which is less than the average of $11.5 million spent yearly since 2011 (GNWT Department of Industry, Tourism and Investment 2016). The fly-in fishing lodge at Lac La Martre (Lac La Martre Adventures) provides work for local guides and economic value to the community of Whatì, with lodge revenues of roughly $432,000 per year (PR#96).

Recreational fishing provides economic value to the NWT, and it likely causes less impact on fish stocks than other harvesting types (e.g., commercial). Many guided fishing operations, such as Lac La Martre Adventures, focus on catch-and release based trophy fishing and may retain a small amount (typically less than 10%) of their catch for meals (PR#96, DFO 2006). In general, recreational fishers do not retain their catch, with recreational fishers in Canada keeping 32% of their catch (an average of 19.1 fish per angler per year) and those in the NWT keeping an even smaller 12% of their catch (an average of 5.2 fish per angler per year; DFO 2012). Recreational fishers are also less likely to travel great distances to fish (Hunt and Lester 2009; de Kerckhove et al. 2015), with sustainable levels of recreational fishing likely to occur in fishing locations further than 100 km from population centres of 100,000 people, where fishing locations tend to remain relatively unexploited (Post et al. 2002, 2008). The nearest major centre to the proposed TASR is Yellowknife (population of 20,960; GNWTBS 2016), which is at least 135 km from the junction of the proposed TASR and Highway 3 and 245 km from Whatì. This distance is greater than average distance travelled by anglers in Ontario where there are fewer fishing opportunities and a greater population density (de Kerckhove et al. 2015). Numerous productive fisheries supporting a variety of fish species exist within close proximity to Yellowknife (PR#91), likely limiting the number of recreational and subsistence fishers travelling to the proposed TASR to find suitable fishing locations. Additionally, the number of recreational fishers has remained generally stable and has even somewhat declined in the NWT over the last 15 years (DFO 2012; GNWT Department of Industry, Tourism and Investment 2016) even though NWT population has steadily increased (GNWTBS 2016).

Lac La Martre (Tsǫ̀tı̀) is a large, very productive lake used extensively for fish harvesting by residents of the lake-side, predominantly Tłı̨chǫ community of Whatì (Bond 1973; GNWTBS 2014). While Lac La Martre was previously used as a commercial fishery (Bond 1973, PR#91), the main non-resident impacts to the fishery currently come from the fly-in trophy fishing lodge (Lac La Martre Adventures) and tourists hiring other local guides and outfitters. An increase in fishing tourism is possible with improved access. Lac La Martre is entirely on Tłı̨chǫ land, and would likely be the primary draw for non-Tłı̨chǫ people using the proposed TASR for access to fishing areas (Table 3.3-2). An increase in access to Lac La Martre from the proposed TASR , and associated potential for tourism, is likely to result in a moderate increase in use by Tłı̨chǫ and non-Tłı̨chǫ fishers on Lac La Martre. Tłı̨chǫ lands are regulated and administered by the Department of Culture and Lands Protection of the Tłı̨chǫ Government. While NWT fishing regulations still apply on Tłı̨chǫ lands, additional access and fishing regulations may be implemented and regulated by the Tłı̨chǫ Government.

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Table 3.3-2: Harvesting Pressure by Fisher Types on VC Fish Populations Due to Improved Road Access: Lac La Martre (Tsǫ̀tı̀)

Lac La Martre (Tsǫ̀tı̀)

Baseline VC Abundance[(a)]	Fisher Type	Base Case		TASR Application Case		
		Access	**Effects on Fishery[(b)]**	**Change in Access**	**Mitigation**	**Effects on Fishery[(b)]**
■ Large populations of Arctic Grayling, Lake Whitefish, Round Whitefish, Lake Trout, Northern Pike, and Walleye (PR#91; PR#97). ■ Small population of Inconnu (PR#91)	Aboriginal Tłı̨chǫ	High access provided by lakeside access from Whatì where there is a small number of subsistence fishers (i.e., local residents)	Negligible	No change in access and use by local fishers	None	Negligible
	Aboriginal, Non-Tłı̨chǫ and Non-Aboriginal NWT residents	■ Low access due to winter road, trail, and fly-in access only ■ Approximately half-day travel to existing trails/winter road at Hwy. 3 (to Lac La Martre) for a small number of available fishers (residents) from non-Tłı̨chǫ communities in NWT	Negligible	Increased access provided by road, resulting in moderate increase in use by available fishers	■ Possible implementation of fishing regulations and boat launch restrictions by Tłı̨chǫ Government ■ Maintenance of existing NWT fishing regulations by DFO ■ Sustainable development of fishing-based tourism opportunities by Tłı̨chǫ Government	Negligible
	Non-NWT resident	■ Minimal access limited by winter road and fly-in access only ■ Multi-day drive from nearest major urban centre to existing trails/winter road network that starts at Hwy. 3 ■ Approximately 150 visitors at Lac La Martre lodge per year, where anglers catch and release only	Negligible	Increased access provided by road and possible increase in tourism, resulting in moderate increase in use by available fishers	As above	Negligible

Base Case and Application Case sources: PR#28; PR#97, Bond 1973

a) Baseline VC abundance population sizes are based on estimates of population sizes for VCs listed in PR documents (TK and IR response documents, DFO documents); population sizes for VC species documented in the water body but not mentioned in the PR documents are based on catch data from scientific literature compared to the catch data for the VC species identified in the PR documents.

b) Effects on fishery considers the effects on the abundance of all VC species present in the water body.

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The upper La Martre River (Tsotìdeè), which is defined in this document as the La Martre River between Lac La Martre and Nàįlįįtı, is a very productive fishery used extensively by the residents of Whatì and, to a lesser extent, Tłįchǫ people residing in other communities (PR#28; PR#91; PR#97). Currently, access to the upper La Martre River is limited to boat access from Lac La Martre, Boyer Lake, or the launch at Nàįlįįtı, or by winter road access, and therefore, is not often fished by non-Whatì residents or non-Tłįchǫ people. The upper La Martre River is located entirely on Tłįchǫ lands and would likely be a primary draw for non-Tłįchǫ people using the proposed TASR to access fishing areas (Table 3.3-3). The proposed TASR crosses the upper La Martre River, and would create an additional point of access to the river allowing vehicle access to a section of river that was previously only accessible by boat during the open water season. An increase in access to the upper La Martre River from the TASR bridge crossing in close proximity of the boat launch is likely to result in a moderate increase in use by Tłįchǫ and non-Tłįchǫ fishers on the upper La Martre River.

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Table 3.3-3: Harvesting Pressure by Fisher Types on VC Fish Populations Due to Improved Road Access: Upper La Martre River

Upper La Martre River (Tsotìdeè; between Lac La Martre and Nàįlįįtı)						
Baseline VC Abundance[(a)]	Fisher Type	Base Case		TASR Application Case		
		Access	Effects on Fishery[(b)]	Change in Access	Mitigation	Effects on Fishery[(b)]
■ Large population sizes of Arctic Grayling, Northern Pike, Lake Whitefish, and Round Whitefish (PR#28; PR#91; PR#97, Chang-Kue et al. 1987) ■ Moderate population size of Lake Trout between Lac La Martre and Boyer Lake (Chang-Kue et al. 1987)	Aboriginal Tłįchǫ	■ Moderate access for a small number of fishers (local residents); relatively close to Whatì but currently requires either boat or winter roads to access most of the river ■ On traditional canoe route	Negligible	No change in access and use by local fishers	None	Negligible
	Aboriginal, Non-Tłįchǫ and Non-Aboriginal NWT residents	■ Low access due to winter road, trail, and fly-in access only ■ Approximately half-day travel to existing access routes/winter road at Hwy. 3 for a small number of available fishers (residents) from non-Tłįchǫ communities in NWT	Negligible	Increased access provided by road and crossing, resulting in moderate increase in use by available fishers	■ Possible implementation of fishing regulations and boat launch restrictions by Tłįchǫ Government ■ Maintenance of existing NWT fishing regulations by DFO ■ Sustainable development of fishing-based tourism opportunities by Tłįchǫ Government	Low
	Non-NWT resident	■ Minimal access for fishers due to winter road and fly-in access only, and without knowledge of existing access from Hwy. 3 to river ■ Multi-day drive from nearest major urban centre to existing trails/winter road network that starts at Hwy. 3	Negligible	Increased access provided by road and possible increase in tourism, resulting in moderate increase in use by available fishers	As above	Negligible

Base Case and Application Case sources: PR#28; PR#97

a) Baseline VC abundance population sizes are based on estimates of population sizes for VCs listed in PR documents (TK and IR response documents, DFO documents); population sizes for VC species documented in the water body but not mentioned in the PR documents are based on catch data from scientific literature compared to the catch data for the VC species identified in the PR documents.

b) Effects on fishery considers the effects on the abundance of all VC species present in the water body.

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The lower La Martre River (Tsotìdeè), which is defined in this document as the La Martre River between Nàı̨lı̨ı̨tı and the Marian River, is a very productive fishery used often by residents of Whatì and, to a lesser extent, Tłı̨chǫ people residing in other communities (PR#28; PR#91; PR#97). Currently, access to the lower La Martre River is limited to boat access from the launch below Nàı̨lı̨ı̨tı and trails requiring off-road vehicles (PR#28; PR#97), and therefore is not often fished by non-Tłı̨chǫ people. The lower La Martre River is located entirely on Tłı̨chǫ lands and access would be marginally improved by the proposed TASR, with a boat or off-road vehicle still required to fish the majority of the river (Table 3.3-4).

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Table 3.3-4: Harvesting Pressure by Fisher Types on VC Fish Populations Due to Improved Road Access: Lower La Martre River

Lower La Martre River (Tsotìdeè; between Nàįlįįtı and the Marian River)						
Baseline VC Abundance[(a)]	**Fisher Type**	**Base Case**		**TASR Application Case**		
		Access	**Effects on Fishery[(b)]**	**Change in Access**	**Mitigation**	**Effects on Fishery[(b)]**
■ Moderate to large population sizes of Lake Whitefish, Northern Pike, and Walleye (Chang-Kue et al. 1987) ■ Small population sizes of Arctic Grayling, Inconnu, and Round Whitefish (Chang-Kue et al. 1987, ARI 2012)	Aboriginal Tłįchǫ	■ Low-to-moderate access for a small number of local fishers (residents); areas below the falls accessible from trails primarily used for hunting and/or trapping ■ On traditional canoe route	Negligible	No change in access and use by local fishers	None	Negligible
	Aboriginal, Non-Tłįchǫ and Non-Aboriginal NWT residents	■ Low access due to winter road, trail, and fly-in access only ■ Approximately half-day travel to existing trails/winter road at Hwy. 3 for a small number of available fishers (residents) from non-Tłįchǫ communities in NWT	Negligible	Increased access provided by road, resulting in minor increase in use by available fishers	■ Possible implementation of fishing regulations and boat launch restrictions by Tłįchǫ Government ■ Maintenance of existing NWT fishing regulations by DFO ■ Sustainable development of fishing-based tourism opportunities by Tłįchǫ Government	Low
	Non-NWT resident	■ Minimal access due to winter road and fly-in access only, and without knowledge of existing trail network to river ■ Multi-day drive from nearest major urban centre to existing trails/winter road network that starts at Hwy. 3	Negligible	Increased access provided by road, resulting in minor increase in use by available fishers	As above	Negligible

Base Case and Application Case sources: PR#28; PR#97

a) Baseline VC abundance population sizes are based on estimates of population sizes for VCs listed in PR documents (TK and IR response documents, DFO documents); population sizes for VC species documented in the water body but not mentioned in the PR documents are based on catch data from scientific literature compared to the catch data for the VC species identified in the PR documents.

b) Effects on fishery considers the effects on the abundance of all VC species present in the water body.

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The Marian River (Gò lo Tı̀ Deè) is a large river and very productive fishery, fed by the La Martre River and draining into Marian Lake. It is currently fished relatively often, particularly seasonally, by Tłı̨chǫ people, and is part of a traditional canoe route between Whatì and Marian Lake (PR#28; PR#97). Currently, access to the Marian River is limited to trails requiring off-road vehicles or boat access from the lower La Martre River or Marian Lake (PR#28; PR#97), and therefore, is not often fished by non-Tłı̨chǫ people. The Marian River is located entirely on Tłı̨chǫ lands and access would be marginally improved by the proposed TASR, with a boat or off-road vehicle still required for access (Table 3.3-5).

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Table 3.3-5: Harvesting Pressure by Fisher Types on VC Fish Populations Due to Improved Road Access: Marian River (Gò lo Tı̀ Deè)

Marian River (Gò lo Tı̀ Deè)

Baseline VC Abundance[(a)]	Fisher Type	Base Case		TASR Application Case		
		Access	Effects on Fishery[(b)]	Change in Access	Mitigation	Effects on Fishery[(b)]
■ Large populations of Lake Whitefish and Walleye (PR#97) ■ Likely moderate to large populations of other VC species as well (PR#91; PR#97)	Aboriginal Tłı̨chǫ	■ Low access for a small number of local fishers (residents), where the river is accessed by trails connecting to the La Martre River below the falls, and then by a traditional canoe route ■ The river is also accessible by traditional canoe route from Marian Lake	Negligible	No change in access and use by local fishers	None	Negligible
	Aboriginal, Non-Tłı̨chǫ and Non-Aboriginal NWT residents	■ Minimal upstream access to the La Martre River boat/canoe launch (upstream of Marian River) due to winter road, trail, and fly-in access only ■ Low downstream access through Marian Lake ■ Approximately half-day vehicle travel to existing trails/winter road (for access to La Martre River) for a small number of available fishers (residents) from non-Tłı̨chǫ communities in NWT	Negligible	Increased access provided by road, resulting in minor increase in use by available fishers	■ Possible implementation of fishing regulations and boat launch restrictions by Tłı̨chǫ Government ■ Maintenance of existing NWT fishing regulations by DFO ■ Sustainable development of fishing-based tourism opportunities by Tłı̨chǫ Government	Negligible
	Non-NWT resident	■ Minimal access due to winter road and fly-in access only, and without knowledge of existing trail network to La Martre River and canoe route to Marian River ■ Multi-day drive from nearest major urban centre to existing trails/winter road network that starts at Hwy. 3	None	Increased access provided by road, resulting in minor increase in use by available fishers	As above	Negligible

Base Case and Application Case sources: PR#28; PR#97

a) Baseline VC abundance population sizes are based on estimates of population sizes for VCs listed in PR documents (TK and IR response documents, DFO documents); population sizes for VC species documented in the water body but not mentioned in the PR documents are based on catch data from scientific literature compared to the catch data for the VC species identified in the PR documents.

b) Effects on fishery considers the effects on the abundance of all VC species present in the water body.

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Boyer Lake (Bòts'ıtı) is a productive fishery used year-round as a subsistence fishery by residents of Whatì but little by non-Whatì residents (PR#28; PR#97). Boyer Lake is located entirely on Tłı̨chǫ lands and just outside of the community of Whatì, and access is currently limited to boat access from Lac La Martre or winter road access. The proposed TASR will improve access to Boyer Lake for non-Whatì residents by improving access to Lac La Martre and increased fishing tourism; however, no direct access to Boyer Lake will be created by the proposed TASR (Table 3.3-6). The increase in access to Boyer Lake from the proposed TASR, and associated potential for tourism, is likely to result in a moderate increase in use by Tłı̨chǫ and non-Tłı̨chǫ fishers on Boyer Lake.

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Table 3.3-6: Harvesting Pressure by Fisher Types on VC Fish Populations Due to Improved Road Access: Boyer Lake (Bòts'ıtı)

Boyer Lake (Bòts'ıtı)						
Baseline VC Abundance[a]	Fisher Type	Base Case		TASR Application Case		
		Access	Effects on Fishery[b]	Change in Access	Mitigation	Effects on Fishery[b]
Moderate to large populations of Arctic Grayling, Lake Trout, Lake Whitefish, Northern Pike, Round Whitefish, and Walleye (PR#28; PR#91; PR#97, Chang-Kue et al. 1987)	Aboriginal Tłįchę	■ Moderate access, relatively close to Whatì but currently requires either boat or winter roads to access ■ On traditional canoe route	Negligible	No change in access and use by local fishers	None	Negligible
	Aboriginal, Non-Tłįchę and Non-Aboriginal NWT residents	■ Minimal-to-low access due to winter road and fly-in access only ■ Approximately half-day travel to existing trails/winter road (Hwy. 3 to Boyer Lake) for a small number of available fishers (residents) from non-Tłįchę communities in NWT	Negligible	Increased access provided by road, resulting in moderate increase in use by available fishers	■ Possible implementation of fishing regulations by Tłįchę Government ■ Maintenance of existing NWT fishing regulations by DFO ■ Sustainable development of fishing-based tourism opportunities by Tłįchę Government	Negligible
	Non-NWT resident	■ Minimal access for fishers due to winter road and fly-in access only, and without knowledge of existing access ■ Multi-day drive from nearest major urban centre to existing trails/winter road network that starts at Hwy. 3	None	Increased access provided by road and possible increase in tourism, resulting in moderate increase in use by available fishers	As above	Negligible

Base Case and Application Case sources: PR#28; PR#97

a) Baseline VC abundance population sizes are based on estimates of population sizes for VCs listed in PR documents (TK and IR response documents, DFO documents); population sizes for VC species documented in the water body but not mentioned in the PR documents are based on catch data from scientific literature compared to the catch data for the VC species identified in the PR documents.

b) Effects on fishery considers the effects on the abundance of all VC species present in the water body.

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Lac Levis (Lake K'ıshıtì) and Lake Łıetı are lakes more than 50 km south of Lac La Martre and west of the proposed TASR. They are located on public land and therefore fall solely under NWT fishing regulations, but are known as good subsistence fisheries for Tłı̨chǫ people, which are used while they are out hunting (PR#28; PR#97). Current access to these lakes requires using trails and off-road vehicles, and fishing pressures are low due to their distances from communities (PR#97). The proposed TASR would improve access marginally by improving access to the trails, but fishing pressures would likely still be limited to subsistence fishing for people who are hunting/trapping for long periods of time (Table 3.3-7).

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Table 3.3-7: Harvesting Pressure by Fisher Types on VC Fish Populations Due to Improved Road Access: Lac Levis (Lake K'ıshıtì) and Lake Łıetı

Lac Levis (Lake K'ıshıtì) and Lake Łıetı

Baseline VC Abundance[a]	Fisher Type	Base Case		TASR Application Case		
		Access	Effects on Fishery[b]	Change in Access	Mitigation	Effects on Fishery[b]
Unknown, though likely moderate to large populations of some VC species (PR#28; PR#91; PR#97)	Aboriginal Tłı̨chǫ	Low access due to remoteness of lakes, and travelling trails/traplines required to reach these lakes	Negligible	No change in access and use by local fishers	None	Negligible
	Aboriginal, Non-Tłı̨chǫ and Non-Aboriginal NWT residents	■ Minimal access due to remoteness of lakes, and winter road and trail access only ■ Approximately half-day travel to existing trails/winter road (to lakes) for a small number of available fishers (residents) from non-Tłı̨chǫ communities in NWT	Negligible	Increased access provided by road, however, no change in use by fishers	Maintenance of existing NWT fishing regulations by DFO	Negligible
	Non-NWT resident	■ Inaccessible due to winter road and trail access only, and limited knowledge of existing access from Hwy. 3 to lakes ■ Multi-day drive from nearest major urban centre to existing trails/winter road network that starts at Hwy. 3	None	Increased access provided by road, however, no change in use by fishers	Maintenance of existing NWT fishing regulations	None

Base Case and Application Case sources: PR#28; PR#91; PR#97

a) Baseline VC abundance population sizes are based on estimates of population sizes for VCs listed in PR documents (TK and IR response documents, DFO documents); population sizes for VC species documented in the water body but not mentioned in the PR documents are based on catch data from scientific literature compared to the catch data for the VC species identified in the PR documents.

b) Effects on fishery considers the effects on the abundance of all VC species present in the water body.

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The James River and James Lake are moderately productive fisheries used occasionally by Tłįchǫ people, especially closer to James Lake. Current access to the James River and James Lake is limited to off-road vehicles using summer and winter trails, and fishing by Tłįchǫ people primarily occurs as subsistence fishing during hunting/trapping activities (PR#28; PR#97). The James River is located primarily on Tłįchǫ lands, though a large stretch (including the area proposed to be crossed by the TASR) exists on public land and is subject only to NWT fishing regulations. James Lake is located entirely on Tłįchǫ lands. The proposed TASR would increase access to the James River, primarily at or near the river crossing, but also by improving access to the trails used to reach downstream areas of the James River and James Lake (Table 3.3-8).

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Table 3.3-8: Harvesting Pressure by Fisher Types on VC Fish Populations Due to Improved Road Access: James River

James River and James Lake

Baseline VC Abundance[(a)]	Fisher Type	Base Case		TASR Application Case		
		Access	Effects on Fishery[(b)]	Change in Access	Mitigation	Effects on Fishery[(b)]
■ Large population sizes of Arctic Grayling, Northern Pike, and Round Whitefish (PR#97) ■ Moderate to large population size of Lake Trout at/near James Lake (PR#91; PR#97)	Aboriginal Tłįchǫ	Low access for a small number of local fishers (residents), access limited to winter road and trail access only	Negligible	Increased access provided by road and crossing, resulting in minor increase in use by local fishers	None	Negligible
	Aboriginal, Non-Tłįchǫ and Non-Aboriginal NWT residents	■ Minimal access due to winter road and fly-in access only; some winter road andtrail access for a small number of fishers (residents) with knowledge of existing trail network from Hwy. 3 ■ Approximately half-day travel to existing trails/winter road for a small number of available fishers (residents) from non-Tłįchǫ communities in NWT	Negligible	Increased access provided by road and crossing, resulting in minor increase in use by available resident fishers	■ Possible implementation of additional fishing regulations by Tłįchǫ Government ■ Maintenance of existing NWT fishing regulations by DFO	Negligible to Low
	Non-NWT resident	■ Minimal access due to winter road and trail access only ■ Multi-day drive from nearest major urban centre to existing trails/winter road network that starts at Hwy. 3	None	Increased access provided by road and crossings, resulting in minor increase in use by available fishers	As above	Negligible to Low

Base Case and Application Case sources: PR#28; PR#91; PR#97

a) Baseline VC abundance population sizes are based on estimates of population sizes for VCs listed in PR documents (TK and IR response documents, DFO documents); population sizes for VC species documented in the water body but not mentioned in the PR documents are based on catch data from scientific literature compared to the catch data for the VC species identified in the PR documents.

b) Effects on fishery considers the effects on the abundance of all VC species present in the water body.

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There are numerous lakes and watercourses along the proposed TASR corridor, several that provide fish habitat likely to sustain small populations of VCs such as Northern Pike, Walleye, and Arctic Grayling (PR#7; Golder 2011). These include six unnamed lakes with areas greater than 10 ha located within 2 km from the proposed TASR corridor, one of which is located on Tłı̨chǫ lands. Current access to most of these areas is limited to winter roads and seasonal trails, and fishing pressures are limited to opportunistic or subsistence fishing by people using the trails for hunting/trapping. Most of the watercourses and lakes near the proposed TASR corridor are on public land, though several are on Tłı̨chǫ lands. The proposed TASR would increase the fishing pressure at these watercourses and lakes, especially those crossed by the TASR (i.e., the Duport River) and within close proximity of areas to park vehicles, such as workspaces and quarries used for TASR construction. Areas further off the TASR corridor would see an increase of fishing pressure as well due to increased access to trails, although accessing these areas would still require off-road vehicles and knowledge of the area (Table 3.3-9).

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Table 3.3-9: Harvesting Pressure by Fisher Types on VC Fish Populations Due to Improved Road Access: Other Water bodies and Watercourses

Other fish-bearing lakes and watercourse along TASR Corridor (i.e., Duport River, unnamed lakes and streams)

Baseline VC Abundance[a]	Fisher Type	Base Case		TASR Application Case		
		Access	Effects on Fishery[b]	Change in Access	Mitigation	Effects on Fishery[b]
Likely small population sizes of Arctic Grayling, Northern Pike, Round Whitefish, and Walleye where adequate fish habitat is present (PR#7, PR#91; Golder 2011)	Aboriginal Tłįchǫ	Low access for a small number of local fishers (residents), access limited to winter road and trail access only	Negligible	Increased access provided by road and crossings, resulting in minor increase in use by local fishers	None	Negligible
	Aboriginal, Non-Tłįchǫ and Non-Aboriginal NWT residents	■ Minimal to low access due to winter road and fly-in access only; some trail access for a small number of fishers (residents) with knowledge of existing trail network from Hwy. 3 ■ Approximately half-day travel to existing trails/winter road for a small number of available fishers (residents) from non-Tłįchǫ communities in NWT	Negligible	Increased access provided by road and crossings, resulting in minor increase in use by available resident fishers	■ Possible implementation of additional fishing regulations by Tłįchǫ Government ■ Maintenance of existing NWT fishing regulations by DFO	Low
	Non-NWT resident	■ Minimal access due to winter road and trail access only ■ Multi-day drive from nearest major urban centre to existing trails/winter road network that starts at Hwy. 3	None	Increased access provided by road and crossings, resulting in minor increase in use by available fishers	As above	Low

Base Case and Application Case sources: PR#28; PR#91; PR#97

a) Baseline VC abundance population sizes are based on estimates of population sizes for VCs listed in PR documents (TK and IR response documents, DFO documents); population sizes for VC species documented in the water body but not mentioned in the PR documents are based on catch data from scientific literature compared to the catch data for the VC species identified in the PR documents.

b) Effects on fishery considers the effects on the abundance of all VC species present in the water body.

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Many of the watercourses and lakes within the RSA would likely see increased fishing pressure following the construction of the proposed TASR. Increased fishing pressure is expected to come primarily from Tłįchǫ people, although the more accessible areas would likely see some increased fishing pressure from non-Tłįchǫ people as well (i.e., Aboriginal and non-Aboriginal NWT residents). However, the proposed TASR will have negligible to low residual effects on existing fisheries within the RSA due to the following:

- small population of people in the NWT
- the distance between the proposed TASR and major population centres
- the abundance of productive fisheries within the RSA and elsewhere in the NWT
- the general stasis of recreational fishing in the NWT

The watercourses and lakes likely to attract the greatest number of subsistence and recreational fishers due to the TASR are also the largest (i.e., Lac La Martre, La Martre River, and Boyer Lake), and have fisheries with substantial VC abundances that can likely support an increase in fishing pressure. These water bodies are also located on Tłįchǫ lands and therefore can have fishing and general access controlled by the Tłįchǫ Government if they deem the NWT fishing regulations inadequate to sustain the relevant fisheries.

Sustainable Lake Trout harvests for interior lakes in Alaska are currently estimated using a multi-lake-based model developed by Evans et al. (1991), which is calculated as $\text{Log10 } H = 0.60 + 0.72 \text{ Log10 } A$, where H is the annual harvest in kilograms and A is the lake surface area in hectares (DFO 2008). Applying this to the lakes most likely to be fished within the RSA, Lac La Martre and Boyer Lake, it is estimated that a sustainable annual Lake Trout harvest would be 23,108 kg for Lac La Martre and 682 kg for Boyer Lake. The annual amount of Lake Trout eaten on average by people in Whatì was estimated at 25 kg per person by Bond (1973), which is currently considered a conservative amount due to a decreased reliance on fish harvesting as a meat source by Tłįchǫ people since that study was completed. However, if this average value is applied to the current population of Whatì (n=549; GNWTBS 2016), an estimated 13,696 kg of Lake Trout would be consumed annually by the community of Whatì. When this is compared to the estimate of sustainable Lake Trout harvest for Lac La Martre and Boyer Lake (a combined 23,790 kg), it indicates that only 58% of the current sustainable harvest is being utilized by residents of Whatì. Since Lake Trout are likely the VC to be most easily overexploited within the RSA due their slow growth and maturity, capacity for a sustainable increase in Lake Trout harvest in Lac La Martre and Boyer Lake indicates that other VC populations could also cope with an increase in harvesting pressure within the RSA.

The small watercourses and lakes near the TASR corridor are also expected to attract fishers due to the TASR, and these locations may face the greatest relative increase in fishing pressure due to the smaller fish population sizes present compared to the larger water bodies in the RSA (Post et al. 2002; Cott et al. 2015). Furthermore, small, low productivity habitats may support small populations of VC species such as Arctic Grayling that spawn and rear in small tributaries, Walleye that may spawn in shallow lakes, or Lake Trout (which are slow to grow and mature in the Arctic) that inhabit small lakes with adequate depths (PR#91, Richardson et al. 2001, Evans et al. 2002). These species may be susceptible to overexploitation by roadside fishers (Schindler 2001; Cott et al. 2015), specifically at crossing locations on the James and Duport rivers, their nearby tributaries and connected lakes, and the six moderately large (>10 ha) unnamed lakes located within 2 km of the proposed TASR corridor. Although these smaller watercourses and lakes have smaller fish populations that may be more vulnerable to harvest (Gunn and Sein 2000), it is expected that most of the harvest pressure from access related

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to the TASR will be on the larger water bodies with known and productive fisheries. These small watercourses and lakes may experience periodic fishing activity, but as there are no shortage of water bodies within the RSA, it is likely that locations with higher value fisheries will be targeted (Hunt and Lester 2009).

It is anticipated that DFO will continue to be able to manage regional fisheries resources and support sustainable fish populations in the NWT. DFO is the management authority for fish and fish habitat in the NWT. DFO is responsible for enacting all regulations under the federal *Fisheries Act*, and is responsible for the biological management of fishery resources, including the sport, commercial and domestic fisheries in the NWT. DFO is responsible for enforcing the *Fisheries Act*, although GNWT officers, under a Memorandum of Understanding with DFO, have been cross appointed to enforce the sport fishing regulations. The GNWT-ENR administers sport fishing licences in the NWT. Fishing is managed as a public resource through territorial licensing requirements, and the establishment of season length, catch limits, and catch-and-release rules. It is also anticipated that the Tłįchǫ Government will further manage the fisheries on Tłįchǫ lands, including future fishing-based tourism opportunities such as fishing lodges and guided fishing tours, where needed to ensure sustainable subsistence fishing is available for Tłįchǫ people.

3.3.3 Reasonably Foreseeable Development Case Results

As per Section 2.2, the RFDs that may occur in or beyond the RSA include:

- Fortune Minerals Ltd. (Fortune) NICO Mine
- Nailii Hydroelectric Project at La Martre Falls
- Tłįchǫ/Whatì Park Area at La Martre Falls

The inclusion of these projects are not expected to interact cumulatively with the residual effects of previous and existing developments and activities and the Project (Application Case), as additional access to water bodies within the fish and fish habitat RSA (Figure 3.1-2) is not expected to occur as a result of these projects.

If the Fortune Minerals Ltd. NICO Project were to move ahead, it would involve an extension of all-season road access from the terminus of the TASR at the community government boundary of Whatì to the proposed location of the NICO mine. As per the Project Description in the DAR for the NICO Project (Fortune 2011), this would involve a northward extension of the Tłįchǫ Road access (approximately 19 km), and then the NICO Project Access Road heading in a northeast direction towards the proposed mine site near Hislop Lake. This development would allow additional access to water bodies and watercourses along this road route and associated potential effects to abundance of fish species from increased fish harvest. However, as these water bodies and watercourses are outside the RSA for the TASR and consist of separate fish populations, the effects would not be expected to interact cumulatively with residual effects from the TASR Application Case. It is recognized that there is a crossing of the Marian River near the proposed mine site; however, this crossing is located more than 40 km upstream from section of the lower Marian River in the TASR fish and fish habitat RSA. Any effects to VC fish populations related to fish harvest at these two locations would not be expected to overlap cumulatively. In the Application Case, residual effects to the Marian River fishery were considered negligible, as the Marian River is a large river with a very productive fishery and access would be marginally improved by the proposed TASR (Table 3.3-5); the residual effects assessment would not change for the Marian River with the addition of the NICO Project.

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It is also recognized that if the NICO Project were to move ahead, there would be additional workers travelling the road and some potentially residing in Whatì. The residual effects analysis for the Application Case, however, considers use of the road by Aboriginal and non-Aboriginal fishers; therefore, effects on abundance of VCs and effects on the fisheries are the same as for the Application Case. Furthermore, as per the DAR for the NICO Project, Fortune will not permit recreational fishing by their staff or contractors at the NICO Project site, or when on the NICO Project Access Road for work purposes (e.g., construction or travel) (Fortune 2011).

The Nailii Hydroelectric Project and the Tłı̨chǫ/Whatì Park Area would use existing roads and not provide additional access to RSA water bodies, and therefore, would not interact cumulatively with the Project to increase fish harvest.

3.4 Prediction Confidence and Uncertainty

There is a high degree of certainty that Project construction activities are expected to result in minor and localized changes to fish and fish habitat.

The confidence in the effects assessment for fish and fish habitat is moderate, considering that the mitigation described in the Fish and Fish Habitat Protection Plan (PR#7, Appendix X) is based on accepted and proven best management practices that are well understood and have been applied to road construction Projects throughout North America. A desktop review was conducted to review existing information along with the results of field surveys. Uncertainty in the assessment has been reduced by making conservative assumptions, planning implementation of known effective mitigation and monitoring measures, including DFO's *Measures to Avoid Causing Harm to Fish and Fish Habitat Including Aquatic Species at Risk* (DFO 2016), and using available adaptive management measures to address unforeseen circumstances should they arise. DFO's self-assessment and request for review process, will be followed, as required. The GNWT will continue to work with DFO through the permitting process.

There is a low to moderate level of uncertainty related to the effects analysis related to the primary pathway of *potential overexploitation of large-bodied fish populations due to improved road access*. Although DFO and GNWT statistics related to fish harvesting and recreational fishing in Whatì, the Tłı̨chǫ region, the NWT, and Canada were reviewed, the actual number of fishers that will access water bodies along the TASR is unknown, as well as the locations and species that will be harvested. However, there is a moderate level of confidence that the effects on VC abundance, and the associated fishery, will be low due to the general remoteness of the locations, generally low level of existing harvest pressure, and the ability of these water bodies to handle a higher level of harvest pressure. Furthermore, recreational fishing numbers are remaining stable even though populations are increasing.

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3.5 Effect Classification and Determination of Significance

3.5.1 Methods

Residual effects are described using the classification criteria identified in Table 3.5-1 and applied to the predicted changes to the measurement indicators for the fish VCs. Classification of residual effects on fish VCs considered direction (positive, negative, or neutral), expected magnitude (e.g., change in abundance, amount of habitat lost or gained), geographic extent (e.g., distance covered or range of the effect), duration and reversibility (e.g., years, decades, permanent/irreversible), frequency (i.e., number of times the effect happens per unit time), and likelihood (e.g., how likely is the effect).

Table 3.5-1: Definitions of Effects Categories Used to Classify Predicted Residual Effects to Fish VCs

Criteria	Definition
Direction	■ Positive – net gain or benefit; effect is desirable ■ Neutral – no change compared with baseline conditions and trends ■ Negative – net loss or adverse effect; effect is undesirable
Magnitude	■ Low – Amount of change to measurement indicator results in no measurable effect to population abundance and distribution, or results in a minor measurable residual effect to the population ■ Moderate – Amount of change to measurement indicator results in a clearly defined change to population abundance and distribution, but the residual effects are well within the predicted resilience limits and adaptive capacity of the VC ■ High – Amount of change to the measurement indicator is sufficiently large that the resulting ranges of residual effects are near or exceeding the predicted resilience limits and adaptive capacity of the VC
Geographic extent	■ Local – predicted maximum spatial extent of direct and indirect effects from changes to a measurement indicator due to a project or activity are well within the RSA (e.g., confined to or immediately adjacent to the Project footprint). ■ Regional – effects from changes to a measurement indicator due to a project or activity extend to the RSA boundary and/or can include cumulative effects from other developments in the RSA ■ Beyond regional – effects from changes to a measurement indicator extends beyond the RSA boundary
Duration/reversibility	■ Short-term – residual effect from changes to a measurement indicator is reversible at the end of construction ■ Medium-term – residual effect from changes to a measurement indicator is reversible soon after operation begins ■ Long-term – residual effect from changes to a measurement indicator is reversible within a defined length of time during operation ■ Permanent – residual effect from changes to a measurement indicator is not reversible
Frequency/Timing	■ Infrequent – the effect from changes to a measurement indicator is expected to occur rarely ■ Frequent – the effect from changes to a measurement indicator is expected to occur intermittently ■ Continuous – the effect from changes to a measurement indicator is expected to occur continually
Likelihood	■ Unlikely – the effect is not likely to occur ■ Possible – the effect may occur, but is not likely ■ Probable – the effect is likely to occur ■ Certain – the effect will occur

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The predicted changes in measurement indicators and associated classification of residual effects provides the foundation for determining the significance of incremental and cumulative effects from the Project and other previous, existing, and RFDs on the assessment endpoints for fish VCs. Significance was determined based on combined effects because the effects of a single project infrequently cause an ecologically significant effect on their own (McCold and Saulsbury 1996), and many environmental effects of primary concern are cumulative (Canter and Ross 2010). Therefore, whether fish VCs would remain self-sustaining and ecologically effective was assessed by combining the effects identified at Base Case with the residual effects identified for the Project and RFDs to assess the total predicted combined effect. If a significant effect was identified, the contribution of the Project to the combined effect was clearly described.

Magnitude, geographic extent, and duration (which includes reversibility) are the primary criteria used to determine the significance of effects on VCs. Other criteria, such as frequency and likelihood are used as modifiers. The approach to determining the significance of combined effects on the VCs incorporated the concepts of resilience and adaptability. Because of the uncertainty regarding the effects of development on VCs, magnitude classification was applied conservatively to increase the level of confidence that effects will not be worse than predicted. Furthermore, the determination of significance considers the key sources of uncertainty in the effects analysis, the management of uncertainties, and the corresponding level of confidence in effects predictions.

Significance was predicted as a binary response, with effects classified as significant or not significant. Residual effects were determined to be significant if a VC is expected to no longer be: (1) self-sustaining, or (2) ecologically effective. Specifically,

- A VC was considered to be no longer self-sustaining where cumulative residual effects were expected to place the abundance of a VC, whether an open or closed population, on a declining trajectory that is not predicted to recover or stabilize. For example, this could include an increase in harvest pressure to a vulnerable population such that there were permanent adverse changes to survival and reproduction at the population level. Part of being self-sustaining, in this context, was that a VC population that stabilizes at a lower abundance is not expected to be extirpated because of unrelated stochastic events. Another part of being self-sustaining was the assumption that no additional mitigation or management actions beyond the proposed Project mitigation strategies and existing management strategies in the region would be required. Effects that are not significant could result in no change, stabilization at lower abundance, stabilization at higher abundance, or a temporary decline followed by recovery.
- A VC that has lost important ecological function would also result in determination of a significant adverse effect, regardless of its self-sustaining status. Loss of ecological function occurs when a population can no longer perform its ecological role, such that it might trigger ecological changes that result in degraded or simplified ecosystems (Soulé et al. 2003).

The level of confidence is also included in the evaluation of significance. Where uncertainty was high and the cumulative effect might be either significant or not significant, the assessment conservatively identified the effect as significant and provided additional follow-up to reduce uncertainty (i.e., precautionary approach).

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3.5.2 Results

The cumulative effects of the TASR and other developments and activities (including recreational and subsistence fisheries) should not have a significant adverse impact on the ability of the fisheries within the RSA, and the VC species that they consist of, to be self-sustaining and ecologically effective (Table 3.5-2). The primary pathway *of potential overexploitation of large-bodied fish populations due to improved road access* has a negligible to low magnitude for the fisheries within the RSA. The watercourses and lakes likely to attract the greatest number of fishers due to the TASR (i.e., Lac La Martre, La Martre River, and Boyer Lake), are large water bodies with abundant VC populations that can support an increase in fishing pressure. The small watercourses and lakes near the TASR corridor are also expected to attract fishers due to the increased access, and these locations may face the greatest relative increase in fishing pressure due to the smaller fish population sizes present compared to the larger water bodies. However, it is expected that most of the increased fishing pressure will be at locations where the TASR has improved access to known, productive, high value fisheries. Although there may be small changes to VC population abundance within water bodies within the RSA, the residual effects would be well within the predicted resilience limits and adaptive capacity of the VC and VC populations would remain self-sustaining and ecologically effective.

The geographic extent is considered local to regional. Effects to VC abundance from increased access may occur primarily at water body crossings near the Project footprint; however, effects on abundance from increased harvest may extend to the RSA and include entire water bodies such as Lac La Martre, La Martre River, and James River, and James Lake.

Duration of the residual effects is considered permanent because the effect from increased harvest pressure are related to the existence of the completed TASR and not just the construction phase. As long as the TASR remains operational, the potential for increased residual effects on VC abundance due to increased fishing pressure exists.

The effects are expected to occur continuously. The effects to VC abundance due to increased fishing pressure within the RSA are likely to occur for portions of the construction phase and the duration of the operation phase of the Project because of the increased access the TASR would provide. The effects on VC abundance would be expected to start as soon as increased access is available during the construction phase. Tłįchǫ people are most likely to use the TASR during the construction phase of the Project, and non-Tłįchǫ residents and non-NWT residents are more likely to start using the TASR during the operation phase of the Project.

The likelihood of the primary pathway affecting VC abundance is probable. The Project will increase access to several currently fished and previously unfished water bodies, and it is expected that there will be an increase in fishing pressure to many of these water bodies.

Overall, the weight of evidence from the analysis of the primary pathway predicts that incremental and cumulative changes to fish abundance from the Project and other developments should not have a significant adverse impact on the ability of VC fish populations (Arctic Grayling, Lake Trout, Northern Pike, Walleye and Whitefish [Coregonid] Species) to be self-sustaining and ecologically effective, where self-sustaining and ecologically effective populations of fish VCs are the foundation for ongoing productivity of fisheries.

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Table 3.5-2: Summary of Residual Effects Classification and Predicted Significance of Cumulative Effects on Fish VCs in the RFD Case

Indicator	Characteristic	Rating/Effect Size	Significance Determination
VC Abundance	Direction	Negative	Not Significant
	Magnitude	Negligible to low	
	Geographic Extent	Local to regional	
	Duration/Reversibility	Permanent (increased access due to the TASR)	
	Frequency/Timing	Continuous	
	Likelihood	Probable	

3.6 Monitoring and Follow-up

Monitoring will be conducted during instream construction (e.g., installation of culverts and bridges) by an Environmental Monitor to observe implementation and report on the effectiveness of the construction procedures and mitigation measures for minimizing potential effects to fish and fish habitat. Turbidity monitoring will be conducted at watercourses flowing at the time of construction as per the In-Field Water Analysis Plan and according to permit requirements (PR#7, Appendix AA). Consideration will be given to the use of best available technology for turbidity monitoring.

Post construction monitoring will be used to provide feedback on the effectiveness of design features and mitigation. Post construction monitoring will be conducted in the two open-water seasons following construction at water body crossings to verify that erosion and sediment control measures have been successful (e.g., bank restoration and revegetation). The integrity of the crossing structures will be inspected regularly and during periods of high run-off, such as the spring freshet. Any changes to the morphology of the water body channel will be identified and addressed, as needed. At culverts, regular monitoring will be conducted to identify and remove blockages (e.g., ice, woody debris), as needed, that would otherwise lead to scouring and effects to channel morphology and fish habitat, and potentially interfere with fish passage.

Using monitoring and adaptive management, mitigation may be modified or additional mitigation may be implemented to reduce unexpected impacts to fish and fish habitat. DFO will enforce NWT fishery regulations which are in place to prevent overfishing in any one area, including water bodies not within the proposed TASR corridor but accessed using the TASR (PR#7). The developer will ensure DFO and the Tłı̨chǫ Government are aware of the changing access and that a review of how fisheries will be managed in the area, including monitoring, may be required. Regional cumulative effects monitoring will be considered through the Marian River Watershed Monitoring Program, managed by the Tłı̨chǫ Government.

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4.0 ASSESSMENT OF EFFECTS TO WILDLIFE

4.1 Introduction

4.1.1 Purpose and Scope

The purpose of the Wildlife Section of the ASR for the Project is to meet the requirements outlined in the TOR (PR#69) and the Adequacy Statement (PR#70) issued by MVEIRB. This section includes a comprehensive assessment of direct and indirect effects on all applicable life stages of wildlife within the temporal and spatial boundaries defined for wildlife. Direct effects occur as the result of changes from the physical disturbance of terrestrial and aquatic habitats from human activities and developments, and natural factors (e.g., fire). Sensory disturbance from human developments, such as noise, lights and smells, can change habitat quality and the movement and behaviour of animals, which produces indirect effects on wildlife abundance and distribution.

The effects assessment evaluates the construction and operation phases of the Project on wildlife species identified as VCs (Section 4.1.2) within the spatial and temporal boundaries defined for the assessment (Section 4.1.3). Cumulative effects are incorporated throughout the wildlife assessment, where applicable. Given the large home ranges of some species, the effects from the Project must be considered in combination with other previous, existing and RFDs and natural factors that influence wildlife within the assessment boundaries.

4.1.2 Valued Components, Assessment Endpoints and Measurement Indicators

Valued components (VCs) refer to environmental features that may be affected by a Project and have been identified to be of concern by the proponent, scientists, government agencies, Aboriginal peoples, or the public (Canadian Environmental Assessment Agency 2014). Wildlife VCs were selected from the suite of species with ranges that overlap spatially with the Project.

Wildlife species at risk with ranges overlapping the Project were identified as VCs, and these species make up the majority of the wildlife VCs for the Project (Table 4.1-1). Plant and amphibian species at risk did not have ranges that overlapped with the Project. However, some wildlife species identified as important in the TK Report (PR#28) and the PDR (PR#7) were also selected as VCs (Table 4.1-1).

Many of the VCs selected for the Project represent a broader group of species or a particular habitat type important for a variety of wildlife. For example, olive-sided flycatcher (*Contopus cooperi*) and common nighthawk (*Chordeiles minor*) represent a guild of species that forage on insects while flying through the air, but nest in different habitats; olive-sided flycatcher nest in trees, whereas common nighthawk nest on the ground. Bank swallow (*Riparia riparia*) and barn swallow (*Hirundo rustica*) are also aerial insectivores, and will nest on man-made structures, such as quarries, and buildings and bridges, respectively. Little brown myotis (*Myotis lucifugus*) occupy mature forests that contain wildlife trees (e.g., dead or decaying trees that provide opportunities for refuge and nesting cavities), whereas horned grebe (*Podiceps auritus*) prefer marshes and ponds, and rusty blackbird (*Euphagus carolinus*) occupy wetland and riparian habitats. Understanding the potential effects of the Project on VCs therefore permits inferences about effects on other wildlife species or guilds with similar life history traits and habitat requirements.

Some of the wildlife VCs selected for the Project can represent conservation values that extend beyond the species itself (i.e., indicator, umbrella, or keystone species; Sergio et al. 2006; Estes et al. 2011) or are highly interactive and have a large influence on the ecosystem (Soulé et al. 2005). For example, species such as woodland caribou (*Rangifer tarandus*) and wolverine (*Gulo gulo*) may act as umbrella species, which require sufficiently large habitat

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areas that their conservation automatically improves conservation prospects for some other species such as American marten (*Martes americana*) and lynx (*Lynx canadensis*) (Carroll et al. 2001). Highly interactive species such as moose have large home ranges, represent key sources of protein and energy for predators (natural and human) and scavengers in the boreal ecosystem, and can have strong influences on the dynamics and persistence of boreal caribou populations (Wittmer et al. 2005; Festa-Bianchet et al. 2011).

Table 4.1-1: Rationale for Selected Wildlife VCs

Valued Components	Conservation Status			Rationale for Selection
	SARC[(a)]	COSEWIC[(b)]	SARA[(c)]	
Boreal caribou	Threatened	Threatened	Threatened	■ importance to hunters, including First Nations ■ federally and territorially listed ■ social/cultural importance ■ relies on large areas of well-connected mature coniferous forest and bog-fen habitat ■ considered an umbrella species to support conservation of other wildlife and regional biodiversity
Barren-ground caribou	Not assessed	Threatened	Under consideration	■ importance to hunters, including First Nations ■ federally listed ■ social/cultural importance ■ highly interactive species in tundra environments
Moose	Not assessed	No status	No status	■ importance to hunters, including First Nations ■ highly interactive species in boreal environments (i.e., large source of protein and energy for predators and scavengers) ■ increase in local moose density could negatively affect woodland or barren-ground caribou populations by increasing carnivore density
Wood bison	Threatened	Special Concern	Threatened	■ federally and territorially listed ■ social/cultural importance ■ large source of energy and protein for predators and scavengers in boreal environments with mixed wood/coniferous forest interspersed with lakes and large open sedge wetlands and meadows
Wolverine	Not At Risk	Special Concern	No status	■ federally listed ■ indicator of large areas of well-connected mature coniferous forest; umbrella species for conservation of regional diversity
Little brown myotis	Not assessed	Endangered	Endangered	■ federally listed ■ dependent on standing dead and live trees for maternity roosts in mature deciduous and mixed stands ■ hibernacula may be limited ■ represents a species that requires open forest/edge habitat in wetter areas, and is a surrogate for other federally listed bats (e.g., northern myotis)
Peregrine falcon	Not assessed	Special Concern	Special Concern	■ federally listed ■ breeding habitat is limited ■ sensitive to noise and human activity during nesting ■ as a top avian predator can be a keystone species
Short-eared owl	Not assessed	Special Concern	Special Concern	■ federally listed

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Table 4.1-1: Rationale for Selected Wildlife VCs (continued)

Valued Components	Conservation Status			Rationale for Selection
	SARC[(a)]	COSEWIC[(b)]	SARA[(c)]	
Bank swallow	Not applicable	Threatened	No status	■ federally listed ■ aerial insectivore that nests in cliffs or eroding stream-side banks, and human-made sites such as sand and gravel quarries
Barn swallow	Not applicable	Threatened	No status	■ federally listed ■ aerial insectivore that nests on human-made structures such as buildings and bridges
Common nighthawk	Not applicable	Threatened	Threatened	■ federally listed ■ aerial insectivore that forages and nests recently disturbed (fire, logged) and open habitats ■ nests on the ground
Olive-sided flycatcher	Not applicable	Threatened	Threatened	■ federally listed ■ aerial insectivore that requires coniferous forest, edges and openings near meadows and ponds ■ nests in trees
Horned grebe (western population)	Not applicable	Special Concern	No status	■ federally listed ■ nests on the surface of marshes and ponds
Red-necked phalarope	Not applicable	Special Concern	No status	■ federally listed
Rusty blackbird	Not assessed	Special Concern	Special Concern	■ federally listed ■ occupy wetlands and low-shrubby riparian areas along edges of lakes, beaver impoundments and watercourses
Yellow rail	Not applicable	Special Concern	Special Concern	■ federally listed ■ prefer wetland habitats with no or little standing water, but soil is saturated
Gypsy cuckoo bumble bee	Not assessed	Endangered	No status	■ federally listed
Yellow-banded bumble bee	Not assessed	Special Concern	No status	■ federally listed

a) Northwest Territories Species at Risk Committee (SARC 2016a). Note that species included in the *Migratory Bird Convention Act* are not covered by the *Species At Risk (NWT) Act*, and are labelled 'Not applicable'.

b) Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2016).

c) *Species at Risk Act*.

Assessment endpoints represent the key properties of each VC that should be protected. Self-sustaining and ecologically effective populations are the assessment endpoints applied to wildlife. Self-sustaining populations are healthy and viable populations, which are by definition robust and capable of withstanding environmental change and accommodating stochastic population processes (Reed et al. 2003). Maintaining viable populations is a conservation target frequently applied by conservation biologists and resource managers (Nicholson et al. 2006; Ruggiero et al. 1994; With and Crist 1995). For example, achieving and maintaining self-sustaining woodland caribou populations are goals of the Recovery Strategy for Woodland Caribou in Canada (Environment Canada 2012; CMA 2017).

Achieving viable populations may not be sufficient to meet conservation objectives for other species or ecosystems that interact with the VC being assessed (Soulé et al. 2005). For highly interactive wildlife VCs that have strong effects on ecosystem structure and function, the concept of ecologically effective populations was applied as an

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assessment endpoint. This includes interaction with humans, such as through harvest. An ecologically effective population differs from a self-sustaining population if the number of individuals needed to maintain ecological function is greater than the number required to maintain a viable population for the long term. Self-sustaining populations can also lose ecological function if animal behaviour changes. The application of the concept of self-sustaining and ecologically effective populations to significance determination for the wildlife assessment is described in Section 4.6.1.

Measurement indicators represent attributes of the environment and VCs that, when changed, can be used to characterize effects to an assessment endpoint in a meaningful way. The measurement indicators for wildlife VCs are defined as follows:

- **Habitat availability** (i.e., quantity and quality): changes to the amount of different quality habitats (e.g., hectares), and animal use of available habitat.
- **Habitat distribution** (i.e., arrangement and connectivity): changes to spatial configuration and connectivity of habitats, and the spatial distribution and movement of animals.
- **Survival and reproduction**: changes to animal abundance from altering survival and/or recruitment.

Each indicator was assessed quantitatively where sufficient information existed to support a numerical assessment, and qualitatively, where necessary.

4.1.3 Assessment Boundaries

4.1.3.1 Spatial Boundaries

The spatial boundaries selected for the wildlife assessment were defined to provide a description of existing conditions in sufficient detail to identify and understand potential Project effects on VCs, including the contribution of the Project to cumulative effects. The wildlife assessment used two spatial boundaries:

- the Project footprint
- VC-specific Regional Study Areas (RSA)

The Project footprint accounts for direct physical disturbance and alteration of wildlife habitat. The Project footprint is comprised of the preferred route and is approximately 94 kilometres (km) in length with a 60 m ROW. A further 3 km of upgrades are required within CGW lands, bringing the total assessed Project footprint to 97 km. The footprint also includes laydown areas, construction camps, and borrow sites with associated access roads with a 30 m ROW. The total predicted area of the Project footprint is 2,198.6 ha. Up to 13 borrow sites may be developed with access roads. Construction camps and laydown areas will be located in either borrow sites or within the 60 m ROW, so neither are expected to require additional land clearing. Almost all access roads are planned to overlap the preferred route ROW and borrow sites, one may be accessed from the existing community access road from Whatì. Thus, access roads to borrow sites should not create additional direct physical disturbance to the landscape.

The cleared driving surface of the preferred route is anticipated to be approximately 8.5 m wide. The Project predominately follows a pre-existing overland winter road route to minimize new disturbance to the landscape. The Project will also include 15 water crossings; 4 of these require bridge structures, 3 require structural culverts

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and 8 will have banks with drainage culverts. To be conservative and not underestimate the effects from habitat loss where there is uncertainty in the road alignment, a 100 m buffer was applied to edge of the preferred route ROW at the La Martre River crossing and a 50 m buffer was applied to the remaining preferred route ROW and anticipated borrow sites (which are to contain construction camps). The buffers should include any physical disturbance to habitat that may occur immediately adjacent to the expected Project footprint. The Project footprint with associated buffers is 3,414.3 ha (55.6% larger than the actual anticipated area of the Project).

The RSAs for wildlife VCs were identified to capture and assess the significance of incremental and cumulative effects from the Project and other previous, existing and RFDs. The VC-specific RSA is the scale at which cumulative effects can be appropriately assessed for each VC.

No information is available to delineate the population boundaries for many of the VCs, particularly bumble bees, birds and little brown myotis. Due to the length of the Project, a number of populations of each of these VCs could be potentially influenced by the Project along the route, and likely have patchy to continuous distributions. Populations intersected by the Project may be discrete or, more likely, exhibit variable connectivity through dispersal and movement.

Without estimates of population boundaries, the analysis of effects on assessment endpoints (self-sustaining and ecologically effective populations) necessarily involves uncertainty, but can still be ecologically appropriate (Table 4.1-2). For bumble bees, the RSA was defined by a 2.5 km buffer around the Project footprint, which is predicted to be large enough to capture the direct and indirect effects from the Project on these species that have small daily movement distances (range: 17 m to 1,286 m [Hagen et al. 2011]). For wildlife VCs with small to moderate breeding home ranges (i.e., bat and bird species), the RSA was also defined by a 2.5 km buffer around the Project footprint (Figure 4.1-4, note also duplicate maps in Appendix G). The assessment area for each wildlife VC is anticipated to be large enough to contain important cumulative effects on populations of bat and bird VCs that are distributed inside the assessment area, but probably also extend beyond its boundaries. A recent meta-analysis showed that effects from infrastructure on bird and mammal populations typically extended over distances of up to approximately 1 km and 5 km, respectively (Benítez-López et al. 2010).

The boreal (woodland) caribou RSA was defined by the Northwest Territories (NT) Range 1 (PR#38) (Figure 4.1-1). Following discussions with Environment and Climate Change Canada (ECCC), GNWT-ENR, and Wek'èezhìı Renewable Resource Board (WRRB), the ASR also includes an assessment of changes to boreal caribou habitat in the WRMA (PR#107).

The RSA for barren-ground caribou, moose and wolverine was largely based on TK information, and included potential ecological interactions among the VCs. Although radio-collar location data for the Bathurst and Bluenose East caribou herds from 1996 to 2015 suggest that barren-ground caribou have not occupied the area around the Project during this period of time, TK observed barren-ground caribou in the area during 1996 to 1998 (PR#28) (Figure 4.1-2). During this period, the Bathurst herd was at high numbers and may have expanded their winter range to include this area of boreal forest. The area near the northern end of the Project was also identified by TK as quality moose habitat (Figure 4.1-2) (PR#28). Based on the above information, the RSA for barren-ground caribou and moose was defined by a 35 km buffer around the Project footprint, which includes areas for these VCs identified by TK. The RSA also includes the western boundary of the winter range of the Bathurst herd, delineated by animal collar locations. Including caribou and moose in the same RSA is ecologically relevant because they are both wide-ranging animals whose ranges may overlap with the potential to interact during winter.

To Table of Contents

Similarly, wolverine population(s) that overlap the RSA would rely on scavenging moose and caribou as food sources.

The RSA for wood bison included the Mackenzie Bison Range and the RSA for barren-ground caribou (moose and wolverine). The Project intersects a very small part of the northeastern boundary of the Mackenzie Bison Range and the RSA for barren-ground caribou was included to address the potential for bison to disperse north along the TASR and expand their range (Figure 4.1-3). Traditional Knowledge also identified bison habitat adjacent to James and Marian lakes in the RSA (PR#28).

4.1.3.2 Temporal Boundaries

The Project is planned to occur during two phases:

- **construction phase:** the period from the start of construction to the start of operation (estimated at two to four years)
- **operation phase:** encompasses operation and maintenance activities throughout the life of the Project, which is anticipated to be indefinite

The assessment of the Project on wildlife considers effects that occur during the construction and operation phases. This timeframe is sufficient to capture the effects of the Project. Temporal boundaries also include the duration of effects from previous and existing developments that overlap with residual effects of the Project, and the period of time that residual effects from the Project overlap with effects from future developments and activities. The assessment considered three assessment cases, as described in Section 2.

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Table 4.1-2: Spatial Boundaries for Wildlife VCs

Valued Component	Study Area	Area	Description	Rationale
All VCs	Project footprint	3,414.3 ha (34.1 km^2)	The Project footprint is the preferred route ROW, laydown yards, construction camps, borrow sites and associated access roads. A 100 m buffer was applied to preferred route at the La Martre River Crossing and a 50 m was applied to the remaining portion of the route and borrow sites.	Designed to capture the direct effects of the physical footprint of the Project.
■ Bumble bees ■ Little brown myotis ■ Peregrine falcon ■ Short-eared owl ■ Bank and barn swallows Common nighthawk ■ Olive-sided flycatcher ■ Horned grebe ■ Red-necked phalarope ■ Rusty black bird ■ Yellow rail	RSA	55,572 ha (555.7 km^2)	A 2.5 km buffer around Project footprint.	■ Defined as an ecologically relevant scale for wildlife species with small to moderate breeding home ranges. ■ Provides a large enough area to assess the cumulative effects on populations of bumble bee, bat and bird VCs that are likely to be distributed inside but extend outside the RSA, and is the scale at which significance is determined.
Boreal caribou	RSA	41,718,686 ha (417,186.9 km^2)	Encompasses the NT1 Boreal Woodland Caribou Range, and includes Wek’èezhìı Resource Management Area.	■ Defined using regional population management boundaries established by GNWT-ENR. ■ Appropriate scale for a cumulative effects assessment on woodland caribou and the scale at which significance was determined. ■ Wek’èezhìı Resource Management Area within NT1 Range assessment was requested by parties.
■ Barren-ground caribou ■ Moose ■ Wolverine	RSA	1,001,520 ha (10,015.2 km^2)	A 35 km buffer around the Project footprint.	■ Defined using Traditional Knowledge and an ecologically relevant scale for wide-ranging mammal VCs that can interact with each other. ■ Appropriate scale for a cumulative effects assessment on these VCs and the scale at which significance was determined.

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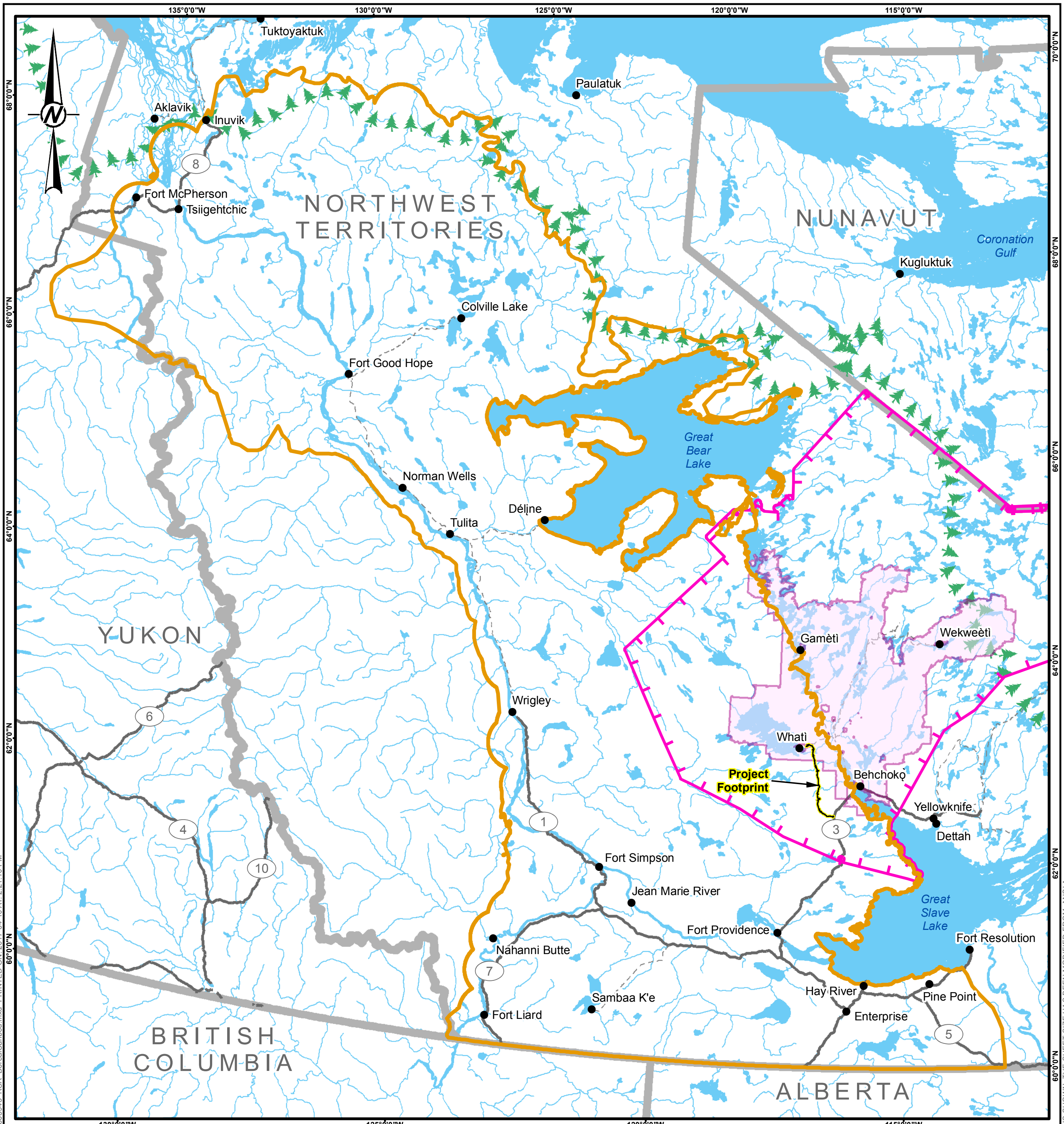
Table 4.1-2: Spatial Boundaries for Wildlife VCs

Valued Component	Study Area	Area	Description	Rationale
Wood bison	RSA	1,001,520 ha (10,015.2 km^2)	Mackenzie Bison Range plus a 35 km buffer around the Project footprint.	■ Defined using regional population management boundaries established by GNWT-ENR, TK and potential range expansion due to the Project. ■ Appropriate scale for a cumulative effects assessment on wood bison and the scale at which significance was determined.

Note: ROW = right-of-way; RSA = Regional Study Area.



LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- WINTER ROAD
- TREELINE
- WATERCOURSE
- PROVINCIAL/TERRITORIAL BOUNDARY
- TŁĮCHQ LAND
- WATER BODY
- BOREAL CARIBOU RSA
- PROJECT FOOTPRINT
- WEK'ÈEZHÌI RESOURCE MANAGEMENT AREA

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1:6,000,000 KILOMETRES

REFERENCE(S)

1. ADMINISTRATIVE REGIONS OBTAINED FROM GOVERNMENT OF NORTHWEST TERRITORIES.
2. BOREAL CARIBOU RANGE OBTAINED FROM ENVIRONMENT CANADA, 2012.
3. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.

PROJECTION: CANADA LAMBERT CONFORMAL CONIC

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
TŁĮCHQ ALL-SEASON ROAD

TITLE
RSA FOR BOREAL CARIBOU

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-04-10
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO.	REV.	FIGURE
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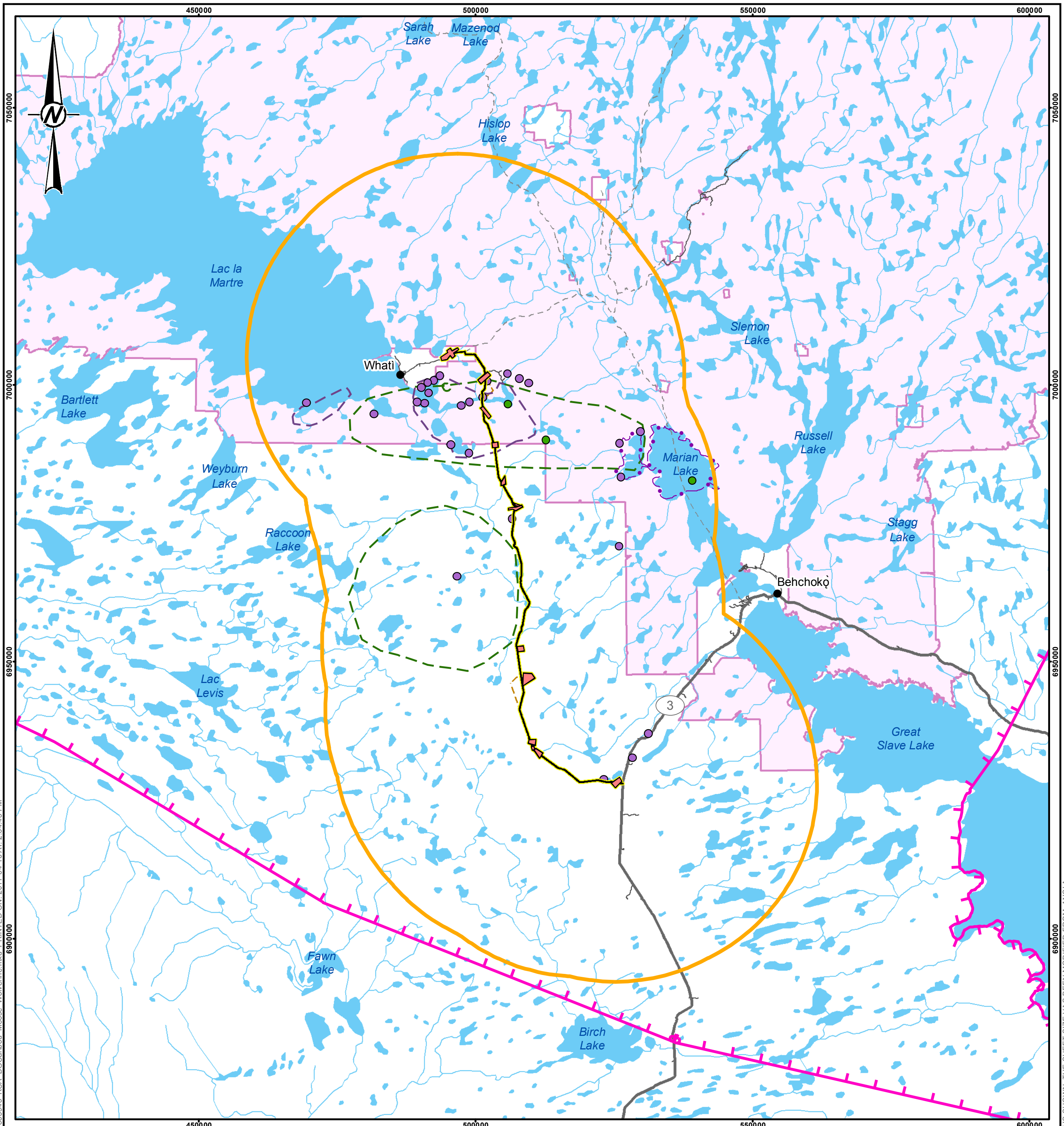

LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- OLD AIRPORT ROAD
- WATERCOURSE
- TŁĮCHǪ LAND
- WATER BODY
- BARREN-GROUND CARIBOU, MOOSE, AND WOLVERINE RSA
- PROJECT FOOTPRINT - BORROW SOURCE
- PROJECT FOOTPRINT - ROAD
- WEK'ÈEZHÌI RESOURCE MANAGEMENT AREA

TRADITIONAL KNOWLEDGE DATA

- BARREN-GROUND CARIBOU HUNTING/KILL SITE
- MOOSE HUNTING/KILL SITE
- MOOSE HUNTING
- BARREN-GROUND CARIBOU HABITAT
- MOOSE HABITAT

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1:1,000,000 KILOMETRES

REFERENCE(S)

1. TRADITIONAL KNOWLEDGE DATA OBTAINED FROM THE TLICHO GOVERNMENT, 2016 .
2. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.

PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT

GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT

TŁĮCHǪ ALL-SEASON ROAD

TITLE

RSA FOR BARREN-GROUND CARIBOU, MOOSE, AND WOLVERINE

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-04-10
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO.	REV.	FIGURE
1665943	0	4.1-2

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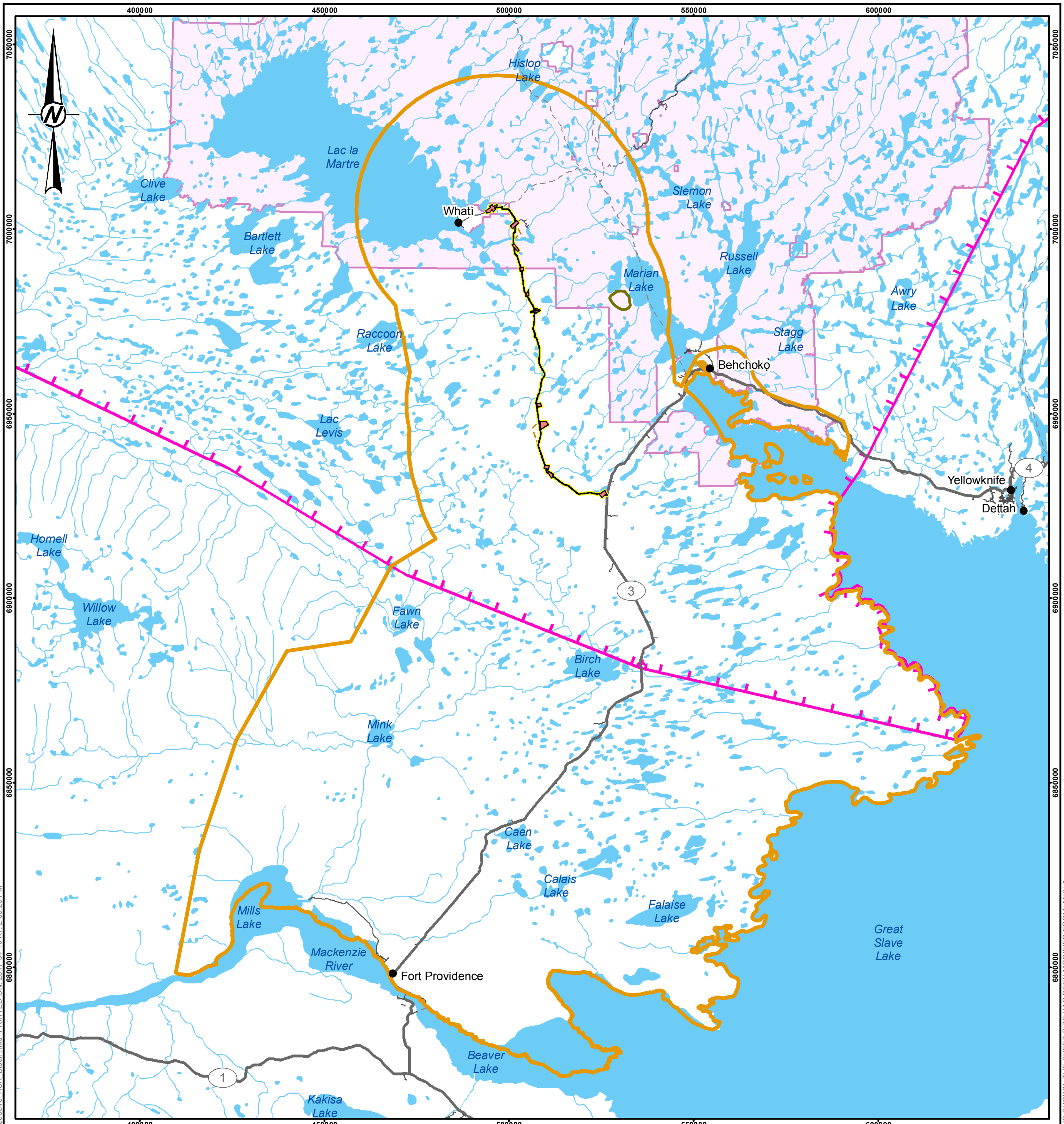

LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- OLD AIRPORT ROAD
- WATERCOURSE
- TŁĮCHǪ LAND
- WATER BODY
- BISON RSA
- PROJECT FOOTPRINT - BORROW SOURCE
- PROJECT FOOTPRINT - ROAD
- WEK'ÈEZHÌI RESOURCE MANAGEMENT AREA

TRADITIONAL KNOWLEDGE DATA

- BISON HABITAT

0 30 60

1:1,500,000 KILOMETRES

REFERENCE(S)

1. TRADITIONAL KNOWLEDGE DATA OBTAINED FROM THE TLICHO GOVERNMENT, 2016 .
2. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.

PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
TŁĮCHǪ ALL-SEASON ROAD

TITLE
RSA FOR BISON

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-04-10
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO.	REV.	FIGURE
1665943	0	4.1-3

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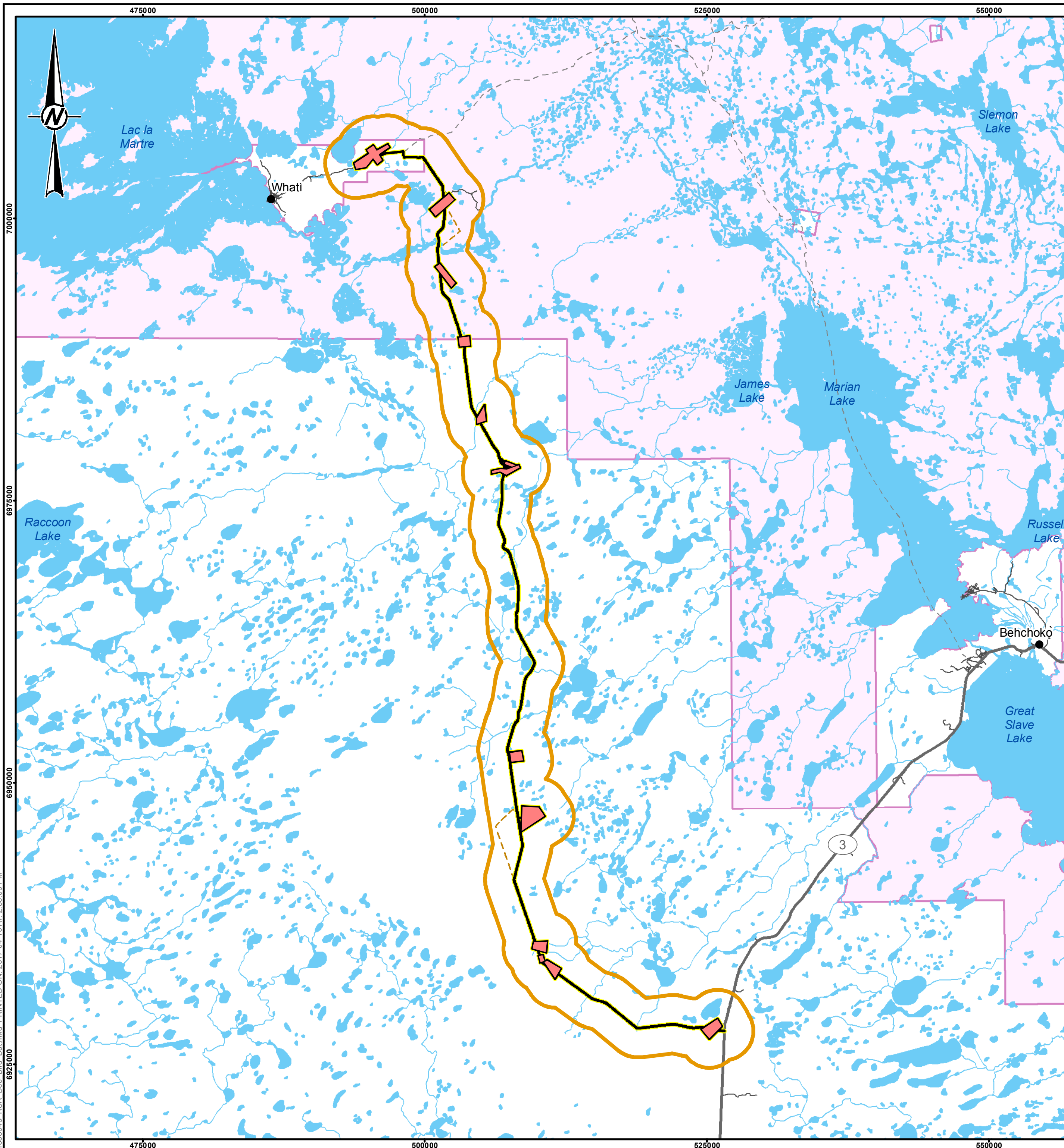

LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- OLD AIRPORT ROAD
- WATERCOURSE
- TŁĮCHǪ LAND
- WATER BODY
- BUMBLE BEE, BIRD, AND BAT RSA
- PROJECT FOOTPRINT - BORROW SOURCE
- PROJECT FOOTPRINT - ROAD

0 10 20
1:500,000 KILOMETRES

REFERENCE(S)
1. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
TŁĮCHǪ ALL-SEASON ROAD

TITLE
RSA FOR BUMBLE BEES, BIRDS AND BAT VALUED COMPONENTS

CONSULTANT
Golder Associates

YYYY-MM-DD	2017-04-10
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO. 1665943 REV. 0 FIGURE 4.1-4

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4.2 Description of Existing Conditions (Base Case)

4.2.1 General Approach

For each VC, the existing conditions were described to provide context for the assessment. Existing conditions identified at Base Case are the outcome of past and present developments and activities, and natural factors that cause environmental change. Consequently, the Base Case describes the current environmental conditions of each VC given the combined effects of past and present developments and activities. The Base Case is supported by existing studies that were completed in the Project area to better understand the existing conditions that may be influenced by the Project, and summarizes results from the Environmental Overview of the Project Description Report (PR#7) and the TK Report (PR#28).

The description of existing conditions considered each indicator for each VC. The importance of combined changes from past and present developments depends on how they have affected the integrity of each VC at the population level. The Base Case assessment therefore seeks to understand the status of each wildlife VC population in its VC-specific RSA at Base Case, which provides context for understanding the sensitivity of the VC to future development. The status of each VC population was considered using the known or inferred ability of the criterion to tolerate disturbance.

The ability of a VC to tolerate disturbance was evaluated using the concepts of ecological adaptability and resilience. Adaptable wildlife species are those that can change their behaviour, physiology, or population characteristics (e.g., reproduction rate) in response to a disturbance such that the integrity of the population remains more or less unchanged. For example, certain wildlife populations can accommodate loss of some individuals without a change in overall population status or trajectory (known as compensatory mortality; Connell et al. 1984), or can adjust their physiology or behaviour to accommodate disturbance (Knopff et al. 2014; Chapron et al. 2015). Adaptable species can accommodate substantial disturbance and sometimes thrive in highly modified environments, whereas species with low adaptability can accommodate little or no disturbance.

Resilience is a concept that is distinct from, yet closely related to, adaptability. Biological populations often have inertia and will continue to function after disturbance up to the point where the disturbance becomes severe and long enough that the population undergoes a fundamental change. Adaptability influences the duration and magnitude of the effect required for this to happen, whereas resilience defines the ability of a species or ecosystem to recover or bounce back from disturbance. Highly resilient wildlife species have the potential to recover quickly from disturbance (e.g., after reclamation is achieved or a mortality source is removed), whereas species with low resilience will recover more slowly or may not recover at all (Weaver et al. 1996).

Ideally, effect threshold values for adaptability and resilience limits of a VC are known (e.g., boreal caribou), and changes in measurement indicators can be quantified accurately with a high degree of confidence to evaluate whether or not a threshold has been exceeded. However, critical thresholds such as amount or distribution of habitat required to maintain a self-sustaining population, or the specific number of individuals required to maintain an ecologically effective population size, are rarely available for wildlife. Moreover, ecological thresholds vary by species, landscape type, and spatial scale (Swift and Hannon 2010; Environment Canada 2013a). Consequently, a detailed and transparent account of likely effects associated with estimated cumulative changes to each measurement indicator was provided for each VC using available scientific literature, data collected in the VC-specific RSA, and logical reasoning (i.e., a weight of evidence, or reasoned narrative approach).

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4.2.2 Habitat Mapping

Availability and distribution of wildlife habitat was estimated and mapped using Landsat SPOT 4/5 (SPOT) imagery data (Olthof et al. 2015). The SPOT data represented a collection of imagery from 2005 to 2010 with a spatial resolution of 20 metres (m). Based on comparison with reference data, accuracy of these data was 85% (Olthof et al. 2015). The SPOT data included 16 different land cover classes. Historical fire data from 1965 to 2016 for the study areas were acquired from the GNWT Centre for Geomatics website. A separate layer was created that identified areas of burn age that were related to patterns of wildlife use. These categories included 0 to 5 years (2011 – 2016), 6 to 10 years (2006 – 2010), 11 to 20 years (1996 – 2005), 21 to 40 years (1976 – 1995) and greater than 40 years (1975 and earlier). While some sections of the Project footprint are already disturbed (as indicated in the ECCC 2010 boreal caribou disturbance data), the data analysis conservatively assumed that the entire Project footprint would be new disturbance.

The GNWT Cumulative Impact Monitoring Program (CIMP) Inventory of Landscape Change data was used to characterize existing human developments on the landscape through 2016. These data included both linear (i.e., all-season and winter roads, and power transmission lines) and polygon features (e.g., mines, lodges, exploration camps, communities) in a GIS layer. Table 4.2-1 identifies the types of developments and assumptions about the area directly disturbed. The type of previous and existing developments in the boreal caribou NT1 range are illustrated in Figure 4.2-1 and RFDs are illustrated in Figure 4.2-2.

Table 4.2-1: Development Disturbance Types, Features and Known and Assumed Footprints

Development Type	Feature Type	Footprint Radius of Buffer (m)
Airstrip	Polygon	Actual or 50 if unknown
Forestry cutblock	Polygon	Actual
Communications	Polygon	Actual
Community	Polygon	Actual
Quarry	Polygon	Actual
Mine	Polygon	Actual
Oil/Gas	Polygon	Actual
Unknown	Polygon	Actual
Well site	Polygon	Actual
Wildfire	Polygon	Actual
Major road	Line	60
Minor road	Line	44
Pipeline[a]	Line	500
Powerline	Line	30
Railway[a]	Line	500
Seismic	Line	6
Trail	Line	12
Unknown	Line	12
Winter road	Line	12
Contaminated/remediated site	Point	200
Cabin/lodge	Point	30
Exploration Camp	Point	100
Fuel Storage[a]	Point	500
Miscellaneous[a]	Point	500

a) Only present in NT1 range for boreal caribou. All feature types for boreal caribou included actual plus a 500 m buffer.

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For boreal caribou, the ECCC data describing fire and development disturbance through 2010 were used. Fire and development disturbance since 2010 were added using the NWT fire and Inventory of Landscape change datasets. Development disturbance polygon, point and linear features included a 500 m buffer in accordance with Environment Canada (2012).

Habitat types used to support various life processes, such as nesting or foraging, were described for each VC based on information from scientific literature. Based on these habitat descriptions, each of the land cover classes were assigned into one of two categories: moderate to high suitability or low to nil suitability. Land cover classes were assigned to the moderate to high suitability category if they were identified as habitat types supporting critical life stages or life processes (e.g. breeding habitat). All moderate to high suitability land cover classes were broadly defined as suitable habitat. Land cover classes representing habitat that does not directly support life processes, or that were identified as habitat types that are specifically avoided (e.g. grassland birds avoid forest), were included in the low to nil suitability category. All low to nil suitability land cover classes were broadly defined as unsuitable habitat. Habitat mapping for each VC or groups of VCs is described below.

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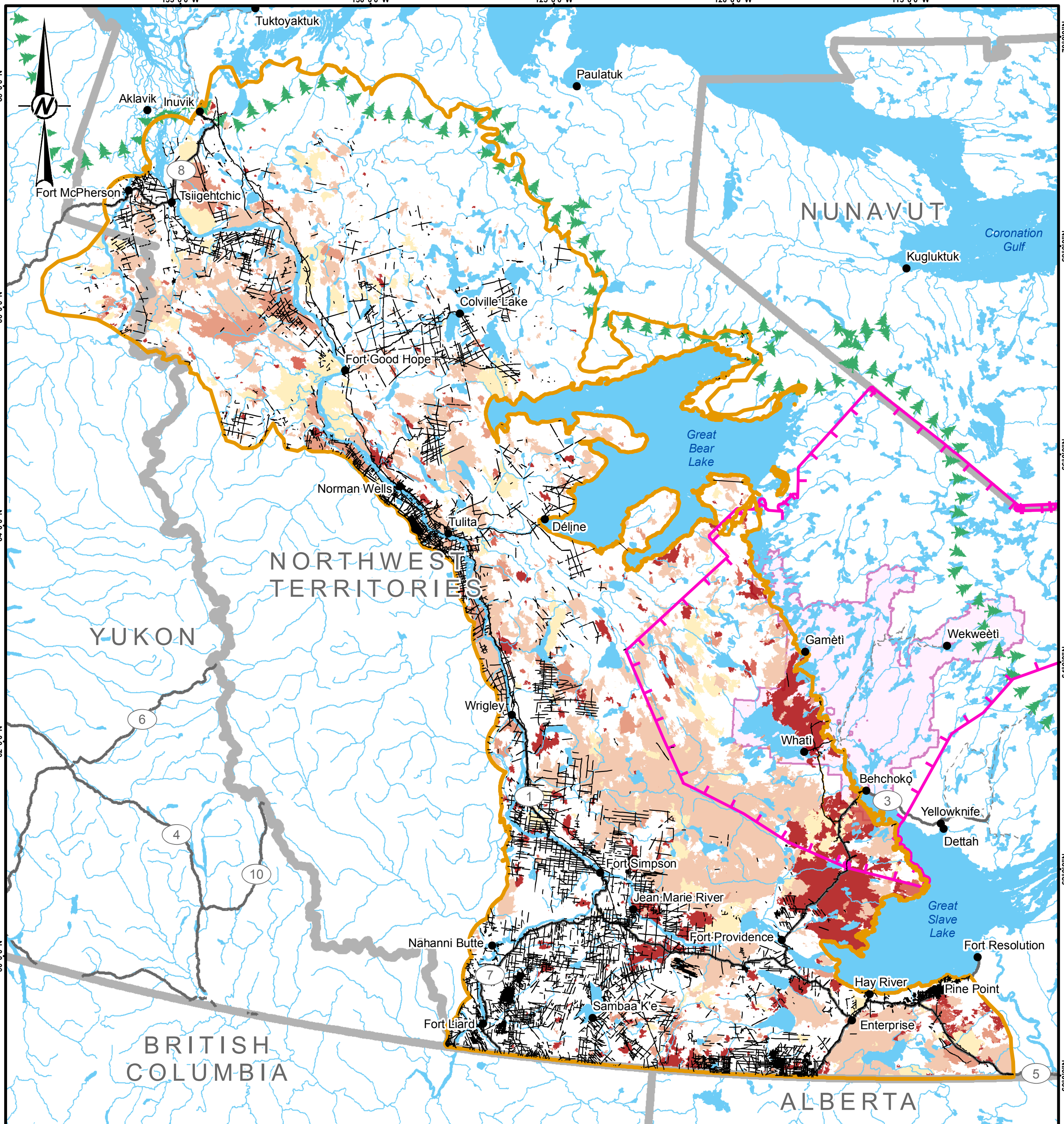

LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- WINTER ROAD
- TREELINE
- WATERCOURSE
- PROVINCIAL/TERRITORIAL BOUNDARY
- TŁĮCHǪ LAND
- WATER BODY
- DEVELOPMENT
- BOREAL CARIBOU RSA
- WEK'ÈEZHÌI RESOURCE MANAGEMENT AREA

FIRE HISTORY

- 0 - 5 YEARS
- 6 - 10 YEARS
- 11 - 20 YEARS
- 21 - 40 YEARS
- >40 YEARS

0 120 240

1:6,000,000 KILOMETRES

REFERENCE(S)

1. ADMINISTRATIVE REGIONS OBTAINED FROM GOVERNMENT OF NORTHWEST TERRITORIES.
2. BOREAL CARIBOU RANGE OBTAINED FROM ENVIRONMENT CANADA, 2012.
3. FIRE HISTORY OBTAINED FROM GOVERNMENT OF NWT WITH PERMISSION.
4. CIMP INVENTORY OF LANDSCAPE CHANGE, OBTAINED FROM THE NWT CENTRE FOR GEOMATICS.
4. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.

PROJECTION: CANADA LAMBERT CONFORMAL CONIC

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
TŁĮCHǪ ALL-SEASON ROAD

TITLE
PREVIOUS AND EXISTING DEVELOPMENTS IN THE BOREAL CARIBOU RSA

CONSULTANT
Golder Associates

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO. 1665943 | REV. 0 | FIGURE 4.2-1

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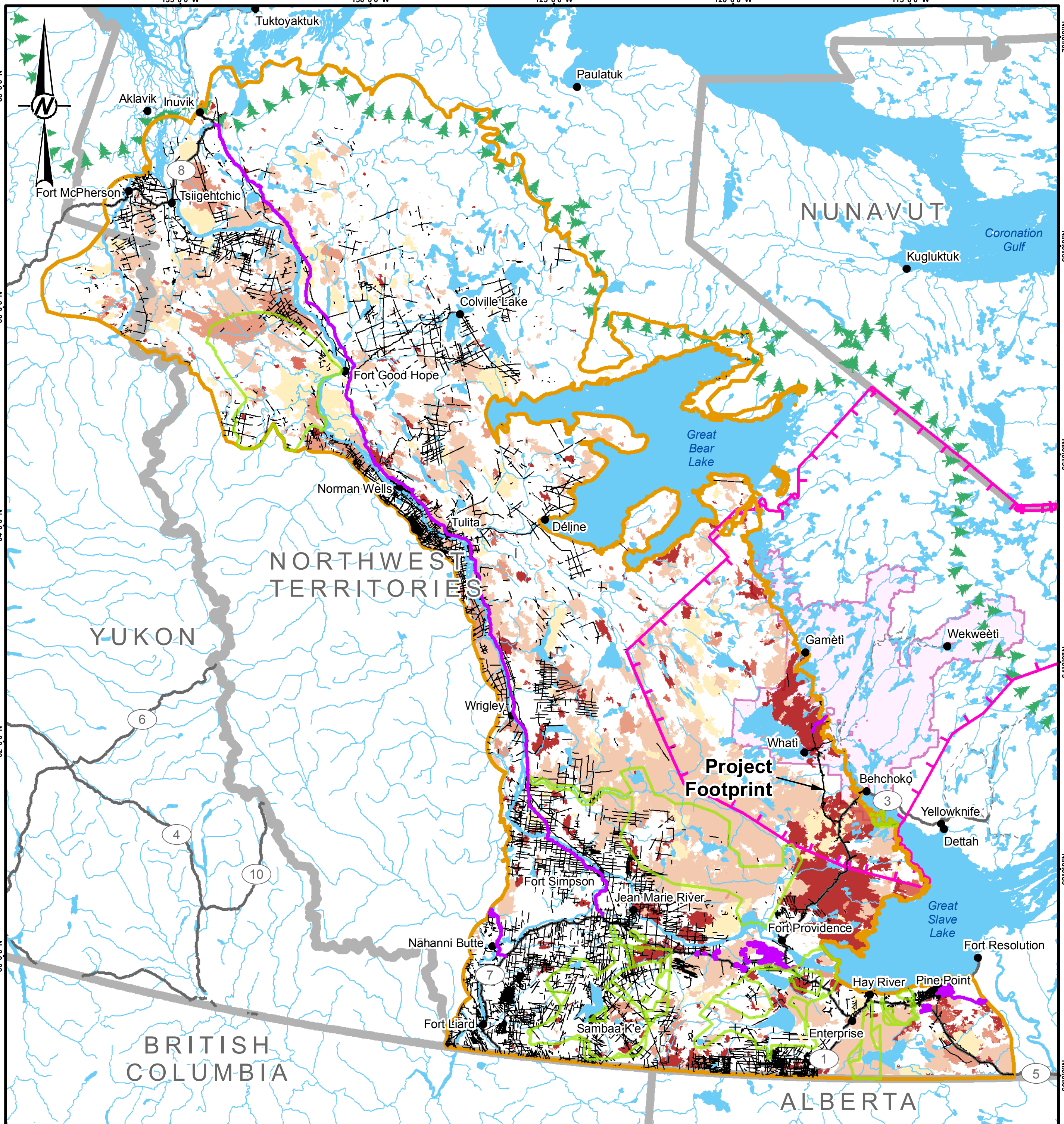

LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- WINTER ROAD
- TREELINE
- WATERCOURSE
- PROVINCIAL/TERRITORIAL BOUNDARY
- TŁĮCHǪ LAND
- WATER BODY
- CANDIDATE PROTECTED AREA
- DEVELOPMENT
- RFD
- BOREAL CARIBOU RSA
- WEK'ÈEZHÌI RESOURCE MANAGEMENT AREA

FIRE HISTORY

- 0 - 5 YEARS
- 6 - 10 YEARS
- 11 - 20 YEARS
- 21 - 40 YEARS
- >40 YEARS

0 120 240

1:6,000,000 KILOMETRES

REFERENCE(S)

1. ADMINISTRATIVE REGIONS OBTAINED FROM GOVERNMENT OF NORTHWEST TERRITORIES.
2. BOREAL CARIBOU RANGE OBTAINED FROM ENVIRONMENT CANADA, 2012.
3. FIRE HISTORY OBTAINED FROM GOVERNMENT OF NWT WITH PERMISSION
4. CIMP INVENTORY OF LANDSCAPE CHANGE, OBTAINED FROM THE NWT CENTRE FOR GEOMATICS.
5. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.

PROJECTION: CANADA LAMBERT CONFORMAL CONIC

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
TŁĮCHǪ ALL-SEASON ROAD

TITLE
RFDS IN THE BOREAL CARIBOU RSA

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO. 1665943 REV. 0 FIGURE 4.2-2

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4.2.2.1 Boreal Caribou

Boreal caribou are distributed across the forested regions of Canada, reaching the northern limit of their range in the NWT. Boreal caribou in the NWT range from the Alberta border north to the tundra, west of Great Bear and Great Slave Lakes (Edmonds and Smith 1991, Environment Canada 2010). Boreal caribou do not have definitive calving grounds like barren-ground caribou, although individual females often show fidelity to previous calving sites (Edmonds and Smith 1991; Dzus 2001). Instead pregnant females separate themselves from other caribou for calving.

Both TK and science based studies of boreal caribou in Wek'èezhìı suggest that boreal caribou have used areas along the proposed Project corridor, including some areas identified as traditional harvest sites and important habitat for boreal caribou at Tłįchǫ community workshops held in 2005 (Hillis and Cluff 2005; Cluff and Hillis 2006a, 2006b and 2006c cited in WRRB 2013). Aerial surveys conducted within the Taiga Plains ecoregion portion of the North Slave Region, where the Project is proposed, recorded densities of boreal caribou ranging from 0.17 to 3.44 animals/100 km^2 (Hillis and Cluff 2005). Observations of boreal caribou primarily occurred in spruce lichen forest, jack pine forest and shoreline areas (Hillis and Cluff 2005). The 2015 TK report confirmed that the boreal caribou range includes km 14 to km 65 of the proposed TASR; however, the Elders indicated that the main habitat is to the west of the proposed corridor (PR#28; PR#7).The current population trend in the North Slave Region and Wek'èezhìı region are unknown but areas except in southern NWT are believed to be stable or increasing (SARC 2012).

Boreal caribou prefer mature to old conifer forests since these habitats contain lichen, which is the caribou's primary winter food source (Dzus 2001). Woodland caribou primarily select peatland-dominated landscapes, such as black spruce bogs and black spruce-tamarack fens, while typically avoiding upland areas; however, caribou will use lichen-rich jack pine stands (Stuart-Smith et al. 1997). Boreal caribou tend to calve in low-lying areas, such as muskeg bogs and fens (Dzus 2001).

Wildfire can alter the availability of forage for caribou inhabiting forested environments (i.e., woodland caribou year-round or barren-ground caribou during the winter). Studies from central Alaska suggest that the depletion in lichen abundance after wildfire changes caribou range use and forces caribou to increase their home range size during the winter (Courtois et al. 2007); however, studies in northern Alberta found no change in caribou range size or use after wildfire (Dalerum et al. 2007). Instead, Dalerum et al. (2007) suggest that caribou occupying large home ranges (i.e., caribou in more northern areas) may be able to use alternative areas within their home ranges to forage for lichen, instead of switching to new, previously unused areas. The severity of a fire may affect boreal caribou populations differently depending on the arrangement of burned and unburned patches that are left after the fire (Environment Canada 2008). The differential effects on boreal caribou habitat quality are related to the effects on forage, the post-disturbance trajectory of burned areas, and the numerical response by predators and competitors. Fire disturbance has been negatively associated with caribou recruitment (Environment Canada 2008) and severe fires may negatively impact boreal caribou since caribou avoid young forests (Schaefer and Pruitt 1991; Dunford 2003; Joly et al. 2003; Dalerum et al. 2007). In the NWT, fire and anthropogenic disturbance due to timber harvesting, roads, pipelines and seismic lines have caused habitat change and loss to the boreal woodland caribou habitat and are considered the two most important factors contributing to loss of habitat availability (Environment Canada 2012; SARC 2012).

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A wide range of forage plants are used by caribou and food habits vary seasonally (Banfield and Jakimchuk 1980). Caribou are not typically browsers and most of the early winter diet consists of lichens (genera *Cladonia and Cladina* spp. preferred) and the green parts of sedges (*Carex* spp.) and horsetails (*Equisetum* spp.) because of their high digestibility and high protein levels (Miller 1976; Case et al. 1996). The consumption of grasses and sedges diminishes over winter, as these plants become less digestible (Kelsall 1968). In late winter, lichens are used extensively, although alder (*Alnus* spp.), birch (*Betula papyrifera*), and willow (*Salix* spp.) may be consumed when other food resources are scarce. Snow characteristics, such as hardness and depth, can influence forage availability and the selection of winter habitat (Case et al. 1996; Dzus 2001). Snow cover, rather than food availability, appears to limit the capacity of winter ranges to support boreal caribou. In spring, lichen uplands are the first areas to become snow free, and shrubby lichens become important until new plant growth emerges. Unique habitat features sought out by caribou include mineral licks of frost boils or mud boils, which are primarily mounds of silt and clay (Pruitt 1960).

Lichen provides a good source of energy but it is not rich in protein (Miller 1992). Therefore, in spring and summer, caribou tend to select new plant growth and flowers, which are rich in minerals and protein (Thompson and McCourt 1981; Miller 1992). During the calving season, willow, dwarf birch (*Betula glandulosa*), green alder (*Alnus crispa*), and cotton grass (*Eriophorum* spp.) are consumed as new growth emerges (Fleck and Gunn 1982). Following calving, caribou will move to areas where new vascular plants are more abundant. Willow, forbs, grasses, and sedges become important forage species in summer (Case et al. 1996; Demarais and Krebs 2000). By late summer, the leaves of deciduous shrubs, such as willow, dwarf birch, and bearberry (*Arctostaphylos* spp.), form much of the diet (Skoog 1986). In the fall, grasses, sedges, mushrooms, birch, and willow leaves remain important because of the protein content (Miller 1992).

Suitable habitat for boreal caribou include the biophysical seasonal habitat attributes for the Taiga Plains ecozone from the Federal Woodland Caribou Recovery Strategy (Environment Canada 2012), which were presented in Table 6-9 of the PDR (PR#7). Boreal caribou habitat was mapped in accordance with methods and data described by the Federal Recovery Strategy for the Woodland Caribou (*Rangifer tarandus caribou*), Boreal population in Canada (Environment Canada 2012). This included applying a 500 m buffer around developments and no buffer was applied to natural disturbance (i.e., fire) footprint. In addition to quantifying disturbed and undisturbed habitat at the NT1 range, a similar assessment was completed for the Wek’èezhìı portion of the NT1 range.

4.2.2.2 Barren-ground Caribou

Habitat selection and barren-ground caribou behaviour are frequently the result of their response to environmental conditions; therefore, caribou can be found in a variety of habitat types at any one time (Case et al. 1996). The selection of habitat appears to be related to food availability, ease of travel, relief from insects, and predation (Curatolo 1975). Barren-ground caribou in the NWT exhibit an annual movement cycle between wintering areas in the southern and calving areas in the northern extent of their annual range.

During winter, barren-ground caribou will select habitats that have an abundance of lichen (Sharma et al. 2009, Barrier and Johnson 2012). The calving season will often find barren-ground caribou in areas of high elevation with sparse vegetation, which likely reduces predation rates (Sharma et al. 2009). During the post-calving season, areas with high quality forage (Sharma et al. 2009) and low insect density (Toupin et al. 1996) are selected. Cows with calves play an important role in influencing caribou behaviour because they direct the overall movements of the herd and pass on traditional movement patterns (Curatolo 1975).

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In the NWT, barren-ground caribou wintering areas overlap the boreal forest (Nagy et al. 2005; Anderson and Johnson 2014; Golder 2016). Caribou may select coniferous stands for access to arboreal lichens as an important winter food resource (Chowns and Gates 2004; Bergerud et al. 2008; Barrier and Johnson 2012). Caribou may avoid recent fires (within 55 years of being burned; Thomas et al. 1998, Joly et al. 2007) because lichen cover may be reduced to 5%, even after 20 to 35 years of regeneration (Jandt et al. 2008).

Although the Project likely occurs outside of the core seasonal range boundaries described by barren-ground collared caribou cows (Nagy et al. 2005; Anderson and Johnson 2014; Golder 2016; Appendix G) and regular interaction with the Project is not expected. TK indicates that barren-ground caribou have occurred in areas near the north end of the Project during winter (PR#28), likely during periods of high abundance. Because the Project is located in the boreal forest, suitable boreal habitats for barren-ground caribou during winter are provided in Table 4.2-2.

Table 4.2-2: Land Cover Types Identified as Suitable Habitat for Barren-ground Caribou in the RSA

Land Cover Code[(a)]	Land Cover Name	Land Cover Description
1	Evergreen Conifer Forest (high density)	≥20% needle-leaved tree cover and <2.5% broad-leaved tree cover
2	Evergreen Conifer Forest (medium density)	<20% and ≥12.5% needle-leaved tree cover, and <2.5% broad-leaved tree cover
11	Bryoid	≥60% lichens and mosses
13	Sparse Conifer Lichen	≥40% lichens and mosses, and ≥30% trees
21	Burns >40 years old	Forest fires >40 years old

a) Grid code of SPOT 20 m land cover data and assigned for wildfire burn ages.

4.2.2.3 Moose

Historically, moose have been distributed across forested regions of Canada; however, moose have recently expanded their range to include prairie and tundra ecosystems. Although considered a generalist species, moose have been shown to prefer deciduous aspen, shrubland, and wetlands interspersed with trees and shrubs. Optimal moose habitat consists of deciduous shrub and ground layers within deciduous, mixed, and conifer forests that offer edge or disturbed areas of early successional vegetation (Poole and Stuart-Smith 2003; Courtois et al. 2002; Osko et al. 2004; Nelson et al. 2008).

In general, it is thought that moose respond more to food availability than cover (Stewart et al. 2010); however, in the winter, moose will adjust their behaviour and move to avoid areas of deep snow (e.g., greater than 90 cm; Peek et al. 1982) and use mature coniferous stands, which intercept snowfall (Courtois et al. 2002). Preferred fall and winter browse includes red-osier dogwood (*Cornus sericea*), willow species (*Salix* spp.), trembling aspen (*Populus tremuloides*), balsam poplar (*Populus balsamifera*), dwarf birch (*Betula occidentalis*), alder (*Alnus* spp.), and beaked hazelnut (*Corylus cornuta*), among others (Stelfox 1993). To access this forage, habitats with high cover of shrub species, such as shrubby fens and bogs and riparian habitats with open canopies, are usually preferred, particularly in late winter. Shrub height is important during winter conditions, as forage shrub species must be higher than the snowpack to be accessed by moose. It has been proposed that, in some landscapes, primary habitat (i.e., high quality forage habitat such as shrubland) can provide all of the necessary winter resources for moose (Stewart et al. 2010). The majority of food resources and cover can be contained in shrubland and, potentially, in deciduous forest (Cairns and Telfer 1980; Dussault et al. 2006a; Stewart et al. 2010).

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In spring, moose tend to seek out low elevation areas, usually wetlands, muskeg, and river floodplains, as this is typically where the first green-up occurs (Stelfox 1993). Moose tend to continue to use these areas in the summer periods where they will also feed in adjacent forest stands. During summer, moose use upland forests and eat fresh shoots and leaves from deciduous shrubs and young deciduous trees (mainly trembling aspen and balsam poplar [*Populus balsamifera*]); however, moose are also known to browse on young coniferous trees, such as balsam fir (*Abies balsamea*), in the summer. In northern Alberta, moose diet in summer was typically made up of 74% shrubs and trees, 25% forbs, and 1% graminoids (Renecker 1987). Moose obtain the majority of their annual salt requirements from pond lilies and aquatic vegetation (Stelfox 1993).

Boreal forest composition and structure is primarily affected by insect outbreaks, wildfire, and disease. Eastern spruce budworm (*Choristoneura fumiferana*) is the most serious forest insect pest species in the NWT because they damage and kill trees (GNWT-ENR 2016a; NRC 2016b). In the NWT between 2002 and 2003, an infestation damaged 2.4 million ha (NRC 2016). Eastern spruce budworm is currently found in the Mackenzie Valley and along the Slave River; however, outbreaks have been spreading northwards (GNWT-ENR 2016a). Forest tent caterpillar (*Malcosoma disstria*), a species that can cause extensive defoliation of trembling aspen and paper birch (*Betula papyrifera*), were recorded in 2015 and 2016 defoliating 136,000 ha of trembling aspen dominated forest in the South Slave Region. Repeated severe defoliation may cause long-term damage to trees (GNWT-ENR 2016a; NRC 2016a). Range expansion and changes in biology and synchrony from climate change may cause effects from insect pests to be greatly magnified over time (Logan and Powell 2005; Hogg and Bernier 2005).

Moose are positively influenced by forest fire because fire increases the availability of deciduous browse species that moose depend on throughout the winter (MacCracken and Viereck 1990; Collins and Helm 1997). Moose densities were found to be greatest in 10 to 26 year old burned areas (Maier et al. 2005). LeResche et al. (1974) and Weixelman et al. (1998) also found that moose populations tended to peak 20 to 30 years post-fire. Moose occupation of burned areas will vary with fire intensity, as severely burned areas will have little vegetation growth for up to 5 years (Gasaway et al. 1989). Between the 1970s and 2016, approximately 579,862 ha of forest have burned wholly or partially within the proposed Project corridor. Just under 60% of the burned areas in the RSA are recent burns that occurred in the last five years. Older burns (older than 20 years) account for approximately 27% of the burned area, while the remaining 14% is accounted for by burns in the 6 to 20 year range. Larger, less frequent, high intensity fires likely have more of an influence on the structure of the landscape than small fires. Climate change is expected to increase the frequency and severity of wildfires throughout forested areas (Parisien et al. 2004; Volney and Hirsch 2005). In addition, climate change may contribute to a shift towards more deciduous forests because longer summers favour the persistence of broadleaved species and limit invasion of poplar stands by conifers (Carleton 2001).

Land cover types that occur in the RSA and that are considered to be suitable habitat for moose are identified in Table 4.2-3. All other land cover types that occur in the RSA are considered to be unsuitable.

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Table 4.2-3: Land Cover Types Identified as Suitable Habitat for Moose in the RSA

Land Cover Code[a]	Land Cover Name	Land Cover Description
1	Evergreen Conifer Forest (high density	≥ 20% needle-leaved tree cover, and <2.5% broad-leaved tree cover
2	Evergreen Conifer Forest (medium density)	<20% and ≥12.5% needle-leaved tree cover, and <2.5% broad-leaved tree cover
3	Evergreen Conifer (low density)	<12.5% needle-leaved tree cover, and <2.5% broad-leaved tree cover
4	Mixed Forest	>2.5% needle-leaved tree cover, and ≥ 2.5% broad-leaved tree cover
6	Young Forest	≥ 40% shrub cover, and ≥30% tree cover (generally >5 years old)
8	Erect Shrub	≥ 60% shrub cover
9	Herb-shrub	≥ 40% herbaceous cover, and ≥30% shrub cover (40% – 60% closure)
13	Sparse Conifer Lichen	≥ 40% lichens and mosses, and ≥30% trees
14	Herbaceous Wetlands	≥ 60% natural and semi-natural aquatic vegetation cover
19, 20	Burns (11 years to 40 years)	Post-burn regenerating forest

a) Grid code of SPOT 20 m land cover data and assigned for wildfire burn ages.

4.2.2.4 Bison

Bison is a grazing animal that uses open habitats such as grasslands and sedge meadows to supply the majority of their diet. Seasonal availability, biomass and quality of forage have been identified as the dominant factors that impact habitat occupation by bison (Larter 1988).

Currently, there are nine subpopulations of wood bison in Canada (COSEWIC 2013a), and three populations in the NWT (SARC 2016a). The Mackenzie range population was established in 1963 with the transfer and release of 18 wood bison captured from Wood Buffalo National Park (GNWT 2010). The most recent population estimate of bison in the Mackenzie range, estimated as of 2013, was 714 individuals (ECCC 2016; SARC 2016a). The Mackenzie range is considered to be a disease-free herd operating as a 'wild' population (COSEWIC 2013a; ECCC 2016). Typical home ranges for bison in the Mackenzie range were reported to be between 179 to 1,442 km^2 (Larter and Gates 1990).

In the Mackenzie Bison Range in the NWT, bison were recorded foraging predominately on grasses and sedges through the winter. Wet meadows that are inaccessible during the summer provide high-quality winter forage when frozen conditions allow access to these habitats (COSEWIC 2013a; SARC 2016b). Gates and Larter (1990) stated that bison occur predominately in wet sedge meadows during the winter. Other areas of suitable grass or sedge forage may be found over-hanging river banks, and along the edges of frozen beaver ponds (COSEWIC 2013a). In the summer, forage is a more diverse mixture of sedges, grasses and shrubs (e.g., willow), while lichens growing in forest habitats adjacent to meadows became an important food source in the fall (COSEWIC 2013a).

Preferred foraging meadows and sedge/grasslands are often associated with dry lakebeds, oxbows and early successional habitat (GNWT 2013). Larter (1988) described this preferred summer habitat as a willow savanna plant community type, but it has also been described as graminoid and/or shrubby fens (Jensen et al. 2003). Although bison do not appear to have specific habitat requirements related to rutting, mating or gestation, they are known to select larger meadows during the calving season (ECCC 2016). Bedding areas are established along trails at the edges of open, grassy areas (SARC 2016b). Salt licks are also used by bison (SARC 2016b).

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Wood bison use the forested areas adjacent to foraging meadows for thermal relief, predator escape, ruminating, to avoid flies, and for protection from deep snow and wind (Larter 1988; COSEWIC 2013a; ECCC 2016). Deciduous and jack pine coniferous forests have been documented as preferred forest types (Jensen et al. 2003; ECCC 2016). Coniferous forests provide high lichen biomass and tend to be more heavily used during the fall season, while deciduous forest is more often used for cover (SARC 2016b). Bison tend to avoid muskeg, dense forest cover, and areas of steep terrain (SARC 2016b).

Research suggests that older, burned forests may provide escape from predators, including wolves and humans, where deadfall impedes movement. However, TK indicates that deadfall may also impede bison movement and in fact increase predation risk rather than reduce it (SARC 2016b). In general, forest fire disturbance is considered beneficial for opening up new foraging habitat areas, and bison have been observed moving into recently burned areas, attracted by the new grass growth (SARC 2016b). However, small patches of recently burned forest are unlikely to influence overall habitat selection of wood bison as they do not typically use the heavily forested areas that may surround these burns. Therefore, inclusion of the recent burns landcover type as suitable habitat is a conservative measure and may result in an overestimation of suitable habitat availability in the RSA.

Land cover types that occur in the bison RSA and that are considered to be suitable bison habitat are identified in Table 4.2-4. All other land cover types that occur in the bison RSA are considered to be unsuitable for bison.

Table 4.2-4: Land Cover Types Identified as Suitable Habitat for Bison in the RSA

Land Cover Code[(a)]	Land Cover Name	Land Cover Description
2	Evergreen Conifer Forest (medium density)	<20% and ≥12.5% needle-leaved tree cover, and <2.5% broad-leaved tree cover
3	Evergreen Conifer (low density)	<12.5% needle-leaved tree cover, and <2.5% broad-leaved tree cover
5	Deciduous Forest	≤ 2.5% needle-leaved tree cover, and ≥ 7.5% broad-leaved tree cover
7	Recent Disturbance	≤ 15% tree cover, generally <5 years old
8	Erect Shrub	≥ 60% shrub cover
9	Herb-shrub	≥ 40% herbaceous cover, and ≥30% shrub cover (40% – 60% closure)
10	Herbaceous	≥ 60% herbaceous cover
13	Sparse Conifer Lichen	≥ 40% lichens and mosses, and ≥30% trees
14	Herbaceous Wetlands	≥ 60% natural and semi-natural aquatic vegetation cover
17	Recent Burns (0-5 years)	Post-burn open areas

a) Grid code of SPOT 20 m land cover data and assigned for wildfire burn ages.

4.2.2.5 Wolverine

Wolverine, the largest member of the weasel family, has a circumpolar distribution in the tundra, taiga plains, and boreal forests (COSEWIC 2014c). In general, studies within North America suggest that wolverines inhabit a variety of treed and treeless areas at all elevations including the northern forested wilderness, the alpine tundra of the western mountains, and the arctic tundra (COSEWIC 2014c). Many studies have examined seasonal habitat use by wolverines across their western North America range and no clear pattern of vegetation habitat associations has emerged (Gardner 1985; Johnson et al. 2005; May et al. 2006; Krebs et al. 2007; COSEWIC 2014c). Instead, habitat use is best described as a function of large undisturbed wilderness areas and seasonal variation in food abundance, denning requirements, or human disturbance (Johnson et al. 2005; May et al. 2006; Krebs et al. 2007; COSEWIC 2014c). Their diet is extremely varied; however, ungulates (in the form of carrion)

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are a main food source across their range (COSEWIC 2014c; SARC 2014). In the central barrens near Daring Lake, NWT, wolverine occurrence was found to be strongly associated with the presence of caribou, wolves, and grizzly bear (Johnson et al. 2005), indicating that caribou are an important food source and that wolves and grizzly bears are important providers of carrion (COSEWIC 2014c). Copeland et al. (2010) reported a strong correlation between global wolverine distribution and persistent spring snow cover, and the availability of adequate insulating snow cover late into spring appears to be an important habitat feature for denning females (Magoun and Copeland 1998; Copeland et al. 2010).

The response of wolverines to disturbed landscapes is largely unknown and is likely tied to the response of their prey and local food availability. Fire is the dominant disturbance agent in the NWT, and the periodicity of fires is about 100 years in the northern boreal forest and increases northward to several thousands of years in the shrub tundra (Payette et al. 1989). Fire may temporarily displace individuals, and post-fire habitat is typically less suitable for wolverines than unburned habitats (Luensmann 2008). However, fire is not considered a threat to wolverine populations in the boreal forests as ecosystem effects may have a positive influence on wolverines through increases in moose habitat and moose abundance (COSEWIC 2014c). Alternatively, caribou typically have a negative response to fire, and wolverines that rely on caribou as their primary food source would likely be negatively affected by fire (Luensmann 2008).

Wolverines are opportunistic feeders that primarily consume ungulate carrion across their range (COSEWIC 2014c; SARC 2014). Therefore, suitable habitat for wolverines generally corresponds to suitable moose and caribou habitat. Land cover types that occur in the RSA and that are considered to be suitable wolverine habitat are identified in Table 4.2-5. All other land cover types that occur in the RSA are considered to be unsuitable for wolverine.

Table 4.2-5: Land Cover Types Identified as Suitable Habitat for Wolverine in the RSA

Land Cover Code[(a)]	Land Cover Name	Land Cover Description
1	Evergreen Conifer Forest (high density)	≥20% needle-leaved tree cover, and <2.5% broad-leaved tree cover
2	Evergreen Conifer Forest (medium density)	<20% and ≥12.5% needle-leaved tree cover, and <2.5% broad-leaved tree cover
4	Mixed Forest	>2.5% needle-leaved tree cover, and ≥2.5% broad-leaved tree cover
7	Recent disturbance	≤ 15% tree cover, generally <5 years
8	Erect Shrub	≥60% shrub cover
9	Herb-shrub	≥40% herbaceous cover, and ≥30% shrub cover (40% – 60% closure)
10	Herbaceous	≥60% herbaceous cover
11	Bryoid	≥60% lichens and mosses
12	Barren	≥60% bare
13	Sparse Conifer Lichen	≥ 40% lichens and mosses, and ≥30% trees
14	Herbaceous Wetland	≥ 60% natural and semi-natural aquatic vegetation cover
19, 20, 21	Burns (11 years to >40 years)	Post-burn regenerating forest

a) Grid code of SPOT 20 m land cover data and assigned for wildfire burn ages.

4.2.2.6 Little Brown Myotis

The habitat requirements of the little brown myotis vary by season (COSEWIC 2013b). In summer, little brown myotis maternity colonies are formed in trees, rock crevices, buildings, bat houses or under bridges and the species forages over open areas such as ponds, rivers, forest gaps, forest edges or along trails and roads

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(Segers and Broders 2014). *Myotis* species are typically closed-canopy specialists (Kalcounis and Brigham 1995; Jung et al. 1999; Morris et al. 2010), however, little brown myotis is more of a generalist than other *Myotis* species (e.g., northern myotis, [*Myotis septentrionalis*]). The trees that this species use for roosts are often large and sometimes partly dead (called snags or wildlife trees), which are generally more abundant in late successional forest (i.e., old growth). Although there is considerable variation in the species of trees in which these bats roost, Lacki *et al* (2007) identified little brown myotis most often in large trembling aspen (*Populus trembloides*), but also in white spruce (*Picea glauca*) and red spruce (*Picea rubra*). Olson and Barclay (2013) found the majority of roosts in trembling aspen or balsam poplar (*Populus balsamifera*). Little brown myotis are also tolerant of anthropogenic disturbance and often roost in man-made structures. (COSEWIC 2013b).

Fire is the main cause of loss of forest biomass in the little brown myotis RSA. A decrease in habitat is expected in forests with fewer large diameter trees and snags that provide roost and maternity potential (COSEWIC 2013b). Little brown myotis typically avoid large clearings including post-fire landscapes (COSEWIC 2013b), although recent research indicates that occurrence of fire on the landscape is an important process for maintenance of forest bat communities, including the little brown myotis (Buchalski et al. 2013). Climate change is expected to increase the frequency and severity of wildfires throughout forested areas (Parisien et al. 2004; Volney and Hirsch 2005). This may result in decreased habitat as this species was found to be more abundant in old versus young forest types in Alberta and central Ontario (Jung et al. 1999; COSEWIC 2013b). However, climate change may contribute to a shift towards more deciduous forests because longer summers favour the persistence of broadleaved species and limit invasion of poplar stands by conifers (Carleton 2001). This may result in increased habitat for the species as little brown myotis has demonstrated a preference for broadleaved forest (e.g., poplar and birch species).

In winter, little brown myotis hibernate in caves or mines where the open and accessible space extends below the frost line, and above zero temperatures and high humidity are relatively constant throughout the winter. Winter hibernacula are likely more limiting than summer maternity roosting habitat because specific physiological requirements limit the number of sites that provide suitable overwintering habitat. In the NWT, little brown myotis hibernate in caves or mines, with approximately 3,000 bats overwintering in just one NWT cave, the largest known hibernation site in Western Canada (GNWT-ENR 2013). An additional hibernaculum has been identified in a cave in the South Slave Region (GNWT-ENR 2013, 2012). Minor hibernacula that harbour smaller concentrations of bats are poorly understood but have the potential to play a critical role in the recovery of the population from white-nose syndrome, a deadly fungal disease that has wiped out most of the northeastern North American populations. A total of 192 hibernacula were identified in Canada as critical habitat required for the survival and recovery of the species, recognizing that this likely represents a small fraction of all occupied hibernacula (Environment Canada 2015b). Because of the congregatory (i.e., grouping) nature of this species, disturbance of hibernacula can have a disproportionate effect on local populations. General grid squares containing critical habitat (i.e., hibernacula) for little brown myotis do not overlap the RSA (Environment Canada 2015b), and most of the known hibernating bats of a region are found in only a few hibernacula.

Habitat mapping for this criterion considered both summer maternity roosting habitat and winter hibernacula. Habitat mapping does not fully capture foraging habitat. Land cover types that occur in the RSA and that are considered to be suitable habitat for little brown myotis are identified in Table 4.2-6. All other land cover types that occur in the RSA are considered to be unsuitable habitat.

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Table 4.2-6: Land Cover Types Identified as Suitable Habitat for Little Brown Myotis in the RSA

Land Cover Code[(a)]	Land Cover Name	Land Cover Description
1	Evergreen Conifer Forest (high density)	≥20% needle-leaved tree cover, and <2.5% broad-leaved tree cover
4	Mixed Forest	>2.5% needle-leaved tree cover, and ≥2.5% broad-leaved tree cover
5	Deciduous Forest	≤ 2.5% needle-leaved tree cover, and ≥ 7.5% broad-leaved tree cover
12	Barren	≥60% bare

a) Grid code of SPOT 20 m land cover data.

4.2.2.7 Bank and Barn Swallow

Bank swallows primarily breed in friable soils in vertical banks, cliffs, and bluffs along ocean coasts, rivers, streams, lakes, reservoirs, and wetlands (Garrison 1999). Most nesting colonies in natural habitats are found along low-gradient, meandering waterways with eroding streamside banks (Garrison 1999). Nesting colonies are also commonly found in artificial habitats such as sand and gravel quarries and road cuts (Garrison 1999). Bank swallows avoid dense forests because of the lack of suitable nesting sites (Garrison 1999). Foraging habitats primarily include wetlands, open water, grasslands, riparian woodlands, agricultural areas, and shrublands (Garrison 1999).

The increase in erosion control measures in riverine, lacustrine, and ocean coast environments have decreased habitat availability for bank swallow (COSEWIC 2013c). Other human interventions such as control of water level fluctuations and peak discharge rates via dams have also drastically reduced bank erosion and therefore suitable bank swallow habitat (COSEWIC 2013c). However, sand and gravel excavation and road cuts have likely increased nesting habitat suitability for bank swallow (COSEWIC 2013c). The availability of artificial habitats in gravel and sand pits and quarries increased at the same time that dams and flood control measures decreased natural habitat availability (COSEWIC 2013c).

Barn swallows typically nest in areas that contain open areas (e.g., fields, meadows) for foraging, a vertical or horizontal substrate (often enclosed) for the nest site, and a body of water that provides mud for nest building (Brown and Brown 1999). Barn swallow nests are typically found inside or outside of buildings, under bridges, and in road culverts and this species commonly forages in open country habitats such as riparian habitats, road ROWs, urban and residential areas, and clearings in wooded areas (Brown and Brown 1999; Heagy et al. 2014). Vegetation clearing can improve habitat by creating open habitats that can be used by barn swallow for foraging (Brown and Brown 1999; Heagy et al. 2014).

Fire suppression activities have likely had negative effects on barn swallow foraging habitat availability relative to what was historically available for this species in the RSA as barn swallows require open areas for foraging.

Land cover types that occur in the RSA and that are considered to be suitable habitat for bank and barn swallows are identified in Table 4.2-7. All other land cover types that occur in the RSA are considered to be unsuitable habitat.

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Table 4.2-7: Land Cover Types Identified as Suitable Habitat for Bank and Barn Swallow in the RSA

Land Cover Code[a]	Land Cover Name	Land Cover Description
7	Recent Disturbance	≤ 15% tree cover, generally <5 years old
8	Erect Shrub	≥ 60% shrub cover
9	Herb-shrub	≥ 40% herbaceous cover, and ≥30% shrub cover (40% – 60% closure)
10	Herbaceous	≥ 60% herbaceous cover
14	Herbaceous Wetlands	≥ 60% natural and semi-natural aquatic vegetation cover
16	Water	≥ 60% inland water bodies, snow and ice - water cover

a) Grid code of SPOT 20 m land cover data.

4.2.2.8 Bumble Bees

The yellow-banded bumble bee is a habitat generalist that is found within a wide variety of open to semi-open habitats including open coniferous, deciduous and mixed-wood forests, wet and dry meadows and prairie grasslands, meadows bordering riparian zones, and along roadsides in taiga adjacent to wooded areas, urban parks, gardens and agricultural areas, and subalpine habitats (COSEWIC 2015). Nests are typically established in abandoned rodent burrows, but also in grassy hummocks, rotted logs, or cavities in dead wood (COSEWIC 2015).

The gypsy cuckoo bumble bee is an obligate social parasite that uses host colonies of bumble bees belonging to the subgenus *Bombus senso stricto* to raise its young (COSEWIC 2015). Consequently, habitat preferences are strongly dependent on host species. Host species have not been confirmed, but in the NWT likely include the yellow-banded bumble bee, the cryptic bumble bee (*Bombus cryptarum*) and the northern subspecies of the western bumble bee (*Bombus occidentalis mckayi*) (COSEWIC 2014a). However, the range of the western bumble bee in the NWT does not approach the RSA (GNWT 2013). Suspected host species have similar habitat preferences. Therefore, the habitat preferences of the yellow-banded bumble bee are considered representative of all three host species for the purposes of this assessment.

Both the yellow-banded bumble bee and gypsy cuckoo bumble bee are generalist foragers, feeding on the nectar and pollen of a wide variety of plant species (COSEWIC 2014a, 2015). Specific overwintering habitat requirements are unknown; however, bumble bees in general overwinter underground near nesting sites (Macfarlane 1974 in COSEWIC 2014a; Benton 2006).

Land cover types that occur in the RSA and that are considered to be suitable habitat for yellow-banded and gypsy cuckoo bumble bees are identified in Table 4.2-8. All other land cover types that occur in the RSA are considered to be unsuitable habitat.

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Table 4.2-8: Land Cover Types Identified as Suitable Habitat for Bumble Bees in the RSA

Land Cover Code[(a)]	Land Cover Name	Land Cover Description
2	Evergreen Conifer Forest (medium density)	<20% and ≥12.5% needle-leaved tree cover, and <2.5% broad-leaved tree cover
3	Evergreen Conifer (low density)	<12.5% needle-leaved tree cover, and <2.5% broad-leaved tree cover
4	Mixed Forest	>2.5% needle-leaved tree cover, and ≥ 2.5% broad-leaved tree cover
5	Deciduous Forest	≤ 2.5% needle-leaved tree cover, and ≥ 7.5% broad-leaved tree cover
10	Herbaceous	≥ 60% herbaceous cover
14	Herbaceous Wetlands	≥ 60% natural and semi-natural aquatic vegetation cover

a) Grid code of SPOT 20 m land cover data.

4.2.2.9 Common Nighthawk

Common nighthawk is an aerial insectivore and is associated with a variety of open habitats in which insects are in higher densities, including forest clearings, burned areas, grassy meadows, rocky outcrops, sandy areas, grasslands, pastures, peat bogs, marshes, lake shores, quarries, and mines. Forested areas with low canopy closure may also provide habitat for the common nighthawk (COSEWIC 2007a). Nighthawks eat a wide variety of insects but most commonly consume queen ants, beetles, caddisflies, moths, and true bugs (Brigham et al. 2011). The RSA is located within the breeding range of the common nighthawk. Breeding habitat for the species likely contained within the RSA includes logged or burned areas of forest, woodland clearings, open forests, and rock outcrops.

Land cover types that occur in the RSA and that are considered to be suitable habitat for common nighthawk are identified in Table 4.2-9. All other land cover types that occur in the RSA are considered to be unsuitable habitat.

Table 4.2-9: Land Cover Types Identified as Suitable Habitat for Common Nighthawk in the RSA

Land Cover Code[(a)]	Land Cover Name	Land Cover Description
7	Recent Disturbance	≤ 15% tree cover, generally <5 years old
9	Herb-shrub	≥ 40% herbaceous cover, and ≥30% shrub cover (40% – 60% closure)
10	Herbaceous	≥ 60% herbaceous cover
11	Bryoid	≥ 60% lichens and mosses
12	Barren	≥ 60% bare
14	Herbaceous Wetlands	≥ 60% natural and semi-natural aquatic vegetation cover
17	Recent Burns (0-5 years)	Post-burn open areas

a) Grid code of SPOT 20 m land cover data and assigned for wildfire burn ages.

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4.2.2.10 Olive-sided Flycatcher

Olive-sided flycatcher breed in coniferous and mixed-wood forests across Canada and parts of the United States, and overwinter in central and south America (Altman and Sallabanks 2012). Olive-sided flycatcher prefer tall trees and snags adjacent to open areas, which provide individuals with perches from which they hunt flying insects. They nest in forested stands, but because of their foraging behaviour, are associated with high contrast habitats including burned forests, logged areas, and natural forest openings such as gaps within old growth forest stands, as well as meadows, rivers, and wetlands adjacent to forested habitat (Altman and Sallabanks 2012; COSEWIC 2007c). As a result, their abundance is correlated with landscapes containing fragmented late seral forest with high contrast edges, mature trees and large numbers of dead trees (Altman and Sallabanks 2012; McGarigal and McComb 1995). In western forests, the olive-sided flycatcher is generally associated with both old growth forest or early to mid-successional forests (0-30 years) derived from wildfire or timber harvest that contain residual live trees (COSEWIC 2007c). Currently, it is unknown whether habitat is limiting for olive-sided flycatcher in Canada, and available information is not adequate to enable the identification of critical habitat under the federal recovery strategy (Environment Canada 2016c).

Fire is the dominant disturbance agent in the NWT, and the periodicity of fires is about 100 years in the northern boreal forest and increases northward to several thousands of years in the shrub tundra (Payette et al. 1989). In fire-dependent ecosystems, olive-sided flycatcher abundance is often highest in early post-fire communities than in other habitat types (Hutto and Young 1999; Altman and Sallabanks 2000; COSEWIC 2007c; Robertson and Hutto 2007; Environment Canada 2016c). Approximately 27,771 ha (48%) of forest have burned wholly or partially within the RSA. Approximately 45% of the burned areas in the RSA are recent burns that occurred in the last five years. Larger, less frequent, high intensity fires likely have more of an influence on the structure of the landscape than small fires. Climate change is expected to increase the frequency and severity of wildfires throughout forested areas (Parisien et al. 2004; Volney and Hirsch 2005). In addition, climate change may contribute to a shift towards more mixed and deciduous forests that benefit olive-sided flycatcher because longer summers favour the persistence of broadleaved species and limit invasion of poplar stands by conifers (Carleton 2001).

Land cover types that occur in the RSA and that are considered to be suitable breeding habitat for olive-sided flycatcher are identified in Table 4.2-10. All other land cover types that occur in the RSA are considered to be unsuitable for olive-sided flycatcher breeding.

Table 4.2-10: Land Cover Types Identified as Suitable Habitat for Olive-sided Flycatcher in the RSA

Land Cover Code[(a)]	Land Cover Name	Land Cover Description
2	Evergreen Conifer Forest (medium density)	<20% and ≥12.5% needle-leaved tree cover, and <2.5% broad-leaved tree cover
3	Evergreen Conifer (low density)	<12.5% needle-leaved tree cover, and <2.5% broad-leaved tree cover
4	Mixed Forest	>2.5% needle-leaved tree cover, and ≥2.5% broad-leaved tree cover
5	Deciduous Forest	≤2.5% needle-leaved tree cover, and ≥7.5% broad-leaved tree cover
6	Young Forest	≥40% shrub cover, and ≥30% tree cover (generally >5 years old)
17, 18, 19, 20	Burns (0 years to 40 years)	Post-burn open areas and post-burn regenerating forest

a) Grid code of SPOT 20 m land cover data and assigned for wildfire burn ages.

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4.2.2.11 Horned Grebe, Yellow Rail and Red-necked Phalarope

Horned Grebe

The RSA is located within the breeding range of the horned grebe (western population). For breeding habitat, horned grebes mainly select semi-permanent and permanent freshwater ponds and shallow bays or marshes containing open water and rich with emergent vegetation such as sedges, rushes and cattails (Stedman 2000). Nests are built within a few metres of open water and are generally floating in emergent vegetation (Stedman 2000). Horned grebes have also been shown to breed in constructed structures with water such as borrow pits in the boreal forest (Fournier and Hines 1999; Kuczynski 2009). Horned grebes have been reported using ponds up to about 18 ha in size for breeding, though most studies suggest smaller ponds up to about 2 ha in size are preferred (COSEWIC 2009).

The decline in the western population of the horned grebe has been largely attributed to the loss of wetland habitat in the prairies, most of which occurred before recent population declines; however, wetland conversion to agriculture and other development continues (COSEWIC 2009). Habitat loss is unlikely to be a major threat to northern populations, and changes to habitat availability in boreal and subarctic regions that have occurred at Base Case have not likely contributed measurably to broad population declines.

Yellow Rail

Yellow rail occupy wetlands dominated by sedges, true grasses, and rushes, where there is little or no standing water, and where the substrate remains saturated throughout the summer (COSEWIC 2009). This most closely describes herbaceous wetland habitat in the RSA. Adult yellow rail eat invertebrates and seeds; the diet of young is unknown (SARA 2017). Yellow rails appear to be sensitive to changes in water levels at breeding sites (Leston and Bookhout 2015). This species may be common at a site one year and scarce or absent the next year if water levels change (Leston and Bookhout 2015). Habitat degradation and loss due to agricultural, commercial, industrial and infrastructure development are identified threats to habitat availability in the breeding range (COSEWIC 2009).

Red-necked Phalarope

The RSA is located within the breeding range of the red-necked phalarope. Red-necked phalaropes nest on mounds or mossy tussocks near (<100 m, typically closer) the edge of freshwater lakes, pools, bogs, marshes and small streams in the tundra and tundra-forest transition zones (Rubega et al. 2000). Bare ground and dense shrub cover are avoided (COSEWIC 2014b). Threats to habitat availability include habitat loss and degradation from climate change, which was identified in the federal status report as likely being the single greatest threat to red-necked phalaropes on their breeding grounds (COSEWIC 2014b). Climate change may have some short-term benefits on the breeding grounds, as permafrost melts and creates wetland habitat (COSEWIC 2014b); however, the shallow wetlands preferred by phalaropes are susceptible to small changes in water levels, and could be lost as permafrost recedes with rising temperatures (COSEWIC 2014b). It appears that some habitat changes are already occurring as the shrinking, premature drying, and disappearance of shallow ponds within their breeding range has been reported (COSEWIC 2014b). Habitat degradation and loss due to industrial activities (particularly oil and gas exploration and mineral extraction; Ashenhurst and Hannon 2008) and overgrazing by snow geese are also identified threats to habitat availability in the breeding range (COSEWIC 2014b).

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Horned grebe, yellow rail and red-necked phalarope are wetland associated species. Land cover types that occur in the RSA and that are considered to be suitable habitat for horned grebes, yellow rail and red-necked phalarope are identified in Table 4.2-11. All other land cover types that occur in the RSA are considered to be unsuitable for breeding.

Table 4.2-11: Land Cover Types Identified as Suitable Habitat for Horned Grebe, Yellow Rail and Red-necked Phalarope in the RSA

Land Cover Code[a]	Land Cover Name	Land Cover Description
14	Herbaceous wetland	≥60% natural and semi-natural aquatic vegetation
16	Water	≥60% inland water bodies, snow and ice - water cover

a) Grid code of SPOT 20 m land cover data.

4.2.2.12 Rusty Blackbird

The RSA is located within the breeding range of the rusty blackbird. Rusty blackbirds breed in isolated, low-elevation wetlands in coniferous and mixed forest habitats across the boreal region to the northern edge of the tundra. Various wetlands and wet forests are used, including bogs, fens, muskegs, swamps, wet meadows, wet forest openings and floodplain forests (Greenberg and Droege 1999; COSEWIC 2006; Avery 2013). Rusty blackbirds will also use shrubby riparian areas along the edges of lakes, beaver impoundments, rivers and other watercourses in coniferous and mixed forests (COSEWIC 2006). Open water may be important for foraging, and nests are typically built near or over water in the branches of living or dead trees or among emergent vegetation (Avery 2013; Shaw 2006). Small forest disturbances (e.g., cutblocks, fires, windthrow) near water that promote the growth of shrubs and saplings have also been used as breeding sites (Avery 2013). Upland forested habitats are rarely used by rusty blackbirds (Avery 2013; COSEWIC 2006).

Although habitat loss and degradation is identified as the primary threat to rusty blackbirds, this threat relates to the conversion of wetlands within the winter range and migratory range south of the boreal region (Environment Canada 2015a). Conversion of boreal wooded wetlands in the breeding range and migratory range is considered to be a low threat, though forest clearing and anthropogenic changes to surface hydrology are considered medium threats across the species' range (Environment Canada 2015a).

Land cover types that occur in the RSA and that are considered to be suitable breeding habitat for rusty blackbirds are identified in Table 4.2-12. All other land cover types that occur in the RSA are considered to be unsuitable for breeding.

Table 4.2-12: Land Cover Types Identified as Suitable Habitat for Rusty Blackbird in the RSA

Land Cover Code[a]	Land Cover Name	Land Cover Description
14	Herbaceous wetland	≥60% natural and semi-natural aquatic vegetation
16	Water	≥60% inland water bodies, snow and ice - water cover

a) Grid code of SPOT 20 m land cover data.

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4.2.2.13 Peregrine Falcon

Peregrine falcon does not appear to prefer any specific terrestrial ecoregions, but occurs wherever there is suitable nesting and foraging habitat. Peregrine falcons prefer to nest on cliffs with open gulfs of air (i.e., not confined areas), but human structures (e.g., skyscrapers) in urban areas can also be used (White et al. 2002). Cliffs ranging in height from 50 to 200 m are preferred (COSEWIC 2007b), and nests are usually constructed within 400 to 800 m of water (OPFRT 2010). Peregrine falcons also require open areas for foraging, such as tundra, grasslands, and waterways (NWT 2016). Birds are the primary prey of peregrines, although occasionally small mammals, bats, amphibians, fish, and insects will also be consumed (White et al. 2002).

Land cover types that occur in the RSA and that are considered to be suitable breeding habitat for peregrine falcon are identified in Table 4.2-13. All other land cover types that occur in the RSA are considered to be unsuitable for breeding. Foraging habitat types have been excluded from the list of suitable land cover types because use of foraging habitat is driven by availability of suitable nesting sites. Land cover types that represent foraging habitat in the RSA are not always associated with those that represent suitable nesting habitat. Therefore, inclusion of foraging habitat could result in an overestimation of suitable breeding habitat availability in the RSA.

Table 4.2-13: Land Cover Types Identified as Suitable Habitat for Peregrine Falcon in the RSA

Land Cover Code[a]	Land Cover Name	Land Cover Description
12	Barren	≥ 60% bare

a) Grid code of SPOT 20 m land cover data.

4.2.2.14 Short-eared Owl

Short-eared owl nest in a variety of grassland and wetland habitats (Wiggins et al. 2006). Females prefer to nest in areas with short (<60 cm), dense grass (Wiggins et al. 2006), as well as in tundra with small willows (COSEWIC 2008). Nest sites are often located on dry sites, such as small knolls or hummocks (Wiggins et al. 2006). Forested areas do not represent suitable breeding habitat (GNWT 2013). Some authors suggest that short-eared owls require habitat patches of at least 100 ha for nesting (Dechant et al. 1998), although nesting has been reported in smaller habitat patches (e.g., 28 ha; Herkert et al. 1999). Although habitat conversion for agriculture or livestock grazing has contributed to population declines in southern Canada, habitat conversion in central and northern Canada has been negligible (COSEWIC 2008). Fragmentation of large expanses of suitable habitat as a result of human activities (e.g., roads) has also been identified as a threat to short-eared owl, although direct impacts are unknown (Environment Canada 2016a).

Short-eared owl diets at northern latitudes are dominated by small mammals, particularly voles and owl spatial distribution and abundance closely tracks that of prey populations (Korpimäki 1994). Food availability therefore is a primary determinant of habitat selection during both summer and winter, and short-eared owls prefer open habitats where prey is abundant and accessible (Wiggins et al. 2006).

Land cover types that occur in the RSA and that are considered to be suitable breeding habitat for short-eared owl are identified in Table 4.2-14. All other land cover types that occur in the RSA are considered to be unsuitable for breeding.

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Table 4.2-14: Land Cover Types Identified as Suitable Habitat for Short-eared Owl in the RSA

Land Cover Code[(a)]	Land Cover Name	Land Cover Description
9	Herb-shrub	≥ 40% herbaceous cover, and ≥30% shrub cover (40% – 60% closure)
10	Herbaceous	≥ 60% herbaceous cover
14	Herbaceous wetland	≥ 60% natural and semi-natural aquatic vegetation cover

a) Grid code of SPOT 20 m land cover data.

4.2.3 Results

4.2.3.1 Boreal Caribou

Habitat Availability

The NT1 range for boreal caribou is 41,718,698 ha in the NWT. At Base Case, existing disturbances in the NT1 range include forestry, fire, linear infrastructure (e.g., roads, seismic lines and rail lines), and urban development. Fire disturbance has altered 10,159,286 ha (24.4%) of the NT1 range (Table 4.2-15). Buffered developments have removed 3,697,637 ha (8.9%) of boreal caribou habitat in the NT1 range. Caribou may respond negatively to anthropogenic disturbance by avoiding areas of otherwise suitable habitat because of its proximity to disturbance (Weclaw and Hudson 2004), which therefore reduces the amount of functional habitat available within the range. Avoidance may vary by type and intensity of disturbance, by season (e.g., Dyer et al. 2001, 2002; Eftestøl et al. 2016; Polfus et al. 2011) and can occur at multiple spatial scales (e.g., Apps et al. 2006; Leblond et al. 2011; Rettie and Messier 2001). In a literature review, Vistnes and Nellemann (2008) found that caribou and reindeer reduced their use of areas within 5 km of disturbances by 50% to 95%. Some studies suggest that caribou avoid areas of high disturbance density. In particular, caribou are thought to avoid areas of high road density (Apps et al. 2006; Faille et al. 2010; Nellemann and Cameron 1998; Pinard et al. 2012). However, development disturbance represents a small proportion of the NT1 range landscape. Overall, 66.8% of the NT1 range is undisturbed boreal caribou habitat, which exceeds the 65% minimum threshold for undisturbed habitat predicted necessary to support a self-sustaining boreal caribou population (Environment Canada 2012). At Base Case, boreal caribou are predicted to be self-sustaining and ecologically effective with a low risk, but are near their resilience limits.

Table 4.2-15: Boreal Caribou Habitat Availability in the NT1 Range, Base Case

Habitat Suitability	Area (ha)	Percent (%)
Fire disturbance	10,159,286	24.4
Buffered development	3,697,637	8.9
Undisturbed habitat	27,861,774	66.8

Note: Numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values. Areas were calculated using Canada Lambert Conformal Conic projection and may not match data presented elsewhere using different projections. ENR typically uses Canada Albers Equal Area Conic projection for calculating boreal caribou habitat, resulting in slightly different results for boreal caribou habitat availability.

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The Wek'èezhìı portion of NT1 range for boreal caribou is 4,632,765 ha (11.1%). Fire disturbance has altered 1,813,041 ha (39.1%) in the Wek'èezhìı portion of the NT1 range (Table 4.2-16). Buffered developments cover 40,840 ha (0.9%) in the Wek'èezhìı portion of the NT1 range. Approximately 60% of the Wek'èezhìı portion of NT1 range is undisturbed boreal caribou habitat. While the Wek'èezhìı portion of NT1 range includes total disturbance above the 65% minimum threshold for self-sustaining populations (Environment Canada 2012), it is important to note the disturbance thresholds identified by ECCC at the NT1 range scale are not necessarily applicable at different spatial scales. This is because patterns of habitat selection are scale-dependent due to varying availability of different habitats across space and time (Johnson 1980; Rettie and Messier 2000; Mayor et al. 2009). For boreal forest caribou, trends in habitat selection at the regional or seasonal range scale are typically driven by an avoidance of deciduous and early succession forest stands that support high densities of moose and deer (Bergerud et al. 1984; reviewed in Dzus 2001; and in Chowns and Gates 2004) neither of which occur (i.e., high densities of moose and deer) in the Wek'èezhìı portion of NT1 range but are present and inherent in the results of southern jurisdictions reflected in the 65% threshold. Thus, boreal caribou in the Wek'èezhìı area may not require as much undisturbed habitat in order to meet their life history requirements and avoid predation.

Table 4.2-16: Boreal Caribou Habitat Availability in the Wek'èezhìı Portion of NT1 Range, Base Case

Habitat Suitability	Area ha)	Percent (%)
Fire disturbance	1,813,041	39.1
Buffered development	40,840	0.9
Undisturbed habitat	2,778,883	60.0

Note: Numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values. Areas were calculated using Canada Lambert Conformal Conic projection and may not match data presented elsewhere using different projections. ENR typically uses Canada Albers Equal Area Conic projection for calculating boreal caribou habitat, resulting in slightly different results for boreal caribou habitat availability.

Habitat Distribution

As described in the PDR (PR#7), the distribution range of the NWT boreal caribou population mainly corresponds to the extent of the Taiga Plains ecozone in the NWT. It extends from the NWT-Alberta border north to the Arctic coast towards Inuvik and is bounded by the Taiga Cordillera ecozone to the west and the Taiga Shield ecozone to the east. The TASR is located in the eastern part of the NT1 range near Whatì.

Boreal caribou are not migratory and remain in forested habitats year round (Dzus 2001). The woodland caribou rut occurs in early- to mid-October (Edmonds and Bloomfield 1984). In November, boreal caribou disperse into smaller groups throughout their annual home range (Dzus 2001). When snow depth increases, caribou tend to move into areas of higher tree cover since movement and feeding are easier in these areas (Fuller and Keith 1981).

Boreal caribou have also been reported to avoid burned and anthropogenic disturbance areas. Boreal caribou in Newfoundland exhibited avoidance of 4 km surrounding an active mine site (Weir et al. 2007) and 9 km around active logging operations (Schaefer and Mahoney 2007). Burned areas are also avoided, either because of lack of food (i.e., lichen) (Schaefer and Pruitt 1991; Joly et al. 2003) or increased abundance of other ungulates and therefore predators (Environment Canada 2008). Linear corridors, such as roads, are also generally avoided (Dyer et al. 2002); possibly because of increased predator or human presence in these areas (James and Stuart-Smith 2000).

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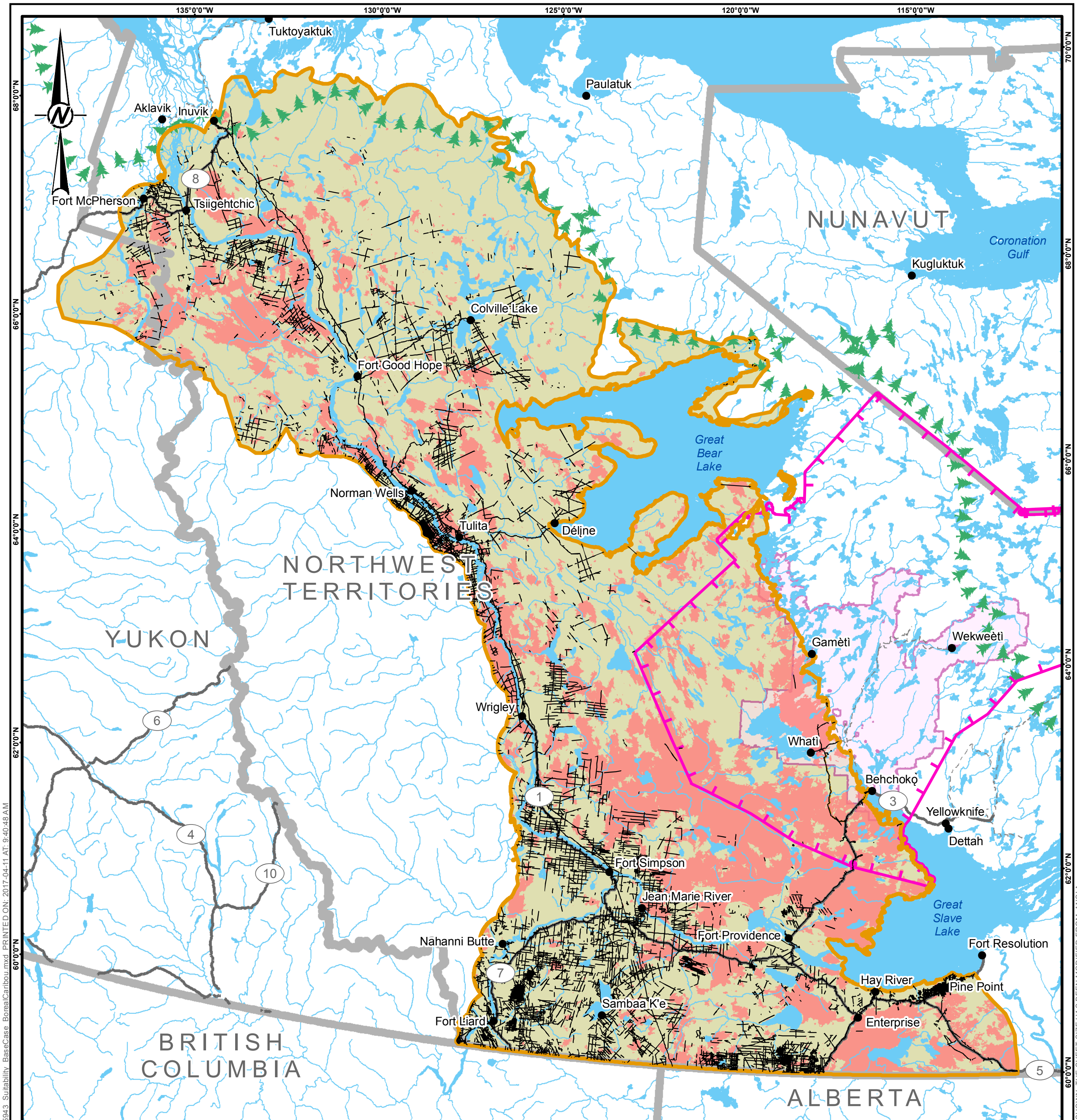
For wide ranging species such as caribou, movement is crucial to facilitate access to resources across space and time (Johnson et al. 1992; Nathan et al. 2008; Taylor et al. 1993). Restricted movement can reduce home range size (Andreassen and Ims 1998; Beauchesne et al. 2014; Muhly et al. 2015) and reduce access to resources required for survival such as predator-free space (Muhly et al. 2015). For example, Leclerc et al. (2014) found that boreal caribou reduce selection of areas as road density increases. Dyer et al. (2002) found that roads act as semi-permeable barriers to movement by reducing the frequency of crossing events as compared to simulated road networks. The magnitude of this effect may vary across seasons. During late winter, caribou road crossing rates were six times lower than the rates calculated using hypothetical road networks (Dyer et al. 2002). Similarly, Wilson et al. (2016) found that some individuals cross roads more slowly, which can delay arrival of caribou at seasonal ranges (Mahoney and Schaefer 2002; Wilson et al. 2016).

Features that act as semi-permeable barrier may exacerbate indirect habitat loss caused by avoidance of disturbance features (Dyer et al. 2002). Beauchesne et al. (2014) suggested that over a certain disturbance threshold it is likely that individuals cannot avoid using unsuitable habitats anymore, leading to decreased movement rates and increased use of suboptimal habitats as movement becomes increasingly risky (Smith et al. 2000; Hebblewhite 2008). Reduced movement rates and restricted home ranges increases the amount of time spent in lower suitability habitats and therefore increases vulnerability of caribou to predation (Beauchesne et al. 2014; Morales et al. 2010; Muhly et al. 2015; Rettie and Messier 2000). Caribou confined to smaller home ranges could be forced into less suitable habitat and be more easily detected by predators (Beauchesne et al. 2014).

At Base Case, undisturbed boreal caribou habitat has a patchy distribution throughout the NT1 range, (Figure 4.2-3). Fire disturbance also occurs in large patches throughout the NT1 Range. The NT1 range has existing linear disturbance, in the form of roads, trails, power transmission lines and seismic lines, particularly in the southern part of the NT1 range. Large but less common patches of undisturbed habitat are also present in the northwestern part of Wek'èezhìı Portion of NT1 Range. Development in the WRMA includes two communities, communication towers, a highway with gravel quarries and existing trails, including the Old Airport Road route to the community of Whatì.



LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- WINTER ROAD
- TREELINE
- WATERCOURSE
- PROVINCIAL/TERRITORIAL BOUNDARY
- TŁĮCHǪ LAND
- WATER BODY
- DEVELOPMENT
- FIRE HISTORY (LESS THAN 40 YEARS OLD)
- UNDISTURBED HABITAT
- BOREAL CARIBOU RSA
- WEK'ÈEZHÌI RESOURCE MANAGEMENT AREA

0 120 240

1:6,000,000 KILOMETRES

REFERENCE(S)

1. ADMINISTRATIVE REGIONS OBTAINED FROM GOVERNMENT OF NORTHWEST TERRITORIES.
2. BOREAL CARIBOU RANGE OBTAINED FROM ENVIRONMENT CANADA, 2012.
3. CIMP INVENTORY OF LANDSCAPE CHANGE, OBTAINED FROM THE NWT CENTRE FOR GEOMATICS.
4. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.

PROJECTION: CANADA LAMBERT CONFORMAL CONIC

CLIENT

GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT

TŁĮCHǪ ALL-SEASON ROAD

TITLE

DISTRIBUTION OF BOREAL CARIBOU HABITAT AT BASE CASE

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO.	REV.	FIGURE
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Survival and Reproduction

Most woodland caribou populations have declined across Canada (GNWT-ENR 2009a). The boreal ecotype of woodland caribou is listed as threatened in the NWT (GNWT-ENR 2017) and by COSEWIC (2017) and SARA (2017). Woodland caribou populations occur at low densities (0.03 to 0.12 caribou/km²) throughout the mid-continent (Stuart-Smith et al. 1997); however, population numbers and trends for woodland caribou in Canada are poorly known. Low densities, large land area, and multiple jurisdictions limit accurate population estimates. The population estimate of woodland caribou in the NWT was between 6,000 and 7,000 in 2011, and likely less than 10,000 (SARC 2012, PR#7). The most recent population status of the NT1 range was completed in 2012 and indicted boreal caribou are likely a self-sustaining population (Environment Canada 2012; PR#79). The result is based on the proportion of undisturbed habitat exceeding 65% in the NT1 range, which Figure 4.2-3 reflects.

Caribou survival and reproduction are related to the availability of suitable habitats that support life history processes. For example, the reproductive success of females and survival of calves are negatively affected if calving and post-calving habitats are unavailable, inadequate or degraded (Environment Canada 2012; McCarthy et al. 2011; Pinard et al. 2012; Thomas and Gray 2002). Habitat suitability is heavily influenced by the habitat's capacity to provide refuge from predation (Bergerud 1974; Environment Canada 2012; Hornseth and Rempel 2015; Racey and Arsenault 2007; Rettie and Messier 2000). Caribou spatially separate themselves from predators and alternate prey (e.g., moose and white tailed deer [*Odocoileus virginianus*]) as an anti-predator strategy, and maintain low population densities across their range (Bergerud 1988, 1996; Environment Canada 2008, 2012; Johnson et al. 2001). Large continuous tracts of undisturbed habitat are therefore important to maintaining self-sustaining caribou populations. Nagy (2011) found a positive correlation between population growth rates and access to secure unburned habitat, particularly where most of the habitat was in patches greater than 500 km².

Predation, primarily by wolves, is considered to be the main factor limiting caribou populations (Bergerud 1988; James 1999; James and Stuart Smith 2000; Seip 1992; Stuart Smith et al. 1997), and increased predation by wolves and possibly other predators is facilitated by underlying landscape changes through apparent competition (Holt 1977). In the case of caribou, apparent competition is manifested when a growing number of prey such as moose and white tailed deer causes an increase in the number of predators, such as wolves, thereby increasing predation pressure. Although the proximate cause of caribou decline is predation, the ultimate cause of caribou decline is linked to a change in habitat (Boutin et al. 2012) because landscape alterations caused by natural and anthropogenic disturbances create early seral habitats suitable for moose and white tailed deer (Latham 2009; Latham et al. 2011; Serrouya et al. 2011). Seral stage is the point along an ecological succession in an ecosystem advancing towards its climax community. However, white tailed deer are uncommon in the NWT.

Caribou are sensitive to changes in predation rate because they have a low reproductive output relative to other ungulates (Environment Canada 2012). Females typically do not reproduce until three years of age and give birth to one calf per year (Bergerud 2000). Calf mortality due to predation can be especially high, particularly within the first 30 days after birth (Bergerud and Elliot 1986; Gustine et al. 2006). In many caribou populations, the proportion of calves that survive to one year of age is usually low and insufficient to compensate for annual adult mortality in declining populations (Bergerud 1974; Stuart Smith et al. 1997; DeMars et al. 2011). Bergerud and Elliot (1986) suggested that caribou populations cannot remain stable when moose densities are sufficient to support more than 6.5 wolves per 1,000 km². Moose densities of approximately 0.11 moose per km² are likely to support such wolf densities (Bergerud and Elliot 1986). Moose densities in northern environments are low (0.05 to 0.15 moose per km² [GNWT-ENR 2016a]) compared to southern boreal forest regions (Sly et al. 2001).

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Surveys completed in the boreal forest of the North Slave Region, north of Great Slave Lake, found lower density rates ranging from 0.02 to 0.04 moose per km^2 in the Taiga Shield and Plains (Cluff 2005) and are less than half the density of moose required to support more than 6.5 wolves per 1,000 km^2 (Section 4.2.3.3).

Local and landscape scale disturbance patterns can influence caribou survival and reproductive success. Linear features (e.g., roads, pipelines, transmission lines, trails) may adversely affect caribou survival (DeCesare et al. 2012; James and Stuart Smith 2000; Whittington et al. 2011). Linear features have been associated with increased predator mobility, leading to a greater risk of predation for caribou when on or near these features (James 1999; Whittington et al. 2011). Leclerc et al. (2014) found that the probability of calf loss was related to the avoidance of areas with increasing density of roads; females whose calves survived demonstrated stronger avoidance of these areas than did females who lost their calves to predation.

Courtois et al. (2007) suggested that mortality increased with the extent of disturbed landscape within caribou home ranges because animals were vulnerable to predation. As the proportion of disturbance increases, it becomes more difficult for caribou to avoid predators and alternate prey. In Alberta and British Columbia, Peters et al. (2013) found a positive relationship between the amount of human induced disturbance and the degree of spatial overlap of caribou and moose. Caribou mortalities were located in areas of high resource use by moose in summer (Peters et al. 2013). Using data from caribou populations across Canada, Environment Canada (2008, 2011) conducted a meta-analysis that quantified a negative relation between recruitment (i.e., calf to cow ratios) and total disturbance (including natural and anthropogenic) within a range. Furthermore, Environment Canada (2011) indicated that the probability of a population remaining stable or undergoing growth is directly influenced by the amount of disturbance within that range, meaning that the likelihood of population persistence decreases as the amount of disturbance increases.

Fragmentation effects that restrict caribou movement can also negatively influence the survival and reproduction of caribou. For wide ranging species that need broad areas for their life history requirements, such as caribou, restricted movement and therefore restricted access to resources within a range can increase extinction probability and reduce lifetime reproductive success (McLoughlin et al. 2007; Revilla et al. 2008). Similarly, in many caribou subpopulations, reduced movements have been associated with fragmented populations and subsequent genetic drift (Serrouya et al. 2012).

Sensory disturbance may affect caribou through physiological stress; however, these effects are difficult to quantify (Dantzer et al. 2014). In general, sensory disturbance is most detrimental at key times of the year, such as late winter periods, when animals tend to be in poor physical condition, and during the reproductive season (spring/early summer) when caribou are raising young (Eftestøl et al. 2016; Kuck et al. 1985; Wolfe et al. 2000; Yarmoloy et al. 1988). Using simulated seismic exploration noise in northeast Alberta (i.e., propane cannons fired every 1 to 2 minutes for one hour with a magnitude of 90 to 110 dB), Bradshaw et al. (1997) found that disturbed caribou moved notably faster and crossed habitat boundaries (i.e., habitat patches) substantially more often than undisturbed caribou. Similarly, Murphy and Curatolo (1987) determined that caribou near oilfield infrastructure (pipelines and roads) in Alaska spent less time lying down, more time running and had higher movement rates than caribou located away from these disturbances. Although these effects may seem minor, displacement and increased wariness may affect energetic expenditures and survival, particularly for young calves.

The TK study report by the Tłı̨chǫ Government (PR#28) indicates that boreal caribou in the WRMA have been harvested in areas along and surrounding the TASR route through a network of trails and routes (Section 5.2.10). Non-aboriginal harvest of woodland caribou is regulated by GNWT-ENR. Hunting regulations for woodland caribou

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allow residents to harvest one boreal or mountain woodland caribou per year and non-residents can only hunt woodland caribou in the Mackenzie Mountains (GNWT-ENR 2016b). The resident hunting season for woodland caribou is from July 15 to January 31, while the non-resident season is from July 25 to October 31. As with barren-ground hunts, non-residents must obtain the services of a licensed outfitter.

Considering cumulative changes to caribou habitat quantity and quality (including proportion of disturbance in the NT1 range), habitat connectivity and arrangement, caribou abundance, and densities of predators and alternate prey, boreal caribou in the NT1 range appear to be within the limits of adaptive capacity and resilience at Base Case.

4.2.3.2 Barren-ground Caribou

Habitat Availability

The barren-ground study area is 1,001,520 ha. There is 117,677 ha (11.7%) or a small amount of moderate to high suitability habitat in the RSA at Base Case (Table 4.2-17). Previous and existing development in the RSA is primarily linear in the form of winter roads and trails and Highway 3. Other developments include communication towers, gravel quarries and the community of Whatì.

Traditional Knowledge indicates that barren-ground caribou have not been common near the Project area since the late 1990s (PR#28). Barren-ground caribou herds with potential to be present during winter include the Bluenose-East (BNE) and Bathurst caribou herds, which are identified as separate herds based on their traditional calving grounds. However, locations of collared cows in these herds indicate the RSA is outside of both Bathurst and BNE core ranges (Nagy et al. 2005; Anderson and Johnson 2014; Golder 2016; Appendix G), so regular interaction with the Project is not expected.

The BNE herd typically calves in the Rae and Richardson rivers' area, west of Kugluktuk and moves south and east past Great Bear Lake in late summer (ACCWM 2011). This herd is most likely to overlap with the proposed TASR during winter. Data collected from collared individuals show that they primarily range between Great Bear Lake to the north and to the south around Grandin Lake; however, some satellite collared cows have been recorded as far south as Behchokǫ̀ (ACCWM 2011) and uncollared barren-ground caribou believed to be part of the BNE herd have been found south of Grandin Lake to Lac La Martre.

The Bathurst caribou typically calve in the Bathurst Inlet area and move south and west into the proposed Project route in the fall, following calving (ACCWM 2011). The Bathurst herd usually winters southeast of Great Bear Lake towards Great Slave Lake, close to the communities of Wekweètì, Whatì, and Gamètì. In the past when population numbers were high, Bathurst herd caribou have been found further south into areas near Yellowknife and Łutsel K'e ; and even as far west as Blackwater and Keller lakes and as far south as northern Saskatchewan (ACCWM 2011). Recent estimates of Bathurst herd's winter range from collared caribou cows indicate no overlap with the Project route (Anderson and Johnson 2014; Golder 2016). While uncollared caribou from the Bathurst herd may use areas outside of the delineated range, they have not been detected within the proposed corridor in recent years during a period of population decline. Barren-ground caribou are expected to have the capacity to adapt and be resilient to existing natural and human-related disturbances and associated variations in habitat availability, which at Base Case are not limiting.

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Table 4.2-17: Barren-ground Caribou Winter Habitat Availability in the RSA, Base Case

Habitat Suitability[a]	Area (ha)	Percent (%)
Moderate to High	117,677	11.7
Low to Nil	883,843	88.3
Total	**1,001,520**	**100**

Note: Numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.
[a] - Refer to Section 4.2.2 for descriptions of each habitat suitability category and and Table 4.2-2 for relevant land cover classes.

Habitat Distribution

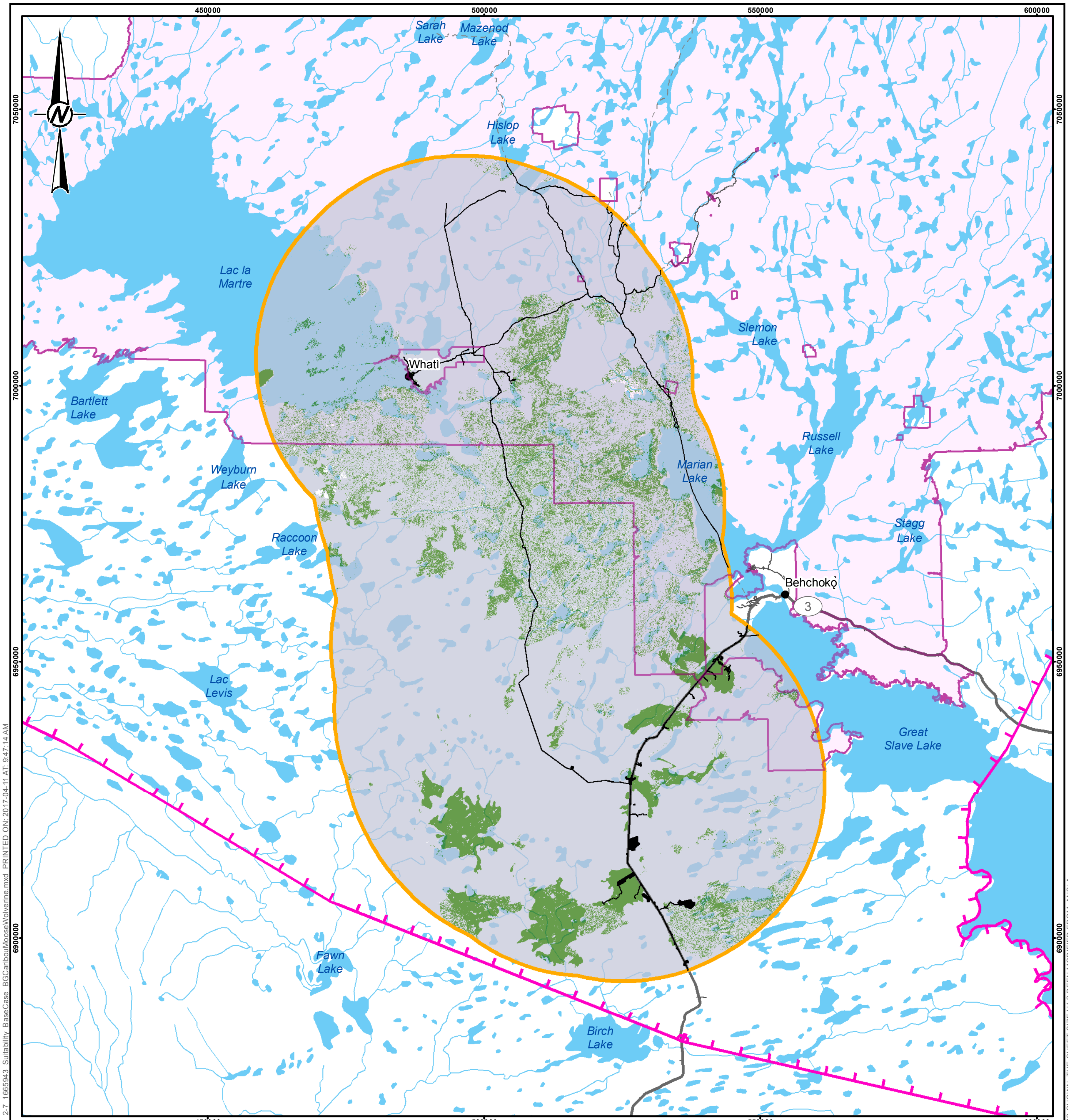
Similar to boreal caribou, barren-ground caribou avoid active developments (Boulanger et al. 2012; Johnson and Russell 2014). In boreal areas of the winter range, burned areas are also avoided, either because of lack of food (i.e., lichen) (Thomas et al. 1998; Barrier and Johnson 2012) or possibly from increased abundance of other ungulates and therefore predators (Environment Canada 2008). Linear features, such as roads, are also generally avoided (Curatolo and Murphy 1987; Johnson and Russell 2014).

For wide ranging species such as caribou, movement is crucial to facilitate access to resources across space and time (Johnson et al. 1992; Nathan et al. 2008; Taylor et al. 1993). Restricted movement can reduce home range size (Andreassen and Ims 1998; Beauchesne et al. 2014; Muhly et al. 2015) and reduce access to resources required for survival such as predator-free space (Muhly et al. 2015). For example, Nellemann and Cameron (1998) found that barren-ground caribou density at calving grounds were inversely related to road density. Specifically, caribou density declined by 63% at road densities between 0.0 and 0.3 km/km^2 and by 86% between 0.6 and 0.9 km/km^2 compared to pre-development conditions. Similarly, Wilson et al. (2016) found that some individuals cross roads more slowly, which can delay arrival of caribou at seasonal ranges (Mahoney and Schaefer 2002; Wilson et al. 2016).

Features that act as semi-permeable barrier effects may exacerbate indirect habitat loss caused by avoidance of disturbance features (Dyer et al. 2002). Beauchesne et al. (2014) suggested that over a certain disturbance threshold it is likely that individuals cannot avoid using unsuitable habitats anymore, leading to decreased movement rates and increased use of suboptimal habitats as movement becomes increasingly risky (Smith et al., 2000; Hebblewhite 2008). Reduced movement rates and restricted home ranges increases the amount of time spent in lower suitability habitats and therefore increase vulnerability to predation (Beauchesne et al. 2014; Morales et al. 2010; Muhly et al. 2015; Rettie and Messier 2000). Caribou confined to smaller home ranges could be forced into less suitable habitat and be more easily detected by predators (Beauchesne et al. 2014).

Traditional Knowledge reports that the frequency and intensity of fire can influence caribou numbers and seasonal ranges (Kendrick et al. 2005). However, recent analysis of collared Bathurst caribou cows indicates that this herd prefers winter on the barren-ground areas north of boreal forest (Golder 2016). Preference for barren-ground wintering areas suggests the Bathurst herd may be less sensitive to loss of habitat from wildfire than previously believed. The BNE winter range occurs almost entirely in boreal forest (ACCWM 2011).

At Base Case, suitable barren-ground caribou winter habitat has a patchy distribution, with small patches dominating the central RSA (Figure 4.2-4). Larger contiguous patches are located at the southern end of the RSA near Highway 3 but these have a low likelihood of use given the winter distributions of BNE and Bathurst caribou herds (Nagy et al. 2005; Anderson and Johnson 2014; Golder 2016: Appendix G). Similarly, barren-ground caribou are expected to be resilient to fragmentation effect and changes to connectivity from previous and existing development and fire disturbance in the RSA at Base Case due to low degree of interaction with the RSA.



LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- WATERCOURSE
- TŁĮCHǪ LAND
- WATER BODY
- DEVELOPMENT
- BARREN-GROUND CARIBOU, MOOSE, AND WOLVERINE RSA
- WEK'ÈEZHÌI RESOURCE MANAGEMENT AREA

HABITAT SUITABILITY

- MODERATE TO HIGH
- NIL TO LOW

0 20 40

1:1,000,000 KILOMETRES

REFERENCE(S)

1. ADMINISTRATIVE REGIONS OBTAINED FROM GOVERNMENT OF NORTHWEST TERRITORIES.
2. CIMP INVENTORY OF LANDSCAPE CHANGE, OBTAINED FROM THE NWT CENTRE FOR GEOMATICS.
3. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.

PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
TŁĮCHǪ ALL-SEASON ROAD

TITLE
DISTRIBUTION OF SUITABLE BARREN-GROUND CARIBOU HABITAT AT BASE CASE

CONSULTANT
Golder Associates

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO.	REV.	FIGURE
1665943	0	4.2-4

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Survival and Reproduction

All herds of barren-ground caribou present in the NWT have declined over the past 10 years (Adamczewski et al. 2009), and 34 of the 43 major herds world-wide are in decline (Vors and Boyce 2009). As a result, all herds of barren-ground caribou in the NWT (with the exception of Peary caribou) are ranked as sensitive in the NWT (GNWT-ENR 2010a). Barren-ground have been assessed as "Threatened" by COSEWIC and are being considered for listing under SARA (SARC 2017a). The number of animals in barren-ground caribou herds increase and decrease at relatively regular intervals, approximately every 30 to 60 years (Case et al. 1996; Boulanger and Gunn 2007; Zalatan et al. 2006; Adamczewski et al. 2009). Although these natural fluctuations in herd size appear to be linked to changes in climatic patterns and winter range quality (Ferguson and Messier 2000; Weladji and Holand 2003; Gunn 2009; Vors and Boyce 2009), the exact mechanisms responsible for generating these population cycles are unknown.

Both the BNE and the Bathurst herds have shown a decline in population numbers. The GNWT-ENR calving ground photo survey results showed that the BNE herd declined from more than 100,000 in 2010 to around 38,600 animals in 2014 (GNWT-ENR 2016c).The Bathurst herd has been in decline since a high of over 350,000 in the mid-1990s. Although it was considered stable at low numbers from 2009-2012 at around 32,000 to 35,000, the photographic survey of the Bathurst calving grounds conducted in June 2015 suggests that the Bathurst herd has further declined to between 16,000 to 22,000 since 2012 (GNWT-ENR 2016d).

Using modelling techniques and data collected from 1996 to 2003, estimated annual survival rates of caribou: female adult = 0.71 to 0.84, female yearlings (age 1) = 0.842, and female calves (i.e., young-of-the-year) = 0.259 (Boulanger and Gunn 2007; GNWT-ENR 2016c,d). Male adult survival was estimated to be from 0.58 to 0.730. Estimates of survival rates for male yearlings and calves were not presented in Boulanger and Gunn (2007) or GNWT-ENR (2016d). Fecundity, defined as the average number of calves produced for each sex and a function of adult survival, was 0.45. Modelling also showed that survival rates of adult females were relatively constant from 1986 to 2006, but that fecundity and calf survival declined during this period. Adult cow survival has been below the 0.83 deemed necessary for herd stability since 2006 in both Bathurst and BNE herds (GNWT-ENR 2016c,d). Furthermore, during surveys on the calving grounds of the Beverly and Qamanirjuaq herds, for every 100 cows there was estimated to be 15 and 20 calves, respectively, which is well below the usual 80 calves per 100 cows.

Natural factors, such as insect pest outbreaks and climate change may also have an important role in population dynamics, and their interacting effects with habitat requirements may confound any perceived relationships with human activity (e.g., Tews et al. 2007). Caribou that experience high levels of insect harassment generally have poor body condition (Weladji and Holland 2003) because they spend less time foraging and more time being active (Toupin et al. 1996; Łutsel K'e Dene Elders and Land-Users et al. 2005). Climate warming is expected to increase the duration and intensity of insect harassment on caribou because of earlier insect emergence, greater insect abundance, and increased insect distribution (Weladji and Holland 2003; Vors and Boyce 2009). Climate change is also expected to increase the frequency and intensity of wildfire and enable plants to expand their ranges northward. As fires increase and plants move north, moose and wolves may also increase their northern distribution, which may negatively impact caribou populations and distributions (Sharma et al. 2009). Climate change is also likely to lead to earlier plant emergence. As plants are most nutritious soon after emergence, it is important for caribou to access these resources as close to plant emergence as possible; however, caribou migrations are mainly cued by day length. For example, the time of year when wintering Bathurst cows

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begin their annual northward migration to calving areas is highly predictable to occur at mid-April (Gunn et al. 2002). Therefore, as the climate becomes warmer, caribou migrations may become out of sync with plant emergence, which may lead to a decline in reproductive success, as has been shown in Greenland (Post and Forchhammer 2008).

Other possible causes of reductions in herd size include commercial and subsistence hunting (Boulanger and Gunn 2007). Case et al. (1996) estimated that between 14,500 and 18,500 Bathurst caribou were harvested annually from 1982 to 1995. Based on the Dogrib Harvest Study, Boulanger and Gunn (2007) estimated that, on average 6.7% of bulls (range = 3.0 to 9.2%) and 4.1% of cows (range = 1.4 to 7.0%) were harvested annually from 1988 to 1993 (based on estimated population size); however, demographic models suggest that reduced levels of hunting generated only a slight increase in adult survival (3%), which was not enough to produce positive population growth (Boulanger and Gunn 2007).

In addition to the above-mentioned environmental and anthropogenic external factors, density dependence may be an important factor in the population dynamics of barren-ground caribou (Tews et al. 2007). Density dependence occurs when the growth rate of a population decreases as its density increases. In some cases, growth rates decrease because of declining forage resources that cause decreases in survival and/or reproduction. This mechanism can lead to cyclical trends in abundance starting when foraging levels surpass a critical level for maintenance of population size, resulting in either gradual reductions in population growth or abrupt population declines. There is both TK (Zalatan et al. 2006) and scientific evidence (Case et al. 1996; Boulanger and Gunn 2007; Adamczyewski et al. 2009; Festa-Banchet et al. 2011) that describe cyclical patterns in abundance in barren-ground caribou.

Winter represents a time of thermoregulatory and nutritional stress for barren-ground caribou because temperatures are below freezing and forage may be less accessible due to snow and ice resulting in higher energetic costs (Fancy and White 1985; Collins and Smith 1991; Brotton and Wall 1997). The energetic cost for travel in snow is also higher than during non-winter periods but the difference in magnitude depends on snow conditions (Boertje 1985; Fancy and White 1985). Winter is when pregnant cows are typically losing weight (Bergerud 1996) and weight loss decreases the probability of calving the following June (Cameron and Ver Heof 1994). Although there is uncertainty about whether barren-ground caribou populations are regulated by the availability of lichens on their winter range (Bergerud 1996), the body condition of females at the end of winter has important implications to the fecundity rates and trajectory of the population.

A TK study report by the Tłįchǫ Government indicates that barren-ground caribou in the WRMA have been harvested in areas along the north end of the proposed TASR route through a network of trails and routes during winter and would include harvest from either BNE or Bathurst herds (PR#28; Section 5.2.10). In addition to existing trails, hunters could access wintering barren-ground caribou beyond the northern end of the TASR by snowmobile in winter using winter road routes before they are open and by truck or snowmobile after winter roads are opened. Harvest restrictions on Bathurst caribou as recommended by the RRB) were in effect for the 2010 to 2014 harvest seasons. This restriction included 150 hunting tags for the Tłįchǫ people and 150 for the Yellowknives Dene First Nation (Tłįchǫ Government-ENR 2010). A no-hunting mobile conservation zone was implemented by GNWT-ENR in 2015 for the Bathurst herd. The number of tags was further reduced to 15 in 2015 and zero from 2016 until 2019 (WRRB 2016). Harvest allowance for aboriginal hunters for the BNE caribou is 750 bulls from 2016 to 2019. Non-aboriginal harvest of barren-ground caribou is regulated by GNWT-ENR. Hunting regulations for barren-ground caribou allow residents to harvest one or two male barren-ground caribou per year and non-residents cannot

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harvest barren-ground caribou in the NWT (GNWT-ENR 2017). The resident hunting season for barren-ground caribou is from August 15 to April 30. Beginning January 1, 2010, barren-ground caribou commercial/meat tag, resident, and non-resident harvesting was closed in the North Slave and South Slave regions, and all hunting was closed in a new no-hunting conservation zone established north of Yellowknife where the Bathurst herd winters. Due to the current low abundance and harvest restrictions of Bathurst caribou and BNE, barren-ground caribou are considered unlikely to be self-sustaining and ecologically effective at Base Case.

4.2.3.3 Moose

Habitat Availability

There is large amount of suitable habitat for moose in the RSA at Base Case. Approximately 322,377 ha (32.2%) of the RSA represents suitable habitat for moose (Table 4.2-18). Moose are expected to have the capacity to adapt and be resilient to existing natural and human-related disturbances and associated variations in habitat availability. Moose are also highly mobile, have large home ranges, and can use many different habitat types.

Table 4.2-18: Moose Habitat Availability in the RSA, Base Case

Habitat Suitability [a]	Area (ha)	Percent (%)
Moderate to High	322,377	32.2
Low to Nil	679,143	67.8
Total	**1,001,520**	**100**

Note: Numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.
[a] - Refer to Section 4.2.2 for descriptions of each habitat suitability category and Table 4.2-3 for relevant land cover classes.

Habitat Distribution

Moose are highly mobile and have large annual home ranges that often encompass thousands of hectares (Murray et al. 2012; Street et al. 2015). Reported dispersal distances range from a few kilometres to extreme cases of greater than 1,000 km (Hoffman et al. 2006). Juvenile moose disperse short distances after being abandoned by cows, typically after their first year (Hoffman et al. 2006). Causes of dispersal include resource competition, resource depletion, predation pressure, and acquiring mates. Hoffman et al. (2006) suggest that high mobility allows moose to exploit suitable habitat patches in heterogeneous landscapes. Evidence to support this includes that moose are at harvestable population levels in the Canadian prairies where patches of wetlands and trees are highly isolated by secondary roads and agriculture. Suitable habitat for moose is widely distributed and connected throughout the central portion of the RSA at Base Case (Figure 4.2-5). Habitat availability is limited and not well connected at the north and southern ends of the RSA.

Traditional moose range encompasses suitable habitat south of the treeline throughout the NWT; however, since the early 1900s, moose have been seen at numerous locations on the tundra where adequate forage is available (GNWT-ENR 2016a). Moose densities in northern environments are low (5 to 15 moose per 100 km^2 [GNWT-ENR 2016a]) compared to southern boreal forest regions (Sly et al. 2001). Surveys completed in the boreal forest of the North Slave Region, north of Great Slave Lake, found lower density rates ranging from 2.0 to 3.5 moose per 100 km^2 (Cluff 2005). The estimated number of moose in the NWT is approximately 20,000 individuals (GNWT-ENR 2016a).

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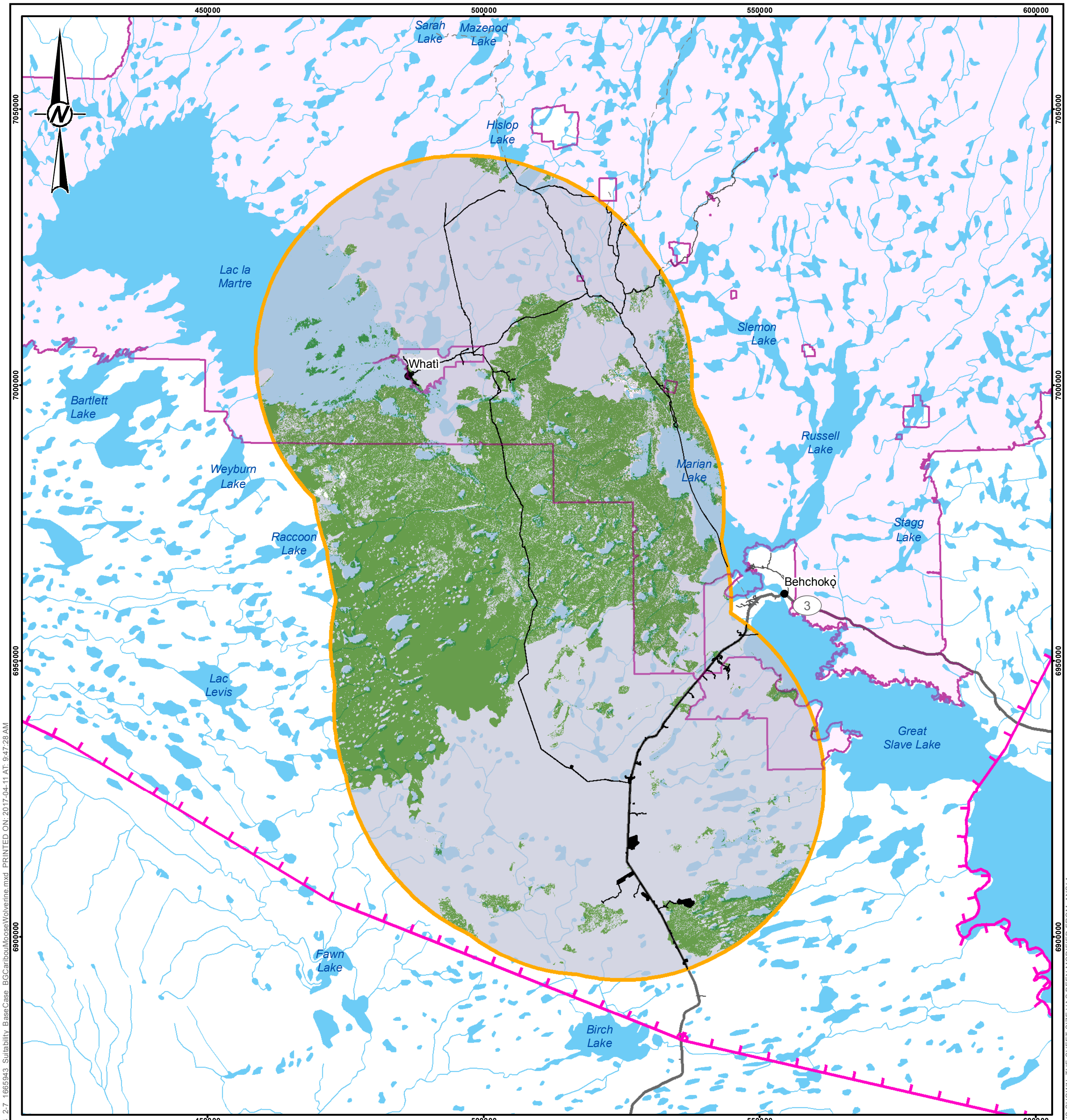
The best areas for moose are characterized by semi-open forest cover, an abundance of willow and aspen stands, and are located close to lakes, river valleys, stream banks, or sand bars. During the summer, moose may move into the tundra where they feed on semi-aquatic vegetation in wetlands and shallow lakes (Bromley and Buckland 1995). Moose cows usually select areas in immediate proximity to small ponds and marshes for calving. Stenhouse et al. (1994) found that mean annual home range for 29 cows monitored in the Mackenzie Valley, NWT was 174 km^2 (standard error = 31 km^2). This home range estimate was larger than those reported for adult moose in other parts of North America (Stenhouse et al. 1994), which may indicate that forage abundance was lower (Mace et al. 1984; Risenhoover 1986).

Sensory disturbance from human activity, such as noise, dust, lights and smells may alter the distribution of moose. In particular, moose distribution may be altered in relation to anthropogenic and natural linear features on the landscape (Bartzke et al. 2015). For example, some studies of moose distribution indicate avoidance of roads by 100 m to 3 km (Jiang et al. 2009; Laurian et al. 2012), but this effect may be seasonal where avoidance of roads is more evident in fall or winter (i.e., during the hunting season) (McLoughlin et al. 2011; Beyer et al. 2013). It has been postulated that avoidance of roads by moose in fall and winter may be an artifact of hunter use of roads to harvest moose (McLoughlin et al. 2011). Moose may also adapt to road activity by altering the time of day that they use habitats near roads to when activity is lower (Neumann et al. 2009).

The presence of a corridor such as a road can also be attractive for moose when making longer movements for natal dispersal or migration (Dussault et al. 2006b; Child 2007). In support of this, Danks and Porter (2010) found that moose-vehicle collisions increased during movements of moose associated with parturition, dispersal, and breeding. Overall, changes in habitat distribution in the moose RSA at Base Case are predicted to be well within the resilience limits and adaptive capacity of moose because this species is highly mobile and can access suitable habitat and food resources even in highly fragmented landscapes.



LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- WATERCOURSE
- TŁĮCHǪ LAND
- WATER BODY
- DEVELOPMENT
- BARREN-GROUND CARIBOU, MOOSE, AND WOLVERINE RSA
- WEK'ÈEZHÌI RESOURCE MANAGEMENT AREA

HABITAT SUITABILITY

- MODERATE TO HIGH
- NIL TO LOW

0 20 40

1:1,000,000 KILOMETRES

REFERENCE(S)

1. ADMINISTRATIVE REGIONS OBTAINED FROM GOVERNMENT OF NORTHWEST TERRITORIES.
2. CIMP INVENTORY OF LANDSCAPE CHANGE, OBTAINED FROM THE NWT CENTRE FOR GEOMATICS.
3. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.

PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
TŁĮCHǪ ALL-SEASON ROAD

TITLE
DISTRIBUTION OF SUITABLE MOOSE HABITAT AT BASE CASE

CONSULTANT
Golder Associates

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO.	REV.	FIGURE
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Survival and Reproduction

Moose are not listed federally or in the NWT (SARC 2016a; *SARA* 2016) nor are they under consideration by COSEWIC (2016). Moose are long-lived ungulates with relatively high adult survival rates in the NWT (e.g., 62% [including harvest] and 70% [excluding harvest]; Stenhouse et al. 1994) and a life expectancy of 12 to 25 years (National Geographic 2016; Arsenault 2000). Moose are primarily threatened by direct and indirect habitat loss (Street et al. 2015), altered predator/prey relationships (Dussault et al. 2005; Street et al. 2015), and hunting (Timmerman et al. 2002).

Currently in the NWT, moose are managed mostly by controlling the hunting season for residents and non-residents (GNWT-ENR 2016a). The estimated total NWT moose harvest is 1,000 to 2,000 animals per year, 80% to 90% of which is taken by General Hunting License holders who are able to hunt during any season. Annual surveys of Yellowknife recreational hunters estimate that 80 to 100 moose are taken per year; however, some of these harvests would occur outside of the North Slave Region (Cluff 2005). Estimates of moose harvest from 1985 indicate that General Hunting Licence holders from Rae, NWT took more moose than any other community in the NWT in that year though moose harvest rates were shown to be decreasing over time (Treseder and Graf 1985). The moose RSA is located within Wildlife Management Zone R. Surveys completed in the boreal forest of the North Slave Region, north of Great Slave Lake within Wildlife Management Zone R, found density rates ranging from 2.0 to 3.5 moose per 100 km^2 (Cluff 2005). This is consistent with surveys conducted north of Yellowknife where the average density of moose was 2 moose per 100 km^2 (Cluff 2005) but lower than surveys conducted in the Dehcho region where the density of moose ranged from 4.4 to 4.9 moose per 100 km^2 (Larter 2009). Based on these results, the density of moose in the moose RSA is expected to be lower than those of most northern environments (5 to 15 moose per 100 km^2) (ENR 2016a).

Potential predators in the NWT include wolves (*Canis lupus*) and black bear (*Ursus americanus*) (Stenhouse et al. 1994). While wolves and bears most often kill calves, wolves are also known to kill moose year-round (Ballard and Van Ballenberghe 1997; Dussault et al. 2005). Predation and snow conditions are interrelated factors that can affect moose survival and recruitment. When snow is deep, moose gather in areas of shallow snow, which increases predation risk from wolves (GNWT-ENR 2016a). In addition, snow depth of over 90 cm greatly hinders their movements and reduces the availability of suitable browse species above the snowpack (GNWT-ENR 2016a).

Moose may use road corridors when making longer movements for natal dispersal or migration, or to gather essential resources including browse and minerals (e.g., sodium) (Dussault et al. 2006b). As a result, moose can be vulnerable to vehicle collisions. However, studies have shown that moose avoid roads by 100 m to 3 km (Jiang et al. 2009; Laurian et al. 2012), though this effect may be seasonal where avoidance of roads is more evident in fall or winter (i.e., during the hunting season) (McLoughlin et al. 2011; Beyer et al. 2013). Moose may adapt to road activity by altering the time of day that they use habitats near roads to when activity is lower (Neumann et al. 2009). In general, roads and their surrounding habitat are perceived to be low-quality habitat (Dussault et al. 2006b).

Moose breed annually in the fall often resulting in one to two calves the following spring. A NWT moose productivity study determined that pregnancy rates were 40% for yearlings and 96% for adult females with twins occurring 25% to 36% of the time and 86% of the females that survived until spring giving birth (Stenhouse et al. 1994). In 2003 and 2004 moose population surveys in the Dehcho region, also located in the Tiaga Plain, were determined to have a cow: calf ratio of 100:32.1 to 100:44.6 (Larter 2009).

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Moose display life history traits (e.g., large home ranges, high reproductive rates, ability to eat many types of plants) that provide flexibility to adapt to different ecozones and rates of development across North America. For example, in the last 30 years, moose populations have increased to harvestable levels in southern Saskatchewan (MOE 2012), which is a landscape where suitable habitat is highly fragmented due to cereal grain agriculture and a network of secondary roads to support this industry. Therefore, it is expected that historical changes in survival and reproduction present at Base Case are probably well within the resilience and adaptability limits for this criterion.

4.2.3.4 Bison

Habitat Availability

Wood bison historically occurred throughout the boreal forest region in northwestern North America. In the NWT, wood bison range covered most of the western portion of the territory. Their range decreased by the end of the 19th century due to overhunting, changes in habitat distribution, and harsh winters (GNWT 2010; ECCC 2016). The first protected bison area, Wood Buffalo National Park, was created in northern Alberta in 1922 (ECCC 2016).

Approximately 1,576,841 ha (57.3%) of the RSA represents suitable habitat for bison at Base Case (Table 4.2-19). Bison are relatively mobile and have large home ranges, and are expected to have the capacity to adapt and be resilient to existing natural and human-related disturbances and associated variations in habitat availability.

Table 4.2-19: Bison Habitat Availability in the RSA, Base Case

Habitat Suitability[a]	Area (ha)	Percent (%)
Moderate to High	1,576,841	57.3
Low to Nil	1,172,895	42.7
Total	**2,749,736**	**100**

Note: Numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.
[a] - Refer to Section 4.2.2 for descriptions of each habitat suitability category and Table 4.2-4 for relevant land cover classes.

Habitat Distribution

Wood bison have always been less abundant than the Plains bison, and occurred in more fragmented populations, due to the availability and distribution of suitable habitat (COSEWIC 2013a). Within the wood bison range, suitable grassland and sedge habitats account for 5% to 20% of the landscape (ECCC 2016). This preferred habitat type is patchy in distribution throughout the boreal forest region (COSEWIC 2013a), and covers only 6% of the landscape in the Mackenzie range (Gates and Larter 1990). Suitable habitat for bison is widely distributed and generally well-connected throughout the RSA at Base Case (Figure 4.2-6).

In a forested landscape, such as the boreal forest region, suitable foraging patches (i.e., meadows) are connected by established trails that allow bison to move between foraging areas (COSEWIC 2013a). These trails may be associated with anthropogenic linear disturbances, such as roads or seismic lines (SARC 2016). Bison movement is typically higher during the winter months when frozen conditions better support their weight (SARC 2016b).

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Although TK and incidental reports indicate travel patterns in the late summer period (SARC 2016b), scientific knowledge of bison behaviour suggests regular seasonal migrations are rare and movement within the home range is considered nomadic in nature (SARC 2016b). Factors such as predation, flooding or deep snow may influence these movements (SARC 2016b). Bison typically avoid areas of rough ice and are hesitant to cross large water bodies, including the Mackenzie River (SARC 2016b).

Anthropogenic disturbances that return the landscape to earlier, graminoid-dominated successional stages could benefit bison in the boreal region (Gates et al. 2001). However, human presence resulting from increased access associated with linear disturbances could reduce the use of these disturbed areas by bison (Fortin et al. 2009). Although agricultural development has reduced available habitat for wood bison (Gates et al. 2001), it has had little negative effect on bison in the NWT where agricultural activity is limited (GNWT 2010; COSEWIC 2013a).

Bison are regularly encountered along the Alaska Highway in the Yukon, where bison are hunted, and on the all-weather gravel road in Wood Buffalo National Park (Government of Yukon 2012; Parks Canada 2014). Bison are also regularly encountered on NWT Highways 3 and 7 (Mackenzie Bison Working Group 2016; GNWT-DOT 2017). Historically bison have been known to congregate along roadways (SARC 2016b). Bison in Yellowstone National Park were less responsive to motorized winter recreational vehicles during winters with high visitation (Borkowski et al. 2006) and vehicular traffic was not a significant predictor of bison movement or distribution within the park (Bruggeman et al. 2006). Conversely, in Prince Albert National Park, bison ran from humans and recreational vehicles during 51% of approaches, with flight responses elicited from as far away as 265 m (Fortin and Andruskiw 2003). In that study, although bison did respond to disturbance, the disturbance did not have an important impact on resource use by bison. Habituation to human activity may vary among populations depending on the existing level of exposure to disturbance (Knopff et al. 2014).

The Mackenzie range population has expanded their range to the north over the last 20 to 30 years (SARC 2016b). Gates and Larter (1990) reported that expansion of the Mackenzie range was driven primarily by population density. Once a critical threshold was reached, individuals went in search of new, unoccupied habitats. Range expansion is often initiated by bulls (SARC 2016b), and is limited by distribution of available habitat (Gates and Larter 1990).

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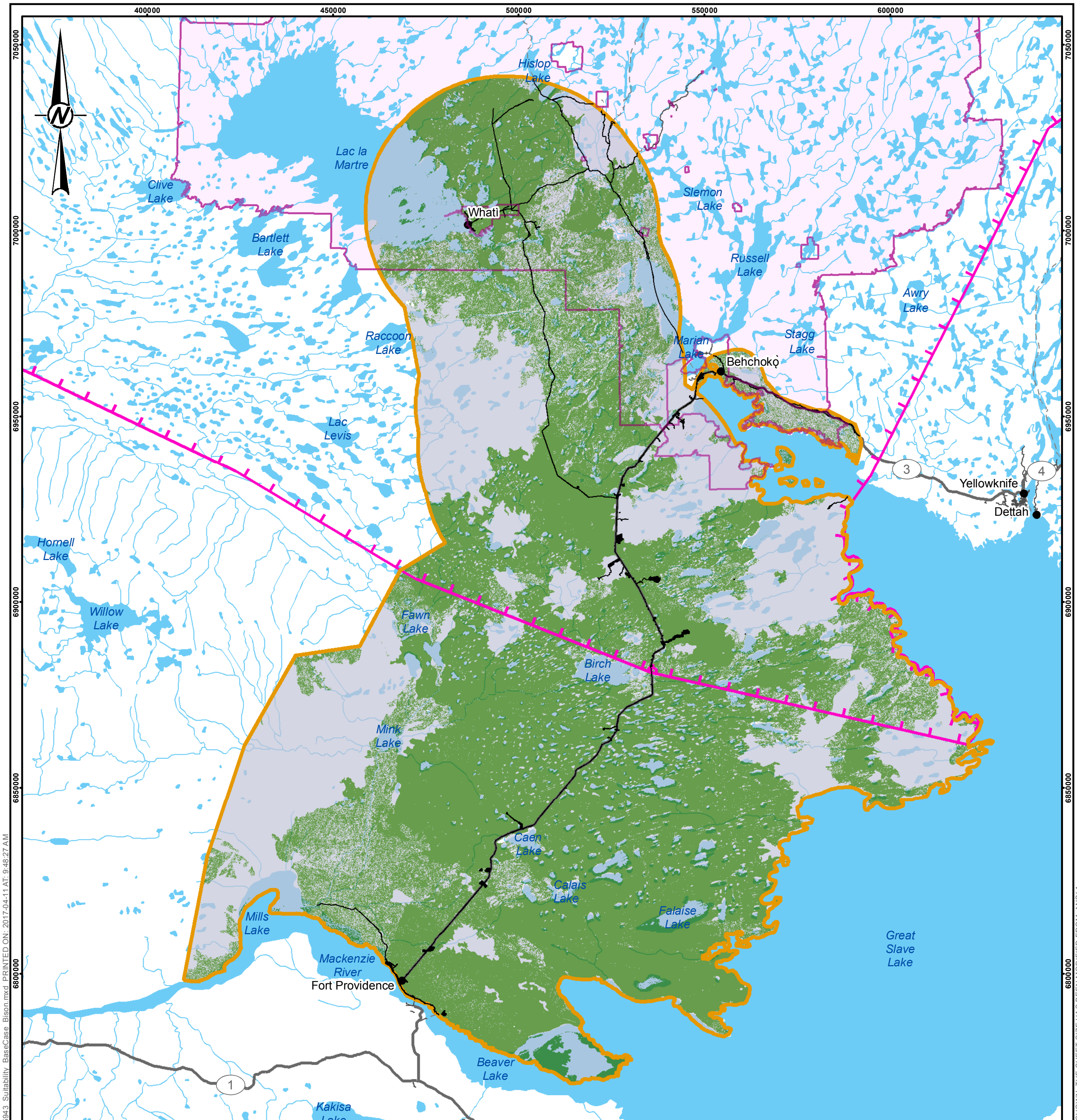

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- LOCAL ROAD
- WINTER ROAD
- WATERCOURSE
- TŁĮCHǪ LAND
- WATER BODY
- DEVELOPMENT
- BISON RSA
- WEK'ÈEZHÌI RESOURCE MANAGEMENT AREA

HABITAT SUITABILITY

- MODERATE TO HIGH
- NIL TO LOW

0 30 60

1:1,500,000 KILOMETRES

REFERENCE(S)

1. ADMINISTRATIVE REGIONS OBTAINED FROM GOVERNMENT OF NORTHWEST TERRITORIES.
2. CIMP INVENTORY OF LANDSCAPE CHANGE, OBTAINED FROM THE NWT CENTRE FOR GEOMATICS.
3. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.

PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
TŁĮCHǪ ALL-SEASON ROAD

TITLE
DISTRIBUTION OF SUITABLE BISON HABITAT AT BASE CASE

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

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Survival and Reproduction

Wood bison is listed federally as threatened on Schedule 1 of SARA, and is designated special concern by COSEWIC (2017). In the NWT, wood bison was assessed as threatened and is under consideration for listing on the NWT List of Species at Risk (GNWT 2013).

Wood bison is the largest land mammal in North America (ECCC 2016). In the wild, bison can live to over 20 years in age, and over 40 years in captivity (COSEWIC 2013a). Bison are social animals and form large mixed herds of cows, calves and young bulls that merge and split frequently. Mature bulls typically roam alone or in small, temporary groups outside of the breeding season (SARC 2016b).

Both females and males become sexually active between 2-3 years of age, although bulls typically don't begin breeding until 7 or 8 due to competition (COSEWIC 2013a; GNWT 2013). The breeding season extends between June and September, with the highest activity typically occurring in July and August. Calves are born in the spring (April to June) (COSEWIC 2013a), and weaned after approximately seven months (GNWT 2013). Cows typically produce a calf every other year, but this can be impacted by environmental conditions, such as harsh winters (SARC 2016b).

The primary natural predator of bison is wolves, although black bears have been suggested as a minor predator (SARC 2016b). Furthermore, research indicates that wolf predation focuses on calves (accounting for up to 45% of calf mortality), which may have resulted in a declining population growth rate (Gates and Larter 1990).

Although bison share the landscape with other large ungulates, such as moose, elk, caribou and deer, there is little overlap in food sources and therefore, a low level of competition (COSEWIC 2013a; SARC 2016b).

The Mackenzie range population experienced growth during the 40 years prior to 2000 and population numbers began to decline between 2000 and 2012. By 2013, the population was estimated at just over 700 individuals, a 53% decline, following mortality from an anthrax outbreak in 2012. Other contributing factors to the population decline included predation, harsh winters, and vehicle collisions along Highway 3 in the NWT (Armstrong 2014). This small population size makes the Mackenzie range population susceptible to genetic drift and loss of genetic diversity (COSEWIC 2013b).

Threats representing a moderate to high level of impact on bison populations include hunting, disease, climate change/severe weather, and roads (COSEWIC 2013a). A moratorium on hunting of the Mackenzie range population was established between 2012 and 2013 following the anthrax outbreak (COSEWIC 2013a). Anthrax, a persistent bacterial spore that lives in soils, only causes problems during outbreaks, which appear to require specific environmental and climactic conditions for emergence and dispersal (ECCC 2016). Outside of traditional aboriginal uses, hunting is primarily used to manage population growth and range expansion, and to minimize bison-human conflicts (COSEWIC 2013a).

Protection efforts in the 1920s resulted in the introduction of cattle diseases Bovine brucellosis and tuberculosis to herds protected in Wood Buffalo National Park (COSEWIC 2013a; ECCC 2016). Because of management tools used to restrict the movement of these diseases to adjacent populations, recovery potential for wood bison is limited (COSEWIC 2013a). The Bison Control Area established in 1987 represents a bison-free buffer zone between the Mackenzie range population and diseased populations to the south, and covers a 39,400 km^2 area of potentially suitable habitat that is unavailable for use (GNWT 2010; ECCC 2016). This area restriction may also influence gene flow and limit diversity (ECCC 2016).

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Severe weather events have resulted in bison mortality due to drownings from flooding and reduced food access due to deep snow (COSEWIC 2013a; SARC 2016b). Alternatively, increased forest fire incidence may benefit bison by creating new, additional habitat (COSEWIC 2013a).

The Mackenzie range population has experienced frequent mortality from vehicle collisions along Highway 3 in the NWT, with a total of 270 collisions reported between 1989 and 2015 according to the Mackenzie Bison Management Plan (PR#80), and 386 mortalities (GNWT unpublished data). Since 2005, an average of 22 bison have been killed in vehicle collisions per year on Highway 3. Prior to 2012, this represented approximately 1% of the population. Post-anthrax outbreak in 2012, collision deaths represented a higher proportion of the population, from over 5% between 2012 and 2013, and 1% to 2% in 2014 and 2015. Reported collisions are highest through the late summer and fall seasons (i.e., August to November) (Mackenzie Bison Working Group 2016). Seed mixtures used in roadside plantings represent favourable foraging plant species, which tends to attract bison (COSEWIC 2013s; Mackenzie Bison Working Group 2016). Bison may also be attracted to the roads for use as a travel corridor during winter months when snow may impede movement (ECCC 2016; Mackenzie Bison Working Group 2016).

4.2.3.5 Wolverine

Habitat Availability

Approximately 287,519 ha (28.7%) of the RSA represents suitable habitat for the wolverine at Base Case (Table 4.2-20). Wolverines typically occupy home ranges that vary from about 50 to 400 km^2 for females (smallest during denning periods), and 230 to 1580 km^2 for males (COSEWIC 2014c; SARC 2014). On the central barrens near Daring Lake, NWT, wolverine home range averaged 126 km^2 for females and 404 km^2 for males (Mulders 2000), and this is likely larger than home ranges in the boreal zone due to the lower productivity of the central barrens (SARC 2014). Assuming a home range size of between 5,000 ha and 12,600 ha for females and between 23,000 ha and 40,400 ha for males, the potential suitable habitat for wolverine in the wolverine RSA may support 22 to 57 females or 7 to 13 males, if all potential habitat is occupied. Wolverines are highly mobile and can access suitable habitat and food resources even in disturbed landscapes, so wolverines are expected to have the capacity to adapt and be resilient to existing natural and human-related disturbances and associated variations in habitat availability.

Table 4.2-20: Wolverine Habitat Availability in the RSA, Base Case

Habitat Suitability[a]	Area (ha)	Percent (%)
Moderate to High	287,519	28.7
Low to Nil	714,002	71.3
Total	**1,001,520**	**100**

Note: Numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.
[a] - Refer to Section 4.2.2 for descriptions of each habitat suitability category and Table 4.2-5 for relevant land cover classes.

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Habitat Distribution

Wolverines tend to avoid recent burns and areas of human disturbance, especially areas of increasing road density and areas where backcountry recreation activities occur (Rowland et al. 2003; May et al. 2006; Krebs et al. 2007; Luensmann 2008; Bowman et al. 2010; COSEWIC 2014c). Female wolverines appear to be particularly sensitive to human disturbance during the denning period and typically select denning sites in remote, undeveloped areas (Copeland et al. 2007; Krebs et al. 2007; May et al. 2012). However, recent research suggests that some wolverines may tolerate human activities in their home ranges, included denning females, and suitable habitats may support resident wolverines, despite potential human disturbance (Heinemeyer and Squires 2013, 2014). Though wolverine movement does not appear to be impeded by linear features (Hornocker and Hash 1981), wolverines negatively respond to spatially extensive and increasing density of linear features, such as road networks (May et al. 2006, Krebs et al. 2007) and seismic lines (Fisher et al. 2013). Wolverines are more likely to avoid roads when ROWs are wide (i.e., greater than 50 m) (Luensmann 2008). Roads also facilitate indirect mortality through improved motorized access for hunters and trappers into remote areas (COSEWIC 2014c).

Dispersal behaviour of wolverines is not well understood and a proportion of the population, typically yearlings, is transient at any given time (COSEWIC 2014c; SARC 2014). Females tend to establish residency closer to their natal home range than males, although both sexes are capable of long distance movements (COSEWIC 2014c; SARC 2014). Mulders (2000) reported average dispersal movements of 133 km (range 69 to 225 km) for females and 231 km (range 73 to 326 km) for males in the NWT. Individual wolverines have been known to travel through burned areas (Luensmann 2008) and cross major natural and artificial landscape barriers such as glaciers, rivers, reservoirs, and major highways that would otherwise act as barriers to the movements of many other species (Hornocker and Hash 1981; COSEWIC 2014c; SARC 2014). However, long distance movements may also lead to increased risk of mortality due to predation, trapping, accident or starvation (COSEWIC 2014c; SARC 2014).

Wolverines in the NWT, Nunavut, and Saskatchewan are part of a larger panmictic core population where there are few barriers to migration (COSEWIC 2014c; SARC 2014). There is genetic structuring of maternally inherited mitochondrial DNA over relatively small geographic areas, including areas within the NWT (Wilson et al. 2000; Chappell et al. 2004; Tomasik and Cook 2005; Cegelski et al. 2006). Together these studies suggest that gene flow is mediated by male-biased dispersal and a strong female preference to remain near their natal territories (SARC 2014).

At Base Case, suitable wolverine habitat has a patchy distribution, with small patches of suitable habitat present at the northern and southern ends of the RSA and larger contiguous patches present across the central RSA (Figure 4.2.7). Overall, available evidence indicates wolverine habitat and populations remain connected in the RSA at Base Case. Habitat connectivity is not a limiting factor for this species in the NWT given its ability to disperse long distances across various habitat types (SARC 2014), and combined changes from natural and human-related disturbance at Base Case should be within the resilience and adaptability limits of this species.

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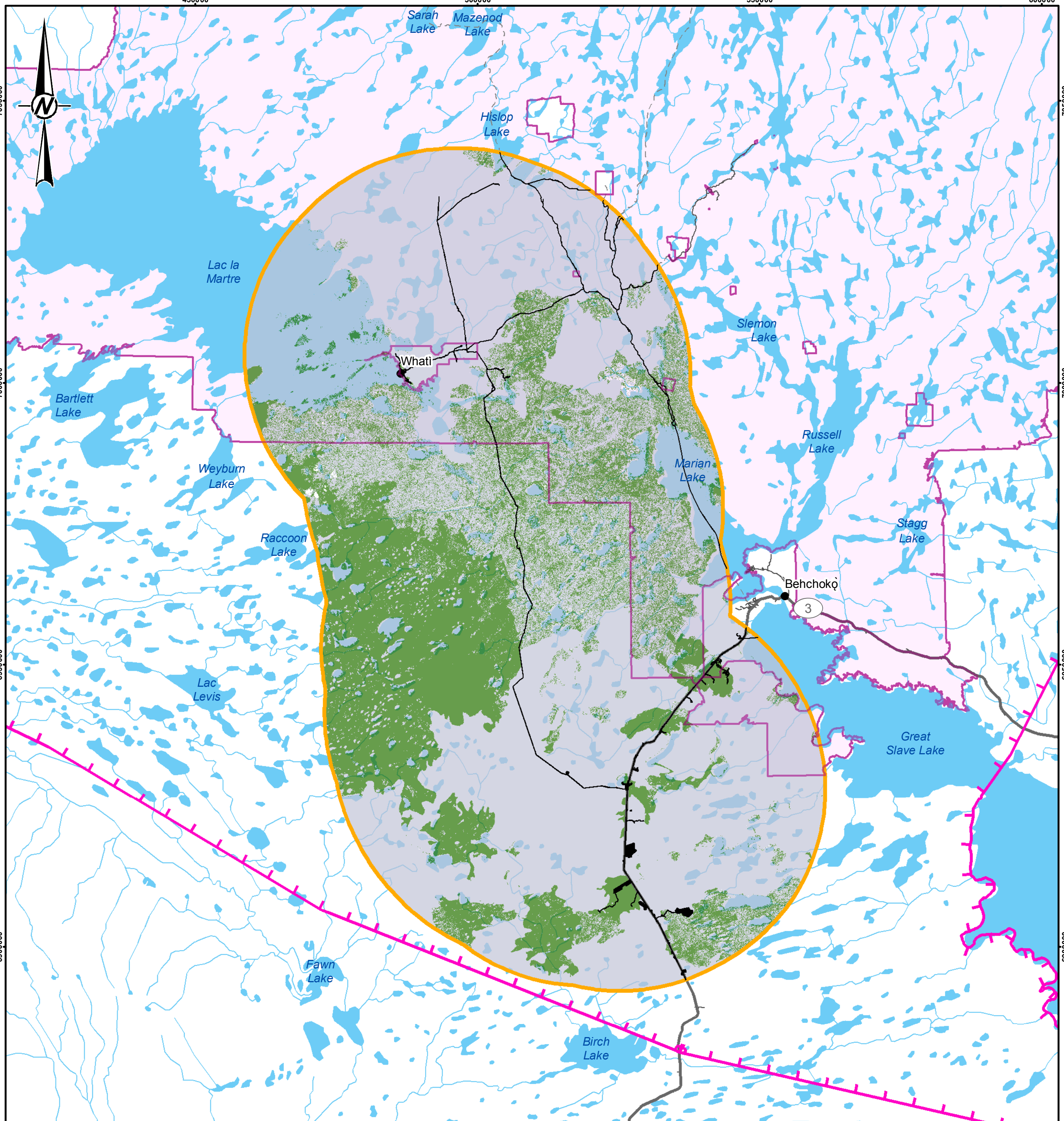

LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- WATERCOURSE
- TŁĮCHǪ LAND
- WATER BODY
- DEVELOPMENT
- BARREN-GROUND CARIBOU, MOOSE, AND WOLVERINE RSA
- WEK'ÈEZHÌI RESOURCE MANAGEMENT AREA

HABITAT SUITABILITY

- MODERATE TO HIGH
- NIL TO LOW

0 20 40

1:1,000,000 KILOMETRES

REFERENCE(S)

1. ADMINISTRATIVE REGIONS OBTAINED FROM GOVERNMENT OF NORTHWEST TERRITORIES.
2. CIMP INVENTORY OF LANDSCAPE CHANGE, OBTAINED FROM THE NWT CENTRE FOR GEOMATICS.
3. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.

PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
TŁĮCHǪ ALL-SEASON ROAD

TITLE
DISTRIBUTION OF SUITABLE WOLVERINE HABITAT AT BASE CASE

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO.	REV.	FIGURE
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Survival and Reproduction

The wolverine was designated as special concern by COSEWIC in 2014 but has yet to be listed under SARA (COSEWIC 2014c); it is considered not at risk in the NWT (SARC 2016a). They range throughout the NWT and occupy a variety of habitats and ecological conditions (SARC 2014). Limited data are available to assess population trends in the wolverine RSA for the Base Case. Wolverine abundance in the RSA has presumably been influenced by multiple factors, including quality and quantity of available habitat, prey abundance, harvest, and connectivity. The main threats to wolverines in the NWT are harvesting, decreasing food availability, and sensitivity to human disturbance; however, those threats are currently deemed to be low to negligible (SARC 2014). Changing climate and weather conditions also have the potential to affect wolverine populations in the NWT, but a climate-driven decline is not evident at this time in much of wolverine range because wolverine population trends in the north, while largely unknown, are possibly stable or increasing in many areas (COSEWIC 2014c; SARC 2014).

The wolverine have low reproductive rates and naturally occur at low population density (COSEWIC 2014c). The north and western part of Canada is considered to be the wolverine population stronghold (COSEWIC 2014c), and the species is considered stable or increasing across much of the NWT (SARC 2014). The highest densities occur in the Northern Mountain, eastern Southern Mountain, and northern Boreal ecological areas (5 to 10 wolverines per 1,000 km^2), where vegetation associations, food resources, and large carnivores are most diverse and abundant (COSEWIC 2014c). There is some indication that abundance may be declining in the central barrens, potentially related to declines in barren-ground caribou; however, the possibility of rescue is considered high from nearby regions (SARC 2014). Populations are considered to be stable in neighboring northern British Columbia, northern Alberta, and Yukon (COSEWIC 2014c; SARC 2014).

The TK study report by the Tłı̨chǫ Government (PR#28) indicates that wolverine in the WRMA have been harvested in areas along the proposed TASR route through a network of trails and routes during winter. Wolverines have a low resilience to trapping pressure due to their low reproductive rates, large home ranges, and long-distance movements (Banci and Proulx 1999). There is no evidence that wolverine abundance in the NWT declined during the period of early settlement or fur trade, and long-term harvest data indicate a stable population in the NWT (SARC 2014). An estimated 3,000 to 6,000 wolverines occur in the NWT (SARC 2014). Between 1992 and 2012, the mean annual harvest of wolverines was 200 individuals, which is estimated to be between 3.3% and 6.7% of the overall population (SARC 2014). Harvest management, including quotas for some individual harvesters, regulated trapping seasons, and the persistence of untrapped refugia act to minimize the threat of trapping in the NWT (SARC 2014). Thus, mortality levels in the RSA at Base Case are likely within the resilience and adaptability limits for this species.

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4.2.3.6 Little Brown Myotis

Habitat Availability

There is a low amount of moderate to high quality little brown myotis habitat in the RSA at Base Case. Approximately 10,592 ha (19.1%) of the RSA represents suitable habitat for little brown myotis at Base Case (Table 4.2-21). Fire disturbance (i.e., within the last 40 years) has altered approximately 26,861 ha (48%) of the RSA at Base Case. While fires have likely resulted in a loss of maternity roosting habitat in the RSA relative to what may have been historically available, the little brown myotis is considered a habitat generalist and is able to use a variety of coniferous and deciduous forest types (COSEWIC 2013a). Moreover, recent research suggests that occurrence of fire on the landscape is an important process for maintenance of forest bat communities, including the little brown myotis (Buchalski et al. 2013). The species is also known to be adaptive to human disturbance and often uses buildings, bat houses and bridges for maternity roosts (COSEWIC 2013a). Overall, little brown myotis are expected to have the capacity to adapt and be resilient to existing natural and human-related disturbances and associated variations in habitat availability.

Table 4.2-21: Little Brown Myotis Habitat Availability in the RSA, Base Case

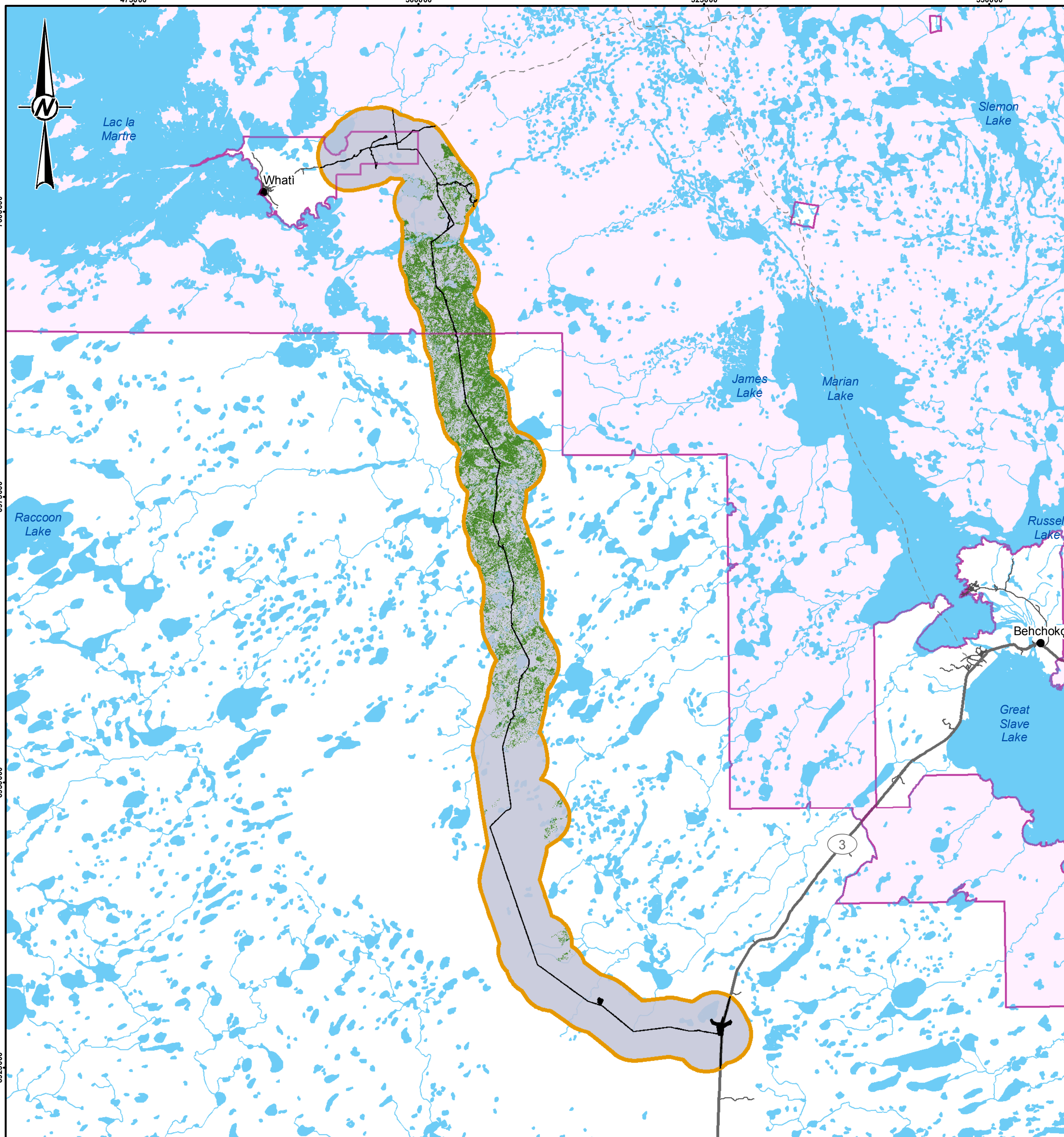
Habitat Suitability[a]	Area (ha)	Percent (%)
Moderate to High	10,592	19.1
Low to Nil	44,981	80.9
Total	**55,572**	**100**

Note: Numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.
[a] - Refer to Section 4.2.2 for descriptions of each habitat suitability category and Table 4.2-6 for relevant land cover classes.

Habitat Distribution

The little brown myotis is widely distributed across Canada and in the NWT; its range extends across the southern third of the province to near the treeline (COSEWIC 2013a). The species is a regional migrant and can move hundreds of kilometres between summer and winter areas (Fenton 1969; Kurta and Murray 2002; Norquay et al. 2013). In general, bats follow linear forest features for commuting and foraging, and little brown myotis are tolerant of linear disturbance, even when associated with noise (e.g., roads) (Abbott et al. 2012). General grid squares containing critical habitat (i.e., hibernacula) for little brown myotis do not overlap the RSA (Environment Canada 2015b), and most of the known hibernating bats of a region are found in only a few hibernacula. In the NWT, little brown myotis hibernate in caves or mines, with approximately 3,000 bats overwintering in just one NWT cave, the largest known hibernation site in Western Canada (GNWT-ENR 2013). Because of the congregatory (i.e., grouping) nature of this species, disturbance of hibernacula can have a disproportionate effect on local populations.

At Base Case, suitable little brown myotis habitat is well-distributed throughout the central portion of the RSA, but limited at the northern and southern ends (Figure 4.2-8). The majority of suitable little brown myotis habitat available in the RSA at Base Case is considered summer maternity roosting habitat as natural habitat features with potential to provide hibernacula for bats (e.g., rock barrens, talus slopes or cliffs) are limited in the RSA. Existing disturbances in the RSA do not function as dispersal barriers for this species at Base Case because bats are highly mobile and burns are considered an important process for maintenance of forest bat communities (Buchalski et al. 2013). Therefore, changes to habitat distribution at Base Case have not exceeded the resilience or adaptability limits of the little brown myotis.



LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- WATERCOURSE
- TŁĮCHǪ LAND
- WATER BODY
- DEVELOPMENT
- BUMBLE BEE, BIRD, AND BAT RSA

HABITAT SUITABILITY

- MODERATE TO HIGH
- NIL TO LOW

0 10 20

1:500,000 KILOMETRES

REFERENCE(S)

1. CIMP INVENTORY OF LANDSCAPE CHANGE, OBTAINED FROM THE NWT CENTRE FOR GEOMATICS.
2. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.

PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT

GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT

TŁĮCHǪ ALL-SEASON ROAD

TITLE

DISTRIBUTION OF SUITABLE LITTLE BROWN MYOTIS HABITAT AT BASE CASE

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-04-11
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PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO.	REV.	FIGURE
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Survival and Reproduction

Little brown myotis has not been assessed by the NWT Species at Risk Committee (SARC 2016a) and currently has no status on the NWT List of Species at Risk. However, little brown myotis is assessed by COSEWIC as endangered (COSEWIC 2016) and listed as endangered on Schedule 1 of the federal *SARA* (2016) due to dramatic population declines resulting from a devastating fungal disease called white-nose syndrome (WNS). Prior to the introduction of WNS, little brown myotis was probably the most common bat in Canada (Environment Canada 2015b). White-nose syndrome has reduced populations by more than 75% in infected hibernacula (Frick et al. 2010).

While WNS has not yet been identified in the NWT (SARC 2017b), environmental variables associated with habitat suitability for WNS indicate that all of the current Canadian range is susceptible to the disease and is expected to be infected within 12 to 18 years (COSEWIC 2013a). Mortality rates at infected sites in eastern Ontario were found to be 92% after two years of exposure (COSEWIC 2012). White-nose syndrome has been estimated to advance at an average rate of 200 km to 400 km per year (COSEWIC 2012). It is anticipated that the entire Canadian population of little brown myotis will be impacted by WNS within 11 to 22 years, or possibly sooner based on the recent confirmation of WNS in Washington State (USGS 2016). The little brown myotis is predicted to be functionally extirpated (i.e., less than 1% of existing population remaining) in Canada and the United States within 16 years (COSEWIC 2012) due to WNS. Although changes to little brown myotis abundance across much of its Canadian distribution may have exceeded the resilience and adaptability limits of this species due to the mortality associated with WNS, populations in the NWT are not known to be infected (SARC 2017b). Other factors that may affect their recovery are discussed below.

Little brown myotis are long-lived but only give birth to one pup per year (Fenton and Barclay 1980; Kuntz and Reichard 2010), making their populations sensitive to increases in adult mortality and slow to recover when the population size is small. Females may be reproductively active during their first year of life and have high fecundity rates (Kuntz and Reichard 2010). Individuals of this species have been recorded to live to over 30 years of age (Fenton and Barclay 1980), although the average life span is thought to be shorter (COSEWIC 2013a). Reproductive rates seem to decline with increasing latitude; a reproductive rate of greater than 96% was recorded in the eastern United States, with lower rates of 42% to 57% in British Columbia (COSEWIC 2013a). There is large uncertainty in survival data; however, mean annual survival of little brown myotis has been found to range from 0.82 to 1.55 for males and 0.71 to 2.2 for females according to studies completed in Indiana and Ontario (COSEWIC 2013a). Survival rates are lowest in the first year of age because juveniles often lack sufficient fat reserves needed for hibernation (COSEWIC 2013a).

Mortality of little brown myotis may result from collision with or barotrauma from wind turbines, extermination on private lands, disturbance during hibernation and declining insect populations. Little brown myotis are vulnerable to extermination because of their tendency to use anthropogenic structures (Environment Canada 2015b). Extermination of large colonies can affect local populations, particularly in areas that are already affected by WNS.

Disturbance during hibernation can result from recreational or industrial activities. Tourists, spelunkers and researchers are the main visitors to hibernacula but their impact is likely minimal because these visits typically occur in the summer (Environment Canada 2015b). Loud noise and vibration from industrial activities has the potential to disturb hibernating bats, or to otherwise interfere with their behaviour by masking echolocation and hearing (Schaub et al. 2008; Siemers and Schaub 2011). At present, little is known about the specific effects of noise on the behaviour of the little brown myotis.

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4.2.3.7 Bank and Barn Swallow

Habitat Availability

Approximately 4,196 ha (7.5%) of the RSA represents suitable breeding habitat for bank and barn swallows at Base Case (Table 4.2-22). Habitat availability may be a limiting factor for both birds due to the specificity of nesting sites. Bank swallow requires specific soil and bank conditions for nesting (COSEWIC 2013), and barn swallow relies heavily on human infrastructure, such as buildings, bridges, and culverts, for nest sites.

However, bank and barn swallow are highly mobile and only present in the RSA seasonally, so they are expected to have the capacity to adapt and be resilient to existing natural and human-related disturbances and associated variations in habitat availability.

Table 4.2-22: Bank and Barn Swallow Habitat Availability in the RSA, Base Case

Habitat Suitability[a]	Area (ha)	Percent (%)
Moderate to High	4,196	7.5
Low to Nil	51,376	92.5
Total	**55,572**	**100**

Note: Numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.
[a] - Refer to Section 4.2.2 for descriptions of each habitat suitability category and Table 4.2-7 for relevant land cover classes.

Habitat Distribution

Bank Swallow

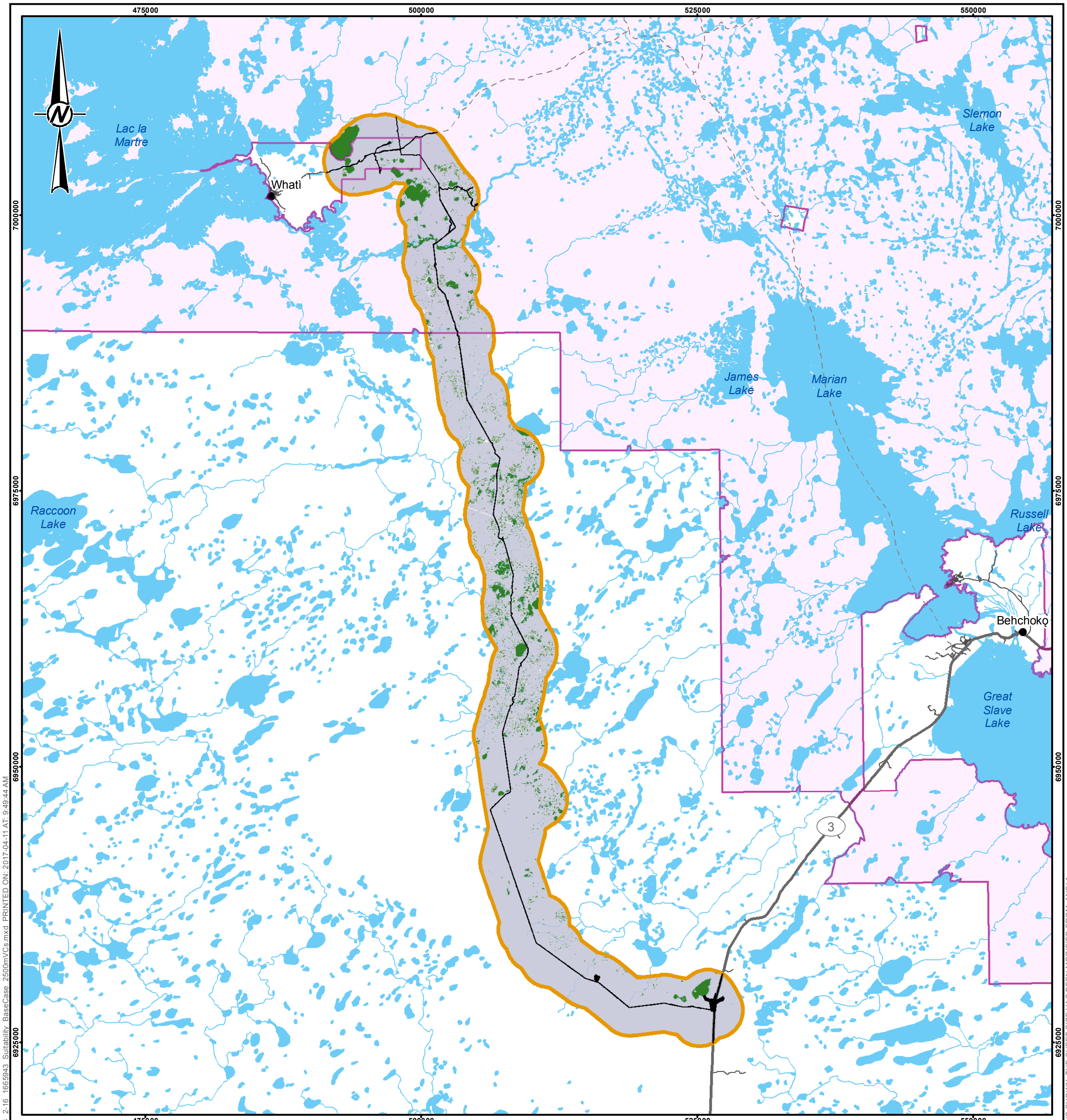
The Project is at the northern edge of this species distribution in Canada (Garrison 1999; COSEWIC 2013c). Suitable habitat for bank swallow is patchily distributed at Base Case (Figure 4.2-9). Habitat is likely a limiting factor for bank swallow at Base Case because this species requires specific soil and bank conditions for nesting (COSEWIC 2013). However, this species is highly mobile and can establish territories in new areas (Ghent 2001).

Barn Swallow

The Project is at the northern edge of barn swallow distribution in Canada (Brown and Brown 1999; COSEWIC 2011). At Base Case, suitable barn swallow habitat is patchily distributed throughout the RSA and is primarily associated with areas containing human infrastructure (Figure 4.2-9). Habitat may be a limiting factor for barn swallow at Base Case because this species relies heavily on human infrastructure, such as buildings, bridges, and culverts, for nest sites. However, this species is highly mobile and can establish territories in new areas.

Narrow linear disturbances, such as road corridors, generally do not represent barriers to bird movement (Desrochers and Hannon 1997). St. Clair et al. (1998) found that some forest birds were reluctant to cross gaps greater than 50 m, but would cross gaps of 200 m when no other choice existed. Existing disturbances in the RSA do not likely function as dispersal barriers for this species at Base Case.

Habitat fragmentation is not thought to be a limiting factor for barn swallow (Gaines et al. 2003), likely because of their high mobility and use of open areas for foraging.



LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- WATERCOURSE
- TŁĮCHǪ LAND
- WATER BODY
- DEVELOPMENT
- BUMBLE BEE, BIRD, AND BAT RSA

HABITAT SUITABILITY

- MODERATE TO HIGH
- NIL TO LOW

0 10 20

1:500,000 KILOMETRES

REFERENCE(S)

1. CIMP INVENTORY OF LANDSCAPE CHANGE, OBTAINED FROM THE NWT CENTRE FOR GEOMATICS.
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PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
TŁĮCHǪ ALL-SEASON ROAD

TITLE
DISTRIBUTION OF SUITABLE BARN AND BANK SWALLOW HABITAT AT BASE CASE

CONSULTANT

YYYY-MM-DD	2017-04-11
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PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO. 1665943 REV. 0 FIGURE 4.2-9

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Survival and Reproduction

Bank Swallow

Canada was thought to support approximately 1.4 million bank swallows in 2007; the current population estimate is likely lower because of the population declines since 2007 (COSEWIC 2013c). The population estimate of bank swallows in the NWT was approximately 40,000 individuals in 2007; however there is low confidence in this estimate as only five Breeding Bird Survey routes were surveyed in the territory (COSEWIC 2013c).

The long-term breeding bird survey (BBS) data show that bank swallow populations in Canada have decreased by 8.84% per year from 1970 to 2011; this in an overall decline of 98% (COSEWIC 2013c). Population trends for bank swallow are not available for the NWT (Environment Canada 2014). This species is considered a priority species under the Bird Conservation Strategy for the region, which has the objective of assessing and maintaining the population (Environment Canada 2013b). The bank swallow was designated as threatened by COSEWIC in 2013 but has yet to be listed under SARA.

A total of 238 individuals have been recorded along Highway 3 between Fort Providence and Edzo from 2013 to 2016 (eBird 2016).

The bank swallow primarily feeds on jumping and flying insects (Garrison 1999). Insect populations are declining worldwide and this may be contributing to bank swallow decline (COSEWIC 2011). Many aerial-foraging insectivorous birds, such as bank swallow, have experienced large declines since the 1980s (Blancher et al. 2009; NABCIC 2012). The declines suggest a single cause related to insect abundance as both forest and non-forest aerial-foraging birds are declining (Blancher et al. 2009; Nebel et al. 2010; Nocera et al. 2012; Paquette et al. 2014). Potential causes of reduced availability of insects include habitat loss, changes to timing of peak food abundance from climate change, and pesticide use (Nebel et al. 2010; Nocera et al. 2012; Paquette et al. 2014). Insect and bird populations in the RSA have likely been affected by all of these factors at Base Case.

Barn Swallow

Canada is thought to support approximately 22% of the North American population of barn swallow (10.9 million individuals), and 6% of the global population (COSEWIC 2011). The population estimate of barn swallows in the NWT was approximately 305,000 individuals in 1999 (COSEWIC 2011). There is low confidence in the population trends for barn swallow in the NWT as there have only been four routes surveyed in the territory (Environment Canada 2014). The estimated trend shows an annual decrease of 7.09%, for an overall decline of 86% from 1989 to 2012 (Environment Canada 2014).

Because the barn swallow population in Canada has declined by 86% from 1989 to 2012, it is considered a priority species under the Bird Conservation Strategy for the region, which has the objective of increasing the population by 50% (Environment Canada 2013b). The barn swallow was designated as threatened by COSEWIC in 2011 but has yet to be listed under SARA.

Six barn swallows were recorded in the community of Whatì in 2004 and a total of 95 individuals have been recorded along Highway 3 between Fort Providence and Edzo from 1999 to 2016, with most observations recorded from 2012 to 2016 (eBird 2016).

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The main threats to barn swallow populations are not well understood. Habitat loss and degradation on breeding grounds, large scale changes in insect prey abundance, climate change, interspecific competition for nest sites from invasive species, nest parasitism, and human persecution are all threats that may be affecting barn swallow populations (COSEWIC 2011).

The barn swallow primarily feeds on flying insects. Insect populations are declining worldwide and this may be contributing to barn swallow decline (COSEWIC 2011). Potential causes of reduced availability of insects include habitat loss, changes to timing of peak food abundance from climate change, and pesticide use (Nebel et al. 2010; Nocera et al. 2012; Paquette et al. 2014). Insect and bird populations in the RSA have likely been affected by all of these factors at Base Case.

4.2.3.8 Bumble Bees

Habitat Availability

The yellow-banded bumble bee is a habitat generalist that is found within a wide variety of open to semi-open habitats including open coniferous, deciduous and mixed-wood forests, wet and dry meadows and prairie grasslands, meadows bordering riparian zones, and along roadsides, in taiga adjacent to wooded areas, urban parks, gardens and agricultural areas, and subalpine habitats (COSEWIC 2015). Nests are typically established in abandoned rodent burrows, but also in grassy hummocks, rotted logs or cavities in dead wood (COSEWIC 2015).

The gypsy cuckoo bumble bee is an obligate social parasite that uses host colonies of bumble bees belonging to the subgenus *Bombus senso stricto* to raise its young (COSEWIC 2015). Consequently, habitat preferences are strongly dependent on host species. Host species have not been confirmed, but in the NWT likely include the yellow-banded bumble bee, the cryptic bumble bee (*Bombus cryptarum*) and the northern subspecies of the western bumble bee (*Bombus occidentalis mckayi*) (COSEWIC 2014a). However, the range of the western bumble bee in the NWT does not approach the RSA (GNWT 2013). Suspected host species have similar habitat preferences. Therefore, the habitat preferences of the yellow-banded bumble bee are considered representative of all three host species for the purposes of this assessment.

Both the yellow-banded bumble bee and gypsy cuckoo bumble bee are generalist foragers, feeding on the nectar and pollen of a wide variety of plant species (COSEWIC 2014a, 2015). Specific overwintering habitat requirements are unknown; however, bumble bees in general overwinter underground near nesting sites (Macfarlane 1974 in COSEWIC 2014a; Benton 2006).

Approximately 16,842 ha (30.3%) of the RSA represents suitable habitat for yellow-banded and gypsy cuckoo bumble bees at Base Case (Table 4.2-23). Both species have a wide historical distribution in Canada that spans multiple ecosystems and generalized habitat preferences, which suggests habitat loss has not been a major driver of population decline for either species (COSEWIC 2014a, 2015). Both bee species are expected to have the capacity to adapt and be resilient to existing natural and human-related disturbances and associated variations in habitat availability.

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Table 4.2-23: Bumble Bee Habitat Availability in the RSA, Base Case

Habitat Suitability[a]	Area (ha)	Percent (%)
Moderate to High	16,842	30.3
Low to Nil	38,731	69.7
Total	**55,572**	**100**

Note: Numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.
[a] - Refer to Section 4.2.2 for descriptions of each habitat suitability category and Table 4.2-8 for relevant land cover classes.

Habitat Distribution

Approximately 50% to 60% of the global range of yellow-banded bumble bee occurs in Canada (COSEWIC 2015). In the NWT, the yellow-banded bumble bee has been recorded in the central Taiga Plains Ecoregion. The most recent observations of this species were made along the lower Nahanni River and Fort Simpson in 2011 (COSEWIC 2015). At Base Case, suitable bumble bee habitat is well-distributed throughout the central portion of the RSA, but limited at the northern and southern ends (Figure 4.2-10).

Predictive habitat modelling conducted for the federal status report did not identify any suitable habitat for the gypsy cuckoo bumble bee in the vicinity of the RSA (COSEWIC 2014a). The gypsy cuckoo bumble bee was last recorded in the NWT in 1972. A total of 38 records have been made of this species in the NWT, from Reindeer Depot, Norman Wells, Fort Smith, Fort Simpson, Hay River, Aklavik, Fort McPherson, and No Name Creek (COSEWIC 2014a). The closest record to the RSA is approximately 190 km to the southeast, at Hay River. No gypsy cuckoo bumble bees were observed during surveys in 2011 in the Nahanni River Region despite the presence of western and yellow-banded bumble bees in the region (COSEWIC 2014a, 2015). However, much of the NWT has not been surveyed for bumble bees.

Information on the dispersal of bumble bees is limited. Most dispersal occurs in the spring when females (future queens) emerge from hibernation to mate and search for suitable nesting habitat in which to establish a colony. A study on bumble bee dispersal in the United Kingdom that used genetic techniques to match the colony of origin with the dispersed queen the next spring found that queens were able to disperse by at least 3 km (Lepais et al. 2010). Males of the buff-tailed bumble bee (*Bombus terretris*), which is closely related to the yellow-banded bumble bee and a known host of the gypsy cuckoo bumble bee in Europe, have been estimated to disperse between 2.6 and 9.9 km from the colony of origin (Kraus et al. 2008). Bumble bees also disperse to search for food, with foraging distances up to 20 km reported (Goulson 2010).

Bees are especially vulnerable to habitat fragmentation because dispersal is important for survival due to small effective population sizes, how spread out suitable habitat is, and the haplodiploid nature of bee reproduction (females hatch from fertilized [diploid] eggs while males hatch from unfertilized [haploid] eggs). Consequences of small population sizes are discussed further in the following section (Survival and Reproduction).

Fragmentation of the population depends on the total area of habitat patches, and the distance separating different habitat patches. Passive dispersal or dispersal through other means, such as by humans, is unlikely. Since the gypsy cuckoo bumble bee is an obligate social parasite, its distribution and ability to disperse are dependent on the distribution of its hosts, and declines in host species have likely impacted its distribution.

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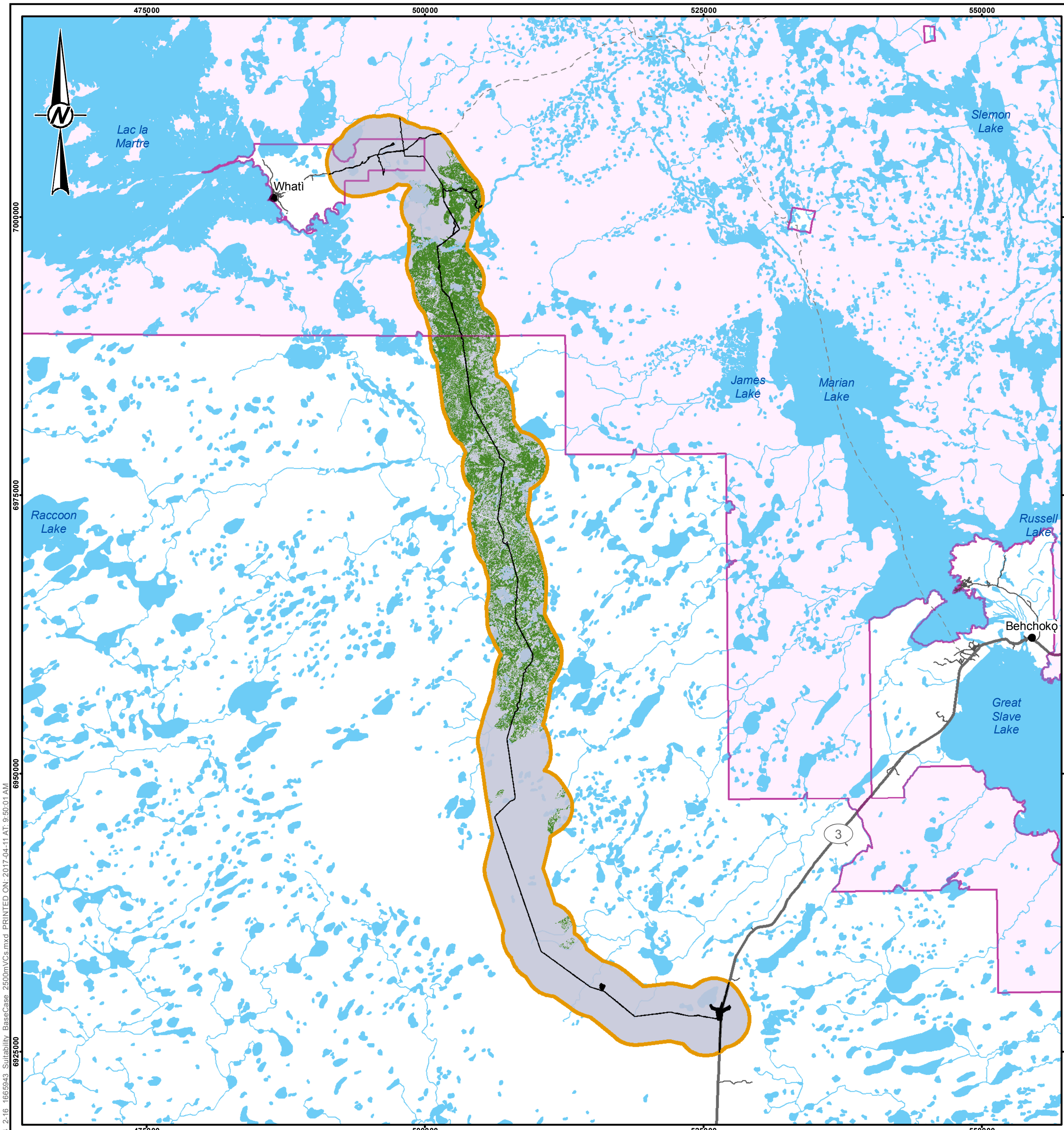

LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- WATERCOURSE
- TŁĮCHǪ LAND
- WATER BODY
- DEVELOPMENT
- BUMBLE BEE, BIRD, AND BAT RSA

HABITAT SUITABILITY

- MODERATE TO HIGH
- NIL TO LOW

0 10 20

1:500,000 KILOMETRES

REFERENCE(S)

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PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
TŁĮCHǪ ALL-SEASON ROAD

TITLE
DISTRIBUTION OF SUITABLE BUMBLE BEES HABITAT AT BASE CASE

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO. 1665943 REV. 0 FIGURE 4.2-10

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Survival and Reproduction

Yellow-banded bumble bee and gypsy cuckoo bumble bee are not assessed by the SARC (2016a), but are federally assessed as special concern and endangered, respectively, by COSEWIC (2016), and are both under consideration by the federal SARA (2016).

The northern range of yellow-banded bumble bee in Canada has been poorly surveyed and an accurate analysis of population changes has not been possible. However, yellow-banded bumble bee is still considered to be relatively common and abundant throughout the northern portion of its range. Across southern Canada, population-level declines of up to 34% have been recorded in recent years (i.e., 2004-2014). Although specific causes of the population decline are uncertain, suspected factors included pesticide use, habitat conversion, and pathogen spillover from managed bumble bee populations (COSEWIC 2015). In the southern part of its range, continued loss of habitat quantity and quality due to agriculture and urbanization is expected to contribute to continued population decline (COSEWIC 2015).

Although numbers of gypsy cuckoo bumble bee in Canada were never abundant, its range was widespread and covered the majority of Canadian provinces and territories (COSEWIC 2014a). Gypsy cuckoo bumble bee is a parasitic species that relies on host species to raise their offspring. As such, the greatest threat to gypsy cuckoo bumble bee survival is the decline of host bumble bee populations. Host species, including western bumble bee and yellow-banded bumble bee, have declined in southern Canada to numbers low enough to cause the local disappearance of gypsy cuckoo bumble bee. The causes of the declines on host species are not yet clear, but are suspected to include competition of non-native bumble bee species, pesticides, and habitat loss (COSEWIC 2014a). However, both host species appear to be stable and abundant across the northern extent of their ranges, including in the NWT (COSEWIC 2014a).

Two major limiting factors to survival that are common across all bumble bee species are reproduction characteristics (i.e., haplodiploid organisms), and an adequate supply of floral resources (i.e., pollen and nectar) throughout the growing season (COSEWIC 2014a, 2015).

Yellow-banded bumble bees mate in the fall, after which the males die and only the mated queen overwinters. The queen emerges the following spring, in April or May, and begins to forage and search for suitable nest sites to colonize. Following the queen's initial egg-laying at the chosen nest site, female workers begin to emerge and forage for the colony. Once maximum female worker production is met, males and potential queens begin to be produced (COSEWIC 2015). Gypsy cuckoo bumble bee follows a similar life cycle, but typically emerges about a month after the host species. It then invades the nest of the host species, displaces the resident queen, and relies on the female workers to raise their offspring (COSEWIC 2014a). Because only the mated queens overwinter, a lack of early-spring resources can result in death of the colony or dispersal of newly emerged queens (COSEWIC 2014a, 2015).

When the effective population size decreases, the frequency of inbreeding increases, which results in a corresponding increase in the numbers of diploid (i.e., sterile) males that are produced (COSEWIC 2014a, 2015). As a result of this increase in sterile males, the number of available mates for queens of that bee species decreases and puts the survivability of that species at risk.

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4.2.3.9 Common Nighthawk

Habitat Availability

Approximately 26,637 ha (47.9%) of the RSA represents suitable breeding habitat for common nighthawk at Base Case (Table 4.2-24). There is a large amount of moderate and high quality habitat in the RSA at Base Case. In addition, the net effects of natural and anthropogenic disturbance and activities in the RSA (e.g., fire) have probably resulted in more suitable habitat than was historically available as common nighthawk can use disturbed areas for breeding (COSEWIC 2007a). As burned areas regenerate, common nighthawk is expected to relocate to newly burned areas or other areas with suitable breeding habitat (COSEWIC 2007a; Campbell et al. 2006).

Common nighthawk is highly mobile and only present in the RSA seasonally, so is expected to have the capacity to adapt and be resilient to existing natural and human-related disturbances and associated variations in habitat availability.

Table 4.2-24: Common Nighthawk Habitat Availability in the RSA, Base Case

Habitat Suitability[a]	Area ha)	Percent (%)
Moderate to High	26,637	47.9
Low to Nil	28,935	52.1
Total	**55,572**	**100**

Note: Numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.
[a] - Refer to Section 4.2.2 for descriptions of each habitat suitability category and Table 4.2-9 for relevant land cover classes.

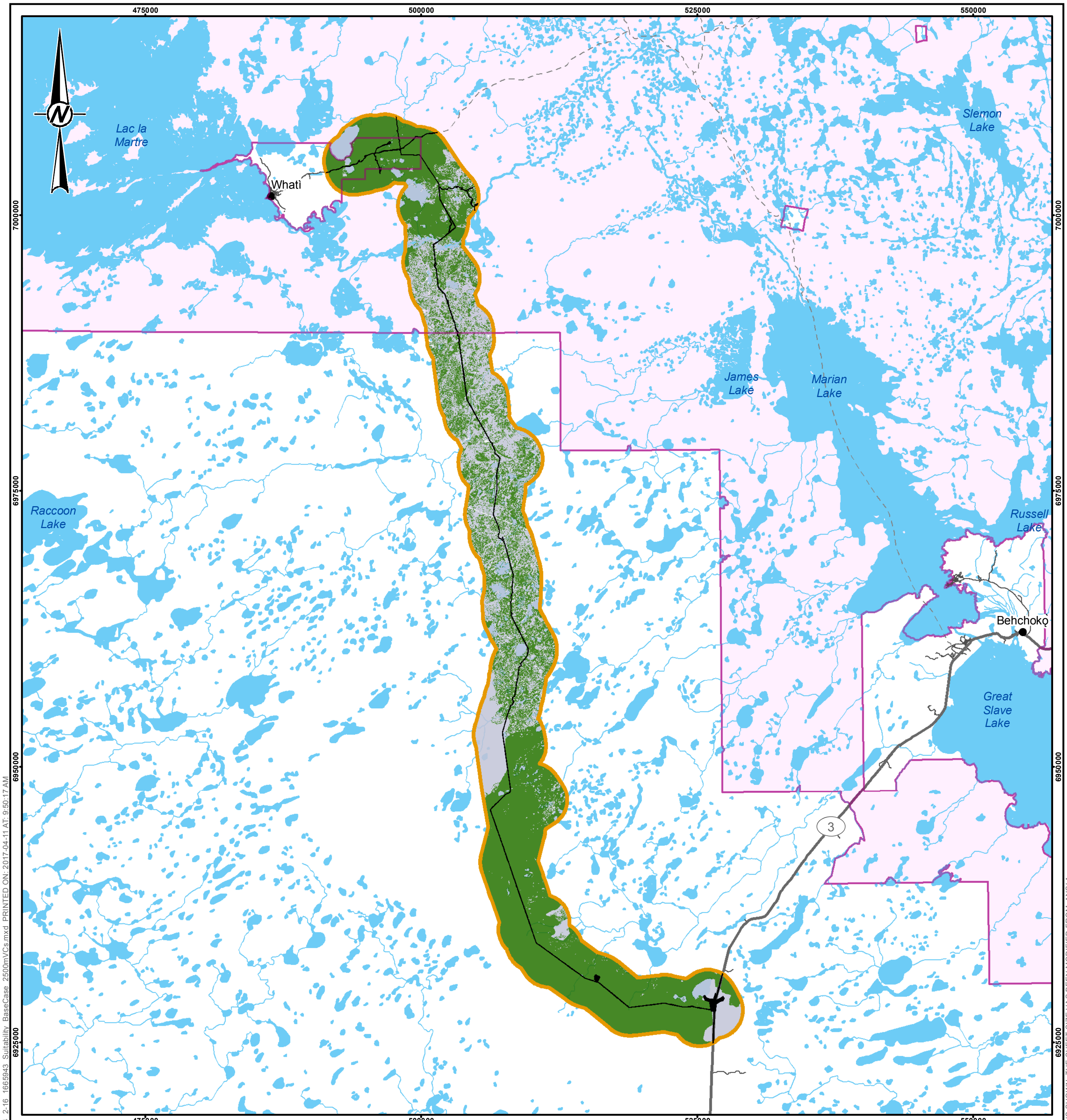
Habitat Distribution

The common nighthawk is widely distributed across Canada and is found in all provinces and territories except Nunavut. In the NWT, its range extends from the southern portion of the territory north along the Mackenzie Valley to Norman Wells (COSEWIC 2007a). The common nighthawk migrates to South America from mid-August to mid-September, returning to Canada from early May to the beginning of June in one of the longest north-south migrations of any species in North America (COSEWIC 2007a).

Common nighthawks are known to roost singly, but occasionally roost in groups of 50 or more individuals (Campbell et al. 2006). Communal roosts observed in British Columbia were predominantly comprised of males and were found in open forest usually near watercourses or water bodies (Campbell et al. 2006). The species may gather in large flocks to feed on hatches of flying insects, especially in late summer (Campbell et al. 2006; Brigham et al. 2011).

Common nighthawk is highly territorial. Territory size is based primarily on the suitability of habitat and availability of nest sites (COSEWIC 2007; Campbell et al. 2006). The size of individual territories varies in urban and natural habitats with territory sizes in urban areas ranging from an estimated 4.14 to 22.8 ha in British Columbia and 18.6 ha in Saskatchewan and territory size in natural habitats being an estimated 28.3 ha (Campbell et al. 2006; COSEWIC 2007).

Natural changes to habitat such as fire, provide opportunities for nesting. Burned areas from 2014 fires in the RSA are expected to provide suitable nesting habitat. As burned areas regenerate, the species is expected to adapt readily to changes by relocating (COSEWIC 2007; Campbell et al. 2006). Existing disturbances in the RSA do not likely function as dispersal barriers for this species at Base Case. Suitable habitat for common nighthawk is widely distributed and connected throughout the RSA at Base Case (Figure 4.2-11), and is particularly dense at the north and south ends of the RSA where recent forest fires have created large areas of suitable habitat.



LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- WATERCOURSE
- TŁĮCHǪ LAND
- WATER BODY
- DEVELOPMENT
- BUMBLE BEE, BIRD, AND BAT RSA

HABITAT SUITABILITY

- MODERATE TO HIGH
- NIL TO LOW

0 10 20

1:500,000 KILOMETRES

REFERENCE(S)

1. CIMP INVENTORY OF LANDSCAPE CHANGE, OBTAINED FROM THE NWT CENTRE FOR GEOMATICS.
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PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
TŁĮCHǪ ALL-SEASON ROAD

TITLE
DISTRIBUTION OF SUITABLE COMMON NIGHTHAWK HABITAT AT BASE CASE

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO.	REV.	FIGURE
1665943	0	4.2-11

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Survival and Reproduction

Common nighthawk are not assessed by the SARC (2016) but are federally assessed as threatened by the COSEWIC (2016) and listed as threatened on Schedule 1 of the federal *SARA* (2016) due to both short- and long-term population declines (COSEWIC 2007a). The population status of the common nighthawk is relatively unknown due to strong variations in local abundance (FAN 2007) and the difficulty of observing the species. However, long-term data collected in Canada from 1968 to 2005 suggests a population decline (COSEWIC 2007a). Based on results from common nighthawk surveys completed from 1968 to 2005, there has been a decline of 13.7% per year in the boreal taiga plains (COSEWIC 2007a). An analysis of BBS data by Environment Canada (2014) shows the common nighthawk population declining at an average rate of 11.90% per year in the NWT from 1989 to 2012. Sauer et al. (2014) analyzed BBS data and estimated that common nighthawk populations in the boreal taiga plain have declined by 7.8% per year from 1966 to 2012. However, BBS data are not designed for surveying for common nighthawks, and the accuracy of trends estimated from those data are therefore unknown.

Reasons for the apparent decline of common nighthawk populations are not well understood, but may be due in part to a reduction of food sources and reduced breeding habitat availability (COSEWIC 2007a; Brigham et al. 2011). The main threats to common nighthawk populations in North America are suggested to be the loss and alteration of suitable breeding habitat (COSEWIC 2007a; Environment Canada 2016b). For example, fire suppression and changes in harvesting practices have reduced the number of open areas in forested regions, and the loss of native prairie to intensive agriculture has reduced common nighthawk nesting habitat (COSEWIC 2007a). In addition, temperature extremes and storms, decreases in wetland habitats, pesticide use, and acid precipitation may contribute to the reduced availability of insect prey (Environment Canada 2016b).

The common nighthawk is vulnerable to vehicle collisions because they roost on gravel roads and forage while flying between feeding areas over roads (Campbell et al. 2006; Brigham et al. 2011; American Bird Conservancy 2016; Environment Canada 2016b). Vehicle collisions are expected to become a growing source of mortality as road infrastructure expands to areas where it has not previously occurred (Environment Canada 2016b). Mortality of the species may also result from activities including shooting and outdoor recreation (e.g., ATVs, foot traffic) (Campbell et al. 2006).

Although information on the age of first breeding is unknown, it is assumed that nighthawks breed at one year of age and every year thereafter (Brigham et al. 2011). Common nighthawks typically lay two eggs and have one clutch per year (Brigham et al. 2011).

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4.2.3.10 Olive-sided Flycatcher

Habitat Availability

There is a large amount of moderate to high quality breeding habitat in the RSA at Base Case. Approximately 43,093 ha (77.5%) of the RSA represents suitable breeding habitat for olive-sided flycatcher (Table 4.2-25). Assuming that the average territory size of olive-sided flycatchers is 18.4 ha (COSEWIC 2007c), there is potential breeding habitat for a large number of olive-sided flycatcher pairs in the RSA at Base Case.

Fire disturbance (i.e., within the last 40 years) has altered approximately 26,861 ha (48%) of the RSA at Base Case. The net effects of natural (e.g., fire) and anthropogenic disturbance in the RSA have probably resulted in more suitable habitat than was historically available as olive-sided flycatcher use disturbed areas for breeding (COSEWIC 2007c; Environment Canada 2016c). As burned areas regenerate, olive-sided flycatcher is expected to relocate to newly burned areas or other areas with suitable breeding habitat (COSEWIC 2007c; Environment Canada 2016c).

It is currently unknown if the availability of breeding habitat is a limiting factor for olive-sided flycatcher (Environment Canada 2016c). In addition, olive-sided flycatcher is highly mobile and only present in the RSA seasonally, so is expected to have the capacity to adapt and be resilient to existing natural and human-related disturbances and associated variations in habitat availability.

Table 4.2-25: Olive-sided Flycatcher Habitat Availability in the RSA, Base Case

Habitat Suitability[a]	Area (ha)	Percent (%)
Moderate to High	43,093	77.5
Low to Nil	12,479	22.5
Total	**55,572**	**100.0**

Note: Numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.
[a] - Refer to Section 4.2.2 for descriptions of each habitat suitability category and Table 4.2-10 for relevant land cover classes.

Habitat Distribution

The olive-sided flycatcher is found throughout forested areas of the NWT (COSEWIC 2007c). It is locally and patchily distributed, and is generally found at low densities throughout its range in Canada (COSEWIC 2007c). The importance of habitat distribution and connectivity for the olive-sided flycatcher is largely unknown (Environment Canada 2016c). McGarigal and McCombs (1995) found that olive-sided flycatcher abundance is positively associated with the amount of old-growth forest, forest edge, and fragmentation. Similarly, point count data collected across Canada indicate that mature conifer stands within patchy landscapes support the highest densities of the species (COSEWIC 2007c; Environment Canada 2016c). A review of the status of landbirds in Alberta's Boreal Plains Ecozone determined that the abundance of olive-sided flycatcher peaked in landscapes with approximately 40% human footprint (ABMI 2012). A recent analysis of habitat requirements completed by Haché et al. (2014) found that the species is negatively affected by linear disturbances, although the mechanisms underlying this response is unclear and requires additional investigation.

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Suitable habitat for olive-sided flycatcher occurs throughout the RSA at Base Case (Figure 4.2-12). Linear disturbances such as the existing Old Airport Road route and the network of trails surrounding the TASR route generally do not represent barriers to bird movement (Desrochers and Hannon 1997; St. Clair et al. 1998), although they may influence territory establishment and delineation (Machtans 2006; Ashenhurst and Hannon 2008). Overall, olive-sided flycatcher breeding habitat is well distributed and connected in the RSA and existing disturbances in the RSA do not likely function as movement or dispersal barriers for this species at Base Case.

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LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- WATERCOURSE
- TŁĮCHǪ LAND
- WATER BODY
- DEVELOPMENT
- BUMBLE BEE, BIRD, AND BAT RSA

HABITAT SUITABILITY

- MODERATE TO HIGH
- NIL TO LOW

0 10 20

1:500,000 KILOMETRES

REFERENCE(S)

1. CIMP INVENTORY OF LANDSCAPE CHANGE, OBTAINED FROM THE NWT CENTRE FOR GEOMATICS.
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PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT

GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT

TŁĮCHǪ ALL-SEASON ROAD

TITLE

DISTRIBUTION OF SUITABLE OLIVE-SIDED FLYCATCHER HABITAT AT BASE CASE

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO.	REV.	FIGURE
1665943	0	4.2-12

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Survival and Reproduction

Olive-sided flycatcher is designated as Threatened by COSEWIC (2007c) and listed as Threatened on Schedule 1 of the *SARA* (Environment Canada 2016c). An estimated 900,000 individuals breed in Canada, which is considered adequate to sustain the Canadian population (Environment Canada 2016c). An estimated 120,000 individuals breed in the NWT and Nunavut (PFSC 2013). The RSA is located in Bird Conservation Region 6, and the density estimates for Bird Conservation Region 6 in the NWT is 0.0116 males/ha (BAMP 2014). Applying this abundance estimate to the total area of the RSA, and assuming each male represents a breeding pair, this equates to a rough abundance estimate of 645 olive-sided flycatcher pairs in the RSA at Base Case, although the density may be higher due to the large amount of suitable habitat present in the RSA at Base Case.

An analysis of BBS survey data by Environment Canada (2014) indicates an annual rate of decline in population size of 3.4% between 1973 and 2012 across Canada, and a decline of 5.4% in the NWT (Environment Canada 2014). A 3.4% annual rate of decline corresponds to an approximate 75% decline in the Canadian population since 1970 (Environment Canada 2014). However; more recent analyses completed by the Boreal Avian Monitoring Project (BAMP) found no evidence for a decline in olive-sided flycatcher density across Canada between 1997 and 2013 (Haché et al. 2014).

The main threats to olive-sided-flycatcher populations include habitat loss or degradation, fire suppression, and reduced availability of insect prey (Environment Canada 2016c). Olive-sided flycatcher have been shown to respond both positively and negatively to forest management activities such as timber harvest on their breeding grounds (Robertson and Hutto 2007; Meehan et al. 2003) and it is currently unknown whether availability of breeding habitat is a limiting factor for this species (Environment Canada 2016c). Some studies suggest that deforestation on tropical wintering grounds may be the primary factor in the decline of this species (Petit et al. 1993; Altman and Sallabanks 2012). In addition, a decline in aerial insect abundance and availability from habitat loss, pesticide use, and climate-induced changes to the timing of insect emergence on their breeding grounds may be contributing to the decline of the species (Environment Canada 2016c). Olive-sided flycatcher may be particularly susceptible to these factors because they have low reproductive potential compared to other passerines and the longest migration distance of all flycatchers (Environment Canada 2016c). The olive-sided flycatcher RSA has likely been affected by some of these factors at Base Case; however, considering the availability and distribution of habitat, changes in survival and reproduction are expected to be within the resilience and adaptive capacity limits for this species.

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4.2.3.11 Horned Grebe, Yellow Rail and Red-necked Phalarope

Habitat Availability

There is limited suitable breeding habitat for horned grebe, yellow rail and red-necked phalarope in the RSA at Base Case. Approximately 3,734 ha (6.7%) of the RSA represents suitable breeding habitat for horned grebe, yellow rail and red-necked phalarope at Base Case (Table 4.2-26). The number of horned grebe, yellow rail, and red-necked phalarope breeding in the RSA likely varies from year-to-year depending on natural factors such changes in water levels and population cycles. Reported average territory sizes of horned grebes (0.78 ha; COSEWIC 2009a) and yellow rails (7.8 ha; COSEWIC 2009b) are small and restricted to their breeding wetlands, while red-necked phalaropes do not defend territories (COSEWIC 2014b).

Horned grebe, yellow rail, and red-necked phalarope are highly mobile and only present in the RSA seasonally, so they are expected to have the capacity to adapt and be resilient to existing natural and human-related disturbances and associated variations in habitat availability.

Table 4.2-26: Horned Grebe, Yellow Rail and Red-necked Phalarope Habitat Availability in the RSA, Base Case

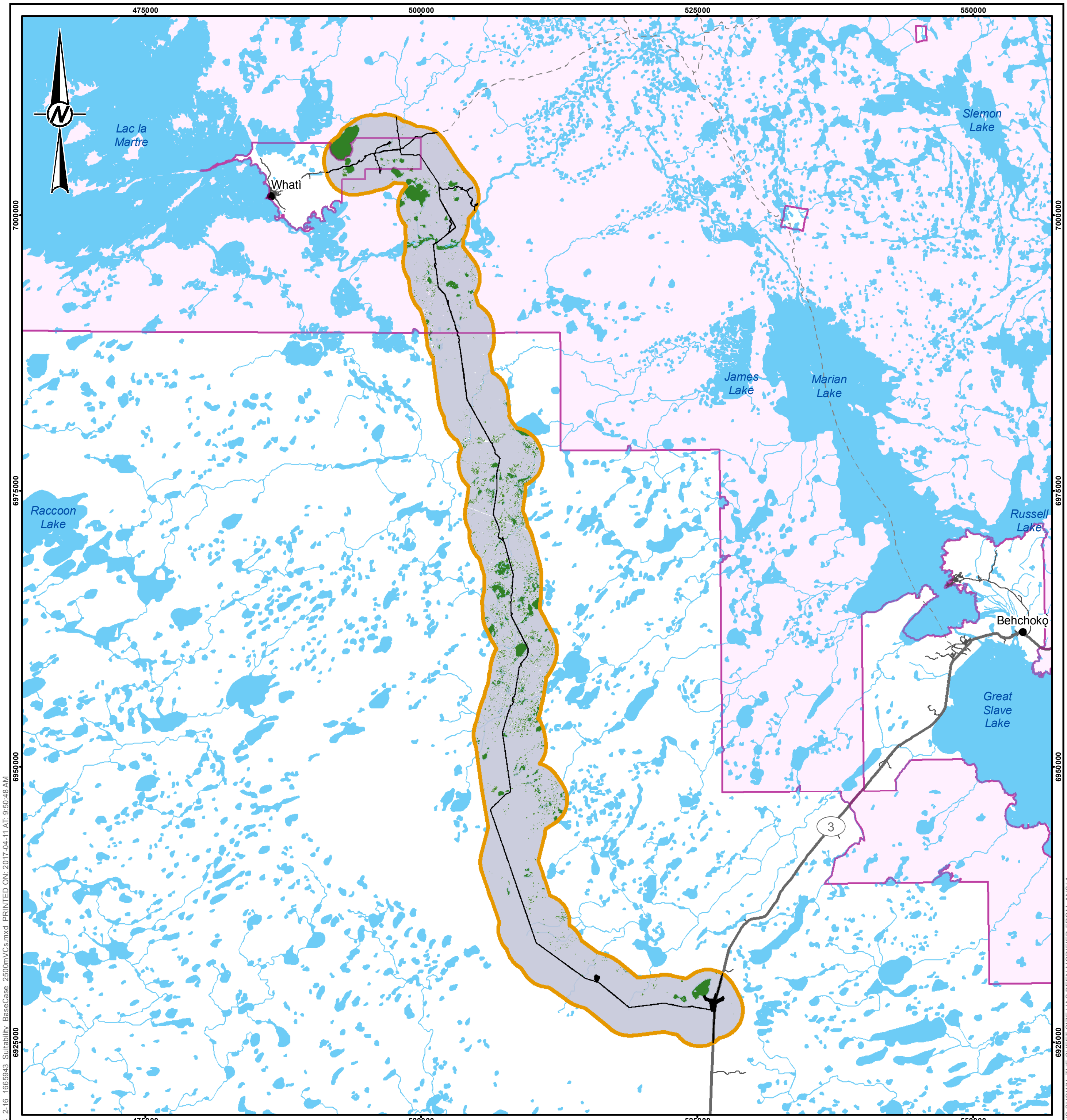
Habitat Suitability[a]	Area (ha)	Percent (%)
Moderate to High	3,734	6.7
Low to Nil	51,839	93.3
Total	**55,572**	**100.0**

Note: Numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.
[a] - Refer to Section 4.2.2 for descriptions of each habitat suitability category and Table 4.2-11 for relevant land cover classes.

Habitat Distribution

Horned grebe, yellow rail and red-necked phalarope are highly mobile wetland associated species that travel annually from their southern wintering grounds to their northern breeding grounds. Within their known breeding ranges, horned grebe, yellow rail and red-necked phalarope are localized and suitable breeding habitats are usually patchily distributed on the landscape as specific wetland conditions are required. Reported average territory sizes of horned grebes (0.78 ha; COSEWIC 2009a) and yellow rails (7.8 ha; COSEWIC 2009b) are relatively small, and red-necked phalaropes do not defend territories (COSEWIC 2014b). Horned grebe and red-necked phalarope show some fidelity to breeding sites (COSEWIC 2009a; COSEWIC 2009b), whereas yellow rail typically do not (Leston and Bookhout 2015).

Suitable habitat for horned grebe, yellow rail and red-necked phalarope occurs in numerous discrete patches throughout the RSA at Base Case (Figure 4.2-13). Linear disturbances such as the existing Old Airport Road route and the network of trails surrounding the TASR route generally do not represent barriers to bird movement (Desrochers and Hannon 1997; St. Clair et al. 1998), although they may influence territory establishment and delineation (Machtans 2006; Ashenhurst and Hannon 2008). Overall, habitat distribution is patchy and not well connected across the RSA, but horned grebe, yellow rail and red-necked phalarope have high mobility and existing disturbances in the RSA do not likely function as movement barriers at Base Case.



LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- WATERCOURSE
- TŁĮCHǪ LAND
- WATER BODY
- DEVELOPMENT
- BUMBLE BEE, BIRD, AND BAT RSA

HABITAT SUITABILITY

- MODERATE TO HIGH
- NIL TO LOW

0 10 20

1:500,000 KILOMETRES

REFERENCE(S)

1. CIMP INVENTORY OF LANDSCAPE CHANGE, OBTAINED FROM THE NWT CENTRE FOR GEOMATICS.
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PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
TŁĮCHǪ ALL-SEASON ROAD

TITLE
DISTRIBUTION OF SUITABLE HORNED GREBE, YELLOW RAIL AND RED-NECKED PHALAROPE HABITAT AT BASE CASE

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO.	REV.	FIGURE
1665943	0	4.2-13

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Survival and Reproduction

Horned Grebe

The horned grebe (western population) is estimated to total between 200,000 and 500,000 individuals (COSEWIC 2009). Horned grebes reach highest breeding abundance in prairie and parkland habitats, with smaller populations found in boreal and subarctic zones (COSEWIC 2009). In the NWT, the horned grebe nests in low densities throughout much of the boreal and subarctic regions (COSEWIC 2009). Although densities similar to those recorded in the prairies (1.5-3.3 pairs/km^2) have been recorded near Yellowknife, NWT (2.2 pairs/km^2), these are not considered representative of the broader region (Fournier and Hines 1999). A population of 23,042 individuals within a 707,592 km^2 area equating to a density of 0.03 individuals/km^2 was estimated from data collected between 1980 and 1982 (Stotts 1988 in COSEWIC 2009). Recent population estimates for the NWT are not available; however, population monitoring since 1986 has detected no long-term trends in population size or productivity within a 38 km^2 study area (COSEWIC 2009).

A significant long-term (1968-2007) population decline of 2.7% per year at the national level has been identified from BBS data (COSEWIC 2009). Causes for the population decline are not known, though habitat loss and increased nest predation by species whose populations have increased in the prairies over the last century, including black-billed magpies (*Pica hudsonia*), ravens (*Corvus corax*) and raccoons (*Procyon lotor*), have been identified as possible causes (COSEWIC 2009). Threats identified in the federal status report apply primarily to populations in the southern portions of the breeding range (COSEWIC 2009).

The existing Old Airport Road route bisects many small patches of moderate and high quality horned grebe habitat, particularly in the central portion of the RSA. This may represent a mortality risk for the precocial chicks when crossing; however, the likelihood of collision is low given the route is a trail with limited use by vehicles and ATVs (PR#7), and chick mortality rates are expected to be negligible. Based on available evidence, historical changes to survival and reproduction at Base Case are expected to be within the resilience and adaptability limits of this species.

Yellow Rail

Yellow rail are listed federally as a species of 'Special Concern' by COSEWIC (2016) and are listed on Schedule 1 of SARA as 'Special Concern' (SARA 2002). Yellow rail begin breeding at one year of age and produce one brood per season that contains 7 to 10 eggs (SARA 2016a). Yellow rail population size and trends are relatively unknown because standardized bird survey methods are not effective at sampling for this species (COSEWIC 2009). A compilation of available information suggests that this species may be in decline due habitat loss and degradation, especially on southern wintering grounds (Environment Canada 2013b).

The existing Old Airport Road route bisects many small patches of moderate and high quality yellow rail habitat, particularly in the central portion of the RSA. This may represent a mortality risk for the precocial chicks when crossing; however, the likelihood of collision is low given the low speed limit and traffic volume on the road, and chick mortality rates are expected to be negligible. Based on available evidence, historical changes to survival and reproduction at Base Case are expected to be within the resilience and adaptability limits of this species.

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Red-necked Phalarope

The North American population of red-necked phalarope is estimated to be at minimum 2.5 million individuals, with about 74% of individuals occurring in Canada; however, declines have been observed at a major migratory stopover (Bay of Fundy), as well as on breeding grounds in Manitoba and Yukon (COSEWIC 2014b). Despite some evidence of local declines at breeding sites, there is insufficient information to determine the status of the population as a whole (Brown et al. 2010; COSEWIC 2014b). Gratto-Trevor (1996) estimated a density of 40 red-necked phalarope pairs per km^2 in moderately wet sedge habitat in the outer Mackenzie Delta region of the NWT.

The red-necked phalarope is a strictly single-brood species (Rubega et al. 2000), and harsh, unpredictable environmental conditions and a short breeding season are naturally limiting factors for this species in northern environments. Further, there is little opportunity for re-nesting in the event that the first nesting attempt fails since females leave breeding sites shortly after egg-laying is completed and males are left to tend to the nests and raise the young alone (Rubega et al. 2000; COSEWIC 2014b). Additional threats include habitat degradation on its breeding ground associated with climate change, although breeding habitat is poorly studied, and the impacts that may result from global climate change are unknown (Brown et al. 2010; COSEWIC 2014b). In addition, the species is susceptible to air-borne pollutants, oil spills, and extreme weather events during migration and winter as large concentrations of birds gather is small areas on the ocean during these time periods (COSEWIC 2014b).

The existing Old Airport Road route bisects many small patches of moderate and high quality red-necked phalarope habitat, particularly in the central portion of the RSA. This may represent a mortality risk for the precocial chicks when crossing; however, the likelihood of collision is low given the low speed limit and traffic volume on the road, and chick mortality rates are expected to be negligible. Based on available evidence, historical changes to survival and reproduction at Base Case are expected to be within the resilience and adaptability limits of this species.

4.2.3.12 Rusty Blackbird

Habitat Availability

There is limited suitable breeding habitat for rusty blackbird in the RSA at Base Case. Approximately 3,734 ha (6.7%) of the RSA represents suitable breeding habitat for the rusty blackbird at Base Case (Table 4.2-27). The availability of breeding habitat in the northern boreal forest is not considered a limiting factor for rusty blackbird (Environment Canada 2015a). In addition, rusty blackbird are highly mobile and only present in the RSA seasonally, so the species is expected to have the capacity to adapt and be resilient to existing natural and human-related disturbances and associated variations in habitat availability.

Table 4.2-27: Rusty Blackbird Habitat Availability in the RSA, Base Case

Habitat Suitability[a]	Area (ha)	Percent (%)
Moderate to High	3,734	6.7
Low to Nil	51,839	93.3
Total	**55,572**	**100.0**

Note: Numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.
[a] - Refer to Section 4.2.2 for descriptions of each habitat suitability category and Table 4.2-12 for relevant land cover classes.

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Habitat Distribution

The rusty blackbird is locally and patchily distributed throughout its range in Canada and is generally found in higher densities in the northwest (COSEWIC 2006). They nest in isolated pairs to loose colonies that can reach densities of more than 8 territories/km^2 in some parts of its range (Environment Canada 2015a). Powell et al. (2010a) reports an average home range size of 37.5 ha for rusty blackbirds in Maine. Adults often forage in multiple unconnected wetlands within their home range (Powell et al. 2010a).

Suitable habitat for rusty blackbirds occurs in numerous discrete patches throughout the RSA at Base Case (Figure 4.2-14). Linear disturbances such as the existing Old Airport Road route and the network of trails surrounding the TASR route generally do not represent barriers to bird movement (Desrochers and Hannon 1997; St. Clair et al. 1998), although they may influence territory establishment and delineation (Machtans 2006; Ashenhurst and Hannon 2008). Overall, habitat distribution is patchy and not well connected across the RSA, but rusty blackbird have high mobility and existing disturbances in the RSA do not likely function as movement barriers at Base Case.

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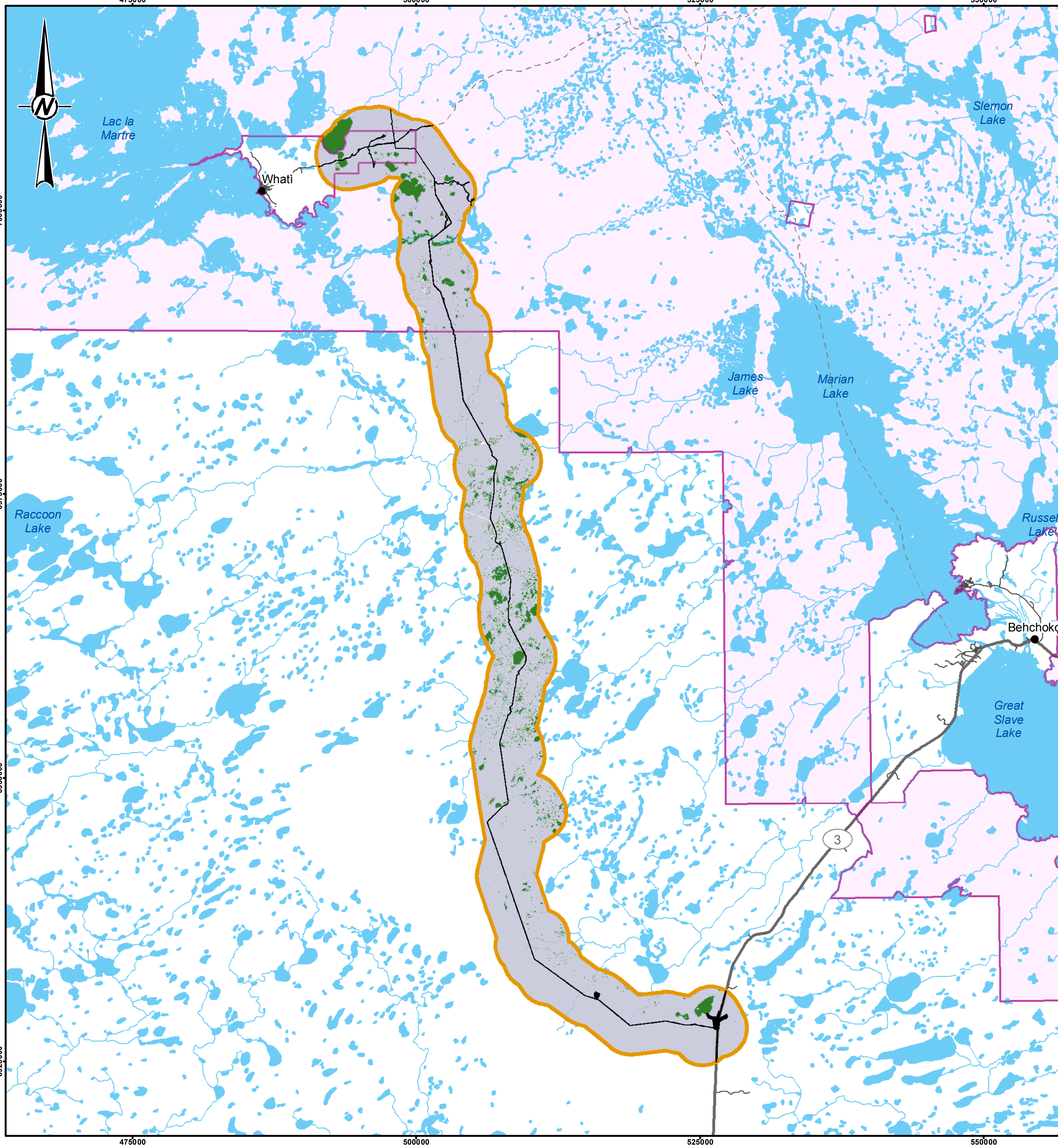

LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- WATERCOURSE
- TŁĮCHǪ LAND
- WATER BODY
- DEVELOPMENT
- BUMBLE BEE, BIRD, AND BAT RSA

HABITAT SUITABILITY

- MODERATE TO HIGH
- NIL TO LOW

0 10 20
1:500,000 KILOMETRES

REFERENCE(S)

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PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
TŁĮCHǪ ALL-SEASON ROAD

TITLE
DISTRIBUTION OF SUITABLE RUSTY BLACKBIRD HABITAT AT BASE CASE

CONSULTANT
Golder Associates

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO.	REV.	FIGURE
1665943	0	4.2-14

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Survival and Reproduction

Rusty blackbird has been declining throughout its range over the last century (COSEWIC 2006; Greenberg and Droege 1999). An analysis of BBS data suggests that the Canadian population declined by an average of 6.3% per year from 1970 to 2012 (Environment Canada 2015a). The management objective for the rusty blackbird in Canada is to stop the national decline by 2024 and ensure a 10-year sustained population increase thereafter (Environment Canada 2015a).

The primary cause of the decline in the species has been attributed to habitat loss within its wintering range, in particular the conversion of the Mississippi Valley flood plain forests to agricultural and urban areas (Greenberg and Droege 1999; COSEWIC 2006; Avery 2013; Environment Canada 2015a). In addition, over 100,000 rusty blackbirds were exterminated in the southern United States between 1974 and 1992 during bird control programs implemented to reduce populations of nuisance birds that damage crops (COSEWIC 2006; Avery 2013).

Based on their natural history and habitat associations, rusty blackbirds could be sensitive to changes in surface hydrology (Greenberg et al. 2011). Activities that result in wetland drainage, changes in water level fluctuations, water diversions and control, and displacement of underground water could impact the rusty blackbird. Currently, there is no research to determine the effects of surface water conditions on rusty blackbird survival or reproductive success (Greenberg et al. 2011).

4.2.3.13 Peregrine Falcon

Habitat Availability

Approximately 487 ha (0.9%) of the RSA represents suitable breeding habitat for peregrine falcon at Base Case (Table 4.2-28). Peregrine falcon is highly mobile and only present in the RSA seasonally, so peregrine falcons are expected to have the capacity to adapt and be resilient to existing natural and human-related disturbances and associated variations in habitat availability.

Table 4.2-28: Peregrine Falcon Habitat Availability in the RSA, Base Case

Habitat Suitability[a]	Area (ha)	Percent (%)
Moderate to High	487	0.9
Low to Nil	55,085	99.1
Total	**55,572**	**100**

Note: Numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.
[a] - Refer to Section 4.2.2 for descriptions of each habitat suitability category and Table 4.2-13 for relevant land cover classes.

Habitat Distribution

Peregrine falcon migrates annually from their wintering grounds in the southern United States, Central and South America to their breeding grounds in the United States and Canada (COSEWIC 2007b). On their breeding grounds, peregrine falcon use habitat on three main scales, which includes the nest site, a nesting territory, and a home range (OPFRT 2010).

Peregrine falcon exhibits strong site fidelity and will often use the same nesting site year after year. Successive generations of falcons may also continue to use the same nesting site (NWT 2016; COSEWIC 2007b). Young birds disperse widely to find new breeding areas, with the majority travelling >100 km from the nest site

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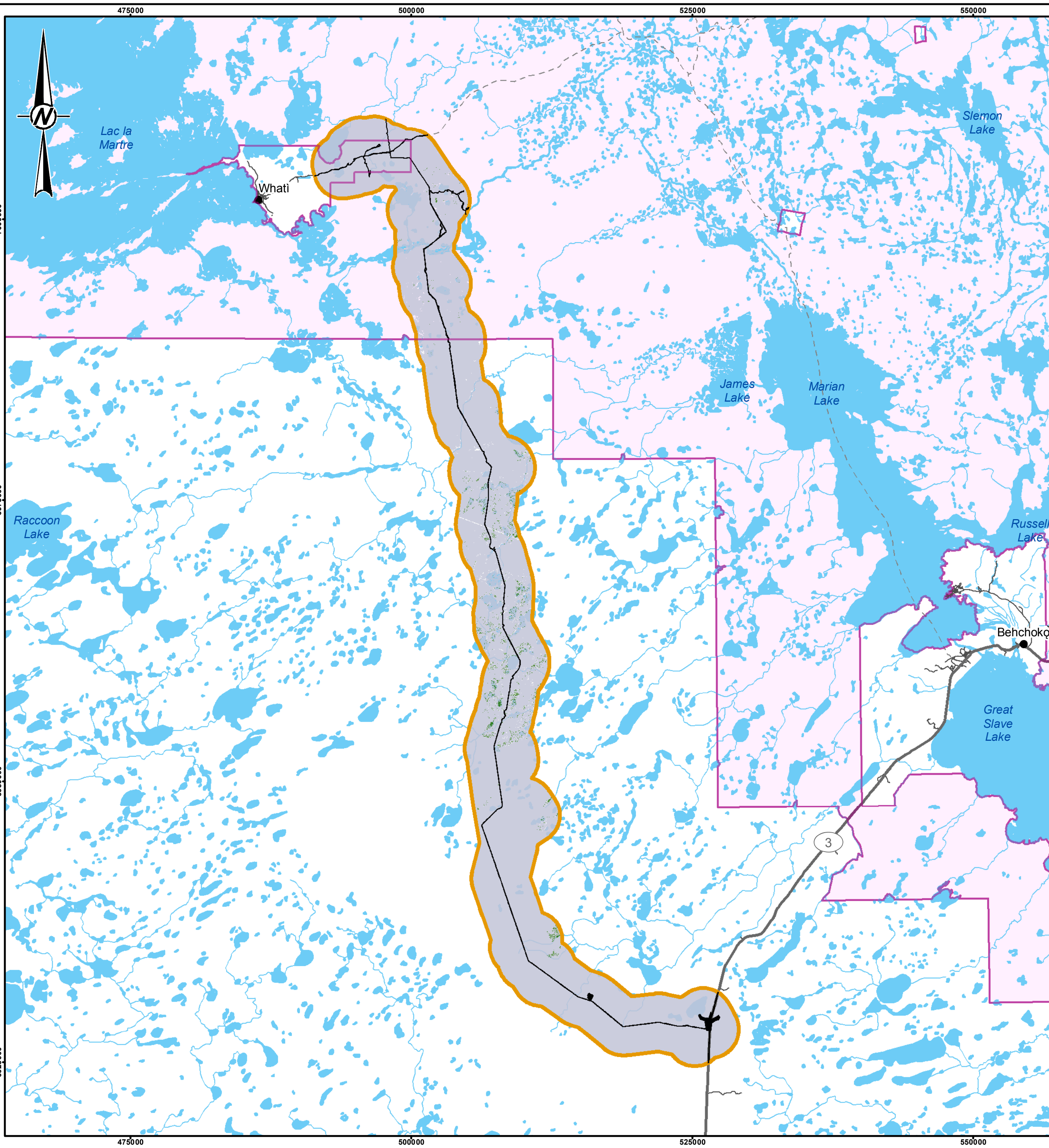
(COSEWIC 2007b; White et al. 2002). The nesting territory corresponds to the area surrounding the nest that a pair defends, and typically extends up to 1 km or more (OPFRT 2010). The home range is largely dictated by prey availability, and can extend up to 27 km from the nest (NWT 2016). The average home range is reported as 500 km^2 (COSEWIC 2007b). Based on data from 1990, 85 pairs were recorded nesting along the Mackenzie River in the NWT, at a density of about 1 pair per 18 km (White et al. 2002). Suitable habitat for peregrine falcon has a patchy distribution throughout the RSA at Base Case (Figure 4.2-15).

Historically, peregrine falcon bred across the majority of North America from Mexico north to the tundra. A major population decline and associated range reduction occurred after 1950 due to widespread use of chlorinated hydrocarbon pesticides, specifically DDT (White et al. 2002). Overall population numbers appeared to rebound by the 1990s due to restrictions on use of DDT, but distribution patterns had changed (White et al. 2002).



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LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- WATERCOURSE
- TŁĮCHǪ LAND
- WATER BODY
- DEVELOPMENT
- BUMBLE BEE, BIRD, AND BAT RSA

HABITAT SUITABILITY

- MODERATE TO HIGH
- NIL TO LOW

0 10 20

1:500,000 KILOMETRES

REFERENCE(S)

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PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
TŁĮCHǪ ALL-SEASON ROAD

TITLE
DISTRIBUTION OF SUITABLE PEREGRINE FALCON HABITAT AT BASE CASE

CONSULTANT
Golder Associates

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO.	REV.	FIGURE
1665943	0	4.2-15

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Survival and Reproduction

The peregrine falcon has not been assessed by the SARC (2016a), but is listed federally as Special Concern by COSEWIC (2016) and as Special Concern on Schedule 1 of the SARA (2002). It is also considered a 'sensitive' species in NWT.

Peregrine falcons begin breeding in their second year (COSEWIC 2007b), and lay two to four eggs between May and early June (NWT 2016). Peregrine falcon does not build a nest, and instead lays eggs in a scrape in the ground (White et al. 2002). The incubation period lasts 33 to 35 days with young hatching in early July (White et al. 2002; COSEWIC 2007b). Young typically leave the nest within 40 days (COSEWIC 2007b). Individuals nesting in remote locations exhibit higher sensitivity to human disturbance than those nesting in urban environments, which have become accustomed to human activity (OPFRT 2010). However, complete nesting failure resulting from disturbances is rare (COSEWIC 2007b).

The Canadian population of peregrine falcon (*anatum* subspecies) was estimated at 969 individuals in 2005 (COSEWIC 2007b). Recent surveys estimate there are 113 breeding pairs of peregrine falcon (*anatum* subspecies) in the Mackenzie Valley, NWT, which is a dramatic increase from 9 nests in 1970 (COSEWIC 2007b). The average number of young per pair in the Mackenzie Valley was 1.0 in 2000 (Rowell et al. 2003).

Because peregrine falcons use a wide range of habitat types, the degree of impact due to habitat degradation is difficult to assess. The most serious consequences are likely to result from loss or modification of nesting sites because these sites are limited and often non-replaceable (White et al. 2002). Peregrines may also prefer wetland areas which have large prey concentrations, and large-scale alterations to wetland ecosystem functions may impact the population (White et al. 2002). However, activities that result in openings in the forest canopy may actually benefit this species, by creating additional open country habitat for foraging (OPFRT 2010).

Mortality due to collisions with buildings and vehicles are most often reported from urban environments, but have been reported to account for up to 17% and 11% of deaths with a known cause, respectively (COSEWIC 2007b).

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4.2.3.14 Short-eared Owl

Habitat Availability

Approximately 993 ha (1.8%) of the RSA represents suitable breeding habitat for short-eared owl at Base Case (Table 4.2-29). There is a small amount of moderate to high quality habitat in the RSA at Base Case. Average territory size for short-eared owls in the prairie region of Manitoba was 73 ha (Clark 1975) and short-eared owls in forested areas in Scotland were found to not use habitat patches less than 50 ha (Shaw 2009). Assuming a territory size of 60 ha, the potential suitable habitat for short-eared owl in the RSA may support 17 owls, if all potential habitat is occupied. Short-eared owls are highly mobile and only present in the RSA seasonally, so short-eared owls are expected to have the capacity to adapt and be resilient to existing natural and human-related disturbances and associated variations in habitat availability.

Table 4.2-29: Short-eared Owl Habitat Availability in the RSA, Base Case

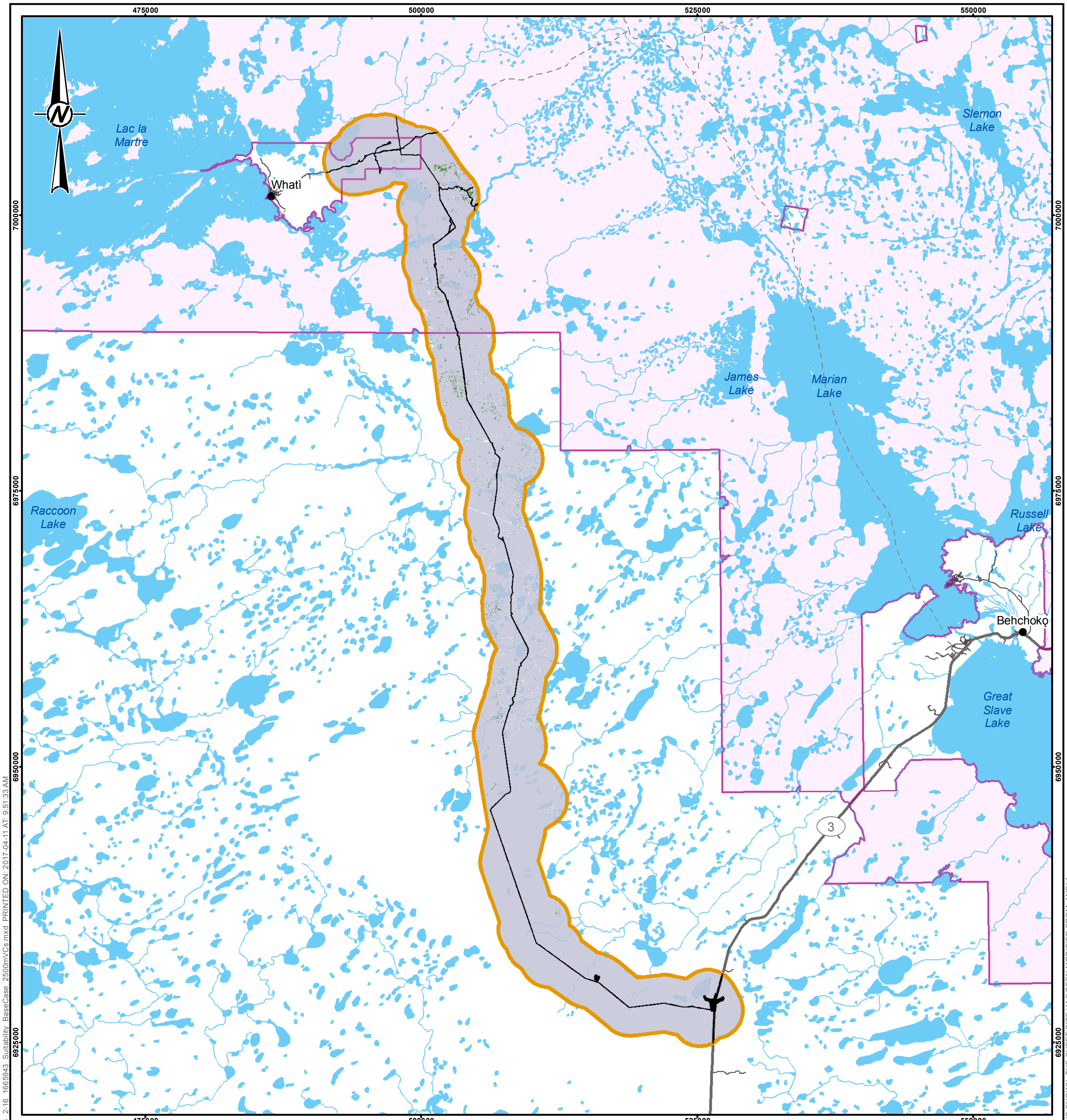
Habitat Suitability[a]	Area (ha)	Percent (%)
Moderate to High	993	1.8
Nil to Low	54,580	98.2
Total	**55,572**	**100.0**

Note: Numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.
[a] - Refer to Section 4.2.2 for descriptions of each habitat suitability category and Table 4.2-14 for relevant land cover classes.

Habitat Distribution

Short-eared owl is most common in the prairie regions of Alberta, Saskatchewan, and Manitoba, and along the Arctic coast (COSEWIC 2008). In the NWT, short-eared owl may breed in suitable habitats across the Taiga Plains Ecoregion, but are most often found breeding on coastal tundra habitat (COSEWIC 2008).

Suitable habitat for short-eared owl occurs in small and not well connected patches across the RSA at Base Case (Figure 4.2-16). Short-eared owl is migratory and even nomadic in many parts of their global range, responding to spatial and temporal heterogeneity in prey abundance (Korpimäki 1994). Short-eared owl travels annually from their wintering grounds in the central and southern United States to their breeding grounds in the northeastern United States and Canada (Wiggins et al. 2006). Short-eared owl exhibits little site fidelity due to fluctuations in food supply and may build a nest up to 1,000 km away from a nest used in the previous breeding season (Environment Canada 2016a).



LEGEND

- ● POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- WATERCOURSE
- TŁĮCHǪ LAND
- WATER BODY
- DEVELOPMENT
- BUMBLE BEE, BIRD, AND BAT RSA

HABITAT SUITABILITY

- MODERATE TO HIGH
- NIL TO LOW

0 10 20

1:500,000 KILOMETRES

REFERENCE(S)

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PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT

GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT

TŁĮCHǪ ALL-SEASON ROAD

TITLE

DISTRIBUTION OF SUITABLE SHORT-EARED OWL HABITAT AT BASE CASE

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO.	REV.	FIGURE
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Survival and Reproduction

The short-eared owl has not been assessed by the SARC (2016a), but is listed federally as Special Concern by COSEWIC (2016) and as Special Concern on Schedule 1 of the SARA (2002).

Short-eared owl likely arrives in the NWT to breed in the spring (April to May) (GNWT 2013). Short-eared owl builds a nest on the ground, consisting of a scrape in the ground lined with grasses and feathers. Eggs are laid by mid-June and owlets hatch in early July (COSEWIC 2008). The owls leave their breeding ground in the fall, and are generally gone by late October (GNWT 2013). Short-eared owls typically prefer to nest in areas that are not prone to human disturbance as the female will often desert the nest if disturbed during the critical laying or incubation stages (COSEWIC 2008). However, this species has been known to nest in close proximity to agricultural activities, including haying, mowing or livestock grazing (COSEWIC 2008).

Data suggests that short-eared owl populations in Canada have decreased approximately 27% between 1998 and 2008 (COSEWIC 2008). Roadside surveys in the Taiga Plains Ecoregion have detected a decrease in short-eared owl populations of an average of 4.12% per year from 1966 to 1994 (Kirk and Hyslop 1998). Information on the current population status and trends of short-eared owls in the NWT is not known. Determining population trends of short-eared owls is difficult because they are nomadic and densities fluctuate in relation to vole populations (COSEWIC 2008).

Nationwide, COSEWIC (2008) identifies habitat loss and degradation on winter range as a primary cause of owl decline. On the breeding range, low or unpredictable levels of prey availability and increased predation are believed to be one of the key factors affecting reproductive success and indirectly, population-level declines (Environment Canada 2016a). Mortality due to vehicle collisions has also been documented, but the significance of this factor on overall population decline is unknown (Environment Canada 2016a).

4.3 Pathway Analysis

4.3.1 Methods

Pathway analysis identifies and assesses the linkages (or interactions) between the Project components and activities and the predicted changes to the environment that may affect wildlife VCs. A pathway analysis was used to refine the understanding of how the Project may affect VCs, identify appropriate mitigation, and to help focus the assessment on key interactions between the Project and the environment. Methods for the pathways analysis are provided in Section 2.0.

4.3.2 Results

Project components and activities, effects pathways, and environmental design features and mitigation are summarized in Table 4.3-1. Classification of effects pathways (i.e., no linkage, secondary, and primary) to wildlife VCs are also summarized in Table 4.3-1 and detailed descriptions are provided in the subsequent sections.

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Table 4.3-1: Pathways Assessment for Wildlife VCs

Tłı̨chǫ Road Project Component/Activity	Effect Pathways	Mitigation	Pathway Assessment
Construction of Project footprint (e.g., road right-of-way, borrow pits, laydown areas and construction camps)	Site preparation, construction and operation activities can result in the loss or alteration of vegetation and topography that may change habitat availability, use, and connectivity and influence wildlife abundance and distribution	■ The current layout of the Project footprint will minimize the amount of new disturbance by primarily following the existing Old Airport Road route to Whatì and intersecting areas previously burned. ■ Habitat loss will be minimized by limiting the proposed TASR corridor to 60 m wide not including the borrow sites and access corridors. ■ Habitat loss by the Project will be minimized by locating construction camps and laydown areas within borrow sites or the ROW. ■ Disturbance of significant wildlife features, such as nests and dens will be avoided using pre-construction monitoring and set-back distances described in the Wildlife Management and Monitoring Plan. ■ The mitigation strategies recommended by Lands' *Northern Land Use Guidelines* will be considered, which includes best practices for avoiding, minimizing and rehabilitation of impacts to vegetation and topography.	Primary
	Site preparation and construction may result in the destruction of roosting or hibernating bats (incidental take)	■ Destruction of bat roosts will be avoided by managing, to the extent possible, the incremental removal of vegetation so that it occurs outside of spring through fall. If vegetation clearing is required within this time, pre-clearing surveys and no-work zones for identified active maternity roost sites will be conducted to avoid disturbance. ■ Avoid disturbance of hibernating bats by surveying for sites of hibernacula potential (i.e., abandoned buildings and mines and caves) within 200 m of ROW for bat use prior to construction.	
	Site preparation and construction may result in the destruction of nests, eggs, and individuals of migratory birds (incidental take)	■ Avoid disturbance to migratory birds by clearing land outside of the bird nesting and fledging season (May to mid-August); however, if vegetation clearing is required within this time, pre-clearing nest surveys will be completed and no-work zones for identified active nesting sites will be used to minimize disturbance.	

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Table 4.3-1: Pathways Assessment for Wildlife VCs (continued)

Tłįchǫ Road Project Component/Activity	Effect Pathways	Mitigation	Pathway Assessment
Construction of Project footprint (e.g., road right-of-way, borrow pits, laydown areas and construction camps)	Dust and air emissions, and subsequent deposition can change soil quality and vegetation, which can affect wildlife habitat availability and distribution	■ Reduced speed limits will assist in minimizing dust production. ■ Construction and maintenance equipment will be equipped with industry-standard emission control systems to minimize air emissions. ■ Dust suppression techniques (as per the GNWT Guideline for Dust Suppression and GNWT-DOT's Erosion and Sediment Control Manual) will be utilized to reduce dust emissions onto vegetation outside of the ROW. ■ Power sources provided at construction camps will minimize unneccesary idling in the winter.	Secondary
	Surface water runoff from the Project area can alter surface water, soil, vegetation, which can change the availability and distribution of wildlife habitat	■ Hazardous materials and fuel will be stored according to regulatory requirements to avoid contamination to the environment and workers (i.e., Hazardous Substances Management Plan). ■ Individuals working on-site and handling hazardous materials will be trained in the Transportation of Dangerous Goods to avoid accidental spills. ■ An approved Spill Contingency Plan will be followed by Project staff to prevent spills and if they were to occur as a result of an accident, that they will be controlled to minimize the area impacted. ■ Emergency spill kits will be available wherever toxic materials or fuel are stored and transferred during construction to minimize effects to vegetation and wildlife habitat. ■ Construction and maintenance vehicles will be equipped with spill kits and fuelled 30 m away from water bodies, to avoid effects to water and minimize effects to vegetation and wildlife habitat. ■ Spill response and containment will be completed expeditiously in accordance with the approved site-specific Spill Contingency Plan to reduce the area impacted. ■ Construction equipment, machinery, and vehicles will be regularly maintained to avoid accidental spills. ■ GNWT-DOT's Erosion and Sediment Control Manual, in conjunction with a suitable road design, will be utilized for erosion and sediment control and slope stabilization, which should minimize damage to riparian, stream, wetland and lake habitat from altered hydrology.	
Construction of Project footprint (e.g., road right-of-way, borrow pits, laydown areas and construction camps)	Changes to hydrology may alter drainage patterns and increase/decrease drainage flows and surface water levels that can cause changes to soils and vegetation, which can affect wildlife habitat availability and distribution	■ GNWT-DOT's Erosion and Sediment Control Manual, in conjunction with a suitable road design, will be utilized for erosion and sediment control and slope stabilization, which should minimize damage to riparian, stream, wetland and lake habitat from altered hydrology. ■ The mitigation strategies recommended by Lands' *Northern Land Use Guidelines* will be employed, which includes best practices for avoiding, minimizing and rehabilitation of impactions to vegetation and topography. ■ Use of culverts and other design features will minimize changes to local flows and drainage patterns and drainage areas. Regular maintenance will occur along the TASR to ensure culverts are clear of debris (including ice during spring thaw).	Secondary

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Table 4.3-1: Pathways Assessment for Wildlife VCs (continued)

Tłı̨chǫ Road Project Component/Activity	Effect Pathways	Mitigation	Pathway Assessment
Construction of Project footprint (e.g., road right-of-way, borrow pits, laydown areas and construction camps)	Sensory disturbance (lights, smells, noise, dust, human activity, viewscape) can change wildlife habitat availability, use and connectivity (movement and behaviour), which can lead to changes in wildlife abundance and distribution	■ Construction activities will be limited during sensitive periods to minimize effects on wildlife. For example, surface blasting will be suspended when caribou are identified within a 'danger zone' and the period for no harm or disturbance to migratory birds and their nesting habitat will be observed. Further details pertaining to wildlife and blasting can be found in the Wildlife Management and Monitoring Plan and Quarry Operations Plan, respectively. ■ Lights will be positioned to shine downwards and/or will be fixed with shielding to minimize the distribution of peripheral light and shut off when not in use. ■ Wildlife will have the right-of-way to minimize sensory disturbance during construction. ■ Recommended setback distances for dens and nests will be followed as per an approved land use permit and Wildlife Management and Monitoring Plan, which will avoid or minimize disturbance. ■ In the event that an active den or nest is identified during construction, GNWT-ENR will be consulted to determine an appropriate strategy to avoid or minimize disturbance. ■ Project staff will communicate the presence of wildlife to other drivers via radio. ■ Observations of caribou and species at risk will be reported to Environmental Monitors. Any next steps will be actioned as per the directions outlined in the WMMP. ■ Harassment and feeding of wildlife by Project staff will be prohibited. ■ Project staff will be provided with environmental awareness training.	Primary
	Physical hazards on the Project site, and collisions with construction vehicles can cause injury or mortality to individual wildlife, leading to decreases in survival and reproduction	■ Speed limits will be established and posted to minimize the risk of wildlife injury and mortality. ■ The presence of caribou and wildlife will be communicated to construction personnel, which will minimize risks of physical hazards through site-wide awareness. ■ All employees will be provided with environmental awareness training, which will minimize risks of physical hazards through site-wide awareness. ■ Environmental Monitors will be on site to document wildlife and manage and minimize risks to wildlife and workers.	Secondary

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Table 4.3-1: Pathways Assessment for Wildlife VCs (continued)

Tłįchǫ Road Project Component/Activity	Effect Pathways	Mitigation	Pathway Assessment
Construction of Project footprint (e.g., road right-of-way, borrow pits, laydown areas and construction camps)	Spills on the Project site can alter surface water quality, soils, vegetation, which can change the availability and distribution of wildlife habitat	■ Hazardous materials and fuel will be stored according to regulatory requirements to avoid contamination to the environment and workers (i.e., Waste Management Plan). ■ Domestic and recyclable waste and dangerous goods will be stored on-site in appropriate containers to avoid exposure until they are shipped off-site to an approved facility. ■ Individuals working on-site and handling hazardous materials will be trained in the Transportation of Dangerous Goods to avoid accidental spills. ■ An approved Spill Contingency Plan will be followed by Project staff to prevent spills. If they were to occur as a result of an accident, they will be controlled to minimize the area impacted. ■ Emergency spill kits will be available wherever toxic materials or fuel are stored and transferred during construction to minimize effects to vegetation and wildlife habitat. ■ Construction and maintenance vehicles will be equipped with spill kits and fuelled 30 m away from water bodies, to avoid effects to water and minimize effects to vegetation and wildlife habitat. ■ To avoid effects to water and minimize effects to vegetation and wildlife habitat, fuel storage areas will be equipped with spill kits, will be located at least 30 m away from water bodies and large fuel storage tanks (2,000 to 50,000 L) will be double walled. ■ Spill response and containment will be completed expeditiously in accordance with the approved site-specific Spill Contingency Plan to reduce the area impacted. ■ Exposure of wildlife to contaminants will be avoided by use of appropriate deterrents (e.g., temporary fencing, noise makers) to discourage wildlife from entering an affected area. ■ Construction equipment, machinery, and vehicles will be regularly maintained to avoid accidental spills.	No Linkage
	Increase in public access could affect wildlife survival and reproduction through vehicle strikes, and/or legal and illegal hunting	■ Speed limits will be established, posted and enforced to reduce the risk of vehicle-wildlife collisions. ■ To avoid wildlife harvest, firearms will not be allowed on-site during construction except for firearms in the possession and control of authorized Environmental Monitors. ■ No hunting or fishing by Project staff will be permitted to avoid wildlife harvest. ■ Access roads to borrow sites will be blocked when no longer active to minimize future access.	Primary

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Table 4.3-1: Pathways Assessment for Wildlife VCs (continued)

Tłıchǫ Road Project Component/Activity	Effect Pathways	Mitigation	Pathway Assessment
Construction of Project footprint (e.g., road right-of-way, borrow pits, laydown areas and construction camps)	Use of linear corridors and converted habitat (i.e., younger, more productive forest) by prey and predators leading to decreases in survival and reproduction of prey	■ The current layout of the Project footprint will primarily follow an existing trail to minimize the amount of new linear disturbance.	Secondary
	Use of linear corridors by bison may lead to range expansion and affect moose and caribou habitat	■ None proposed.	Primary
	Loss of functional habitat due to competition with other wildlife species (in particular bison)	■ None proposed.	Primary
Tłıchǫ Road Project Component/Activity	**Effect Pathways**	**Mitigation**	**Pathway Assessment**
Construction of Project footprint (e.g., road right-of-way, borrow pits, laydown areas and construction camps)	Altered movement patterns, including any changes to interactions with other caribou herds	■ Construction activities will be limited during sensitive periods to minimize effects on wildlife. For example surface blasting will be suspended when caribou are identified within a 'danger zone' and the period for no harm or disturbance to migratory birds and their nesting habitat will be observed. Further details pertaining to wildlife and blasting can be found in the Wildlife Management and Monitoring Plan and Quarry Operations Plan, respectively. ■ Wildlife will have the right-of-way to minimize sensory disturbance. ■ Observations of species at risk by Project staff will be reported to GNWT-ENR and trigger mitigation to avoid or minimize impacts. ■ Construction will be temporarily suspended when species at risk, moose and barren-ground caribou are known to be within construction activities to minimize sensory disturbance. Environmental Monitors will be used to help identify the presence of wildlife. ■ Recommended setback distances for dens and nests will be followed to avoid disturbance as per an approved land use permit and Wildlife Management and Monitoring Plan. ■ In the event that an active den or nest is identified during construction, GNWT-ENR will be consulted to determine an appropriate strategy to avoid or minimize disturbance. ■ The TASR route will overlap the existing Old Airport Road route and reduce the amount new sensory disturbance. ■ Surface blasting will be temporarily suspended if wildlife are observed within the danger zone identified by the blast supervisor. ■ All employees will be provided with environmental awareness training, which will minimize risks of physical hazards through site-wide awareness.	Primary

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Table 4.3-1: Pathways Assessment for Wildlife VCs (continued)

Tłįchǫ Road Project Component/Activity	Effect Pathways	Mitigation	Pathway Assessment
Construction of Project footprint (e.g., road right-of-way, borrow pits, laydown areas and construction camps)	Reduced habitat availability and distribution due to any increases in fires resulting from use of the road.	■ Camping areas are not included in the road design, minimizing areas where campfires could be used. ■ Signs indicating the daily wildfire risk will be posted at the TASR junctions at Highway 3 and the existing Whatì community access road to minimize the risk of accidental fires.	Secondary
	Attraction of wildlife to the Project (e.g., food waste, petroleum based products, salt) during construction may increase human wildlife interactions and change predator-prey relationships, which can affect wildlife survival and reproduction	■ Development and implementation of a Waste Management Plan to avoid access to food waste by wildlife ■ Food wastes will be collected in suitable receptacles that minimize attraction or impact to wildlife. ■ Waste products will be stored in secured containers and transported to appropriate facilities to avoid access by wildlife. ■ Recyclables and hazardous waste materials will be stored on-site in appropriate containers to avoid wildlife access until shipped off-site to an approved facility. ■ Littering and feeding of wildlife will be prohibited to avoid wildlife attraction to the site. ■ All workers and visitors will be educated on waste management practices for the Project site to avoid wildlife attraction. Waste management practices will be enforced. ■ All employees will be provided with environmental awareness training to avoid attracting wildlife to site. ■ All employees will be provided with training on the risk associated with feeding wildlife and careless disposal of food garbage to avoid attracting wildlife to site.	Secondary
	Introduction and spread of noxious and invasive plant species can affect plant community composition, which can affect wildlife habitat availability and distribution	■ Cleaning and inspection of Project vehicles and equipment prior to entering the NWT to avoid introducing noxious and invasive plants. ■ Re-cleaning Project vehicles and equipment if an area of weed infestation is encountered, prior to advancing to a weed-free area to minimize the spread of noxious and invasive plants. ■ Locating and managing cleaning locations on the Project site to avoid the spread of noxious and invasive plants. ■ Any required reseeding will be done so with an approved local seed to avoid the introduction of noxious and invasive plants. ■ Monitoring of roadsides for invasive species will be conducted each year of construction and invasive vegetation will be controlled immediately to avoid seed production and long-term establishment. This monitoring will be incorporated into operations and maintenance processes for at least two years after construction to account for additional time that may be needed to observe establishment of invasive species.	Secondary

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4.3.2.1 No Linkage Pathways

A pathway has no linkage if the mitigation or environmental design features result in no measurable environmental change and, therefore, no residual effects to wildlife VCs. The only pathway identified as having no linkage to wildlife was:

- *Spills on the Project site can alter surface water quality, soils, vegetation, which can change the availability and distribution of wildlife habitat.*

Spills have the potential to change water quality, soils and vegetation. Spills that occur in high enough concentrations could cause effects on aquatic organisms, soil organisms, vegetation and wildlife habitat. Chemical spills can also affect wildlife survival and reproduction if animals are directly exposed to the chemical (e.g., ingestion).

Transport and handling of hazardous materials during construction will be carefully managed. Storage facilities for hazardous materials and waste will meet regulatory requirements and will be designed to protect the environment and workers from exposure, as per the Waste Management Plan (PR#7). Emergency spill kits will be available at transfer locations for toxic materials and fuel. Project vehicles will be equipped with spill kits and fuelled 30 m away from water bodies. Construction equipment, machinery, and vehicles will be regularly maintained to limit leaks. Construction workers will respond to, report, and monitors spills involving hazardous materials as per the Spill Contingency and Waste Management plans (PR#7). Spills will be contained locally and either disposed of through site waste handling systems or removed for disposal in approved facilities. Individuals working on site and handling hazardous materials will be trained in best practices related to the transportation and handling of dangerous goods.

The implementation of the Spills Contingency Plan (PR#7), the Emergency Response Plan (PR#7) and training of personnel in safe handling of chemicals and hazardous materials are anticipated to avoid and minimize the frequency, spatial extent, and severity of spills to the environment.

During operations, speed limits will be posted and enforced. Transport Canada enforces the *Transportation of Dangerous Goods Act/Regulations*. Other commercial operators using the road would also have their own spill contingency plans in place.

Mitigation designs for the Project will help regulate how chemicals and hazardous wastes are stored and where they are used and how they are transported to limit the risk of accidental spills. Additional mitigation will be in place if an accidental spill occurs that will allow spills to be controlled and remediated in a timely manner. The implementation of the Spills Contingency Plan (PR#7), the Emergency Response Plan (PR#7) and training of personnel in safe handling of chemicals and hazardous materials are anticipated to avoid and minimize the frequency, spatial extent, and severity of spills during construction. Therefore, spills on the Project are expected to result in no measurable changes to wildlife habitat or to survival and reproduction.

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4.3.2.2 Secondary Pathways

In some cases, both a source and a pathway exist, but the change caused by the Project is anticipated to be minor and have a negligible residual effect on wildlife VCs. The pathways described in the following bullets are anticipated to be secondary for wildlife and were not carried forward to the residual effects assessment.

- *Changes to hydrology may alter drainage patterns and increase/decrease drainage flows and surface water levels that can cause changes to soils and vegetation, which can affect wildlife habitat availability and distribution.*

Changes in drainage patterns and increases/decreases in drainage flows and surface water levels beyond the natural range of variation could lead to a loss of soils through increased erosion, affect vegetation, and alter wildlife habitat availability and distribution. A change in local water flows could alter the distribution of wetlands, riparian, and upland areas in relation to the changes in soil moisture (Nilsson and Svedmark 2002; Odland and del Moral 2002; Shafroth et al. 2002; Leyer 2005). As soil moisture levels change because of changes in surface flows and water levels, plant species that thrive in drier soil moisture regimes can out compete riparian species that rely on fluctuations in soil moisture (Shafroth et al. 2002; Leyer 2005).

Mitigation measures have been included in the Project design to limit loss of soils, and include installing culverts or bridges using best management practices and following environmental approval conditions. This includes regular maintenance along the Project to ensure culverts are clear of debris, including ice during spring thaw. Project activities are expected to not influence broad scale drainage patterns. Some measurable changes to localized soil moisture regimes (and erosion) adjacent to smaller drainages are predicted during construction and into operations until vegetation cover is restored in the surrounding area. Overall, minor and local changes in the abundance and distribution of soils and plant communities are predicted relative to Base Case conditions. Therefore, this pathway was determined to have a negligible net effect on the availability and distribution of wildlife habitat.

- *Dust and air emissions, and subsequent deposition can change soil quality and vegetation, which can affect wildlife habitat availability and distribution*

Air and dust emissions, and subsequent deposition can change soil quality and alter vegetation and wetlands, which can adversely influence wildlife habitat availability and distribution. Sulphur dioxide and nitrogen oxides from combustion of fossil fuels and dust deposition can affect soil pH and nutrient content, and soil fauna composition. Changes in soil quality (physical, chemical and biological properties) can affect plant community composition, structure and diversity. Dust that falls directly on plants also can have a physical effect by smothering plant leaves or blocking stomata openings. Plant species have different levels of tolerance to dust deposition, which can result in changes to above ground biomass and species composition. For example, bryophyte and lichens can be sensitive to the chemical effects of dust because they obtain moisture and nutrients from the atmosphere and immediate surroundings, including substances that are trapped or deposited directly on the surface of the bryophyte leaf or lichen thalli. Bryophytes and lichens may experience the largest effects close to roads where the greatest amount of deposition frequently occurs. Rates of dust deposition and accumulation are dependent on the rate of supply from the source, wind speed, precipitation events, topography, and vegetation cover.

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Accumulation of dust (i.e., total suspended particulate deposition) and concentrations of air emissions produced from the Project may result in a local indirect change on the quality of habitat available. Dust particles of various sizes will be generated by handling of embankment and granular materials in borrow sources and along the proposed Project corridor during construction. Heavy equipment movements, loading and unloading material, crushing, screening, blasting, erosion from stockpiles, vehicle traffic, etc. are expected to contribute to dust generation. Dust control products such as calcium and magnesium chloride that are traditionally used in spot applications each year as part of highways maintenance, can coat granular dust particles and the chemical can become airborne with the dust particle as the dust control application nears the end of its serviceable life (a few months without re-watering). Larger particles (>44 µm diameter) are typically associated with nuisance issues, while smaller particles (<10 µm diameter) can potentially create human health issues at elevated levels in populated areas.

Emissions from diesel engine combustion exhaust during (carbon monoxide, nitrogen oxides, sulphur dioxide and particulate matter) construction and operation will be generated and can negatively impact air quality in the local area around where the equipment is operating at the particular time. Power sources will be included at construction camps to minimize the need to keep a vehicle or equipment running during cold weather.

Daily incineration of combustible waste at camp site locations is not expected to impact air quality as incinerators will be operated and maintained as per manufacturers' expectations and will follow the Project's Waste Management Plan (PR#7). Incinerator use will follow Environment Canada's Guideline for Batch Waste Incineration and meet applicable standards (Canadian Standards Association or Underwriters' Laboratories of Canada).

Vehicles travelling on the all-season and winter roads during operation have the potential to transfer dust from vehicles and loads (e.g., dust deposited on wheels and undercarriage in other communities); however, the relative contribution of these loads to the overall dust accumulation for the Project is considered to be negligible. Similarly, dust generation from vehicles along the Project would occur annually, but would likely be higher during the non-winter period and not continuous (i.e., would occur less frequently during wet and cool conditions).

Dust deposition is expected to result in minor and localized changes to vegetation and wildlife habitat along the ROWs for the Project. For example, Walker and Everett (1987) and Everett (1980) reported that effects were confined to a 50 m buffer on either side of a road in open tundra and less in areas where trees intercept dust fall (Walker and Everette 1987). Moreover, Meininger and Spatt (1988) found that most effects occurred within 5 to 50 m of a road, with less obvious effects observed between 50 m and 500 m from a road. Similarly, annual emissions from up to 40 vehicles on the roads are anticipated to result in no detectable changes to soils and vegetation. Therefore, dust deposition and emissions from vehicles along Project are predicted to result in negligible residual effects to wildlife habitat availability and distribution.

- *Surface water runoff from the Project area can alter surface water, soil, vegetation, which can change the availability and distribution of wildlife habitat*

Contaminated surface water runoff into natural areas can kill vegetation and reduce the availability and distribution of habitat. Mitigation associated with the transport and handling of hazardous materials will be used to manage sources and the spread of contaminants to the environment during construction. Storage facilities for hazardous materials and waste will meet regulatory requirements and will be designed to protect the environment and workers

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from exposure, as per the Waste Management Plan (PR#7). Emergency spill kits will be available at transfer locations for toxic materials and fuel. Project vehicles will be equipped with spill kits and fuelled 30 m away from water bodies. Construction equipment, machinery, and vehicles will be regularly maintained to limit leaks. Employees will respond to, report, and monitor spills involving hazardous materials as per the Spill Contingency and Waste Management plans (PR#7). Spills will be contained locally and either disposed of through site waste handling systems or removed for disposal in approved facilities. Individuals working on site and handling hazardous materials will be trained in best practices related to the transportation and handling of dangerous goods. The implementation of the Spills Contingency Plan (PR#7), the Emergency Response Plan (PR#7) and training of personnel in safe handling of chemicals and hazardous materials are anticipated to avoid and minimize the frequency, spatial extent, and severity of spills.

During operations, speed limits will be posted and enforced. Transport Canada enforces the *Transportation of Dangerous Goods Act/Regulations*. Other commercial operators using the road would also have their own spill contingency plans in place. Because of mitigation in place for the Project, negligible effects from contaminated surface water runoff on water, soils and vegetation are expected.

- *Physical hazards on the Project site, and collisions with vehicles cause injury or mortality to individual wildlife, leading to decreases in survival and reproduction*

There is potential for an increase in the risk of injury or death to wildlife species through collisions with Project vehicles and equipment or physical hazards, such as blasting activities, associated with the Project. Construction and operation of the TASR will cause an increase in the volume of vehicle traffic. As such, the potential for collisions of vehicles with wildlife may increase (Romin and Bissonette 1996; Hussain et al. 2007). The primary factors that contribute to road-related wildlife deaths are traffic volume and vehicle speed (EBA 2001; Jaarsma et al. 2006; Litvaitis and Tash 2008). These factors directly affect the success of an animal reaching the opposite side of the road. An increase in either factor reduces the probability of an animal crossing safely (Underhill and Angold 2000).

A total of 113 collisions involving animals have been reported in the NWT from 2010 to 2014 (GNWT-DOT 2011, 2012, 2013, 2014, 2015). Approximately 65% of animal collisions during this period were reported to involve bison. Most of these collisions occurred on highways (95%), with a few collisions reported in communities (5%) and none reported in rural areas (GNWT-DOT 2011, 2012, 2013, 2014, 2015). The majority of bison collisions on Highway 3 occur in the Mackenzie Bison Sanctuary where the maximum speed limit is 90 km/h. Traffic flow on the Project is predicted to be primarily between the Tłįchǫ communities and Yellowknife, which intersects a very small portion of the Mackenzie Bison Sanctuary.

Surface blasting in aggregate borrow areas will increase the potential for mortality or injury to wildlife as a result of fly rock from the blasting. Fly rock is more likely to impact large mammals or ungulates due to their physical size (i.e., larger target) compared to birds, smaller mammals and insects.

To mitigate the increase in mortality risk due to vehicle-collisions in the Project footprint, several environmental design features will be implemented. All employees will receive environmental awareness training, and the presence of wildlife will be monitored and communicated to site personnel. Speed limits will be posted and enforced on the Project site during construction. During operation, the posted speed limit will be 70 km/h, which is

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considered a low highway speed. Lower speeds allow the motorist and animal to avoid a collision by increasing reaction time (van Langevelde et al. 2009).

In addition, the presence of caribou and wildlife will be monitored and communicated to site personnel, and surface blasting will be temporarily suspended if wildlife are observed within the danger zone identified by the blast supervisor. The risk of wildlife from collisions with vehicles, heavy equipment or physical hazards on-site is predicted to be low during construction, and predicted to increase during operations at night. The implementation of mitigation measures is expected to result in minor changes in mortality rate from physical hazards and wildlife-vehicle collisions relative to existing conditions.

- *Use of linear corridors and converted habitat (i.e., younger, more productive forest) by prey and predators leading to decreases in survival and reproduction of prey*

Increased linear density and the associated creation of edge habitat from the Project has the potential to change predator-prey dynamics and decrease the survival and reproduction of prey species. Prey species that are most vulnerable to increased predation due to increases in linear density include ungulates (e.g., caribou; Latham et al. 2013) and hunted/trapped species such as moose and wolverine. Some species of birds, typically forest-breeding birds, may experience reduced reproductive success with increasing linear density due to increased rates of brood parasitism. Other species are more resilient to adverse effects associated with increases in linear density because they are predators (e.g., peregrine falcon and wolverine), because they may use edge habitat (e.g., foraging little brown myotis), or because they are not particularly vulnerable to brood parasitism (e.g., bank swallow [Garrison 1999], barn swallow [Brown and Brown 1999], common nighthawk [Brigham et al. 2011], rusty blackbird [Avery 2013], and olive-sided flycatcher [Altman and Sallabanks 2012]).

To minimize the amount of new linear disturbance, the current layout of the Project footprint will intersect the existing Old Airport Road route and burned habitat. Therefore, increase in the amount of linear disturbance by the Project will be small relative to existing conditions.

With the implementation of design features and mitigation measures, decreases in survival and reproduction of prey due to changes in predator and prey use of linear corridors and converted habitat is expected to have negligible net residual effects.

- *Attraction of wildlife to the Project (e.g., food waste, petroleum based products, salt) during construction may increase human wildlife interactions and change predator-prey relationships, which can affect wildlife survival and reproduction*

Food smells and other aromatic compounds such as petroleum-based chemicals can attract carnivores to human developments (Benn and Herrero 2002; Peirce and Van Daele 2006; Canadian Wildlife Service 2007). In addition, infrastructure, such as buildings at temporary work camps, may also attract carnivores as it can serve as a refuge to escape extreme heat or cold (Canadian Wildlife Service 2007). Corvids (e.g., crows and ravens) and raptors may also be attracted to anthropogenic food sources (Restani et al. 2001; Canadian Wildlife Service 2007; Kristan and Boarman 2007). Attraction of carnivores, raptors, corvids, and gulls can increase predation pressure on prey species (e.g., moose, passerines, and waterfowl) (CWS 2007; Liebezeit et al. 2009). This increase in predation may have the potential to cause local and regional population declines of these prey species (Monda et al. 1994;

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CWS 2007; Liebezeit et al. 2009). The attraction of wildlife to the Project also has the potential to increase human-wildlife interactions, which may result in the removal of individuals by mortality or relocation.

Numerous mitigation measures to appropriately manage food and other waste will be implemented. Waste, including food waste, recyclables, and hazardous waste materials will be stored in appropriate, secured containers on site to prevent wildlife attraction and exposure, prior to transport to appropriate facilities. An approved Waste Management Plan (PR#7) will be implemented and enforced for the Project. Littering and feeding of wildlife will be prohibited, and all employees will be provided with environmental awareness training, and training on the risks associated with feeding wildlife and careless disposal of food waste.

Mitigation measures and management plans should limit attractants to the Project and result in a minor increase in wildlife mortality risk from human-wildlife interactions and predation relative to baseline conditions and have a negligible residual effect on the survival and reproduction of wildlife populations.

- *Reduced habitat availability and distribution due to any increases in fires resulting from use of the road.*

Humans cause slightly more than half of all wildfires in Canada, typically in populated forest and grassland areas (NRC 2017). However, in the NWT, approximately 90% of wildfires are due to lightning strikes (GNWT-ENR 2017) with the wildfire season occurring from April to October annually. When winter or summer precipitation is low, unattended campfires and cigarettes that are not extinguished fully have the potential to proliferate and result in wildfire and loss of wildlife habitat. The design of the Project does not include camping areas, which will minimize the places where campfires may be used. Signs indicating the daily wildfire risk will be posted at the junctions of the TASR with Highway 3 and the Whatì community access road to alert drivers of the wildfire risk. The implementation of these design features and mitigation is anticipated to minimize risk of accidental human caused fires, and is predicted to result in negligible residual effects to wildlife habitat availability and distribution.

- *Introduction and spread of noxious and invasive plant species can affect plant community composition, which can affect wildlife habitat availability and distribution.*

The ground disturbance associated with construction and operation of the Project can create the type of habitat favoured by invasive plant species. Newly cleared areas, including roads, provide dispersal avenues for non-native and invasive species, and invasions may be more likely to succeed as a result of stress placed on native species from habitat alteration (Trombulak and Frissell 2000). Vehicles and machinery can serve as dispersal mechanisms for plant seeds and vegetative parts that can get lodged in tires, the undercarriage, or mud on the surface of the vehicle.

The introduction of non-native and invasive plant species can upset the natural balance of established ecosystems (Forman 1995). When non-native or invasive plant species (e.g., Canada thistle) are introduced or invade from an adjacent area, they may compete with native species for resources, degrade habitats, or modify genetic diversity resulting in population declines of native species (Pimentel et al. 2007). Once invasive species are introduced into an area and become established, they are difficult to eradicate (Simberloff 1997). Non-native plant species can negatively affect wildlife habitat quality if non-native species come to dominate native vegetation in certain areas, thereby reducing habitat niches for some wildlife. Construction equipment originating from outside of the NWT will be washed prior to arrival to remove any attached soil and vegetation. If an area of weed infestation is encountered,

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construction vehicles will be re-cleaned prior to advancing to a weed-free area to minimize the spread of noxious and invasive plants.

The implementation of mitigation is anticipated to minimize the introduction and spread of noxious and invasive species so that any effect to native vegetation would be localized and minor, and is predicted to result in negligible residual effects to wildlife habitat availability and distribution.

4.3.2.3 Primary Pathways

The following primary pathways were identified from the screening-level assessment after consideration of mitigation.

- *Site preparation, construction and operation activities can result in the loss or alteration of vegetation and topography that may change habitat availability, use, and connectivity and influence wildlife abundance and distribution.*
- *Site preparation and construction may result in the destruction of roosting or hibernating bats (incidental take).*
- *Site preparation and construction may result in the destruction of nests, eggs, and individuals of migratory birds (incidental take).*
- *Sensory disturbance (lights, smells, noise, dust, human activity, viewscape) can change wildlife habitat availability, use and connectivity (movement and behaviour), which can lead to changes in wildlife abundance and distribution.*
- *Altered movement patterns, including any changes to interactions with other caribou herds.*
- *Increase in public access could affect wildlife survival and reproduction through vehicle strikes, and/or legal and illegal hunting.*
- *Use of linear corridors by bison may lead to range expansion and affect moose and caribou habitat.*
- *Loss of functional habitat due to competition with other wildlife species (in particular bison).*

Primary pathways identify potential effects of the Project on wildlife in general, and the potential for each VC to be affected by each primary pathway varies. For example, some wildlife species are highly susceptible to sensory disturbance (Dahlgren and Korschgen 1992; Kempenaers et al. 2010; Kuck et al. 1985; Manci et al. 1988;Yarmoloy et al. 1988), whereas others are unaffected by it, or habituate easily (Borkowski et al. 2006; Hardy 2001; Herrero et al. 2005; Smith et al. 2005). Valued components that are likely to be little affected by the cumulative changes from the Project and previous and existing developments, and have no interaction with RFDs would be predicted to not be significantly influenced by cumulative effects. (Section 4.3.1). The expected strength of the interactions between primary pathways and each VC is identified in Table 4.3-2, which was based on Base Case results, potential to be influenced by RFDs (Figure 4.3-1), and literature on the responses of each VC to the effects from road construction and operations (Section 4.1.2).

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For those VCs that are predicted to have weak interactions with primary pathways, a quantitative and qualitative analysis of changes to measurement indicators from the Project relative to Base Case conditions, along with a description of potential changes to populations, is provided in Sections 4.3.3 to 4.3.12. However, a formal classification of residual effects and determination of significance was completed only for those VCs that are expected to have strong interactions with Project pathways (Section 4.3.1). Species for which the Project may have strong interactions were barren-ground and boreal caribou, moose, and wolverine (Table 4.3-2).

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Table 4.3-2: Interaction Strength between Primary Pathways and VCs

Primary Pathway	Barren-ground Caribou	Boreal Caribou	Bison	Moose	Wolverine	Little Brown Myotis	Bank and Barn Swallow	Common Nighthawk	Olive-sided flycatcher	Horned grebe	Yellow rail	Red-necked phalarope	Rusty blackbird	Peregrine falcon	Short-eared owl	Bumble bees
Site preparation, construction and operation activities can result in the loss or alteration of vegetation and topography that may change habitat availability, use, and connectivity and influence wildlife abundance and distribution	+	+	-	+	+	-	-	-	-	-	-	-	-	-	-	-
Site preparation and construction may result in the destruction of roosting or hibernating bats (incidental take)	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Site preparation and construction may result in the destruction of nests, eggs, and individuals of migratory birds (incidental take)	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-	-	-	-	-	-	-	n/a
Sensory disturbance (lights, smells, noise, dust, human activity and viewscape can change wildlife habitat availability, use and connectivity (movement and behaviour), which can lead to changes in wildlife abundance and distribution	+	+	-	+	+	-	-	-	-	-	-	-	-	-	-	-
Altered movement patterns, including any changes to interactions with other caribou herds	-	-	-	-	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Increase in public access could affect wildlife survival and reproduction through vehicle strikes, and/or legal and illegal hunting	+	+	-	+	+	-	-	-	-	-	-	-	-	-	-	-
Use of linear corridors by bison may lead to range expansion and affect moose and caribou habitat	-	-	-	-	n//a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Loss of functional habitat due to competition with other wildlife species (in particular bison)	-	-	n/a	-	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

+ = strong interaction; - = weak interaction; n/a = not applicable.

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4.3.3 Bison

Habitat Availability

Although the Mackenzie range wood bison population overlaps with the Project, a minimal amount of moderate to high suitability habitat is predicted to be removed due to the Project. The RSA is estimated to contain 1,576,841 ha (57.3%) of potentially suitable habitat and the Project is predicted to remove 2,546 ha (0.16%) of moderate to high suitability habitat (Table 4.3-3). The direct loss of moderate to high suitability bison habitat is primarily associated with the construction of the Project footprint. The Project will cause an incremental increase in the amount of disturbance in the RSA. In addition, the Project may create new suitable foraging habitat for wood bison along the road corridor. This amount of habitat loss corresponds to a small fraction of the typical home range size for wood bison, and connectivity of the remaining habitat patches is expected to be maintained. Suitable habitat is well distributed through the Mackenzie Bison Sanctuary portion of the RSA but more patchily distributed in the areas adjacent to the Project (Figure 4.3-1). Wood bison are relatively mobile and already travel within their home ranges to find suitable habitat patches for food and cover. Therefore, changes in habitat availability and distribution at Base Case are expected to be well within the resilience limits and adaptive capacity of bison.

Table 4.3-3: Bison Habitat Availability in the Application Case

Habitat Suitability	Base Case (ha)	Application Case (ha)	Change in Area (ha)	Percent (%)
Moderate to High	1,576,841	1,574,294	-2,546	-0.16
Nil to Low	1,172,895	1,175,441	2,546	0.22

Note: Numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.

Sensory Disturbance

Sensory disturbance may reduce habitat quality and cause some individuals to avoid moderate and high suitability habitat in the RSA. The primary source of sensory disturbance from the Project during operations will be traffic, which is predicted to include up to 40 vehicles per day, or an average of 1.7 vehicles per hour, assuming future developments occur. Some individuals with home ranges that overlap the Project footprint may currently be habituated to sensory disturbance due to the presence of the existing highway, Old Airport Road route and the network of trails surrounding the Project route. Traffic will contribute noise and dust disturbances relative to the Base Case, however, these disturbances will be periodic given the low predicted traffic volume and only affect the area immediately adjacent to the road. Although noise or visual stimulus from traffic may illicit avoidance behaviour by bison, it does not affect overall resource use. In addition, these types of sensory disturbances are expected to be low during the operation phase and unlikely to result in permanent barrier effects.

Improved Access

The Project is intended to improve access to the community of Whatì by developing the Old Airport Road route into an all-season road surface designed to allow trucks and heavier traffic. Bison are vulnerable to collisions with vehicles and collision rates are often dependent on vehicle speed and traffic frequency (Borkowski et al. 2006). Up to 40 vehicles are predicted to use the road per day during the Project operational phase, assuming all future developments occur. Over the life of the Project, injury or mortality to bison from vehicle strikes may occur. Posted speed limits will be low during operation, , which scientific literature indicates will help reduce the potential risk for vehicle-wildlife collisions (Jaarsma et al. 2006; Litvaitis and Tash 2008; Neuman et al. 2012). Speed limits are not considered a mitigation action and the effectiveness is not expected to be monitored. Mortality from animal-vehicle collisions associated with the Project is expected to have a small net effect on bison populations in the RSA.

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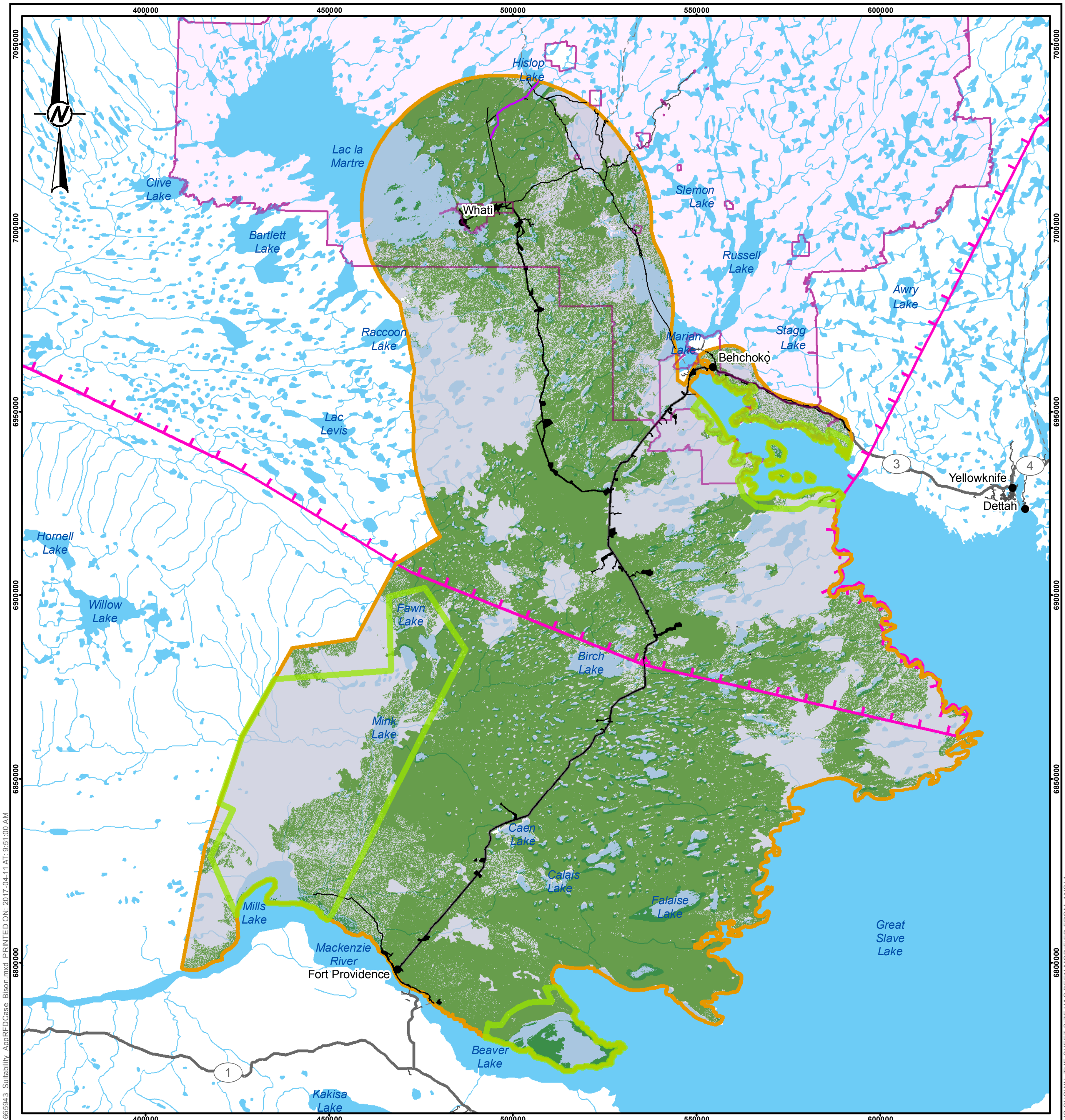
Destruction of Moose and Caribou Habitat

Bison are known to use linear features such as roads for travel, and an increase in linear disturbances may facilitate dispersal of bison into new areas that would otherwise not be accessible or available (GNWT 2010). Because range expansion to the south and east of the RSA is limited by the Bison Control Area and Great Slave Lake, bison are more likely to move north or west, and the Project corridor may encourage the northward movement. A northward range expansion may result in destruction or degradation of moose and caribou habitat. Bison behaviours, such as grazing down to the dirt, trampling meadows, wallowing, creating trails and rubbing on trees, may lower the quality of habitat available for use by moose and caribou where the ranges overlap (GNWT 2010; Clark et al. 2016). Although there appears to be a large block of suitable habitat at the north end of the RSA, north of Whatì, this habitat is primarily associated with a recently burned area. Recent burns may provide suitable foraging habitat for bison in the short term due to creation of early successional habitat. Once the successional habitat progresses to young forest, it will become unsuitable for bison. As such, this block of habitat is not expected to represent long-term suitable habitat for bison that could support a northward range expansion. Traditional Knowledge also indicates there is little suitable bison habitat near the Project (PR#28, Figure 4.3-1). Because available habitat at the north end of the RSA is expected to be limited in the long-term, potential range expansion facilitated by the Project is expected to be negligible. In addition, local communities will be engaged to develop and implement actions to reduce the number and frequency of bison within communities based on the Wood Bison Management Strategy range management actions (PR#80).

Loss of Functional Habitat from Competition

Although bison share the landscape with other large ungulates, such as moose, elk, caribou and deer, there is little overlap in food sources and therefore, a low level of competition (COSEWIC 2013b; SARC 2016b). Minor overlap in the foraging resources of moose and caribou may occur in the fall or spring when bison target lichen and willows as food sources. A study evaluating the potential for competition between re-introduced bison populations and caribou and moose in the Yukon concluded there is low overlap in habitat and diet between bison and caribou or moose during both the summer and winter periods (Jung et al. 2015). Traditional Knowledge indicates that these species also avoid one another based on smell (PR#28). Based on the limited overlap of preferred habitat between bison and caribou or moose, potential for competition of resources and a loss of functional habitat due to competition is expected to be low.



LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- WATERCOURSE
- TŁĮCHQ LAND
- WATER BODY
- CANDIDATE PROTECTED AREA
- DEVELOPMENT
- RFD
- BISON RSA
- WEK'ÈEZHÌI RESOURCE MANAGEMENT AREA

HABITAT SUITABILITY

- MODERATE TO HIGH
- NIL TO LOW

0 30 60

1:1,500,000 KILOMETRES

REFERENCE(S)

1. ADMINISTRATIVE REGIONS OBTAINED FROM GOVERNMENT OF NORTHWEST TERRITORIES.
2. CIMP INVENTORY OF LANDSCAPE CHANGE, OBTAINED FROM THE NWT CENTRE FOR GEOMATICS.
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PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
TŁĮCHQ ALL-SEASON ROAD

TITLE
DISTRIBUTION OF SUITABLE BISON HABITAT AT APPLICATION CASE AND RFD CASE

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO.	REV.	FIGURE
1665943	0	4.3-1

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4.3.4 Little Brown Myotis

Habitat Availability

Although little brown myotis overlap with the Project, there is a small amount of suitable habitat for the species in the RSA at Base Case. The Project is predicted to directly disturb 521 ha (4.9%) of suitable little brown myotis habitat in the RSA (Table 4.3-4) that is generally well connected across the central portion of the RSA (Figure 4.3-2). The direct loss of little brown myotis habitat is primarily associated with construction of the Project footprint. This partially represents the loss of foraging habitat for little brown myotis compared to the Base Case. There is some uncertainty associated with how little brown myotis will respond along sections of the Project footprint that open up closed canopy forest because activities that create open habitat can sometimes improve, or create, little brown myotis habitat. For example, little brown myotis are aerial insectivores that typically forage in forest gaps and edges, and the loss of some foraging habitat may be compensated by the creation of forest openings along the TASR ROW that facilitate movement and foraging behaviour.

There are no RFDs in the RSA, thus cumulative effects to suitable little brown myotis habitat are restricted to the application of the Project. Little brown myotis are highly mobile and they demonstrate flexibility in habitat selection including use of human disturbance such as buildings and roads. Therefore, changes in habitat availability and distribution in the Application Case are expected to be well within the resilience limits and adaptive capacity of little brown myotis. Overall, changes in habitat availability and distribution resulting from the Project are not predicted to change little brown myotis populations in the RSA.

Table 4.3-4: Little Brown Myotis Habitat Availability in the Application Case

Habitat Suitability	Base Case (ha)	Application Case (ha)	Change in Area (ha)	Percent (%)
Moderate to High	10,592	10,071	-521	-4.9
Nil to Low	44,981	45,502	521	1.2

Note: Numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.

Sensory Disturbance

Little brown myotis aggregate in hibernacula and are not active in the RSA during winter. Majority of vegetation clearing for the Project will preferentially take place in winter so sensory disturbances associated with clearing are less likely occur when little brown myotis are not active. Pre-construction surveys of locations with hibernacula potential (e.g., abandoned cabins, caves) along the Project route will be completed prior to land clearing activities and avoided if used. Because construction will be conducted when bats are active, contingency mitigation will be in place. This includes restricting activity around known maternity roots within the Project footprint to reduce sensory disturbance to maternity nests that may be present near the Project.

The primary source of sensory disturbance from the Project during operations will be traffic, which is predicted to include up to 40 vehicles per day, or an average of 1.7 vehicles per hour, assuming future developments occur. Loud traffic noise may interfere with the ability of bats to echo locate prey (Siemers and Schabb 2011). Traffic will contribute noise and dust disturbances relative to the Base Case, however, these disturbances will be periodic given the low predicted traffic volume and only affect the area immediately adjacent to the Project and only when bats are active in summer.

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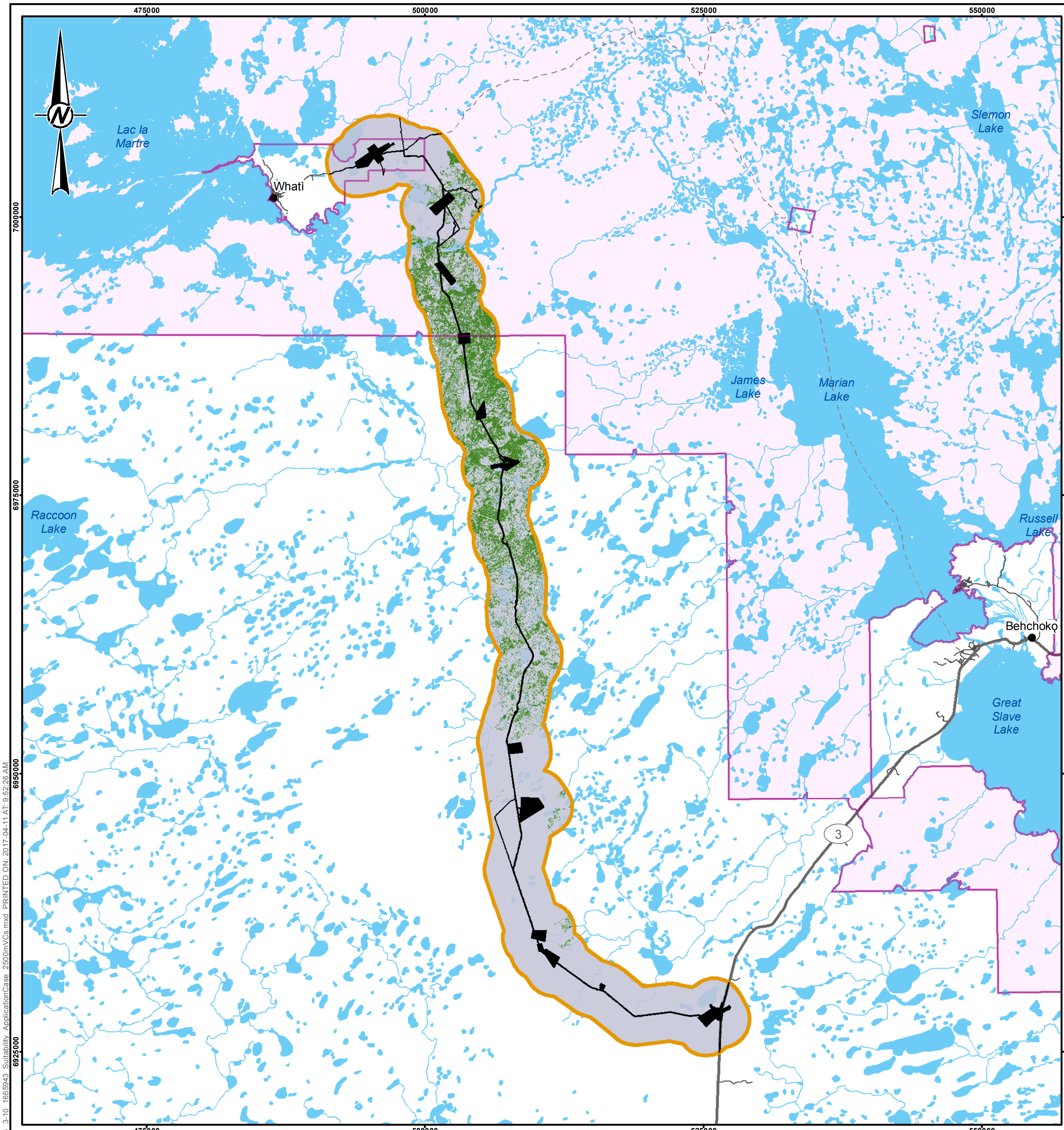
Little brown myotis is tolerant of anthropogenic disturbance often favouring man-made structures, and prefer to forage over open areas including forest edges or along trails and roads (Segers and Broders 2014). Bats are highly mobile and have the ability to fly over the Project and so, movements of little brown myotis are unlikely to be restricted by the physical presence of the road or noise generated by traffic. The effect of sensory disturbance is predicted to be minor for little brown myotis populations in the RSA.

Improved Access

The Project is intended to improve access to the community of Whatì by developing the Old Airport Road route into an all-season road surface designed to allow trucks and heavier traffic. A meta-analysis indicates that *Myotis* species are vulnerable to collisions with vehicles and that collision rates are dependent on traffic volume and adjacent habitat quality, with traffic volumes of less than 100 vehicles per day resulting in low mortality rates (Fensome and Mathews 2016). Up to 40 vehicles are predicted to use the road per day during the Project operational phase, assuming all future developments occur. Posted speed limits will be low during operation, which will help reduce the potential risk for vehicle-wildlife collisions. Access roads to borrow sites will be blocked to prevent future use when no longer active. Over the life of the Project, injury or mortality to little brown myotis from vehicle strikes may occur but will be limited to summer months when this species are active and present. Given the relatively low amount of suitable little brown myotis habitat in the RSA, and the location of the RSA at the northern edge of the species' ranges, the number of little brown myotis present is predicted to be low. In addition, mitigation implemented for the Project is anticipated to limit vehicle-wildlife collisions. Thus, the effect of increased access is not predicted to change little brown myotis populations in the RSA.



LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- WATERCOURSE
- TŁĮCHǪ LAND
- WATER BODY
- DEVELOPMENT
- BUMBLE BEE, BIRD, AND BAT RSA

HABITAT SUITABILITY

- MODERATE TO HIGH
- NIL TO LOW

0 10 20

1:500,000 KILOMETRES

REFERENCE(S)

1. CIMP INVENTORY OF LANDSCAPE CHANGE, OBTAINED FROM THE NWT CENTRE FOR GEOMATICS.
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PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
TŁĮCHǪ ALL-SEASON ROAD

TITLE
DISTRIBUTION OF SUITABLE LITTLE BROWN MYOTIS HABITAT AT APPLICATION CASE

CONSULTANT
Golder Associates

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO.	REV.	FIGURE
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4.3.5 Bank and Barn Swallow

Habitat Availability

The Project is at the northern edge of bank and barn swallow distribution in Canada, and there is expected to be a limited abundance of these species in the RSA. The RSA is estimated to contain 4,196 ha (7.5%) of potential suitable habitat for bank and barn swallow (Table 4.2-22). The Project is predicted to directly disturb 1.0% (44 ha) of suitable bank and barn swallow habitat in the RSA (Table 4.3-5). The direct loss of bank and barn swallow habitat is minimal and primarily associated with construction of the Project footprint. Habitat is also patchily distributed and not well connected across the RSA (Figure 4.3-3). Bank and barn swallow are highly mobile and are capable of establishing territories in new locations. Therefore, changes in habitat availability and distribution at Base Case are expected to be well within the resilience limits and adaptive capacity of bank and barn swallow.

Mitigation such as locating borrow sites and access roads in burned areas and placing construction camps and laydown areas in borrow sites will limit the loss of suitable habitat. There are no RFDs in the RSA, thus cumulative effects to suitable bank and barn swallow habitat are restricted to the application of the Project. Changes in habitat availability resulting from the Project are not predicted to change bank and barn swallow populations in the RSA.

Table 4.3-5: Bank and Barn Swallow Habitat Availability in the Application Case

Habitat Suitability	Base Case (ha)	Application Case (ha)	Change in Area (ha)	Percent (%)
Moderate to High	4,196	4,152	-44	-1.0
Nil to Low	51,376	51,420	44	0.08

Sensory Disturbance

Bank and barn swallows are migratory and not present in the RSA during winter. Vegetation clearing for the Project will primarily take place in winter when bank and barn swallows are not present, so there is negligible risk to nesting birds. If summer land clearing is required, nest surveys will be conducted prior to clearing to avoid disturbing nesting birds (PR#7). Borrow sites and access roads will be blocked to prevent future use when no longer active. Because construction will be conducted in the summer when bank and barn swallows are present, contingency mitigation will be in place. This includes avoidance of land clearing during the migratory bird breeding season (April 25 to August 24; PR#7).

Sensory disturbance during the operational phase may also result in localized avoidance of habitats near the Project from traffic or maintenance vehicles. The primary source of sensory disturbance from the Project during operations will be traffic, which is predicted to include up to 40 vehicles per day, or an average of 1.7 vehicles per hour, assuming future developments occur. Traffic will contribute noise and dust disturbances relative to the Base Case, however, these disturbances will be periodic given the low predicted traffic volume and only affect the area immediately adjacent to the road. Bank and barn swallows are highly mobile and have the ability to fly over the Project and so, movements are unlikely to be restricted by the physical presence of the road or noise generated by traffic. The effect of sensory disturbance is not predicted to cause any change in bank and barn swallow populations in the RSA.

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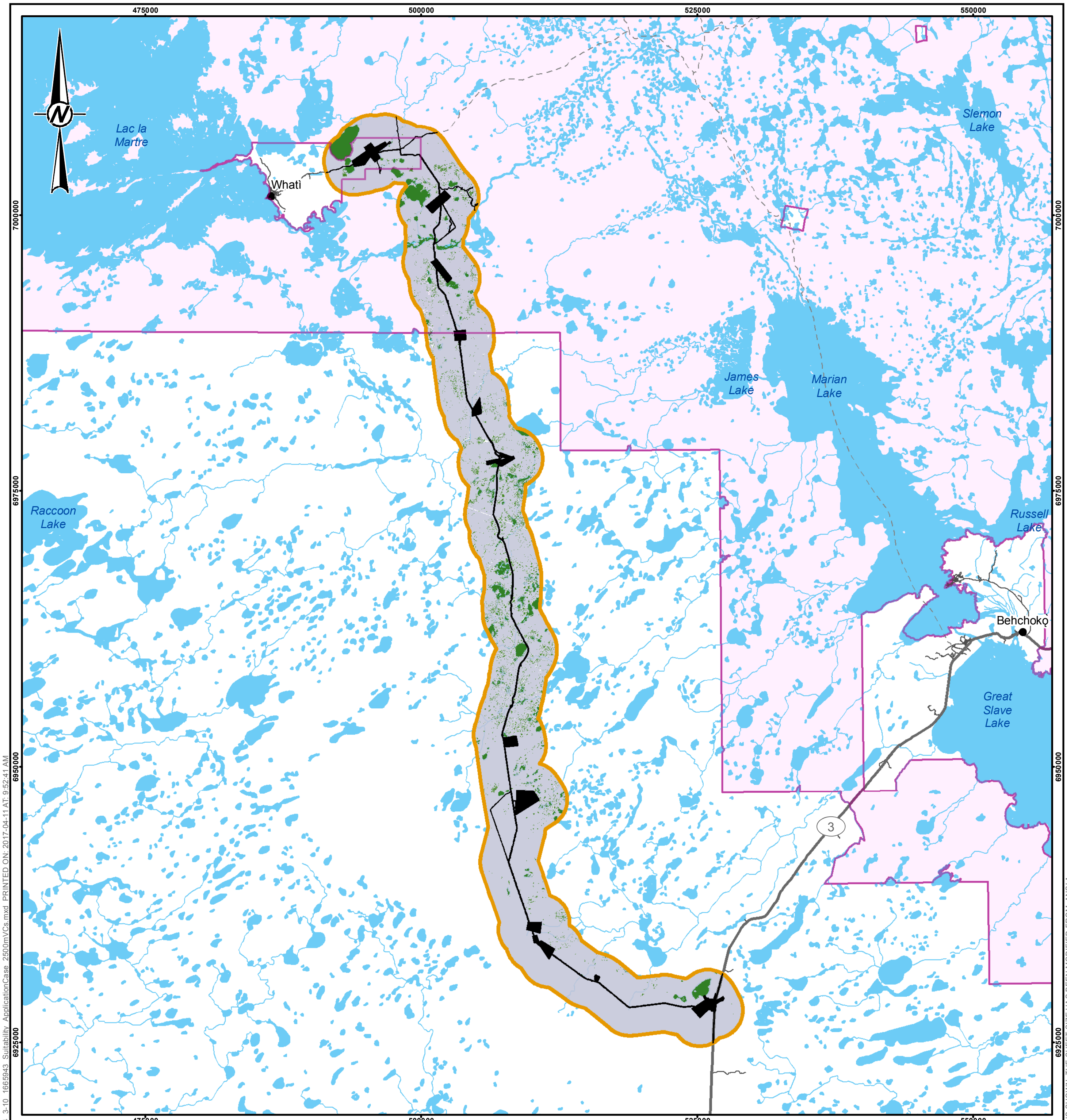
Improved Access

The Project is intended to improve access to the community of Whatì by developing the Old Airport Road route into an all-season road surface designed to allow trucks and heavier traffic. Birds are vulnerable to collisions with vehicles and collision rates are dependent on vehicle speed, visibility and weather (Bishop and Brogan 2013). Up to 40 vehicles are predicted to use the road per day during the Project operational phase, assuming all future developments occur. Posted speed limits will be low during operation, which will help reduce the potential risk for vehicle-wildlife collisions. Access roads to borrow sites will be blocked to prevent future use when no longer active. Over the life of the Project, injury or mortality to bank and barn swallow from vehicle strikes may occur but will be limited to summer months when migratory birds may be present. Given the relatively low amount of suitable bank and barn swallow habitat in the RSA, and the location of the RSA at the northern edge of these species' ranges, the number of bank and barn swallows present is predicted to be low. In addition, mitigation implemented for the Project is anticipated to limit vehicle-wildlife collisions. Thus, the effect of increased access is not predicted to change bank and barn swallow populations in the RSA.



LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- WATERCOURSE
- TŁĮCHǪ LAND
- WATER BODY
- DEVELOPMENT
- BUMBLE BEE, BIRD, AND BAT RSA

HABITAT SUITABILITY

- MODERATE TO HIGH
- NIL TO LOW

0 10 20

1:500,000 KILOMETRES

REFERENCE(S)

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PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT

GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT

TŁĮCHǪ ALL-SEASON ROAD

TITLE

DISTRIBUTION OF SUITABLE BANK AND BARN SWALLOW HABITAT AT APPLICATION CASE

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO.	REV.	FIGURE
1665943	0	4.3-3

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4.3.6 Common Nighthawk

Habitat Availability

The common nighthawk is widely distributed across Canada and is found in all provinces and territories except Nunavut. In the NWT, its range extends from the southern portion of the territory north along the Mackenzie Valley to Norman Wells (COSEWIC 2007a). There is a large amount of potential suitable breeding habitat for common nighthawk in the RSA at Base Case. The RSA is estimated to contain 26,637 ha (47.9%) of potential suitable habitat for common nighthawk (Table 4.2-24), that is generally well connected across the RSA (Figure 4.3-4).

The Project is predicted to directly disturb 7.0% (1,866 ha) of suitable common nighthawk habitat in the RSA (Table 4.3-6). The direct loss of common nighthawk habitat is primarily associated with construction of the Project footprint. There is some uncertainty associated with how common nighthawk will respond along sections of the Project footprint that open up closed canopy forest because activities that create open habitat can sometimes improve, or create, common nighthawk habitat. Common nighthawks are highly mobile and they demonstrate flexibility in habitat selection including use of human disturbance such as clear cuts and utility corridors. Therefore, changes in habitat availability and distribution at Base Case are expected to be well within the resilience limits and adaptive capacity of common nighthawk.

There are no RFDs in the RSA, thus cumulative effects to suitable common nighthawk habitat are restricted to the application of the Project. Changes in habitat availability resulting from the Project are not predicted to change common nighthawk populations in the RSA.

Table 4.3-6: Common Nighthawk Habitat Availability in the Application Case

Habitat Suitability	Base Case (ha)	Application Case (ha)	Change in Area (ha)	Percent (%)
Moderate to High	26,637	24,771	-1,866	-7.0
Nil to Low	28,935	30,802	1,866	6.5

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Sensory Disturbance

Common nighthawks are migratory and not present in the RSA during winter. Vegetation clearing for the Project will primarily take place in winter when common nighthawks are not present, so there is negligible risk to nesting birds. If summer land clearing is required, nest surveys will be conducted prior to clearing to avoid disturbing nesting birds (PR#7). Borrow sites and access roads will be blocked to prevent future use when no longer active. Because construction will be conducted when common nighthawks are present, contingency mitigation for sensory disturbance will be in place. This includes avoidance of construction activity during the migratory bird breeding season (April 25 to August 24; PR#7).

Sensory disturbance during the operational phase may also result in localized avoidance of habitats near the Project from traffic or maintenance vehicles. The primary source of sensory disturbance from the Project during operations will be traffic, which is predicted to include up to 40 vehicles per day, or an average of 1.7 vehicles per hour, assuming future developments occur. Traffic will contribute noise and dust disturbances relative to the Base Case; however, these disturbances will be periodic given the low predicted traffic volume and only affect the area immediately adjacent to the road. Common nighthawks are highly mobile and have the ability to fly over the Project and so, movements are unlikely to be restricted by the physical presence of the road or noise generated by traffic. The effect of sensory disturbance is not predicted to cause any change in common nighthawk populations in the RSA.

Improved Access

The Project is intended to improve access to the community of Whatì by developing the Old Airport Road route into an all-season road surface designed to allow trucks and heavier traffic. Birds are vulnerable to collisions with vehicles and collision rates are dependent on vehicle speed, visibility and weather (Bishop and Brogan 2013). Up to 40 vehicles are predicted to use the road per day during the Project operational phase, assuming all future developments occur. Posted speed limits will be low during operation to reduce the potential risk for vehicle-wildlife collisions. Access roads to borrow sites will be blocked to prevent future use when no longer active. Over the life of the Project, injury or mortality to common nighthawk from vehicle strikes may occur but will be limited to summer months when migratory birds may be present. The common nighthawk is vulnerable to vehicle collisions because they roost on gravel roads and forage while flying between feeding areas over roads (Campbell et al. 2006; Brigham et al. 2011; American Bird Conservancy 2016; Environment Canada 2016b). However, mitigation implemented for the Project is anticipated to limit vehicle-wildlife collisions and mortality from vehicle collisions is expected to have a small net effect on common nighthawk populations in the RSA.

LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- WATERCOURSE
- TŁĮCHǪ LAND
- WATER BODY
- DEVELOPMENT
- BUMBLE BEE, BIRD, AND BAT RSA

HABITAT SUITABILITY

- MODERATE TO HIGH
- NIL TO LOW

0 10 20

1:500,000 KILOMETRES

REFERENCE(S)

1. CIMP INVENTORY OF LANDSCAPE CHANGE, OBTAINED FROM THE NWT CENTRE FOR GEOMATICS.
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PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT

GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT

TŁĮCHǪ ALL-SEASON ROAD

TITLE

DISTRIBUTION OF SUITABLE COMMON NIGHTHAWK HABITAT AT APPLICATION CASE

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO.	REV.	FIGURE
1665943	0	4.3-4

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4.3.7 Olive-Sided Flycatcher

Habitat Availability

The olive-sided flycatcher is common throughout its range and breeding individuals are currently distributed throughout the Canadian range (Environment Canada 2016c). There is a large amount of potential suitable breeding habitat for olive-sided flycatcher in the RSA at Base Case. The RSA is estimated to contain 43,093 ha (77.5%) of potential suitable habitat for olive-sided flycatcher (Table 4.2-25) that is well connected across the RSA (Figure 4.3-5). The Project is estimated to remove approximately 2,754 ha of suitable olive-sided flycatcher habitat, which is 6.4% of suitable habitat in the RSA (Table 4.3-7).

Habitat changes summarized in Table 4.3-7 result from a conversion of moderate to high suitability olive-sided flycatcher habitat to lower suitability habitats (i.e., nil to low). The direct loss of olive-sided flycatcher habitat is primarily associated with construction of the Project footprint. There is some uncertainty associated with how olive-sided flycatcher will respond along sections of the Project footprint that open up closed canopy forest because activities that create early seral habitat and increase forest to edge ratios can sometimes improve olive-sided flycatcher habitat. However, Haché et al. (2014) found that the density of olive-sided flycatcher was negatively affected by linear disturbances on the landscape.

Table 4.3-7: Olive-sided flycatcher Habitat Availability in the Application Case

Habitat Suitability	Base Case (ha)	Application Case (ha)	Change in Area (ha)	Percent (%)
Moderate to High	43,093	40,340	-2,754	-6.4
Nil to Low	12,479	15,233	2,754	22.1

Sensory Disturbance

Olive-sided flycatchers are migratory and not present in the RSA during winter. Vegetation clearing for the Project will primarily take place in winter when olive-sided flycatchers are not present, so there is negligible risk to nesting birds. If summer land clearing is required, nest surveys will be conducted prior to clearing to avoid disturbing nesting birds (PR#7). Borrow sites and access roads will be blocked to prevent future use when no longer active. Because construction will be conducted when olive-sided flycatchers are present, contingency mitigation for sensory disturbance will be in place. This includes avoidance of construction activity during the migratory bird breeding season (April 25 to August 24; PR#7).

Sensory disturbance during the operational phase may also result in localized avoidance of habitats near the TASR from traffic or maintenance vehicles. The primary source of sensory disturbance from the Project during operations will be traffic, which is predicted to include up to 40 vehicles per day, or an average of 1.7 vehicles per hour, assuming future developments occur. Traffic will contribute noise and dust disturbances relative to the Base Case, however, these disturbances will be periodic given the low predicted traffic volume and only affect the area immediately adjacent to the road. Olive-sided flycatchers are highly mobile and have the ability to fly over the Project and so, movements are unlikely to be restricted by the physical presence of the road or noise generated by traffic. The effect of sensory disturbance is not predicted to cause any change in olive-sided flycatcher populations in the RSA.

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Improved Access

The Project is intended to improve access to the community of Whatì by developing the Old Airport Road route into an all-season road surface designed to allow trucks and heavier traffic. Birds are vulnerable to collisions with vehicles and collision rates are dependent on vehicle speed, visibility and weather (Bishop and Brogan 2013). Up to 40 vehicles are predicted to use the road per day during the Project operational phase. Posted speed limits will low during operation to reduce the potential risk for vehicle-wildlife collisions. Access roads to borrow sites will be blocked to prevent future use when no longer active. Over the life of the Project, injury or mortality to olive-sided flycatcher from vehicle strikes may occur but will be limited to summer months when migratory birds may be present. Given that olive-sided flycatchers are only present in the region during the summer and that they typically nest several meters above the ground and travel and forage near or above the canopy level of the surrounding forest (COSEWIC 2007c; Environment Canada 2016c), the effect of increased access is not predicted to change olive-sided flycatcher populations in the RSA.

LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- WATERCOURSE
- TŁĮCHǪ LAND
- WATER BODY
- DEVELOPMENT
- BUMBLE BEE, BIRD, AND BAT RSA

HABITAT SUITABILITY

- MODERATE TO HIGH
- NIL TO LOW

0 10 20

1:500,000 KILOMETRES

REFERENCE(S)

1. CIMP INVENTORY OF LANDSCAPE CHANGE, OBTAINED FROM THE NWT CENTRE FOR GEOMATICS.
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PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
TŁĮCHǪ ALL-SEASON ROAD

TITLE
DISTRIBUTION OF SUITABLE OLIVE-SIDED FLYCATCHER HABITAT AT APPLICATION CASE

CONSULTANT

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO. 1665943 REV. 0 FIGURE 4.3-5

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4.3.8 Rusty Blackbird

Habitat Availability

The rusty blackbird is locally and patchily distributed throughout its range in Canada and is generally found in higher densities in the northwest (COSEWIC 2006). Although rusty blackbird overlap with the Project, there is little potential suitable habitat for rusty blackbird in the RSA at Base Case. The RSA is estimated to contain 3,734 ha (6.7% of RSA) of potential suitable habitat for rusty blackbird (Table 4.2-27). Habitat is also patchily distributed and not well connected across the RSA (Figure 4.3-6).

Powell et al. (2010a) reported an average home range size of 37.5 ha for rusty blackbirds in Maine. Assuming a territory size of 37.5 ha, the potential suitable habitat for rusty blackbird in the RSA may support 99 breeding pairs, if all potential habitat is occupied. The Project is predicted to remove <1.0% (24 ha) of suitable rusty blackbird habitat in the RSA, which is less than one breeding territory. Habitat changes summarized in Table 4.3-8 result from a conversion of moderate to high suitability rusty blackbird habitat to lower suitability habitats (i.e., nil to low). The direct loss of rusty blackbird habitat is primarily associated with construction of the Project footprint. Mitigation such as locating borrow sites and access roads in burned areas and placing construction camps and laydown areas in borrow sites or the ROW will limit the loss of suitable habitat.

There are no RFDs in the RSA, thus cumulative effects to suitable rusty blackbird habitat are restricted to the application of the Project. The decline in rusty blackbird populations has been largely attributed to the loss of habitat within their wintering range and is not likely to be compounded by habitat change from the Project because the availability of suitable breeding habitat is not likely to be limiting within and beyond the RSA. Changes in habitat availability resulting from the Project are not predicted to change rusty blackbird populations in the RSA.

Table 4.3-8: Rusty Blackbird Habitat Availability in the Application Case

Habitat Suitability	Base Case (ha)	Application Case (ha)	Change in Area (ha)	Percent (%)
Moderate to High	3,734	3,710	-24	-0.6
Nil to Low	51,839	51,863	24	<0.1

Sensory Disturbance

Rusty blackbirds are migratory and not present in the RSA during winter. Vegetation clearing for the Project will primarily take place in winter when rusty blackbirds are not present, so there is negligible risk to nesting birds. If summer land clearing is required, nest surveys will be conducted prior to clearing to avoid disturbing nesting birds (PR#7). Borrow sites and access roads will be blocked to prevent future use when no longer active. Because construction will be conducted when rusty blackbirds are present, contingency mitigation for sensory disturbance will be in place. This includes avoidance of construction activity during the migratory bird breeding season (April 25 to August 24; PR#7).

Sensory disturbance during the operational phase may also result in localized avoidance of habitats near the Project from traffic or maintenance vehicles. The primary source of sensory disturbance from the Project during operations will be traffic, which is predicted to include up to 40 vehicles per day, or an average of 1.7 vehicles per hour, assuming future developments occur. Traffic will contribute noise and dust disturbances relative to the Base Case, however, these disturbances will be periodic given the low predicted traffic volume and only affect

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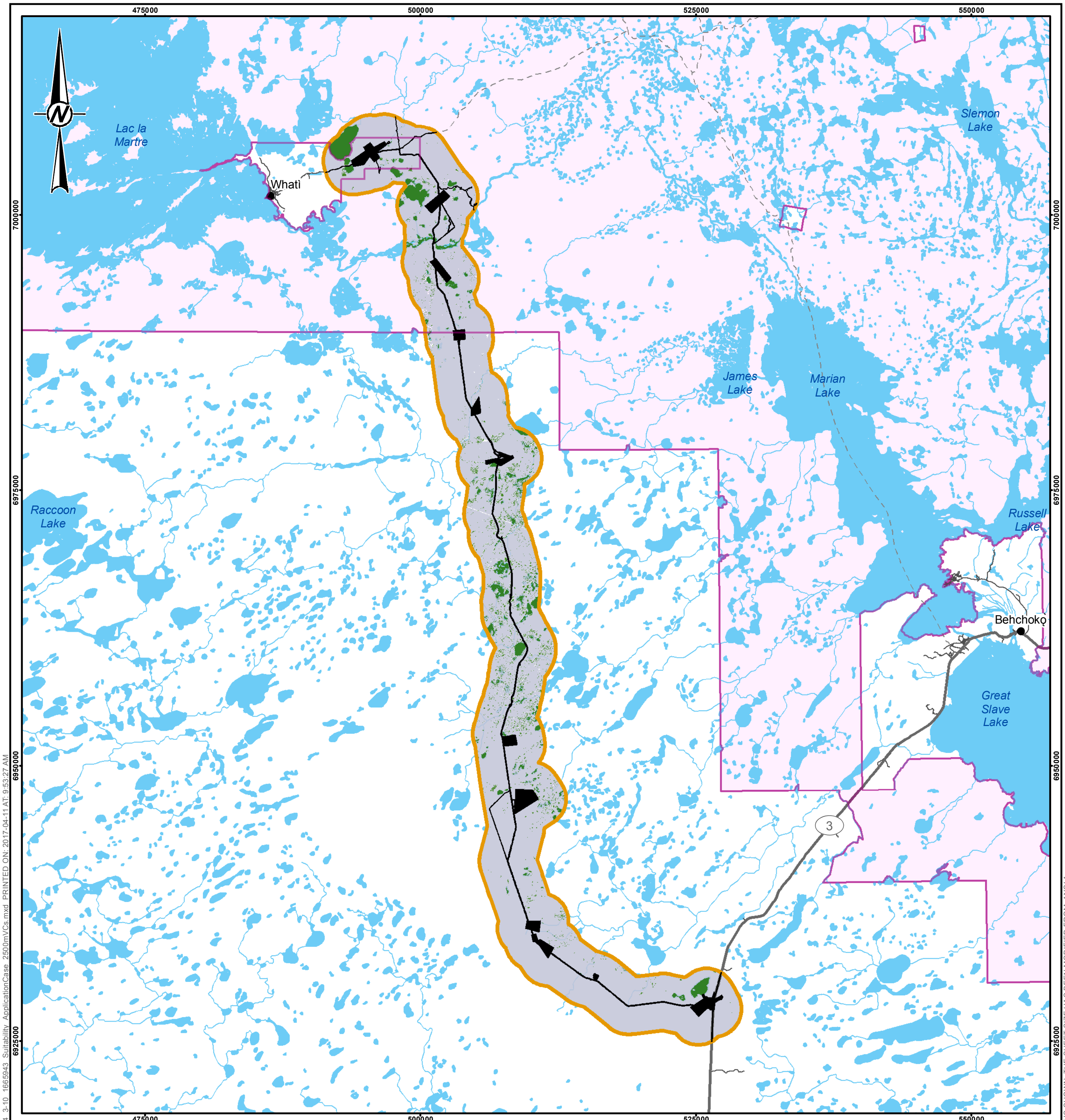
the area immediately adjacent to the road. Rusty blackbirds are highly mobile and have the ability to fly over the Project and so, movements are unlikely to be restricted by the physical presence of the road or noise generated by traffic. The effect of sensory disturbance is not predicted to cause any change in rusty blackbird populations in the RSA.

Improved Access

The Project is intended to improve access to the community of Whatì by developing the Old Airport Road route into an all-season road surface designed to allow trucks and heavier traffic. Birds are vulnerable to collisions with vehicles and collision rates are dependent on vehicle speed, visibility and weather (Bishop and Brogan 2013). Up to 40 vehicles are predicted to use the road per day during the Project operational phase, assuming future developments occur. Posted speed limits will be low during operation and will reduce the potential risk for vehicle-wildlife collisions. Access roads to borrow sites will be blocked to prevent future use when no longer active. Over the life of the Project, injury or mortality to rusty blackbird from vehicle strikes may occur but will be limited to summer months when migratory birds may be present. Given that rusty blackbird are only present in the region during the summer and the low suitability of habitat in the RSA, the effect of increased access is not predicted to change rusty blackbird populations in the RSA.



LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- WATERCOURSE
- TŁĮCHǪ LAND
- WATER BODY
- DEVELOPMENT
- BUMBLE BEE, BIRD, AND BAT RSA

HABITAT SUITABILITY

- MODERATE TO HIGH
- NIL TO LOW

0 10 20

1:500,000 KILOMETRES

REFERENCE(S)

1. CIMP INVENTORY OF LANDSCAPE CHANGE, OBTAINED FROM THE NWT CENTRE FOR GEOMATICS.
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PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT

GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT

TŁĮCHǪ ALL-SEASON ROAD

TITLE

DISTRIBUTION OF SUITABLE RUSTY BLACKBIRD HABITAT AT APPLICATION CASE

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO.	REV.	FIGURE
1665943	0	4.3-6

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4.3.9 Horned Grebe, Yellow Rail and Red-necked Phalarope

Habitat Availability

Horned grebe, yellow rail and red-necked phalarope are widely distributed across northern Canada, but presence within their breeding ranges is patchy as local populations occur in areas of shallow water rich in emergent vegetation (COSEWIC 2009a, COSEWIC 2009b, COSEWIC 2014b). There is little potential suitable habitat for horned grebe, yellow rail and red-necked phalarope, in the RSA at Base Case. The RSA is estimated to contain 3,734 ha (6.7% of RSA) of potential suitable habitat for horned grebe, yellow rail and red-necked phalarope (Table 4.2-26). Habitat is also patchily distributed and not well connected across the RSA (Figure 4.3-7).

The Project is predicted to remove <1.0% (24 ha) of potential suitable breeding habitat for horned grebe, yellow rail and red-necked phalarope. Habitat changes summarized in Table 4.3-9 result from a conversion of moderate to high suitability habitat to lower suitability habitats (i.e., nil to low). The direct loss of horned grebe, yellow rail, and red-necked phalarope habitat is primarily associated with construction of the Project footprint. Mitigation such as locating borrow sites and access roads in burned areas and placing construction camps and laydown areas in borrow sites will limit the loss of suitable habitat.

There are no RFDs in the RSA, thus cumulative effects to suitable horned grebe, yellow rail and red-necked phalarope habitat are restricted to the application of the Project. Changes in habitat availability resulting from the Project are not predicted to change horned grebe, yellow rail and red-necked phalarope populations in the RSA.

Table 4.3-9: Horned Grebe, Yellow Rail, and Red-necked Phalarope Habitat Availability in the Application Case

Habitat Suitability	Base Case (ha)	Application Case (ha)	Change in Area (ha)	Percent (%)
Moderate to High	3,734	3,710	-24	-0.6
Nil to Low	51,839	51,863	24	<0.1

Sensory Disturbance

Horned grebe, yellow rail and red-necked phalarope are migratory and not present in the RSA during winter. Vegetation clearing for the Project will primarily take place in winter when horned grebe, yellow rail and red-necked phalarope are not present, so there is negligible risk to nesting birds. If summer land clearing is required, nest surveys will be conducted prior to clearing to avoid disturbing nesting birds (PR#7). Borrow sites and access roads will be blocked to prevent future use when no longer active. Because construction will be conducted when horned grebe, yellow rail and red-necked phalarope are present, contingency mitigation for sensory disturbance will be in place. This includes avoidance of construction activity during the migratory bird breeding season (April 25 to August 24; PR#7).

Sensory disturbance during the operational phase may also result in localized avoidance of habitats near the Project from traffic or maintenance vehicles. The primary source of sensory disturbance from the Project during operations will be traffic, which is predicted to include up to 40 vehicles per day, or an average of 1.7 vehicles per hour, assuming future developments occur, assuming future developments occur. Traffic will contribute noise and dust disturbances relative to the Base Case, however, these disturbances will be periodic given the low predicted traffic volume and only affect the area immediately adjacent to the road. Horned grebe, yellow rail

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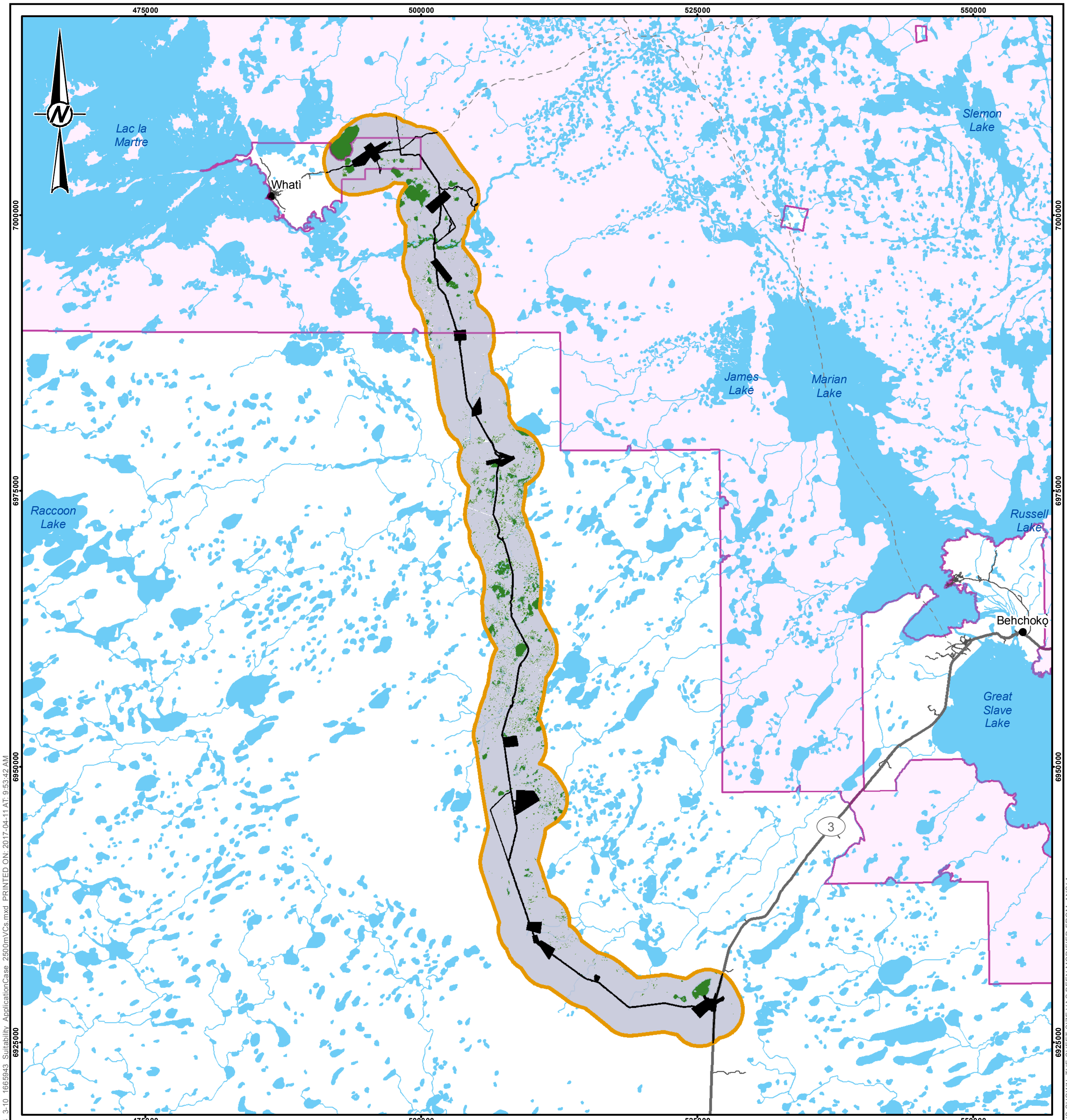
and red-necked phalarope are highly mobile and have the ability to fly over the Project and so, movements are unlikely to be restricted by the physical presence of the road or noise generated by traffic. The effect of sensory disturbance is not predicted to cause any change in horned grebe, yellow rail and red-necked phalarope populations in the RSA.

Improved Access

The Project is intended to improve access to the community of Whatì by developing the Old Airport Road route into an all-season road surface designed to allow trucks and heavier traffic. Birds are vulnerable to collisions with vehicles and collision rates are dependent on vehicle speed, visibility and weather (Bishop and Brogan 2013). Up to 40 vehicles are predicted to use the road per day during the Project operational phase, assuming future developments occur. Posted speed limits will low during operation and will reduce the potential risk for vehicle-wildlife collisions. Access roads to borrow sites will be blocked to prevent future use when no longer active. Over the life of the Project, injury or mortality to horned grebe, yellow rail and red-necked phalarope from vehicle strikes may occur but will be limited to summer months when migratory birds may be present. Given that horned grebe, yellow rail and red-necked phalarope are only present in the region during the summer and the low suitability of habitat in the RSA, the effect of increased access is not predicted to change horned grebe, yellow rail and red-necked phalarope populations in the RSA.



LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- WATERCOURSE
- TŁĮCHQ LAND
- WATER BODY
- DEVELOPMENT
- BUMBLE BEE, BIRD, AND BAT RSA

HABITAT SUITABILITY

- MODERATE TO HIGH
- NIL TO LOW

0 10 20

1:500,000 KILOMETRES

REFERENCE(S)

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PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT

GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT

TŁĮCHQ ALL-SEASON ROAD

TITLE

DISTRIBUTION OF SUITABLE HORNED GREBE, YELLOW RAIL AND RED-NECKED PHALAROPE HABITAT AT APPLICATION

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO.	REV.	FIGURE
1665943	0	4.3-7

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4.3.10 Peregrine Falcon

Habitat Availability

Although peregrine falcons overlap with the Project, there is relatively little potential suitable habitat for peregrine falcon in the RSA at Base Case. The RSA is estimated to contain 487 ha (0.9% of RSA) of potential suitable habitat for peregrine falcon (Table 4.2-28). Habitat is also patchily distributed across the RSA (Figure 4.3-8). The Project is predicted to directly disturb 1.8% (9 ha) of suitable peregrine falcon habitat in the RSA (Table 4.3-10). The direct loss of peregrine falcon habitat is primarily associated with construction of the Project footprint.

There are no RFDs in the RSA, thus cumulative effects to suitable peregrine falcon habitat are restricted to the application of the Project. Changes in habitat availability resulting from the Project are not predicted to change peregrine falcon populations in the RSA.

Table 4.3-10: Peregrine Habitat Availability in the Application Case

Habitat Suitability	Base Case (ha)	Application Case (ha)	Change in Area (ha)	Percent (%)
Moderate to High	487	478	-9	-1.8
Nil to Low	55,085	55,094	9	0.02

Sensory Disturbance

Peregrine falcons are migratory and not present in the RSA during winter. Vegetation clearing for the Project will primarily take place in winter when peregrine falcons are not present, so there is negligible risk to nesting birds. If summer land clearing is required, nest surveys will be conducted prior to clearing to avoid disturbing nesting birds (PR#7). Borrow sites and access roads will be blocked to prevent future use when no longer active. Because construction will be conducted when peregrine falcons are present, contingency mitigation for sensory disturbance will be in place. This includes avoidance of construction activity during the migratory bird breeding season (April 25 to August 24; PR#7).

Sensory disturbance during the operational phase may also result in localized avoidance of habitats near the TASR from traffic or maintenance vehicles. The primary source of sensory disturbance from the Project during operations will be traffic, which is predicted to include up to 40 vehicles per day, or an average of 1.7 vehicles per hour, assuming future developments occur. Traffic will contribute noise and dust disturbances relative to the Base Case, however, these disturbances will be periodic given the low predicted traffic volume and only affect the area immediately adjacent to the road. Peregrine falcons are highly mobile and have the ability to fly over the Project and so, movements are unlikely to be restricted by the physical presence of the road or noise generated by traffic. The effect of sensory disturbance is not predicted to cause any change in peregrine falcon populations in the RSA.

Improved Access

The Project is intended to improve access to the community of Whatì by developing the Old Airport Road route into an all-season road surface designed to allow trucks and heavier traffic. Birds are vulnerable to collisions with vehicles and collision rates are dependent on vehicle speed, visibility and weather (Bishop and Brogan 2013). Up to 40 vehicles are predicted to use the road per day during the Project operational phase, assuming future

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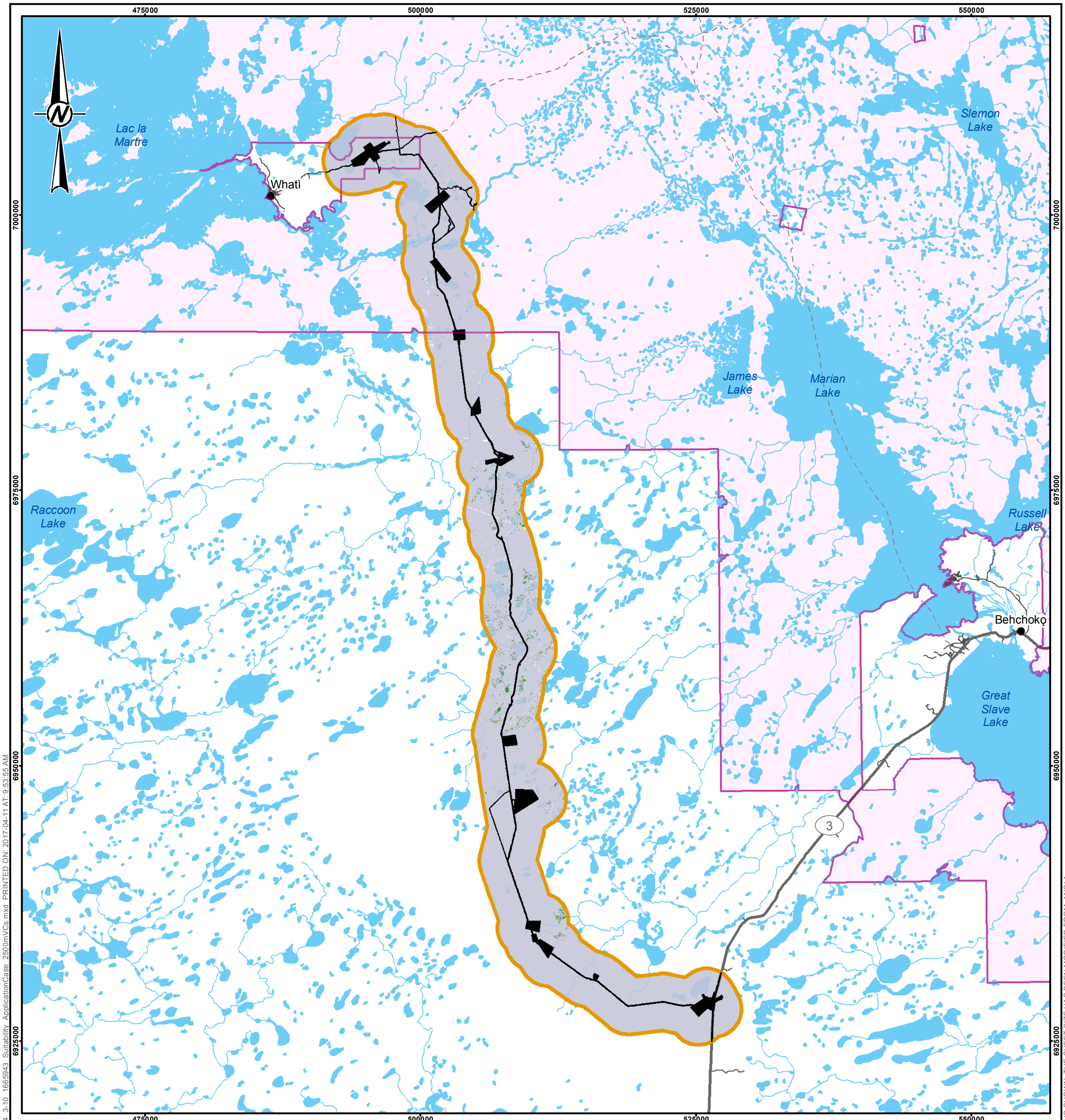
developments occur. Posted speed limits will be low during operation, which will reduce the potential risk for vehicle-wildlife collisions. Access roads to borrow sites will be blocked to prevent future use when no longer active. Over the life of the Project, injury or mortality to peregrine falcon from vehicle strikes may occur but will be limited to summer months when migratory birds may be present. Mortality of peregrine falcon due to collisions with vehicles are most often reported from urban environments, but have been reported to account for up to 11% of deaths with a known cause (COSEWIC 2007b). However, mitigation implemented for the Project is anticipated to limit vehicle-wildlife collisions and mortality from vehicle collisions is expected to have a small net effect on peregrine falcon populations in the RSA.



LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- WATERCOURSE
- TŁĮCHQ LAND
- WATER BODY
- DEVELOPMENT
- BUMBLE BEE, BIRD, AND BAT RSA

HABITAT SUITABILITY

- MODERATE TO HIGH
- NIL TO LOW

0 10 20

1:500,000 KILOMETRES

REFERENCE(S)

1. CIMP INVENTORY OF LANDSCAPE CHANGE, OBTAINED FROM THE NWT CENTRE FOR GEOMATICS.
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PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
TŁĮCHQ ALL-SEASON ROAD

TITLE
DISTRIBUTION OF SUITABLE PEREGRINE FALCON HABITAT AT APPLICATION CASE

CONSULTANT

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO. 1665943 | REV. 0 | FIGURE 4.3-8

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4.3.11 Short-eared Owl

Habitat Availability

Short-eared owl are most common in the prairie regions of Alberta, Saskatchewan, and Manitoba, and along the Arctic coast; local populations are patchily distributed within its range (Wiggins et al. 2006; COSEWIC 2008a). Although short-eared owls overlap with the Project, there is little potential suitable habitat for short-eared owl in the RSA at Base Case. The RSA is estimated to contain 993 ha (1.8%) of potential suitable habitat for short-eared owl Table 4.3-11). Habitat is also patchily distributed and not well connected across the RSA (Figure 4.3-9). The RSA may be occupied by a few individuals and the number likely varies from year-to-year depending on natural factors and population cycles, but habitat is predicted to be marginal for supporting short-eared owls.

Territory sizes for short-eared owl are not available for the NWT. Short-eared owls are highly dependent on vole densities and may occupy territories as small as 16 ha in years of vole outbreaks; however, territories of 62 to 112 ha are more typical (Shaw 2009). Average territory size for short-eared owls in the prairie region of Manitoba was 73 ha (Clark 1975) and short-eared owls in forested areas in Scotland were found to not use habitat patches less than 50 ha (Shaw 2009). Assuming a territory size of 60 ha, the potential suitable habitat for short-eared owl in the RSA may support 17 owls, if all potential habitat is occupied. The Project is predicted to directly disturb 2.8% (27 ha) of suitable short-eared owl habitat in the RSA, which is less than one breeding territory. Mitigation such as locating borrow sites and access roads in burned areas and placing construction camps and laydown areas in borrow sites will limit the loss of suitable habitat. There are no RFDs in the RSA, thus cumulative effects to suitable short-eared owl habitat are restricted to the application of the Project. Changes in habitat availability resulting from the Project are not predicted to change short-eared owl populations in the RSA.

Table 4.3-11: Short-eared Owl Habitat Availability in the Application Case

Habitat Suitability	Base Case (ha)	Application Case (ha)	Change in Area (ha)	Percent (%)
Moderate to High	993	965	-27	-2.8
Nil to Low	54,580	54,607	27	0.1

Sensory Disturbance

Short-eared owls are migratory and not present in the RSA during winter. Land clearing activities for the Project will primarily take place in winter so sensory disturbances associated with construction will occur when short-eared owls are not present. If summer land clearing is required, nest surveys will be conducted prior to clearing (PR#7). Borrow sites and access roads will be blocked to prevent future use when no longer active. Should construction be necessary when short-eared owls are present, contingency mitigation will be in place. This includes avoidance of land clearing activity during the migratory bird breeding season (April 25 to August 24; PR#7).

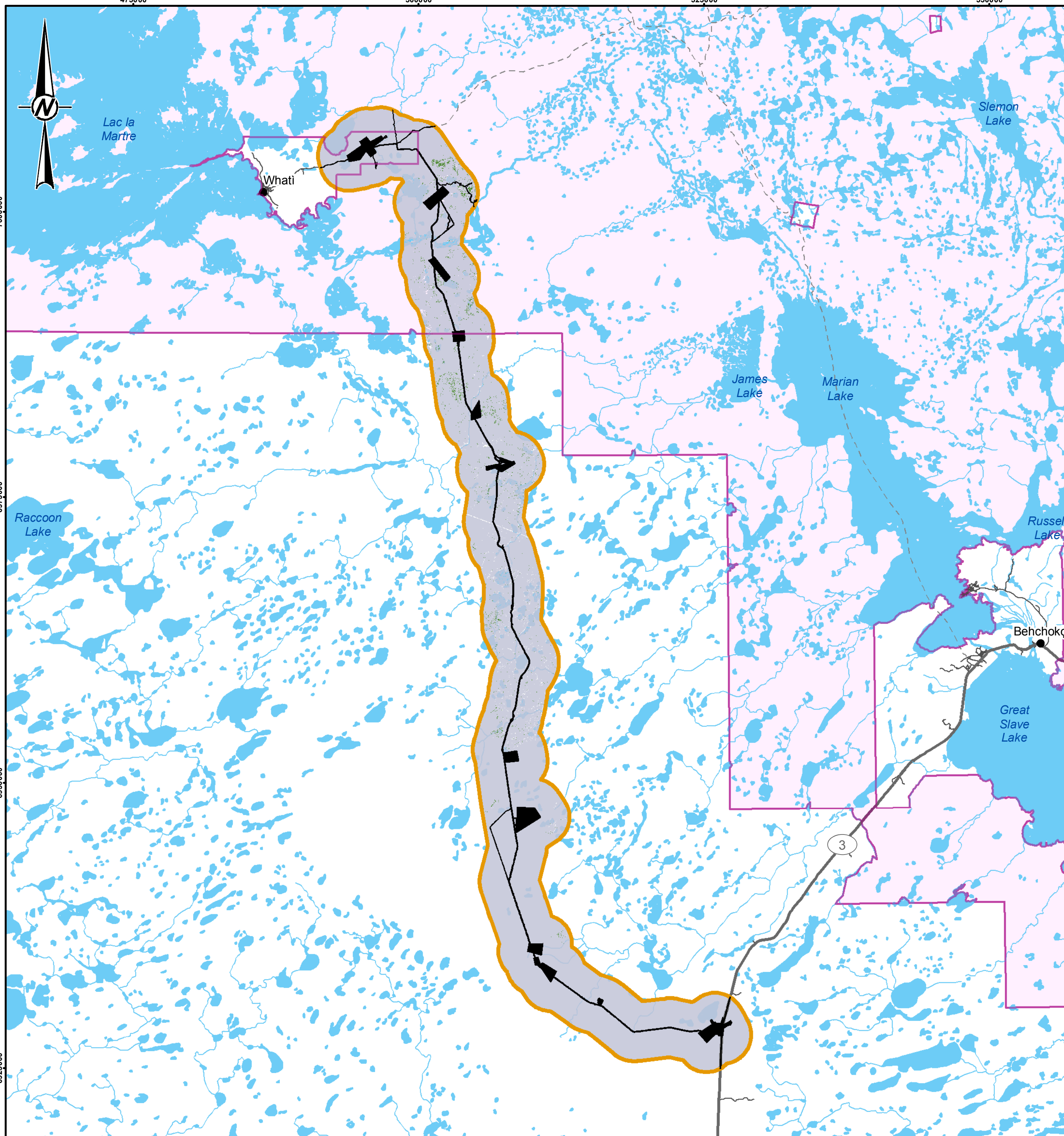
Sensory disturbance during the operational phase may also result in localized avoidance of habitats near the TASR from traffic or maintenance vehicles. The primary source of sensory disturbance from the Project during operations will be traffic, which is predicted to include up to 40 vehicles per day, or an average of 1.7 vehicles per hour, assuming future developments occur. Traffic will contribute noise and dust disturbances relative to the Base Case, however, these disturbances will be periodic given the low predicted traffic volume and only affect the area immediately adjacent to the road. Short-eared owls are highly mobile and have the ability to fly over the

To Table of Contents

Project and so, movements are unlikely to be restricted by the physical presence of the road or noise generated by traffic. The effect of sensory disturbance is not predicted to cause any change in short-eared owl populations in the RSA.

Improved Access

The Project is intended to improve access to the community of Whatì by developing the Old Airport Road route into an all-season road surface designed to allow trucks and heavier traffic. Birds are vulnerable to collisions with vehicles and collision rates are dependent on vehicle speed, visibility and weather (Bishop and Brogan 2013). Up to 40 vehicles are predicted to use the road per day during the Project operational phase, assuming future developments occur. Posted speed limits will be low and reduce the potential risk for vehicle-wildlife collisions. Access roads to borrow sites will be blocked to prevent future use when no longer active. Over the life of the Project, injury or mortality to short-eared owl from vehicle strikes may occur but will be limited to summer months when migratory birds may be present. Given the low suitability of short-eared owl habitat in the RSA, the number of short-eared owls present is predicted to be low. Thus, the effect of increased access is not predicted to change short eared owl populations in the RSA.



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LEGEND

- ● POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- WATERCOURSE
- TŁĮCHǪ LAND
- WATER BODY
- DEVELOPMENT
- BUMBLE BEE, BIRD, AND BAT RSA

HABITAT SUITABILITY

- MODERATE TO HIGH
- NIL TO LOW

0 10 20

1:500,000 KILOMETRES

REFERENCE(S)

1. CIMP INVENTORY OF LANDSCAPE CHANGE, OBTAINED FROM THE NWT CENTRE FOR GEOMATICS.
2. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.

PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
TŁĮCHǪ ALL-SEASON ROAD

TITLE
DISTRIBUTION OF SUITABLE SHORT-EARED OWL HABITAT AT APPLICATION CASE

CONSULTANT
Golder Associates

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO. 1665943 REV. 0 FIGURE 4.3-9

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4.3.12 Bumble Bees

Habitat Availability

The RSA is estimated to contain 16,842 ha (30.3%) of potential suitable habitat for yellow-banded and gypsy cuckoo bumble bees. The Project is predicted to directly disturb 5.3% (886 ha) of suitable bumble bee habitat in the RSA (Table 4.3-12;Figure 4.3-10). The direct loss of bumble bee habitat is primarily associated with construction of the Project footprint. However, roadside vegetation has also been known to provide suitable foraging habitat for bees (Way 1977) and therefore, some of the initial habitat loss may be restored following the construction phase of the Project. Bumble bees are highly mobile and capable of establishing hives in new locations. In addition, yellow-banded bumble bee is a habitat generalist, and so is gypsy cuckoo bumble bee by virtue of its parasitic relationship with its host. Therefore, changes in habitat availability and distribution at Base Case are expected to be well within the resilience limits and adaptive capacity of yellow-banded bumble bee and gypsy cuckoo bumble bee.

Table 4.3-12: Bumble Bees Availability in the Application Case

Habitat Suitability	Base Case (ha)	Application Case (ha)	Change in Area (ha)	Percent (%)
Moderate to High	16,842	15,955	-886	-5.3
Nil to Low	38,731	39,617	886	2.3

Sensory Disturbance

Bumble bees hibernate and are not active in the RSA during winter. Vegetation clearing for the Project will primarily take place in winter so sensory disturbances associated with clearing will occur when bees are not active. Because construction will be conducted when bees are active, contingency mitigation will be in place.

The primary source of sensory disturbance from the Project during operations will be traffic, which is predicted to include up to 40 vehicles per day, or an average of 1.7 vehicles per hour, assuming future developments occur. Traffic will contribute noise and dust disturbances relative to the Base Case, however, these disturbances will be periodic given the low predicted traffic volume and only affect the area immediately adjacent to the road.

Knowledge of noise effects on invertebrates, including bees, is limited and largely unstudied. Some studies have shown invertebrates to be sensitive to low frequency vibrations. For example, honeybees have been observed to stop moving for up to 20 minutes in response to sounds between 300 and 1 kHz at intensity levels of 107-120 dB. A bee's response to sound is thought to be received via vibrations through the legs, and not as airborne sound. Studies have demonstrated that only bees in hives responded to the noise treatment, while bees foraging in nearby fields or at the entrance to the hive were not affected (Frings and Little 1957). However, Kirchner (1993) conducted studies that concluded bees can hear airborne sounds at low frequencies (i.e., up to 500 Hz) that are created during dances, a method of bee communication. Furthermore, roadsides are known to be used by bees for nesting sites due to the availability of sunny, bare surfaces with undisturbed soils (Linsley 1958; Delaplane and Mayer 2000), so traffic noise is unlikely to disturb bees. As such, movements of bees are unlikely to be restricted by the physical presence of the road or noise generated by traffic. The effect of sensory disturbance is not predicted to cause any change in bumble bee populations in the RSA.

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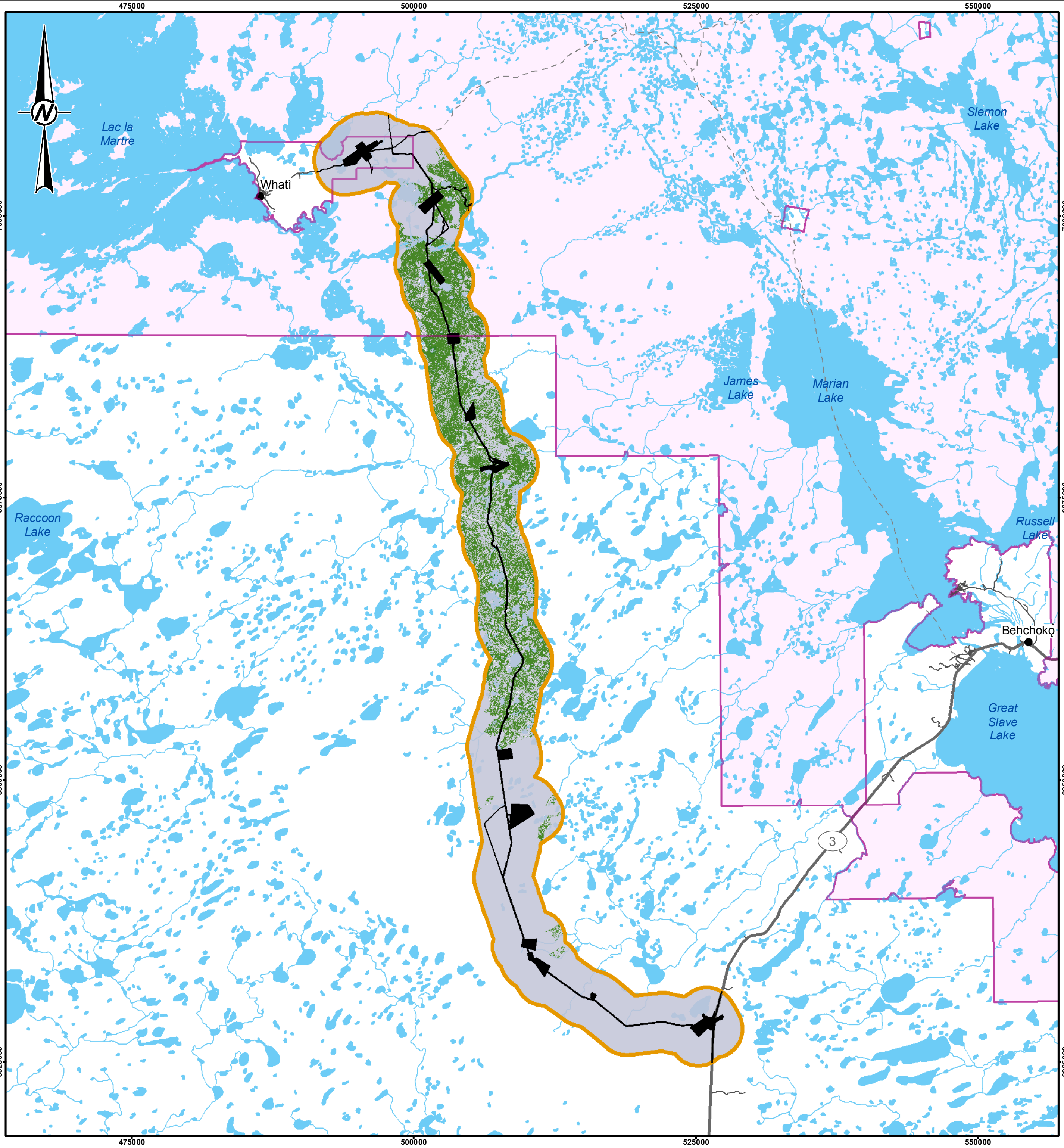
Improved Access

The Project is intended to improve access to the community of Whatì by developing the Old Airport Road route into an all-season road surface designed to allow trucks and heavier traffic. Vehicle collisions are not considered a significant threat to bumble bee survival. Up to 40 vehicles are predicted to use the road per day during the Project operational phase, assuming future developments occur. Posted speed limits will be low, which will reduce the potential risk for vehicle-wildlife collisions. Over the life of the Project, mortality to bumble bees from vehicle strikes may occur, but will be limited to summer months when bees are active, and likely only to occur on a rare basis. Thus, the effect of increased access is not predicted to change bumble bee populations in the RSA.



LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- WATERCOURSE
- TŁĮCHǪ LAND
- WATER BODY
- DEVELOPMENT
- BUMBLE BEE, BIRD, AND BAT RSA

HABITAT SUITABILITY

- MODERATE TO HIGH
- NIL TO LOW

0 10 20

1:500,000 KILOMETRES

REFERENCE(S)

1. CIMP INVENTORY OF LANDSCAPE CHANGE, OBTAINED FROM THE NWT CENTRE FOR GEOMATICS.
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PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
TŁĮCHǪ ALL-SEASON ROAD

TITLE
DISTRIBUTION OF SUITABLE BUMBLE BEE HABITAT AT APPLICATION CASE

CONSULTANT
Golder Associates

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO.	REV.	FIGURE
1665943	0	4.3-10

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4.4 Residual Effects Analysis

4.4.1 Approach and Methods

The residual effects analysis is based on pathways determined to be primary in the pathway analysis (Section 4.3.2.3), and on those VCs identified as having strong interactions with the Project (Table 4.3-2). The following primary pathways are analyzed and carried through the residual effects classification and determination of significance for boreal caribou, barren-ground caribou, moose and wolverine:

- *Site preparation, construction and operation activities can result in the loss or alteration of vegetation and topography that may change habitat availability, use, and connectivity and influence wildlife abundance and distribution.*
- *Sensory disturbance (lights, smells, noise, dust, human activity, viewscape) can change wildlife habitat availability, use and connectivity (movement and behaviour), which can lead to changes in wildlife abundance and distribution.*
- *Increase in public access could affect wildlife survival and reproduction through vehicle strikes, and/or legal and illegal hunting.*

As described in Section 2.3, the residual effects analysis is completed for the Application Case and the RFD Case, relative to the Base Case. The Application Case represents predictions of the effects from the Base Case combined with the effects from the Project, and is also used to identify the incremental changes from the Project. The RFD Case represents predictions of the cumulative effects of the Application Case, which includes the Base Case, plus the Project and RFDs. A list of potential RFDs is provided in Section 2.2 and presented on Figures 4.2-2 and 4.3-1. The RFD Case also considers other disturbance factors such as climate change, which can influence VCs beyond the RSAs.

The residual effects analysis for the Application Case is completed by calculating and predicting changes to measurement indicators. Residual effects of the Project are those effects that remain after implementation of all mitigation. Changes in measurement indicators for VCs were estimated relative to the Base Case to describe the following residual effects.

- Changes in habitat availability and animal use were estimated quantitatively by calculating differences in the amount of different types of suitable habitat for each VC, and qualitatively considering potential changes in habitat use (e.g., avoidance due to sensory disturbance).
- Changes in habitat distribution, including the effects on wildlife movement and habitat connectivity, were estimated by qualitatively examining changes to the distribution of habitat patches within the VC-specific RSA, and considering potential barriers to movement.
- Changes in survival and reproduction (abundance) were identified qualitatively and quantitatively using the results from changes in habitat, and knowledge of potential changes in abundance from other Project components and activities. Predictions of change were made using data collected in the RSAs, where possible, and supported by scientific literature.

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To be conservative, the Project footprint of 2,198.6 ha (which includes all Project components and activities) was buffered by 100 m around the La Martre River crossing and 50 m around the remaining portion of the preferred road route and borrow sites so that direct effects to wildlife VCs would not be underestimated. As a result, the change in habitat from direct disturbance due to the Project is overestimated by about 1,219 ha (56%).

Similar to the Application Case, effects in the RFD Case were predicted using quantitative and qualitative changes in measurement indicators. Where actual footprint size and location were known for RFDs, the analysis of changes in habitat availability was quantitative, otherwise the analysis was qualitative. Potential effects from beyond regional disturbance factors such as climate change were also qualitatively discussed.

4.4.2 Application Case Results

4.4.2.1 Boreal Caribou

Habitat Availability

The Project will increase the area of buffered developments disturbance by 4,504 ha (0.1%) and reduce caribou habitat availability in the NT1 range by removal of 1,780 ha (<0.1%) of habitat that is undisturbed under existing conditions (Table 4.4-1). The buffered Project will overlap more with areas already affected by fire disturbance under existing conditions and these areas account for 2,725 ha (60%) of the Project footprint. At the Application Case, 66.8% of the NT1 range is predicted to remain undisturbed boreal caribou habitat, a number that does not change from existing conditions (Section 4.2.3.1) because of the size of the NT1 range relative to the area of the Project.

Table 4.4-1: Boreal Caribou Habitat Availability in the NT1 Range, Application Case

Habitat Suitability	Base Case (ha)	Application Case (ha)	Change in Area (ha)	Percent (%)
Fire disturbance[a]	10,159,286	10,156,561	-2,725	<-0.0
Buffered developments	3,697,637	3,702,142	4,504	0.1
Undisturbed habitat	27,861,774	27,859,995	-1,780	<-0.1

a) The buffered Project will overlap with areas already affected by fire disturbance and therefore reduce the area classified as fire disturbance in the Application Case

In the Wek'èezhìı portion of the NT1 Range, the Project will remove 0.1% of habitat that is undisturbed under existing conditions (Table 4.4-2). The buffered Project will overlap to a greater extent with areas already affected by fire disturbance under existing conditions, which accounts for 2,725 ha (60%) of the Project footprint. The Project is predicted to increase buffered development by 11.0% relative to Base Case. The proportion of total disturbance will increase from 40.0% at Base Case to 41.1% in the Application Case. The proportion of undisturbed habitat will be 59.9% at the Application Case for the Wek'èezhìı portion of the NT1 Range.

Table 4.4-2: Boreal Caribou Habitat Availability in the Wek'èezhìı Portion of NT1 Range, Application Case

Habitat Suitability	Base Case (ha)	Application Case (ha)	Change in Area (ha)	Percent (%)
Fire disturbance[a]	1,813,041	1,810,316	-2,725	-0.2
Buffered developments	40,840	45,345	4,504	11.0
Undisturbed habitat	2,778,883	2,777,104	-1,780	-0.1

a) The buffered Project will overlap with areas already affected by fire disturbance and therefore reduce the area classified as fire disturbance in the Application Case

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Habitat Distribution

At the Application Case, there is little change in the distribution of undisturbed boreal caribou habitat in the NT1 range or in the Wek'èezhìı Portion of NT1 Range relative to the Base Case (Figure 4.4-1). Habitat losses, either through direct or indirect effects, can result in changes to the distribution of available habitat (and ultimately caribou within the range) through two processes. The first process being through a reduction in habitat resulting in avoidance of affected areas and localized changes in the distribution of animals. Consistent with the above interpretation of Project-related habitat losses, changes to local distributions of individual caribou are expected to be minor, particularly where the Project ROW intersects burned areas that are less than 40 years old. Direct disturbance of caribou habitat will occur during construction, so effects to local distributions of individual caribou will be temporary. Project effects will also be minimized by timing land clearing primarily during winter to reduce disturbing boreal caribou during sensitive periods, such as calving and post-calving periods. Other construction activities will continue during calving and post-calving periods but effects will likely be limited to the 1,780 ha of undisturbed habitat where boreal caribou may be present during these periods. Traditional Knowledge indicates that key boreal caribou habitat includes areas near Lake Ethletitso and smaller lakes west of Tsigatii (PR#28), which are approximately 5 to 10 km west of the Project. Although some displacement of animals may result from the Project, a contraction in the NT1 range is not expected from localized changes in habitat suitability (given the anticipated scale of disturbance).

Construction activities are likely to alter boreal caribou movement and behaviour around the Project footprint resulting in a temporary, indirect loss of habitat. Indirect habitat loss was measured by applying a 500 m buffer around the Project footprint (Environmental Canada 2012). Habitat effects will be minimized by aligning the Project route to intersect areas burned by forest fire, which caribou avoid under existing conditions. The buffered Project footprint overlaps with the existing Old Airport Road route (i.e., within 500 m), which is associated with vehicular activity, noise and other sensory disturbances under existing conditions (PR#7; PR#28) and therefore, measurable losses in local habitat use from indirect effects from the Project during construction and operation are predicted to be small and confined to 1,780 ha of undisturbed habitat (Table 4.4-1).

The distribution of available habitat can also change where there are impacts to movement corridors or changes that prevent access to key habitats, such as nursery or winter use areas. The location of the TASR is near the eastern boundary of the NT1 range and will not completely isolate a portion of the range. Thus, effects to movement from either fragmentation or avoidance of the TASR during construction or operation will be localized and not likely to be measurable at the NT1 range scale. Caribou appear to be more sensitive to the human activities associated with construction, traffic, and noise, than to the infrastructure per se (Curatolo and Murphy 1986; Murphy and Curatolo 1987; Nellemann and Cameron 1998; Smith et al. 2000; Dyer et al. 2001). Mitigation, such as restricting construction activities when boreal caribou are known to be present. As well, up to 40 vehicles are predicted to use the road daily, which represents approximately 1.7 vehicles per hour on average. Thus, noise or visual stimulus from traffic will be periodic and unlikely to result in permanent reduction of movement potential through the area.

The Project will cause an incremental increase in fragmentation of the RSA by adding a linear disturbance to the landscape, which will alter 1,780 ha of habitat that is undisturbed under existing conditions. However, the change is predicted to be small given that the Project alignment follows an existing linear feature and that may already influence movement under existing conditions from existing human use (PR#7; PR#28) or use by predators. Effects will be minimized by applying mitigation to limit the amount of vegetation disturbance during construction. This includes aligning the Project to intersect caribou habitat that has been previously disturbed by fire within the last 40 years and avoided by caribou and using existing disturbance from the existing Old Airport Road alignment.

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As well, construction camps and laydown areas will be located within borrow sites or the Project ROW. Fragmentation and linear disturbance effects at the Application Case are predicted to increase but be small relative to the Base Case.

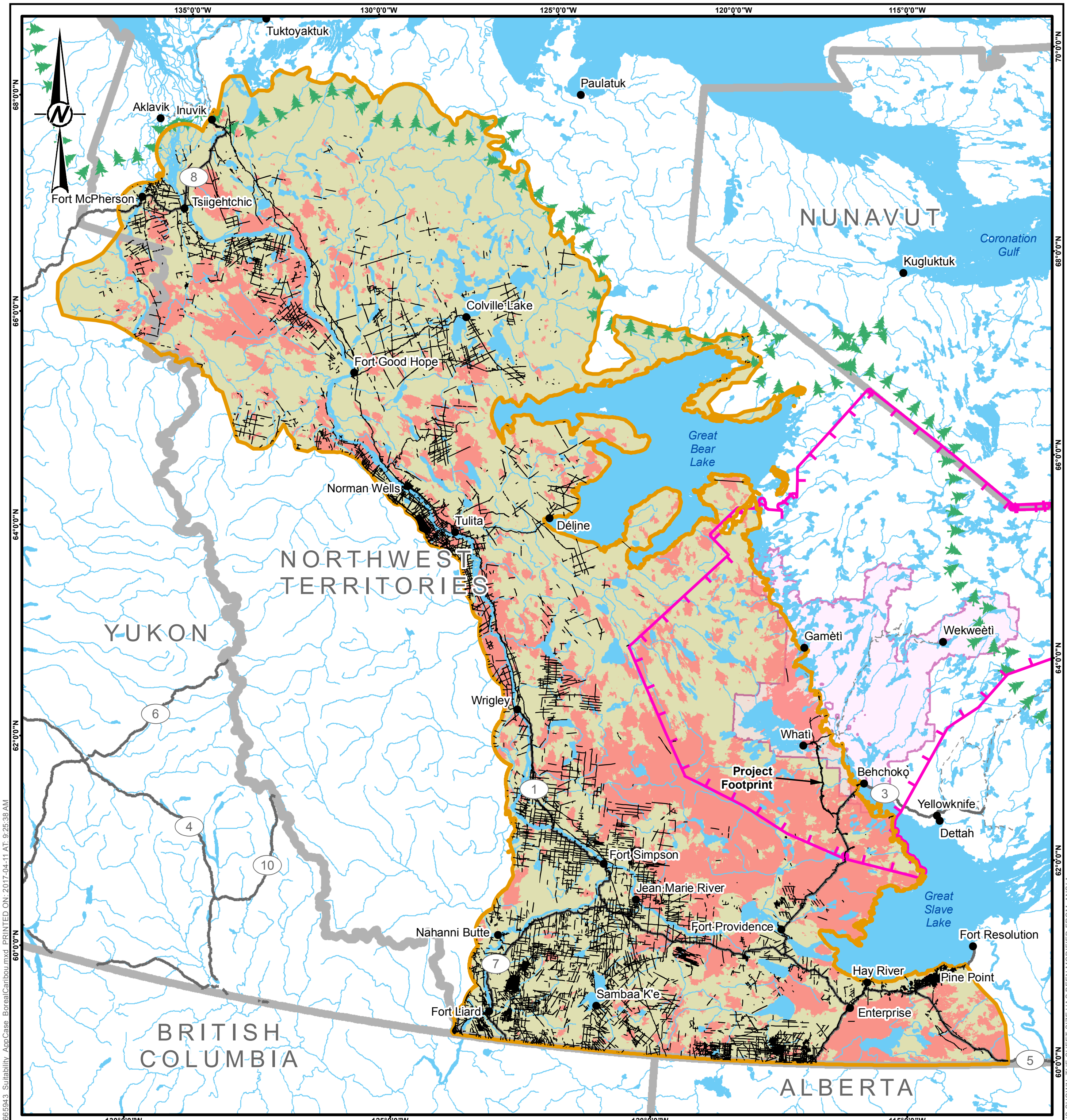
Survival and Reproduction

The Project will affect boreal caribou survival and reproduction through habitat loss (vegetation clearing), sensory disturbances, and increased harvest pressure and injuries and mortalities from vehicle strikes due to greater access. Vegetation clearing along the TASR ROW and for ancillary facilities (e.g., borrow sits and access roads) will create early seral habitat, which is more favourable for moose. Increased moose densities can cause associated increases in wolf densities, which can increase predation pressure on caribou. Habitat loss from Project development is predicted to alter 1,780 ha (<0.1%) of undisturbed habitat (including sensory disturbance) in the NT1 range.

Features that act as semi-permeable barrier effects may exacerbate indirect habitat loss caused by avoidance of disturbance features (Dyer et al. 2002). Reduced movement rates and restricted home ranges increases the amount of time spent in lower suitability habitats and therefore increase vulnerability to predation (Beauchesne et al. 2014; Morales et al. 2010; Muhly et al. 2015; Rettie and Messier 2000). Caribou confined to smaller home ranges could be forced into less suitable habitat and be more easily detected by predators (Beauchesne et al. 2014). The Project will use mitigation that will help minimize avoidance of suitable habitat resulting from sensory disturbance. During construction, the amount of noise and lights will be limited by restricting construction activities when boreal caribou are present and fugitive dust will be reduced by completing land clearing primarily during winter. For summer construction, mitigation such as restricting construction activities when boreal caribou are known to be present will reduce noise and activity during construction. During operation up to 40 vehicles are predicted to use the road daily, which represents approximately 1.7 vehicles per hour on average and a low volume of traffic. Thus, noise or visual stimulus from traffic will be periodic and unlikely to result in continual barrier effects.

Injury or mortality from vehicle collisions and increased harvest pressure facilitated by the development of new access roads may also influence boreal caribou survival and reproduction. Boreal caribou are mobile and can avoid interactions with Project activities that could result in injury or mortality. The Project will include monitors during construction to help detect boreal caribou and other wildlife and protect them from Project activities. Construction activities will be suspended or restricted when caribou are known to be present as described in the Wildlife Management and Monitoring Plan (WMMP; PR#7). The Project also has the potential to increase mortality through collisions with vehicles, especially during operations; however, the likelihood of collision is low given the low speed limit and low predicted traffic volume on the road.

The development of the Project will improve access, which could directly affect boreal caribou survival and reproduction through increased harvest during the construction and operation phase. This effect will be avoided during construction by not allowing construction workers to harvest wildlife and by blocking access roads to borrow sites when no longer active to restrict future access. Improved access could also directly affect boreal caribou survival and reproduction through increased harvest during the operation phase, especially if the Project facilitates greater access for hunters to high suitability caribou habitat. The Project will intersect undisturbed habitat, which is likely to increase harvest potential and harvest during operation. However, a reduction of boreal caribou survival and reproduction as a result of greater access is predicted to be small and not affect the population given that boreal caribou occur in low densities (0.17 to 3.44 animals/100 km^2 [Hillis and Cluff 2005]), use large areas of undisturbed habitat (Nagy et al. 2011) and the Project ROW follows an existing linear feature that is currently used by hunters to harvest caribou and access the WRMA at Base Case (PR#7; PR#28).



LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- WINTER ROAD
- TREELINE
- WATERCOURSE
- PROVINCIAL/TERRITORIAL BOUNDARY
- TŁĮCHQ LAND
- WATER BODY
- DEVELOPMENT
- FIRE HISTORY (LESS THAN 40 YEARS OLD)
- UNDISTURBED HABITAT
- BOREAL CARIBOU RSA
- WEK'ÈEZHÌI RESOURCE MANAGEMENT AREA

0 120 240

1:6,000,000 KILOMETRES

REFERENCE(S)

1. ADMINISTRATIVE REGIONS OBTAINED FROM GOVERNMENT OF NORTHWEST TERRITORIES.
2. BOREAL CARIBOU RANGE OBTAINED FROM ENVIRONMENT CANADA, 2012.
3. CIMP INVENTORY OF LANDSCAPE CHANGE, OBTAINED FROM THE NWT CENTRE FOR GEOMATICS.
4. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.

PROJECTION: CANADA LAMBERT CONFORMAL CONIC

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
TŁĮCHQ ALL-SEASON ROAD

TITLE
DISTRIBUTION OF BOREAL CARIBOU HABITAT AT APPLICATION CASE

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO.	REV.	FIGURE
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4.4.2.2 Barren-ground Caribou

Habitat Availability

Locations of collared cows in the Bathurst and BNE herds indicate the RSA is outside of core seasonal ranges (Nagy et al. 2005; Anderson and Johnson 2014; Golder 2016; Appendix G) but some caribou may be present when these herds are more abundant (PR#28). The construction of the Project would contribute to a loss of 264 ha (0.2%) of moderate to high suitability winter habitat relative to existing conditions (Table 4.4-3). Project mitigation to minimize the effects to habitat availability includes aligning the Project route to intersect caribou habitat that has been previously disturbed by fire within the last 40 years and avoided by caribou at Base Case. The Project will also occur in areas of existing disturbance from an old linear winter road route minimizing the amount of new disturbance. As well, construction camps and laydown areas will be located within borrow sites or the Project ROW.

Table 4.4-3: Barren-ground Caribou Winter Habitat Availability in the RSA, Application Case

Habitat Suitability	Base Case (ha)	Application Case (ha)	Change in Area (ha)	Percent (%)
Moderate to High	117,677	117,413	-264	-0.2
Nil to Low	883,843	884,107	264	<0.0

In addition to direct habitat loss, indirect loss may occur in the RSA if animals avoid suitable areas due to sensory disturbance. Loud noises, lights, smells, dust and human activity could potentially cause displacement of individuals (Bradshaw et al. 1998; Johnson et al. 2005; Boulanger et al. 2012), loss of foraging and resting habitat, and changes in predator-prey relationships. For example, Bradshaw et al. (1998) found that disturbed caribou in the boreal forest of Alberta move rapidly from the noise source for about 15 minutes. Benítez-López et al. (2010) indicate that the spatial effects of sensory disturbance on large mammals can extend up to 5 km from human developments. Sensory disturbance from the Project is predicted to have a negligible effect on barren-ground caribou populations due to low presence in the area.

Given the small amount of suitable habitat directly altered by the Project and the low likelihood of regular presence in the RSA, it is anticipated that very few individuals will occupy habitats near the Project ROW under existing conditions during winter. Barren-ground caribou can adapt to sensory disturbance (Johnson and Russell 2014) and any caribou using the area around the Project have previous experience with human activity along the existing network of trails surrounding the Project route at Base Case (PR#28). Individual caribou that avoid suitable habitat during construction due to temporary sensory disturbance are expected to reoccupy the habitat once the disturbance is removed. Vehicle traffic during the operation phase may also disturb individual caribou; however, such events will be infrequent, isolated, and short-term in duration and only if barren-ground caribou are present during winter, which may be more common when barren-ground caribou herd sizes are near peak abundance (PR#28).

Changes in habitat availability at the Application Case are predicted to be small relative to the Base Case and are not expected to result in any measurable change in the number of barren-ground caribou present in the RSA.

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Habitat Distribution

The Project will remove 264 ha (0.2%) of moderate to high suitability winter habitat in the RSA. Similar to habitat availability, a small reduction in the amount of disturbed habitat is unlikely to influence the distribution of regional barren-ground caribou populations because barren-ground caribou are not regularly present in the RSA (Figure 4.4-2). If present, mitigation such as restricting construction activities when barren-ground caribou are known to be present. As well, up to 40 vehicles are predicted to use the road daily, which represents approximately 1.7 vehicles per hour on average. Thus, noise or visual stimulus from traffic will be intermittent and of short duration and unlikely to result in permanent reduction in movement through the area.

Although some barren-ground caribou may avoid areas near the Project, a contraction in the winter range is not expected from localized changes in habitat suitability, given the anticipated small scale of disturbance. Construction activities are not likely to alter barren-ground caribou movement and behaviour around the Project footprint resulting in a temporary, indirect loss of habitat. At the current low barren-ground herd sizes, little interaction during the Project construction phase is expected. Even so, habitat effects will be minimized by aligning the Project route to intersect areas burned by forest fire, which caribou avoid. The Project footprint also overlaps the existing Old Airport Road route, which is associated with human activity, noise and other sensory disturbances at Base Case (PR#7; PR#28). Collar locations from Bathurst or BNE herds indicate that there is a low likelihood of regular interaction of these herds with the Project (Nagy et al. 2011, Anderson and Johnson 2014, Golder 2016), except when these herds are near peak abundance as in the early 1990s (PR#28). Therefore, measurable losses in local habitat use from indirect effects from the Project are not predicted during construction but may be small during operation if caribou interact with the Project when more abundant and burned habitat becomes suitable over time through succession.

Survival and Reproduction

The Project could affect barren-ground caribou survival and reproduction through winter habitat loss (vegetation clearing), sensory disturbances, and increased harvest pressure and injuries and mortalities from vehicle strikes due to improved access. Vegetation clearing along the Project ROW and for ancillary facilities (e.g., borrow sites and access roads) will create early seral habitat, which is more favourable for moose. Increased moose densities can cause associated increases in wolf densities, which can increase predation pressure on caribou. Habitat loss from Project development is predicted to alter 264 ha (<0.2%) of undisturbed habitat (including sensory disturbance) in the RSA.

Features that act as semi-permeable barrier effects may exacerbate indirect habitat loss caused by avoidance of disturbance features (Dyer et al. 2002). Reduced movement rates and restricted home ranges increases the amount of time spent in lower suitability habitats and therefore increase vulnerability to predation (Beauchesne et al. 2014; Morales et al. 2010; Muhly et al. 2015; Rettie and Messier 2000). Caribou confined to smaller winter home ranges could be forced into less suitable habitat and be more easily detected by predators (Beauchesne et al. 2014). Alternatively, semi-permeable barriers may have energetic costs to caribou if their migratory routes are disrupted.

The Project will use mitigation that will help minimize avoidance of suitable habitat resulting from sensory disturbance. During construction, the amount of noise and lights will be limited by restricting construction activities when caribou are known to be present. During operation, up to 40 vehicles are predicted to use the road daily, which represents approximately 1.7 vehicles per hour on average and a low volume of traffic. Barren-ground caribou will only be exposed to the sensory disturbances from the Project during winter when they are present,

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which is only likely when nearby herds are near peak abundance (PR#28). Recent analysis of collared caribou movements from the Bathurst herd provides some insight into the energetic implications of development (De Beers 2010, DDEC 2014). Analysis of caribou encounters with development in the post-calving to autumn period for the Jay Project estimated a mean of 18.6 encounters with a zone of influence per season, and similar results were found for the Gahcho Kué Project (this modelling was not completed for this Project due to a lack of collar data in the area, confirming that this is not a commonly used area). Even when the effects of disturbance were over-estimated, insect abundance was found to be the greatest driver of caribou energy expenditures (De Beers 2010, DDEC 2014). Similar analysis was completed for the Fortune Minerals NICO Project, incorporating also the energetic costs of walking through snow (Golder 2011). This analysis considered several scenarios including a severe spring (i.e. additional energy expenditure of walking and cratering through deep snow) and disturbance events that elecit a response from caribou. As there is more development in the boreal regions of the NWT, a conservative estimate of 40 encounters with developments was included. The analysis indicated that although human developments during autumn and early winter movements in the winter range of the Bathurst herd may affect the demography of the herd, the effect is relatively small compared to weather-related factors.

While Project is near the Bathurst caribou winter range and insect harassment would not be an issue, it is likely that similar environmental variables such as snow depth, hardness and freezing rain events (Bianci et al. 2007, Adamczewski et al. 1987) would still dominate caribou energy expenditures in the a zone of influence. Bergerud et al. (1984) contend that there is little to no evidence that sensory disturbance activities affect herd productivity. Thus, noise or visual stimulus from traffic will be periodic and unlikely to result in permanent barrier effects that will reduce survival and reproduction.

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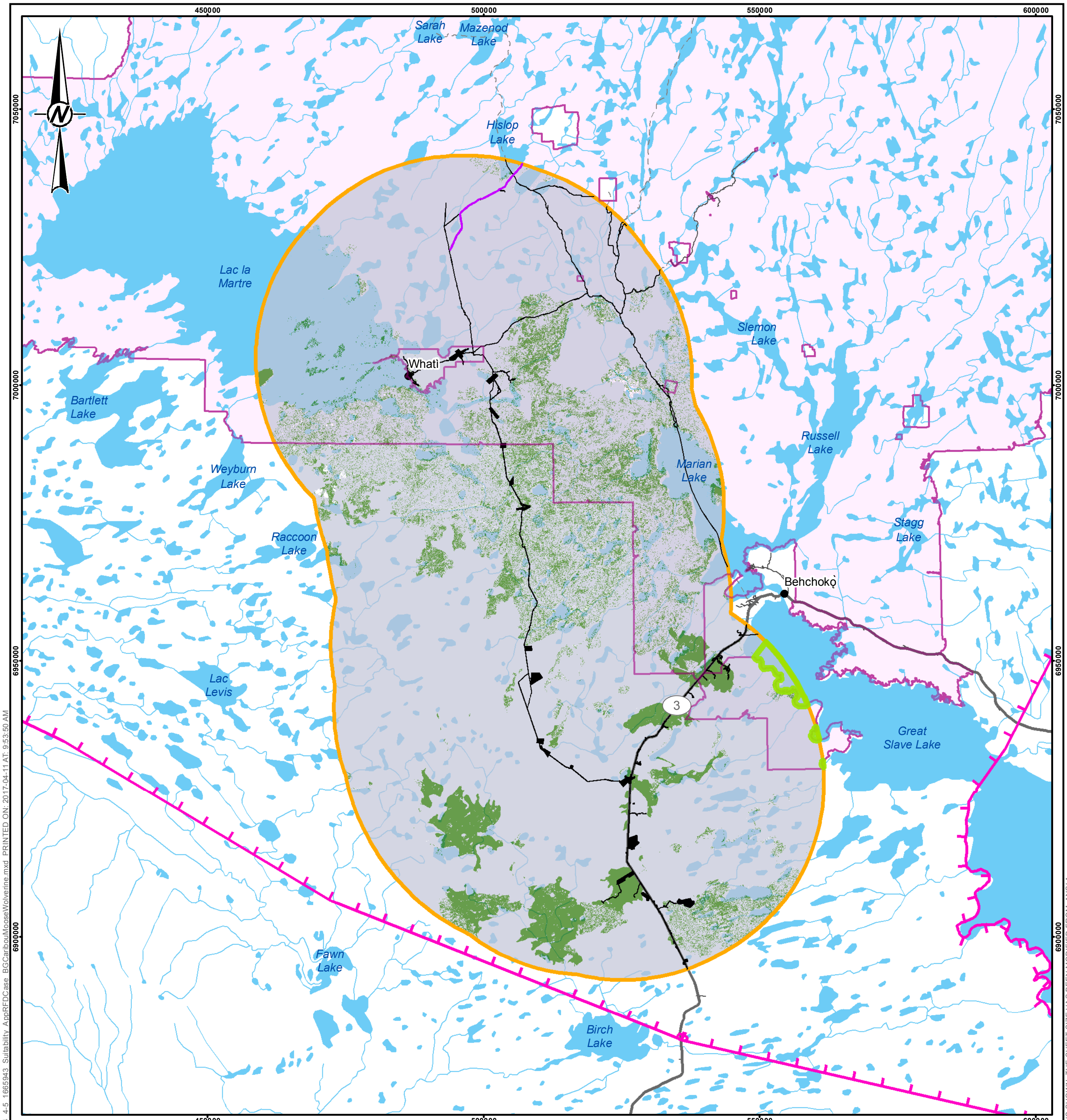

LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- WATERCOURSE
- TŁĮCHǪ LAND
- WATER BODY
- CANDIDATE PROTECTED AREA
- DEVELOPMENT
- RFD
- BARREN-GROUND CARIBOU, MOOSE, AND WOLVERINE RSA
- WEK'ÈEZHÌI RESOURCE MANAGEMENT AREA

HABITAT SUITABILITY

- MODERATE TO HIGH
- NIL TO LOW

0 20 40

1:1,000,000 KILOMETRES

REFERENCE(S)

1. ADMINISTRATIVE REGIONS OBTAINED FROM GOVERNMENT OF NORTHWEST TERRITORIES.
2. CIMP INVENTORY OF LANDSCAPE CHANGE, OBTAINED FROM THE NWT CENTRE FOR GEOMATICS.
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PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
TŁĮCHǪ ALL-SEASON ROAD

TITLE
DISTRIBUTION OF SUITABLE BARREN-GROUND CARIBOU HABITAT AT APPLICATION CASE AND RFD CASE

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO.	REV.	FIGURE
1665943	0	4.4-2

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Injury or mortality from vehicle collisions and increased harvest pressure facilitated by the development of new access roads may also influence barren-ground caribou survival and reproduction. Barren-ground caribou are mobile and can avoid interactions with Project activities that could result in direct mortality. The Project will include monitors during construction to help detect caribou and other wildlife and protect them from Project activities. Construction activities will be suspended or restricted as described in the WMMP (PR#7) when caribou are known to be present. The Project also has the potential to increase mortality through collisions with vehicles, especially during operations; however, the likelihood of collision is low given the low speed limit and low predicted traffic volume on the road.

Highway 3 and one existing all-weather road (Highway 4) provide access to a small amount of area within the barren-ground winter ranges. Access is less limited in the winter because existing winter roads pass through the caribou study area (Figure 4.4-1). The winter roads to Wekweètì and Gamètì are typically open from early February to mid-April (GNWT-DOT 2016). At Base Case, snowmobiles can access the most of the study area and beyond through existing trails, and this is facilitated by the presence of existing winter roads (PR#28). The construction of the Project will provide year-round access by vehicles to the region and is anticipated to result in a 10 to 14 day earlier opening and closing of these winter roads (PR#7), which may allow hunters to use trucks with snowmobile trailers to reach caribou wintering near or beyond these communities. However, construction of winter roads requires at least 10 cm of snow cover for environmental protection and minimum ice thickness to support construction equipment, which is not achieved until January. Historical winter road operational periods are variable for the Wekweètì winter access road and trending toward opening later in the year (Figure 4.4-3), which is consistent with predictions of climate warming and with trends observed for other NWT winter roads (GNWT-DOT 2016). The winter road to Gamètì opening dates have ranged from February 14 in 2011 to March 31 in 2008. Thus, there is uncertainty in how much earlier the winter roads north of Whatì will be open and how long they will be viable if climate warming continues, so earlier access for trucks with snowmobiles may be temporary.

Both the Wekweètì and Gamètì winter access roads historically close mid-April (GNWT-DOT 2016). The BNE begin their migration to northern calving areas in early April (Nagy et al. 2005). While the road may improve access for snowmobilers during winter road shoulder seasons, Bathurst caribou begin their migration to northern calving areas in mid-April (Gunn et al. 2002) so a longer operational period of these winter roads resulting from the Project may not increase harvest because caribou may not be available past mid-April as they migrate north to calving areas. As well, recent winter habitat selection analysis on Bathurst caribou indicates preference for barren-ground areas (Golder 2016), which means only a fraction of this herd may be present below the treeline, near these communities and available for harvest. The GNWT-ENR has also implemented a no-hunting mobile conservation zone for the Bathurst herd with no hunting tags available between 2016 and 2019 (WRRB 2016). While the BNE herd does winter below the treeline, the BNE herd currently has regulated harvest of 750 bulls for aboriginal hunters. The Project will have a no hunting policy in place for construction workers as mitigation to avoid harvest of wintering barren-ground caribou. Access roads to borrow sites will be blocked, which will impede future use of areas required for Project construction. Therefore, Application Case effects to survival and reproduction for barren-ground caribou are predicted to be small relative to the Base Case.

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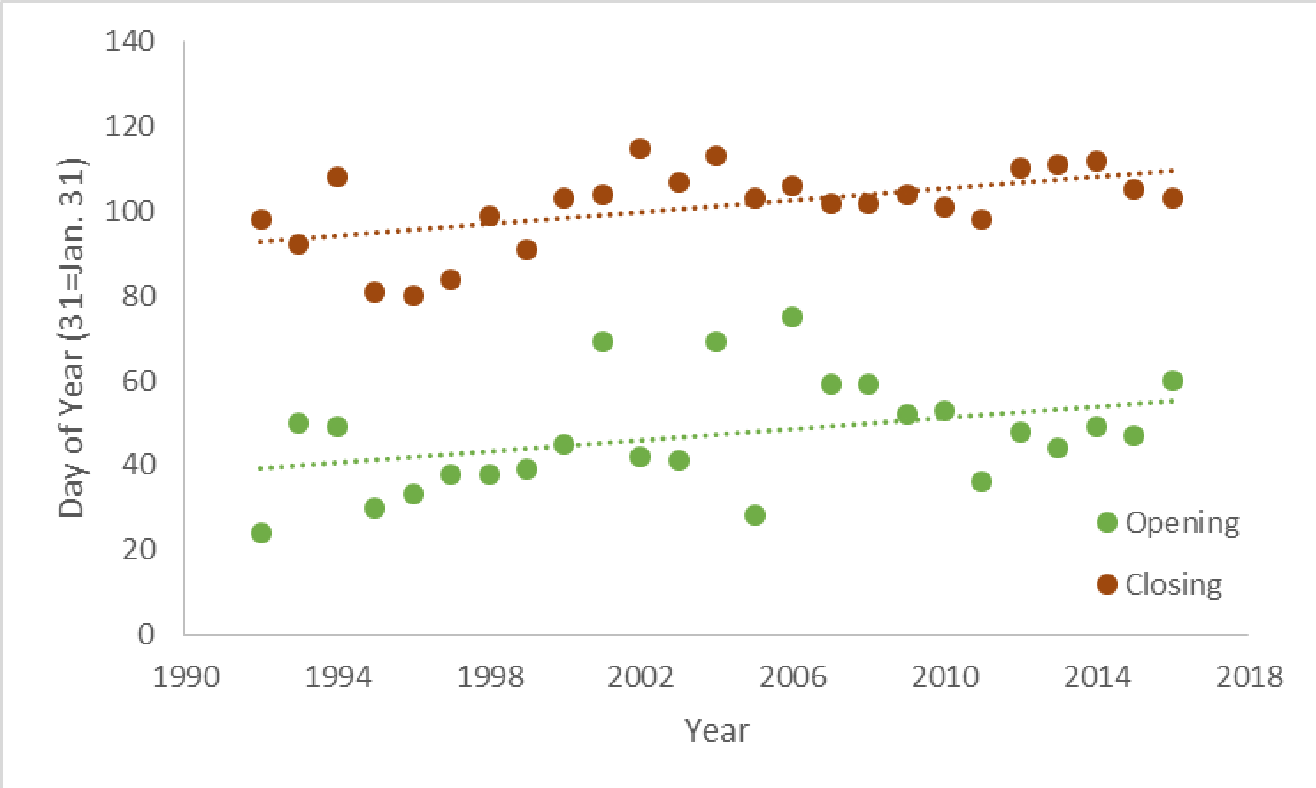

Figure 4.4-3: Opening and Closing Dates of the Wekweètì Winter Access Road, 1992 to 2016

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4.4.2.3 Moose

Habitat Availability

Site preparation and activities associated with the construction phase of the Project would contribute to a minimal loss of moderate to high quality moose habitat in the Application Case. The total area of moose habitat available in the RSA at Base Case was 322,377 ha (32.2% of the RSA). In the RSA, approximately 1,097 ha (0.3%) of moderate to high suitability moose habitat is predicted to be removed (Table 4.4-4). The direct loss of moderate to high suitability moose habitat is primarily associated with the construction of the Project footprint. Project mitigation to minimize effects to habitat availability include aligning the ROW in areas of existing disturbance from an old linear winter road route minimizing the amount of new disturbance. Construction camps and laydown areas will be located in either borrow sites or within the ROW to avoid additional land clearing. Most borrow source access roads are also planned to overlap the ROW and borrow sites.

The development of edge habitat along the proposed TASR route may also benefit moose as moose prefer to eat deciduous shrubs and trees (Stelfox 1993), of which many species (e.g., trembling aspen) may have greater abundance in areas with a thinned canopy cover (e.g., forest edges and clearings) (Rice et al. 2001).

Moose display life history traits (e.g., large home ranges, high reproductive rates, ability to eat many types of plants) that provide flexibility to adapt to changes from human development. Habitat availability effects at the Application Case are predicted to be negligible relative to the Base Case.

Table 4.4-4: Moose Habitat Availability in the Application Case

Habitat Suitability	Base Case (ha)	Application Case (ha)	Change in Area (ha)	Percent (%)
Moderate to High	322,377	321,280	-1,097	-0.3
Nil to Low	679,143	680,240	1,097	0.2

In addition to direct habitat loss, indirect loss may occur in the RSA due to sensory disturbance. Sensory disturbance may reduce habitat quality and cause some individuals to avoid moderate to high suitability habitat at the local scale in the RSA. Some individuals with home ranges that overlap the Project footprint may currently be habituated to sensory disturbance due to the presence of the existing Old Airport Road route and the network of trails surrounding the TASR route. Project mitigation will be implemented to minimize avoidance of suitable habitat resulting from sensory disturbance. During construction, the amount of noise and lights will be limited by restricting construction activities when moose are present. Disturbance from fugitive dust will be reduced by completing land clearing primarily during winter. During operation, up to 40 vehicles are predicted to use the road daily, assuming all future developments are built, which represents approximately 1.7 vehicles per hour on average and a low volume of traffic. Thus, noise or visual stimulus from traffic will be periodic and unlikely to result in permanent barrier effects.

Habitat Distribution

Linear features, such as roads, may alter movements by moose due to habitat fragmentation effects, or represent a barrier to some individuals within the population. For example, roads may contribute to fragmentation of populations through both increased mortality and modifications of behaviour that makes animals less likely to cross roads (Trombulak and Frissell 2000; Dussault et al. 2006; Laurian et al. 2008). Moose may seasonally avoid roads by 100 m to 3 km (Jiang et al. 2009; Laurian et al. 2012) or interact with roads during periods of low activity (Neumann et al. 2009). In some cases, roads appear to be “leaky barriers” (some animals do manage to cross successfully) but they may nevertheless restrict the regional-scale dynamics of species (Treweek 1999).

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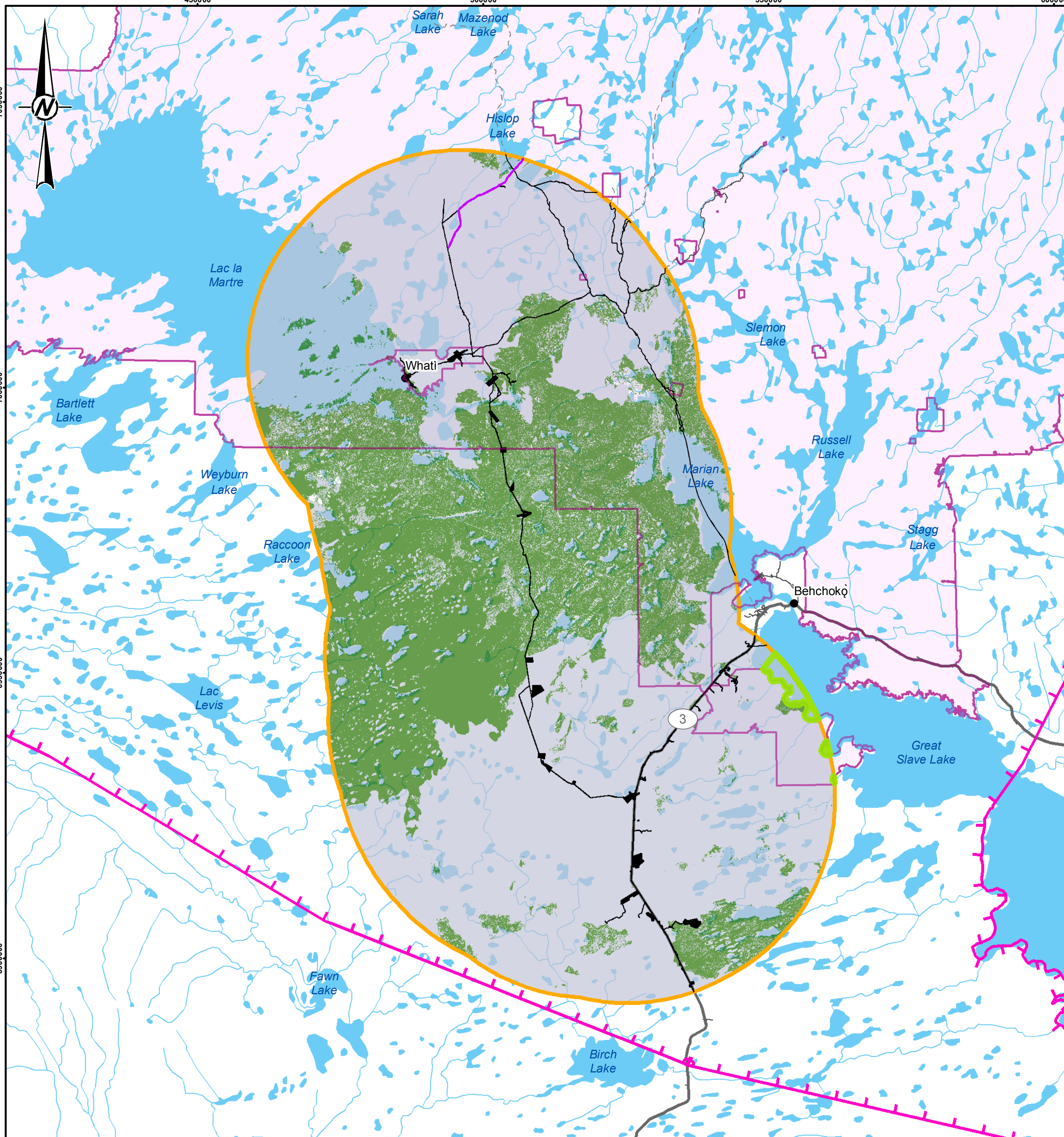
Despite some additional fragmentation from the proposed TASR ROW, as well as facilities such as laydown areas, borrow sites, and construction camps, most moderate and highly suitable moose habitat will remain abundant and well-connected across the landscape in the Application Case compared to the Base Case (Figure 4.4-4). Construction camps and laydown areas will be located in either borrow sites or within the ROW to avoid additional land clearing. Most access roads are also planned to overlap the ROW and borrow sites. Implementation of these mitigation measures may limit effects from changes to moose habitat distribution. Furthermore, the TASR route will largely follow the existing Old Airport Road alignment that is currently in use. Connectivity of moose populations in the RSA is likely already restricted to a degree by this linear feature and so the Project is unlikely to result in a measurable reduction to moose connectivity compared to Base Case conditions.



LEGEND

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HABITAT SUITABILITY

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PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
TŁĮCHǪ ALL-SEASON ROAD

TITLE
DISTRIBUTION OF SUITABLE MOOSE HABITAT AT APPLICATION CASE AND RFD CASE

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

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Survival and Reproduction

Effects pathways associated with the Project that may influence survival and reproduction of moose include injury or mortality from vehicle collisions, habitat loss (vegetation clearing), sensory disturbances and improved hunter access from the development of new roads and trails. Moose may be attracted to regenerating vegetation along the TASR, which may increase the interaction of moose with wolves, vehicles, and hunters. Moose are mobile and can avoid interactions with Project activities that could result in direct mortality. In addition, studies have shown moose avoid roads by up to 3 km, and this trend is more often observed during the fall and winter when hunting pressure is high (McLoughlin et al. 2011; Beyer et al. 2013). Moose may already be deterred from the Project area based on the existing disturbance of the Old Airport Road corridor and the access it provides. The Project will include monitors during construction to help detect moose and other wildlife and protect them from Project activities. Construction activities will be suspended or restricted as described in the WMMP (PR#7) when moose are known to be present. The Project also has the potential to increase mortality through collisions with vehicles, especially during operations; however, the likelihood of collision is low given the low speed limit and low predicted traffic volume on the road.

Sensory disturbance can result in increased levels of stress and energy expenditure, and disruption of feeding behaviour, which may result in illness or mortality. Sensory disturbance is expected to have the greatest potential for impact during the construction phase of the Project. During construction, the amount of noise and lights will be limited by restricting construction activities when moose are present. Disturbance from fugitive dust will be reduced by completing land clearing primarily during winter. During operation up to 40 vehicles are predicted to use the road daily, assuming all future developments are built, which represents a low volume of traffic. Thus, noise or visual stimulus from traffic will be periodic and unlikely to result in a significant disruption of normal moose behaviour.

The development of the Project will improve access, which could directly affect moose survival and reproduction through increased harvest during the construction and operation phase. This effect will be avoided by not allowing construction workers to harvest wildlife and minimized by blocking access roads to borrow sites when no longer active to restrict future access. Improved access could also directly affect moose survival and reproduction though increased harvest during the operation phase. However, changes to moose survival and reproduction as a result of improved access is predicted to be negligible given that the TASR ROW follows an existing linear feature that is currently used by hunters to harvest moose and access the WRMA at Base Case (PR#7; PR#28; Section 5.2.10).

4.4.2.4 Wolverine

Habitat Availability

The construction of the Project would contribute to a minimal loss of moderate and high wolverine habitat in the Application Case. The Project will remove 560 ha (0.2%) of potential moderate to high suitability wolverine habitat in the RSA, relative to the Base Case (Table 4.4-5; Figure 4.4-5). Wolverines typically occupy home ranges that vary from about 50 to 400 km^2 for females (smallest during denning periods) and 230 to 1,580 km^2 for males (COSEWIC 2014c; SARC 2014). On the central barrens near Darling Lake, NWT, wolverine home range averaged 126 km^2 for females and 404 km^2 for males (Mulders 2000), and this is likely larger than home ranges in the boreal zone due to the lower productivity of the central barrens (SARC 2014). Assuming a home range size of between 5,000 ha and 12,600 ha for females and between 23,000 ha and 40,400 ha for males, the Project is predicted to remove approximately 4% to 11% of a single female home range or 1% to 2% of a single male home range (560 ha). Project mitigation to minimize effects to habitat availability include aligning the ROW in areas of existing disturbance along the existing Old Airport Road alignment minimizing the amount of new disturbance. Construction

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camps and laydown areas will be located in either borrow sites or within the ROW to avoid additional land clearing. Most access roads are also planned to overlap the ROW and borrow sites. The development of edge habitat along the proposed TASR route may also benefit wolverine with sufficient recovery of vegetation to support moose populations (Luensmann 2008). Overall, the small changes in the amount of suitable wolverine habitat in the RSA from physical development features of the Project are likely to be ecologically non-measurable for the wolverine population in the RSA.

In addition to direct habitat loss, wolverine habitat suitability in the RSA may be reduced if wolverine avoid areas due to sensory disturbance. Loud noises, lights, smells, dust and human activity could potentially cause displacement of individuals, loss of foraging and resting habitat, and changes in predator-prey relationships. The response of wolverines to sensory disturbance is unclear. It is generally accepted that wolverines are sensitive to human disturbance (Rowland et al. 2003; May et al. 2006; Krebs et al. 2007; Luensmann 2008; Bowman et al. 2010; COSEWIC 2014c); however, recent research indicates that wolverines may tolerate infrequent and occasional human disturbance in their home range, including denning females (Heinemeyer and Squires 2013, 2014). Thus, sensory disturbance from the Project may reduce habitat quality and cause some individuals to avoid potential suitable habitat at the local scale; however, others may be tolerant to sensory disturbance due to the presence of the existing Old Airport Road route and the network of trails surrounding the TASR route. Individual wolverines that avoid suitable habitat during construction due to temporary sensory disturbance are expected to reoccupy the habitat once the disturbance is removed. Vehicle traffic during the operation phase may also disturb individual wolverines; however, such events will be infrequent, isolated, and short-term in duration.

Table 4.4-5: Wolverine Habitat Availability in the Application Case

Habitat Suitability	Base Case (ha)	Application Case (ha)	Change in Area (ha)	Percent (%)
Moderate to High	287,519	286,958	-560	-0.2
Nil to Low	714,002	714,562	560	0.1

Habitat Distribution

The extent to which linear disturbances affect wolverine movement and connectivity is largely unknown. Some research indicates that wolverines avoid crossing wide roads and it is suggested that ROWs greater than 100 m have a greater influence on wolverine movements than roads with narrow ROWs (Austin 1998). The TASR will be up to 60 m, which is narrower than the width observed to elicit avoidance by wolverine (Austin 1998) and well below the reported daily movement distances and dispersal distances for wolverines. For example, Banci and Harestad (1990) reported that wolverines can travel up to 40 km per day, and Mulders (2000) reported average dispersal movements of 133 km (range 69 to 225 km) for females and 231 km (range 73 to 326 km) for males in the NWT. Long distance movements of 378 km and 300 km (over 8 and 5 months, respectively) have also been reported (Gardner et al. 1986).

Roads with high traffic volumes may also limit wolverine movement. Carnivores (including wolverine) in Banff National Park were found to cross roads with traffic volumes of 300 to 500 vehicles per day significantly fewer times than roads with lower traffic volumes (Alexander et al. 2005). For this assessment, traffic volume on the TASR was predicted to be up to 40 vehicles per day, or an average of 1.7 vehicles per hour. Sensory disturbance from this increased traffic may increase avoidance of the TASR by wolverines; however, traffic volumes are not anticipated to be high enough to affect the crossing rate of wolverine.

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The TASR will cause an incremental increase in fragmentation of the RSA by adding another linear disturbance to the landscape. The change is unlikely to result in a measurable change given that the TASR ROW follows an existing linear feature and may already influence movement of wolverines and their prey (i.e., caribou and moose carrion) at Base Case. Effects will be minimized by applying mitigation to limit the amount of vegetation disturbance during construction. This includes locating construction camps and laydown areas within borrow sites or the TASR ROW to avoid additional land clearing. Most access roads are also planned to overlap the ROW and borrow sites. Wolverines are highly mobile and strong dispersers and wolverine connectivity in the RSA is not predicted to be measurably reduced compared to Base Case conditions as a result of the Project.

Survival and Reproduction

Primary pathways associated with the Project that may influence survival and reproduction of wolverine include injury or mortality from vehicle collisions and increased harvest pressure facilitated by the development of new access roads. Wolverines are mobile and can avoid interactions with Project activities that could result in direct mortality. The Project also has the potential to increase mortality through collisions with vehicles, especially during operations; however, the likelihood of collision is low given the low speed limit and low predicted traffic volume on the road (Kloeden et al. 2001).

The development of the Project will improve access, which could indirectly affect wolverine survival and reproduction through increased harvest of moose and caribou during the construction and operation phase, thereby reducing the amount of food available to wolverine in the RSA. This effect will be minimized by not allowing construction workers to harvest wildlife and by blocking access roads to borrow sites when no longer active to minimize future access. Improved access could also directly affect wolverine survival and reproduction though increased harvest during the operation phase, especially if the TASR facilitates greater access for trappers to high suitability wolverine habitat. However, changes to wolverine survival and reproduction as a result of improved access is predicted to be negligible given that the TASR ROW follows an existing linear feature that is currently used by trappers to access the WRMA to harvest wolverine at Base Case (PR#7; PR#28).

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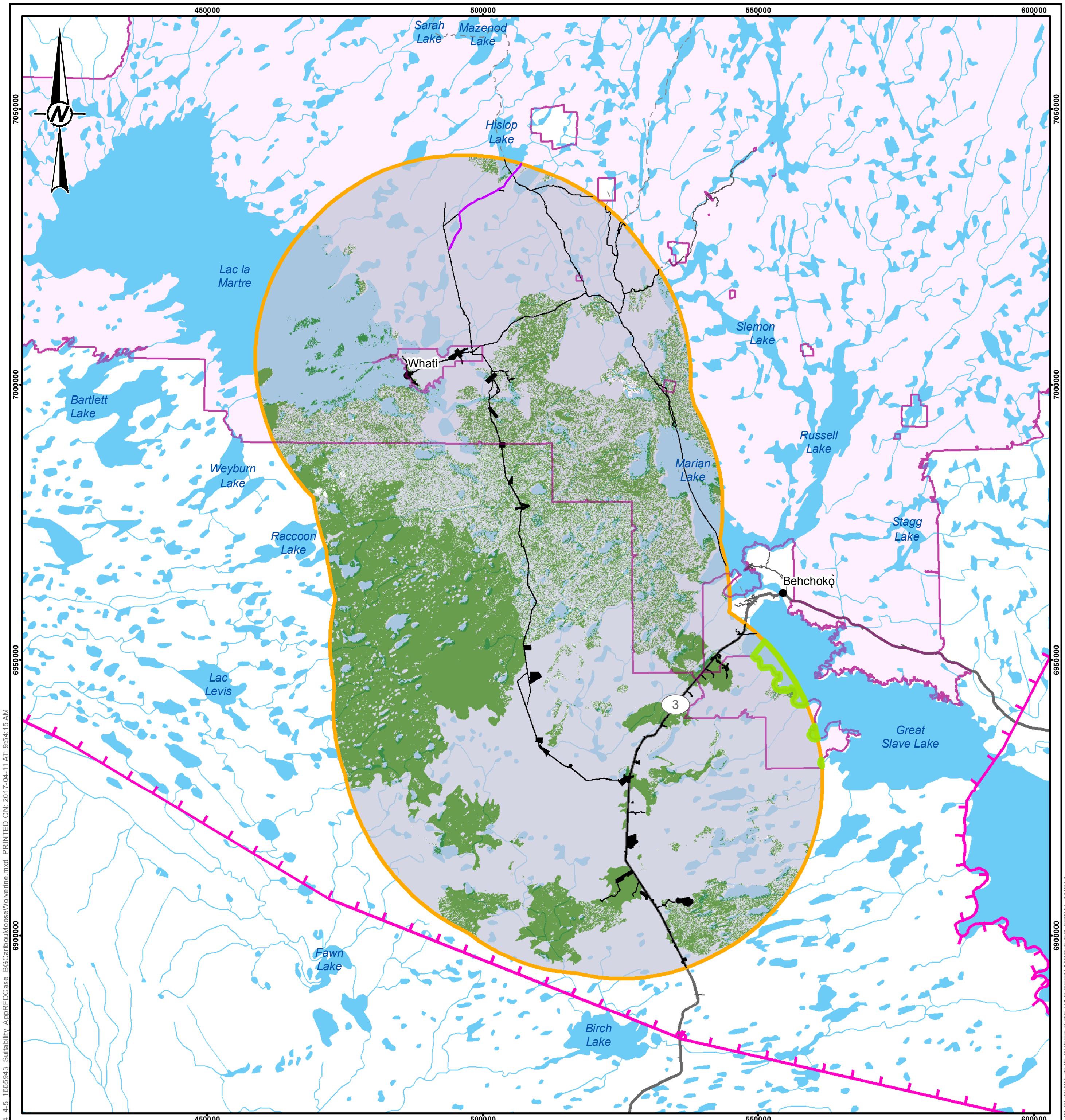

LEGEND

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PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT
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PROJECT
TŁĮCHǪ ALL-SEASON ROAD

TITLE
DISTRIBUTION OF SUITABLE WOLVERINE HABITAT AT APPLICATION CASE AND RFD CASE

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO.	REV.	FIGURE
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4.4.3 Reasonably Foreseeable Development Case Results

4.4.3.1 Boreal Caribou

Habitat Availability

The buffered developments in the RFD Case, including the Project, will reduce boreal caribou habitat availability in the NT1 range by removal of 57,507 ha (0.2%) of undisturbed habitat under existing conditions (Table 4.4-6). Because the NT1 range is larger than the RSA for most other VCs, the RFD Case for boreal caribou considers additional developments, including the Prairie Creek Mine Project and Mackenzie Valley Highway. In the RFD Case, fire disturbance covers 10,141,116 ha (24.3%) of the NT1 range. The buffered developments will overlap with and reduce fire disturbance by 18,170 ha (0.2%) under existing conditions and accounts for 23.5% of the total area of buffered footprints. The total amount of disturbance will increase by 77,456 ha (2.1%) and the proportion from 33.2% at Base Case to 33.4% in the RFD Case. The proportion of undisturbed boreal caribou habitat is predicted to be 66.6% in the NT1 range, which exceeds the minimum threshold of 65% predicted to be necessary for self-sustaining boreal caribou populations (Environment Canada 2012). Regenerating forest post-burn may become available in the near future, although these areas may also be at risk of burning again. Given that RFDs are future developments that are not present on the landscape, there is uncertainty about mitigation detail that will be used to avoid, minimize rehabilitate or off-set effects to boreal caribou habitat availability. Therefore, the assessment assumes that mitigation designs will be similar or similarly effective to those used by the Project. Thus, the reduction in availability of undisturbed habitat for boreal caribou in the RFD Case is predicted to be small relative to the Base Case and near the resilience limits and adaptive capacity of boreal caribou.

Table 4.4-6: Boreal Caribou Habitat Availability in the NT1 Range, RFD Case

Habitat Suitability	Base Case (ha)	RFD Case (ha)	Change in Area (ha)	Percent (%)
Fire disturbance [a]	10,159,286	10,141,116	-18,170	-0.2
Buffered developments[b]	3,697,637	3,775,093	77,456	2.1
Undisturbed habitat	27,861,774	27,802,488	-57,507	-0.2

a) The buffered Project will overlap with areas already affected by fire disturbance and therefore reduce the area classified as fire disturbance in the Application Case

b) Buffered developments in the RFD Case include Fortune Minerals Ltd. NICO Mine, Nailii Hydroelectric Project, Tłı̨chǫ/Whatì Park Area, Prairie Creek Mine Project and Mackenzie Valley Highway.

In the Wek'èezhìı portion of the NT1 Range, buffered development disturbance in the RFD Case will reduce undisturbed habitat availability by 1,835 ha (0.1%) (Table 4.4-7). The total amount of buffered disturbance will increase by 5,897 (14.4%) and 4,062 ha (68.9%) will overlap with habitat disturbed by fire under existing conditions. The proportion of disturbed habitat from fire and buffered developments will change from 40.0% in the Application Case to 41.1% in the RFD Case, so 59.9% of the Wek'èezhìı portion of the NT1 Range is predicted to be undisturbed habitat

Table 4.4-7: Boreal Caribou Habitat Availability in the Wek'èezhìı Portion of NT1 Range, RFD Case

Habitat Suitability	Base Case (ha)	RFD Case (ha)	Change in Area (ha)	Percent (%)
Fire disturbance[a]	1,813,041	1,808,979	-4,062	-0.2
Buffered developments[b]	40,840	46,737	5,897	14.4

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Table 4.4-7: Boreal Caribou Habitat Availability in the Wek'èezhìı Portion of NT1 Range, RFD Case

Habitat Suitability	Base Case (ha)	RFD Case (ha)	Change in Area (ha)	Percent (%)
Undisturbed habitat	2,778,883	2,777,048	-1,835	-0.1

a) The buffered Project will overlap with areas already affected by fire disturbance and therefore reduce the area classified as fire disturbance in the Application Case

b) Buffered developments in the RFD Case include Fortune Minerals Ltd. NICO Mine, Nailii Hydroelectric Project, and Tłı̨chǫ/Whatì Park Area

Because wildfire is the predominant source of habitat loss in the NT1 range, RFDs may also overlap with burned areas, and not completely remove suitable habitat as with the Project. Climate change is also likely to affect boreal caribou habitat availability for the foreseeable future. The magnitude will depend on how much climate change and fire alter the amount of habitat availability in the NT1 range. There is also uncertainty around the location, geographic extent, and feasibility of the development of RFDs. However, it is expected that RFDs will be required to implement mitigation that will limit cumulative effects on the habitat availability for boreal caribou. Although there is uncertainty in the magnitude of changes to habitat availability, effects are anticipated to be near but not exceed the resilience or adaptability limits of this species in the RFD Case.

Habitat Distribution

RFDs occurring in the NT1 range will result in additional fragmentation of boreal caribou habitat in the NT1 compared to the Base Case (Figure 4.4-6). It is currently unknown how much the proposed Nailii Hydroelectric Project would contribute to cumulative changes to fragmentation of undisturbed habitat in the Wek'èezhìı portion of the NT1 range or NT1 range because its size is unknown but is expected to be small. Overall, the expected landscape level changes in the distribution of suitable boreal caribou habitat in the RSA due to RFDs (including the Project) are small, and the effect is predicted to be permanent because there is currently a poor understanding of the reclamation plans associated with RFDs and because the Project will exist indefinitely.

As with habitat availability, climate change and wildfire may contribute cumulatively to changes in the distribution of boreal caribou habitat. Climate warming is predicted to alter forest landscape composition and the availability of spring snow cover in the northern boreal forest (Weber and Flannigan 1997; IPCC 2007). This may affect habitat connectivity by changing the extent and location of suitable habitats and movement corridors as caribou avoid deep snow (Boertje 1985; Fancy and White 1987). For example, reduced canopy cover in burns leads to higher snow depths, which appear to increase mobility costs and decrease travel rates for caribou and increase predation risk (Boertje 1985; Fancy and White 1987; Thomas et al. 1998). Alternatively, climate change may reduce spring snow cover and increase the areas with more favourable travel conditions and connectivity for caribou. However, the intensity and amount of areas affected by wildfire is predicted to increase, which will remove habitat for boreal caribou and reduce connectivity in the NT1 range and WRMA.

Overall, connectivity among boreal caribou habitat patches is expected to be maintained at the RFD Case despite potential increased fragmentation from natural factors and RFDs. The effect is considered continuous and beyond regional in geographic extent (because of potential changes from climate change). For the purpose of this assessment, the changes to boreal caribou habitat distribution from human developments and natural factors are assumed to be permanent because the Project is expected to operate indefinitely, reclamation plans are not available for RFDs, and climate change will continue over the foreseeable future. This represents a precautionary

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approach so effects are not underestimated. However, Project footprint cleanup and reclamation activities, as well as reclamation of RFDs, is likely to reduce effects from habitat fragmentation. Although there is a large amount of uncertainty around the location and feasibility of the development of RFDs, it is expected that future development will be required to implement mitigation that will limit cumulative effects on habitat distribution of boreal caribou. While there is uncertainty in the magnitude of changes to habitat distribution, effects are not expected to exceed the resilience or adaptability limits of boreal caribou in the RFD Case.

Survival and Reproduction

Cumulative effects to survival and reproduction of boreal caribou from RFDs (including the Project) are predicted to be small at the NT1 range and in the WRMA. Future developments occurring in the RSA are assumed to use established mitigation such as giving wildlife the right-of-way and speed restrictions on their leases that will limit wildlife injury and mortality from vehicle collisions. As a conservatism, the traffic volume in the Application Case was assessed assuming up to 40 vehicles daily during operation. As noted in the PDR (PR#7), this amount includes traffic volume associated with the NICO Project. Thus, no additional wildlife-vehicle collisions due to this RFD is predicted. No hunting policies for workers at RFDs are also assumed to be effective to limit cumulative effects to caribou from harvest. Winter or all-season access roads to RFDs, such as the NICO Project, may be used by the public, however, the WRMA is already accessible through a network of existing trails at Base Case (PR#7; PR#28) and will still require use of these trails to reach more suitable caribou habitat a considerable distance beyond the RSA. Therefore, changes in the survival and reproduction of boreal caribou in the RSA due to RFDs, as well as the Project, are predicted to be small and not expected to exceed the resilience or adaptability limits of boreal caribou in the RFD Case.

Climate change may also contribute cumulatively to changes in survival and reproduction of boreal caribou by altering fire change the amount of habitat availability of spring snow cover and the distribution of food resources. A decline in the amount and duration of snowpack may reduce areas of deep snow where caribou are more susceptible to predation by wolves (Boertje 1985; Fancy and White 1987; Thomas et al. 1998). However, reduced canopy cover in burns leads to higher snow depths and loss of lichen stores which negatively affect caribou survival and reproduction (Boertje 1985; Fancy and White 1987; Thomas et al. 1998). A changing climate may also alter the composition of forested ecosystems and result in changes to ungulate distribution and abundance, although changes that negatively affect one species (e.g., caribou) may benefit another (e.g., moose), such as the loss of conifer forest cover. Overall, uncertainty is high regarding the potential effects of climate change on boreal caribou survival and reproduction because the predicted outcomes are variable. It is expected that RFDs will be required to implement mitigation that will limit cumulative effects on the survival and reproduction for boreal caribou. Although there is uncertainty in the magnitude of changes to survival and reproduction, effects are not expected to exceed the resilience or adaptability limits of boreal caribou in the RFD Case.

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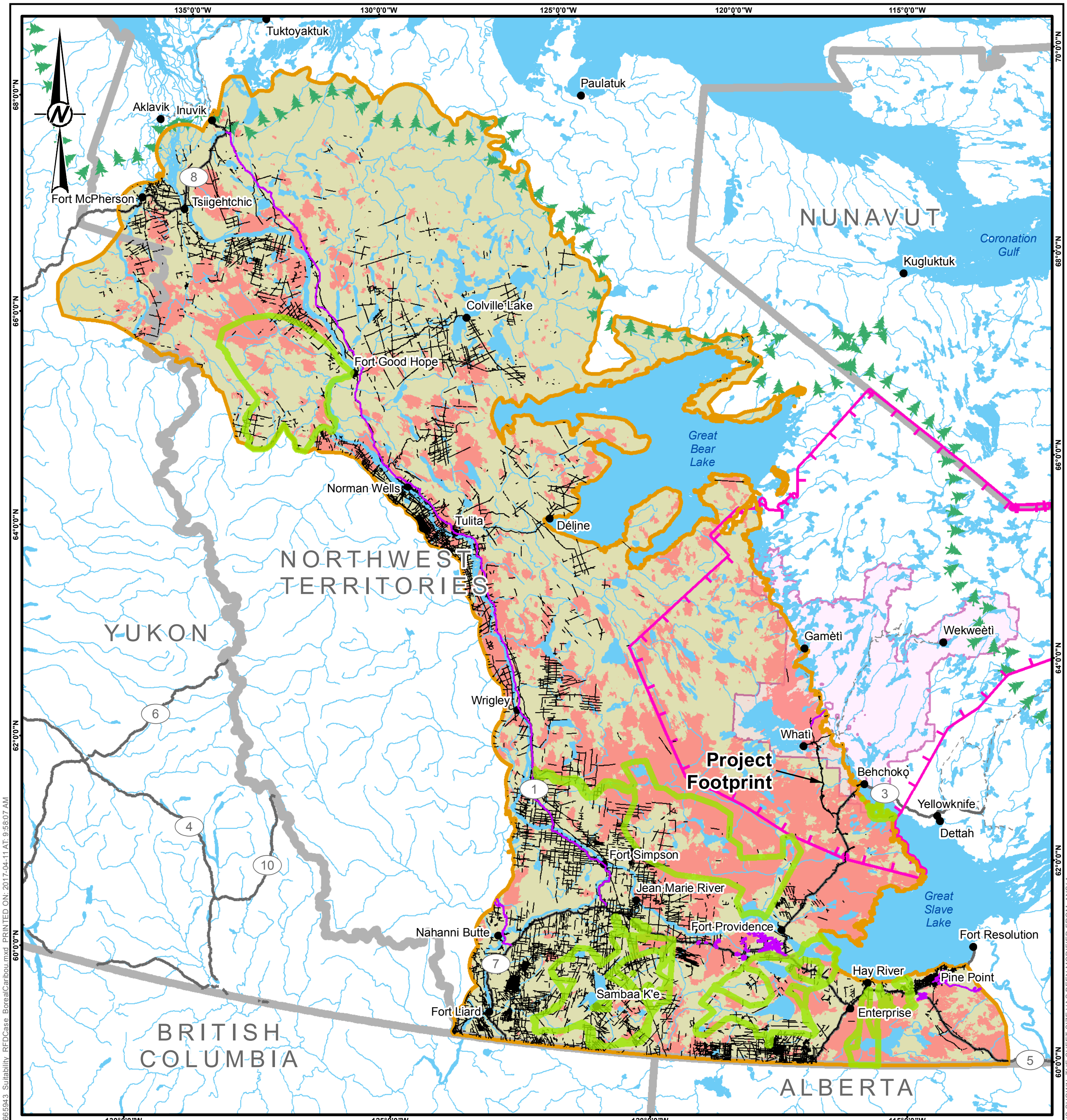

LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- WINTER ROAD
- TREELINE
- WATERCOURSE
- PROVINCIAL/TERRITORIAL BOUNDARY
- TŁĮCHǪ LAND
- WATER BODY
- CANDIDATE PROTECTED AREA
- DEVELOPMENT
- RFD
- FIRE HISTORY (LESS THAN 40 YEARS OLD)
- UNDISTURBED HABITAT
- BOREAL CARIBOU RSA
- WEK'ÈEZHÌI RESOURCE MANAGEMENT AREA

0 120 240

1:6,000,000 KILOMETRES

REFERENCE(S)

1. ADMINISTRATIVE REGIONS OBTAINED FROM GOVERNMENT OF NORTHWEST TERRITORIES.
2. BOREAL CARIBOU RANGE OBTAINED FROM ENVIRONMENT CANADA, 2012.
3. CIMP INVENTORY OF LANDSCAPE CHANGE, OBTAINED FROM THE NWT CENTRE FOR GEOMATICS.
4. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.

PROJECTION: CANADA LAMBERT CONFORMAL CONIC

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
TŁĮCHǪ ALL-SEASON ROAD

TITLE
DISTRIBUTION OF BOREAL CARIBOU HABITAT AT RFD CASE

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO.	REV.	FIGURE
1665943	0	4.4-6

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4.4.3.2 Barren-ground Caribou

Habitat Availability

Locations of collared cows in the Bathurst and BNE herds indicate the RSA is outside of core ranges (Nagy et al. 2005; Anderson and Johnson 2014; Golder 2016; Appendix G) but some caribou may be present when these herds are more abundant (PR#28). RFDs, including the Project, are predicted to reduce moderate to high suitability barren-ground caribou habitats by 264 ha (0.2%) in the RSA relative to the Base Case (Table 4.4-8). Changes to habitat availability in the RFD Case are the same as the Application Case. This is because the NICO Project all-season road reduced a small amount (72 ha) of recently burned areas (from 2011 and 2016) relative to the Application Case, but recently burned areas do not provide suitable habitat for barren-ground caribou. Thus, while the area of individual habitats types changed, these changes only affected types that were of poor quality. It is currently unknown how much habitat will be removed by the proposed Nailii Hydroelectric Project for barren-ground caribou in the RFD Case compared to the Base Case. However, it is assumed that this run-of-river hydro project will have a relatively small footprint and implement similar mitigation measures that avoid, reduce, or limit effects to habitat availability for barren-ground caribou.

Table 4.4-8: Barren-ground Caribou Winter Habitat Availability in the RSA, RFD Case

Habitat Suitability	Base Case (ha)	RFD Case (ha)	Change in Area (ha)	Percent (%)
Moderate to High	117,677	117,413	-264	-0.2
Nil to Low	883,843	884,107	264	<0.0

In addition to development, natural factors such as climate change and wildfire may contribute cumulatively to influence habitat availability for barren-ground caribou, although the extent of habitat loss from climate change is uncertain. Climate warming is predicted to result in warmer conditions and changes in precipitation patterns in northern boreal forest, which will increase the occurrence and severity of fire and affect the composition of forested ecosystems as some plants expand their ranges northward (Weber and Flannigan 1997). This may result in loss of conifer cover and snow conditions which are important to caribou, but may benefit moose (and wolves) that are likely to increase their northern distribution with changing vegetation patterns (Sharma et al. 2009). Wildfire will reduce the availability of suitable boreal caribou habitat immediately post-disturbance due to the loss of lichens (Barrier and Johnson 2014). Caribou begin to use post-fire areas 40 to 50 years later when lichens are available (Thomas et al. 1998), so habitat loss from fire is temporary and reversible. It is not expected that fire suppression activities will change habitat availability for caribou in the RSA as the majority of the RSA would be considered low priority for suppression given the remoteness of the region and the limited economic value of the forests in the RSA (GNWT-ENR 2017).

Climate change is also likely to affect barren-ground caribou habitat availability for the foreseeable future. The magnitude will depend on how much climate change and fire change, change the amount habitat available in the RSA. There is also uncertainty around the geographic extent and feasibility of the development of RFDs. However, it is expected that RFDs will be required to implement mitigation similar to the Project (e.g., footprints that overlap existing disturbance) which will limit cumulative effects on the habitat availability for this species. Although there is uncertainty in the magnitude of changes to habitat availability, effects are anticipated to not exceed the resilience or adaptability limits of this species in the RFD Case.

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Habitat Distribution

The two RFDs occurring in the RSA are not predicted to result in additional fragmentation of barren-ground caribou winter habitat since the amount of moderate to high suitability is not predicted to change in the RFD Case compared to the Application Case (Figure 4.4-2). It is currently unknown if the proposed Nailii Hydroelectric Project would contribute to cumulative changes to fragmentation of moderate to high suitability barren-ground caribou habitat in the RSA because the exact location and size is not available. Habitat connectivity may be reduced locally due to the Nailii Hydroelectric Project and NICO Project all-season access road.

Much like the Project, the NICO Project all-season access road will also follow an existing linear disturbance (trail) present at Base Case (Figure 4.4-2). As well, good quality habitat does not appear to be limited in the boreal winter range of barren-ground caribou beyond the RSA (Barrier and Johnson 2014). Overall, landscape level changes in the distribution of suitable barren-ground caribou habitat in the RSA due to RFDs (including the Project) are anticipated to be small, and the effect is predicted to be permanent because there is currently a poor understanding of the reclamation plans associated with RFDs and because the Project will exist indefinitely. It is also assumed that the RFDs will implement mitigation measures that avoid, reduce or limit effects to connectivity.

As with habitat availability, climate change and wildfire may contribute cumulatively to changes in the distribution of barren-ground caribou habitat. Climate warming is predicted to alter forest landscape composition and the availability of spring snow cover in the northern boreal forest (Weber and Flannigan 1997; IPCC 2007). This may affect habitat connectivity by changing the extent and location of suitable habitats and movement corridors as caribou avoid deep snow (Boertje 1985, Fancy and White 1987). For example, reduced canopy cover in burns leads to higher snow depths, which appear to increase mobility costs and slow travel for caribou and increase predation risk (Boertje 1985; Fancy and White 1987; Thomas et al. 1998). Alternatively, climate change may reduce spring snow cover and increase the areas with more favourable travel conditions for caribou.

Overall, connectivity among habitat patches is expected to be maintained at the RFD Case despite potential increased fragmentation from natural factors and RFDs. Regenerating forest post-burn may become available in the near future, although these areas may also be at risk of burning again.

Although there is a large amount of uncertainty around the location and feasibility of the development of RFDs, it is expected that future development will be required to implement mitigation that will limit cumulative effects on habitat distribution of this species. While there is uncertainty in the magnitude of changes to habitat distribution, effects are not expected to exceed the resilience or adaptability limits of barren-ground caribou in the RFD Case.

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Survival and Reproduction

Cumulative effects to survival and reproduction of barren-ground caribou from RFDs (including the Project) are predicted to be small. Vegetation clearing by the proposed Nailii Hydroelectric Project and all-season access road for the NICO Project are not predicted to affect the amount of quality habitats relative to the Application Case, which represents no change to survival and reproduction. While the exact location and size of the Nailii Hydroelectric Project is unknown, it is a small scale run-of-river design so it is unlikely to remove a large amount of suitable habitat.

While the presence of new roads may delay migratory caribou movement (Wilson et al. 2016), Bathurst caribou are familiar with roads and appear to cross them when encountered at Ekati (ERM Rescan 2014). RFDs occurring in the RSA are assumed to use established mitigation such as giving wildlife the right-of-way and speed restrictions on their leases that will limit wildlife injury and mortality from vehicle collisions. As a conservatism, the traffic volume in the Application Case was assessed assuming up to 40 vehicles daily during operation. As noted in the PDR (PR#7), this amount includes traffic volume associated with the NICO Project. Thus, no additional wildlife-vehicle collisions due to this RFD are predicted. No hunting policies for workers at RFDs are also assumed to be effective to limit cumulative effects to caribou from harvest. Winter or all-season access roads to RFDs, such as the NICO Project, may be used by the public, however, the RSA is already accessible through a network of existing trails at Base Case (PR#7; PR#28) and will still require use of these trails and winter roads to reach more suitable caribou habitat a considerable distance beyond the RSA. Climate warming is anticipated to reduce the operational period of winter roads in the region and the long-term feasibility of their use. Thus, use of winter roads to reach core winter ranges of barren-ground caribou outside the RSA for harvest may be temporary. Therefore, changes in the survival and reproduction of barren-ground caribou in the RSA due to RFDs, as well as the Project, are not expected to exceed the resilience or adaptability limits of barren-ground caribou in the RFD Case.

Climate change may also contribute cumulatively to changes in survival and reproduction of barren-ground caribou by altering the availability of spring snow cover and the distribution of food resources. A decline in the amount and duration of snowpack may reduce areas of deep snow where caribou are more susceptible to predation by wolves (Boertje 1985; Fancy and White 1987; Thomas et al. 1998). However, reduced canopy cover in burns leads to higher snow depths and loss of lichen stores which negatively affect caribou survival and reproduction (Boertje 1985; Fancy and White 1987; Thomas et al. 1998). A changing climate may also alter the composition of forested ecosystems and result in changes to ungulate distribution and abundance, although changes that negatively affect one species (e.g., caribou) may benefit another (e.g., moose), such as the loss of conifer forest cover. Overall, uncertainty is high regarding the potential effects of climate change on barren-ground caribou survival and reproduction because the predicted outcomes are variable.

Changes to barren-ground survival and reproduction in the RFD Case are predicted to be beyond regional, possible and permanent because the Project is expected to operate indefinitely and there is uncertainty regarding reclamation plans for RFDs. Climate change will affect barren-ground caribou populations, although the direction and magnitude of changes is uncertain because predictions are variable. There is also some uncertainty around the location, geographic extent, and feasibility of the development of RFDs. It is expected that RFDs will be required to implement mitigation that will limit cumulative effects on the survival and reproduction for this barren-ground caribou. Although there is uncertainty in the magnitude of changes to survival and reproduction, effects are not expected to exceed the resilience or adaptability limits of barren-ground caribou in the RFD Case.

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4.4.3.3 Moose

Habitat Availability

RFDs, including the Project, will remove 1,097 ha (0.3%) of moderate to high suitability habitat in the RSA compared to the Base Case (Table 4.4-9). Changes to habitat availability in the RFD Case are the same as the Application Case. This is because RFDs reduced a small amount (72 ha) of recently burned areas (from 2011 and 2016) relative to the Application, but recently burned areas do not provide suitable habitat for moose. Thus, while the area of individual habitat types changed, these changes only affected types that were of poor quality.

Although the Fortune Minerals Ltd. NICO Mine Project overlaps the RSA, the predicted change in the amount of moderate to high suitability moose habitat in the RSA in the RFD Case compared to the Base Case is expected to result primarily from the construction of the proposed Project footprint. It is currently unknown if the proposed Nailii Hydroelectric Project will result in a loss of suitable habitat for moose in the RFD Case compared to the Application Case; however, it is assumed that the Nailii Hydroelectric Project will have a relatively small footprint and implement mitigation measures that avoid, reduce or limit effects to habitat availability for moose.

Moose display life history traits (e.g., large home ranges, high reproductive rates, ability to eat many types of plants) that provide flexibility to adapt to changes from human development. Habitat availability effects at the RFD Case are predicted to be negligible relative to the Base Case.

Table 4.4-9: Moose Habitat Availability in the RSA, RFD Case

Habitat Suitability	Base Case (ha)	RFD Case (ha)	Change in Area (ha)	Percent (%)
Moderate to High	322,377	321,280	-1,097	-0.3
Nil to Low	679,143	680,240	1,097	0.2

In addition to development, natural factors such as climate change and wildfire may contribute cumulatively to influence habitat availability for moose, although the extent of habitat loss from climate change is uncertain. Climate warming is predicted to result in warmer conditions and changes in precipitation patterns in northern boreal forest, which will increase the occurrence and severity of fire and affect the composition of forested ecosystems as some plants expand their ranges northward (Weber and Flannigan 1997). This may result in loss of conifer cover and snow conditions, which may benefit moose (and wolves) cause moose to increase their northern distribution with changing vegetation patterns (Sharma et al. 2009). Forest fires reduce the availability of suitable moose habitat in the early years post-burn because forage and canopy cover is removed. However, areas that have been burned become optimal for moose at 10 to 26 years post-fire (reviewed by Nelson et al. 2008) so habitat loss from wildfire is short-term and reversible.

It is expected that RFDs will be required to implement mitigation to limit cumulative effects on habitat availability for this species. While there is uncertainty in the magnitude of changes to habitat availability, effects are not expected to exceed the resilience or adaptability limits of this species in the RFD Case.

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Habitat Distribution

RFDs occurring in the RSA may result in additional fragmentation of moose habitat through the development of roads associated with the Fortune Minerals Ltd. NICO Mine Project. However, the expected road requirements of the mine were considered during the design process of the proposed TASR, and additional effects are not expected. Traffic volumes associated with the mining Project were integrated into the projected traffic volumes for the proposed TASR, and thus suitable mitigations will be implemented.

It is currently unknown if the proposed Nailii Hydroelectric Project will result in additional fragmentation of suitable habitat for moose in the RFD Case compared to the Application Case. If this Project were to proceed, transmission lines would need to be installed to connect power into the Snare hydro system and to connect the community of Whatì. It is possible that the community access road corridor would be wide enough to easily accommodate transmission lines rather than needing to construct a parallel corridor for the lines. In addition, it is assumed that the Nailii Project will implement mitigation measures that avoids and minimizes effects to moose habitat and population connectivity.

As with habitat availability, climate change and wildfire may contribute cumulatively to changes in the distribution of moose habitat. Climate warming is predicted to alter forest landscapes through reduced forest patch size, diversity, and distribution as local conditions favour different plant species (Thompson et al. 1998). An increase in the frequency and intensity of wildfire could also fragment suitable habitats for moose. More frequent and intense wildfires from climate warming are predicted to enable fire-tolerant plants to expand their ranges northward (Thompson et al. 1998). Bioclimatic moose density models that capture these types of changes predict that moose densities will be lower and their distribution contracted in the presence of future climate change (Rempel 2012).

Overall, connectivity among moose habitat patches is expected to be maintained at the RFD Case despite potential increased fragmentation from natural factors and RFDs. Effects from RFDs are considered continuous and regional in geographic extent. For the purpose of this analysis the changes to moose habitat distribution from human developments and natural factors are assumed to be permanent and irreversible. This represents a precautionary approach so effects are not underestimated. However, Project footprint cleanup will take place throughout the construction and into operations so effects from fragmentation due to temporary Project components may be reduced. Reclamation of habitat on RFDs is also likely to reduce effects from fragmentation on moose population in the RSA. The effect from changes to habitat distribution is probable and the magnitude will depend on the timing, geographic extent, and location of RFDs, as well as on how climate change and wildfire change habitat distribution in the RSA. Although there is uncertainty in the magnitude of changes to habitat distribution, effects are not expected to exceed the resilience or adaptability limits of this species in the RFD Case.

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Survival and Reproduction

Injury or mortality from vehicle collisions and improved hunter access by development of new roads and trails can affect the survival and reproduction of moose. Similar to the Project, RFDs are assumed to use established mitigation such as giving wildlife the right-of-way, which will limit injury and mortalities from collision with traffic. Restricting public access to areas developed by future developments is also assumed to limit cumulative effects to harvest rates of moose.

Climate change is predicted to contribute to cumulative changes to the survival and reproduction of moose. The ability of moose to lose body heat has been postulated as a demographic constraint of their large body size and as an explanation for selection of wetland and mature forest that provide thermal relief (Renecker and Hudson 1986; Street et al. 2015b). A reduction in the abundance or distribution of these habitats from climate change may reduce moose survival and reproduction rates due to increased energy expenditure from intraspecific competition or dispersal to acquire these important habitats.

Moose have high reproductive rates and have recently expanded their ranges to include prairie and tundra ecosystems. The recent expansion into prairie ecosystems suggests that moose can adapt to warmer climates and highly fragmented landscapes. Changes to moose survival and reproduction in the RFD Case are assumed to be permanent and irreversible because the Project is expected to operate indefinitely and there is uncertainty regarding reclamation plans for RFDs. Climate change will also affect moose populations for the foreseeable future. The direction and magnitude of changes in the RFD Case is uncertain because climate change predictions are based on simulations that can be highly variable. There is also a large amount of uncertainty around the location, geographic extent, and feasibility of the development of RFDs. It is expected that RFDs will be required to implement mitigation to limit cumulative effects on the survival and reproduction for this species. Although there is uncertainty in the magnitude of changes to habitat availability, effects are not expected to exceed the resilience or adaptability limits of this species in the RFD Case.

4.4.3.4 Wolverine

Habitat Availability

RFDs including the Project are predicted to reduce habitat quantity and quality for wolverine by 560 ha (0.2%) in the RSA relative to the Base Case (Table 4.4-10). Changes to habitat availability in the RFD Case are the same as the Application Case. RFDs reduced a small amount (72 ha) of recently burned areas (from 2011 and 2016) relative to the Application Case, but recently burned areas do not provide suitable habitat for wolverine. Thus, while the area of individual habitats types changed, these changes only affected types that were of poor quality. It is currently unknown how much suitable wolverine habitat the proposed Nailii Hydroelectric Project will remove in the RFD Case compared to the Application Case; however, it is a run-of-river design, which will limit terrestrial disturbance. It is assumed that the RFDs will implement mitigation measures that avoid, reduce or limit effects to habitat availability for wolverine and their primary food source (caribou and moose carrion).

In addition to development, natural factors such as climate change and wildfire may contribute cumulatively to influence habitat availability for wolverine and their primary food sources (caribou and moose carrion), although the extent of habitat loss from climate change is uncertain (COSEWIC 2014c). Climate warming is predicted to result in warmer conditions and changes in precipitation patterns in northern boreal forest, which will increase the occurrence and severity of fire and affect the composition of forested ecosystems as some plants expand their ranges northward (Weber and Flannigan 1997). This may result in loss of conifer cover and snow conditions,

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which are important to caribou, but may benefit moose that are likely to increase their northern distribution with changing vegetation patterns (Sharma et al. 2009). Wildfire may also reduce the availability of suitable wolverine habitat immediately post-disturbance due to the loss of overstory cover (Luensmann 2008). However, fire is not considered a threat to wolverine populations in the boreal forests as ecosystem effects may have a positive influence on wolverine through increases in moose habitat and moose abundance (COSEWIC 2014c). Habitat loss from fire is therefore considered temporary and reversible. It is not expected that fire suppression activities will change habitat availability for wolverine in the RSA as the majority of the RSA would be considered low priority for suppression given the remoteness of the region and the limited economic value of the forests (GNWT-ENR 2017).

It is expected that RFDs will be required to implement mitigation that will limit cumulative effects on the habitat availability for this species. Although there is uncertainty in the magnitude of changes to habitat availability, effects are anticipated to not exceed the resilience or adaptability limits of this species in the RFD Case.

Table 4.4-10: Wolverine Habitat Availability in the RSA, RFD Case

Habitat Suitability	Base Case (ha)	RFD Case (ha)	Change in Area (ha)	Percent %)
Moderate to High	287,519	286,958	-560	-0.2
Nil to Low	714,002	714,562	560	0.1

Habitat Distribution

RFDs occurring in RSA are not predicted to result in additional fragmentation of wolverine habitat as the amount of moderate to high suitability wolverine habitat in the RSA is not predicted to change in the RFD Case compared to changes from the Base Case to Application Case (Tables 4.4-10 and 4.4-5) . It is currently unknown if the proposed Nailii Hydroelectric Project would contribute to cumulative changes to fragmentation of moderate to high suitability wolverine habitat in the RSA. Habitat connectivity may be reduced at a local scale due to the Nailii Hydroelectric Project but not over the entire RSA as wolverine have high dispersal capabilities, including the ability to cross significant natural and artificial landscape barriers such as glaciers, rivers, reservoirs, and major highways (Hornocker and Hash 1981; COSEWIC 2014c; SARC 2014). Overall, landscape level changes in the distribution of suitable wolverine habitat in the RSA due to RFDs (including the Project) are unlikely, and the effect is predicted to be permanent because there is currently a poor understanding of the reclamation plans associated with RFDs and because the Project will exist indefinitely. It is also assumed that the RFDs will implement mitigation measures that avoid, reduce or limit effects to wolverine connectivity.

As with habitat availability, climate change and wildfire may contribute cumulatively to changes in the distribution of wolverine habitat. Climate warming is predicted to alter forest landscape composition and the availability of spring snow cover in the northern boreal forest (Weber and Flannigan 1997; IPCC 2007). This may affect wolverine habitat connectivity by changing the extent and location of suitable habitats and movement corridors. Models that capture these types of changes predict that wolverine abundance will be lower and their distribution contracted in the presence of future climate change (Peacock 2011; McKelvey et al. 2011). However, uncertainty is high regarding the potential effects of climate change because predictions are based on simulations that can be highly variable.

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Overall, connectivity among wolverine habitat patches is expected to be maintained at the RFD Case despite potential increased fragmentation from natural factors and RFDs. The effect is considered continuous and beyond regional in geographic extent (because of potential changes from climate change). For the purpose of this analysis, the changes to wolverine habitat distribution from human developments and natural factors are assumed to be permanent because the Project is expected to operate indefinitely, reclamation plans are not available for RFDs, and climate change will continue over the foreseeable future. This represents a precautionary approach so effects are not underestimated. However, Project footprint cleanup and reclamation activities, as well as reclamation of RFDs, is likely to reduce effects from habitat fragmentation. Although there is a large amount of uncertainty around the location and feasibility of the development of RFDs, it is expected that future development will be required to implement mitigation that will limit cumulative effects on habitat distribution of this species. While there is uncertainty in the magnitude of changes to habitat distribution, effects are not expected to exceed the resilience or adaptability limits of this species in the RFD Case.

Survival and Reproduction

RFDs occurring in the RSA are assumed to use established mitigation such as giving wildlife the right-of-way and speed restrictions on their leases that will limit wildlife injury and mortality from vehicle collisions. Restricting public access to RFDs is also assumed to limit cumulative effects to wolverine harvest rates. In addition, adult wolverine are mobile and can avoid clearing activities outside of the denning period. In addition, all moderate to high quality wolverine habitat is predicted to remain intact in the RSA (Table 4.4-10), and large expanses of ecologically intact areas favour wolverine survival (SARC 2014). Trapping records also indicate that the regional population is capable of withstanding constant harvest pressure (SARC 2014). Therefore, changes in the survival and reproduction of wolverine populations that overlap the RSA due to RFDs, as well as the Project, are unlikely and effects are not expected to exceed the resilience or adaptability limits of this species in the RFD Case.

Climate change may also contribute cumulatively to changes in survival and reproduction of wolverine by altering the availability of spring snow cover and the distribution of prey (i.e., ungulates). Wolverine den in areas of deep snowpack, and a decline in the amount and duration of snowpack may reduce wolverine survival by reducing the amount of reproductive denning habitat available. However, reductions in the extent of wolverine denning habitat due to reductions in snow cover is uncertain, and a decrease in snow season length may not impact denning because a net increase in snowfall could compensate for the shorter snow season (COSEWIC 2014c). A changing climate may also alter the composition of forested ecosystems and result in changes to ungulate distribution and abundance, although changes that affect one species (i.e., caribou) may benefit another (i.e., moose), such as the loss of conifer forest cover. Overall, uncertainty is high regarding the potential effects of climate change on wolverine survival and reproduction because predictions are based on simulations that can be highly variable.

Changes to wolverine survival and reproduction in the RFD Case are predicted to be beyond regional, possible and permanent because the Project is expected to operate indefinitely and there is uncertainty regarding reclamation plans for RFDs. Climate change may also affect wolverine populations, although the direction and magnitude of changes is uncertain because predictions are based on simulations that can be highly variable. There is also some uncertainty around the location, geographic extent, and feasibility of the development of RFDs. It is expected that RFDs will be required to implement mitigation that will limit cumulative effects on the survival and reproduction for this species. Although there is uncertainty in the magnitude of changes to survival and reproduction, effects are not expected to exceed the resilience or adaptability limits of this species in the RFD Case.

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4.5 Prediction Confidence and Uncertainty

Prediction confidence refers to the degree of certainty in the residual effects predictions and associated determination of significance. The ASR deals with predictions of future circumstances, and predicts interactions of the Project and other developments or activities within complex ecosystems. Scientific inference is associated with uncertainty, and prediction confidence (how confident we are in our assessment results) depends on the level of uncertainty and the manner in which it is addressed. Primary factors affecting confidence in the predictions made in the wildlife assessment include:

- availability and accuracy of baseline data
- accuracy of landcover maps (Ecological Landscape Classification data) and qualitative wildlife habitat models
- level of understanding of the strength of effects pathways (i.e., mechanisms) on each VC
- level of certainty associated with the effectiveness of proposed mitigation, where applicable
- level of understanding of the cumulative drivers of change in measurement indicators and associated effects on assessment endpoints

The level of certainty is considered during the effects assessment, and how uncertainty was addressed to increase the level of confidence so that residual effects will not be worse than predicted, such as building conservatism into the analysis and assessment. Uncertainty in the assessment was managed by:

- using the best available land cover data
- reviewing historical data and relevant wildlife studies conducted in the study areas
- collecting local and regional data to understand ecological relationships relevant to potential pathways, and inform the assessment
- using data to make inferences about ecological interactions and mechanisms of change
- comparing assessment results to relevant published literature

Remaining uncertainty was primarily addressed by making assumptions that overestimated rather than underestimated potential effects of the Project and RFDs (i.e., a precautionary assessment). For example, the Project will use existing access as much as possible to minimize new disturbance to the landscape; to be conservative and not underestimate effects of habitat loss, the assessment overestimated the Project footprint by about 56%. The Project footprint assessed included 13 borrow sites and access roads but development of the Project will likely not require the use of all these sites. Thus, predicted effects from changes in wildlife habitat availability and distribution due to the Project have a high level of confidence.

Similarly, for the purpose of this assessment the loss of wildlife habitat due to the preferred route of the Project and RFDs is assumed to be permanent because the Project is expected to operate indefinitely and reclamation plans are not available for planned RFDs. Some habitats disturbed by the Project through temporary laydown and storage yards, and construction camps are expected to be reclaimed, which would contribute to reducing residual Project effects. Therefore, the confidence in predictions concerning effects to wildlife from the Project is moderate to high.

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Climate change models predict an increase in average global temperatures in the Project Case and the RFD Case; however, the effect of these changes on ecosystem processes is uncertain (Deser et al. 2010; Walther 2010). Predicting how an ecosystem or an individual species will cope with climate change is difficult and many scenarios are possible (Dawson et al. 2011). Climate warming is predicted to result in warmer conditions and changes in precipitation patterns in northern boreal forest, which will increase the occurrence and severity of fire and affect the composition of forested ecosystems as some plants expand their ranges northward (Weber and Flannigan 1997, GNWT-ENR 2008) and in the VC-specific RSAs. Changes in water levels and flows are uncertain, and may result in negative or positive effects to wildlife and wildlife habitat. For most species, climate change will have both positive and negative effects on habitat availability, habitat distribution and survival and reproduction (Nituch and Bowman 2013).

An increase in wildfire is predicted with climate change. The number, frequency, and severity of wildfires in many parts of the world have increased from 1960 to 2013 (Bladon et al. 2014). Climate change and fire suppression practices are thought to be the largest contributors to the trend. A recent prediction for Canada indicates the potential for a 74% to 118% increase in average burn area by the end of this century (Flannigan et al. 2005). Fire alters many components of the environment including air quality, water quality, soil characteristics, vegetation cover, and hydrological processes.

Climate change is also expected to alter the onset of spring and summer. Spring and summer are expected to begin earlier and the growing season is expected to last longer (GNWT-ENR 2008). These changes may provide migratory birds with opportunities to produce second broods or re-nest if the first attempt fails. However, climate change is also predicted to increase the frequency and intensity of extreme weather events which can result in reduced nest success for many bird species (Conrey et al. 2016; George et al. 1992). As expected, there is a low level of confidence in predicted effects from climate change to wildlife. However, where there was ambiguity in the response of a species to climate change, the assessment considered a precautionary outcome for each VC (i.e., adverse effect of climate change on wildlife populations in the RFD Case).

4.6 Effects Classification and Determination of Significance

4.6.1 Methods

Residual effects are described using the classification criteria identified in Table 4.6-1 and applied to the predicted changes in measurement indicators for each VC. Classification of residual effects on wildlife VCs considered direction (positive, negative or neutral), expected magnitude (e.g., number of hectares lost or gained, change in survival), geographic extent (e.g., distance covered or range of the effect), duration and reversibility (e.g., years, decades, permanent/irreversible), frequency (i.e., number of times the effect happens per unit time), and likelihood (e.g., how likely is the effect).

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Table 4.6-1: Definitions of Effects Categories Used to Classify Predicted Residual Effects to Wildlife VCs

Criteria	Definition
Direct	■ Positive – net gain or benefit; effect is desirable ■ Neutral – no change compared with baseline conditions and trends ■ Negative – net loss or adverse effect; effect is undesirable
Magnitude	■ Magnitude will be expressed quantitatively or qualitatively for each VC to reflect VC-specific characteristics
Geographic extent	■ Local – predicted maximum spatial extent of direct and indirect effects from changes to a measurement indicator due to a project or activity are well within the RSA (e.g., confined to or immediately adjacent to the Project footprint). ■ Regional – effects from changes to a measurement indicator due to a project or activity extend to the RSA boundary and/or can include cumulative effects from other developments in the RSA ■ Beyond regional – effects from changes to a measurement indicator extends beyond the RSA boundary
Duration/reversibility	■ Short-term – residual effect from changes to a measurement indicator is reversible at the end of construction ■ Medium-term – residual effect from changes to a measurement indicator is reversible soon after operation begins ■ Long-term – residual effect from changes to a measurement indicator is reversible within a defined length of time during operation ■ Permanent – residual effect from changes to a measurement indicator is not reversible
Frequency/Timing	■ Infrequent – the effect from changes to a measurement indicator is expected to occur rarely ■ Frequent – the effect from changes to a measurement indicator is expected to occur intermittently ■ Continuous – the effect from changes to a measurement indicator is expected to occur continually
Likelihood	■ Unlikely – the effect is not likely to occur ■ Possible – the effect may occur, but is not likely ■ Probable – the effect is likely to occur ■ Certain – the effect will occur

Duration and frequency were described categorically using the categories identified in Table 4.6-1, but were also described more precisely using years, where applicable and possible. The more precise definition was applied to avoid confusion or misinterpretation of the effects assessment that sometimes accompanies broad categories.

Magnitude was not described categorically. Classifying magnitude using an ordinal scale (i.e., low, moderate, or high) in a manner meaningful for wildlife VCs requires that the effect size be placed in the ecological context of the VC, incorporating resilience, adaptability, and amount of historic disturbance. Universal effect size boundaries, such as a 20% change at the RSA scale used to define a high magnitude effect, work poorly because they fail to consider ecological context. A 20% additional loss in habitat availability and distribution from existing conditions in the RSA may be required to cause a high magnitude effect on some VCs, whereas a 2% loss may be sufficient for others, depending on ecological context (BC EAO 2013). Integrating ecological context to understand the point at which an effect size is large enough to be important for a VC is directly linked to the self-sustaining and ecologically effective status of the population, and therefore directly linked to significance. To avoid providing a definition of magnitude synonymous with the determination of significance, predicted effect sizes were provided in specific terms (i.e., a narrative or qualitative expression, or numeric quantification). The ecological context of the predicted effect size is discussed in a reasoned narrative for the determination of significance.

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The predicted changes in measurement indicators and associated classification of residual effects provides the foundation for determining the significance of incremental and cumulative effects from the Project and other previous, existing, and RFDs on the assessment endpoints for wildlife VCs. Significance was determined based on combined effects because the effects of a single project infrequently cause an ecologically significant effect on their own (McCold and Saulsbury 1996), and many environmental effects of primary concern are cumulative (Canter and Ross 2010). Therefore, whether wildlife VCs would remain self-sustaining and ecologically effective was assessed by combining the effects identified at Base Case with the residual effects identified for the Project and RFDs to assess the total predicted combined effect. If a significant effect was identified, the contribution of the Project to the combined effect was clearly described.

Magnitude, geographic extent, and duration (which includes reversibility) are the primary criteria used to determine the significance of effects on VCs. Other criteria, such as frequency and likelihood are used as modifiers. The approach to determining the significance of combined effects for each VC incorporated the concepts of resilience and adaptability using the reasoned narrative provided in the Application and RFD cases. Although the determination of significance was informed by the classification of residual effects, the interaction between ecological context from the Base Case and the magnitude, duration, and geographic extent of the interacting residual effects were the most important factors. For example, the magnitude of an effect on wildlife VCs depends on the current level of disturbance, population status and resilience of the VC to further changes in habitat availability, connectivity and survival and reproduction. Similarly, duration includes consideration of reversibility, and the duration of residual effects to VCs with high resilience (ability to recover from disturbance) would be expected to be shorter relative to VCs with lower resilience to disturbance.

Because of the uncertainty regarding the effects of development on VCs, magnitude classification was applied conservatively to increase the level of confidence that effects will not be worse than predicted. Furthermore, the determination of significance considers the key sources of uncertainty in the effects analysis, the management of uncertainties, and the corresponding level of confidence in effects predictions.

Significance was predicted as a binary response, with effects classified as significant or not significant. Residual effects were determined to be significant if a VC is expected to no longer be: (1) self-sustaining, or (2) ecologically effective. Specifically:

- A VC was considered to be no longer self-sustaining where cumulative residual effects were expected to place the abundance of a VC, whether an open or closed population, on a declining trajectory that is not predicted to recover or stabilize. For example, loss of habitat that causes permanent adverse changes to survival and reproduction at the population level. Part of being self-sustaining, in this context, was that a VC population that stabilizes at a lower abundance is not expected to be extirpated because of unrelated stochastic events. Another part of being self-sustaining was the assumption that no additional mitigation or management actions beyond the proposed Project mitigation strategies and existing management strategies in the region would be required. Effects that are not significant could result in no change, stabilization at lower abundance, stabilization at higher abundance, or a temporary decline followed by recovery. Even where populations remain stable, fragmentation effects that cause populations to become isolated or substantially disconnected (e.g., severely reducing or eliminating gene flow and/or demographic rescue within one regional or meta-population or between two or more local populations) may be considered significant.

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- A VC that has lost important ecological function would also result in determination of a significant adverse effect, regardless of its self-sustaining status. Loss of ecological function occurs when a population can no longer perform its ecological role, such that it might trigger ecological changes that result in degraded or simplified ecosystems (Soulé et al. 2003). The potential to lose ecological function is more common for highly interactive wildlife VCs that have important ecological effects on other species, such as predators or species described as ecosystem engineers (e.g., beavers, earthworms) (Soulé et al. 2003).

The level of confidence is also included in the evaluation of significance. Where uncertainty was high and the cumulative effect might be either significant or not significant, the assessment conservatively identified the effect as significant and provided additional follow-up to reduce uncertainty (i.e., precautionary approach).

4.6.2 Results

4.6.2.1 Boreal Caribou

The cumulative effects from the Project and other developments should not have a significant influence on the ability of the boreal caribou to be self-sustaining and ecologically effective in the NT1 range. For all primary pathways influencing the habitat availability of boreal caribou, cumulative impacts were determined to be regional in geographic extent due to climate change (Table 4.6-2), which implies that at least a portion of the population is affected during any given year, but likely not the entire population every year. The geographic extent of Project-specific effects ranged from local to regional. Local impacts from habitat loss were associated with the physical footprint and sensory disturbance from construction and operational activities, and are predicted to influence individuals that travel through or occupy habitats within 500 m of the Project site (Environment Canada 2012), and possibly more depending on traffic volumes. Regional effects are a function of incremental and cumulative changes to caribou habitat loss and sensory disturbance from Project-related traffic on the Highway 3 and human activities from other developments in the NT1 range. The likelihood of impacts occurring is expected to be possible to certain for all pathways (Table 4.6-2), which does not change the expected magnitude and duration (or environmental significance). Similarly, the frequency of most impacts is anticipated to occur continuously throughout the life of the Project, depending on presence of boreal caribou near the Project and other developments. Caribou presence may be low temporarily if developments overlap with burned areas that are less than 40 years old (Environment Canada 2012) as is the case with the Project and other previous, existing and future developments in the RFD Case. For the assessment of effects to caribou, physical disturbance to terrestrial habitat from developments was considered permanent (Table 4.6-2). Northern boreal ecosystems are slow to recover from disturbance (e.g., 40 years post-burn before caribou use), and it is uncertain as to what the revegetated landscape will look like long-term into the future.

Reductions in quality habitats due to the sensory disturbance from development may result in a decrease in the carrying capacity of the NT1 range, which was assessed for boreal caribou with buffered developments (Environment Canada 2012). Direct habitat and indirect loss from the Project and previous and existing developments (Application Case) removed 8.9% of the NT1 range but the Project accounted for less than a 0.1% reduction of undisturbed habitat. The cumulative direct disturbance from the Project and all previous, existing, and reasonably foreseeable future developments is predicted to be less than 0.4% of the total area in the NT1 range and will remove 0.2% of undisturbed habitat (Table 4.4-6.4). When human activities are present, caribou are known to alter their behaviour to avoid disturbed landscapes. Initially, the response of caribou to roads is avoidance (Polfus et al. 2011), but over time they can become habituated to the presence of roads and traffic (Haskell and Ballard 2008; ERM Rescan 2014a,b; Johnson and Russell 2014). At Base Case, boreal caribou are considered a

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self-sustaining population based on greater than 65% undisturbed habitat in the NT1 range. Cumulative habitat loss from development through the RFD Case does not alter this conclusion.

The cumulative effects of fragmentation on boreal caribou across the NT1 range is expected from the conservative approach to the analyses that included overestimated (i.e., buffered) footprint areas and irreversible effects from human disturbance features (Section 4.5). Changes to habitat fragmentation from the Base Case to the RFD Case is expected to be negligible given the relatively low amount of development disturbance in the NT1 range. However, burned areas are considered unsuitable for boreal caribou for up to 40 years (Environment Canada 2012), and wildfire is the dominant but temporary form of habitat loss in the NT1 range. Fragmentation effects have less influence than direct habitat loss when there is a large proportion of undisturbed habitat on the landscape (Fahrig 1997, 2003; Andrén 1999; Flather and Bevers 2002; Swift and Hannon 2010), which is apparent across the NT1 range. Boreal caribou are predicted to be resilient to these small changes in physical habitat loss from development, and there should be a negligible effect on distribution or connectivity across the NT1 range.

The cumulative negative effects to boreal caribou are predicted to lower survival and reproduction. Per the previous discussion, changes to habitat loss and distribution are expected to be near but within the resilience limits and adaptive capacity of boreal caribou and so, are not predicted to significantly influence survival and reproduction. Cumulative effects to survival and reproduction from vehicle strikes and improved access are predicted to be negative, of low magnitude and regional. The predominant factors that contribute to road-related wildlife deaths are visibility, traffic volume and vehicle speed (EBA 2001; Neumann et al. 2012). These factors directly affect the success of an animal reaching the opposite side of the road. An increase in either factor reduces the probability of an animal crossing safely (Underhill and Angold 2000). The proportion of development in the NWT is relatively low (8.9%) with little road infrastructure and low traffic volume, likely related to NWT's small human population size. Boreal caribou are mobile and can avoid interactions with active areas, such as roads (Polfus et al. 2011). The risk of vehicle strikes is continuous and permanent for all-season roads but strikes may not be frequent enough to influence survival at the NT1 range scale, and therefore this effect is probable but predicted not to have a strong influence on caribou survival or reproduction.

All-Season roads may improve access and increase harvest of boreal caribou, which will reduce survival and productivity, regionally in the RFD Case. Harvest of boreal caribou will be dependent on their presence, which is likely to be a function of habitat quality and distribution but also hunter experience and skill. Boreal caribou populations occur at low densities (0.03 to 0.12 caribou/km^2) throughout the mid-continent (Stuart-Smith et al. 1997) and are a wide ranging species to facilitate access to resources across space and time (Johnson et al. 1992; Nathan et al. 2008; Taylor et al. 1993). Boreal caribou may avoid areas of activity including roads (Polfus et al. 2011), so boreal caribou may not always be present near roads all the time and be available for harvest. There are existing trails that provide access to trucks, ATVs and snowmobiles at Base Case where the Mackenzie Valley highway and the Project will be located and, which are already used for harvest (Section 5.2.10; PR#7; PR#28). At Base Case, hunters using existing trails are likely from nearby communities (Section 5.2.10; PR#28), and would have experience in the area. Whereas, hunters from more distance communities and using the all-season roads to access these areas would not in the Application Case or RFD Case. Thus, the magnitude of change from future development is predicted to lower survival and reproduction, although improved access will be continuous and permanent.

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If climate change results in more frequent and severe fires in the NT1 range, habitat availability may decrease and lead to declines in recruitment. Large continuous tracts of undisturbed habitat are important to maintaining self-sustaining caribou populations. Nagy (2011) found a positive correlation between population growth rates and access to secure unburned habitat, particularly where most of the habitat was in patches greater than 500 km². Nagy et al. (2011) also showed that boreal caribou form two sub-populations of females organized as individuals across ranges separated by large areas burned by wildfires in the central NWT. This habitat discontinuity may be temporary if natural habitat regeneration occurs. Results from Nagy et al. (2011) are consistent with the observation of Bergerud (1996) that boreal caribou tend to form a near-continuum across a region of favourable calving sites, which are represented by very late seral-stage vegetation communities such as black spruce and bog-fen complexes. As such, changes to the amount and quality of habitat in the NT1 range is difficult to predict. Adding to the unpredictability of effects is the knowledge that caribou have behavioural plasticity to shift seasonal ranges to adapt to changes in range conditions (Nagy 2011). As well, climate change may also increase the amount of white-tailed deer habitat and their presence in the NWT, which could lead to an incidental predation of boreal caribou by wolves (Latham 2009; Latham et al. 2011; Serrouya et al. 2011), and is a beyond regional effect and possible.

Although future development is uncertain, the Mackenzie Valley highway, Canyon Creek road, Prairie Creek mine, Forest Management Agreements, NICO Project, and the Nailii Hydroelectric Project are reasonably foreseeable projects within the NT1 range (Section 4.4.3) that could affect caribou abundance, distribution, and population connectivity by decreasing habitat availability and distribution, and survival and reproduction. If developed, the Mackenzie Valley highway and Canyon Creek road will remove boreal caribou habitat and may influence animal movements and increase mortality from vehicle strikes or increased harvest within the NT1 range. However, these roads occur near or overlap with existing disturbance, which boreal caribou may already avoid. It is assumed that these developments will be required to have wildlife management plans that identify mitigation for these types of effects. The Nailii Hydroelectric Project is also is an uncertain, a future run-of-river 2 MW hydro facility connected to Whatì to reduce dependency on diesel generated power, and a transmission line to the existing Snare Hydro Complex to distribute power to Behchokǫ̀ and Yellowknife. Expansion of the hydroelectric grid could change caribou habitat use and distribution if animals avoid or restrict movements near the transmission lines (Vistnes and Nelleman 2008; Vistnes et al. 2008; Tyler et al. 2014). There are also several reasonably foreseeable protected areas that will limit future development disturbance of boreal caribou habitat.

Overall, the weight of evidence from the analysis of the primary pathways predicts that incremental and cumulative changes to measurement indicators from the Project and other developments should have no significant adverse effect on self-sustaining and ecologically effective boreal caribou populations. The confidence in this prediction is higher for the Application Case than the RFD Case. Extending the assessment into the future (RFD Case) decreases confidence in effects predictions, which is largely due the uncertainty in the actual timing (e.g., amount of overlap in time with the Project and existing developments), location and size of developments, and the variability inherent in making long-term predictions in ecological systems. The present structure and inputs of habitat models may not be applicable to future environments and caribou behavioural responses and population characteristics, which increases the uncertainty in cumulative effects from physical habitat loss and sensory disturbance on habitat availability and distribution. Still, confidence in the predictions for the RFD Case is based on the consistent low effect sizes (i.e., magnitudes of change) that were determined from the incremental and cumulative changes from the Project and other developments for habitat availability and distribution. Although each development likely influences the local movement and distribution of caribou, there is no strong

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mechanism causing an adverse and long-term or permanent change in population survival and reproduction rates. The low traffic volume and speed limits is predicted to mitigate effects to injury and mortality and connectivity for self-sustaining and ecologically effective boreal caribou populations.

Table 4.6-2: Summary of Residual Effects Classification and Predicted Significance of Cumulative Effects on Boreal Caribou in the RFD Case

Indicator	Characteristic	Rating/Effect Size	Significance Determination
Habitat availability	Direction	Negative	Not significant
	Magnitude	■ Direct and indirect loss of 57,507 ha (0.2%) of undisturbed habitat in the NT1 range from Base Case to RFD Case. ■ Reduced habitat quality and possible avoidance in the NT1 range from sensory disturbance from construction through closure. ■ Reduction in carrying capacity from northern contraction of forest habitat due to climate change. ■ Magnitude will depend on the influences from climate change.	
	Geographic Extent	Beyond regional (due to climate change)	
	Duration/Reversibility	■ Long-term (direct loss to habitats and sensory disturbance) ■ Permanent (alterations from all-season roads and climate change)	
	Frequency/Timing	Continuous	
	Likelihood	■ Certain (direct loss) ■ Probable (sensory disturbance) ■ Possible (climate change)	
Habitat distribution	Direction	Negative	
	Magnitude	■ Small reduction in movements among habitat patches due to the Project and RFDs ■ Reduced forest patch size, diversity, and distribution due to climate change	
	Geographic Extent	Beyond regional (due to climate change)	
	Duration/Reversibility	■ Long-term (direct loss to habitats and sensory disturbance) ■ Permanent (alterations from all-season roads climate change)	
	Frequency/Timing	Continuous	
	Likelihood	■ Certain (direct loss) ■ Probable (sensory disturbance) ■ Possible (climate change)	
Survival and reproduction	Direction	Negative	
	Magnitude	Lower boreal caribou densities due to climate change	
	Geographic Extent	Regional (from improved access due to roads and strikes)	
	Duration/Reversibility	■ Long-term (direct loss habitats and sensory disturbance) ■ Permanent (alterations from climate change and roads)	
	Frequency/Timing	Continuous	
	Likelihood	■ Certain (direct loss) ■ Probable (sensory disturbance) ■ Probable (vehicle strikes and improved access) ■ Possible (climate change)	

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4.6.2.2 Barren-ground Caribou

The cumulative effects from the Project and other developments should not have a significant influence on the ability of the barren-ground caribou to be self-sustaining and ecologically effective in the RSA. For all primary pathways influencing the habitat availability of barren-ground caribou, cumulative impacts were determined to be regional to beyond regional in geographic extent (Table 4.6-3). The geographic extent of Project-specific effects ranged from local to beyond regional. Local impacts from habitat loss were associated with the physical footprint and sensory disturbance from construction and operational activities, and are predicted to influence individuals that travel through or occupy habitats near the Project site. Beyond regional effects are a function of incremental and cumulative changes to sensory disturbance and access from Project-related traffic on the Gamètì and Wekweètì winter roads. The likelihood of impacts occurring is expected to be possible to certain for all pathways (Table 4.6-3), which does not change the expected magnitude and duration (or environmental significance). Similarly, the frequency of most impacts is anticipated to occur continuously throughout the life of the Project, depending on presence of barren-ground caribou near the Project and other developments. Caribou presence may be low temporarily if developments overlap with burned areas that are less than 40 years old (Thomas et al. 1998, Joly et al. 2007) as is the case with the Project. For the assessment of effects to caribou, physical disturbance to terrestrial habitat from developments was considered permanent (Table 4.6-3). Northern boreal ecosystems are slow to recover from disturbance (e.g., 40 years post-burn before caribou use), and it is uncertain as to what the revegetated landscape will look like long-term into the future. However, the degree of effects to habitat availability, distribution and survival and reproduction are anticipated to be within the adaptive capacity and resilience limits of barren-ground caribou.

Reductions in quality habitats due to the sensory disturbance from development may result in a decrease in the carrying capacity in the RSA, which was qualitatively assessed for barren-ground caribou. Direct habitat and indirect loss from the Project and previous and existing developments (Application Case) removed 0.2% of quality habitat in the RSA. The cumulative direct disturbance from the Project and all previous, existing, and reasonably foreseeable future developments is predicted to be 0.2% but only affect poor quality habitat. When human activities are present, caribou are known to alter their behaviour to avoid disturbed landscapes. Initially, the response of caribou to roads is avoidance, but over time it is possible that they may become habituated to the presence of roads and traffic (Haskell and Ballard 2008; Johnson and Russell 2014).

The cumulative effects of fragmentation on barren-ground caribou across the RSA is expected from the conservative approach to the analyses that included overestimated (i.e., buffered) footprint areas and irreversible effects from human disturbance features (Section 4.5). Changes to habitat fragmentation from the Base Case to the RFD Case are expected to be negligible given the relatively low amount of development disturbance in the RSA. However, burned areas are considered unsuitable for barren-ground caribou for 40 to 50 years (Thomas et al. 1998; Joly et al. 2007), and wildfire is the dominant but temporary form of habitat loss in the RSA. Fragmentation effects have less influence than direct habitat loss when there is a large proportion of undisturbed habitat on the landscape (Fahrig 1997, 2003; Andrén 1999; Flather and Bevers 2002; Swift and Hannon 2010), which is apparent across the RSA. Barren-ground caribou are predicted to be resilient to these small changes in physical habitat loss from development, and there should be a negligible effect on distribution or connectivity across the RSA.

The cumulative negative effects are predicted to lower the barren-ground caribou survival and reproduction. Per the previous discussion, changes to habitat loss and distribution are expected to be within the resilience limits

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and adaptive capacity of barren-ground caribou and so, are not predicted to significantly influence survival and reproduction. Cumulative effects to survival and reproduction from vehicle strikes and improved access are predicted to be negative, of low magnitude and regional. The predominant factors that contribute to road-related wildlife deaths are visibility, traffic volume and vehicle speed (EBA 2001). These factors directly affect the success of an animal reaching the opposite side of the road. An increase in volume or speed and reduction in visibility reduces the probability of an animal crossing safely (Underhill and Angold 2000). Barren-ground caribou are mobile and can avoid interactions with active areas, such as roads (Vistnes and Nellemann 2001; Johnson and Russell 2014). The risk of vehicle strikes is continuous and permanent for all-season roads but strikes may not be frequent enough to influence survival at the population scale. This is because barren-ground caribou are likely only exposed to risk of strikes in winter when herd sizes are large enough that their distribution overlaps where the Project and winter roads occur during operation (PR#28). Therefore, this effect is possible but predicted not to have a strong influence on caribou survival or reproduction.

All-Season roads may improve access and increase harvest of barren-ground caribou, which will reduce survival and productivity, in the RFD Case. Collared caribou data from the Bluenose East and Bathurst herds since the mid-1990s indicate these herds tend to winter much further north of the RSA. Hunters may use the Project and existing Gamètì and Wekweètì winter roads to reach these areas as at Base Case (PR#7). Harvest of barren-ground caribou will be dependent on their presence, which is likely to be a function of habitat quality and distribution and herd size. Both of these herds are currently much less abundant than in the early 1990s when they were available for harvest in the RSA (PR#28; Section 5.2.10; Adamczewski et al. 2009). Range size is positively correlated to herd size in response to more selective use of resources, which may yield shifted and smaller seasonal ranges and is consistent with density-dependent resource selection (McLoughlin et al. 2006). Recent analysis on Bathurst collared caribou during the Dominion Diamond Ekati Corporation Jay Project environmental assessment found that individuals that ultimately wintered in the boreal forest were arriving later in the year as herd size declined (DDEC 2015), although not all caribou wintered below the treeline. As well, recent analysis of winter range selection indicates preference by this herd to winter above the treeline (Golder 2016). While the Bathurst herd currently has extreme harvest restrictions due to its significant vulnerability state, the Bluenose East herd has a regulated harvest. Thus, improved access provided by the Project and Gamètì and Wekweètì winter roads may result in increased harvest when the herds are much more abundant and closer to the Gamètì and Wekweètì winter roads but also at a time when the herd is more resilient to harvest (i.e., when more abundant). There is uncertainty about how long Gamètì and Wekweètì winter roads may be economically viable due to warming from climate change. Therefore, this effect is possible but predicted not to have a strong influence on caribou survival or reproduction.

If climate change results in more frequent and severe fires in the NWT, winter habitat availability may decrease and lead to declines in recruitment. Climate change is also expected to increase the frequency and intensity of wildfires and enable certain plant species to expand their ranges northward. As fires increase and plants move north, moose and wolves may also increase their northern distribution, which may negatively affect caribou populations and distributions (Sharma et al. 2009). Traditional Knowledge also contends that fire frequency and intensity affects caribou numbers and distribution (Kendrick et al. 2005). As such, changes to the habitat availability and distribution in the winter range of the Bathurst caribou herd are difficult to predict. Adding to the unpredictability of effects is the knowledge that caribou have behavioural plasticity to shift seasonal ranges to adapt to changes in range conditions (Messier et al. 1988; Ferguson and Messier 2000; Tyler 2010, Gustine et al. 2014). In addition

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to habitat availability and distribution, climate change may also reduce the operational time of Gamètì and Wekweètì winter roads which will reduce access to barren-ground caribou.

Although future development is uncertain, the NICO Project, and the Nailii Hydroelectric Project are reasonably foreseeable projects (Section 4.4.3) that could affect caribou abundance, distribution, and population connectivity by decreasing habitat availability and distribution, and survival and reproduction. If developed, the NICO Project all-season access road will remove caribou habitat and may influence animal movements and increase mortality from vehicle strikes or increased harvest within Bathurst winter range outside of the RSA. However, this road will overlap with an existing trail north of Whatì, which barren-ground caribou may already avoid. It is assumed that these developments will be required to have wildlife management plans that identify mitigation for these types of effects. The Nailii Hydroelectric Project is also an uncertain, future run-of-river 2 MW hydro facility connected to Whatì to reduce their dependency on diesel generated power. It will include a transmission line to the existing Snare Hydro Complex to distribute power to Behchokǫ̀ and Yellowknife. Expansion of the hydroelectric grid could change caribou habitat use and distribution if animals avoid or restrict movements near the transmission lines (Vistnes and Nelleman 2008; Vistnes et al. 2008; Tyler et al. 2014).

Overall, the weight of evidence from the analysis of the primary pathways predicts that incremental and cumulative changes to measurement indicators from the Project and other developments should have no significant adverse effect on self-sustaining and ecologically effective barren-ground caribou populations. The confidence in this prediction is higher for the Application Case than the RFD Case. Extending the assessment into the future (RFD Case) decreases confidence in effects predictions, which is largely due to the uncertainty in the actual timing (e.g., amount of overlap in time with the Project and existing developments), location and size of developments, and the variability inherent in making long-term predictions in ecological systems. The present structure and inputs of habitat models may not be applicable to future environments and caribou behavioural responses and population characteristics, which increases the uncertainty in cumulative effects from physical habitat loss and sensory disturbance on habitat availability and distribution. Still, confidence in the predictions for the RFD Case is based on the consistent low effect sizes (i.e., magnitudes of change) that were determined from the incremental and cumulative changes from the Project and other developments for habitat availability and distribution. Although each development likely influences the local movement and distribution of caribou, there is no strong mechanism causing an adverse and long-term or permanent change in population survival and reproduction rates.

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Table 4.6-3: Summary of Residual Effects Classification and Predicted Significance of Cumulative Effects on Barren-ground Caribou in the RFD Case

Indicator	Characteristic	Rating/Effect Size	Significance Determination
Habitat availability	Direction	Negative	Not significant
	Magnitude	▪ Direct and indirect loss of 264 ha (0.2%) of undisturbed habitat in the RSA range from Base Case to RFD Case. ▪ Reduced habitat quality and possible avoidance in the RSA from sensory disturbance from construction through closure. ▪ Reduction in carrying capacity from northern contraction of forest winter habitat due to climate change. ▪ Magnitude will depend on the influences from climate change.	
	Geographic Extent	Beyond regional (due to climate change)	
	Duration/Reversibility	▪ Long-term (direct loss to habitats and sensory disturbance from non-road developments) ▪ Permanent (direct loss to habitats and sensory disturbance alterations from all-season roads and climate change)	
	Frequency/Timing	Continuous	
	Likelihood	▪ Certain (direct loss) ▪ Probable (sensory disturbance) ▪ Possible (climate change)	
Habitat distribution	Direction	Negative	
	Magnitude	▪ Small reduction in movements among habitat patches due to the Project and RFDs ▪ Reduced forest patch size, diversity, and distribution due to climate change	
	Geographic Extent	Beyond Regional (due to climate change)	
	Duration/Reversibility	▪ Long-term (direct loss to habitats and sensory disturbance from non-road developments) ▪ Permanent (alterations from all-season roads climate change)	
	Frequency/Timing	Continuous	
	Likelihood	▪ Certain (direct loss) ▪ Probable (sensory disturbance) ▪ Possible (climate change)	
Survival and reproduction	Direction	Negative	
	Magnitude	Lower barren-ground caribou densities due to climate change	
	Geographic Extent	▪ Beyond regional (from improved access due to roads and strikes) ▪ Beyond regional (due to climate change)	
	Duration/Reversibility	▪ Long-term (direct loss habitats and sensory disturbance and roads) ▪ Permanent (alterations from climate change)	
	Frequency/Timing	Continuous	
	Likelihood	▪ Certain (direct loss) ▪ Possible (sensory disturbance) ▪ Probable (vehicle strikes and improved access) ▪ Possible (climate change)	

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4.6.2.3 Moose

The cumulative effects from the Project and other developments should not have a significant influence on the ability of moose to be self-sustaining and ecologically effective in the RSA. For all primary pathways influencing the habitat availability of moose, cumulative impacts were determined to be regional to beyond regional in geographic extent (Table 4.6-4). The geographic extent of Project-specific effects ranged from local to beyond regional. Local impacts from habitat loss were associated with the physical footprint and sensory disturbance from construction and operational activities, and are predicted to influence individuals that travel through or occupy habitats near the Project site. Beyond regional effects are a function of incremental and cumulative changes to sensory disturbance and access from Project-related traffic on the Gamètì and Wekweètì winter roads and human activities from other developments. The likelihood of impacts occurring is expected to be possible to certain for all pathways (Table 4.6-4), which does not change the expected magnitude and duration (or environmental significance). Similarly, the frequency of most impacts is anticipated to occur continuously throughout the life of the Project, depending on presence of moose near the Project and other developments. For the assessment of effects to moose, physical disturbance to terrestrial habitat from developments was considered long-term (Table 4.6-4). Northern boreal ecosystems are slow to recover from disturbance, and it is uncertain as to what the revegetated landscape will look like long-term into the future. However, the degree of effects to habitat availability, distribution and survival and reproduction are anticipated to be within the adaptive capacity and resilience limits of moose.

Reductions in quality habitats due to the sensory disturbance from development may result in a decrease in the carrying capacity in the RSA, which was qualitatively assessed for moose. Direct habitat and indirect loss from the Project and previous and existing developments (Application Case) removed 0.3% of quality habitat in the RSA. The cumulative direct disturbance from the Project and all previous, existing, and reasonably foreseeable future developments is predicted to be 0.3% but only affect poor quality habitat. When human activities are present, moose are known to alter their behaviour to avoid disturbed landscapes. Initially, the response of moose to roads is avoidance, but over time they can become habituated to the presence of roads and traffic.

The cumulative effects of fragmentation on moose across the RSA is expected from the conservative approach to the analyses that included overestimated (i.e., buffered) footprint areas and irreversible effects from human disturbance features (Section 4.5). Changes to habitat fragmentation from the Base Case to the RFD Case are expected to be negligible given the relatively low amount of development disturbance in the RSA. Fragmentation effects have less influence than direct habitat loss when there is a large proportion of undisturbed habitat on the landscape (Fahrig 1997, 2003; Andrén 1999; Flather and Bevers 2002; Swift and Hannon 2010), which is apparent across the RSA. Moose are predicted to be resilient to these small changes in physical habitat loss from development, and there should be a negligible effect on distribution or connectivity across the RSA.

The cumulative negative effects are predicted to lower moose survival and reproduction. Per the previous discussion, changes to habitat loss and distribution are expected to be within the resilience limits and adaptive capacity of moose and so, are not predicted to significantly influence survival and reproduction. Cumulative effects to survival and reproduction from vehicle strikes and improved access are predicted to be negative, of low magnitude and regional. The predominant factors that contribute to road-related wildlife deaths are visibility, traffic volume and vehicle speed (EBA 2001). These factors directly affect the success of an animal reaching the opposite side of the road. An increase in volume or speed and reduction in visibility reduces the probability of an animal crossing safely (Underhill and Angold 2000). Moose are mobile and can avoid interactions with active

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areas, such as roads. The risk of vehicle strikes is continuous and permanent for all-season roads, but strikes may not be frequent enough to influence survival at the population scale, and therefore this effect is possible but predicted not to have a strong influence on moose survival or reproduction.

All-Season roads may improve access and increase harvest of moose, which will reduce survival and productivity, in the RFD Case. Harvest of moose will be dependent on their presence, which is likely to be a function of habitat quality and distribution. As well, moose may avoid areas of activity including roads (McLoughlin et al. 2011; Beyer et al. 2013), so moose may not always be present near roads all the time and available for harvest. There are existing trails that provide access to trucks, ATVs and snowmobiles at Base Case where the Project will be located and, which are already used for harvest (PR#7; PR#28; Section 5.2.10). At Base Case, hunters using existing trails are from nearby communities (PR#28; Section 5.2.10), and would have experience in the area. Whereas, hunters from more distant communities using the all-season roads to access these areas would not likely have experience in the Application Case or RFD Case. Thus, the magnitude of change from future development is predicted to be low although improved access will be continuous and permanent. There is uncertainty about how long Gamètì and Wekweètì winter roads may be economically viable due to warming from climate change. Therefore, this effect is possible but predicted not to have a strong influence on moose survival or reproduction.

If climate change results in more frequent and severe fires in the NWT, habitat availability may decrease or result in more fragmented habitat patches. A reduction in the abundance or distribution of preferred habitats, which provide thermal relief for moose, from climate change may reduce moose survival and reproduction rates due to increased energy expenditure from intraspecific competition or dispersal to acquire these important habitats. Climate change is also expected to increase the frequency and intensity of wildfires and enable plants to expand their ranges northward. As fires increase and plants move north, fire-tolerant plants may become more prevalent and may negatively affect moose populations and distributions (Rempel 2012). As such, changes to the habitat availability and distribution of moose are difficult to predict. In addition to habitat availability and distribution, climate change may also reduce the operational time of winter roads which will reduce access to moose.

Although future development is uncertain, the NICO Project, and the Nailii Hydroelectric Project are RFDs (Section 4.4.3) that could affect moose abundance, distribution, and population connectivity by decreasing habitat availability and distribution, and survival and reproduction. If developed, the NICO Project all-season access road will remove moose habitat and may influence animal movements and increase mortality from vehicle strikes or increased harvest within the RSA. However, the NICO Project all-season road will overlap an existing trail north of Whatì, which moose may already avoid due to human use. It is assumed that these developments will be required to have wildlife management plans that identify mitigation for these types of effects. The Nailii Hydroelectric Project is also an uncertain, future run-of-river 2 MW hydro facility connected to Whatì to reduce their dependency on diesel generated power. It will include a transmission line to the existing Snare Hydro Complex to distribute power to Behchokǫ̀ and Yellowknife. Expansion of the hydroelectric grid could change moose habitat use and distribution if animals avoid or restrict movements near the transmission lines (Vistnes and Nelleman 2008; Vistnes et al. 2008; Tyler et al. 2014).

Overall, the weight of evidence from the analysis of the primary pathways predicts that incremental and cumulative changes to measurement indicators from the Project and other developments should have no significant adverse effect on self-sustaining and ecologically effective moose populations. The confidence in this prediction is higher for the Application Case than the RFD Case. Extending the assessment into the future (RFD Case) decreases

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confidence in effects predictions, which is largely due the uncertainty in the actual timing (e.g., amount of overlap in time with the Project and existing developments), location and size of developments, and the variability inherent in making long-term predictions in ecological systems. The present structure and inputs of habitat models may not be applicable to future environments and moose behavioural responses and population characteristics, which increases the uncertainty in cumulative effects from physical habitat loss and sensory disturbance on habitat availability and distribution. Still, confidence in the predictions for the RFD Case is based on the consistent low effect sizes (i.e., magnitudes of change) that were determined from the incremental and cumulative changes from the Project and other developments for habitat availability and distribution. Although each development likely influences the local movement and distribution of moose, there is no strong mechanism causing an adverse and long-term or permanent change in population survival and reproduction rates.

Table 4.6-4: Summary of Residual Effects Classification and Predicted Significance of Cumulative Effects on Moose in the RFD Case

Indicator	Characteristic	Rating/Effect Size	Significance Determination
Habitat availability	Direction	Negative	Not significant
	Magnitude	■ Direct loss of 1,097 ha (0.3%) of suitable habitat in the RSA from Base Case to RFD Case. ■ Reduced quality of habitat and possible avoidance in the RSA from sensory disturbance from construction through closure. ■ Reduction in carrying capacity from northern contraction of forest habitat due to climate change. ■ Magnitude will depend on the influences from climate change.	
	Geographic Extent	Beyond regional (due to climate change)	
	Duration/Reversibility	■ Long-term (direct loss to habitats and sensory disturbance) ■ Permanent (direct loss to habitats and sensory disturbance alterations from all-season roads and climate change)	
	Frequency/Timing	Continuous	
	Likelihood	■ Certain (direct loss) ■ Probable (sensory disturbance) ■ Possible (climate change)	
Habitat distribution	Direction	Negative	
	Magnitude	■ Small reduction in movements among habitat patches due to the Project and RFDs ■ Reduced forest patch size, diversity, and distribution due to climate change	
	Geographic Extent	Beyond regional (due to climate change)	
	Duration/Reversibility	■ Long-term (direct loss to habitats and sensory disturbance) ■ Permanent (direct loss to habitats and sensory disturbance alterations from all-season roads and climate change)	
	Frequency/Timing	Continuous	
	Likelihood	■ Certain (direct loss) ■ Probable (sensory disturbance) ■ Possible (climate change)	

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Table 4.6-4: Summary of Residual Effects Classification and Predicted Significance of Cumulative Effects on Moose in the RFD Case (continued)

Indicator	Characteristic	Rating/Effect Size	Significance Determination
Survival and reproduction	Direction	Negative	Not significant
	Magnitude	Small reduction in movements among habitat patches due to the Project and RFDs	
	Geographic Extent	Beyond regional (due to climate change)	
	Duration/Reversibility	■ Long-term (direct loss habitats and sensory disturbance) ■ Permanent (alterations from climate change)	
	Frequency/Timing	Continuous	
	Likelihood	■ Certain (direct loss) ■ Probable (sensory disturbance) ■ Probable (vehicle strikes and improved access) ■ Possible (climate change)	

RSA = Regional Study Area.

4.6.2.4 Wolverine

The cumulative effects from the Project and other developments should not have a significant influence on the ability of the wolverine to be self-sustaining and ecologically effective in the RSA. For all primary pathways influencing the wolverine habitat availability, cumulative impacts were determined to be regional to beyond regional in geographic extent (Table 4.6-5). The geographic extent of Project-specific effects ranged from local to beyond regional. Local impacts from habitat loss were associated with the physical footprint and sensory disturbance from construction and operational activities, and are predicted to influence individuals that travel through or occupy habitats near the Project site. Beyond regional effects are a function of incremental and cumulative changes to sensory disturbance and access from Project-related traffic on the winter roads and human activities from other developments. The likelihood of impacts occurring is expected to be possible to certain for all pathways (Table 4.6-5), which does not change the expected magnitude and duration (or environmental significance). Similarly, the frequency of most impacts is anticipated to occur continuously throughout the life of the Project, depending on presence of wolverine near the Project and other developments. Wolverine presence may be low temporarily if developments overlap with burned areas that do not support ungulate populations (Luensmann 2008) as is the case with the Project. For the assessment of effects to wolverine, physical disturbance to terrestrial habitat from developments was considered permanent (Table 4.6-5). Northern boreal ecosystems are slow to recover from disturbance, and it is uncertain as to what the revegetated landscape will look like long-term into the future. However, the degree of effects to habitat availability, distribution and survival and reproduction are anticipated to be within the adaptive capacity and resilience limits of wolverine.

Direct habitat and indirect loss from the Project and previous and existing developments (Application Case) removed 0.2% of quality habitat in the RSA (560 ha). The cumulative direct disturbance from the Project and all previous, existing, and reasonably foreseeable future developments is predicted to be 0.2% but only affect poor quality habitat. Reductions in quality habitats due to the sensory disturbance from development may result in a decrease in the carrying capacity in the RSA, which was qualitatively assessed for wolverine. Effects from direct habitat loss are certain and effects from sensory disturbance are probable because habitat degradation from sensory disturbances will be reduced in the operation phase as vehicle traffic will be infrequent, isolated, and of short duration and some individuals may tolerate sensory disturbance (Heinemeyer and Squires 2013, 2014).

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The cumulative effects of habitat distribution and connectivity on wolverine across the RSA is expected from the conservative approach to the analyses that included overestimated (i.e., buffered) footprint areas and irreversible effects from human disturbance features (Section 4.5). Changes to habitat distribution from the Base Case to the RFD Case is expected to be negligible given the relatively low amount of development disturbance in the RSA. The Project may result in changes to individual movement patterns at the local scale, but these changes are not expected to alter the extent of occurrence of the population(s) that overlap with the RSA because wolverine are highly mobile and capable of long distance movements. In addition, fragmentation effects have less influence than direct habitat loss when there is a large proportion of undisturbed habitat on the landscape (Fahrig 1997, 2003; Andrén 1999; Flather and Bevers 2002; Swift and Hannon 2010), which is apparent across the RSA. Wildfire is the dominant form of habitat loss and fragmentation in the RSA, which may result in a temporary loss of suitable wolverine habitat (Luensmann 2008); however, fire is not considered a threat to boreal wolverine populations as ecosystem effects may have a long-term positive influence on wolverine through increases in moose habitat and moose abundance (COSEWIC 2014c). Wolverine are predicted to be resilient to the small changes in physical habitat loss from development, and there should be a negligible effect on distribution or connectivity across the RSA.

The cumulative negative effects are predicted to lower wolverine survival and reproduction. Per the previous discussion, changes to habitat loss and distribution are expected to be within the resilience limits and adaptive capacity of wolverine and are not predicted to significantly influence survival and reproduction. Cumulative effects to survival and reproduction from vehicle strikes and improved access are predicted to be negative, of low magnitude, and regional. The predominant factors that contribute to road-related wildlife deaths are visibility, traffic volume and vehicle speed (EBA 2001). These factors directly affect the success of an animal reaching the opposite side of the road. An increase in either factor reduces the probability of an animal crossing safely (Underhill and Angold 2000). The proportion of development in the NWT is relatively low (8.9%) with little road infrastructure and low traffic volume. Wolverine are mobile and can avoid interactions with active areas, such as roads (Austin 1998). The risk of vehicle strikes is continuous and permanent for all-season roads but strikes may not be frequent enough to influence survival at the scale of the RSA, and therefore is possible but low.

All-Season roads may improve access and increase harvest of wolverine, which could reduce survival and productivity regionally in the RFD Case. Harvest of wolverine will be dependent on presence, which is likely to be a function of habitat quality and distribution. Wolverines are a wide-ranging species and populations occur at low densities (5 to 10 wolverines per 1,000 km^2) throughout the northern boreal forest (COSEWIC 2014). As well, wolverine may avoid areas of activity including roads (Austin 1998), so wolverines may not always be present near roads all the time and be available for harvest. In addition, there are existing trails that provide access to trucks, ATVs and snowmobiles at Base Case where the Project will be located and, which are already used for harvest (PR#7; PR#28).

Climate change also has the potential to alter habitat availability, habitat distribution and survival and reproduction of wolverine; however, the effects were not quantified in this assessment. In general, the RSA may be subjected to warmer temperatures, changes in snow cover, and shifts in vegetation communities, all of which may be a disadvantage to wolverine and possibly result in a decline in recruitment. Climate warming may also result in changes to abundance and distribution of ungulate populations that wolverines rely on for food, although changes that negatively affect one species (i.e., caribou) may benefit another (i.e., moose), such as more frequent fires and the loss of conifer forest cover. Overall, there is high uncertainty regarding the potential effects of climate change

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on wolverine because predictions are based on simulations that can be highly variable and many scenarios are possible.

Although future development is uncertain, the NICO Project and the Nailii Hydroelectric Project are reasonably foreseeable projects (Section 4.4.3) that could affect wolverines by decreasing habitat availability and distribution, and survival and reproduction. If developed, the NICO Project all-season access road will remove wolverine habitat and may influence movements and increase mortality from vehicle strikes or increased harvest. However, this road will overlap with an existing trail north of Whatì, which wolverine may already avoid. It is assumed that these developments will be required to have wildlife management plans that identify mitigation for these types of effects.

Overall, the weight of evidence from the analysis of the primary pathways predicts that incremental and cumulative changes to measurement indicators from the Project and other RFDs should have no significant adverse effect on self-sustaining and ecologically effective wolverine populations in the RSA. The confidence in this prediction is higher for the Application Case than the RFD Case. Extending the assessment into the future (RFD Case) decreases confidence in effects predictions, which is largely due the uncertainty in the actual timing (e.g., amount of overlap in time with the Project and existing developments), location and size of developments, and the variability inherent in making long-term predictions in ecological systems. The present structure and inputs of habitat models may not be applicable to future environments and wolverine behavioural responses and population characteristics, which increases the uncertainty in cumulative effects from physical habitat loss and sensory disturbance on habitat availability and distribution. Still, confidence in the predictions for the RFD Case is based on the consistent low effect sizes (i.e., magnitudes of change) that were determined from the incremental and cumulative changes from the Project and other RFDs for habitat availability and distribution. Although each RFD likely influences the local movement and distribution of wolverine, there is no strong mechanism causing an adverse and long-term or permanent change in population survival and reproduction rates. The low traffic volume and speed limits are predicted to mitigate effects to injury and mortality and connectivity for self-sustaining and ecologically effective wolverine populations.

Table 4.6-5: Summary of Residual Effects Classification and Predicted Significance of Cumulative Effects on Wolverine in the RFD Case

Indicator	Characteristic	Rating/Effect Size	Significance Determination
Habitat availability	Direction	Negative	Not significant
	Magnitude	■ Direct loss of 560 ha (0.2%) of suitable habitat in the RSA from Base Case to RFD Case. ■ Reduced habitat quality and possible avoidance in the RSA from sensory disturbance from construction through closure. ■ Reduction in carrying capacity from northern contraction of forest habitat due to climate change. ■ Magnitude will depend on the influences from climate change.	
	Geographic Extent	Beyond regional (due to climate change)	
	Duration/Reversibility	■ Long-term (direct loss to habitats and sensory disturbance) ■ Permanent (alterations from all-season roads and climate change)	
	Frequency/Timing	Continuous	
	Likelihood	■ Certain (direct loss) ■ Probable (sensory disturbance) ■ Possible (climate change)	

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Table 4.6-5: Summary of Residual Effects Classification and Predicted Significance of Cumulative Effects on Wolverine in the RFD Case (continued)

Indicator	Characteristic	Rating/Effect Size	Significance Determination
Habitat distribution	Direction	Negative	
	Magnitude	■ Small reduction in movements among habitat patches due to the Project and RFDs ■ Reduced forest patch size, diversity, and distribution due to climate change	
	Geographic Extent	Beyond regional (due to climate change)	
	Duration/Reversibility	■ Long-term (direct loss to habitats and sensory disturbance) ■ Permanent (alterations from all-season roads and climate change)	
	Frequency/Timing	Continuous	
	Likelihood	■ Certain (direct loss) ■ Probable (sensory disturbance) ■ Possible (climate change)	
Survival and reproduction	Direction	Negative	
	Magnitude	Lower wolverine densities due to climate change	
	Geographic Extent	Beyond regional (due to climate change)	
	Duration/Reversibility	■ Long-term (direct loss habitats and sensory disturbance) ■ Permanent (alterations from climate change)	
	Frequency/Timing	Continuous	
	Likelihood	■ Certain (direct loss) ■ Possible (sensory disturbance) ■ Probable (vehicle strikes and improved access) ■ Possible (climate change)	

4.7 Monitoring and Follow-up

Monitoring activities are described in the Wildlife Management and Monitoring Plan (WMMP, PR#7). The WMMP is a draft version and amendments to remove, modify or add mitigation policies and practices, and monitoring activities may be incorporated during the EA review process. The WMMP will be finalized during the regulatory process. A summary of the conceptual monitoring activities relevant to the protection of wildlife and wildlife habitat are described below:

- The Environmental Monitor will monitor the Project during construction for incidental sensitive features (e.g., sensitive wildlife habitat) that have not previously been identified on or near the Project footprint. In the event that a sensitive feature is suspected, then GNWT-ENR will be consulted to determine next steps (e.g., suspension of activities, set-back distances).
- Environmental Monitors will be present during construction to observe wildlife and wildlife mitigation, alter mitigation as required or implement new mitigation and report findings to the Supervisor daily. Environmental Monitors will respond to wildlife-human conflicts including wildlife-vehicle and wildlife-construction interactions and support the management of such interactions. Environmental Monitors will liaise with the appropriate regulatory authorities should unique circumstances arise.
- Project staff will also be required to report wildlife when observed.

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- Erosion and sedimentation control measures will be monitored to avoid and minimize sediment mobilization from disturbed areas to drainages, wetlands or watercourses.
- Soil topsoil piles and the ROW will be monitored for invasive species such as weeds. If invasive species are identified within the ROW, a response plan will be prepared.
- Reclamation concerns would be monitored and managed, and include soil erosion, re-vegetation and slope stability.
- In March 2017, ENR deployed 20 collars on boreal caribou in Wek'èezhìı that will be used to monitor boreal caribou movements and habitat use in response to the TASR. Details will be provided in an updated WMMP.

Monitoring information will be collected, reported and evaluated daily and weekly during construction as outlined in Figure 1 of the WMMP (PR#7). These time scales will allow management actions to be adjusted based on adaptive management principals and minimize impacts to wildlife and wildlife habitat. A summary report that provides impact predictions, monitoring results and mitigation effectiveness will be prepared and disseminated per permitting or licensing requirements. The report will also discuss the results of adaptive management including when mitigation was determined to be effective and no new management action was required. Finally, options for moving the GNWT-ENR check station to a new location to continue monitoring harvest of caribou and wildlife activity will be explored. The results of this monitoring will reduce uncertainty related to effects to harvest from improved access due to the Project.

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5.0 ASSESSMENT OF SOCIO-ECONOMIC EFFECTS

5.1 Introduction

5.1.1 Purpose and Scope

The Tłįchǫ All-Season Road, once operational, represents a change in year-round access between the community of Whatì and other communities, most notably Behchokǫ̀ and Yellowknife. Scoping studies with the community of Whatì (PR# 7, Appendix B) have identified a number of potential Project benefits, as well as concerns regarding potential adverse effects. The change in access brought about by the Project is expected to bring about benefits for residents of the community, improving year-round access to goods, services and harvesting areas, and alleviating seasonal isolation. Changed access also, however, could bring about potentially adverse effects on the community such as greater access to illegal or controlled substances, erosion of traditional culture, and road safety challenges. The Whatì Inter-Agency Committee have been meeting since 2013 to undertake "community readiness" activities to limit the potential for adverse Project effects, while maximizing potential benefits. The socio-economic impact assessment (SEIA) identifies potential Project effects on social, economic, and cultural aspects of communities, proposes mitigations to address adverse effects and benefit enhancement measures to maximize positive effects, and determines the residual effect of the Project on communities. The SEIA is focused largely on the community of Whatì, and is scoped to focus on those issues deemed most important by the community's residents, and by the Tłįchǫ.

5.1.2 Valued Components

Valued socio-economic components (VSECs) are defined as features of the socio-economic environment that are important to people's wellbeing and quality of life. For a socio-economic feature to qualify as "valued" for purposes of SEIA, it must be known (or be reasonably expected) to occur in a project's area of influence. There must be a reasonable expectation that the feature could be meaningfully affected by a project, and people must articulate that value is in fact assigned to the feature.

A list of VSECs and topics for the Project SEIA was provided in the TOR (PR#9) based on community scoping meetings (Whatì, August 18, 2016; Yellowknife, August 24, 2016), comments and developer responses from the Wek'èezhìı Land and Water Board Online Review System, the developer's PDR (PR#7), ongoing consultation, and other information from MVEIRB's Public Registry.

VSECs and their associated indicators identified for purposes of this SEIA are listed in Table 5.1-1 in the order of presentation in the assessment of effects sections. The VSECs and measurement indicators are not organized to reflect relative importance to communities, but rather are organized in an effort to provide a narrative framework of cause and effect relationships that does not require excessive length, cross-referencing or repetition.

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Table 5.1-1: Valued Socio-Economic Components, Topics and Indicators

VSEC	Topic	Indicator
Economic Wellbeing	Employment and Economy	Employment and incomes
		Training
		Business development
		Gross Domestic Product and government revenues[(a)]
	Traditional and Non-Wage Economy	Time for traditional activities
		Traditional harvesting and country food consumption
Stable and Healthy Communities	Population Sustainability	Out-migration, population mobility
		In-migration, population composition
	Use and Maintenance of Infrastructure	Housing
		Utilities
	Community Cohesion	Connecting families, alleviating isolation
		Outsiders coming in
		Social pressures[(b)]
	Public Safety	Road safety
		Protective, emergency and social services
	Equity and Vulnerability	Food Security
		Cost of Living
		Vulnerability
Traditional Use, Cultural and Heritage Resources	Traditional Use and Way of Life	Practice of traditional activities and culture
		Quantity or quality of traditionally harvested resources
		Perception of the land by traditional users
	Harvesting	Competition for resources
	Heritage and Cultural Resources	Archaeological sites
		Culturally significant areas

a) Gross Domestic Product and government revenues, while not identified in the MVEIRB Adequacy Statement (2016), have been included to reflect the existing work that has been conducted in relation to the Project's potential economic effects.

b) "Social Pressures (PR#7, Appendix B)" is defined as a number of concerns raised in consultations such as teen pregnancies, sexually transmitted infections, absentee parenting, drug and alcohol use and crime.

With regard to Table 5.1-1, elements not specifically identified here as VSECs are not unimportant. On the contrary, all elements of economic, social and cultural life integrate and contribute to overall individual, family and community quality of life. Most are subsumed (and will be discussed) within broader VSECs. Further, the diversity of human experience and the range of responses to a project have the result that every component of the socio-economic environment is important to at least some people. A significant effect on a component valued by even a limited number of individuals or families can be important to consider. In addition, there are a number of themes that cut across more than one VSEC; themes that are considered but are not easily framed as discrete VSECs. These include, as examples, gender, self-reliance, vulnerability to change, and sustainability.

In order to fully discuss the potential for the Project to influence the vulnerability of those most sensitive, the assessment must first determine the potential effects that could increase vulnerability, including changes to both economic and social conditions. As a result, while vulnerability was identified as a topic within the "Economic Wellbeing" VSEC by the TOR for the Project, for the purpose of this assessment it is addressed as a topic within the "Stable and Healthy Communities VSEC". The assessment of the Project's effects on vulnerability builds on the assessment of other Project effects to the economic and social situation in Whatì.

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5.1.3 Spatial and Temporal Boundaries

The SEIA for the Project is not bounded by a spatial locale or RSA. Rather, the SEIA discusses the Project's potential effects on the community of Whatì, and, where appropriate, to other Tłįchǫ communities and the territory. This discussion varies, depending on the VSEC, topic and indicator. For example, while the assessment of the Project's effects on physical infrastructure is appropriately conducted at the community level (e.g., Whatì), the discussion of impacts to Gross Domestic Product (GDP) is necessarily conducted at the territorial level (e.g., NWT). Where the Project's potential effects are expected to be highly localized (e.g., road safety, disturbance to culturally important or historical sites), the assessment is conducted at the footprint level. The assessment of Project effects on Traditional Land Use is conducted within the spatial boundary of the terrestrial or aquatic resource being used (e.g., traditional fishing is assessed within the fish and fish habitat study areas).

The existing environment is described based on information presented in the PDR (PR#7), the Socio-Economic Issues Scoping Study prepared in support of the PDR (PR#7, Appendix B), the Economic Evaluation Report prepared for the Project (PR#7, Appendix C), and the Tłįchǫ Government's responses to the MVEIRB Adequacy Statement (PR#96). The description of the existing environment temporally corresponds to the time of writing of each document (March 2016, March 2015, March 2015, and December 2016, respectively), and establishes baseline (Base Case) conditions against which the Project's effects are assessed. The assessment of the Project's potential socio-economic effect (Application Case) is temporally split between construction over a two to four year period, and operations into the indefinite future.

The SEIA does assess combined effects of other RFDs (RFD Case) potentially driving cumulative socio-economic effects. The bulk of measurable Project-related socio-economic effects (e.g., employment and economic effects) are confined to a construction period during which no additional large-scale development is planned with certainty in or around Whatì. Further, the evaluation of how the Project and other developments could interact during the indefinitely long operational period to have a cumulative effect on less measureable, more nuanced socio-economic features is not reliable or effective beyond identifying the potential for interaction.

5.2 Description of Existing Conditions (Base Case)

Existing socio-economic conditions associated with VSECs identified for the Project are presented below based on information presented in baseline studies conducted for the PDR (PR#7, Appendix B).

5.2.1 Population

The population of Whatì was 519 in 2012, with approximately 99% of residents identifying as Aboriginal (GNWTBS 2013a). The average annual growth rate in the community between 2001 and 2012 was 0.4%, relative to the territorial average of 0.7%. Approximately 93% of Aboriginal residents reported speaking an Aboriginal language in 2009. The GNWTBS currently projects a decline in the population of Whatì from 510 residents in 2016, to 507 in 2026[1] (PR#96 TG IR 1).

5.2.2 Employment

The Whatì labour force is largely employed by Tłįchǫ, community and territorial governments in work associated with infrastructure maintenance (e.g., road clearing, public works, winter road[2] maintenance) and

[1] This straight line (no additional development) projection does not include the potential development of the Project.

[2] Reference to the "winter road" throughout Section 5 refers to the Tłįchǫ Winter Road System between Highway 3 and Whatì.

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public service provision (day care supervision, teaching). A smaller portion works in the mining industry, forestry, or for local businesses (e.g., the Whatì Community Store, construction contractors) (PR#7, Appendix B). Some of the employment in the community is seasonal. Current employment positions in the community include (PR#96 TG IR 1):

- 30 Canadian Ranger positions
- 25 to 30 mining industry positions
- 1 position with a recycling business
- 20 CGW positions
- 20 GNWT positions
- 1 position with a delivery company
- 8 Tłįchǫ Government positions
- 5 positions at the Whatì Community Store
- 1.5 positions with the NWT Power Corp
- 6 Development Corporation positions
- 4 positions with Air Tindi
- 9 construction positions (seasonal)
- 5 to 6 forestry positions (seasonal)
- 15 casual summer positions for the CGW (seasonal)

Six Whatì youth are hired annually through the new Tłįchǫ Įmbè program, a six-week program that hires secondary and post-secondary summer students in each of the Tłįchǫ communities. Many community members are employed in trapping activities during the winter, as well as caribou harvesting, and some earn an income by selling traditional crafts and items such as moccasins, drums, purses, wallets, and paddles. Others gather, and sell fire wood and morel mushrooms, and prepare dry fish for sale (PR#7, Appendix B).

The labour force within the Tłįchǫ region is 488 (PR#7, Appendix B). The labour force conditions in Tłįchǫ communities are shown in Table 5.2-1. Labour force participation is low in Whatì relative to Gamètì, Wekweètì and the NWT, but slightly higher than in Behchokǫ̀. The unemployment rate is higher in Whatì than in other Tłįchǫ communities or the territory, and personal, employment and family incomes are lower than the Tłįchǫ or territorial averages.

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Table 5.2-1: Labour Force Conditions in Tłı̨chǫ Communities

Indicator	Community				
	Whatì	*Behchokǫ̀*	*Gamètì*	*Wekweètì*	*NWT*
Population	514	2,104	269	136	44,088
Employment Rate%	39.5	37.9	41.8	55.3	65.6
Unemployment Rate%	35.3	33.4	26.0	19.4	10.6
Participation Rate%	61.2	56.9	56.5	68.6	73.4
Average Personal Income $	34,406	38,535	37,711	n/a	58,329
Average Employment Income $	31,054	41,165	34,765	n/a	58,744
Average Family Income $	77,000	84,647	80,750	n/a	124,103

Source: GNWTBS (2015).
n/a = not available.

5.2.3 Education and Training

In 2014, the percentage of the Whatì population that had achieved an education at the high school level or higher was 43.1%, on par with other communities in the region (Behchokǫ̀ [45.4%], Gamètì [41.0%], and Wekweètì [35.9%]) but below the territory (73.6%) (GNWTBS 2015). The Mezi Community School in Whatì offers classes from kindergarten through grade 12, and there are no local post-secondary options (PR#7, Appendix B), although Aurora College has at times delivered customized courses and programs in the community.

All elementary school students receive daily instruction in Tłı̨chǫ language, and there are three Tłı̨chǫ language credit courses offered at the high school level. The school's cultural program makes use of cabins, snowmobiles, and boats to get youth out on the land. In addition to the programs offered at Mezi, the TCSA operates the Community Learning Centre, and has daycare and preschool programs, staff training, schooling programs, and services for school-aged children that provide assessments, intervention, and support to those who require it. The Mezi Community School has a total capacity of 220, but as of 2016, is at 65% capacity. There has been some suggestion that the school could benefit from portable classrooms, and increased teacher accommodations in the future (CGW 2016).

Training courses are available from Aurora College (PR#96 TG IR 1). In summer 2016, a two-week Introductory Heavy Equipment Operator course was delivered by the GNWT Department of Municipal and Community Affairs (MACA) in Whatì. Students built up the road from Whatì to the junction of the proposed Project. Training also included a three-week Safety Boot Camp delivered by Mine Training Society staff that provided the trainees with seven safety certifications (GNWT 2017). Also, in 2014, the Tłı̨chǫ Government delivered a Commercial Camp Cook course at the Tłı̨chǫ Learning and Development Centre ($320,000 delivery costs) and produced 11 graduates. Over 12 weeks, students were taught how to prepare food for a large groups, in a service camp setting (PR#96 TG IR 1).

Other training initiatives undertaken by the GNWT in recent years include:

- 2014-2015:
  - Interview Skills workshop at the high school 31 participants
  - Sawmill training project 12 trainees plus six sponsored by the Tłı̨chǫ Government

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- 2015-2016:
  - Skills and Work Ethics workshop at the high school and Aurora College 30 participants
  - Apprenticeship workshop at the high school and Aurora College 20 participants
  - Eight participants in a Small Community Employment Support, Youth program
  - Funded the Tłı̨chǫ Government to develop a Strategic Plan pertaining to economic development and employment for the Tłı̨chǫ communities including Whatì
- 2016-2017:
  - Apprenticeship workshop at the high school 20 participants
  - Interview Skills, SFA, Job Search, Resume and Personality Dimension workshops at the high school 40 participants
  - Four participants under the Small Community Employment Support, Youth program
  - Participated on the Įmbè program by providing some workshops in the Tłı̨chǫ communities

Among the noted areas where expanded education opportunities are sought in Whatì include: cooking, building trades and trades apprenticeships in general, Heavy Equipment Operations, environmental monitoring, and wildlife officer training. Many young and working age Whatì residents hope that there will be adequate education and training infrastructure (both of which are largely suggested as insufficient right now by Whatì residents) for the development of more skills among the working age and youth demographic (PR#7, Appendix B).

During the June 24, 2015 Special Inter-Agency Committee meeting, Aurora College indicated that it would be developing curriculum and training in the areas of small business and customer service, and on equipment training opportunities. The TSCA and the GNWT Department of Education, Culture and Employment are working together on establishing funding for training. The Department of Education, Culture and Employment also has a program in place that allows people with a criminal background to overcome this barrier with respect to employment in a strict security environment, such as the mining sector (PR#7).

5.2.4 Business Development

Whatì has a small business sector. Business is limited within the community due to the expense and difficulty of obtaining utilities, basic goods, fuel oil and gas. There are a few locally owned private businesses at present. The Tłı̨chǫ Government owns and operates the Tłı̨chǫ Investment Corporation, an entity that amalgamated the business interests of the Tłı̨chǫ communities' Band Councils and the Treaty 11 Council in 2005. Its businesses located directly in Whatì are Lac La Martre Development Corp. Ltd., the Wha Ti Ko Gha K'aode Ltd. community store, and Lac La Martre Adventures (40% owned) (PR#7).

The Whatì Gha K'aode community store offers post office services, a cash machine, groceries, hardware, dry goods, post cards, souvenirs, a community bulletin board, and financial transaction services. Other prominent businesses in Whatì include Tli Cho Air Inc., a joint venture between Air Tindi and the Tłı̨chǫ Investment Corporation, that offers air passenger and cargo services to the Tłı̨chǫ communities. The Lakeview Bed and Breakfast, a seven-room accommodation located on the shores of Lac La Martre, closed in recent years. An eight-room hotel is also under development in the community (PR#7).

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The Band councils of Behchokǫ̀, Gamètì, Wekweètì, and Whatì as well as the Treaty 11 Council business interests fall under the oversight of the Tłı̨chǫ Investment Corporation. The mission of the Tłı̨chǫ Investment Corporation is to enhance the economic self-reliance, prosperity and certainty for Tłı̨chǫ citizens by creating sustainable economic development. The Tłı̨chǫ Investment Corporation is owned by the Tłı̨chǫ Government and includes businesses and joint venture partnerships with other groups and companies (Table 5.2-2).

Table 5.2-2: Tłı̨chǫ Investment Corporation Businesses and Subsidiaries, 2015

Tłı̨chǫ Investment Corporation Business (Subsidiary)	Main Office Location	Percent Owned by Tłı̨chǫ Investment Corporation
5352 NWT Ltd. (Operating as Snare Lake Lodge)	Wekweètì	100% (Common Shares)
6224 NWT Ltd. (Operating as Lac La Martre Adventures)	Whatì	40%
964053 NWT Ltd. (Tłı̨chǫ Land Tran Transport Ltd.)	Yellowknife	80%, (51%)
Aboriginal Diamonds Group Ltd. (DICAN Ltd.)	Yellowknife	33%, (ADG 51%)
Aboriginal Engineering Ltd.	Yellowknife	100%
Behcho Ko Development Corp. (Tłı̨chǫ Orica Blasting Services)	Behchokǫ̀	100%, (51%)
Denendeh Investments Limited Partnership	Yellowknife	22%
DLFN Holdings Ltd. (Tli Cho Domco Inc.)	Wekweètì	100%, (51%)
Dogrib Power Corporation	Yellowknife	100%
Gamètì Development Corporation ltd.	Gamètì	100%
Hozila Naedik'e Ltd.	Wekweètì	100%
Kete Whii Limited (Kete Whii Procon)	Yellowknife	50%, (50%)
Lac La Martre Development Corp. Ltd.	Whatì	100%
Nishi-Khon Engineering Services Ltd.	Yellowknife	100%
Nishi-Khon/SNC Lavalin Ltd.	Yellowknife	51% Nishi-Khon Engineering
Rae Band Construction Ltd.	Behchokǫ̀	100%
Rae Lakes General Store Ltd.	Gamètì	100%
Rae-Edzo Dene Band Dev. Corp	Behchokǫ̀	100%
Resolution Construction Inc.	Other	49%
Tli Cho Air Inc.	Yellowknife	52%
Tłı̨chǫ Clark Builders Corporation	Yellowknife	51%
Tli Cho Construction Ltd.	Behchokǫ̀	100%
Tli Cho Engineering and Environmental Services Ltd.	Behchokǫ̀	100%
Tłı̨chǫ Equipment Leasing Ltd.	Other	100%
Tli Cho Learning and Development Center	Behchokǫ̀	100%
Tli Cho Logistics Inc. (Ventures West Transport LP)	Yellowknife	100%, (60%)
Tłı̨chǫ McCaw North Drilling and Blasting Services JV	Yellowknife	n/a
Tłı̨chǫ Quantum Murray Incorporated	Other	51%
Tli Cho Road Constructors Ltd.	Behchokǫ̀	100%
Wekweètì Development Corporation Ltd.	Wekweètì	100%
Whatì Ko Gha K'aode Ltd.	Whatì	100%

Note: percentages in brackets represent the percentage of the subsidiary company owned by the parent company. For example, the TIC owns 80% of 964053 NWT Ltd., which in turn owns 51% of Tłı̨chǫ Land Tran Transport Ltd.

Source: Tłı̨chǫ Investment Corporation (2015).

n/a = information was not available.

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Infrastructure deficits, high costs of freight, lack of an adequate population base to support business activities, and effects of isolation due to the seasonal road have all been cited as business deficits. The Tłı̨chǫ are also cautious when dealing with natural resource development. For example, there has been a reluctance to risk long-term decline in fish stocks in Lac La Martre with a commercial fishery, which led to the closure of the commercial fishery in 1973 (PR#7).

The Tłı̨chǫ Resource and Economic Development Working Group (TREDWG) is a partnership between the four Tłı̨chǫ community governments (Behchokǫ̀, Gamètì, Wekweètì and Whatì) and the Tłı̨chǫ Government aimed at strengthening cooperative economic development in the Tłı̨chǫ region. The group works with the GNWT Department of Industry, Tourism and Investment, the Business Development Officer in Behchokǫ̀, and the Economic Development Officers in Gamètì, Wekweètì, and Whatì (Tłı̨chǫ Government 2015).

5.2.5 Tourism

In recent years, the potential of eco- and cultural tourism has been of central interest to the Tłı̨chǫ Government as tourism is seen as a sustainable future economic sector (PR#7, Appendix B). The section below is focused on tourism activities on Tłı̨chǫ lands, as potential tourism activities facilitated by the Project are expected to be largely staged out of Whatì. Other tourism activities exist throughout the NWT, including guided outfitting, fishing, canoeing, camping, and aurora viewing, among other activities.

The Tłı̨chǫ Traditional Knowledge and Socio-economic Issues Scoping reports have identified that the Tłı̨chǫ have been wary of non-Tłı̨chǫ residents constructing cabins and hunting and fishing on their land as they perceive these activities will place increased pressure on the environment, which may affect their culture and heritage (PR#28). However, the Tłı̨chǫ Government recognizes that ecotourism (touring natural habitats in a manner meant to minimize ecological impact) will allow for a balanced approach as it can help protect the land, while also providing local benefits for Tłı̨chǫ residents. The Tłı̨chǫ Government will continue to manage the location of cabins as part of lease agreements within Tłı̨chǫ lands.

Currently, a relatively small fishing lodge on Lac La Martre is the only active lodge on Tłı̨chǫ lands; therefore, there is ample space for growth (PR#7, Appendix B). Revenues at the lodge are approximately $432,000 seasonally when capacity is reached and all customers book a three-day excursion. In summer 2016, the Lodge was booked to capacity (150 guests) and the lodge expects to see similar numbers in the future (PR#96 TG IR 5.1). Future tourism opportunities in Whatì include a new hotel that is currently being constructed and a café. Both opportunities are anticipated to increase the Whatì tourism revenue and infrastructure in supporting more visitors (PR#96 TG IR 5.1).

The GNWT Department of Industry, Tourism and Investment supports the development of Aboriginal Cultural Tourism by: strengthening Aboriginal Cultural Tourism capacity, respectfully sharing of Aboriginal culture and the preservation of culture and heritage. Funding support is available by application (GNWT 2017). The recent release of the GNWT Tourism 2020 plan, which includes Aboriginal Cultural Tourism as a key focus, states that “the overall goal is to increase the value of the [tourism] industry to $207 million annually by 2021, which represents growth of 35% between 2016/17 and 2020/21 within Tłı̨chǫ lands (GNWT 2016).

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5.2.6 Housing and Infrastructure

According to the GNWTBS, overcrowding and the number of houses needing repair in Whatì has decreased over the past decade. Despite this decrease, the number of housing problems in the community has remained high. In 2014, of the 124 households in Whatì, 47% were considered to be in core need, having housing problems such as structural pitching due to shifting permafrost, cracks in the walls from shifting, faulty furnaces, broken windows and doors, frozen pipes, and poor insulation (GNWTBS 2015).

Most of the homes in the community are privately owned (69.1%). Forty-two homes are owned by the NWT Housing Corporation. According to CGW representatives, there is currently no available housing stock (PR#7, Appendix B), though lots for development are available. It generally takes between three to four years to build a new house, and currently there are no plans in place to build new units. There are currently unoccupied lots that could be occupied with upgrades (PR#96 TG IR 9.1; 9.3).

Since 2014, the Northwest Territories Housing Corporation (NWTHC) has invested over $4 million in housing programming in Whatì including homeownership repairs and the construction of a seniors' 9-plex. Of the 124 houses in Whatì, the NWTHC manages 42 rental units. There is a waitlist of 5 (as of January 2017 [GNWT 2017]) applicants for NWTHC rental housing. Of the 42 units that NWTHC rents out in Whatì, 17 of the units are affordable/market housing units that would be appropriate for community workers (PR#96 TG IR 9.1).

The NWTHC conducts both preventative and on demand maintenance on its social housing units. In the construction of housing, the NWTHC takes into consideration permafrost melt and the changing climate. Adaptive construction practices include using above-ground foundation technologies such as space frame foundations, and screw jacks to help level houses where there is shifting.

Private homeowners can access different programs that assist with providing repairs to their home, including the CARE (Contributing Assistance for Repairs and Enhancements) program, which assists existing homeowners in making necessary repairs to their home to ensure a safe and healthy residence. The, SAFE (Securing Assistance for Emergencies) program is also available when residents are faced with situations like freeze-ups and furnace failures.

Infrastructure in the region is limited. A single all-season road, Highway 3, connects Behchokǫ̀ with Yellowknife and the southern NWT. Winter roads are built annually to connect Whatì, Gamètì and Wekweètì with Highway 3. Each community has an airstrip and other municipal infrastructure including water supply, sewage and solid waste disposal, schools and community halls. The Snare River hydro - electric system, which consists of four generating stations, supplies hydro electric energy to Behchokǫ̀ and Yellowknife. Electricity in Gamètì, Wekweètì and Whatì is provided through local diesel generators. Telephone and internet services are available in all communities (PR#7).

The CGW has expressed strong concerns and taken action about existing and likely future limitations of existing municipal utility infrastructure, such as the existing water treatment plant, lagoon system, and the existing solid waste facilities (PR#7, Appendix B). As a result, upgrades to utility infrastructure have been planned. Municipal and Community Affairs (MACA) provides the CGW with annual funding to support capital and operational costs of municipal infrastructure. The CGW Council decides on their own spending priorities and has the capacity to plan for and address changing needs through their annual capital plan and O&M budget. The CGW currently has plans to upgrade their sewage lagoon and has also been approved for additional funding from the Government of Canada to support this; construction should be finished by 2019. This upgrade will be able to accommodate a

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population of 800, relative to the current population of just over 500 (PR#98 TG IR 9.3). According to MACA, the water treatment plant is assessed to be in good condition and has the ability to increase its production. It is also possible to build storage tanks for treated water if needed. The solid waste site also has available area to construct new cells. These are normal upgrades that the community is able to handle within their capital planning and MACA staff are available to help.

5.2.7 Public Safety

Public safety in Whatì is the responsibility of the CGW and the RCMP. The Whatì RCMP detachment has two full-time officers, and delivers policing services in accordance with the Territorial Police Services Agreement between the GNWT and the federal Department of Public Safety. The GNWT funds 70% of policing services. The Minister of Justice can identify and recommend to the RCMP "G" Division the annual objectives, priorities and goals of the Territorial Police Service, and can determine the level of policing services provided (GNWT 2017).

The CGW deals with emergency response services within the boundaries of the Whatì municipality. Community governments are not mandated to provide ground ambulance or highway rescue services to residents. Although there are no formal rescue vehicles in the community, there is an active search and rescue group in Whatì, which is comprised of volunteers. Volunteers are personnel from public works and members of the Canadian Rangers (a sub-component of the Canadian Armed Forces). The Canadian Rangers have been doing training in the community of Whatì and occasionally train and provide support outside of community boundaries. Large investment would be required to establish such a search and rescue service due to the cost of equipment, maintenance and regular training. As well, search and rescue does not provide training for extraction or advanced medical responses such as Emergency Medical Technicians.

Currently, road safety issues associated with operation of the winter road are low. There have only been seven collisions on the Whatì winter road in the period of 1989 to 2016, none of which resulted in fatalities. Average Daily Traffic at the Whatì junction on the Tłįchǫ Winter Road System is presented in Table 5.2-3. Traffic on the winter road is spread throughout its operational period, with incidental spikes occurring at varying periods, depending on the year.

Table 5.2-3: Average Daily Traffic on the Whatì Winter Road

Year	Month				Average
	Jan	Feb	March	April	
2016	0	38	41	60	46
2015	87	38	54	51	39
2014	62	73	57	48	54
2013	66	7	114	97	47

Source: PR#96 TG IR 9.

Note: This table presents data for traffic entering/leaving Whatì. The low traffic volume in February 2013 is likely attributed to a traffic counter malfunction. As there is no traffic counter at the Whatì junction, ADT for Whatì was extrapolated using the other traffic counters available in the area.

5.2.8 Traditional and Non-Wage Economy

In terms of subsistence value, both general community knowledge and GNWT-collected statistics illustrate the high importance of the traditional economy to Tłįchǫ citizens. Tłįchǫ identify that the subsistence economy (and mixed economy such as trapping for pelt sales or personal use) plays a multitude of roles, including promoting the following Tłįchǫ values:

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- developing functional skills and key Tłı̨chǫ personality traits (e.g., patience, acute observation, adaptability)
- self-sufficiency and pride therein
- insurance against fluctuations in the wage economy, and the high cost of store-bought foods, especially for food security
- strengthening cultural identity and continuity, practicing the same mode of life as prior generations and passing that on to future generations
- inter-generational relations, especially between Elders and youth
- getting out on the land as often as possible, which promotes physical and mental health
- healthy eating
- promoting TK of animals, their habitat, and the Tłı̨chǫ cultural landscape
- creating spiritual relationships with animals and the natural world
- having “eyes on the land” and identifying changes that need to be reported to decision-makers
- communal sharing of food, which strengths family and community bonds
- sharing knowledge, cultural practices and ceremonies, among other values (PR#7, Appendix B)

Until recently, the land-based traditional economy was the entire source of livelihood for the Tłı̨chǫ. Today, Tłı̨chǫ communities are still amongst the most reliant on country foods of any Aboriginal groups in the NWT. In 2013, over 90% of Tłı̨chǫ households consumed fish or meat obtained from hunting and fishing (PR#96 TG IR 1; GNWTBS 2013b). The consumption of country food is an especially important aspect of the cultural life in Whatì, and helps to provide food security for residents. Nearly 60% of households in Whatì reported that country food accounted for at least half or more of their diet in 2014 (GNWTBS 2015). This is slightly higher than the community of Behchokǫ̀ (58.9%), but notably lower than the communities of Gamètì (82.0%) and Wekweètì (88.6%). In 2014, 55.4% of Whatì residents hunted and fished, a higher percentage than what was reported in Behchokǫ̀ (40.5%) and Gamètì (52.9%), but lower than Wekweètì (73.8%). Transportation costs make it difficult to obtain fresh food at the local store year round (PR#7, Appendix B p. 14).

Some community members have observed and commented on a loss of community values and an increase in individualistic thinking, exemplified by less sharing of resources in the community. Some members of the community have the perception that “the environment is no longer viewed as communal food storage and is now seen as a pool used to fill freezers and individual food supplies” (PR#7, Appendix B).

The Tłı̨chǫ traditional economy extends beyond the direct participation in hunting, trapping and gathering activities. Traditional household economy also involves the preparation, cooking and distribution of country foods, activities carried out by men, women and children. While not represented in official statistics, these activities are key to sustaining Tłı̨chǫ traditional economy.

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5.2.9 Traditional Use and Way of Life

The traditional way of life is considered to be invaluable to the Tłįchǫ, as it promotes key Tłįchǫ values, strengthens cultural identity, promotes TK of animals and their habitats, the Tłįchǫ cultural landscape, the sharing of traditional foods, knowledge and cultural practices (PR#73 IR 4.1). Tłįchǫ communities are amongst the most reliant on country foods of any Aboriginal groups in the NWT, and in 2013, over 90% of Tłįchǫ households were eating meat or fish obtained from hunting and fishing (PR#96 TG IR 4.1; GNWTBS 2013). The Whatì community in particular maintains strong ties to culture, traditional way of life and language, and have higher participation rates in traditional activities compared to both the Tłįchǫ and NWT averages (PR#7, Appendix B; PR#96 TG IR 4.1).

The Tłįchǫ have been using the Project area since time immemorial and the region is still used extensively for traditional and cultural activities (PR#28; PR#7, Appendix B). The TK study results indicated several hunting, trapping, fishing and culturally important sites such as travel routes, cabins, camp sites, grave sites, and sacred sites that overlap with the Project footprint and wider region (PR#28 Maps 4 and 5).

The Métis have deep ancestral connections to the local landscape, and traditional use of the land is a fundamental part of their Aboriginal well-being and way of life (PR#98 NSMA IR). NSMA members have been practicing traditional and cultural activities in the region north of Great Slave Lake historically and in recent years, and the Project area is currently used for hunting, trapping, fishing and other cultural and traditional purposes (PR#98 NSMA IR).

The traditional territory (Chief Drygeese Territory) of the Yellowknives Dene First Nation (YKDFN) extends south of the Project, and they have a long history of traditional use of the area, including harvesting and the existence of a number of culturally significant sites (PR#24). The Deh Gah Got'ie First Nations (DGGFN) also have treaty rights near the Project area (PR#60).

5.2.10 Harvesting

The Tłįchǫ Elders' knowledge of the land and wildlife derives from their intimate relationship of living off of the land, and hunting, trapping, and travelling to different areas throughout the year to harvest specific resources. Tsotìdeè (La Martre River) and its many small lakes are of central importance for traditional activities such as fishing, hunting and trapping. Fishing is conducted year round, and during the spring and summer of each year, large numbers of people camp on the islands of Tsotìdeè and set fishnets to prepare dry fish for the coming season. Bòts'ıtı̀ (Boyer Lake), southeast of Whatì, is also considered a good fishing location.

Trapping during the spring and summer occurs by boat or canoe where ponds and lakes are accessed to trap muskrat and beavers, and during the winter trapping occurs by snowmobile for furbearers such as marten, lynx, and wolverine. During the winter, trappers follow the numerous trails from Whatì and Behchokǫ̀ through the forest by snowmobile. To facilitate travel between lakes in the forested landscape, trails and portages are cut in the forest. K'àgòò tıĮ ıı̀ (the Old Airport Road), is used as a snowmobile trail during the winter to access the numerous lakes on both east and west sides of the trail, and traplines are run on small trails for about one kilometre off each side of K'àgòò tıĮ ıı. Trappers hunt and fish for food while they are on the trapline using fish nets on lakes or under the ice. The Lakes K'ıshìt ı̀ (Lac Levis) and Łıetı̀ are considered good fishing locations.

The interconnected trail system extends through the Project area (Map 5 PR#28). Traplines have been set from Whatì and Behchokǫ̀ all the way to Edeèzhıì (Horn Plateau). During the winter, trappers from Whatì generally use the following areas: (1) east from Whatì along Bòts'ıtı̀ and Tsotìdeè towards Ɂehtł'ètı̀ (James Lake), following

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Màa tilì; (2) south along the water system from Bòts'ıtı̀ (Boyer Lake) to Ɂehtł'ètıı̀ soa and to Tsigaàtı̀, and further south to Weghałaàtǫǫdaàtı (see Map 5 PR#28); and (3) south along K'àgòò tıı̨ ıı̀ where traplines are run on both east and west sides of the trail. Harvesters from Whatì trap about halfway down K'àgòò tıı̨ ıı. The Horn Plateau area has also been used by other Aboriginal communities (e.g., Deh Gah Got'ie First Nation).

The southern part of the K'àgòò tıı̨ ıı̀, from Tsigaàtì to Highway 3, and the surrounding area are utilized mostly by trappers from Behchokǫ̀ (see Map 5 PR#28). A cabin built by Joe Migwi, which was located along K'àgòò tıı̨ ıı̀ a few kilometres west of Highway 3, served as a strategic base and landmark for trappers and hunters; however, this cabin was destroyed during forest fires in 2014 and is no longer being utilized. The family of Joe Migwi is re-building the cabin.

The main trapping areas for the trappers from Behchokǫ̀ generally are: (1) from Ɂehtł'ètı̀ (James Lake) to Tsigaàtı̀, to Weghałaàtǫǫdaàtı̀ and further southwest to K'ıshıı̀ ı̀ (Lac Levis); and (2) the trails from the southwest shore of Ɂıı̨ dak'ètı̀ (Marian Lake) following the numerous lakes and ponds to Joe Migwi's cabin site on K'àgòò tıı̨ ıı̀. From Joe Migwi's cabin site, the traplines follow K'àgòò tıı̨ ıı̀ north to Ɂehtł'ètıdı̀ ee (James River). Several traplines have been made going both eastward and westward from K'àgòò tıı̨ ıı̀, to numerous smaller lakes and ponds (see Map 5 PR#28). Traplines run west from the K'àgòò tıı̨ ıı̀ to Weghałaàtǫǫdaàtı̀, and from the K'àgòò tıı̨ ıı̀ to Łıetı̀. These are important as the trails connect with other trails in a westward direction towards K'àyetìdeè (Horn River) and Edeèzhıı̀ (Horn Plateau).

Spring is considered the main trapping season for beaver and muskrat, and trappers use smaller canoes to portage more easily and access smaller lakes and ponds. Tsotìdeè (La Martre River) is a popular area for beaver and muskrat trapping, along the entire length from Whatì to Ɂıı̨dak'ètı̀ (Marian Lake). The area around Bòts'ıtı̀ (Boyer Lake) is also an important habitat for beavers and muskrat. A short portage south from Tsotìdeè leads trappers to Ɂehtł'ètıı̀ soa and Ɂehtł'ètıdı̀ aà (see Map 5 PR#28). Subsequent portages lead the trappers to Ɂehtł'ètıı̀ so and to Tsigaàtı̀ and Tsigaàtıdı̀eè. This entire water system is considered beaver and muskrat habitat and harvesters trap along these shores every year. From Ɂehtł'ètı (James Lake)̀, trappers follow the numerous small lakes and the Ɂehtł'ètıdı̀ eè (James River) towards Tsigaàtı. The area located southwest of Joe Migwi's cabin site used to be an important trapping area for beaver and muskrat during the spring. The numerous lakes and ponds around Łıetı̀ have been preferable trapping locations.

Tłı̨chǫ hunt for moose, woodland caribou, and barren-ground caribou in the Project area (see Map 5 PR#28). Barren-ground caribou migrate through the Project area on their annual migration route from the barren lands to their winter habitat in the forest. They feed in the forest during the winter before heading northward in March and April to the calving grounds on the barren lands. Tłı̨chǫ Elders stated that barren-ground caribou frequently used the area in the past, but they have not been observed in recent years which they attributed to increased development on the barren lands and on the wintering grounds. Barren-ground caribou were primarily hunted at Bòts'ıtı (Boyer Lake), and from Tsotìdeè (La Martre River) along the trail past Ts'otıı̀ so to Ɂehtł'ètı (James Lake).Woodland caribou move throughout the entire Project area, but their main habitat is considered in the centre of the Project area, and mainly west of K'àgòò tıı̨ ıı̀ (the Old Airport Road). The areas south of Bòts'ıtı̀ (Boyer Lake) around the Lake Ethletitso and the smaller lakes west of Tsigatii towards Whatì are identified as key woodland caribou habitat, and is primarily where hunters travel to hunt them.

Moose can be found anywhere on the land, but prefer areas along shallow lakes. Moose use key habitat located east of Ɂehtł'ètıı̀soa toward Ɂehtł'ètıdı̀eè, and the south side of Whatì where they share the same habitat as

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woodland caribou (see Map 6 PR#28). Moose are hunted around the shore of Bòts'ıtı̀ (Boyer Lake) and along both sides of Tsotìdeè (La Martre River), where hunters use boats along the shorelines of lakes and rivers to search for moose in the fall.

Moose and caribou are harvested by NSMA, and caribou remains the principle item in their diet and a secure source of food (PR#99 NSMA IR). Bluenose East caribou are harvested based on a limited number of tags that are allocated by the GNWT, and the harvest of Bathurst caribou is currently not permitted until the population recovers. NSMA members are concerned about the Project potentially leading to declines in caribou health and abundance, particularly of the Bluenose East herd, which would adversely affect their connections to the land and community, and traditional and cultural values. Other concerns raised are related to adverse effects on the environment, particularly cumulative effects on caribou.

The YKDFN have a long history of harvesting in the Project area. YKDFN members have indicated concerns about the Project creating barriers to movement for barren-ground caribou, woodland caribou, bison and moose, which could potentially affect their long-term ability to engage in traditional practices (PR#24). The DGGFN also have treaty rights near the Project area and commonly hunt the same caribou as Tłı̨chǫ in the Horn Plateau area (PR#60).

5.2.11 Heritage and Cultural Resources

Tsotìdeè (La Martre River) is the main entry point to the entire area southeast of the community and runs eastward towards Ɂıhdak'ètı̀ (Marian Lake) (PR#28). The river is considered integral to the traditional economy in terms of its cultural and economic significance. It provides several important resources and a secure source of food, and is the primary transportation route connecting to other Tłı̨chǫ communities and to other important land use areas. The river and its many small lakes are used extensively by Tłı̨chǫ during the summer as a canoe/boat route, and for hunting, trapping, fishing, and camping, and during the winter as a snowmobile route for trapping.

The river is accessed at T'oohdeèhoteè, an important portage site used during the summer and winter, and located where the existing route of K'àgòò tıłıı̀ crosses Tsotìdeè (see Map 3 PR#28). People often camp at this portage when traveling on the river. Both sides of the portage at T'oohdeèhoteè are considered important fishing areas where grayling, suckers, and whitefish are fished, primarily during the summer and fall. The proposed Project route crosses the Tsotìdeè at T'oohdeèhoteè, where a bridge will be built to cross the river west of the portage.

The Nàıļıı̨ waterfalls and the lake above the falls are considered sacred sites that are treated with great respect. Their cultural significance lies in the historical accounts of a battle at Whatì between the Chipewyan and the Tłı̨chǫ, and the ensuing pursuit ending at Nàıļıı̨. The Nàıļıı̨ waterfalls are located east of the proposed Project.

Ewaashì is a culturally sensitive site located adjacent to the proposed Project route (see Map 4 PR#28). The site is considered sensitive because Elders and harvesters are unsure of the nature of the site and the type of beings or spirits that might dwell there. The appropriate protocol is to leave the site alone which avoids potentially disturbing the place. The Elders from Behchokǫ̀ identified Kweyì ı̨goèɂàa Wets'àts'ìdì as a culturally sensitive site meaning "cave tunnel" and "pay respect to", and is located approximately 40 km south of Edzo on Highway 3. Six grave sites were identified to the west of the Project, including two north of Tsotìdeè, one on the west side of Ɂehtł'ètıı̀ so, one by the portage between Ɂehtł'ètıı̀soa and Ɂehtł'ètıı̀daà, and two unidentified graves south of Ɂehtł'ètıı̀daà (see Map 4 PR#28) The gravesites are located between approximately 2.5 km and 10 km from the Project footprint. The Elders stated that grave sites are considered an important link for the Tłı̨chǫ to their land and are most often located by open water and rivers.

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The Tłįchǫ have travelled through the Project area extensively, as evidenced by the numerous overland trails and water routes extending through the region. Several travel routes intersect with the Project footprint (see Map 4 PR#28).

The Ɂelà etò is a canoe/boat route that travels east from Whatì along Tsotìdeè, to Marian River. It is used extensively by the Tłįchǫ during the summer who hunt and fish by boat. During the winter, Màa tıį ıı̀ is a highly used snowmobile route for travellers between Whatì and Behchokǫ̀, and by trappers and hunters. The proposed Project route predominantly follows the route of an old overland military road, defined by Tłįchǫ Elders as K'àgòò tįlìì, meaning tractor trail, and referred to as the Old Airport Road. The trail is extensively used by Tłįchǫ as a snowmobile and ATV route that connects with numerous other trails intersecting it from east-west. The Campbell trail is also defined as a tractor trail, and travels from Whatì to Ɂehtł'ètì in an easterly direction. Whaàhdòò etò is an Ancestors' trail that travels from the southwest shore of Marian Lake to Joe Migwi's cabin site on K'àgòò tıį ıı̀, and further southwest towards Łıetı̀, as an Whaàhdòòetò.

YKDFN members have indicated concerns about potential effects of the Project on important cultural and archaeological sites (PR#24).

5.3 Pathways Analysis

Pathway analysis is a screening step that is used to determine the existence and magnitude of linkages from the initial list of potential Project effects. This screening step is largely a qualitative assessment, and is intended to focus the effects analysis on pathways that require a more comprehensive assessment of effects on VSECs. Pathways are determined to be primary, secondary, or as having no linkage, following the methods described in Section 2.0.

It is generally accepted that a project will impact people and communities differently. While benefits can be expected (e.g., employment, business development, incomes), they may not be realized by all individuals, families or communities. Further, some may experience adverse project effects in the context of overall net socio-economic benefits. Mitigation can attempt to address adverse Project effects, and benefit enhancement measures can seek to maximize project benefits for a wider group of people, however the extent to which both are effective is not always apparent or measurable. This is in contrast to adverse biophysical Project effects, which are most often mitigated into insignificance through engineering design, good practice policies and management and other means. The approach to SEIA is thus more qualitative and nuanced than for biophysical assessment. In coming to conclusions, including describing pathways, there is necessarily a high dependence on engagement results and comparable experiences (in this case, with other roads). Considerable engagement has been carried out for the Project to date, including an issues scoping exercise (PR#7, Appendix B), and has yielded a number of pathways of potential effect.

Many socio-economic effects are difficult to predict and measure. For example, changes related to community cohesion and resiliency are difficult to measure without development of measurable and reliable indicators. Community cohesion is typically assessed qualitatively or through community member interviews and perception checking. Further, for some socio-economic features that *can* be measured, there may be no acceptable amount of change that would allow for a ranking of low, moderate or high in terms of significance. There is no acceptable (or manageable) level of increase in violent crime, for example. All socio-economic pathways determined to have a linkage to the Project are considered to be 'primary', regardless of whether the change is indirect or direct or whether it is felt by some or many. In this regard, the SEIA does not identify 'secondary' pathways of effect.

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Some potential pathways, while important to address as they related to public concern over perceived effects, are not expected to materialize, or will have a weak linkage to the Project not resulting in a beyond-negligible effect. Where the assessment of potential effects (Section 5.4) finds this to be the case, the pathway is not carried forward for residual effects assessment.

A summary of socio-economic pathways is provided in Table 5.3-1, and further assessment of the effects of primary pathways is provided in Section 5.5 Residual Effects Analysis.

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Table 5.3-1: Socio-Economic Pathways of Effect

VSEC	Topic	Indicator	Project Component / Activity	Potential Effects Pathway	Mitigation and Benefit Enhancement Measures
Economic Wellbeing	Employment and Economy	Employment opportunities	■ Construction – Two to Four year Period; ■ Operations – Year-round Maintenance	Project construction and operations would generate employment opportunities and associated incomes	**Tłįchǫ Government Benefit Enhancement** ■ Mobilization of the Economic Development Officers in communities to prepare the workforce for employment opportunities (Mitigation 4 of PR#96, Appendix D Motion 2015-018). ■ Development of a training strategy by the Tłįchǫ Regional Economic Development Working Group (TREDWG), in conjunction with Aurora College and the Mine Training Society, that identifies available skilled labour for construction employment opportunities in each of the communities (PR#96 TG IR 1). ■ To avoid inequitable distribution of employment to regional or migrant labour forces, the TREDWG has identified that the local labour force required for construction is available (PR#96 TG IR 1). ■ Planning for employment and local opportunity catchment is expected to reduce a surge in the required out-of-territory labour force during construction, reducing the potential for in-migration into the region. (PR#96 TG IR 1). **GNWT Benefit Enhancement** GNWT provided support in the form of funding and expertise to the Tłįchǫ Government to develop the Tłįchǫ Regional Economic Development and Training Strategy and assists with economic development and employment for the Tłįchǫ communities including Whatì.
		Training opportunities	Construction	Project construction could drive the uptake of ongoing training opportunities in the region by those seeking employment	**Tłįchǫ Government Benefit Enhancement** ■ Development of a training strategy by the TREDWG, in conjunction with Aurora College and the Mine Training Society, that identifies available skilled labour for construction employment opportunities in each of the communities (PR#96 TG IR 1). ■ The TREDWG will receive $10 million dollars over four years for Employment and Social Development Canada. This Training and Economic Development Strategy includes three Heavy Equipment Operators (HEO) training courses through Aurora College. This is a 9-week training program which costs approximately $400,000 to $425,000 to deliver. These HEO courses can be delivered in Behchokǫ̀ and Whatì, in the new fiscal year with Aboriginal Skills and Employment Training Strategy (ASETS) funding, partnered with the contractor. ■ The Tłįchǫ Government delivered a Commercial Camp Cook course (2014) at the Tłįchǫ Learning and Development Centre ($320,000 delivery costs) and 11 people graduated from that course. Over 12 weeks, students were taught how to prepare food for a large group of people, in a service camp setting (PR#96 TG IR 1). **GNWT Benefit Enhancement** ■ **In Partnership with the Mine Training Society, a two-week** Heavy Equipment Operator course was delivered by the GNWT Department of Municipal and Community Affairs in Whatì in July 2016. Training also included a three-week Safety Boot Camp delivered by Mine Training Society staff that provided the trainees with seven safety certifications that will assist them in obtaining employment with this Project (GNWT 2017). ■ ECE continues to partner with the Tłįchǫ Government in the implementation of the Tłįchǫ Regional Economic Development and Training Strategy, and community action plans. These identify priorities and actions that target specific training needs and help to fill those gaps. ■ There are Community Learning Centres in Behchokǫ̀, Gamètì, Whatì and Wekweètì. There are also Community Adult Educators in those communities who deliver Adult Literacy and Basic Education, and Literacy and Essential Skills courses.
		Business Development	Operations – Year-round Access to and from Whatì	Project operations could enhance opportunity for year-round tourism activities in the region	**Tłįchǫ Government Benefit Enhancement Measure** The Tłįchǫ Government currently maintains Economic Development Officers in the communities who assist Tłįchǫ residents in establishing their own businesses and building business acumen, and who focuses on local economic development issues (Mitigation 4 of PR#96, Appendix D Motion 2015-018). **GNWT Benefit Enhancement Measure** ■ Project construction and operations will be funded through the P3 procurement process, and so will be exempt from the GNWT Business Incentive Policy requirements. However, the GNWT will include conditions in bid contracts that include a requirement for Tłįchǫ and Northern hires. Contractors should demonstrate how local labour and businesses will be sourced, plans to provide and maximize on-the-job training for local residents, and an approach to communicating and collaborating with local governments and Aboriginal organizations regarding local involvement in construction and operations. ■ In the event that incidental Project activities are funded extra to the P3 process, the GNWT Business Incentive Policy will be applied, as appropriate.
			■ Construction – Two to Four year Period; ■ Operations – Year-round Maintenance	Project construction and operations could support existing local business, and could facilitate the development of new businesses in Whatì	
			Operations – Year-round Access to Whatì	Project operations could change the nature or viability of some existing local businesses	
		GDP and Government Revenues	■ Construction – Two to Four year Period; ■ Operations – Year-round Maintenance	Project construction and operation could contribute to GDP and to government revenues from taxation	Positive Pathway - No mitigation required, no practical benefit enhancement measures identified

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Table 5.3-1: Socio-Economic Pathways of Effect (continued)

VSEC	Topic	Indicator	Project Component / Activity	Potential Effects Pathway	Mitigation and Benefit Enhancement Measures
Economic Wellbeing	Employment and Economy	Time for traditional activities	■ Construction – Two to Four Year Period; ■ Operations – Year-round Maintenance and Year-round Access to and from Whatì	Project construction and operations could change the time available for participation in the traditional economy	**Tłįchǫ Government Mitigation** ■ The Tłįchǫ Government will continue to manage cabin construction on Tłįchǫ lands. ■ To ensure effective management, the Tłįchǫ Government will investigate the need for regulations and policies to manage the construction of cabins and design of hunting, trapping, and fishing in the area, in order to minimize impacts on local animal populations. The Tłįchǫ Government will work to provide clear guidance on this topic. (Mitigation 10 of PR#96, Appendix D Motion 2015-018). **GNWT Mitigation** ■ GNWT-ENR will enforce the NWT's hunting regulations which are in place to ensure that wildlife is conserved for future generations and that hunting is done safely. ■ GNWT Department of Lands conducted a land use scoping study of the WRMA with an aim to establish land use guidelines in the WRMA (PR#7; GNWT 2017). ■ The GNWT, in collaboration with the Tłįchǫ Government and other planning partners, is in the process of working towards the development of a land use plan for public lands in the Wek'èezhìı Management Area.
		Traditional harvesting and country food consumption	Operations – Year-round Access to and from Whatì	Project operations could change the role of the traditional economy in the economic wellbeing of Whatì residents	
Stable and Healthy Communities	Population Sustainability	Out-migration, population stability	Operations – Year-round Access to and from Whatì	Project operations could help to stabilize the existing Whatì population by removing the need to out-migrate for employment, or for better access to services	Positive Pathway - No mitigation required, no practical benefit enhancement measures identified
		In-migration, population composition	Operations – Year-round Access to and from Whatì	Project operations and associated economic growth could result in in-migration to Whatì	**Tłįchǫ Government Mitigation** Annual coordination between the Councils of Whatì and Behchokǫ̀ to ensure that any changes and impacts are being collectively considered, addressed and managed (Mitigation 13 of PR#96, Appendix D Motion 2015-018).
	Use and Maintenance of Infrastructure	Housing and Utilities	Operations – Year-round Access to and from Whatì	Project operations and associated in-migration could place additional demand on community services, housing and utilities in Whatì	**Tłįchǫ Government and GNWT Shared Mitigation** ■ A Local Housing Organization has been established in Whatì to assess ongoing housing stock and condition and a Tłįchǫ Government and GNWT housing working group has been established to identify and implement actions to address housing issues in Tłįchǫ communities. Current limitations to building more housing units include available skilled labour and trades, high costs of bringing in trades, high costs of building materials, and seasonality of accessing building materials. ■ Sewage is trucked, and an increase in population could be managed. The sewage ponds are currently being expanded and repaired and by 2019 will be able to service a population of 800 (PR#96 TG IR 9). The water treatment facility can accommodate a population of 800. Maximum water use according to the water licences for Whatì (W2007L3-0002) and Behchokǫ̀ (W2014L3-0002) are 30,000 m^3 and 300,000 m^3, respectively.
			Construction – demand generated by camp facilities	Project construction could place additional demand on waste disposal and utility infrastructure in Whatì	
	Community Cohesion	Connecting families, alleviating isolation	Operations - Year-Round Access to and from Whatì	Project operations could spread seasonal movements in and out of Whatì over a longer period, avoiding the "pulse" facilitated by winter road operation	Positive Pathway - No mitigation required, no practical benefit enhancement measures identified
			Operations – Year-round Access to and from Whatì	Project operations and associated access to and from Whatì could connect families and alleviate isolation	

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Table 5.3-1: Socio-Economic Pathways of Effect (continued)

<table>
<tr><th>VSEC</th><th>Topic</th><th>Indicator</th><th>Project Component / Activity</th><th>Potential Effects Pathway</th><th>Mitigation and Benefit Enhancement Measures</th></tr>
<tr><td rowspan="3">Stable and Healthy Communities</td><td rowspan="3">Community Cohesion</td><td>Outsiders coming in</td><td>Operations – Year-round Access to and from Whatì</td><td>Project operations could increase the presence of outsiders in the community year-round, potentially creating a sense of reduced safety, security and community</td><td rowspan="3">Tłįchǫ Government Mitigation
■ The Community Government of Whatì is investigating a Community Bylaw Officer position to strengthen community security. This is an issue that needs to be addressed jointly by the Tłįchǫ Government and the Community Government of Whatì, as well as other supportive agencies. The Community Government of Whatì intends to increase by-law enforcement for the first year of operation (Mitigation 1 of PR#96, Appendix D Motion 2015-018).
■ Continuation of the Whatì Inter-Agency Committee[3]. The Whatì Inter-Agency Committee responds to issues related to community preparedness. Issues such as emergency response, social programs, and the community & lands concerns are all brought to this forum. Reasonable discussions about costs, liabilities and insurance will need to be addressed at this forum (Mitigation 6 of PR#96, Appendix D Motion 2015-018).
■ There is a need for locally agreed-upon goals and plans for Community Well-Being. The Whatì Inter-Agency Committee should develop a small set of community based goals of resilience. As an example: A number of local gardens, and the support of a community garden, could be an example, with goals set for 2020 and 2025. The Community Government of Whatì committed to forming a small set of community goals during the 2015 Strategic Planning process (March 6 & 7), and then monitoring progress towards goals over-time (Mitigation 9 of PR#96, Appendix D Motion 2015-018).
■ Annual coordination between the Councils of Whatì and Behchokǫ̀ to ensure that any changes and impacts are being collectively considered, addressed and managed (Mitigation 13 of PR#96, Appendix D Motion 2015-018).
■ The Whatì community emergency plan was updated in 2016, and an Emergency Management Bylaw (147-16) was passed by the Whatì council to address ongoing emergency preparedness (PR#96 TG IR 8.4).
■ To incorporate on-the-land treatment for substance abusers that incorporates guidance from Elders, it is recommended that the Nishi Program be introduced, subject to funding sources.
GNWT Mitigation
■ The TCSA commits to providing more information for local health nurses on a range of health issues, such as sexually transmitted infections, among other issues (Mitigation 12 of PR#96, Appendix D Motion 2015-018).
■ The TCSA has a Social Worker and Mental Health Worker. Neither would actually monitor or keep track of people, but are used more as a means of responding to issues. For example, the social worker would not monitor children, but would respond if someone phoned regarding a child protection matter.
■ The TCSA will be participating in the Healthy Living Fairs in each community in order to provide community specific information and education to all community members. These fairs increase awareness of common infections, diseases and illnesses, and promote a healthy lifestyle.
■ Substance abuse and bootlegging have been identified as a priority by the community of Whatì in their Policing Priorities Action Plan the last two years. By continuing to include these as priorities in both the Whatì Policing Priorities Action Plan and the Community Justice Committee priorities, the Department of Justice Community Justice and Policing division and the RCMP can continue to focus efforts on providing education and awareness around these issues. One such example in 2016 was a community feast during Addictions Awareness Week organized by the Whatì Community Justice Committee with assistance from local RCMP Members (GNWT 2017).
■ In collaboration with the RCMP, each NWT community identifies its annual Policing Priorities and develops an Action Plan based on its priorities, taking into account the financial and human resources available. Working together on an Action Plan enhances communications between partners and increases the level of commitment towards achieving local goals. Communities benefit from this process by being active partners and having a direct role in making their community a safer place to live. If concerns with resourcing are raised, then the RCMP will work with the community to address the issue.
■ The RCMP will conduct patrols and check stops and will inspect vehicles for illegal substances if they have reasonable grounds to do so (PR#7, Table 8-8), and will work to address community-reported bootlegging and trafficking.
■ The GNWT has a number of initiatives in place for the prevention of family violence, including “What Will it Take?”, a territorial-level social marketing campaign aimed at changing attitudes and beliefs about family violence. As part of the campaign, a four-part Rant Series has been developed. The fourth rant, entitled “It’s a Community Issue” is planned to feature members of Tłįchǫ communities. The focus of this fourth rant in the series is on dispelling the myth that family violence is a private matter. People in the community often know when violence is happening and have the right to intervene safely and make a positive difference.
■ The GNWT also has services in place to help victims of family violence, such as the ability to apply for an emergency protection order “24/7”, community-based Victim Services, and funding to support victims of family violence (PR#7, Table 8-8; GNWT 2017).
■ There are no shelters in the Tłįchǫ region, however the TCSA and the GNWT are engaging with the communities to create community specific family violence protocols and response teams. This is done via a contribution agreement between the Department of Health and Social Services and the TCSA to cover the costs associated with community engagement and development of the protocols by a consultant. .
■ RCMP “G” Division has a Family Violence Coordinator position that monitors high risk files, provides training and support to Members responding to family violence situations, and represents the RCMP on family violence committees (PR#7, Table 8-8).</td></tr>
<tr><td rowspan="2">Social Pressures</td><td>Operations – Year-round Access to and from Whatì</td><td>Project operations could increase access to drugs and alcohol, both in Whatì and for those travelling to other communities, exacerbating social pressures</td></tr>
<tr><td>Operations – Year-round Access to and from Whatì</td><td>Project operation and associated social pressures exacerbated by access to drugs and alcohol could increase demand for policing and social services</td></tr>
</table>

[3] The Whatì Inter-agency Committee includes Aurora College, the GNWT-DOT, NWT Housing, the CGW, the Mezi School, Fortune Minerals, Air Tindi, the TCSA, MACA, the RCMP, the Tłįchǫ Government, the GNWT Department of Education, Culture and Employment, and the Tłįchǫ Investment Coprporation (PR#96 TG IR 3.3A).

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Table 5.3-1: Socio-Economic Pathways of Effect (continued)

VSEC	Topic	Indicator	Project Component / Activity	Potential Effects Pathway	Mitigation and Benefit Enhancement Measures
Stable and Healthy Communities	Public Safety	Road safety	Construction – Two to Four year Period	Project construction could increase demand for emergency services in response to construction accidents	**Tłı̨chǫ Government Mitigation** ■ Investigate, with Northwest Tel, areas of no cellular coverage along the road with an aim to increase cell coverage to the full TASR, allowing for emergency communication in the event of an accident. ■ The CGW will continue public education locally to ensure that travellers of the road report when they depart, and when they arrive to track road users in the event of inclement weather (PR#96 TG IR 2.3). ■ The CGW is investigating the establishment of a Community Bylaw Officer to support policing efforts during Project operations to mitigate activities that could result in accidents or emergencies along the road. **GNWT Mitigation** Speed limits aimed at maintaining safe driving speeds for vehicles.
			Operations – Year-round Access to and from Whatì	Project operations could introduce the potential for year-round risk of traffic accidents for those travelling to and from Whatì	
			Operations – Year-round Access to and from Whatì	Project operations could reduce the potential risk of traffic accidents relative to the current winter road, spreading the otherwise temporally concentrated traffic out over the year	
			Operations – Year-round Access to and from Whatì	Project operations could reduce the potential for non-traffic related accidents associated with unstable winter road conditions during seasonal transition periods	
		Protective, emergency and social services	Operations – Year-round Access to and from Whatì	Project operations could improve the efficiency of search and rescue efforts	
			Operations – Year-round Access to and from Whatì	Project operations could reduce the seasonal demand for response services associated with winter road operations and enhance year-round emergency response services	
	Equity and Vulnerability	Food Security	Operations – Year-round Access to and from Whatì	Project operations could improve food security through enhanced year-round access to groceries	Positive Pathways - No mitigation required, no practical benefit enhancement measures identified
		Cost of Living	Operations – Year-round Access to and from Whatì	Project operations could change the cost of living for residents of Whatì	
		Vulnerability	Operations – Year-round Access to and from Whatì	Project operations could influence the vulnerability of those most sensitive to economic pressures	
			Operations – Year-round Access to and from Whatì	Project operations could influence the vulnerability of Youth	**Tłı̨chǫ Government Mitigation** ■ Continuation of the Whatì Inter-Agency Committee. The Inter-Agency Committee responds to issues related to community preparedness. Issues such as emergency response, social programs, and the community & lands concerns are all brought to this forum. Reasonable discussions about costs, liabilities and insurance will need to be addressed at this forum. (Mitigation 6 of PR#96, Appendix D Motion 2015-018). ■ Annual coordination between the Councils of Whatì and Behchokǫ̀ to ensure that any changes and impacts are being collectively considered, addressed and managed (Mitigation 13 of PR#96, Appendix D Motion 2015-018).
			Operations – Year-round Access to and from Whatì	Project construction and operations could influence the vulnerability of Young Women	
			Operations – Year-round Access to and from Whatì	Project operations could influence the vulnerability of Elders	

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Table 5.3-1: Socio-Economic Pathways of Effect (continued)

VSEC	Topic	Indicator	Project Component / Activity	Potential Effects Pathway	Mitigation and Benefit Enhancement Measures
Traditional Use, Cultural and Heritage Resources	Traditional Use and Way of Life	Practice of traditional activities and culture	Operations – Year-round Access to Traditional Lands	Enhanced year-round access to hunting, trapping and fishing areas for harvesters	Positive Pathway - No Mitigation Required
			Construction	Direct disturbance to preferred traditional use areas including culturally significant areas	■ The current layout of the Project footprint will minimize the amount of new disturbance by primarily following an existing trail and intersecting areas previously burned. ■ Disturbance will be minimized by limiting the Proposed TASR corridor to 60 m wide not including the borrow sites and access corridors. ■ Disturbance by the Project will be minimized, such as, by locating construction camps and laydown areas within borrow sites and the ROW. ■ The mitigation strategies recommended by Lands' *Northern Land Use Guidelines* will be considered, which includes best practices for avoiding, minimizing and rehabilitation of impacts to vegetation and topography **GNWT Mitigation** ■ Bridges will mitigate effects to navigability of waterways ■ Suitable road crossings, pullouts and signage should be installed at access points of winter snowmobile trails, or summer ATV trails that intersect the TASR, to ensure that travel is not impeded (PR#28; PR#7).
			Operations – Year-round Access to Traditional Lands	Increased mobility and time spent away from the community may result in changes to traditional way of life and culture	**Tłįchǫ Government Mitigation** ■ Continuation of the Whatì Inter-Agency Committee. The Whatì Inter-Agency Committee responds to issues related to community preparedness. Issues such as emergency response, social programs, and the community & lands concerns are all brought to this forum. Reasonable discussions about costs, liabilities and insurance will need to be addressed at this forum (Mitigation 6 of PR#96, Appendix D Motion 2015-018). ■ Annual coordination between the Councils of Whatì and Behchokǫ̀ to ensure that any changes and impacts are being collectively considered, addressed and managed (Mitigation 13 of PR#96, Appendix D Motion 2015-018). ■ Maintain the K-12 language program in Whatì to encourage retention of traditional language. ■ Explore the possibility of having a medium for youth to express themselves and communicate in Tłįchǫ (e.g., radio show, video programming)
		Quantity or quality of traditionally harvested resources	Operations – Year-round Access to Traditional Lands	Effects to wildlife and fish resulting in changes in the availability of traditional resources for harvesting	Refer to mitigations identified for effects to wildlife and fish.
		Perception of the land by traditional users	Operations – Year-round Access to Traditional Lands	Effects to wildlife and fish resulting in changed traditional perceptions of the land	No practical mitigation
	Harvesting	Competition for resources	Operations – Year-round Access to Traditional Lands	Increased access and use of the region may result in increased harvesting pressure on wildlife and fish by outside harvesters	**Tłįchǫ Government Mitigation** ■ The Tłįchǫ Government will continue to manage cabin construction on Tłįchǫ lands ■ To ensure effective management, the Tłįchǫ Government will investigate the need for regulations and policies to manage the construction of cabins and design of hunting, trapping, and fishing in the area, in order to minimize impacts on local animal populations. The Tłįchǫ Government will work to provide clear guidance on this topic. (Mitigation 10 of PR#96, Appendix D Motion 2015-018). **GNWT Mitigation** ■ GNWT-ENR will enforce the NWT's hunting regulations which are in place to ensure that wildlife is conserved for future generations and that hunting is done safely. ■ GNWT Department of Lands conducted a land use scoping study of the WRMA with an aim to establish land use guidelines in the WRMA (PR#7; GNWT 2017). ■ The GNWT, in collaboration with the Tłįchǫ Government and other planning partners, is in the process of working towards the development of a land use plan for public lands in the Wek'èezhìı Management Area. **Tłįchǫ Government and GNWT Mitigation** The Tłįchǫ Government has the authority and jurisdiction to write laws, develop its own strategies, and maintain a balance between subsistence harvesting and industrial development on its lands (see the Tłįchǫ Agreement and Tłįchǫ Land Use Plan). The Tłįchǫ Government will work with the GNWT to review the mitigations that are developed and considered for managing harvesting impacts that occur as a result of the new all-season access of the TASR. (PR#96 IR 4.3, page 69)
	Heritage and Cultural Resources	Archaeological sites	■ Construction – Two to Four year Period; ■ Operations – Year-round Maintenance and Use	Construction activities and operational maintenance and use of the Project could result in disturbances to archaeological sites	**GNWT Mitigation** Implement the Archaeological Site Find Protocol to provide guidance to employees and contractors conducting ground disturbing operations
		Culturally significant areas	■ Construction – Two to Four year Period; ■ Operations – Year-round Maintenance and Use	Construction activities and operational maintenance and use of the Project could result in disturbances to culturally significant areas	**Tłįchǫ Government Mitigation** The Tłįchǫ Government and/or the CGW will erect signage to prevent damage to culturally significant areas (such as the La Martre Falls)

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5.4 Potential Effects, Mitigation and Benefit Enhancements

5.4.1 Economic Wellbeing

The Project is expected to bring about opportunities for greater connection to larger centres and markets, providing greater access to and, potentially, lower costs of goods and services. The Project's potential to enhance access to out-of-community goods and services, while reducing cost of living, can also have knock-on effects to existing businesses, changing the nature of the goods and services that they offer. The Project would contribute positively to employment through direct opportunities in road construction and maintenance, and through indirect opportunities in other non-road-related industries and businesses benefiting from the enhanced access brought about by a road (e.g., tourism, retail, wholesale).

5.4.1.1 Employment and Economy

- *Project construction and operations would generate employment opportunities and associated incomes.*

Construction planning has not advanced to the stage where firm employment requirements or schedules are available, and a construction contractor has not been selected. However, a general timeline and total annual workforce requirement has been determined for the purpose of assessment. The Project will likely be constructed over a two to four-year period, with workers housed in construction camps while on-shift. The Project would also generate indirect employment opportunities in industries supplying the Project with goods and services. Project construction would generate 266 person-years of combined direct and indirect employment in each of the first two years, translating to approximately $25 million in annual labour income (PR#7 PDR Appendix C).

It is anticipated that there will be capacity in the labour force of Tłįchǫ communities, including Behchokǫ̀ and Whatì, to respond to the Project's demand for construction and construction camp labour, and that the existing labour force possesses many of the skills required for road construction and maintenance, or camp services. Many of the direct employment positions associated with Project construction, including camp operations, will not require advanced levels of training and education. These entry level positions could be targeted to the local labour force that has not completed secondary or post-secondary education. A number of other semi-skilled and skilled positions that require some level of training or certification could be met by both the local labour force already in possession of these qualifications, or by those who take-up existing training programs offered in partnership through the GNWT, the Mine Training Society, and Aurora College.

Existing training efforts by the Tłįchǫ Government, the GNWT, and educational bodies are expected to enhance the ability of the local labour force to capture Project-related employment benefits. A two-week Heavy Equipment Operator course was delivered by the GNWT Department of Municipal and Community Affairs (MACA) in Whatì in July 2016. Training also included a three-week Safety Boot Camp delivered by Mine Training Society staff that provided the trainees with seven safety certifications that will assist them in obtaining employment with this Project (GNWT 2017). All 12 students graduated with a MACA Heavy Equipment Operator certification, and seven received safety certifications from the Mine Training Society (PR#96 TG IR 1). MACA's School of Community Government also delivers a Heavy Duty Operator Skills Development/Enhancement Course where skills such as loading trucks or digging ditches is taught. Course delivery is triggered by request (GNWT 2017). In 2014, the Tłįchǫ Government delivered a Commercial Camp Cook course at the Tłįchǫ Learning and Development Centre ($320,000 delivery costs). Over 12 weeks, eleven students were taught how to prepare food for a large group of people, in a service camp setting, and received certification (PR#96 TG IR 1).

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As per Mitigation 4 of the Tłı̨chǫ Government's Motion 2015-08 (PR#96, Appendix D), an Economic Development Officer will be mobilized to facilitate the ability of local contractors and the local labour force to respond to Project contracting and employment opportunities. The Economic Development Officer will be supported by the TREDWG, which has already identified the construction employment opportunities associated with the Project, along with requisite training.

The Project's construction contractors will be required to adhere to Tłı̨chǫ and northern hiring requirements. As part of the bid process, contractors will be obliged to demonstrate how local labour and businesses will be sourced and used as part of construction activities. Contractors will also be required to identify their approach for communicating to and collaborating with local governments, including Aboriginal governments, on employment and subcontracting opportunities. This targeted approach, along with the pre-emptive labour force training activities lead by the TREDWG, are expected to further maximize the ability of the local labour force to respond to employment opportunities associated with Project construction.

There will be a small number of maintenance and monitoring positions (i.e., approximately six to eight) associated with Project operations. It is expected that some of the construction workforce could be transitioned to operations employment, and that those already involved in the construction and maintenance of the winter road could find operational employment with the Project. The economic evaluation for the Project (PR#7, Appendix C) estimates that, during operations, the Project would require a smaller workforce than that required to build and maintain the winter road, and that Project operations would result in a net reduction in employment of minus 0.7 person years, and an associated net reduction in employment income of $62,000. This reduced employment requirement relative to the winter road could be offset by additional development in tourism brought about by Project operations, and associated growth in businesses supplying the tourism industry.

Project construction and operations are expected to have a positive residual effect on employment and incomes.

- *Project construction could drive the uptake of ongoing training opportunities in the region by those seeking employment.*

The Economic Development Officer will be supported by the TREDWG, which has already identified the construction employment opportunities associated with the Project, along with requisite training. The TREDWG is in the process of developing a catchment plan with Aurora College and the Mine Training Society to train the required workforce, where needed. Community Learning Centers in Whatì, Behchokǫ̀, Gamètì and Wekweètì offer a number of courses that would be pertinent to Project construction employment, such as Heavy Equipment Operator, Transport Truck Driver, construction trades helpers and labourers, cooks and kitchen helpers, shippers and receivers, and Environmental Monitors. Contractors will also be required to provide plans for maximizing on-the-job training opportunities for the local labour force. Training obtained to access Project construction employment opportunities will have a long-lasting benefit on the local labour force, and construction employment will develop transferable skills extending to opportunities beyond the Project's construction phase.

Project construction is expected to have a positive residual effect on the uptake of ongoing training opportunities.

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- *Project operations could enhance opportunity for year-round tourism activities in the region.*

The Project, in and of itself, is not expected to attract people from outside of the NWT. Rather, it would facilitate tourism activities in the region around Whatì, connecting tourists with opportunities to experience the remote, natural setting in which the community lies. The Tłįchǫ Government has developed a local tourism strategy, and the GNWT recently released an Aboriginal Cultural Tourism strategy (GNWT 2016). The TREDWG strategic plan was developed through community consultation, and includes a strategy for improving tourism in Tłįchǫ communities. Specific opportunities in the Tłįchǫ region include:

- Whatì: marketing natural attractions, including Whatì Falls (La Martre Falls)
- Behchokǫ̀: proposal for an Economic Development Officer/Tourism Coordinator
- Gamètì: marketing the bed and breakfast, and constructing a "culture camp"
- Wekweètì: expanding the existing culture camp

These strategies, along with the potential development of local capacity and businesses servicing the tourism industry, could encourage higher levels of tourism in and around Whatì. Ecotourism (e.g., guided outfitting, canoeing, aurora viewing) could, in particular, becoming an increasingly important form of tourism staged out of the community. There is also the potential for the sale of traditional arts and crafts to visitors to the community, creating opportunities in the traditional economy (please refer to Sections 5.4.1.2 and 5.4.3.1 for further discussion of the traditional economy and traditional way of life).

The Project is expected to result in a positive residual effect on tourism activity in the Tłįchǫ region around Whatì.

- *Project construction and operations could support existing local business, and could facilitate the development of new businesses in Whatì.*

The Project is expected to result in capital expenditures during construction of over $150 million (total). Preliminary estimates indicate that 96% would be sourced locally from the Tłįchǫ region, with the remaining 4% being sourced from other parts of the NWT, most likely Yellowknife (PR#7, Appendix C). It should be noted that, while fuel and parts for construction equipment are anticipated to be sourced through an NWT business, the actual producer and supplier of the fuel will not be from the NWT. Removing the cost of fuel and parts, capital expenditures during construction on labour, equipment, materials and engineering design services sourced from the Tłįchǫ region would amount to nearly $122 million, or 80% of the total capital construction cost of the Project (PR#7, Appendix C).

As noted above, the bid process for Project construction will include requirements for contractors to demonstrate their commitment to hiring locally. It is expected that this focus on local content will lend to the prioritization of existing local businesses with the ability to competitively support Project construction contracting requirements. There are a number of local (Tłįchǫ) businesses that could provide services and equipment for Project construction and operations. Some of these businesses have requirements for local and Aboriginal involvement in their workforces. Aboriginal Engineering Ltd., for example, has a requirement that approximately 85% of their workforce will be Aboriginal during Project work, and has a commitment to training and capacity building for the local workforce. Table 5.2-1 provides a breakdown of Tłįchǫ construction and development companies that could

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service Project construction. In prioritizing local content through the contracting process, Project construction could support existing local businesses in Tłı̨chǫ communities.

The TREDWG supports Tłı̨chǫ residents in establishing small businesses, and maximizing contract opportunities associated with Project construction. While it is expected that the majority of the Project's construction contracting needs will be met by existing local businesses, in operation, the Project's growth effect on tourism could lead to indirect development of new businesses in support of the tourism industry. Residents of Whatì have suggested that accommodations and food service could be two growth areas for local business (PR#7, Appendix B).

Project operations is expected to have a positive residual effect on local business development.

- *Project operations could change the nature or viability of some existing local businesses.*

With easier and more cost effective year-round access to larger centres such as Yellowknife, it is anticipated that residents of Whatì will choose to purchase consumer goods outside of their community. This is particularly true if goods such as groceries and household items can be procured at a lower cost in the city relative to the Whatì Community Store. Residents of Whatì have suggested that the Community Store sees a decrease in business during the months when the winter road is in operation (PR#7, Appendix B). With year-round access facilitated by the Project, this seasonal decline in business could translate to an overall reduction in revenue for the Community Store that could threaten its viability.

Several strategies have been proposed with an aim of preventing threats to the viability of the Whatì Community Store, both of which involve changing the nature of the Store's business. The first strategy to maintain store revenues involves transitioning part of the store operations to focus on expediting deliveries between Whatì and Behchokǫ̀, and from Yellowknife to the Sahtu region. A second strategy is to begin to provide wholesale groceries for mineral exploration and operations activities in the region. This second strategy relies, in part, on ongoing mining development such as the NICO Mine. In both scenarios, the main function of the store would change, with the provision of groceries and household goods taking on a secondary, convenience-based role in the community. While Project operations could result in some residents purchasing the bulk of their groceries and household goods in Yellowknife or Behchokǫ̀, the Whatì Community Store would still provide convenient access to every-day items.

Project operations would likely also change the demand for air services currently flying in and out of Whatì. With the more economical option of road travel in place year-round for community residents, many may choose to avoid air travel when visiting family in other communities, or when commuting for shopping, employment or other reasons. As this potential indirect Project effect is dependent on the choices of individual travellers, no practical mitigation measures have been identified.

The Project has the potential to have the residual effect of changing the nature of the Whatì Community Store.

- *Project construction and operation could contribute to GDP and to government revenues from taxation.*

The Project is estimated to have a combined direct and indirect territorial GDP effect of $35 million in the first two to four years of construction (PR#7, Appendix C). Project operations was determined to have a negative annual effect on GDP of minus $174,000 as a result of the lower annual cost of maintaining the Project compared to the annual construction and operation of the current winter road. These figures are preliminary, based on early

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economic modelling of the Project's fiscal effects, and will evolve as Project construction and operations planning advance.

Employment income generated by direct and indirect Project construction and operations employment will be taxed. So too will incomes earned by businesses directly supporting Project construction, and those that are formed indirectly in response to increased tourism facilitated by the Project. This taxation will result in increased government revenues. The Tłįchǫ Government (PR#96 TG IR 6) anticipates that the increase in government revenues associated with the Project, along with the reduced annual capital cost relative to the construction and operation of the winter road, may offset some of the costs associated with mitigating the Project's potential adverse effects, and enhancing benefits to communities.

While the Project has the potential to reduce GDP during operations, taxation is expected to offset potential changes to government revenues. The Project is, therefore, expected to have a positive overall effect on government revenues. This effect is anticipated to be negligible, however, relative to other revenue sources, and so has not been carried forward for residual effects assessment.

5.4.1.2 Traditional and Non-wage Economy

Determining the Project's effect on the economic wellbeing of the people of Whatì as a result of changes to the traditional economy is complex. The Tłįchǫ Government and the GNWT do not calculate the value of the traditional economy in dollars. To do so is culturally unacceptable and efforts to commodify the traditional economy have been largely invalidated by policy makers, Elders, knowledge holders and the academic community[4]. It is illusory and contradictory to the intent of the Tłįchǫ Agreement, as well as core Tłįchǫ cultural values, to try to translate the Tłįchǫ way of life on the land to an economic value. The assessment of the Project's potential effect on the traditional, non-wage economy as related to economic wellbeing focuses, therefore, on changes to the reliance on traditional resources to offset cost of living and provide country foods. Further discussion regarding the Project's potential effects on competition for traditional resources harvested as part of the traditional economy is provided in Section 5.4.3 Traditional Use, Culture and Heritage.

- *Project construction and operations could change the time available for participation in the traditional economy.*

Participation in construction employment may require Tłįchǫ workers to be away from their home community for extended on-rotation periods of time, potentially impacting their time available to participate in traditional hunting, fishing and trapping activities. Construction activities will not be continuous, and will be staggered depending on the stage of road construction. Despite these points, reduced time available for participation in traditional activities by the Project's construction workforce could result in a lower amount of country foods present in Tłįchǫ communities. Further, less time spent undertaking traditional activities with younger generations can impact the transmission of TK and hinder the development of skills required to hunt in the future. This in turn could increase reliance on store-bought foods and could potentially impact food security for those more reliant on country foods such as Elders (discussed further in Section 5.4.2.5).

[4] Non-exclusive examples from this literature include: Brody 1981; Kuokkanen 2011; Natcher 2009, Usher et al. 2003.

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Operations employment is expected to be limited to six to eight maintenance positions. Those employed for ongoing Project maintenance would not work on a rotational basis, and so would not be taken away from their community. Project operation is not expected to result in a change in the time available for workers to participate in traditional harvesting or fishing activities, relative to any other form of wage employment.

Given that the potential for a reduced amount of time to participate in traditional activities during Project construction is, from an economic wellbeing perspective, offset to an extent by enhanced access to goods from outside markets, no beyond-negligible residual effect to the economic wellbeing of the residents of Whatì is anticipated. This pathway has not been carried forward for residual effects assessment. Further discussion of the potential for and nature of the residual effect of less time for participation in traditional activities, relative to traditional use and culture, is provided in Section 5.4.3 and 5.5.3.

- *Project operations could change the role of the traditional economy in the economic wellbeing of Whatì residents.*

The traditional economy plays an important role in the economic wellbeing of residents of Whatì, acting to offset cost of living by providing country foods as an alternative to store-bought groceries. The Project is expected to increase access to traditional harvesting and fishing areas around Whatì for other non-resident users, potentially placing increased pressure on and competition for traditional resources. This in turn could reduce the availability of country foods for home consumption, and increase reliance on store-bought foods to supplement diets. Further, enhanced access to groceries from outside the community year-round could reduce the reliance on country foods in Whatì residents' diets.

To avoid or otherwise mitigate the potential loss of animals, reduced harvesting success, increased costs of food or change in diet, the Tłįchǫ Government will continue to manage cabin construction on Tłįchǫ lands. To ensure effective management, the Tłįchǫ Government will also investigate the need for regulations and policies to manage the construction of cabins and hunting, trapping, and fishing activities in the area, in order to minimize impacts on local animal populations. One of the priorities identified in the GNWT Recreational Leasing Management Framework (RLMF) is to engage in a dialogue with Aboriginal governments about respectful and effective ways to identify and manage rights-based cabins (GNWT 2017).

The Tłįchǫ Government has the authority and jurisdiction to write laws, develop its own strategies, and maintain a balance between subsistence harvesting and industrial development on its lands (see the Tłįchǫ Agreement and Tłįchǫ Land Use Plan). The Tłįchǫ Government will work with the GNWT to review the mitigations that are developed and considered for managing harvesting impacts that occur as a result of the new all-season access of the Project. The Project's effect of increasing access to groceries year-round, and the associated potential for decreased reliance on country foods is predicted to change the role of the traditional economy in the day to day lives of the residents of Whatì. The extent to which this occurs will depend on the response of individuals and households to this enhanced access, and choices around dietary composition. Country food consumption, while potentially reduced, is not expected to be eliminated from the diet of Whatì residents, and will continue to be an important source of nutrition.

The link between the Project and the role of country foods in the economic wellbeing of residents of Whatì is considered to be weak, and no residual effect of a beyond-negligible magnitude is anticipated. This pathway has not been carried forward for residual effects assessment.

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5.4.2 Stable and Healthy Communities

The development of roads in rural areas can bring about a number of social benefits and issues, in addition to their importance to local economies. Specific benefits that have come from year round mobility have included increased opportunity to expand social networks, maintain social ties, and form new connections with previously distant and often inaccessible communities. The ability to travel any time by vehicle has been suggested to reduce the sense of isolation caused by a lack of practical and affordable modes of transport out of the community (i.e., by air) (PR#7, Appendix B). All-weather roads can improve access to healthcare and other services that are more typical of larger centres, and improved transportation routes has the potential to decrease accident rates related to poor road conditions. The increased access brought by new roads also, however, has the potential to result in adverse effects, such as a reduced sense of cohesion in the community, the importation of and access to drugs and alcohol, anxiety about higher crime rates, and a decrease in one's personal sense of safety.

5.4.2.1 Population Sustainability

- *Project operations could help to stabilize the existing Whatì population by removing the need to out-migrate for employment, or for better access to services.*

Out-migration from small communities to larger centres where employment opportunities, services and amenities are more available is an existing trend in the NWT. The Project will provide year-round, ground-based access between Whatì and other communities, including Behchokǫ̀ and Yellowknife. Currently, access is limited to the period of winter road operations, and via costly air transportation during the months when the winter road would otherwise be non-operational. The Project would facilitate commuting between communities for employment, and would provide residents of Whatì with improved access to the services and amenities offered in the larger centre of Yellowknife. This access is not anticipated to increase out-migration from Whatì, as the ability to do so during months when the winter road is operational or by air travel during months when the winter road would otherwise be non-operational exists already. Rather, this year-round connection is expected to alleviate, to some extent, the need to permanently move to Behchokǫ̀ or Yellowknife for those seeking employment opportunities, services and amenities. Over time, the road is expected to increase employment in Whatì, and its proximity to the NICO Project and other exploration sites, could boost employment in the local area.

As noted above, Project construction is expected to yield employment opportunities for residents of Whatì over the two to four year construction period. During operations, the Project is expected to improve tourism opportunities staged out of Whatì, supporting the development of businesses servicing the tourism industry and resulting in associated indirect employment. Further, the Project is expected to create a limited (i.e., six to eight) number of employment opportunities associated with road maintenance during operation, some of which are expected to accrue to the community of Whatì. These Project-related employment opportunities would allow workers from Whatì to remain in their home community while employed, removing the need to out-migrate for work.

While out-migration from Whatì may still occur based on the decisions made by individuals, the Project is expected to have a moderating, positive residual effect on this trend, and could serve to potentially stabilize the community's population.

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- *Project operations and associated economic growth could result in in-migration to Whatì.*

The GNWTBS currently projects a decline in the population of Whatì from 510 residents in 2016, to 507 in 2026. This projection does not consider the development of the Project, or the possibility of other developments in the region (e.g., mineral exploration, infrastructure development). As noted above, the Project is expected to moderate the effect of *out-migration* on this net population decline. The Project is not, however, anticipated to result in substantial *in-migration*. There is the possibility that, during operation, some may choose to relocate to Whatì in the hopes of benefiting from tourism-related employment, or other employment opportunities that develop over time. With the increased connectivity of Whatì to services and amenities in Yellowknife facilitated by Project operations, former residents and other Tłįchǫ may also choose to relocate to the community to regain ties with family residing therein. While the exact number who would choose to in-migrate to Whatì is not known, given the existing size of the community and the relatively modest number of operational employment opportunities, it could be reasonably assumed to be low relative to the existing community population of just over 500 (PR#96 TG IR 10.3). The CGW has indicated that it could manage gradual in-migration of up to 50 families.

The Project is not expected to result in near-future in-migration beyond the threshold of manageability identified by the CGW, or at levels that would result in inflation. The Project's residual effect on in-migration is, therefore, neither assessed as positive nor negative.

5.4.2.2 Use and Maintenance of Infrastructure

- *Project operations and associated in-migration could place additional demand on community services, housing and utilities in Whatì.*

As noted above, Project operation is not expected to result in substantial in-migration to Whatì beyond a level currently manageable by the CGW. In interviews with local authorities, the CGW identified that the municipality could absorb gradually the inclusion of 50 new families in the region, with appropriate planning efforts (PR#96 TG IR 9.3). The Senior Administrative Officer, upon review of the potential for Project-driven in-migration, determined that there is capacity for in-migration to the community without adverse effects to community services (PR#96 TG IR 1). The Project is, therefore, not expected to have an adverse effect on community services that would push them beyond capacity.

A Local Housing Organization has been established in Whatì to assess ongoing housing stock and condition and a Tłįchǫ Government and GNWT housing working group has been established to identify and implement actions to address housing issues in Tłįchǫ communities. Housing stock in Whatì would need to grow in response to in-migration; however, growth could be accommodated. There are 20 to 25 lots in Whatì that are zoned and subdivided for development. Current limitations cited to building more housing units include available skilled labour and trades, high costs of bringing in trades, high costs of building materials, and seasonality of accessing building materials (PR#96 TG IR 9.3). The installation of an all-season road would facilitate construction of new builds in a shorter time frame and at a reduced cost relative to the current winter road scenario. Project operation is, therefore, not expected to adversely affect the housing situation in Whatì, even in the event that it results in limited in-migration (PR#96 TG IR 9.3).

The limited in-migration driven by Project operations is not expected to push utility infrastructure beyond current or planned capacity. Sewage is trucked to storage ponds currently under expansion, which when completed in

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2017/2018 will accommodate a population of 800. Water treatment services in Whatì can currently accommodate a population of 800 (PR#96 TG IR 9.3). In both cases, utility infrastructure could accommodate substantial growth relative to the current community population of just over 500. Project operation is, therefore, not expected to have an adverse effect on utility services in Whatì.

The Project is not expected to push community services, housing, or utilities beyond their current capacity, or beyond a level that is manageable by the CGW, the Tłįchǫ Government, and the GNWT. This pathway has, therefore, not been carried forward for residual effects assessment.

- *Project construction could place additional demand on waste disposal and utility infrastructure in Whatì.*

Project construction planning is not yet at a stage where the demand for solid waste disposal, sewage, and water requirements associated with construction activities and large construction camp operations is known. It is assumed that Project construction will generate demand for these utilities; however, the construction contractor will be required to identify their approach to waste management and utility use as part of the bid process.

Sewage from large camps will be collected in a sewage lift station fitted with floats, switches and then transferred with a macerating pump to a larger holding tank that will be heated and insulated. The Community Government of Behchokǫ̀ has indicated that they are able to perform sewage removal services. The successful contractor will ensure that heated, insulated and bermed effluent watertight storage tanks are installed within the temporary construction camps. These tanks will be large enough to store wastewater generated by a 150-person camp for up to five days given the probability in the region for adverse weather conditions. This should allow for a comfortable cushion in the event that severe weather hampers the travel of mobile equipment.

Sewage from large camp accommodations will be transported via tandem or off-road vacuum trucks to the Behchokǫ̀ sewage lagoon on a daily basis. Tanks on the transport vehicles will be watertight, baffled tanks and will be maintained to the manufacturer's specifications to ensure dependable performance.

It is expected that service agreements will be reached with utility service providers with capacity to respond to Project construction requirements. As a result, no beyond-negligible effect on waste and utility infrastructure is anticipated as a result of Project construction. This pathway has not been carried forward for residual effects assessment.

5.4.2.3 Community Cohesion

- *Project operations could spread seasonal movements in and out of Whatì over a longer period, avoiding the "pulse" facilitated by winter road operation.*

Currently, the winter road acts as a "pressure valve" on the community of Whatì, alleviating the isolation of residents and allowing access to other communities. This relief does not come without some negative consequence. Scoping studies conducted in support of the Project indicate that the concentrated seasonal movement of residents out of the community with the operation of the winter road has deleterious impacts on public safety and community cohesion. Instances of children and Elders being left without care, school absenteeism, drug and alcohol use and associated family and community problems have all been observed as increasing sharply when the winter road becomes operational each year (PR#7, Appendix B; PR#96 TG IRs 1, 2

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and 3). Community members and service providers have suggested that, with access to and from Whatì year-round, this seasonal "pulse" in social pressures could be alleviated. Further, the "ghost town" effect created by the movement out of the community could be reduced as people spread their time out of the community throughout the year. During operations, the Project is therefore expected to have a moderating effect on movements out of the community, and the pulse in social ills associated with the opening of the winter road.

- *Project operations and associated access to and from Whatì could connect families and alleviate isolation.*

Year-round access to and from Whatì as a result of Project operations would allow for free movement of people unhampered by seasonal conditions. Residents of Whatì have indicated that the Project would facilitate visitation of family members in other communities, and allow families to connect with Whatì Elders who may have difficulty leaving the community due to mobility or other health issues (PR#7, Appendix B). Enhanced mobility for residents of Whatì could lift the isolation felt during months when the winter road is not operational. During scoping studies, this effect was of particular importance to youth, who feel that greater connection to the outside world could open them to new experiences and educational opportunities (PR#7, Appendix B). The Project is, therefore, expected to have the positive effect of connecting families and alleviating isolation for some residents of Whatì.

It has also been suggested that year-round, ground-based access to Yellowknife could improve the ease with which relatives who have gone to the city and fallen into drug and alcohol abuse, or those potentially left homeless, could be transported back to Whatì for on-the-land treatment and support (PR#96 TG IR 1). Currently, during months when the winter road is not operating, the only practical option to bring these relatives back to the community is via air transport, which is costly and requires passengers to be fit to fly prior to boarding the plane. This assessment does not assume that the Project would reduce either addictions or homelessness. While the Project could improve the opportunity to bring those struggling with these issues back to Whatì, it is not possible to effectively assess whether this will actually happen.

- *Project operations could increase the presence of outsiders in the community year-round, potentially creating a sense of reduced safety, security and community.*

Enhanced year-round access to and from Whatì as a result of Project operations is not unanimously viewed as positive by residents of the community. Residents define safety and security, in part, in relation to their comfort with isolation, and discomfort with the ability of outsiders to enter their community. Currently, residents know each other, and know who else is visiting the community (PR#7, Appendix B). The potential for outsiders coming into the community via the Project throughout the year is, thus, seen by some as reducing the sense of safety, security and community that currently exists with the relative isolation of Whatì. It has, however, also been suggested that most visitors to the community are expected to come from other Tłįchǫ communities while visiting family, or to be associated with government and ecotourism. These types of visitors to the community are not anticipated to behave in a disrespectful manner (PR#96 TG IR 1). During construction, out-of-area workers will be housed in camp accommodations outside of Whatì, limiting their ability to enter the community. Operations will generate a limited number of employment opportunities that are expected to be filled by the current labour force in Whatì.

To strengthen the sense of security in Whatì, the CGW is investigating the addition of a Community Bylaw Officer. The issue of security will be addressed jointly by the Tłįchǫ Government, the CGW, and other supportive agencies. The CGW will ensure there is increased by-law enforcement in place for the first year of operation (PR#96,

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Appendix D Mitigation 1). Given the nature of visitors to the community and mitigations, the Project is not expected to result in an increase in the number of undesirable residents in the community. Perceptions that Whatì is less safe and secure, may persist, despite measures to make the community safe. Ongoing reporting of incidents and improved confidence in policing can help to alleviate lingering concerns regarding community safety.

- *Project operations could increase access to drugs and alcohol, both in Whatì and for those travelling to other communities, exacerbating social pressures.*

It has been noted that access to drugs and alcohol is already an issue in Whatì (PR#96 TG IR 1). Community members have expressed concern that the Project could exacerbate the existing drug and alcohol problem in the community, particularly as related to access by youth. Concern has also been raised that any increase in substance abuse could also impact other social pressures such as rates of teen pregnancies, sexually transmitted infections (STIs), child neglect and abuse, fetal alcohol spectrum disorder, domestic violence, and crime, and the services in place to deal with each (PR#7, Appendix B). Youth in specific expressed concern regarding the possibility of absentee parenting in the event that parents leave the community to go drinking in Yellowknife or Behchokǫ̀.

As drugs and alcohol are already being brought into the community year-round via other modes of transport (e.g., mail, snowmobiles, boats), service providers have suggested that the Project would not likely change the current seasonal drug and alcohol dynamic in Whatì (PR#96 TG IR 2). The ability of the Project to change the *current market* for drugs and alcohol in the community is, therefore, considered limited. Easier and faster transport via the Project could have the effect of increasing access to drugs and alcohol, though road travel does involve greater risk of being stopped by RCMP patrols, relative to transporting drugs by boat or snowmobile. Increased year-round access to other, larger communities where drugs and alcohol may be more accessible could contribute to substance abuse by individuals travelling between communities and Whatì.

The Tłı̨chǫ Government will implement mitigations aimed at reducing the potential for increased abuse of drugs and alcohol. It has been recommended that on-the-land treatment for substance abusers be addressed by the TCSA through the introduction of the Nishi Program (PR#96, Appendix D Mitigation 2). The CGW is currently reconsidering the prohibition of alcohol in Whatì in favour of more proactive resilience strategies for managing alcohol and drug consumption in the community, in consultation with the TCSA and the RCMP (PR#96, Appendix D Mitigation 3), and has committed to forming a set of community goals and monitoring progress towards meeting them (PR#96, Appendix D Mitigation 9). The TCSA has committed to providing more information for local health nurses on a range of health issues, which could include treatment for and awareness of substance abuse and associated risks (PR#96, Appendix D Mitigation 12). There will also be annual coordination between the Councils of Whatì and Behchokǫ̀ to ensure that changes to the community, including those associated with drug and alcohol abuse, are being addressed and managed (PR#96, Appendix D Mitigation 13).

In collaboration with the RCMP, each NWT community identifies its annual Policing Priorities and develops an Action Plan based on its priorities, taking into account the financial and human resources available. Working together on an Action Plan enhances communications between partners and increases the level of commitment towards achieving local goals. Communities benefit from this process by being active partners and having a direct role in making their community a safer place to live. If concerns with resourcing are raised, then the RCMP will work with the community to address the issue.

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Substance abuse and bootlegging have been identified as a priority by the community of Whatì in their Policing Priorities Action Plan the last two years. By continuing to include these as priorities in both the Whatì Policing Priorities Action Plan and the Community Justice Committee priorities, the Department of Justice Community Justice and Policing division and the RCMP can continue to focus efforts on providing education and awareness around these issues. The RCMP will conduct patrols and check stops and will inspect vehicles for illegal substances if they have reasonable grounds to do so (PR#7), and will work to address community-reported bootlegging and trafficking.

Alcohol and drug use often coincides with family violence and abuse. The GNWT has a number of initiatives in place for the prevention of family violence, including, "What Will it Take?", a territorial-level social marketing campaign aimed at changing attitudes and beliefs about family violence. As part of the campaign, a four-part Rant Series has been developed. The fourth rant, entitled, "It's a Community Issue", is planned to feature members of Tłı̨chǫ communities. The focus of this fourth rant in the series is on dispelling the myth that family violence is a private matter. People in the community often know when violence is happening and have the right to intervene safely and make a positive difference.

The GNWT also has services in place to help victims of family violence, such as the ability to apply for an emergency protection order "24/7", community-based Victim Services (PR#7). There are no shelters in the Tłı̨chǫ region, however the TCSA and the GNWT are engaging with the communities to create community specific family violence protocols and response teams. This is done via a contribution agreement between the Department of Health and Social Services and the TCSA to cover the costs associated with community engagement and development of the protocols by a consultant. The RCMP "G" Division has a Family Violence Coordinator position that monitors high risk files, provides training and support to officers responding to family violence situations, and represents the RCMP on family violence committees (PR#7). These approaches to building healthy families and communities are expected to limit, to some extent, the deleterious effects of increased year-round access to drugs and alcohol that could, potentially, occur during Project operations.

- *Project operation and associated social pressures exacerbated by access to drugs and alcohol could increase demand for policing and social services.*

Should Project-related access to drugs and alcohol exacerbate substance abuse and associated social pressures, it could be expected that there would be a change in the demand for services in place to address them. The RCMP detachments in Behchokǫ̀ and Whatì currently deal with a high volume of issues associated with addictions and related criminal activity, particularly during the months when the winter road is open. It has been suggested that the Project will alleviate some of this seasonal pressure, but also that it would increase year-round demand for policing and social services associated with drugs and alcohol beyond current levels. This increased pressure is expected to be greatest in the first year of operations when the Project and the access it creates is likely to be of great novelty, potentially requiring additional RCMP check stops in Whatì (PR#96 TG IR 1).

5.4.2.4 Public Safety

- *Project construction could increase demand for emergency services in response to construction accidents.*

Project construction activities could result in accidental injury to workers requiring emergency medical care. While the occurrence of these is not predictable with accuracy, preventative actions can be developed pro-actively to

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address public concern and reduce risk of accidents. The selected contractor will construct the Project with the highest standard of health, safety and risk management. Driver and equipment operator safety training can minimize the risk of traffic and construction accidents. Project risk management and emergency response planning pre-emptively establishes procedures to minimize risk of injury to workers, communities, and the environment associated with construction-related accidents. Access to areas of active construction activities will be secured to prevent public access and potential resultant injury. Despite best efforts on the part of the construction contractor to mitigate the risk of construction-related incidents, accidents or emergencies, by their very nature, may still occur. This assessment does not attempt to determine the probability with which such accidents could occur, but rather identifies their potential as an effect during construction.

- *Project operations could introduce the potential for year-round risk of traffic collisions for those travelling to and from Whatì.*

The Project is expected to increase year-round traffic between Whatì and Highway 3 relative to months when the winter road is currently not in service. Traffic is expected to consist of vehicle trips by Whatì residents and visitors, including relatives, government representatives, and tourists, and traffic associated with the transportation of goods. Daily traffic using the Project is expected to be between 20 and 40 vehicles (PR#7). When combined with existing average daily traffic on the winter road, the total daily traffic volume on the TASR is expected to be well within the 200 vehicle trips per day that the Project is designed to accommodate. The commute between Whatì and even the closest community connected by road (e.g., Behchokǫ̀) will be of a long distance, similar to that of the existing winter road. Those travelling to and from farther away (e.g., Yellowknife) will experience an even lengthier commute. Concern has been expressed that these long-distance commutes impart greater risk of traffic collisions associated with inclement weather conditions, poor visibility at night, and fatigue (PR#7, Appendix B; PR#96 TG IR 1). By creating year-round access, the Project has the potential to introduce additional risk of traffic accidents associated with lengthy commutes during months when the winter road is not operational.

To mitigate the risk of traffic accidents to the extent possible, speed limits aimed at maintaining safe driving speeds for vehicles will be in place during operation. The Tłįchǫ Government will investigate, with Northwest Tel, areas of no cellular coverage along the road with a goal of increasing cellular coverage to the full TASR, allowing for emergency communication in the event of an accident. The CGW will continue public education locally to ensure that road travellers report when they depart, and when they arrive to track road users in the event of inclement weather (PR#96 TG IR 2.3). The CGW is investigating the establishment of a Community Bylaw Officer to support policing efforts during Project operations to mitigate activities that could result in accidents or emergencies along the road. While these mitigations are expected to help limit the potential for traffic accidents, by their very nature, they may still occur.

- *Project operations could reduce the potential risk of traffic accidents relative to the current winter road, spreading the otherwise temporally concentrated traffic out over the year.*

It has been observed that the seasonality of the current winter road places pressure on residents of Whatì to exit the community while conditions allow, concentrating traffic volumes within the short window of winter road operations (PR#7, Appendix B; PR#96 TG IR 2.3). Since 1989, there have been seven traffic accidents on the winter road, none of which resulted in a fatality (PR#96 TG IR 1). By removing the need to conduct all road-based travel within this window, the Project is expected to reduce the risk of traffic accidents relative to operation of the

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current winter road. Mitigation measures identified above aimed at reducing the risk of accidents year-round will act as benefit enhancement measures relative to the Project's positive effect on the potential for traffic accidents compared to winter road operations. As with the potential for increased accidents during months when the winter road would otherwise be non-operational, this assessment does not attempt to determine with reasonable certainty the probability of reduced accidents during months when the winter road would otherwise be in operation.

- *Project operations could reduce the potential for non-traffic related accidents associated with unstable winter road conditions during seasonal transition periods.*

Residents of Whatì have been known to use the winter road route during transitional periods between seasons when the operational safety of the winter road is uncertain (PR#96 TG IR 2.3). This has created the risk of non-traffic-related accidents and emergencies associated with poor road conditions. Residents are at times pushed to this option in the event that they require emergency resupply of goods from other communities (PR#7, Appendix B). The Project would not only remove the requirement for this sort of seasonally-driven emergency resupply trip, but would also provide a ground-based transportation option that is maintained in safe operating condition year-round. The Project would thus remove this seasonal risk, benefiting road users.

- *Project operations could improve the efficiency of search and rescue efforts.*

Currently, travel along the winter road and on snowmobile paths during the winter results in the need for search and rescue activities. Each year, around six search and rescue efforts are conducted during the winter at a cost of between $15,000 and $200,000 (for extensive efforts). By addressing the risk of accidents during periods of seasonal transition and associated degradation of the condition of the winter road, the Project may reduce the need for search and rescue activities associated with those left stranded by vehicles and snowmobiles that get stuck. The Project will also provide a year-round, all-season route between Whatì and Highway 3, potentially reducing the use of alternate snowmobile pathways when the winter road is not operational. It has been suggested that, while search and rescue activities will likely still be required, if snowmobile traffic is more concentrated along the Project route, the efficiency of these efforts may be improved (PR#96 TG IR 2.3).

- *Project operations could reduce the seasonal demand for response services associated with winter road operations and enhance year-round emergency response services.*

As noted above, the Project is expected to reduce the current flux in traffic and potential for accidents and emergencies associated with the operation of the winter road. This in turn is expected to alleviate some demand for emergency services during this period. The same is true during periods of seasonal transition, again as discussed above in relation to traffic safety. During months when the winter road would otherwise be non-operational, the Project will provide enhanced access to the community of Whatì for emergency services personnel and equipment from Behchokǫ̀ and Yellowknife, in the event of in-community emergencies.

There has yet to be discussion of the emergency response capabilities of Whatì in relation to Project operations, however the Whatì community emergency plan was updated in 2016, and an Emergency Management Bylaw (147-16) was passed by the Whatì council to address ongoing emergency preparedness (PR#96 TG IR 8.4). There is interest in expanding the current capacity of firefighting services and personnel in the community, in consultation with the GNWT and any other emergency response departments/organizations (PR#96 TG IR 7.7). Whatì currently

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does not have ambulance certification and cannot provide this service, but has obtained a patient transport vehicle (2014) which is currently in operation. The nearest ambulance service is the community of Behchokǫ̀, where the TCSA maintains three ambulances in the community (PR#96 TG IR 7.5). The Community Governments of Behchokǫ̀ and Whatì will seek to enter into discussions with the GNWT and other emergency response departments and organizations to ensure a strategy is in place for emergency response measures along the Project route (PR#96 TG IR 8.1).

The CGW is investigating the establishment of a Community Bylaw Officer to support policing efforts during Project operations to mitigate activities that could result in accidents or emergencies along the road (PR#96, Appendix D Mitigation 1). The Whatì Inter-Agency Committee[5] will continue to function during Project operations. The Committee responds to issues related to community preparedness. Issues such as emergency response, social programs, and the community and lands concerns are all brought to this forum. Discussions about cost, liability and insurance will need to be addressed at this forum, in relation to the provision of emergency response services during Project operations (PR#96, Appendix D).

5.4.2.5 Equity and Vulnerability

Vulnerability is "a situation or condition characterized by low resilience and/or higher risk and reduced ability of an individual, group or community to cope with shock or negative impacts … associated with having low socio-economic status, disability, ethnicity, or one or more of the many factors that influence people's ability to access resources and development opportunities" (PR#96 TG IR 3B). According to community members in Whatì, the most vulnerable groups in Whatì include youth, young women, and Elders (PR#7, Appendix B).

- *Project operations could improve food security through enhanced year-round access to groceries.*

As noted above, the Project will provide residents of Whatì with year-round access to lower-cost goods in Yellowknife, and is expected to result in a reduction in the cost of goods in-community. The reliability of access to groceries is also expected to improve with the Project, as an on-ground, year-round transportation corridor removes the need to stockpile goods when the winter road is not in operation, and addresses the risk of grounded freight flights due to inclement weather. This increased access to and reduced cost of groceries is expected to improve food security year-round for residents of Whatì.

- *Project operations could change the cost of living for residents of Whatì.*

Current total spending by residents of Whatì is estimated at $11.9 million annually (PR#7, Appendix C). Transportation of goods and people via the winter road and air transport is estimated to represent 6% of this spending. If the Project resulted in a reduction in the cost of transportation of goods and people to the national economy-wide average of 3.4% of total spending (Statistics Canada 2006), this would amount to a $342,000 reduced total cost of living annually in Whatì (PR#7, Appendix C). Dividing this total community-level cost of living reduction by the population of Whatì does not, however, translate to a realistic cost of living reduction per

[5] The Whatì Inter-agency Committee includes Aurora College, the GNWT-DOT, NWT Housing, the CGW, the Mezi School, Fortune Minerals, Air Tindi, the TCSA, MACA, the RCMP, the Tłı̨chǫ Government, the GNWT Department of Education, Culture and Employment, and the Tłı̨chǫ Investment Coprporation (PR#96 TG IR 3.3A).

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community resident. No such estimate has been made in this assessment as, depending on the spending habits of individuals and families, the Project's potential to reduce cost of living varies greatly.

The Project would result in a lower per-trip cost for the transportation of people between Whatì and other communities relative to air transportation. However, if the Project results in a greater number of trips due to the less prohibitive cost per trip, depending on the number of trips out of the community per individual or family, cost of living associated with the cost of transportation of people could remain unchanged or, potentially, increase.

Conversely, the Project is expected to have a positive effect on the cost of goods and services brought into the community. Lower transportation costs for goods could yield a reduction in the cost to consumers purchasing from the Whatì Community Store, even in the event that the nature of the store's business changes as predicted in Section 5.4.1.1. An all-year, ground-based shipping corridor between Whatì and Yellowknife would create a more reliable means of delivering goods, and could result in less need for bulk purchase of food items by the Whatì Community Store during the winter, and associated potential for price-influencing spoilage and waste. Further, for those purchasing goods in Yellowknife where costs are lower relative to those currently in place at the Whatì Community Store, cost of living could decrease. This decrease in the cost of living associated with the purchase of household goods assumes that Whatì residents' demand for goods would remain constant, and that people would not buy a greater quantity of items in response to a lower cost.

Given that the Project is not expected to result in substantial in-migration (please refer to Section 5.4.2.1 for further discussion of potential Project population effects), and so is not expected to adversely impact the cost of housing and goods in Whatì, inflation during construction or operations is not expected. The residual effect of the Project on cost of living is, therefore, expected to be positive.

- *Project operations could influence the vulnerability of those most sensitive to economic pressures.*

The Project is not expected to result in the in-migration of non-Tłįchǫ to Whatì, although it has some potential to result in Tłįchǫ, including former Whatì residents, relocating to the community (described further in Section 5.4.2). The CGW has indicated that it could manage gradual in-migration of up to 50 families, and Project-driven in-migration is not expected to exceed this threshold. As a result, the Project and any induced in-migration is not expected to result in price inflation or increases in the cost of living and housing in Whatì. The Project is expected to reduce cost of living in Whatì, and to improve food security. This is of potential benefit to those vulnerable to fluctuations in the price of household goods and groceries (e.g., Elders, young families, the unemployed). Much of the housing in Whatì is subsidized by the GNWT, and available for those on the lowest economic margin of the community including those identified as vulnerable. Incidental increases in the cost of housing in the community would be seen in market housing, and so would not be expected to affect those most vulnerable.

- *Project operations could influence the vulnerability of Youth.*

Scoping studies in support of the Project indicate that residents of Whatì are most concerned about increased vulnerability of youth as related to absentee parenting, school absenteeism, pressure to use drugs and alcohol, and transmission of cultural traditions and language (PR#7, Appendix B).

Community members in Whatì, and in particular youth, have expressed concern that the Project could result in more frequent instances of children being left alone while their parents travel to other communities to procure

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supplies, or for more detrimental purposes such as drinking and gambling (PR#7, Appendix B). Service providers have suggested that, in lessening the pressure for adults to leave Whatì during the short period of winter road operations, the Project is expected to have a positive, limiting effect on the current spike in absentee parenting, and is expected to reduce incidences of children being put in alternative care, child apprehension, and involvement of social services during the winter road season (PR#96 TG IR 2). There remains the potential, however, that increased access facilitated by the road during months when the winter road would otherwise be non-operational could result in an increase in these issues relative to current seasonal conditions. While planning efforts on the part of the Whatì Inter-Agency Committee work to address the symptom of absentee parenting, mitigations identified in Section 5.4.2.3 aimed at reducing the implication of increased access to drugs and alcohol, and associated periods out of the community could limit the knock-on effect of children being left at home alone.

There is strong concern from the community that this same access could adversely affect student attendance at the local school. Educators identified higher rates of school absenteeism as an issue during winter road operation. While, as with parental absenteeism, the Project could serve to limit this seasonal spike, it also represents an increased opportunity for students to leave the community during months when the winter road would otherwise be non-operational, potentially resulting in lower school attendance year-round (PR#7, Appendix B). The Councils of Whatì and Behchokǫ̀ will coordinate annually to ensure that any changes to the community, including those associated with school absenteeism, are being collectively considered, addressed and managed (PR#96, Appendix D Mitigation 13).

As with the general population, the Project could increase access to drugs and alcohol for youth (please refer to Section 5.4.2.3 for further discussion of the mechanisms through which the Project could potentially influence drug and alcohol abuse, and associated mitigations). Community members raised specific concern about youth accessing drugs and alcohol both in the community and outside, and have suggested that they are particularly vulnerable to this adverse effect. Abuse of drugs and alcohol by youth can compound other vulnerabilities, impacting educational performance, health, and development. Youth are likely more susceptible to pressure to abuse these substances, and any increase in the potential increase in access to and use of is considered to be a serious concern by the community (PR#7, Appendix B).

The TCSA is engaging with the communities to come up with a plan on how to work together to address social issues, including use of drugs and alcohol by youth. There is a contribution agreement with the Department of Health and Social Services to cover the costs of working with communities for these services. The Tłįchǫ Government will also implement mitigations aimed at reducing the potential for increased abuse of drugs and alcohol by youth. The CGW is currently reconsidering the prohibition of alcohol in Whatì in favour of more proactive resilience strategies for managing alcohol and drug consumption in the community, in consultation with the TCSA and the RCMP (PR#96, Appendix D Mitigation 3).

The TCSA has committed to providing more information for local health nurses on a range of health issues, which could include treatment for and awareness of substance abuse and associated risks (PR#96, Appendix D Mitigation 12). There will also be annual coordination between the Councils of Whatì and Behchokǫ̀ to ensure that any changes to the community, including those associated with drug and alcohol abuse by youth, are being collectively considered, addressed and managed (PR#96, Appendix D Mitigation 13).

Youth have suggested that they are at risk of losing their connection to their cultural heritage, and that increased year-round opportunities to leave the community associated with Project operations could further this risk (PR#96

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TG IR 3.1B and 3.2B). There is concern about changes to their ongoing knowledge and retention of Tłı̨chǫ language and culture. With increased access to other activities outside of the community, some youth suggest that they would not participate in traditional hand games and drumming, or be involved in culture activities and gatherings as regularly. Time spent in places like Yellowknife where Tłı̨chǫ is not spoken as widely could limit the chances youth have to speak the language, and would expose them to outside cultures (PR#7, Appendix B). While youth are at particular risk of losing their connection to their cultural roots, this is an overarching potential effect of development and increased interaction with outside communities and cultures. The importance of and response to this potential effect to the people of Whatì is not appropriately determined through the process of residual effects assessment, and instead will be monitored and addressed by the Tłı̨chǫ themselves.

- *Project construction and operations could influence the vulnerability of Young Women.*

Concern has been raised about increased rates of STIs and teen pregnancies during construction, relative to interaction between the out-of-area construction workforce and young women (PR#7, Appendix B). Construction camps will be located outside the community boundaries of Whatì and Behchokǫ̀. Further, much of the construction workforce is expected to be drawn from the Tłı̨chǫ region, and so will be residents of the communities. The potential for an out-of-area Project construction workforce to influence rates of STIs or teen pregnancies in communities is, therefore, not considered to be likely. Project operations is expected to employ a small (i.e., six to eight) number of people, all of which are expected to be drawn from the local labour force. It is similarly not expected that this home-community workforce would influence rates of STIs or teen pregnancies in Whatì.

The Project's operational effect of enhanced year-round access to and from Whatì has the potential to have both positive and negative effects on young women. There is the concern that increased access to and from the community for young women and outsiders could adversely affect incidences of STIs and teen pregnancies (PR#7, Appendix B). Conversely, it has also been suggested that year-round access would alleviate the pressures created by the limited window of seasonal access via the winter road, and that the associated social ills and "frenzied activity" may be less pronounced. Hope has been expressed that enhanced access to programs and services could provide better education for young men and women regarding sexual health(PR#7, Appendix B; PR#96 TG IR). To avoid potentially deleterious operational effects on the sexual health of young women, the Whatì Inter-Agency Committee has identified a need for greater focus from the TCSA on the provision of programming around sexual health awareness for young women. This programming would also be extended to providing sexual health education for young men. This assessment does not presume to determine how individuals will respond to such programming, and does not impose a determination of the direction or magnitude of the Project's operational effect on the sexual health of young women. Rather, it is acknowledged that Project operations could represent both benefits and risks with this aspect of the vulnerability of young women.

Further concern has been raised regarding the potential for the abduction and, potentially, sexual assault of young women hitchhiking along the Project route during operations. It is considered likely that hitchhiking would increase with the installation of a year-round road. While checking in with relatives or other contacts upon departure and arrival can aid in tracking the safe arrival of all road users, including young women, it does not mitigate the risk of abduction itself. Continued education of the hazards of hitchhiking and safe road use can help to prevent the development of an otherwise unsafe situation for young women walking along the Project's operational route. Women potentially fleeing abusive situations in the community can be encouraged to have a 'safety plan' in place so that they are not forced to hitchhike or accept rides from strangers. Despite such effort to enhance awareness

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of the dangers associated with hitchhiking, the risk still remains. Attempting to assess the magnitude of this risk is inappropriate, as it cannot be assumed that abductions will or will not happen simply for the purpose of effects assessment. Rather, this assessment acknowledges the introduction of this risk to the vulnerability of young women during Project operations.

- *Project operations could influence the vulnerability of Elders.*

Elders have suggested that the largest risks posed by Project operations are associated with the potential for lack of support from younger generations, and decreased food security (PR#7, Appendix B).

Community members have suggested that the Project could, as discussed above, result in a "ghost town" effect in the event that people leave the community, particularly on the weekends, and that this could leave many vulnerable Elders unsupported (PR#7, Appendix B). It is felt that fewer people would be available to bring Elders fire wood and country foods, or to assist with day to day chores and care. Elders expressed concern that, with increased year-round access to and from the community, there won't be young people around to help them (PR#7, Appendix B). If entire families choose to leave the community for extended visits elsewhere during the months when the winter road would otherwise be non-operational, this could result in a loss of communication with Elders, affecting the connection of younger generations with their cultural roots (PR#96 TG IR 3).

Protecting Elders has been identified as one of the highest priorities for the community of Whatì in response to development, including the Project (PR#7, Appendix B). Scoping studies in support of the Project suggest that economic marginalization of Elders is already a recognized issue in the community. There are strong concerns amongst some Elders that they could be particularly vulnerable should the Project result in increased inflation, cost of living, or a reduction in the availability of country foods to offset the cost of groceries. Further, Elders have expressed concern that they will also not be able to benefit from the economic and employment opportunities associated with Project construction and operations, and so cannot offset the adverse effects of economic growth.

While the Project is not expected to result in increased inflation, and will actually have a positive effect on the cost of living in Whatì , there remains the potential Project effect of a decreased reliance on the traditional economy for the provision of country foods offsetting the cost of store bought foods. While this can be a neutral effect for many, for Elders relying on country foods provided by relatives for sustenance, a reduction in the availability of country foods in the community due to less time or need for participation in traditional harvesting could jeopardize their food security. While some may have their diets supplemented by store-bought food provided by family members, those without support could still be at risk. While Old Age Security and Guaranteed Income Supplement payments are made to senior Elders over the age of 65, and can offset this risk to some extent, there are those under this age that are still highly dependent on country foods.

5.4.3 Traditional Use, Culture and Heritage Resources

5.4.3.1 Traditional Use and Way of Life

Effects on Traditional Use, Culture and Heritage Resources include both direct and indirect effects. For the purposes of this assessment, direct effects are related to changes in access to traditional use areas, including culturally significant sites (e.g., spiritual, grave sites), or disturbance to land that would result in the land no longer being available for traditional activities. Direct effects also include direct disturbance (i.e., alteration, damage or destruction) to heritage or cultural resources.

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Indirect effects are related to changes in the availability of traditional resources, such as wildlife and fish used by traditional harvesters. Indirect effects are therefore related to residual adverse effects on other aspects of the environment, such as changes in the quantity, or abundance and distribution of wildlife and fish resources, and changes in the quality of these resources. As a result, the assessment of Project effects on Traditional Use, Culture and Heritage Resources considers the results of effects assessments of VCs for Wildlife and Wildlife Habitat (Section 4.3) and for Fish and Fish Habitat (Section 3.3). For culturally significant areas, indirect effects include landscape disturbances reducing connection to the cultural landscape or specific traditional use sites based on changes in quality (e.g., noise, visual or dust disturbance). Indirect effects are also related to changes in traditional use or value of traditional use areas based on people's changed perceptions of the land or resources.

This assessment also considers the intangible aspects of Traditional Use, Culture and Heritage Resources, such as connection to land, transfer of TK, and continued practice of the Indigenous way of life on the land, which are important considerations for Indigenous people in the WRMA (PR#7). By enhancing access to traditional use areas, the Project plays a role in the connection of people, including youth, to their culture. The ability of the Project to reduce isolation is discussed further in Section 5.4.2.3 above.

- *Enhanced year-round access to hunting, trapping and fishing areas for harvesters.*

The Project is situated in an area that has been used by the Tłįchǫ since time immemorial and is still used extensively for traditional and cultural activities, as evidenced by the vast network of overland trails and water routes extending throughout the region (PR#28; PR#7 Appendix B). The TK study results indicated several hunting, trapping, fishing and berry picking areas, and culturally important sites such as travel routes, cabins, camp sites, grave sites, and sacred sites that overlap with the Project footprint and wider region (PR#28 Maps 4 and 5). NSMA members also indicated that the Project area is used for hunting, trapping and fishing and other traditional purposes (PR#98 NSMA IR).

The proposed road predominantly follows the old Airport Road, defined by Tłįchǫ Elders as K'àgòò tįlìì, meaning tractor trail, and is currently used by Tłįchǫ community members and other NWT residents via snowmobiles, dog sleds, ATVs and trucks in some parts (PR#7). The K'àgòò tįlìì is located in an important harvesting area itself and is used by harvesters to access other hunting and trapping areas, along numerous intersecting trails running east-west (PR#28). Whatì community members identified one of the potential benefits of an all-weather road as improved community access to the old military road area, potentially increasing Tłįchǫ hunting and trapping in the area (PR#7, Appendix B 2015). NSMA members stated that the TASR would considerably increase access to the numerous water routes that will be crossed by the TASR (PR#98 NSMA IR). These perceived benefits are supported by the results of the literature review on the impacts of all-weather-roads introduced in remote regions showing improved access to water resources, berries, hunting grounds, fishing holes, and trapping areas (PR#7, Appendix B). Operation of the TASR is expected to lead to increased use and facilitate access to the existing trail network used by Tłįchǫ and NSMA harvesters, and to preferred traditional use areas and potentially other new hunting, trapping and fishing areas in the region by opening new territory previously inaccessible most of the year. The opportunity to explore new land use areas is expected to promote increased participation in traditional activities among Tłįchǫ community members, particularly younger harvesters who are interested in expanding their understanding of the cultural landscape and in discovering new areas with valuable wildlife and fish harvesting opportunities over previously inaccessible areas (PR#97 IR 2).

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- *Direct disturbance to preferred traditional use areas including culturally significant areas.*

Construction activities will result in direct disturbance to the land, which may result in areas no longer being available for traditional or cultural use. As previously described, the proposed TASR predominantly follows the Old Airport Road locally known as K'àgòò tįlìì, which is still used by Tłįchǫ and other NWT residents today, and therefore the alignment has remained disturbed (PR#7). The disturbance level along the route varies based on ease of access and terrain type. According to Tłįchǫ Elders, the route is considered a 'tractor trail' and is not considered as culturally significant as an Ancestor trail, which was built directly by Tłįchǫ Elders (PR#7). Direct disturbance to culturally important sites from Project construction activities is discussed in Section 5.4.3.3 (Heritage and cultural resources).

The Project will cross two major rivers considered culturally important to Tłįchǫ; Tsotìdeè (La Martre River) which is used extensively during the summer as a canoe/boat route and for hunting and fishing, and during the winter as a snowmobile route and for hunting and trapping, and the Ɂehtł'ètìdeè (James River), which is used for trapping during the summer and winter, and for fishing. Tsotìdeè (La Martre River) is accessed at T'oohdeehotee, an important portage site used during the summer and winter, and located where the existing route of K'àgòò tıլıı̀ crosses Tsotìdeè. The Elders stressed the importance of not disturbing this portage site, and ensuring that the Tsotìdeè (La Martre River) is unobstructed during construction to maintain access during the summer and winter (PR#28). The Project will be designed to avoid direct disturbance of Tsotìdeè (La Martre River) through the construction of a bridge approximately 240 metres northwest of T'oohdeèhoteè (PR#7). A bridge will also be constructed at Ɂehtł'ètìdeè (James River), therefore navigability of both river travel routes will be maintained (PR#7).

Spring and summer trapping areas for beaver and muskrat are not anticipated to be affected by the Project since most of these trails follow a north-south direction near Boyer and Mud Lakes and are located approximately 3.5 km from the Project footprint (PR#7). Spring and summer trapping also occurs along La Martre River into James Lake. The Project footprint crosses this trapping area near La Martre River portage site, where a bridge will be installed, therefore it is unlikely that this trapping area will be affected due to direct disturbance (PR#7).

Winter trapping for wolverine, marten and lynx occurs over a wide area, and several traditional use areas intersect with the Project footprint. Winter trapping areas identified in the TK study follow La Martre River and the Màa tıլlıì trail into James Lake, and along the Campbell trail which intersects with the TASR near James River. Whaàhdòò etò, meaning Ancestor's trail, extends southwest from Marian Lake to Łıetı and intersects with the Project footprint at approximately KM 45.2 and continues west towards the Horn Plateau Fort Providence areas, and an Ancestor Trail travels from Behchokǫ̀ to Joe Migwi's cabin site (within the first 8 km of the proposed road) and continues westward (PR#7). Construction of the TASR is estimated to take between two to four years and will occur year-round, and different sections of the road will be constructed at varying times, depending on engineering and design components (PR#7). Construction activities should not affect access to winter trapping areas that intersect with the Project footprint, since snowmobiles will be able to travel around construction equipment. During operations, access along winter routes will be maintained with the installation of bridges over the La Martre River, James River and the Whaàhdòò etò trail (PR#7). Suitable road crossings, pullouts and signage should be installed at access points of other winter snowmobile trails, or summer ATV trails that intersect the TASR, to ensure that travel is not impeded (PR#28; PR#7). Safety concerns of vehicles on the TASR and users of the land will play a key role in the design and implementation of any access points during both construction and operation.

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A minimal loss of moderate to high wolverine habitat will occur within the entire wolverine range; therefore, harvesters will still be able to access preferred trapping areas, since the majority of furbearer key habitat will remain available across the landscape (Section 4.4.2.4). Individual trappers who have active traplines in the area have already received compensation to relocate their traplines as a result of the impact of fires in recent years, therefore traplines intersecting with the Project are not expected to be affected by Project construction (PR#7).

Direct disturbance to preferred hunting areas for caribou and moose is expected to be low.

A limited amount of suitable barren-ground caribou and boreal caribou habitat will be lost within their entire ranges, and harvesters will still be able to access preferred hunting areas since the majority of caribou key habitat will remain available across the landscape (Section 4.3). Direct disturbance to preferred areas used for hunting will be minimized through mitigation that limits the amount of vegetation clearing disturbance during construction; this includes aligning the Project route along the existing trail and intersecting areas previously disturbed by fire (Section 4.4.2). Lac La Martre is not crossed by the Project footprint, and therefore will not be directly disturbed. Overall, with the implementation of mitigation measures, Project construction is not expected to result in a residual effect on preferred traditional use areas including culturally significant areas, due to direct disturbance.

- *Increased mobility and time spent away from the community may result in changes to traditional way of life and culture.*

The traditional economy is considered to be invaluable to the Tłı̨chǫ, and it continues to promote key Tłı̨chǫ values, including strengthening cultural identity and continuity (PR#96 TG IR 4.1). Data from the GNWT indicated that Tłı̨chǫ communities are amongst the most reliant on country foods of any Aboriginal groups in the NWT, and in 2013, over 90% of Tłı̨chǫ households were eating meat or fish obtained from hunting and fishing (PR#96 TG IR 4.1). The Whatì community in particular maintains strong ties to culture, traditional way of life and language, and have higher participation rates in traditional activities compared to both the Tłı̨chǫ and NWT averages (PR#7, Appendix B; PR#96 TG IR 4.1). However, a decline in traditional practices has been observed in recent years, especially among youth (PR#7, Appendix B). Whatì community members are concerned that the TASR will contribute to further declines in traditional way of life of community members, including hunting, trapping, fishing and cultural activities, and reduced reliance on country foods. Other important aspects of the traditional economy include, but are not limited to, the sharing of country foods, the transfer of TK between generations, and contributing to the continuation of the Tłı̨chǫ way of life (PR#96 TG IR 4.1). For further discussion of the traditional economy refer to Section 5.2.8 and 5.4.1.2.

Whatì community members indicated that some of the potential benefits of an all-season road included potential increased Tłı̨chǫ hunting and trapping in the old military road area because of enhanced access, and reduced pressure to stock up on resources in a short amount of time, therefore leaving adequate time to continue traditional harvesting practices throughout the winter season (PR#7, Appendix B). Conversely, community members are concerned that increased mobility and access to a wider region over an extended period will result in decreased use of traditional areas near the community. Harvesting is expected to still be practiced at preferred traditional land use sites near the community, but other areas located further away will also likely be used more frequently. Use of all of these areas will be extended over the year rather than condensed in a relatively short period over a few months, which may be perceived as both a benefit and risk. Although the new road will facilitate access to and potentially increased consumption of store-bought food, it is also expected to facilitate continued harvesting,

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therefore access to traditional resources and country foods is expected to be maintained. There is uncertainty regarding how the Project will affect the reliance on country foods over time; however, maintaining access to traditional resources and healthy food options will be critical, given that the consumption of country foods is considered an especially important aspect of the cultural life and well-being in Whatì.

Results of the literature review conducted during the Scoping Study (PR#7, Appendix B) on effects of all-season roads introduced to remote regions included both positive and negative impacts on culture. Positive impacts included increased access to water resources, berries, hunting grounds, fishing holes, and trapping areas; increased options for practicing traditional activities; and increased means by which individuals and communities could occupy their traditional territory. Negative impacts were also identified, including losses of traditional practices and cultural values (PR#7, Appendix B). The community of Whatì is already vulnerable to the declining interest and practice of cultural activities and language skills among youth, and community members are concerned that these critical elements of well-being and cultural identity will be further threatened by a number of pressures should an all-weather road be developed (PR#7, Appendix B). For example, one community member stated that given the ease and speed of transit along the all-season-road, Tłı̨chǫ citizens may choose to use traditional land and water travel routes to important cultural sites less frequently (PR#7, Appendix B).

Although the Project will bring faster and easier travel by vehicle, it is located along a route that is already traditionally used by Tłı̨chǫ, and use of the area is expected to increase thereby fostering participation in traditional activities. Furthermore, the existing route is considered a main artery that provides access to several other traditional trails that can only be used by boat/canoe or ATVs during the summer and by snowmobile during the winter. The Project will allow these trails to be reached quicker, and the mode of travel used on traditional trails is expected to remain unchanged. The installation of roadside pullouts and snowmobile crossing structures and signs along the Project will facilitate the continued use of traditional trails (PR#97 IR 2; PR#7).

Youth are particularly concerned about keeping their culture alive and the transfer of TK and skills (PR#7, Appendix B). The TREDWG will continue to work with the youth in Whatì so they are provided with the opportunity to continue discussions and contribute to the development of appropriate mitigations (PR#7 Section 5.2.1.2). The Project will enhance connectivity between Whatì and Behchokǫ̀, which will facilitate more opportunities to participate in cultural activities such as hand game tournaments and drum dances (PR#96 Table 1-1). The CGW and Community Government of Behchokǫ̀ wish to proactively induce these benefits and have therefore committed to the annual coordination and planning (e.g., hand games or joint cultural events), between the councils of Whatì and Behchokǫ̀ and to ensure that any changes and impacts are being collectively considered, addressed and managed. There are several cultural programs that Whatì community members are currently engaged in that are considered a strength in the community and could potentially be enhanced, such as the trappers program and “on the land program” (PR#96 TG IR 1). Additionally, the continued development of traditional arts and crafts can be promoted with the establishment of a craft store and the anticipated increase in tourism from the Project. The maintenance of traditions and culture will help Tłı̨chǫ community members become more resilient to social and economic pressures (PR#96 TG IR 1).

The Project may have a negative effect on knowledge and use of Tłı̨chǫ language, as was observed in the community of Behchokǫ̀ following the development of a road (PR#96 TG IR 1) The Tłı̨chǫ Government and CGW will explore the possibility of having a medium for youth to express themselves and communicate in Tłı̨chǫ (e.g., radio show, video programming), and the K-12 language program will be maintained in Whatì to encourage retention of traditional language (PR#96). The Project may strengthen family ties by providing year-round access

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between communities (PR#96 TG IR 1). Whatì has been relatively isolated from other communities for much of the year, and the road may facilitate the sharing of traditional foods, and traditional and cultural knowledge among family and community members (PR#7, Appendix B).

There is uncertainty in how the Project will affect traditional way of life and culture, and this assessment does not presume to determine how individuals will respond to change; rather it is acknowledged that Project operations could represent both benefits and risks to Tłı̨chǫ traditional way of life and culture. It is expected that proactive planning and ongoing communication with Tłı̨chǫ community members by the Tłı̨chǫ government will help to reduce perceived risks and address uncertainty about the potential effects of the Project on cultural identity and well-being, and that policies and programs will be developed to help manage and monitor the Project to reduce risks and maximize benefits (PR#7, Appendix B).

- *Effects to wildlife and fish resulting in changes in the availability of traditional resources for harvesting.*

Tłı̨chǫ Elders' knowledge of the land and resources derives from the intimate relationship of living on the land and the practice of hunting, trapping, fishing and travelling to different locations to harvest resources at each season of the year (PR#28). Tłı̨chǫ Elders emphasized that people live off the land and that the land provides for the people in terms of food, materials, and well-being (PR#28 pg. 38). Wildlife and fish resources are of critical importance to the Tłı̨chǫ, evidenced by the high number of people who rely on meat and fish obtained from hunting and fishing.

Results of the TK study indicated that Tłı̨chǫ Elders and harvesters are concerned about potential impacts of the Project on the animals they hunt and their habitat, and the subsequent adverse effects on hunters' ability to hunt in the area. Impacts to wildlife would affect both the local hunting economy and the cultural practices related to being on the land (PR#28 pg.37). Specific concerns raised were related to animals avoiding the area as a result of noise, dust, smells and pollution from road construction and continuous traffic on the road; the growth of new types of habitat near the road and introduction of new wildlife species (i.e., bison) resulting in avoidance of the area by woodland caribou and moose; changes in the abundance and migration routes of barren-ground caribou due to development; and increased difficulty hunting woodland caribou and moose, and bringing meat home to one's family. These concerns stem from uncertainty of the sustainability of the Tłı̨chǫ hunting and trapping economy and way of life, if wildlife populations were to decline or disappear from the area around K'àgòò tı̨lıì (PR#28). Additional concerns were raised about contamination of the environment from potential spills on the road, and the possibility of more development in wildlife habitat and preferred harvesting areas.

NSMA members emphasized that hunting and fishing have been and continue to be very important to their well-being and way of life. Moose and caribou are harvested, and the Bluenose East caribou herd provides an important food source (PR#98 NSMA IR). NSMA members are concerned that declines in caribou health and abundance, especially to the Bluenose East herd, would adversely affect their connections to the land and community, and traditional cultural values. Other concerns raised were related to adverse effects on the environment, particularly the cumulative effects on caribou.

YKDFN members expressed concerns about the Project on wildlife and their habitat, including barriers to wildlife movement, habitat loss for wintering barren-ground caribou, woodland caribou, bison and moose, and cumulative effects on caribou (PR#24).

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The wildlife and wildlife habitat assessment (Section 4.4) assessed the potential effects of the Project on ungulates and furbearers, including changes in abundance and distribution, and therefore changes in the availability of resources for harvesting. Residual effects were determined for boreal caribou, barren-ground caribou, moose and wolverine. For the purposes of this assessment, effects to wolverine represent effects to other furbearers considered important for trapping, since it is considered an umbrella species with large habitat requirements and protecting this species indirectly protects other furbearers (Section 4.1.2).

Road construction and operations may affect the distribution of boreal and barren-ground caribou at the regional scale which may affect harvesting patterns. The implementation of mitigation measures, including preferential land clearing primarily during winter to avoid sensitive periods, limiting the amount of noise and lights during construction, reducing disturbance from dust within the ROW and enforcing speed limits will help to minimize the effects of sensory disturbance and barriers to movement (Section 4.3-1). Construction will be temporarily suspended when species at risk and barren-ground caribou are known to be within construction activities, and environmental monitors will be used to help identify the presence of caribou. Low traffic volumes and speeds will reduce the risk of vehicle collisions. Increased access and harvest by non-Tłı̨chǫ residents of both boreal caribou and barren-ground caribou may reduce survival and productivity at the regional scale, which is discussed in more detail in Section 4.4.2.1 and 4.4.2.2.

Under the direction of GNWT-ENR, caribou movement patterns will continue to be monitored in collaboration with Aboriginal government, co-management boards (such as the Wek’èezhìı Renewable Resources Board), caribou management boards and neighbouring jurisdictions. The GNWT will continue to monitor caribou and implement strategies as needed, as described in the Wildlife Management and Monitoring Plan (PR#7).

Similarly, changes in moose and wolverine movement and local distributions are expected during Project construction and operations, which may affect harvesting patterns. The majority of moderate and highly suitable moose habitat will remain abundant and well-connected across the landscape, and a reduction in moose populations is not expected at the regional scale (Section 4.4.2.3). Moose may be attracted to regenerating vegetation along the TASR, which may increase the interaction of moose with wolves, vehicles, and hunters, leading to increased mortality. Environmental Monitors will be present during construction, and the low speed limit and low predicted traffic volume on the road during operations will reduce the likelihood of a collision. Wolverines that avoid suitable habitat during construction due to temporary sensory disturbance are expected to reoccupy the habitat once the disturbance is removed (Section 4.4.2.4). Traffic volumes are not anticipated to be high enough during operations to affect the crossing rate across the TASR.

Tłı̨chǫ Elders stated that construction of a bridge across the Rivers Tsotìdeè (La Martre River) and Ɂehtł’ètìdeè (James River) would not have any impact on fish populations as long as the rivers were untouched and the timing of construction avoided the peak migration periods of certain fish species to reduce the possibility of disturbance (PR#28). NSMA is interested in discussing mitigation measures that will improve the management of fisheries based on improved access to water routes, including to Lac La Martre (PR#98 NSMA IR).

The fish and fish habitat assessment (Section 3.4) assessed the potential effects of the Project on fish habitat availability and distribution and fish abundance. Bridges will be installed at four major crossings with high quality habitat, including Duport River, James River, La Martre River, and the unnamed watercourse at km 45.2 (crossing #9), which will minimize disturbance and maintain fish passage. Culverts will be designed and installed to allow fish movement and maintain water flow at other water crossings. The construction of crossings is expected

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to result in minor and localized changes to fish abundance and distribution. In-water work will be timed to avoid sensitive life history periods or life stages to protect fish. During operation of the road, potential effects from dust and debris, and spills are expected to result in negligible changes to fish abundance and distribution with the effective implementation of best management practices and mitigation measures.

Given implementation of mitigation measures described in Section 3.4, there are no anticipated residual effects from construction activities, or from dust, debris and spills during operations on the maintenance of self-sustaining populations of Arctic Grayling, Lake Trout, Northern Pike, Walleye, and Whitefish species. However, there is the potential for the overexploitation of large-bodied fish populations due to improved road access, which may result in changes to the availability of fish for harvesting by Tłı̨chǫ residents. Changes in fish abundance and distribution due to increased harvesting pressure is discussed in Section 3.4.

There will be increased contamination risks through dust, spills, accidents and greater human presence on the TASR during construction and operations. The GNWT-ENR keeps precise records of the types of spills that occur on highways, and manages spill response using best management practices (PR#7). Approved dust suppression techniques will be utilized during construction to reduce areas impacted by dust during construction, and an approved spill contingency plan (PR#7, Appendix L) will be followed in the event of a spill.

The GNWT will be refining the draft WMMP, submitted with the PDR and expanding it to include a Wildlife Effects Monitoring Plan. The WMMP will identify the mitigations that will be implemented to address the potential impacts of the Project, and will demonstrate how potential impacts and the effectiveness of mitigation will be monitored. Should greater than expected adverse effects on wildlife occur, or more refined information be revealed, an adaptive management plan would be implemented. Additionally, GNWT-ENR has developed the NWT Boreal Caribou Recovery Strategy and is in the process of developing regional range plans to demonstrate how the requirements in the federal Recovery Strategy for the Woodland Caribou, Boreal population in Canada will be met in the NWT.

Furthermore, the Tłı̨chǫ Government has the authority and jurisdiction to write laws, develop its own strategies, and maintain a balance between subsistence harvesting and industrial development on its lands (see the Tłı̨chǫ Agreement and Tłı̨chǫ Land Use Plan). The Tłı̨chǫ Government will also develop a mineral policy for Tłı̨chǫ lands, so that there is clear and predictable regulation in the region (Mitigation 11 of PR#96, Appendix D Motion 2015-018). Any proposed exploration or mining development would have to adhere to the land use permit and proponents are required to apply for approval. The implementation of these mitigation measures are expected to minimize the negative residual effects of the Project on the availability of traditional resources for harvesting due to effects to wildlife and fish.

- *Effects on wildlife and fish resulting in changed traditional perceptions of the land.*

There is uncertainty in how the Project will affect perceptions of the land and value of the land, and this assessment does not presume to determine how individuals will respond to change. Cultural change is not necessarily either unidirectional or predetermined in nature. Different people in Whatì or other communities may experience the effects of change from the Project in positive and negative ways. People are generally risk averse by nature and want to protect what they already have in the face of uncertainty, leading to fear of change and the likelihood of seeing more risks than benefits (PR#7, Appendix B). Perceptions of risk, or harm are primarily due to a lack of familiarity with a Project, uncertainty about outcomes that may arise, knowledge or experience of similar Projects

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with poor outcomes, fear of outcomes that are expected or foreseen, and level of confidence in the organizations responsible for managing impacts.

Results of consultation with Tłįchǫ, NSMA, and YKDFN community members indicated concerns about the potential adverse effects of the Project on traditional way of life and culture due to potential effects on wildlife, fish, and the land. Engaging communities in learning about risks and benefits, characterizing their likelihood, magnitude and the ability to manage them, empowers people to confront and overcome these concerns in a meaningful way (PR#7, Appendix B). As already described above for potential changes to traditional way of life and culture, it is expected that the Tłįchǫ Government will continue to engage with communities to address uncertainty and develop policies and programs to help manage and monitor the Project to reduce risks and maximize benefits (PR#7, Appendix B).

5.4.3.2 Harvesting

- *Increased access and use of the region may result in increased harvesting pressure on wildlife and fish by outside harvesters.*

As previously discussed, Tłįchǫ communities are amongst the most reliant on country foods of any Aboriginal groups in the NWT, and in 2013, over 90% of Tłįchǫ households were eating fish or meat obtained from hunting and fishing. Whatì community members are highly engaged in traditional cultural and harvesting activities with higher participation rates compared to both Tłįchǫ and NWT averages (PR#96 TG IR 4.1). Similarly, NSMA members reported that hunting and fishing are fundamental aspects of Aboriginal well-being and way of life, and that caribou remains the principal item in their diet (PR#98 NSMA IR). YKDFN members indicated their long history of traditional use in the Chief Drygeese Territory for harvesting, and expressed concerns about the Project potentially affecting their long-term ability to engage in traditional practices (PR#24).

Tłįchǫ Elders and harvesters expressed concern that the TASR may potentially lead to the construction of new cabins by non-Tłįchǫ residents in the region and increased use of trails and harvesting pressure on local furbearers and ungulate populations near the TASR. This in turn could result in increased competition for traditional resources, and may pose difficulties for the maintenance of Tłįchǫ hunting and trapping economy and way of life. Concerns were also raised regarding increased pressure on various fish populations resulting from an increased number of outsiders fishing in Tsotìdeè and Lac La Martre. NSMA members are concerned about the effective implementation of mitigation measures to improve the management of fisheries potentially affected by the Project because of increased access to water routes.

Tłįchǫ harvesters stated that increased development in the barren-grounds have disrupted caribou migration into the Whatì area, which is a concern since they now have to travel further north towards Grandin Lake and Gamètì to be able to hunt barren-ground caribou (p. 38 PR#28; PR#97 IR 2). The GNWT (PR#7 page 5-10) anticipates that a Whatì community access road will extend the winter road season to Gamètì and Wekweètì by approximately 4 weeks, which may also extend access to barren-ground caribou habitat for non-Tłįchǫ harvesters. Historical winter road operational periods indicate that the Wekweètì winter access road is variable and trending toward opening later in the year, consistent with predictions of climate warming. Therefore, there is uncertainty in how much earlier the winter roads north of Whatì will be open and improved earlier access for trucks with snowmobile trailers may be temporary (Section 4.4). Furthermore, both the Wekweètì and Gamètì winter access roads historically close mid-April. The BNE and Bathurst caribou herds begin their migration to northern calving areas in

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early April and mid-April, respectively, meaning caribou may not be available past mid-April even if the winter roads have a longer operational period (Section 4.4.2.2).

It is unlikely that there will be increased harvesting pressure from outsiders on the Bathurst herd because of low population numbers occurring below the treeline and in the Project area (PR#7). Harvest restrictions on Bathurst caribou were in effect for the 2010 to 2014 harvest seasons, and a no-hunting mobile conservation zone was implemented by GNWT-ENR in 2015. The number of tags were further reduced to zero from 2016 until 2019 (WRRB 2016). Non-Tłı̨chǫ harvesters may be able to drive to Gamètì later in the season to hunt the Bluenose East Caribou on their migration to northern calving grounds, thereby increasing competition for resources (PR#97 IR 2). Although the Bluenose East herd does winter below the treeline, its harvest is currently heavily restricted with a harvest allowance of 750 bulls from 2016 to 2019, and all Aboriginal harvesters require authorization cards from the GNWT-ENR. Non-aboriginal harvest of barren-ground caribou is regulated by GNWT-ENR, and non-residents cannot harvest barren-ground caribou in the NWT (GNWT-ENR 2017). It is unlikely that non-Aboriginal residents will expend the time and energy to engage in an illegal activity with extremely strict restrictions in place. Although the winter road season will be extended, Tłı̨chǫ Government, WRRB, and GNWT-ENR are monitoring the herd and harvesting activity (PR#97 IR 2). During construction, a no hunting policy for wildlife by workers will limit harvest of wintering barren-ground Caribou, and access roads to borrow sites will be blocked when no longer active to minimize access (Table 4.3-1). NSMA members currently have an equitable allocation of tags of the limited Aboriginal harvest permitted for the Bluenose East herd for the 2014-2017 harvest seasons. While there is no longer any harvest of the Bathurst caribou herd permitted, the GNWT will provide the NSMA with an equitable allocation of harvesting tags once the population recovers. The GNWT and the NSMA regularly engage in consultation regarding the management of caribou herds and other wildlife in the NWT, and regarding the *NWT Wildlife Act*, Transboundary Water Agreements and the Northwest Territory Métis Nation Agreement in Principle. NSMA also sits on a number of committees dedicated to managing and preserving the health of caribou affected by the TASR (PR#99 NSMA IR).

There is the potential for the Project to result in increased harvesting pressure and competition for boreal caribou and moose by non-Tłı̨chǫ harvesters (Section 4.4). As there is a limited number of existing roads in the North Slave region for accessing the broader landscape, there is likely to be an increase of outside traffic on an all-season road (PR#97 IR 2). A reduction in boreal caribou populations as a result of greater access is predicted to be small given that boreal caribou occur in low densities and use large areas of undisturbed habitat (Section 4.4.2.1). Furthermore, reductions in boreal caribou and moose populations are expected to be limited because the Project ROW follows an existing linear feature that is currently used by hunters to harvest caribou and moose, and to access the WRMA (Sections 4.4.2.1 and 4.4.2.3). To ensure effective management, the Tłı̨chǫ Government will continue to manage the construction of cabins on Tłı̨chǫ lands, and hunting, trapping, and fishing activities in the area, in order to minimize impacts on local animal populations. Non-aboriginal harvest of woodland caribou is regulated by GNWT-ENR, and the GNWT Department of Lands is responsible for managing and administering the issuance of recreational leases for cabins on Territorial land and is currently working on the development of a Recreational Leasing Management Framework (PR#7). To protect wildlife, organizations such as WRRB, Tłı̨chǫ Government, and GNWT Departments of Lands and GNWT-ENR will need to continue to work together to develop guidelines and conditions for use within the WRMA. The GNWT-ENR will enforce the NWT's hunting regulations, which are in place to ensure that wildlife is conserved for future generations and that hunting is done safely. The Tłı̨chǫ Government has the authority and jurisdiction to write laws, develop its own strategies, and maintain a balance between subsistence harvesting and industrial development on its lands (see the Tłı̨chǫ

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Agreement and Tłįchǫ Land Use Plan). The Tłįchǫ Government will work with the GNWT to review the mitigations that are developed and considered for managing harvesting impacts that occur as a result of the new all-season access of the Project (PR#96 TG IR 4.3). Additionally, the Tłįchǫ Government could establish a public awareness program that would include signage along the proposed TASR corridor highlighting hunting restrictions and discouraging excessive hunting. Options for new check stations and better and more accurate community reporting are also being explored (PR#7 Section 8.7.1.4).

The fish and fish habitat assessment analysed the potential effects of overexploitation of large-bodied fish populations due to improved access (Section 3.4). Changes in access to water bodies for non-Tłįchǫ fishers varied, depending on the location. Implementation of mitigation measures to minimize potential adverse effects on fishing due to overharvesting by outsiders include implementation of restricted fishing during sensitive periods and of daily catch limits, as needed, by the Tłįchǫ Government on Tłįchǫ lands; maintenance of existing NWT fishing regulations by DFO; and, sustainable development of tourism opportunities DFO is the management authority for fish and fish habitat in the NWT, and they are responsible for managing regional fisheries resources to ensure the sustainability of fish populations in the NWT. Cabins cannot be constructed along Lac La Martre without approval of the Department of Culture and Lands Protection.

Harvesting wildlife and fish by non-Tłįchǫ residents must follow appropriate territorial and federal regulations, which prevent overharvesting (PR#7). These regulations are reviewed periodically to ensure that wildlife and fish harvesting remains sustainable, and restrictions can be implemented for certain species if they are identified to be at risk. Due to the rules and restrictions outlined in the Tłįchǫ Land Use Plan, exploitation of Tłįchǫ resources by unauthorized users is anticipated to be low (PR#7). The implementation of these mitigation measures are expected to limit the adverse residual effects on harvesting from increased competition due to harvesting pressure by outsiders.

5.4.3.3 Heritage and Cultural Resources

- *Construction activities and operational maintenance and use of the Project could result in disturbances to heritage resources and culturally important sites.*

Results of the Tłįchǫ TK Study identified several cultural value sites in the vicinity of the Project, and include important Tłįchǫ trails, water routes, sacred sites, and burial locations (Map 4, PR#28; IR 3). Potential effects of the Project to overland trails and water routes and mitigation are discussed in Section 5.4.1.3. Map 3-1 and Table 3-1 of PR#97 IR 3 illustrate the heritage resources and culturally important sites identified in the TK study within a 5 km local study area centered on the TASR corridor. There were no specific cultural sites identified by NSMA in the Project area. NSMA members would like further Archaeological studies to be undertaken in consultation with them so that their traditional way of life and history can be preserved for future generations (PR#99 NSMA IR). Similarly, YKDFN did not identify any specific cultural sites in the Project area, but they are concerned about potential effects of the Project on culturally significant and archaeological sites.

Ewaashì is a culturally sensitive site in which the nature of the site and type of spirits that dwell there is unknown. The Elders requested that the site is undisturbed and should be respected (PR#28). Project design and construction activities will avoid passing through this culturally sensitive area (PR#7). Six grave sites were identified in the vicinity of the TASR, which represent an important connection to the land for the Tłįchǫ. No grave sites were identified in the immediate proximity to the Project footprint, and no mitigation is required. Kweyì įgoèʔàa

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Wets'àts'ìdì is a culturally sensitive site meaning "cave tunnel" and "pay respect to", and is located approximately 40 kilometres south of Edzo on Highway 3. The Elders requested that this site is not disturbed, and suggested closing the trail leading to it to avoid any potential disturbance (PR#28). A number of cabins and camp sites were identified within 5 km of the Project footprint; however these sites were destroyed during the 2014 forest fires and therefore no direct or indirect disturbance to these sites is expected to occur (PR#97 IR 3). The family of Joe Migwi is re-building their cabin. The Tłįchǫ Government and the CGW will erect signage to prevent damage to culturally significant areas (such as La Martre Falls) (PR#7 pg 8-33). The Tłįchǫ Government is committed to ensuring the protection and management of cultural heritage throughout the construction and operation of the TASR.

In addition to the TK Study conducted by the Tłįchǫ Government, an Archaeological Impact Assessment (PR#7, Appendix U) was conducted on the TASR. This study involved a ground reconnaissance via helicopter across the length of the TASR, ground truthing of areas with high archaeological potential and shovel testing. The results of the Archaeological Impact Assessment indicated that no newly recorded sites were discovered (PR#97 IR 3). The potential for the construction of the proposed TASR to affect archaeology sites exists and GNWT will establish a minimum buffer of 30 m around identified sites to ensure ongoing avoidance and where practical, a 100 m buffer will be established (PR#7). Should the proposed TASR footprint change and encroach on the 30 m buffer zone of the previously recorded archaeology site (identified in PR#7, Appendix U), consultation with the community and with the Department of Education, Culture and Employment (GNWT-ECE) will be conducted to ensure there are no concerns with the impact of this location. This site is perceived to have low heritage value based on conversations with Tłįchǫ residents and evidence of recent use at this previously recorded archaeology site (PR#7, Appendix U).

A follow-up Archaeological Overview Assessment to guide development of selected borrow source areas was conducted in December 2016 and an Archaeological Impact Assessment is planned for the spring or summer of 2017. GNWT-ECE accepted the results of the 2016 Archaeological Overview Assessment and will continue to work with GNWT-DOT to ensure the selection of borrow source areas considers the protection of archaeological sites.

Routing options have been developed to avoid the significant cultural sites identified in the TK Study, such as the La Martre Falls. Should the proposed TASR footprint change during final alignment decisions, these identified sites will again be considered and an appropriate buffer will be used and communities will be consulted, where required. Furthermore, the GNWT-DOT in consultation with the GNWT-ECE has drafted an Archaeological Site Find Protocol (PR#7, Appendix Y) to provide guidance to employees and contractors conducting ground disturbing operations for the TASR. The document provides the framework for identifying archaeological deposits and avoiding unforeseen disturbance to cultural heritage resources. The Protocol ensures that employees and contractors are educated of the regulations, how to identify archaeological sites prior to engaging in ground disturbing operations and what procedural steps should be followed if a suspected archaeological or heritage resource is discovered (PR#7).

With the implementation of mitigation measures, Project construction and operations for the TASR are not expected to result in a residual effect on heritage resources and culturally important sites.

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5.5 Residual Effects Analysis

5.5.1 Economic Wellbeing

5.5.1.1 Employment and Economy

- *Project construction and operations would generate employment opportunities and associated incomes.*

The positive residual effect of the Project on employment and incomes is expected to be substantial during construction, and modest during operations, and has been assessed as a being of moderate magnitude overall. Project-related employment and incomes are expected to be concentrated in the Tłı̨chǫ region, and so are considered local in extent, and will persist into the short- (construction) to long- (operations) term.

- *Project construction could drive the uptake of ongoing training opportunities in the region by those seeking employment.*

The magnitude of the Project's positive residual effect on the uptake of ongoing training opportunities by the local labour force effect is assessed as moderate given that, while a large amount of training has already been delivered to Tłı̨chǫ citizens, the Project's requirement for a trained construction workforce is substantial relative to the size of the local labour force. This demand could increase the uptake of existing training opportunities of those hoping to secure Project employment. The Project's residual effect on the uptake of training is expected to materialize locally in the Tłı̨chǫ region, and will be of short-term (construction) duration.

- *Project operations could enhance opportunity for year-round tourism activities in the region.*

The Project's positive residual effect on tourism opportunities in the region around Whatì is modest, and of low magnitude given that, while the Project will enhance year-round access to Whatì for potential tourists, the ability to participate in ecotourism staged out of the community already exists. The residual effect will be local to the Tłı̨chǫ region and the community of Whatì, and will continue indefinitely into the long-term (operations) for the life of the Project.

- *Project construction and operations could support existing local business, and could facilitate the development of new businesses in Whatì.*

Project construction is expected to generate substantial demand for local businesses supplying construction-related goods and services. Project operation is expected to facilitate the development of businesses supporting the tourism industry, but with a much more modest effect on local business development than that experienced during construction. The magnitude of the Project's positive residual effect on local business development is assessed as moderate, largely localized to the Tłı̨chǫ Region, and of short- (construction) to long- (operations) term duration.

- *Project operations could change the nature or viability of some existing local businesses.*

The Project's potential to change residents' demand for goods offered at the Whatì Community Store is not expected to threaten its viability. Rather, it is expected that, as is typical of businesses, the Store will adapt to

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changing demands from consumers and other businesses it might work with. This change is neither assessed as positive nor negative, and the application of a magnitude rating is not considered appropriate. The change is expected to be isolated to the Community Store (local) and is expected to be permanent, persisting indefinitely with Project operation.

5.5.1.2 Traditional and Non-wage Economy

No beyond-negligible residual effects to the traditional and non-wage economy, as related to economic wellbeing, are anticipated. Please refer to Section 5.5.3 for further discussion of residual effects on traditional use and culture.

5.5.2 Stable and Healthy Communities

5.5.2.1 Population Sustainability

- *Project operations could help to stabilize the existing Whatì population.*

The potential residual effect of the Project on the current and projected trend of out-migration from Whatì is expected to be positive. The magnitude of this effect is difficult to predict with certainty. Should Project operations prompt those who would otherwise out-migrate for better access to goods, services and employment opportunities elsewhere to instead remain in the community, the effect could be of moderate magnitude relative to the existing trend. However, should some still choose to leave the community, and the trend continues to a lesser extent, the magnitude of this effect could be low. The Project's residual effect of potentially stabilizing out-migration is local to Whatì, and will persist into the long-term with Project operations.

- *Project operations and associated economic growth could result in in-migration to Whatì.*

The Project's residual effect of potential in-migration to Whatì is considered to be manageable by the CGW, and to not result in inflation, and so is assessed as neutral, and of low magnitude, depending on the number of people who in-migrate in hopes of securing employment. In the event that in-migration during Project operations is substantially below the manageable threshold identified by the CGW, this determination of magnitude could reduce to negligible. In-migration would be local to Whatì, and, while a spike could be expected in the early years of Project operation, could persist over the long-term with Project operations.

5.5.2.2 Use and Maintenance of Infrastructure

Project construction and operation is not anticipated to push existing housing, waste, or water infrastructure and services in Whatì beyond current capacity, or beyond manageability by the CGW, the Tłįchǫ Government, or the GNWT. Therefore, no beyond-negligible residual effects are anticipated.

5.5.2.3 Community Cohesion

Determining with certainty or accuracy whether or not potential Project effects to community cohesion will materialize is difficult. The potential for an effect to be realized is highly dependent on individual responses to the Project and the enhanced access to and from Whatì that it brings about. For example, it is not realistic to assume that an EA can determine how people will choose to move between communities seasonally with year-round access, the extent to which people will use the Project to visit relatives, or whether or not outsiders will decide to venture into Whatì. Determining the Project's residual effects on community cohesion is even more problematic, as the effectiveness of mitigations and benefit enhancement measures are highly dependent on uptake by those

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potentially affected by the Project. For example, programs aimed at educating the public on the dangers of substance abuse, or treating those with addictions may or may not be taken up by the intended audience. It is also not known whether or not these programs will have lasting mitigating effects. With such great uncertainty, it is not possible to accurately assign residual effects criteria for the Project's potential effects on community cohesion. The SEIA recognizes the possibility for these effects to occur, and that ongoing monitoring and adaptive management through the Whatì Inter-Agency Committee will occur.

5.5.2.4 Public Safety

The selected contractor will construct the Project with the highest standard of health, safety and risk management. Driver and equipment operator safety training can minimize the risk of traffic and construction accidents. Project risk management and emergency response planning pre-emptively establishes procedures to minimize risk of injury to workers, communities, and the environment associated with construction-related accidents. Access to areas of active construction activities will be secured to prevent public access and potential resultant injury. Despite mitigation, accidents associated with construction activities and traffic during Project operation, by their very nature, may or may not occur. Attempting to assess the magnitude or likelihood of accidents is problematic. A minor accident could result in a small amount of property damage to personal vehicles, while a major one could cause fatalities. Further, should no accident occur, there will be no adverse effect. It cannot be reasonably assumed that accidents will or will not occur, simply for the purpose of residual effects assessment. Similarly, it is not possible to effectively predict with certainty the magnitude or likelihood of the realization of potential Project benefits associated with improved road safety relative to the winter road, improved search and rescue services, or changed demand for emergency services. For these reasons, it is not considered appropriate to attempt to assign residual effects criteria to the Project's potential positive and negative effects related to accidents and emergencies. This does not imply that the Project will not influence public safety, but rather that the SEIA can only be conducted in terms of the potential for safety-related effects to occur. The CGW, Tłįchę Government, GNWT and other bodies concerned with public safety will continue to monitor, assess, and respond to changing safety conditions and issues along the Project route, and in the community of Whatì.

5.5.2.5 Equity and Vulnerability

The Project has the potential to have both positive and adverse effects for those deemed most vulnerable to the knock-on effects of development. As discussed in Section 5.4.2.5, scoping studies in support of the Project suggest that youth, young women, and Elders are particularly vulnerable to some of the changes that development brings about. As with potential changes to community cohesion, potential effects to vulnerable groups, be they positive or negative, are not appropriately assessed through the assignment of residual effects criteria. The realization, magnitude and duration of an effect may vary depending on the individual impacted, their responses to development, mitigation and benefit enhancement measures, and their resilience in the face of development-induced change. Further, the determination of whether or not these effects are significant and to whom is best reached by those affected. Therefore, the SEIA does not characterize residual Project effects on vulnerable groups using EA criteria and processes. Rather, it is acknowledged that the potential for positive and negative residual Project effects is expected to exist during Project operation. Ongoing monitoring and adaptive management through the Whatì Inter-Agency Committee will occur.

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5.5.3 Traditional Use, Culture and Heritage Resources

5.5.3.1 Traditional Use and Way of Life

- *Enhanced year-round access to hunting, trapping and fishing areas for harvesters.*

Project operations will improve access to the existing trail network and preferred hunting, trapping, fishing and culturally important areas for Tłįchǫ and NSMA members, and potentially to new areas in the region previously inaccessible most of the year. Increased access to the land will likely lead to increased opportunities for traditional use and promote greater participation in traditional activities among Tłįchǫ residents.

Enhanced access to hunting, trapping, fishing and other traditional land use areas for Tłįchǫ and NSMA harvesters is predicted to be moderate in magnitude, regional in context, permanent and continuous throughout operation of the TASR. The ability of Tłįchǫ, NSMA, YKDFN and DGGFN members to continue practicing traditional land and resource use activities and maintain their traditional way of life will not be significantly affected due to the Project.

- *Increased mobility and time spent away from the community may result in changes to traditional way of life and culture.*

As discussed in Section 5.4.3, Project operations can have both positive and negative effects on traditional way of life and culture due to increased mobility and time spent away from the community. Determining with certainty or accuracy whether or not potential Project effects to traditional way of life and culture will materialize is difficult. The potential for an effect to be realized is highly dependent on individual responses to change brought about by increased access in the region. It is not realistic to assume that an environmental and socio-economic assessment can determine how people will choose to spend their time seasonally with year-round access, and whether their interest in traditional and cultural activities will increase or decrease. Determining the Project's residual effects on traditional way of life and culture is even more difficult, as the effectiveness of mitigations measures are highly dependent on the level of participation and resilience to change from development by those potentially affected by the Project.

With this uncertainty, it is not possible to accurately assign residual effects criteria for the Project's potential effects on traditional way of life and culture. The SEIA recognizes the possibility for these effects to occur; however the monitoring, assessment and management of Project-related adverse changes to traditional way of life and culture in Whatì, should they occur, will fall to the CGW and the Tłįchǫ Government.

- *Effects to wildlife and fish resulting in changes in the availability of traditional resources for harvesting.*

Changes in the availability of traditional resources for harvesting are anticipated due to Project and cumulative effects on wildlife, and Project effects on fish. Changes in boreal caribou and barren-ground caribou distribution, survival and reproduction are anticipated to be regional and beyond regional in scale, respectively, permanent in duration and continuous (Section 4.4). However, residual effects on distribution are expected to be negligible, given the relatively low amount of development disturbance in the ranges for caribou, and adverse and long-term changes in caribou populations are not anticipated. Similarly, changes in moose and wolverine distribution, survival and reproduction are anticipated to be beyond regional in scale, permanent in duration and continuous (Section 4.4). Given the relatively low amount of development disturbance in the wildlife RSA range of moose and

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wolverine, negligible effects on distribution and connectivity are expected, and adverse and long-term changes in population survival and reproduction rates are not anticipated.

Residual effects of the Project on the availability of wildlife resources for harvesting is predicted to be permanent and continuous, since wildlife availability may decrease in certain preferred harvesting areas. However, this effect is expected to be limited since the regional area contains high proportions of habitat undisturbed by anthropogenic sources for boreal caribou, barren-ground caribou, moose and furbearers where they can be harvested.

Residual effects of the Project on fish populations were only identified for the potential overexploitation of large-bodied fish populations due to improved road access (Section 3.4). Changes in fish harvesting due to increased competition is discussed under Harvesting below. Residual effects of the Project on the availability of fish resources is predicted to be negligible to low in magnitude, permanent and continuous, since fish availability may decrease in certain preferred fishing areas.

It is anticipated that DFO will continue to be able to manage regional fisheries resources and support sustainable fish populations in the NWT, and the Tłįchę Government will further manage the fisheries on Tłįchę lands to ensure sustainable subsistence fishing is available for Tłįchę people.

- *Effects on wildlife and fish resulting in changed traditional perceptions of the land.*

The Project has the potential to result in both positive and adverse effects on people's perceptions of the land, and how they value the land. As with potential changes in traditional way of life and culture, potential changes in perceptions can be positive or negative, depending on how people experience and respond to change; therefore, they are not appropriately assessed through the assignment of residual effects criteria. Furthermore, determining the effect of changed perceptions of the land on traditional use and value of the land is even more difficult to do, and will depend on people's responses to development and their resilience to change. Therefore, the SEIA does not characterize residual Project effects on perceptions of the land using EA criteria and processes. Rather, it is acknowledged that the potential for positive and negative residual Project effects is expected during Project operation.

5.5.3.2 Harvesting

- *Increased access and use of the region may result in increased harvesting pressure on wildlife and fish by outside harvesters.*

Increased harvesting pressure on wildlife and fish by non-Tłįchę harvesters is expected due to TASR operations, leading to increased competition of resources. Residual effects to the survival and reproduction of boreal caribou, barren-ground caribou, moose and wolverine due to increased harvesting were predicted to be low in magnitude, permanent and continuous, but adverse and long-term changes in wildlife populations are not anticipated (Section 4.6.2). Residual effects of the Project on wildlife harvesting due to increased competition from overharvesting by outsiders is predicted to be low in magnitude, regional (boreal caribou) to beyond regional (barren-ground caribou, moose and wolverine) in geographic extent, permanent and continuous.

Residual effects on fish abundance due to changes in fish harvesting pressure is expected to range from negligible to low in magnitude, local to regional in geographical extent, and will be permanent (Section 3.3). DFO will continue

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to enforce the NWT's fishery regulations which are in place to prevent overfishing in any one area. Tłı̨chǫ lands are regulated and administered by the Department of Culture and Lands Protection of the Tłı̨chǫ Government. While NWT fishing regulations still apply on Tłı̨chǫ lands, additional access and fishing regulations may be implemented and regulated by the Tłı̨chǫ Government to ensure that lakes and watercourses continue to have productive fisheries with abundant resources (i.e., Lac La Martre, La Martre River, and Boyer Lake). Residual effects of the Project on fish harvesting due to increased competition from overharvesting by outsiders is predicted to be negligible to low in magnitude, local to regional in geographic extent, permanent and continuous.

Overall, residual effects of the Project on wildlife and fish due to increased competition from overharvesting by non-Tłı̨chǫ residents will not have a significantly adverse effect on the ability of wildlife and fish to be self-sustaining, and therefore on the ability of Tłı̨chǫ, NSMA, YKDFN and DGGFN members to continue harvesting.

5.5.3.3 Heritage and Cultural Resources

Project construction and operation is not anticipated to disturb heritage resources, or impede use of culturally important sites in a meaningful way. Therefore, no residual effects to heritage and cultural resources are anticipated.

5.5.4 Summary of Residual Socio-Economic Effects

A summary of the Project's residual effects on VSECs is provided in Table 5.5-1.

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Table 5.5-1: Summary of Residual Project Socio-Economic Effects

VSEC	Topic	Indicator	Effects Pathway	Direction	Magnitude	Geographic Extent	Duration
Economic Wellbeing	Employment and Economy	Employment opportunities	Project construction and operations would generate employment opportunities and associated incomes	Positive	Moderate	Local	Short- to Long-term
		Training opportunities	Project construction could drive the uptake of ongoing training opportunities in the region by those seeking employment	Positive	Moderate	Local	Short-term
		Business development	Project operations could enhance opportunity for year-round tourism activities in the region	Positive	Low	Local	Long-term
			Project construction and operations could support existing local business, and could facilitate the development of new businesses in Whatì	Positive	Moderate	Local	Short- to Long-term
			Project operations could change the nature or viability of some existing local businesses	Neutral	n/a	Local	Long-term
Stable and Healthy Communities	Population Sustainability	Out-migration, population mobility	Project operations could help to stabilize the existing Whatì population	Positive	n/a	Local	Long-term
		In-migration, population composition	Project operations and associated economic growth could result in in-migration to Whatì	Neutral	Low	Local	Long-term
	Community Cohesion	Connecting families, alleviating isolation	Project operations could spread seasonal movements in and out of Whatì over a longer period, avoiding the “pulse” facilitated by winter road operation	Positive	Not applicable – Please refer to Sections 5.5.2.3, 5.5.2.4, and 5.5.2.5 for further discussion as to why residual effects criteria are not appropriately assigned to these Project pathways.		
			Project operations and associated access to and from Whatì could connect families and alleviate isolation	Positive			
		Outsiders coming in	Project operations could increase the presence of outsiders in the community year-round, potentially creating a sense of reduced safety, security and community	Negative			
		Social pressures	Project operations could increase access to drugs and alcohol, both in Whatì and for those travelling to other communities, exacerbating social pressures	Negative			
			Project operation and associated social pressures exacerbated by access to drugs and alcohol could increase demand for policing and social services	Negative			
	Public Safety	Road safety	Project construction could increase demand for emergency services in response to construction accidents	Negative			
			Project operations could introduce the potential for year-round risk of traffic accidents for those travelling to and from Whatì	Negative			
			Project operations could reduce the potential risk of traffic collisions relative to the current winter road, spreading the otherwise temporally concentrated traffic out over the year	Positive			
			Project operations could reduce the potential for non-traffic related accidents associated with unstable winter road conditions during seasonal transition periods	Positive			
		Protective, emergency and social services	Project operations could improve the efficiency of search and rescue efforts	Positive			
			Project operations could reduce the seasonal demand for response services associated with winter road operations and enhance year-round emergency response services	Positive			
	Equity and Vulnerability	Food security	Project operations could improve food security through enhanced year-round access to groceries	Positive			
		Cost of living	Project operations could change the cost of living for residents of Whatì	Positive			
		Vulnerability	Project operations could influence the vulnerability of those most sensitive to economic pressures	Positive			
			Project operations could influence the vulnerability of Youth	Positive and Negative			
			Project construction and operations could influence the vulnerability of Young Women	Positive and Negative			
			Project operations could influence the vulnerability of Elders	Positive and Negative			
Traditional Use, Culture and Heritage Resources	Traditional Use and Way of Life	Practice of traditional activities and culture	Enhanced year-round access to hunting, trapping and fishing areas for harvesters	Positive	Moderate	Local	Long-term
			Increased mobility and time spent away from the community may result in changes to traditional way of life and culture	Positive and Negative	n/a	Local	Long-term
		Quantity or quality of traditionally harvested resources	Effects to wildlife and fish resulting in changes in the availability of traditional resources for harvesting	Negative	n/a (wildlife); Negligible to low (fish)	Regional to beyond regional (wildlife); Local to regional (fish)	Permanent (wildlife); Permanent (fish)
		Perception of the land by traditional users	Effects to wildlife and fish resulting in changed traditional perceptions of the land	Positive and Negative	n/a	Local	Long-term
	Harvesting	Competition for resources	Increased access and use of the region may result in increased harvesting pressure on wildlife and fish by outside harvesters	Negative	n/a (wildlife); Negligible to low (fish)	Regional to beyond regional (wildlife); Local to regional (fish)	Permanent (wildlife); Permanent (fish)

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5.6 Monitoring and Follow-up

Socio-economic monitoring will continue through the GNWT, CGW, TCSA and the Whatì Inter-Agency Committee, as relevant to each organization's jurisdiction. The Communities and Diamonds initiative, while not directly attributing socio-economic change in diamond-mining affected communities to any one development such as the Project, will continue to identify community-level socio-economic conditions and trends in Whatì. Ongoing consultation activities will identify community concerns and adverse trends. Adaptive management in response to changing social and economic conditions, as described throughout Section 5.5, will be employed by the appropriate authority in an effort to mitigate adverse socio-economic trends, while maximizing potential benefits.

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APPENDIX A

Concordance Table

Table A-1: EA-1617-01 Terms of Reference Concordance Table

TOR Section	Description	Applicable Section in PDR	Applicable Section in ASR	Applicable Sub-Section in ASR
2.2.1 Statutory scope of assessment requirements	Section 117(2) of the MVRMA stipulates that the every EA shall include consideration of the impact of the development on the environment, including: ▪ Cumulative Effects– the Review Board is required to assess the cumulative effects of the proposed development under paragraph 117(2)(a) of the MVRMA. Direction on this topic is provided in section 4.2, which describes the assessment methodology, and in section 7, which requests a summary of cumulative effects. ▪ Accidents and Malfunctions – The Review Board is required to assess the effects of potential accidents and malfunctions under paragraph 117(2)(a) of the MVRMA. Direction on this topic is found in section 4.1.	9.0 8.13	2.0 3.0 4.0 5.0	2.3 3.1.4; 3.3.3 4.1.3; 4.4.3; 4.6 5.5 3.2; 4.3; 5.3
2.2.2 Valued components	Valued components are elements of the biophysical or human environment identified as having scientific, social, cultural, economic, historical, archaeological or aesthetic importance. After reviewing the body of evidence on the public record, the Review Board has determined that there is a potential for significant adverse impacts on the following valued components; these valued components will be the focus of this environmental assessment: ▪ Fish and fish habitat ▪ Caribou ▪ Wildlife and species at risk ▪ Traditional use, culture and heritage resources ▪ Economic well-being ▪ Stable and healthy communities	8.9 8.7 8.10 8.11	3.0 4.0 5.0	3.1.3 4.1.2 5.1.2
	Table 1 lists topics related to each valued component that the Review Board requires the developer to address in the DAR. The developer will discuss how potential direct and indirect Project effects are likely to affect the valued components in the context of each related topic.	N/A	N/A	N/A
	Topics for Valued Component: Fish and fish habitat ▪ Fish habitat ▪ Fish harvesting	8.9	3.0	3.2; 3.3; 3.5
	Topics for Valued Component: Caribou ▪ Barren-ground caribou ▪ Boreal caribou	8.9	4.0	4.2.3; 4.4; 4.6
	Topics for Valued Component: Wildlife, including species at risk[a] ▪ Mammals (moose, bison and wolverine) ▪ Mammals (bats), birds, fish, plants, amphibians, ▪ insects	8.9	4.0	4.3; 4.4; 4.6

Table A-1: EA-1617-01 Terms of Reference Concordance Table (cont'd)

TOR Section	Description	Applicable Section in PDR	Applicable Section in ASR	Applicable Sub-Section in ASR
2.2.2 Valued components (cont'd)	Topics for Valued Component: Traditional use, culture and heritage resources ▪ Traditional use and way of life ▪ Harvesting ▪ Heritage and cultural resources	N/A	5.0	5.5.3
	Topics for Valued Component: Economic well-being ▪ Equity and vulnerability(b) ▪ Traditional and non-wage economy	N/A	5.0	5.1.1; 5.5
	Topics for Valued Component: Stable and healthy Communities ▪ Community cohesion ▪ Use and maintenance of infrastructure ▪ Public safety ▪ Population sustainability	N/A	5.0	5.5.2
2.2.3 Geographic scope of assessment	The DAR must define the spatial boundaries (geographic scope) for the assessment of potential impacts to each valued component in the DAR. The geographic scope of assessment for each valued component should be appropriate to the characteristics of that component, or to the nature and extent of the impact and/or impact source.	N/A	N/A	N/A
	In defining the geographic scope of assessment, the developer should consider: ▪ the habitat range of wildlife species; ▪ the extent to which Project effects are no longer measurable (e.g. downstream water quality); ▪ community and traditional knowledge; ▪ current or traditional land and resource use by Indigenous groups; and ▪ other ecological, technical, social and cultural considerations.	N/A	3.0 4.0 5.0	3.1.4.1 4.1.3.1 5.1.3
	For cumulative impacts, the geographic scope will generally include a much larger study area that combines effects from past, present and reasonably foreseeable future projects that are predicted to combine with the impacts of the Project over its lifespan. This will include cumulative impacts to valued components associated with the extended operating period of the winter roads to Gamètì and Wekweètì.	N/A	2.0 3.0 4.0 5.0	2.3 3.1.4; 3.3.3 4.1.3; 4.4.3; 4.6 5.5
	The developer will indicate and provide rationale for the geographic scope of assessment selected for each valued component.	N/A	3.0 4.0 5.0	3.1.4.1 4.1.3.1 5.1.3

Table A-1: EA-1617-01 Terms of Reference Concordance Table (cont'd)

TOR Section	Description	Applicable Section in PDR	Applicable Section in ASR	Applicable Sub-Section in ASR
2.2.4 Temporal Scope of Assessment	In addition to geographic scope, the developer must define and provide rationale for the temporal scope for the assessment of potential impacts on each valued component. For example, while some impacts may be very short or limited to a particular Project phase (e.g. sensory disturbance to caribou during road construction), others may occur over a longer period (e.g. barrier effects to caribou over the life of a project).	N/A	3.0 4.0 5.0	3.1.4.2 4.1.3.2 5.1.3
	In defining the temporal scope of assessment, the developer should consider: ▪ periods during the development when predicted effects are most intense (such as during initial construction); ▪ periods when valued components are most sensitive to potential impacts (such as key times for wildlife, migration periods, population cycles, shifts in distribution/range or wildlife harvesting periods); ▪ the duration of effects, with attention to how these effects relate to the life of the Project; and ▪ appropriate temporal boundaries for considering any impacts that may require long-term monitoring and management.	N/A	3.0 4.0 5.0	3.1.4.2 4.1.3.2 5.1.3
	For cumulative impacts, the temporal scope includes the period of effects of past, present and reasonably foreseeable future projects that are predicted to combine with the impacts of the proposed Project.	9.0	3.0 4.0 5.0	3.3.3 4.4.3 5.5
3.2 Incorporation of traditional knowledge	In accordance with section 115.1 of the MVRMA, the Review Board must consider both traditional knowledge and scientific information that is made available during an EA. In addition, paragraph 115(1)(c) of the MVRMA requires that the EA process have regard for the importance of conservation to the well−being and way of life of the Aboriginal peoples of Canada to whom Section 35 of the Constitution Act 1982 applies and who use an area of the Mackenzie Valley. As such, the developer should make all reasonable efforts to collect and use traditional knowledge, where applicable, in project design and in evaluating impacts and proposing mitigations in the PDR/ASR.	Traditional Knowledge Study Report	2.0	2.4
	The Board is encouraged by the collaboration between the Tłı̨chǫ Government and the developer and by the former's satisfaction with the developer's work in this regard. However, the ASR must contain a comprehensive, stand−alone section summarizing the use and consideration of traditional knowledge, as described below. This will assist the Board in evaluating the incorporation and use of traditional knowledge in its determinations of significant adverse impacts. This summary will explain how traditional knowledge has been incorporated into specific aspects of: Project design; impact predictions; and potential mitigations.	N/A	2.0	2.4
	The methods used in the acquisition, analysis and presentation of traditional knowledge are at the developer's discretion but should be consistent with the Review Board's Guidelines for Incorporating Traditional Knowledge into the Environmental Impact Assessment Process.	N/A	2.0	2.4

Table A-1: EA-1617-01 Terms of Reference Concordance Table (cont'd)

TOR Section	Description	Applicable Section in PDR	Applicable Section in ASR	Applicable Sub-Section in ASR
3.3 Public engagement	The Review Board acknowledges the engagement activities (described in the PDR, PR#7, Appendix E) the developer has already undertaken with communities, Aboriginal groups and other organizations with interests related to the construction and operation of an all-season road. For any additional engagement activities that have occurred during the environmental assessment, and up to the submission of the PDR/ASR, the developer will submit an updated engagement log and summary at the time of the PDR/ASR submission. This engagement log and summary should describe dates, individuals and organizations engaged with, as well as the mode of communication, discussion topics and positions taken by participants, including: ▪ all commitments and agreements made in response to issues raised by the public during these discussions, and how these commitments altered the planning of the proposed Project; and ▪ all issues that remain unresolved, documenting any further efforts envisioned by the parties to resolve them.	Appendix E	Appendix E	N/A
3.4 Developer commitments and mitigation measures	The Review Board acknowledges that the developer has listed numerous mitigation measures in their PDR. For the Review Board to consider this information as part of the PDR/ASR, the proponent will provide a commitments table listing all mitigation measures the developer will undertake related to the TASR. This includes, but is not limited to any commitments and mitigation measures identified in the PDR and on the public record, including from the Preliminary Screening process. The commitments table will also contain the following summary information: ▪ describe the purpose of the mitigation; and ▪ identify the responsible authority for implementing and enforcing the mitigation measure.	N/A	1.0 2.0 3.0 4.0 5.0 Appendix F	1.3 2.3.1 3.2 4.3 5.3
3.5 Summary materials	The following summary materials will be required in the PDR/ASR: ▪ a plain language summary of the PDR/ASR in English and Tłı̨chǫ; ▪ a concordance table for new materials that cross references the items in the TOR and Adequacy Statement with relevant sections of the PDR/ASR; and, ▪ an updated list of anticipated authorizations, permits, licenses and other approvals, including any authorizations required from the Tłı̨chǫ Government, DFO or other responsible authorities that are not already covered in the PDR	N/A	Plain Language Summary Appendix A 1.0	N/A N/A 1.5

Table A-1: EA-1617-01 Terms of Reference Concordance Table (cont'd)

TOR Section	Description	Applicable Section in PDR	Applicable Section in ASR	Applicable Sub-Section in ASR
3.6 Development description	The developer will ensure that a description of all Project components and activities is included in the PDR/ASR, including any proposed or existing components and activities not listed in Section 2.1 of these TOR.	4.0	1.0	1.2
	Where the developer feels it would be helpful to reviewers, the PDR/ASR should describe alternative development components, management systems or alternative locations for physical works and activities considered for the Project. Where applicable, the developer will provide reference to research that identifies the successful use of the specific technologies being proposed, and their relevance for this environmental setting.	N/A	N/A	N/A
	Describe the proposed Project, providing details and a schedule for all physical works and activities throughout the construction and operations phases, with a description of major activities by phase. Include milestone events (e.g. bridge construction, halfway point, project completion, etc.) and anticipated progress of construction activities (e.g. length of road constructed per year).	N/A	Appendix B	N/A
	The development description will describe all Project components and activities for the construction and operations phases including, but not limited to: ▪ project components (i.e. physical infrastructure) ▪ use of chemicals and explosives ▪ stockpiling of material ▪ water usage, management and treatment ▪ waste management ▪ power generation ▪ transportation needs ▪ maintenance ▪ public safety ▪ management and monitoring plans	4.0	1.0	1.2
3.7 Land use Plans	The TASR is entirely within the Wek'èezhìı Resource Management Area. Seventeen kilometers of the TASR cross Tłı̨chǫ lands and are thus subject to the Tłı̨chǫ Land Use Plan. The developer should demonstrate how the Project conforms to this land use plan and/or if an exemption from the land use plan would be required for any specific activities. If an exemption is required, the Developer will state if the exemption is likely to alter the Project. In such a case, the developer will describe the likelihood of those changes, and any additional direct or indirect impacts on valued components that might result.	N/A	1.0	1.4

Table A-1: EA-1617-01 Terms of Reference Concordance Table (cont'd)

TOR Section	Description	Applicable Section in PDR	Applicable Section in ASR	Applicable Sub-Section in ASR
3.8 Developer information	The following information about the developer is required: (a) how the developer will ensure that its contractors and subcontractors honour commitments made by the developer in the context of the EA; (b) environmental performance record for the GNWT−DOT on its regulatory compliance on previous construction projects; and (c) description of any corporate policies, codes of practice, programs or plans concerning the developer's environmental, sustainable development, community engagement, northern hiring, and workplace health and safety policies, with corresponding description of how they relate to the Project.		Appendix D	N/A
4 Assessment Methodology	The purpose of the PDR/ASR is to assess the potential impacts on the environment from the Project. The major steps in impact assessment are: ▪ describing the pathways of effect that link the development to valued components of the environment; ▪ forming and refining impact predictions with the help of consultation and expert knowledge (including traditional knowledge); ▪ identifying mitigation measures to reduce or avoid adverse impacts; and ▪ predicting and characterizing residual impacts[(c)]. Any deviation from the listed methodology must be accompanied by detailed rationale regarding the selected methodology in assessing Project effects on the environment.	N/A	2.0	2.2; 2.3
4.1 Impact assessment steps	For each valued component identified in section 2.2.2, the developer will complete an impact assessment, considering scientific and traditional knowledge as applicable, using the following methodology: 1. Identify the natural range of the baseline conditions without the Project, considering variability (including seasonal, inter−annual, and spatial variability for applicable/ appropriate parameters) and trends over time. 2. Identify the potential effect pathways, or interactions, between the Project and the valued component. 3. Predict potential direct and indirect impacts. a. describe the techniques used in the impact predictions (e.g. models,); b. describe all assumptions and the level of uncertainty associated with each prediction; c. consider likely climate change and fire scenarios and how scenarios affect predicted effects of the Project on valued components; and d. consider and predict how accidents and malfunctions may contribute to predicted impacts. Provide a brief risk assessment for identified accidents or malfunctions on the valued component that includes any residual effects affecting that valued component. 4. Describe the impacts in terms of: a. the mechanism that causes the predicted impact; b. geographical extent of the impact and rationale for its selection; c. the duration and frequency of the impact;	N/A	2.0 3.0 4.0 2.0	N/A

Table A-1: EA-1617-01 Terms of Reference Concordance Table (cont'd)

TOR Section	Description	Applicable Section in PDR	Applicable Section in ASR	Applicable Sub-Section in ASR
4.1 Impact assessment steps (cont'd)	d. magnitude of the impact (what degree of change is expected); e. reversibility of the impact; f. uncertainty associated with prediction; g. overall implication of the impact on the valued component; and h. likelihood of the impact. When describing impacts, compare the predicted impacts to pre−development conditions or to conditions without the Project, as appropriate. 5. Identify and describe any proposed mitigation measures: a. describe the link between the mitigation measure and the Project component responsible for the impact, and demonstrate how the proposed mitigation measures will reduce or avoid the predicted impacts. Include predictions that will help evaluate the effectiveness of the mitigation measures; and b. evaluate the technical and economic feasibility of the mitigation measures, discussing constraints, uncertainties and implementation challenges. 6. Predict the residual impacts by updating the impact predictions in step 3 to include the proposed mitigation measures. Describe any residual impacts according to step 4, and discuss the overall implication of the impacts on the valued component. 7. Describe any monitoring, evaluation and adaptive management plans that will be used to: a. detect unexpected changes; b. determine whether impact predictions are accurate; c. evaluate the effectiveness of mitigations; and d. adjust management actions to minimize adverse impacts. Demonstrate how the plans adhere to adaptive management best practices, such as those described in guidelines listed in Appendix A.			

Table A-1: EA-1617-01 Terms of Reference Concordance Table (cont'd)

TOR Section	Description	Applicable Section in PDR	Applicable Section in ASR	Applicable Sub-Section in ASR
4.2 Cumulative effects assessment steps	A cumulative effect is an impact (biophysical, socio−economic, or cultural) that results from the proposed development in combination with other past, present or reasonably foreseeable future developments. In the PDR/ASR, the developer will conduct a cumulative effects assessment for any valued component that is susceptible to cumulative effects.	9.0	3.0 4.0 5.0	3.3 4.4 5.5
	In conducting a cumulative effects assessment for each applicable valued component, the developer will use the steps below: 1. Describe and provide rationale for which past, present or reasonably foreseeable future developments, human activities, climate and fire scenarios are being considered in the cumulative effects assessment. 2. Combine the Project−related residual impact predicted under step 6 in section 4.1 with the impacts from the developments and human activities identified above: a. identify and discuss the way in which a cumulative impact may occur; b. predict the potential direct and indirect cumulative impacts; c. describe techniques utilized in impact prediction (e.g. models,), assumptions and the level of uncertainty; and d. discuss the contribution of the Project to the overall cumulative impact. 3. Characterize the cumulative impact according to steps 4 – 6 in section 4.1.	9.2	3.0 4.0 5.0	3.3 4.4 5.5
	Consideration should also be given to identifying ways in which the developer, either on its own or cooperatively with others, can reduce or avoid any predicted cumulative impacts. Current efforts on cumulative effects assessment and management should be described, including (if applicable) the developer's efforts to coordinate its monitoring and management to contribute towards a regional approach. Lessons learned from previous or current relevant cumulative effects initiatives should be discussed.		3.0 4.0 5.0	3.3 4.4 5.5
5 Baseline Information Requirements	In order to complete the impact assessment in the PDR/ASR, additional baseline information related to the assessment of specific valued components may be required. Step 1 of the impact assessment steps in section 4.1 requires the developer to identify the baseline conditions needed to assess impacts to valued components. The developer is required to incorporate sufficient baseline information so that the linkage between Project activities and impacts to valued components as a result of the Project are clearly described and evaluated.	6.0 7.0	3.0 4.0 5.0	3.1.5 4.2 5.2
7 Cumulative Effects Summary	Cumulative effects must be assessed for all relevant valued components as described in section 4.2. The developer will also provide a summary of the assessment of cumulative impacts. The summary will include a discussion of any proposed mitigations by which the developer, either on its own or cooperatively with others, will reduce or avoid any predicted cumulative impacts.	N/A	3.0 4.0 5.0	3.3 4.4 5.5

Table A-1: EA-1617-01 Terms of Reference Concordance Table (cont'd)

TOR Section	Description	Applicable Section in PDR	Applicable Section in ASR	Applicable Sub-Section in ASR
8 Follow−Up and Monitoring Programs	The PDR/ASR will include a section that summarizes proposed follow−up, monitoring and adaptive management plans and programs. This summary will: 1. Describe any monitoring, evaluation and adaptive management plans that will be used to achieve the following objectives: a. detect unexpected changes; b. determine whether impact predictions are accurate; c. evaluate the effectiveness of mitigations; d. adjust management actions to minimize adverse impacts; and e. discuss responsibilities for data collection, analysis and dissemination. 2. Describe how Project−specific monitoring will be compatible with the NWT Cumulative Impact Monitoring Program or other regional monitoring and research programs. 3. Demonstrate how the plans adhere to adaptive management best practices, such as those described in guidelines listed in Appendix A. 4. Clearly describe how these plans relate to regulatory and non−regulatory monitoring requirements for the life of the Project.		1.0 3.0 4.0 5.0	1.6 3.6 4.7 5.6
	The developer is encouraged to discuss and adopt common data collection and monitoring protocols with local and regional monitoring programs including GNWT−Environment and Natural Resources to facilitate Project impact analysis. The extent and quality of data used to establish the baseline conditions for any monitoring program should be explained.	N/A	1.0	1.6
	In addition, the developer is encouraged to use management response plans to accomplish adaptive management. Guidance on a management response framework, how to link monitoring results to management decisions and how management activities can be developed adaptively in response to changes in the environment can be found in the WLWB document Guidelines for Adaptive Management – a Response Framework for Aquatic Effects Monitoring. Draft. Oct 17, 2010	10.0 and updated plans	N/A	N/A

Notes:

a) For this EA, "species at risk" includes any species whose range is within the scope of assessment that is listed under the Species at Risk Act or the Species at Risk (NWT) Act; a species in the Northwest Territories under consideration for listing (as of July 2016); or a species considered "at risk" by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC).

b) According to the International Association for Impact Assessment (IAIA) guidelines on Socio-economic Impact Assessment, vulnerability is defined as "a situation or condition characterized by low resilience and/or higher risk and reduced ability of an individual, group or community to cope with shock or negative impacts. Vulnerability is associated with having low socio-economic status, disability, ethnicity, or one or more of the many factors that influence people's ability to access resources and development opportunities."

c) Residual impacts are effects that remain after the application of mitigation measures.

Table A-2: EA-1617-01 Adequacy Statement Concordance Table

Adequacy Statement Section	Adequacy Statement Description	Applicable Section in ASR	Applicable Sub-Section in ASR
3.1 Presentation of Material	Provide all ASR material according to the instructions in Section 3.1 of the TOR	Entire document	N/A
3.2 Incorporation of TK	Provide a stand-alone TK summary section in the ASR based on the instructions in Section 3.2 of the TOR.	2.0	2.4
3.3 Public Engagement	Reporting on ongoing engagement will follow the instructions in Section 3.3 of the TOR.	1.2.5, Appendix E	N/A
3.4 Developer Commitments	Provide a table of commitments, based on the instructions in Section 3.4 of the TOR.	Tables 3.2-1, 4.3-1, 5.3-1 and Appendix F	N/A
3.5 Summary Materials	Based on the instructions in Section 3.5 of the TOR, provide: ▪ a plain language summary of the response to the Adequacy Statement; ▪ a concordance table (against requirements in Adequacy Statement); and ▪ an updated list of anticipated authorizations, permits, licenses and other approvals, including any authorizations required from the Tłı̨chǫ Government, DFO or other responsible authorities that are not already covered in the PDR	Plain Language Summary Appendix A 1.0	N/A N/A 1.5
3.6 Development description	Based on the instructions in Section 3.6 of the TOR, provide: ▪ a detailed schedule for project activities (including estimated duration for each activity and any seasonal timing constraints and contingency plans), milestones, and timing of construction based on the estimated schedule; and ▪ an updated description of activities during the operations phase.	1.0 Appendix B	1.2 N/A
3.7 Land Use Plans	GNWT-DOT needs to state if accessing the borrow sources within the cultural heritage zone will alter the project and list any ensuing impacts that might result to valued components.	1.0	1.4
3.8 Developer	Provide information required under item b of Section 3.8 of the TOR.	Appendix D	N/A
4 Assessment Methodology	Project-related effects: refer to sections 4.1, 4.2, and 4.3 of this document for elaboration. Cumulative effects: refer to section 4.3 of this document for elaboration.	2.0	3.3 4.4 5.5
5 Assessment Methodology	Refer to Sections 4 and 4.3 of the Adequacy Statement	See above	N/A
6 Detailed Requirements Assessment	Refer to Section 4.3 of the Adequacy Statement	See above	N/A
7 Cumulative Effects Summary	Provide a summary of cumulative effects, based on the instructions in Section 7 of the TOR.	3.0 4.0 5.0	3.3 4.4 5.5

Table A-2: EA-1617-01 Adequacy Statement Concordance Table

Adequacy Statement Section	Adequacy Statement Description	Applicable Section in ASR	Applicable Sub-Section in ASR
8 Follow-up & Monitoring	Provide a summary, based on the instructions in Section 8 of the TOR.	3.0 4.0 5.0	3.6 4.7 5.5
4.1 Potential impacts and mitigation measures	The assessment of each Project-related environmental impact begins with a description of the mechanisms whereby specific Project components and activities could result in an impact to a valued component. For each valued component topic identified in section 2.2.2 of the Terms of Reference, the developer will clearly describe for all phases of the project: ▪ the potential impacts that may occur; ▪ the project component(s) and/or activities to which the impact is linked; and ▪ how the proposed mitigations will reduce or avoid the potential impact.	3.0 4.0 5.0	3.2 4.3 5.3
	The developer will provide a thorough description of the potential impacts and proposed mitigations associated with the adequacy items identified in section 4.3 of this document. The results should be summarized in a table.	3.0 4.0 5.0	3.2 4.3 5.3
4.2 Residual impacts	Building on the description required under section 4.1 above, the developer will predict and characterize residual environmental impacts (i.e. the environmental impacts that remain after mitigation has been applied) for all Project components. Thorough characterization of residual impacts is critical for the Review Board to make a final determination on significance at the end of the environmental assessment.	2.0 3.0 4.0 5.0	2.3 3.3 4.4 5.5
4.3 Cumulative impacts	In order to fully assess potential cumulative impacts, the developer will conduct a cumulative effects assessment for any valued component listed in Table 1 of the Terms of Reference (section 2.2.2): a) that is susceptible to cumulative effects: and b) for which project-related residual impacts are predicted.	3.0 4.0 5.0	3.3 4.4 5.5
	To complete the cumulative effects assessment for each relevant valued component, the developer will: ▪ Combine the Project-related residual impacts predicted (see section 4.2 of this document) with the impacts from the developments, human activities, climate and fire scenarios identified in the PDR: – identify and discuss the way in which a cumulative impact may occur; – predict the potential direct and indirect cumulative impacts according to the same methodology applied for assessing project-specific impacts; – describe techniques and assumptions utilized in impact prediction (e.g. models); and – discuss the contribution of the project to the overall cumulative impact. ▪ Characterize the cumulative impact according to steps 4 to 6 in section 4.1 of the Terms of Reference.	3.0 4.0 5.0	3.3 4.4 5.5

Table A-2: EA-1617-01 Adequacy Statement Concordance Table

Adequacy Statement Section	Adequacy Statement Description				Applicable Section in ASR	Applicable Sub-Section in ASR
	Topic	Adequacy Item	Relevant Methodology	Additional Requirement		
5.1 Valued Component: Fish and fish habitat	Fish Habitat	Water quality	Adequacy 4.1	Describe the potential impacts and mitigation measures to water quality related to fish and fish habitat from the use of explosives.	3.0	3.2
			Adequacy 4.2	Conduct a residual impact assessment to address potential project effects to water	3.0	3.3
		Accidents and spills	Adequacy 4.1	Describe the potential impacts and mitigation measures to fish habitat and water quality resulting from accidents or spills during construction and operation phases.	3.0	3.2
			Adequacy 4.2	Conduct a residual impact assessment to address potential project effects to fish habitat and water quality resulting from accidents or spills. Where appropriate, distinguish between construction and operation phases of the Project.	3.0	3.3
		Physical Impacts	Adequacy 4.1	Expand on the impact information listed on page 8-28 of the PDR, as per the requirements of assessment step.4.1 (Appendix A), providing all information requested in Table 4-1 of the Adequacy Statement. Indicate the species, critical life stages, and habitat these effects may apply to.	3.0	3.2
			Adequacy 4.2	Confirm whether or not the list of anticipated residual impacts on page 6 of Appendix T of the PDR is also the comprehensive list of residual impacts from all potential effects listed from pages 8-28 to 8-30 of the PDR. Conduct a residual impact assessment to address any potential project effects to fish habitat.	3.0	3.3
	Fish Harvesting		Adequacy 4.2	Conduct a residual impact assessment to address potential project effects to fish harvesting resulting from accidents or spills. Where appropriate, distinguish between construction and operation phases of the Project. Consider responses from Review Board IR#1.	3.0	3.3
			Adequacy 4.2	Conduct a residual impact assessment to address project effects on fish harvesting due to increased access and pressure from road users. Include an estimate of the likely number of additional users by category (accounting for seasonal variation): ▪ Aboriginal, non-Tłı̨chǫ harvesters ▪ NWT resident fishers ▪ Non-NWT fishers	3.0	3.3
		Important Fishing Areas	Adequacy 4.1	Describe the potential impacts and mitigation measures from increased access to the areas identified in the Traditional Knowledge Study Report (PR#28) and from responses to Review Board IR#1	3.0	3.2
			Adequacy 4.2	Conduct a residual impact assessment on the ability of the areas identified in the Traditional Knowledge Study Report (PR#28) to sustain increased use and fishery pressure.	3.0	3.3

Table A-2: EA-1617-01 Adequacy Statement Concordance Table

Adequacy Statement Section	Adequacy Statement Description				Applicable Section in ASR	Applicable Sub-Section in ASR
5.2 Valued Component: Caribou	Topic	Adequacy Item	Relevant Methodology	Additional Requirement	N/A	
	Barren- ground caribou	Mortality	Adequacy 4.1	Describe the potential impacts and mitigation measures related to barren-ground caribou as a result of increased harvesting pressure along the roads north of Whatì. Include consideration of the longer winter road season and a potential for increased road users.	4.0	4.3
			Adequacy 4.2	Conduct a residual impact assessment for barren- ground caribou from increased harvesting pressure related to the longer winter road season, including consideration of: ▪ potential impacts and mitigations that may affect population recovery; and ▪ overall effects on abundance, distribution and population trends of barren-ground caribou.	4.0	4.4
	Boreal caribou	Mortality risk	Adequacy 4.1	Describe potential impacts and mitigation measures related to boreal caribou as a result of construction and operation, including: ▪ change in harvesting pressure from a change in ▪ access into region; ▪ change in harvesting pressure north of Whatì ▪ due to extended season winter road; ▪ vehicle collisions; and ▪ changes in predator-prey relationships.	4.0	4.3; 4.4
			Adequacy 4.2	Conduct a residual impact assessment on boreal caribou from project-related activities, including the above identified effects.	4.0	4.4
		Habitat	TOR 4.1 step 1	Discuss the baseline range for boreal caribou in relation to the project and its effects, including: ▪ seasonal variation; and ▪ location of critical habitat along the road corridor.	4.0	4.2.2.1

Table A-2: EA-1617-01 Adequacy Statement Concordance Table

<table>
<tr><th>Adequacy Statement Section</th><th colspan="4">Adequacy Statement Description</th><th>Applicable Section in ASR</th><th>Applicable Sub-Section in ASR</th></tr>
<tr><td rowspan="5">5.2 Valued Component: Caribou (cont'd)</td><td rowspan="5">Boreal caribou (cont'd)</td><td rowspan="2">Habitat (cont'd)</td><td>Adequacy 4.1</td><td>Describe potential impacts and mitigations from direct and indirect alteration of boreal caribou habitat, inclusive of disturbance, displacement, and barrier effects. Include potential impacts:
▪ from the road disturbance footprint;
▪ from visual, smell, noise, light, and other sensory disturbances (including potential habitat avoidance or loss of effective habitat);
▪ on critical habitat areas for various life stages and movement corridors;
▪ from dusting to boreal caribou and habitat;
▪ to loss of functional habitat due to competition with other wildlife species (in particular bison);
▪ to movement patterns, including any changes in interactions with other caribou herds; and
▪ to habitat availability and distribution, due to any increases in fires resulting from use of the road.</td><td>4.0</td><td>4.4</td></tr>
<tr><td>Adequacy 4.2</td><td>Conduct a residual impact assessment on boreal caribou habitat from project-related activities, including the above identified impacts.</td><td>4.0</td><td>4.4</td></tr>
<tr><td rowspan="3">Population health</td><td>TOR 4.1 step 1</td><td>Describe the abundance, distribution, and population of boreal caribou populations</td><td>4.0</td><td>4.4</td></tr>
<tr><td>Adequacy 4.1</td><td>Describe the potential impacts and mitigations related to boreal caribou populations and population trends, including:
▪ potential effects on sensitive life stages or sensitive or critical habitat;
▪ potential effects on habitat use by boreal caribou;
▪ potential changes to the ability of boreal caribou habitat or populations to recover; and
▪ overall effects on abundance, distribution, and population trends of boreal caribou.</td><td>4.0</td><td>4.4</td></tr>
<tr><td>Adequacy 4.2</td><td>Conduct a residual impact assessment on boreal caribou population health from project-related activities, including the above identified impacts.</td><td>4.0</td><td>4.4</td></tr>
</table>

Table A-2: EA-1617-01 Adequacy Statement Concordance Table

Adequacy Statement Section	Adequacy Statement Description				Applicable Section in ASR	Applicable Sub-Section in ASR
5.3 Valued component: Wildlife, including species at risk	The PDR provides information in sections 6.6.3, 6.5.3, and 6.8.3 regarding which wildlife (including birds, amphibians, and insects), vegetation and fish species at risk may occur in the project area. However, additional information is required regarding the habitat ranges of wildlife and species at risk and the likelihood of their presence in the immediate vicinity of the project area.				4.0	4.2
5.3 Valued component: Wildlife, including species at risk	In their PDR, the developer proposed a number of mitigations that would address project-related effects to wildlife (e.g. PR#7 p5-2, p8-15, pp8-22 to 8-25). As mentioned for caribou, above, the effectiveness of some of these mitigation measures was challenged during the preliminary screening process (see PR#24 NSMA#1- Attachment letter p8) and was a supporting rationale in the Review Board's Reasons for Decision for Environmental Assessment to refer the TASR to EA (PR#2 p1). A discussion of how likely these mitigation measures are to reduce or eliminate concerns to wildlife and species at risk has not occurred. Neither has a description of any residual effects following implementation of the mitigation measures occurred. Both steps are required to assess potential impacts of the project to wildlife and other species at risk. Table 5-3 outlines the additional assessment required for this topic.				4.0	4.3
5.3 Valued component: Wildlife, including species at risk	Topic	Adequacy Item	Relevant Methodology	Additional Requirement	N/A	N/A
5.3 Valued component: Wildlife, including species at risk	Moose, bison, wolverine	Competition	Adequacy 4.1	Describe the potential impacts and mitigations related to moose, bison and wolverine from loss of functional habitat due to competition with other species. Include the potential impact of bison moving into the project area on moose.	4.0	4.3
5.3 Valued component: Wildlife, including species at risk	Moose, bison, wolverine	Competition	Adequacy 4.2	Conduct a residual impact assessment on moose, bison and wolverine from project-related activities, including the above identified impacts.	4.0	4.4
5.3 Valued component: Wildlife, including species at risk	Moose, bison, wolverine	Mortality risk	Adequacy 4.1	Describe potential impacts and mitigation measures to reduce impacts to moose, bison and wolverine as a result of project components, including: ▪ changes in harvesting from changes in access into region; ▪ vehicle collisions; and ▪ changes in predator-prey relationships.	4.0	4.3
5.3 Valued component: Wildlife, including species at risk	Moose, bison, wolverine	Mortality risk	Adequacy 4.2	Conduct a residual impact assessment on moose, bison and wolverine from project-related activities, including the above identified impacts.	4.0	4.4
5.3 Valued component: Wildlife, including species at risk	Species at risk	Impacts on species at risk including monitoring	Adequacy 4.2	Conduct a residual effects assessment on species at risk from project-related activities. ▪ Assess potential impacts ▪ Identify mitigation ▪ Propose monitor that considers the effectiveness of mitigation and consistency with recovery or management strategies	4.0	4.4

Table A-2: EA-1617-01 Adequacy Statement Concordance Table

Adequacy Statement Section	Adequacy Statement Description				Applicable Section in ASR	Applicable Sub-Section in ASR
5.3 Valued component: Wildlife, including species at risk (cont'd)	Species at risk for mammals, birds, fish, plants, amphibians, insects (excluding boreal caribou)	Population health	Adequacy 4.1	Describe the potential impacts to any mammal (including bats), bird, fish, plant, amphibian, and insect species at risk that have the potential to occur in the vicinity of the project	4.0	4.3
			Adequacy 4.2	Conduct a residual impact assessment on any mammal, bird, fish, plant, amphibian, and insect species at risk from project components.	4.0	4.4
5.4 Valued component: traditional use, culture, and heritage resources	Topic	Adequacy Item	Relevant Methodology	Additional Requirement	N/A	N/A
	Traditional use and way of life	Traditional use	Adequacy 4.1	Describe any potential impacts and mitigations to traditional use and way of life from project-related activities, including those identified in responses from Review Board IR#2 and from: ▪ anticipated disturbances to wildlife and wildlife movement associated with the operation of an all-season road affecting the perception of the land by traditional users; ▪ a change in perception of the land resulting in changes to traditional use or value of the area; and ▪ from increased mobility and time spent away from the community, including youth.	5.0	5.3; 5.4
			Adequacy 4.2	Conduct a residual impact assessment on traditional use and way of life affected by project-related activities, including the above-identified impacts.	5.0	5.5
	Harvesting	Wildlife harvesting	Adequacy 4.1	Describe any potential impacts and mitigations to traditional use and way of life of Whatì residents from increased competition for harvest resources resulting from increased access and use of region by outside harvesters.	5.0	5.3; 5.4
			Adequacy 4.2	Conduct a residual impact assessment on harvesting affected by project-related activities, including the above identified impacts.	5.0	5.5
	Heritage and cultural resources	Heritage resources	TOR 4.1 step 1	Describe important heritage resources for aboriginal groups that may be affected by the project and its related activities, including those identified in responses to Review Board IR#3.	5.0	5.2.11
			Adequacy 4.1	Describe any potential impacts and mitigations to heritage resources for any areas identified as valued heritage resources, including those identified in responses to Review Board IR#3.	5.0	5.4.3.3
			Adequacy 4.2	Conduct a residual impact assessment on heritage resources for any additional identified resources.	5.0	5.5.3.3
	In addition, the Review Board acknowledges that archaeological work has been completed (AOA and AIA) for the road corridor, but requires further clarification on assessing the archaeological potential of borrow sources and access to these locations.				5.0	5.4.3.3

Table A-2: EA-1617-01 Adequacy Statement Concordance Table

<table>
<tr><th>Adequacy Statement Section</th><th colspan="4">Adequacy Statement Description</th><th>Applicable Section in ASR</th><th>Applicable Sub-Section in ASR</th></tr>
<tr><td rowspan="7">5.5 Valued Component: Economic Well-being</td><td>Topic</td><td>Adequacy Item</td><td>Relevant Methodology</td><td>Additional Requirement</td><td>N/A</td><td>N/A</td></tr>
<tr><td rowspan="3">Equity and vulnerability</td><td rowspan="3">Vulnerability</td><td>TOR 4.1 step 1</td><td>Identify the most vulnerable groups in the community least likely to benefit from the Project or from reasonably foreseeable future economic activities, including those identified in the responses to Review Board information requests.</td><td>5.0</td><td>5.2</td></tr>
<tr><td>Adequacy 4.1</td><td>Describe any potential impacts and mitigation measures related to vulnerable groups as a result of anticipated economic benefits associated with the Project, including any corresponding impact on community cohesion, and considering the responses to Review Board information requests.</td><td>5.0</td><td>5.4.2.5</td></tr>
<tr><td>Adequacy 4.2</td><td>Conduct a residual impact assessment on vulnerable groups affected by project-related activities, including the above identified impacts.</td><td>5.0</td><td>5.5.2.5</td></tr>
<tr><td rowspan="3">Traditional and Non- wage economy</td><td rowspan="3">Non-wage economy</td><td>TOR 4.1 step 1</td><td>Describe the non-wage economy in Whatì and the degree of local reliance on it to offset cost of living.</td><td>5.0</td><td>5.2; 5.4.3.1</td></tr>
<tr><td>Adequacy 4.1</td><td>Describe any potential impacts and mitigation measures related to the non-wage economy from an anticipated increase in harvesting pressure and competition associated with increased access to the region.</td><td>5.0</td><td>5.4.3.1</td></tr>
<tr><td>Adequacy 4.2</td><td>Conduct a residual impact assessment on aspects of the non-wage economy affected by project- related activities, including the above identified impacts.</td><td>5.0</td><td>5.5.1.2</td></tr>
<tr><td rowspan="3">5.6 Valued component: Stable and Healthy Communities</td><td>Topic</td><td>Adequacy Item</td><td>Relevant Methodology</td><td>Additional Requirement</td><td>N/A</td><td>N/A</td></tr>
<tr><td rowspan="2">Use and maintenance of infrastructure</td><td rowspan="2">Solid waste & sewage treatment facilities</td><td>Adequacy 4.1</td><td>Describe any potential impacts and mitigations to community solid waste facilities and sewage treatment facilities used by the Project during construction and maintenance activities, including consideration of:
▪ the anticipated incremental demand on the infrastructure from construction and maintenance (e.g. tonnes of waste or volume of sewage); and
▪ the existing capacity of the infrastructure to accommodate the increased demand.</td><td>5.0</td><td>5.4.2.2</td></tr>
<tr><td>Adequacy 4.2</td><td>Conduct a residual impact assessment on community solid waste facilities and sewage treatment facilities used by the Project during construction and maintenance activities, including the above identified impacts.</td><td>5.0</td><td>5.5.2.2</td></tr>
</table>

Table A-2: EA-1617-01 Adequacy Statement Concordance Table

Adequacy Statement Section	Adequacy Statement Description				Applicable Section in ASR	Applicable Sub-Section in ASR
5.6 Valued component: Stable and Healthy Communities (cont'd)	Public safety	Traffic safety	TOR 4.1 step 1	Describe the current levels of mobility for Whatì residents (i.e. movement in and out of), including: ▪ as a percentage of the community population; ▪ by age and gender; ▪ frequency during winter road season; ▪ frequency outside of winter road season; and ▪ by mode of transport.	5.0 Appendix C	Appendix C Tables C-1, C-2, C-3, C-4
			TOR 4.1 step 3a, 3b, 3d	Elaborate on how the vehicle traffic number of 20-40 vehicles per day was derived, including: ▪ proportion of public vs private traffic; ▪ seasonal variations; and ▪ anticipated rate of increase corresponding to anticipated population change and economic opportunities.	Appendix C	N/A
			TOR 4.1 step 3d	Provide an estimate on the likelihood, number and severity of motor vehicle accidents affecting Whatì and/or NWT residents on the all-season road using data from other NWT communities with road access as a reference point. Include any statistics from vehicle accidents on the annual winter road to Whatì.	5.0	N/A
	Public Safety	Accidents & Emergency Response	TOR 4.1 step 1	Describe the emergency response services for accidents on NWT public highways, including: ▪ how traffic accidents are currently managed; and ▪ who the responsible authorities are for emergency response and the planning thereof.	5.0	5.4.2.4
			TOR 8	Provide an emergency response plan for how accidents and emergencies will be addressed on the proposed TASR highway, including the responsible authorities for implementation. List any new requirements and expenses for mentioned organizations to implement the plan.	5.0	5.4.2.4

Table A-2: EA-1617-01 Adequacy Statement Concordance Table

Adequacy Statement Section	Adequacy Statement Description				Applicable Section in ASR	Applicable Sub-Section in ASR
5.6 Valued component: Stable and Healthy Communities (cont'd)	Public Safety and Community Cohesion	Well-being indicators	Adequacy 4.1	Describe potential impacts to public safety and community cohesion from construction camps, including: ▪ pregnancy; ▪ sexually transmitted infections; ▪ drug and alcohol use; and ▪ crime-violent and property.	5.0	5.4.2
			Adequacy 4.2	Conduct a residual impact assessment for the above noted indicators and their overall effect on community cohesion.	5.0	5.5
	Population sustainability	Population growth	TOR 4.1 step 3	Describe the anticipated population level change resulting from the operation of an all-season road, including: ▪ estimate the rate of population change from the time the road is constructed and projected through to include reasonable foreseeable economic activities; and ▪ list the likely source populations for people moving to Whatì. For smaller communities, provide an estimate of the migrants as a percentage of the community of origin (e.g. 10% of Gamètì).	5.0	5.2.1
			Adequacy 4.1	Describe any potential impacts and mitigation measures of the anticipated population change, including those identified in the response to the Review Board's information request to TG and CGW on population growth, and to: ▪ community stability for affected communities; and ▪ community of Whatì infrastructure (i.e. housing, sewage treatment, solid waste facility, law enforcement and health and social services).	5.0	5.4.2.1
			Adequacy 4.2	Conduct a residual impact assessment for the anticipated population change and its effect on affected communities (e.g. community stability & infrastructure).	5.0	5.5.2.1

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APPENDIX B

Tentative Construction Schedule and Typical Operations and Maintenance Activities

Tentative Construction Schedule of TASR Project (Option 1: One Spread)

Km 0.0 - Km 30.0 (30 Kms), Year 1 - 2018/2019				
Activity ID	Name of Activity	**Duration(day)**	Start	Finish
1	Design submittals by Project Co.	**40.0**	3-Sep-18	12-Oct-18
2	Review of design submittals	**12.0**	15-Oct-18	26-Oct-18
3	Design finalization & approvals	**10.0**	29-Oct-18	7-Nov-18
4	Submission of work schedule	**7.0**	8-Nov-18	14-Nov-18
5	Pre-construction meeting	**1.0**	15-Nov-18	15-Nov-18
6	Project commencement & Inauguration	**1.0**	16-Nov-18	16-Nov-18
7	Mobilization	**14.0**	17-Nov-18	30-Nov-18
8	Construction Camp Setup	**14.0**	17-Nov-18	30-Nov-18
9	Right of Way Clearing, Km 0-94	**200.0**	30-Nov-18	17-Jun-19
10	Drilling & Blasting in RoW (if required), Km 0-94	**60.0**	10-Jan-19	10-Mar-19
11	Construction of Quarry Access Road	**47.0**	30-Nov-18	15-Jan-19
12	Clearing/grubbing at Quarry	**41.0**	6-Dec-18	15-Jan-19
13	Drilling & Blasting in Quarry/Production for Embankment materials	**320.0**	15-Jan-19	30-Nov-19
14	Construction of Embankment	**308.0**	1-Feb-19	5-Dec-19
15	Culvert installation	**308.0**	1-Feb-19	5-Dec-19
16	Development of Drainage & Ditching	**308.0**	1-Feb-19	5-Dec-19
17	Sediment and erosion control	**308.0**	1-Feb-19	5-Dec-19
18	Quarry Reclamation	**7.0**	29-Nov-19	5-Dec-19
Km 30.0 - Km 55.0 (25 Kms), Year 2 - 2020				
Activity ID	Name of Activity	**Duration(day)**	Start	Finish
1	Construction of Quarry Access Road	**30.0**	15-Jan-20	13-Feb-20
2	Clearing/grubbing at Quarry	**30.0**	22-Jan-20	20-Feb-20
3	Drilling & Blasting in Quarry/Production for Embankment materials	**316.0**	20-Jan-20	30-Nov-20
4	Construction of Embankment	**309.0**	1-Feb-20	5-Dec-20
5	Culvert installation	**309.0**	1-Feb-20	5-Dec-20
6	Development of Drainage & Ditching	**309.0**	1-Feb-20	5-Dec-20
7	Sediment and erosion control	**309.0**	1-Feb-20	5-Dec-20
8	Approach Rd & construction, Duport River Bridge Structure Km 40+410	**92.0**	10-Jan-20	10-Apr-20
9	Approach road & Construction of Bridge Structure Km 45+190km	**92.0**	10-Jan-20	10-Apr-20
10	Quarry Reclamation	**7.0**	29-Nov-20	5-Dec-20
Km 55.0 - Km 80.0 (25 Kms), Year 3 - 2021				
Activity ID	Name of Activity	**Duration(day)**	Start	Finish
1	Construction of Quarry Access Road	**30.0**	15-Jan-21	13-Feb-21
2	Clearing/grubbing at Quarry	**30.0**	22-Jan-21	20-Feb-21
3	Drilling & Blasting in Quarry	**315.0**	20-Jan-21	30-Nov-21
4	Production of Aggregate in Quarry for Sub-base/base	**200.0**	15-Jan-21	2-Aug-21
5	Construction of Embankment	**308.0**	1-Feb-21	5-Dec-21
6	Culvert installation	**308.0**	1-Feb-21	5-Dec-21
7	Development of Drainage & Ditching	**308.0**	1-Feb-21	5-Dec-21
8	Sediment and erosion control	**308.0**	1-Feb-21	5-Dec-21
9	Construction of Sub-base/Base Course, **Km 0-55**	**334.0**	1-Jan-21	30-Nov-21
10	Approach road & Construction of Arch Culvert Km 48+223.5	**91.0**	10-Jan-21	10-Apr-21
11	Approach road & Construction of James River Bridge Structure Km 68+715	**91.0**	10-Jan-21	10-Apr-21
12	Installation of Steel W-beam Guardrail as needed	**300.0**	1-Feb-21	27-Nov-21
13	Quarry Reclamation	**7.0**	29-Nov-21	5-Dec-21
Km 80.0 - Km 94.0 (14 Kms), Year 4 - 2022				
Activity ID	Name of Activity	**Duration(day)**	Start	Finish
1	Construction of Quarry Access Road	**30.0**	15-Jan-22	13-Feb-22
2	Clearing/grubbing at Quarry	**30.0**	22-Jan-22	20-Feb-22
3	Drilling & Blasting in Quarry	**80.0**	21-Jan-22	10-Apr-22
4	Construction of Embankment	**212.0**	1-Feb-22	31-Aug-22
5	Culvert installation	**212.0**	1-Feb-22	31-Aug-22
6	Development of Drainage & Ditching	**212.0**	1-Feb-22	31-Aug-22
7	Sediment and erosion control	**212.0**	1-Feb-22	31-Aug-22
8	Construction of Sub-base/Base Course, **Km 55-94**	**229.0**	15-Jan-22	31-Aug-22
9	Approach road & Construction of La Martre Bridge Structure Km 84+480	**90.0**	10-Jan-22	9-Apr-22
10	Installation of Steel W-beam Guardrail as needed	**212.0**	1-Feb-22	31-Aug-22
11	Quarry Reclamation	**10.0**	1-Sep-22	10-Sep-22
12	Installation of Traffic Signs, Delineators & Km posts	**76.0**	1-Jul-22	14-Sep-22
13	Deficiency rectification and Cleanup	**243.0**	1-Jan-22	31-Aug-22
14	Final inspection	**45.0**	1-Aug-22	14-Sep-22
15	As-built drawing update	**90.0**	17-Jun-22	14-Sep-22
16	Completion & Certification	**10.0**	21-Sep-22	30-Sep-22
17	Demobilization	**30.0**	1-Sep-22	30-Sep-22
18	Project Opening	**1.0**	25-Nov-22	25-Nov-22

Tentative Construction Schedule of TASR Project (Option 2: Two Spreads)

Km 0.0-Km 15.0 and Km 94.0 - Km 79.0 (30 Kms), Year 1 - 2018/2019				
Activity ID	Name of Activity	**Duration(day)**	Start	Finish
1	Design submittals by Project Co.	**40.0**	3-Sep-18	12-Oct-18
2	Review of design submittals	**12.0**	15-Oct-18	26-Oct-18
3	Design finalization & approvals	**10.0**	29-Oct-18	7-Nov-18
4	Submission of work schedule	**7.0**	8-Nov-18	14-Nov-18
5	Pre-construction meeting	**1.0**	15-Nov-18	15-Nov-18
6	Project commencement & Inauguration	**1.0**	16-Nov-18	16-Nov-18
7	Mobilization	**14.0**	17-Nov-18	30-Nov-18
8	Construction Camp Setup	**14.0**	17-Nov-18	30-Nov-18
9	Right of Way Clearing, Km 0-94	**200.0**	30-Nov-18	17-Jun-19
10	Drilling & Blasting in RoW (if required), Km 0-94	**60.0**	10-Jan-19	10-Mar-19
11	Construction of Quarry Access Road	**47.0**	30-Nov-18	15-Jan-19
12	Clearing/grubbing at Quarry	**41.0**	6-Dec-18	15-Jan-19
13	Drilling & Blasting in Quarry/Production for Embankment materials	**320.0**	15-Jan-19	30-Nov-19
14	Construction of Embankment	**308.0**	1-Feb-19	5-Dec-19
15	Culvert installation	**308.0**	1-Feb-19	5-Dec-19
16	Development of Drainage & Ditching	**308.0**	1-Feb-19	5-Dec-19
17	Sediment and erosion control	**308.0**	1-Feb-19	5-Dec-19
18	Approach road & Construction of La Martre Bridge Structure Km 84+480	**90.0**	10-Jan-19	9-Apr-19
19	Quarry Reclamation	**7.0**	29-Nov-19	5-Dec-19
Km 15.0-Km 27.5 and Km 79.0 -Km 66.5 (25 Kms), Year 2-2020				
Activity ID	Name of Activity	**Duration(day)**	Start	Finish
1	Construction of Quarry Access Road	**30.0**	15-Jan-20	13-Feb-20
2	Clearing/grubbing at Quarry	**30.0**	22-Jan-20	20-Feb-20
3	Drilling & Blasting in Quarry/Production for Embankment materials	**316.0**	20-Jan-20	30-Nov-20
4	Construction of Embankment	**309.0**	1-Feb-20	5-Dec-20
5	Culvert installation	**309.0**	1-Feb-20	5-Dec-20
6	Development of Drainage & Ditching	**309.0**	1-Feb-20	5-Dec-20
7	Sediment and erosion control	**309.0**	1-Feb-20	5-Dec-20
8	Approach road & Construction of James River Bridge Structure Km 68+715	**90.0**	10-Jan-20	8-Apr-20
9	Quarry Reclamation	**7.0**	29-Nov-20	5-Dec-20
Km 27.5 - Km 40.0 and Km 66.5 - Km 54.0 (25 Kms), Year 3-2021				
Activity ID	Name of Activity	**Duration(day)**	Start	Finish
1	Construction of Quarry Access Road	**30.0**	15-Jan-21	13-Feb-21
2	Clearing/grubbing at Quarry	**30.0**	22-Jan-21	20-Feb-21
3	Drilling & Blasting in Quarry	**315.0**	20-Jan-21	30-Nov-21
4	Production of Aggregate in Quarry for Sub-base/base	**200.0**	15-Jan-21	2-Aug-21
5	Construction of Embankment	**308.0**	1-Feb-21	5-Dec-21
6	Culvert installation	**308.0**	1-Feb-21	5-Dec-21
7	Development of Drainage & Ditching	**308.0**	1-Feb-21	5-Dec-21
8	Sediment and erosion control	**308.0**	1-Feb-21	5-Dec-21
9	Construction of Sub-base/Base Course, **Km 0-35 & Km 94-59 (70 Kms)**	**334.0**	1-Jan-21	30-Nov-21
10	Approach Rd & construction, Duport River Bridge Structure Km 40+410	**92.0**	10-Jan-21	10-Apr-21
11	Approach road & Construction of Bridge Structure Km 45+190km	**92.0**	10-Jan-21	10-Apr-21
12	Installation of Steel W-beam Guardrail as needed	**300.0**	1-Feb-21	27-Nov-21
13	Quarry Reclamation	**7.0**	29-Nov-21	5-Dec-21
Km 40.0 - Km 47.0 and Km 54.0 - Km 47.0 (14 Kms), Year 4-2022				
Activity ID	Name of Activity	**Duration(day)**	Start	Finish
1	Construction of Quarry Access Road	**30.0**	15-Jan-22	13-Feb-22
2	Clearing/grubbing at Quarry	**30.0**	22-Jan-22	20-Feb-22
3	Drilling & Blasting in Quarry	**80.0**	21-Jan-22	10-Apr-22
4	Construction of Embankment	**212.0**	1-Feb-22	31-Aug-22
5	Culvert installation	**212.0**	1-Feb-22	31-Aug-22
6	Development of Drainage & Ditching	**212.0**	1-Feb-22	31-Aug-22
7	Sediment and erosion control	**212.0**	1-Feb-22	31-Aug-22
8	Construction of Sub-base/Base Course, **Km 35-47 & Km 59-47 (24 Kms)**	**229.0**	15-Jan-22	31-Aug-22
9	Approach road & Construction of Arch Culvert Km 48+223.5	**91.0**	10-Jan-22	10-Apr-22
10	Installation of Steel W-beam Guardrail as needed	**212.0**	1-Feb-22	31-Aug-22
11	Quarry Reclamation	**10.0**	1-Sep-22	10-Sep-22
12	Installation of Traffic Signs, Delineators & Km posts	**76.0**	1-Jul-22	14-Sep-22
13	Deficiency rectification and Cleanup	**243.0**	1-Jan-22	31-Aug-22
14	Final inspection	**45.0**	1-Aug-22	14-Sep-22
15	As-built drawing update	**90.0**	17-Jun-22	14-Sep-22
16	Completion & Certification	**10.0**	21-Sep-22	30-Sep-22
17	Demobilization	**30.0**	1-Sep-22	30-Sep-22
18	Project Opening	**1.0**	25-Nov-22	25-Nov-22

List of Typical Operations and Maintenance Activities for a Gravel Highway

#	Activity List	Summary Description	Objective
1. Road Surfaces and Shoulders			
1.1	Wet and Dry Blading	Blade and reshape gravel roads including scarifying as required to correct deficiencies such as: a) Inadequate crown or super elevation; b) Potholed, rutted or corrugated conditions; c) Windrows or loose gravel; and d) To recover the lost gravel from grade side slopes.	Maintain gravel road surfaces free of deficiencies that will impede the safe and comfortable use of the road and maintain intended design standards as practicable with the given available maintenance resources.
1.2	Gravel Surfacing	Gravel surfacing of continuous sections of gravel surfaced roads by the annual replacement of lost material through normal road use (traffic kick-off, erosion, grade absorption, snowplowing, etc.) The quantities in the annual gravel replacement program should not be confused with major gravelling that could be required to re-establish a specific section of highway or upgrade a highway to a certain level.	Maintain a safe driving surface on gravel roads by the annual replacement of lost material to avoid major and extensive rehabilitation and preserve the surface in a cost-effective manner.
1.3	Spot Gravelling	Spot patching of short (less than 0.2 km) sections of the highway and gravel surfaces to correct such deficiencies as: a) localized road depressions, b) settlement at utility cuts or culverts, c) potholes and minor unstable areas, and d) areas lacking gravel.	Ensure the traveled surface of gravel highways is maintained to the intended cross-section.
1.4	Grade Repairs-Gravel Surfaces	The repair of the grade including shoulders and grade side slopes using selected clay, pit run gravel, crush or other suitable materials to correct deficiencies such as: a) Unstable areas/frost upheaval b) Settlement (including problems relating to permafrost) c) Grade washout/erosion d) Grade slippage e) Loss of surface cross-section f) This operation includes the excavation beyond the failure zone.	Maintain the cross section integrity of the gravel road to preserve the original design standard, given available maintenance resources.
1.5	Dust Treatment	Dust abatement and surface stabilization of gravel road surface; may include the use of dust abatement chemicals as allowed for within environmental regulation.	Provide a safer and more comfortable service while preserving the integrity of the road surface by retaining surface material.
2. Drainage			
2.1	Clean and Inspect Culverts	Clean and inspect culverts to determine structural integrity and to correct deficiencies such as: a) Blockage or constriction with debris b) Debris in outlet and inlet channels c) Minor damage to culvert ends d) Erosion at culvert ends e) Installation and maintenance of steam pipes f) Removal of ice and snow inside or adjacent to the culvert ends g) Removal of beaver dams that impact the culvert drainage area, as allowed for within environmental regulation.	Ensure the proper functioning of culverts and identify possible culvert failures that could cause hazardous road condition.
2.2	Culvert Repair/ Replacement	Repair and/or replace damage or undersized culverts up to maximum diameter of 1,200 millimetres, where the embankment depth to obvert at centreline is less that 2,000 millimetres. Obvert is the top of the culvert while invert describes the bottom of the culvert.	Maintain the integrity of the culverts to ensure adequate drainage capacity and the safe usage of the highway.
2.4	Ditch Reclamation	Ditch reclamation is the reclamation of existing roadside, interceptor and off take drainage ditches by excavating, loading, hauling and disposing of material removed to correct deficiencies such as: a) Ditch erosion b) Non-conformity in grade line, or cross section c) Blockages caused by rubbish and debris d) Water flow restricted by trees and brush	Restore a drainage system that will provide adequate water movement away from the highway to preserve the integrity of the highway grade.
2.4	Ditch Reclamation	Ditch reclamation is the reclamation of existing roadside, interceptor and off take drainage ditches by excavating, loading, hauling and disposing of material removed to correct deficiencies such as: a) Ditch erosion b) Non-conformity in grade line, or cross section c) Blockages caused by rubbish and debris d) Water flow restricted by trees and brush	Restore a drainage system that will provide adequate water movement away from the highway to preserve the integrity of the highway grade.
2.5	Beaver Dam Removal	The removal of obstruction caused by beaver or other animals in culverts, natural waterways, interceptors and off-take ditches to correct drainage deficiencies that affect the highway grade, as allowed for within environmental regulation.	Remove beaver dams that cause water ponding and the possibility of grade damage due to water seepage or the potential of a grade washout.
3. Bridges			
3.1	Bridge Inspection	Conduct routine inspection and reporting of structural conditions of highway structures - bridges and bridge-culverts (large culverts 1500 mm and over).	Determine, from visual observation, that the highway structure is safe for the intended use.
3.2	Bridge Cleaning	Bridge cleaning will be performed on all exposed bridge components to remove all dirt and debris, de-icing chemicals, winter sand or any other material with harmful effect on the bridge.	Ensure that bridges are clean in order to reduce rust and corrosion to the structure, facilitate proper inspection, and improve the appearance.
3.3	Bridge Maintenance	The following is a list of typical bridge maintenance items: a) Monitor structures during the normal course of road inspections and notify the Head of Structures of any problems or anything unusual at a bridge site (e.g., accident damage, deck joint problems, abnormal alignment, etc.) b) If there are any problems at a bridge site that are an immediate traffic safety concern, take immediate action to accommodate traffic and/or to alleviate the safety concern until the Head of Structures or Structures Section staff can assess the situation (e.g., barricade lane, remove debris from roadway surface, etc.) c) Supply, install, and maintain all signing for bridge structures in accordance with current Department standards, including the maintenance of reflectors and hazard markers on bridge rails. d) Wash all exposed and accessible bridge components such as the decks, drains, curbs, railing, signs, abutments, piers, and the splash zones and bottom chords of trusses (de-icing salts should be removed as soon as practical). Each structure will have an issued "As Built" report on the best methods to complete bridge washing. e) Patch and crack fill Asphalt Concrete Pavement (ACP) deck wearing surfaces. f) Repair of bank and headslope erosion and scour holes including replacement of damaged or undersized rock rip rap.	Provide a safe and comfortable use of the structure and to maintain to the intended usage standard given available maintenance resources.

List of Typical Operations and Maintenance Activities for a Gravel Highway

#	Activity List	Summary Description	Objective
		g) Maintain bridge drainage (trough drains at ends of bridge, deck drains, etc.) including drainage of bridge approaches. h) Repair or replace timber stripdecks (running boards). i) Remove drift, beaver dams, or other debris and sediment that may impede the flow at bridges and bridge-culverts. j) Repair or replace bridge flexbeam railing (not posts). k) Repair or replace approach road railing (flexbeams and timber posts). l) Repair bumps at bridge and culvert approaches to reduce impact on structure. Non-routine, more specialized maintenance activities like approach slab settlement may be carried out under the direction of the Bridge Engineer. m) Paint over graffiti on bridge structures. n) Monitor and provide minor repairs to struts in culverts. o) Provide flag persons/traffic control devices for short-term repairs or inspections.	
4. Roadside			
4.1	Machine Mowing	Machine mowing of grass, small brush and other vegetation within the highway right of way to: a) Control unwanted growth b) Maintain visibility for safety c) Improve roadside appearance d) Minimize formation of snowdrifts	Control brush and improve the sight distance for the safety of the user of the road.
4.2	Brush And Debris Removal	Clearing right-of-way of trees, brush, stones and debris to correct deficiencies such as: a) Restricted sight distance b) Obstructed visibility of signs c) Interference to mowing d) Could create snow drifts on road surface	Improve sight distance and remove debris to enhance the safety for the user of the road.
4.3	Machine Cutting Brush and Trees	The cutting of undesirable brush and trees with a hydraulically operated rotary brushcutter mounted in either a grader or a skidder.	Improve sight distances to enhance the safety for the user of the road
4.4	Hand Brushing	The use of labor with hand tools to: a) Cut and dispose of brush from areas such as rock cuts, steep slopes, permafrost and swampy areas or adjacent to sign posts, etc. b) To provide a view or vista at specific locations c) Clean up and disposal of windfall.	Brush by hand when other methods are either impractical or impossible.
4.5	Litter Pick-Up	The removal and disposal of litter, debris, objects and unwanted materials from the highway and its right of way and the general cleanup of ditches includes: a) Removal of objects or litter which may present a hazard to the highway user b) Removal of objects or litter which could harm maintenance forces personnel or damage equipment during normal maintenance operations. c) To give the highway a generally neat and tidy appearance.	Ensure that the area within the right of way is maintained to an attractive appearance while enhancing the safety of the highway user.
4.6	Rest Stops/ Litter Barrels	All work associated with rest stops and litter barrel sites such as: a) Installation and maintenance of litter barrels b) Pickup of any litter adjacent to the litter barrels c) Emptying of the litter barrels d) Disposal of the litter.	Provide highway users with a convenient method of disposing litter.
5. Winter			
5.1	Snow Plowing	Plowing snow from the surface of the road; this includes winging as required. Typically begins when snow reaches a depth of eight centimetres on the gravel driving surface and continues until the surface is bared. Note that in order to protect the gravel driving surface, snow plowing activities may leave a snow cushion from one to two centimetres of snow on the driving surface. Special attentions for areas of concern including intersections, bridges, critical hills and corners can become slippery. As much snow as possible should be removed without unnecessarily scalping the gravel driving surface.	Maintain travel services that provide driving conditions that are as safe as possible, during and after a snow storm, based on a level of service specific to the road category and recognizing specific conditions.
5.2	Snow Removal	Snow removal from guardrails, bridge decks, railroad crossings, intersections, and other critical areas where snow cannot be simply bladed off the road surface during the snow plowing operation. Includes: a) Plowing snow to the nearest area where it can be deposited over the shoulder. b) Loading and hauling to a disposal site. c) Hand Shovelling.	Provide a safe driving surface recognizing specific conditions at the time.
5.3	Ice Blading	Spot or continuous removal of sheet ice from road surfaces using a grader equipped with ice or carbide tipped scarifier blades. Tandem truck complete with underblade equipped with ice blades may be substituted for the grader.	Provide a safe travel surface.
5.4	Sanding	Spreading of sand on slippery road surfaces using a truck equipped with a mechanical spreader to provide traction for vehicles when other methods to correct the condition are neither timely nor practical; in accordance with road safety audits.	Maintain the highways in a safe condition by eliminating hazardous slippery surface conditions given the available resources.
5.5	Stockpiling Winter Sand	The stockpiling of winter sand includes: a) Screening of the aggregate when necessary, b) Hauling, c) Blending with chemicals or freeze drying the aggregate, d) Stockpiling the processed material.	Stockpile material which is readily workable in below freezing temperatures, and will provide good traction on ice or compacted snow.
5.6	Snowfences	Snowfencing includes the installation, annual inspection, repair and removal as and when required.	Control or reduce snow drifts from forming on the highway.
5.7	Culvert Steaming	The thawing/opening of frozen culverts includes: a) Use of a portable steam generator b) The installation and maintenance of steam pipes installed in culverts. c) Removal of ice and snow from inside or adjacent to culvert ends.	Permit the local drainage pattern to function.
5.8	Glaciation/ Overflow Control	Glaciation/overflow control involves all work relating to the problems created by below freezing temperatures which cause ponding of water or a build-up of either adjacent to or on the highway and in drainage structures includes: a) Cutting off or diverting the water source. b) Building berms of snow, ice, etc. to prevent or to reduce the build-up of ice in culverts and ditches or on the road surface.	Prevent ice build-up on road surfaces and in drainage structures by controlling unwanted winter water flows.

List of Typical Operations and Maintenance Activities for a Gravel Highway

#	Activity List	Summary Description	Objective
6. Traffic Services			
6.1	Guiderail Services	Guiderail maintenance includes the repair, replacement, cleaning, etc. of flexible beam, box beam and concrete barrier type guiderail to correct deficiencies such as: a) Broken, rotted posts b) Posts out of alignment c) Incorrect height of posts d) Loose bolts, broken offset blocks e) Bent or damaged guiderail f) Removal of debris and vegetation under the guiderail g) Dirty guiderail	Maintain existing guiderail in a condition that will satisfactorily serve its design purpose and have a reasonably neat appearance.
6.2	Erect New Signs	Erecting permanent signs at new locations on all weather roads as approved by the Department.	Guide motorists in a safe and orderly movement of traffic as facilities ahead change or new signage concepts are approved.
6.3	Sign Maintenance	Sign maintenance includes straightening, repairing, cleaning and the replacement of permanent highway signs, markers, delineators and posts to correct deficiencies such as: a) Damage to signs, markers, delineators and posts b) Sign illegibility c) Paint deterioration d) Obstructed visibility e) Acts of vandalism f) Replacement of obsolete signs g) Poor reflectivity This activity also includes reflectivity testing of signs and all work relating to culvert markers and kilometer posts.	Maintain signs in a good condition at all times.
6.4	Temporary and Seasonal Signs	This temporary and seasonal signs activity includes the erection, maintenance and removal of: a) Temporary signs on all weather highways, b) Barricading, detour and emergency signing and flagpersons when not directly chargeable to other activities, c) Traffic control activities not otherwise covered, and d) Includes the manufacture of the required barricades and sign stands.	Provide a safe and orderly method of traffic control on seasonal roads, through work areas and where emergency situations arise.
6.5	Traffic Counting	Traffic counting includes: a) Installation, reading and servicing of traffic counters b) Physical traffic counts c) Compilation and analysis of the data collected	Obtain meaningful traffic volume data. The quality and accuracy of the data collected is important as the overall counts are essential for planning needs and for gauging usage of the highway.
6.6	Surface Deflection Testing	Surface deflection testing determines rebound levels at selected points on a flexible pavement.	Test surfaces to establish the load bearing strength, which is primarily used for setting load restrictions on highways.
7. Projects			
7.1	Culvert Installation	Culvert installation includes: a) Installation of culverts at new locations to correct drainage problems. b) Installation of culverts to facilitate access for the convenience of the Department. c) Replacement of culverts that are considered to be beyond the scope of normal maintenance.	Install culverts to facilitate drainage and preserve the grade.
7.2	Binder Application	Binder application involves the application of a clay binder to gravel on the road surface to: a) Reduce ravelling b) Corrugation c) Loss of gravel	Stabilize loose surface gravel with binder to provide a smoother safer driving surface.
7.3	Gravel Surface Rehabilitation	Gravel surface rehabilitation involves the application of traffic gravel on continuous long sections of gravel surface with significant quantities to: a) Re-establish design cross-section b) Upgrade a gravel surface (i.e. major increases in traffic or road category change that requires wet blading)	Re-establish the design cross section or upgrade gravel surface to a specific level with a major application of gravel when the quantities in the annual surfacing program are inadequate.
7.4	Major Grade Repairs	Major grade repair involves the repair of long sections, or large areas of roadway with deficiencies such as grade failures, washout or slides. Includes shoulders and side slopes.	Rectify serious grade problems that require major corrective action.
7.5	Bridge Painting	Painting of steel bridges by hand or with spray equipment, including all related operations such as setting up scaffolding and cleaning the steel by wire brushing, chipping, sand blasting, etc.	Prevent corrosion of the steel components.
7.6	Major Bridge Repairs	Major bridge repair includes major structural repairs, repair or replacement of joints, bearings, timber and concrete decking, etc.	Repair a bridge structure
7.7	Crush Surface Aggregate	The production of crushed or screened gravel material with proper storage in stockpiles as per the development plan per pit of quarry.	Produce crushed or screened gravel meeting required specifications for use in highway resurfacing, chipseal coating and other maintenance needs such as winter sand.
7.8	Drainage Channel Improvement	Drainage channel improvement includes: a) Major rehabilitation or realignment of drainage ditches and stream channels b) Extensive rip-rap installations c) Construction of new drainage ditches or channels d) Diversion or control of water which causes glaciation e) Ditch blocks	Restore or upgrade drainage channels for the preservation of the grade.
7.9	Right Of Way Improvement	Right of way improvement involves: a) The removal of brush, trees, rocks and debris and landscaping to enhance safety, improve aesthetics or permit routine right of way maintenance activities. b) Reshaping or flattening cuts or slopes to reduce or eliminate snow problems.	Upgrade the right of way to enhance safety and improve reliability of service.
7.10	Road Closure	Involves work relating to road closures following a major unplanned event such as high water, major slide, or forest fire. All such work will be coordinated with the Department.	Open road or detour within 48 hours of a major unplanned event causing the road to be closed.

List of Typical Operations and Maintenance Activities for a Gravel Highway

#	Activity List	Summary Description	Objective
8. Service Functions and Overhead			
8.1	Road Patrol	Road patrol is the inspection of highway conditions and highway facilities to detect conditions that may adversely affect: a) The comfort and safety of the users of the road b) The environment c) Structure of the highway d) Or otherwise be in contravention of highway policy	Identify needed maintenance in order to establish priorities for required work and ensure that the completed work or services were effective.
8.2	Equipment Servicing/Repair	Equipment servicing/repair completed by equipment operators and field personnel.	Service and repair equipment to achieve safe and reliable operations.
8.3	Stockpiling Materials	Stockpiling and hauling at/or to storage areas of such materials as: a) Gravel and sand b) Culvert materials c) Dust inhibitors d) Signs and signposts e) Guiderail materials f) Ice removal chemicals g) Bridge materials, etc.	Acquire, produce, and stockpile materials for future requirements.
8.4	Buildings and Grounds	All servicing and repairs for buildings and grounds associated with operations and maintenance work on the highway, includes all work performed in the maintenance of camp or grader shelter buildings and yards.	Maintain a neat, safe and well organized base of operations.
8.5	Camp Operations	Camp operation includes all operating expenses of permanent maintenance camps including but not limited to such items as: a) Heating fuels (used by remote camps only) b) Sewer water (remote camps) c) Propane (not chargeable to other activities) d) Self-generated electrical energy e) Groceries, small non-capital or expendable items	Operate camps for maintenance and repair staff.

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APPENDIX C

Traffic Analysis

Appendix C: GNWT Traffic Analysis

Estimated Traffic Projections for Tłı̨chǫ All-Season Road

MVEIRB indicated that it wanted GNWT to elaborate on how the 20 to 40 vehicles per day traffic projection was estimated. This traffic analysis hopes to provide the necessary clarification regarding traffic projections for the TASR once it is in operation.

The 20 to 40 vehicles per day traffic projection was extrapolated both qualitatively and quantitatively by relying on GNWT's Tłı̨chǫ Winter Road Project Officer's numerous years of experience, Tłı̨chǫ winter road traffic counters, Tłı̨chǫ winter road community resupply details, and the estimated traffic volumes of a metals mine north of Whatì. After reanalysis of various datasets, such as resupply traffic volumes, GNWT's initial traffic projection remains the same. The design criteria for the all-season road will allow for an average daily traffic volume of up to 200 vehicles per day; therefore, the road will be able to handle both the expected traffic load and any unexpected traffic increases that could occur far (>40 years) into the future.

Background on GNWT Traffic Counters:

The *Northwest Territories 2015 Highway Traffic Report* (2016) summarizes the monthly average daily traffic of NWT winter roads across multiple years. This document is a useful resource in understanding NWT traffic volumes; however, the traffic counters themselves have been noted to have performance issues. Section 1.2 of the *Traffic Report* states:

> *"In 2015, approximately 35 percent of all potential data was useable for determining traffic volumes. This performance is attributed to the age of the traffic counters, breakdown of the loops and malfunctioning batteries and data modules, but represents a significant improvement since 2006….The Department is working to improve data collection activities, including the purchase of new counters and loops and the installation of temporary counters."*

Because the GNWT only has a limited number of traffic counters available at any one time, it has not been possible to install traffic counters at each community junction each year. The first Whatì traffic counter was originally in operation between 1993 and 1997 until the counter was placed elsewhere within the NWT highway system. The Whatì traffic counter was reinstated in 2017 in an effort to better understand the current Whatì winter traffic volumes. As there has been no recent traffic counter at the Whatì junction, the only way to estimate the traffic volume entering Whatì would be to remove the Gamètì and Wekweètì daily traffic numbers from the Marian Lake North counter. This estimate is in no way accurate though as not all traffic from the Gamètì and Wekweètì counters necessarily passed through Marian Lake (i.e., could be travelling to and from the three northern Tłı̨chǫ communities rather than coming from Highway 3 or Behchokǫ̀).

Additional challenges associated with the available raw traffic counter data are that the counters register recreational vehicles such as ATVs and snowmobiles in addition to typical road traffic. Counters are set for an 8 second delay (except for the Wekweètì Spur in 2015 which was set at 16 seconds) so only one vehicle should be recorded no matter the number of axels; however, if vehicles are travelling too closely together and are not a safe distance apart, vehicles can be undercounted. Traffic counter errors such as battery issues and counters being stolen exacerbate the situation. The Tłı̨chǫ counter 1 km off Highway 3 has very high volumes because of all the Behchokǫ̀ traffic travelling off the highway (shorter distance coming south) or travelling to and from Edzo; therefore, utilizing that traffic counter is not a very effective tool though it is this traffic counter that is used for the annual highway traffic reports (and not the Marian Lake North counter). Traffic counters also do not differentiate between the directions of traffic. In certain instances, the traffic counters are only put up and activated after the road is open so not all traffic is captured for the entire year.

The Marian Lake North traffic counter was installed and recorded data for 2014 and 2016. The counter was also installed in 2015; however, there was a counter or battery malfunction so no data was recorded at that station. The Gamètì and Wekweètì counters have been installed for 2013, 2014, 2015, and 2016; however, the Wekweètì counter was stolen in 2016 so that year's data could not be retrieved. 2014 is the only year that has data from all three stations; however, the counters all begin at the same time and the Marian Lake station only began recording after the opening date of that section of road. The initial few hours of recording for that year at the Gamètì and Wekweètì counter locations were also very high (+1000 vehicles/hour). It is likely that the extremely high traffic counts from Gamètì and Wekweètì at that time were because those portions of the winter roads were in the middle of construction and so maintenance vehicles working at those locations for extended periods of times would have continually activated the traffic counters. Any additional maintenance work that would have occurred at each of the traffic counter locations during the winter road period could have also been a contributing factor as to why some stations were abnormally high. Though, it is understood that during Tłı̨chǫ events and gatherings it is expected and not uncommon to have very large spikes in traffic volume as community members travel from their communities to the event location. The most recent raw data from the Marian Lake North, Gamètì and Wekweètì traffic counters have been compiled in Table C-1 for reference.

There are currently four temporary traffic counters installed along the Tłı̨chǫ Winter Road System that can provide useful traffic data for the 2017 winter road season assuming there are no malfunctions with the counters and none are stolen. The locations of these counters are as follows:

Gamètì	1 km north of junction with Whatì Access Road
Whatì	1 km west of junction with Tłı̨chǫ Winter Road
Wekweètì	1 km east of junction with Tłı̨chǫ Winter Road
Marian Lake North	situated on the portage at the very north end of Marian Lake

As the 2017 winter road season is currently in operation and will not end until after April 2017, the current year's data is not available.

Tłı̨chǫ Winter Road System:

The number of days winter roads are open have ranged from a mere 29 days to 89 days (Table C-2), when comparing Gamètì, Whatì and Wekweètì winter roads from 1993 - 2016 (GNWT, 2016). March and April remain the busiest months travelled between all four roads, with the Wekweètì road being the least travelled. The monthly average daily traffic (ADT) for the Tłı̨chǫ winter roads have been summarized in Table C-2. This data originates from the *2015 Traffic Report* (GNWT, 2016). Blanks in Table C-2 may indicate insufficient data to calculate monthly ADT, road closed, or counter not installed. For counters located on access roads and winter roads, no extra information is introduced.

In 2016, winter road access to Gamètì and Wekweètì were noted primarily from February to April, with traffic estimated at 40 vehicles and 41 vehicles per day, respectively for these communities (GNWT, 2016). Each year, community resupply occurs over a 7 to 14 day period. Resupply typically consists of fuel, grocery and building supplies. In 2016, an estimated 56 commercial loads for resupply were delivered to Gamètì, while Wekweètì had 36 commercial loads (Table 1). Whatì had an estimated 91 commercial loads in 2016. As mentioned previously, monthly ADT from traffic counters are not available for Whatì in 2016; however, GNWT's Project Officer estimated that the ADT was 46 based on extrapolated raw data from other counters and personal experience.

Table 1. 2016 Tłı̨chǫ Winter Road Community Resupply Data

Description	Max GVW / KG	Estimated Loads
Whatì		
Fuel Resupply	34,000	65
Grocery Resupply	34,000	6
Whatì Hotel	34,000	20
Seniors Complex - 9 Plex		
		Subtotal: 91
Gamètì		
Fuel Resupply	34,000	50
Grocery Resupply	34,000	6
		Subtotal: 56
Wekweètì		
Fuel Resupply		28
Grocery Resupply		6
Whatì Hotel		2
Seniors Complex - 9 Plex		
		Subtotal: 36
		Total Estimated Loads: 183

Tłı̨chǫ All-Season Road Projections:

By converting monthly ADT values for the Tłı̨chǫ winter roads into an annual per day value, Whatì can be expected to have an estimated 12 vehicles per day entering or leaving the community. It is estimated that an extra 8 vehicles per day could be expected on the all-season road as a result of increased access, potential population growth, and as a result of the diversion of air travel into vehicle traffic. This would bring the total estimate to 22 vehicles per day. In addition to this traffic, commercial loads are estimated to total 9.5 commercial loads per day (once the NICO Mine is operational). Fortune Minerals expects up to 9 vehicles per day, which accounts for the majority of expected daily commercial traffic (Fortune

Minerals Limited, 2013). The extra 0.5 load per day comes from the estimated daily volume of trucks required for community resupply. The total sum of daily traffic is therefore estimated at 31.5 vehicles per day.

- *Air Traffic*

Regarding air traffic, currently Air Tindi is the main airline servicing Whatì. Scheduled airline traffic to Whatì is tabulated on an annual basis. Air travel between Whatì remains relatively consistent throughout the year, with eleven trips per week each way from Yellowknife to Whatì (3 operating on Monday), as demonstrated in Table 2 below. Military, government and private air flights account for an additional 1000 passengers per year, which is not represented in the table below.

Table 2. Total number of passengers per year and month, arriving and departing Whatì

Year	Passengers (Total)	Passengers (month)
2010	7152	596
2011	7283	606.9
2012	6509	542.4
2013	6524	543.7
2014	6511	542.6
2015	6567	547.3

It is estimated that passenger totals are likely to decrease somewhat once the Tłı̨chǫ All-Season road opens, due to air travel no longer being the main mode of travel available (outside the winter road season).

- *Seasonal Variations*

The only seasonal variation expected for the TASR would occur in the winter. Increased traffic along the TASR is expected to occur when the winter roads to Gamètì and Wekweètì are open as these community winter roads will begin from Whatì once the TASR is in operation. Fluctuations are expected to be similar to the volumes estimated in the *Traffic Report* (GNWT, 2016). As the TASR will be designed to handle 200 vehicles per day, the road should be able to accommodate the seasonal variation associated with the two community winter roads.

- *Vehicle Registration and Driver's License Data*

In regards to population, Whatì has an estimated 549 people, 271 people for Gamètì and 148 for Wekweètì (NWT Bureau of Statistics, 2016). For ease of comparison, in 2015, 78 (14.2% of population), 60 (22.1% of population) and 29 (19.6% of population) class 5 licenses were issued in Whatì, Gamètì and Wekweètì, respectively. There are total of 41, 27 and 17 registered passenger cars in Whatì, Gamètì and Wekweètì, respectively (Table C-3), however the data does not list if it is registered to more than one driver. Additionally, there are 44, 34 and 18 registered pickup trucks in Whatì, Gamètì and Wekweètì, respectively (Table C-4). Other vehicles used are mini vans, light utility vehicles and all trailers. Not listed in vehicles types are snowmobiles and ATV, as there is no specific data on these modes of transportation. Additionally, the GNWT is unable to provide statistics on the age and gender of traffic data as well as 2016 data regarding licensed drivers and registered vehicles. Traffic collisions were discussed in Section 5.6 Valued component: stable and healthy communities, of the ASR.

Conclusions:
As demonstrated, using both qualitatively and quantitatively data from GNWT's Tłįchǫ Winter Road Project Officer's numerous years of experience, Tłįchǫ winter road traffic counters, Tłįchǫ winter road community resupply details, and the estimated traffic volumes of a metals mine north of Whatì, the 20 to 40 vehicles per day traffic projection remains the best available estimation.

References:

Fortune Minerals Limited. 2013. Report of Environmental Assessment and Reasons for Decision. Nico Project. EA0809-004. Online. http://www.reviewboard.ca/upload/project_document/EA0809-004_NICO_Report_of_EA_and_Reasons_for_Decision__corrected_.PDF

Government of Northwest Territories (GNWT). 2016. Northwest Territories 2015 Highway Traffic Report. Online. http://www.dot.gov.nt.ca/media/95762cac-cfef-4138-940b-8c1ab5758c1c/DQ5wsQ/Documents/1350-20-06%20Highway%20Traffic%20Report/2015%20Highway%20Traffic%20Report.pdf

NWT Bureau of Statistics. 2016. Population Estimates by Community. Online. http://www.statsnwt.ca/population/population-estimates/bycommunity.php

Table C-1. Tłįchǫ Winter Road System Raw Data from Traffic Counters

Delay for all counters was set at 8 seconds, except for Wekweètì Spur in 2015 which was set at 16 seconds.

Counter delay should allow for the recording of only one vehicle no matter the number of axels. It is possible to under count vehicles if drivers are tailgating and not leaving a safe distance between vehicles.

Recreational traffic such as ATVs and snowmobiles can register on the counters.

Marian Lake North data only started in 2014.

Marian Lake North 2015 counter did not start/batter issue so no data.

Wekweètì Spur 2016 counter was stolen so no data.

Traffic counters may not start or end on the same open/close dates of the roads.

Abnormally high counter recordings could be because of maintenace vehicles working in the area for an extended period of time

Marian Lake North			Marian Lake North			Gamètì Spur			Gamètì Spur			Gamètì Spur			Gamètì Spur			Wekweètì Spur			Wekweètì Spur			Wekweètì Spur		
Open date: 14-01-24			Open date: 16-02-05			Open date: 13-02-13			Open date: 14-02-18			Open date: 15-02-16			Open date: 16-02-29			Open date: 13-03-07			Open date: 14-03-07			Open date: 15-03-07		
Close date: 14-04-22			Close date: 16-04-12			Close date: 13-04-21			Close date: 14-4-22			Close date: 15-04-15			Close date: 16-04-12			Close date: 13-04-09			Close date: 14-04-22			Close date: 15-04-15		
Start date:	14-01-27		Start date:	16-02-11		Start date:	13-05-15		Start date:	14-01-27		Start date:	15-02-20		Start date:	16-02-11		Start date:	13-02-15		Start date:	14-01-27		Start date:	15-03-16	
End date:	14-04-24		End date:	16-04-15		End date:	13-04-25		End date:	14-04-24		End date:	15-04-22		End date:	16-04-15		End date:	13-04-25		End date:	14-04-09		End date:	15-04-24	
Date	Time	Counter	Date	Time	Counter	Date	Time	Counter	Date	Time	Counter	Date	Time	Counter	Date	Time	Counter	Date	Time	Counter	Date	Time	Counter	Date	Time	Counter
14-01-28	0:00	0	16-02-12	0:00	2	13-02-16	0:00	2	14-01-28	0:00	0	15-02-21	0:00	13	16-02-12	0:00	2	13-02-16	0:00	0	14-01-28	0:00	1	15-03-17	0:00	0
14-01-28	1:00	0	16-02-12	1:00	2	13-02-16	1:00	0	14-01-28	1:00	0	15-02-21	1:00	4	16-02-12	1:00	0	13-02-16	1:00	0	14-01-28	1:00	0	15-03-17	1:00	0
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14-04-11	16:00	1
14-04-11	17:00	2
14-04-11	18:00	1
14-04-11	19:00	3
14-04-11	20:00	8
14-04-11	21:00	7
14-04-11	22:00	4
14-04-11	23:00	1
14-04-12	0:00	3
14-04-12	1:00	1
14-04-12	2:00	2
14-04-12	3:00	1
14-04-12	4:00	1
14-04-12	5:00	0
14-04-12	6:00	1
14-04-12	7:00	1
14-04-12	8:00	1
14-04-12	9:00	0
14-04-12	10:00	1
14-04-12	11:00	5
14-04-12	12:00	3
14-04-12	13:00	4
14-04-12	14:00	0
14-04-12	15:00	2
14-04-12	16:00	0
14-04-12	17:00	1
14-04-12	18:00	0
14-04-12	19:00	1
14-04-12	20:00	2
14-04-12	21:00	4
14-04-12	22:00	1
14-04-12	23:00	3
14-04-13	0:00	0
14-04-13	1:00	0
14-04-13	2:00	2
14-04-13	3:00	1
14-04-13	4:00	0
14-04-13	5:00	0
14-04-13	6:00	0
14-04-13	7:00	1
14-04-13	8:00	0
14-04-13	9:00	1
14-04-13	10:00	0
14-04-13	11:00	2
14-04-13	12:00	0
14-04-13	13:00	3
14-04-13	14:00	2
14-04-13	15:00	1
14-04-13	16:00	1
14-04-13	17:00	2
14-04-13	18:00	7
14-04-13	19:00	4
14-04-13	20:00	4
14-04-13	21:00	0
14-04-13	22:00	4
14-04-13	23:00	2
14-04-14	0:00	1
14-04-14	1:00	1
14-04-14	2:00	0
14-04-14	3:00	2
14-04-14	4:00	1
14-04-14	5:00	0
14-04-14	6:00	2
14-04-14	7:00	0
14-04-14	8:00	1

14-04-14	9:00	6
14-04-14	10:00	8
14-04-14	11:00	6
14-04-14	12:00	3
14-04-14	13:00	6
14-04-14	14:00	1
14-04-14	15:00	8
14-04-14	16:00	2
14-04-14	17:00	3
14-04-14	18:00	9
14-04-14	19:00	5
14-04-14	20:00	2
14-04-14	21:00	3
14-04-14	22:00	8
14-04-14	23:00	3
14-04-15	0:00	2
14-04-15	1:00	3
14-04-15	2:00	0
14-04-15	3:00	3
14-04-15	4:00	0
14-04-15	5:00	0
14-04-15	6:00	4
14-04-15	7:00	4
14-04-15	8:00	4
14-04-15	9:00	5
14-04-15	10:00	2
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14-04-15	15:00	2
14-04-15	16:00	4
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14-04-15	18:00	6
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14-04-15	20:00	7
14-04-15	21:00	2
14-04-15	22:00	6
14-04-15	23:00	11
14-04-16	0:00	0
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14-04-16	2:00	1
14-04-16	3:00	3
14-04-16	4:00	0
14-04-16	5:00	0
14-04-16	6:00	0
14-04-16	7:00	1
14-04-16	8:00	2
14-04-16	9:00	2
14-04-16	10:00	0
14-04-16	11:00	0
14-04-16	12:00	1
14-04-16	13:00	3
14-04-16	14:00	2
14-04-16	15:00	2
14-04-16	16:00	0
14-04-16	17:00	1
14-04-16	18:00	3
14-04-16	19:00	2
14-04-16	20:00	6
14-04-16	21:00	4
14-04-16	22:00	6
14-04-16	23:00	9
14-04-17	0:00	4
14-04-17	1:00	6
14-04-17	2:00	1

14-04-14	9:00	0
14-04-14	10:00	2
14-04-14	11:00	2
14-04-14	12:00	2
14-04-14	13:00	2
14-04-14	14:00	7
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14-04-14	18:00	2
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14-04-14	20:00	1
14-04-14	21:00	2
14-04-14	22:00	1
14-04-14	23:00	3
14-04-15	0:00	0
14-04-15	1:00	1
14-04-15	2:00	2
14-04-15	3:00	0
14-04-15	4:00	0
14-04-15	5:00	0
14-04-15	6:00	2
14-04-15	7:00	2
14-04-15	8:00	0
14-04-15	9:00	1
14-04-15	10:00	1
14-04-15	11:00	1
14-04-15	12:00	0
14-04-15	13:00	1
14-04-15	14:00	1
14-04-15	15:00	3
14-04-15	16:00	1
14-04-15	17:00	1
14-04-15	18:00	2
14-04-15	19:00	2
14-04-15	20:00	3
14-04-15	21:00	2
14-04-15	22:00	0
14-04-15	23:00	3
14-04-16	0:00	4
14-04-16	1:00	0
14-04-16	2:00	1
14-04-16	3:00	1
14-04-16	4:00	0
14-04-16	5:00	1
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14-04-16	12:00	0
14-04-16	13:00	0
14-04-16	14:00	1
14-04-16	15:00	1
14-04-16	16:00	0
14-04-16	17:00	1
14-04-16	18:00	0
14-04-16	19:00	1
14-04-16	20:00	1
14-04-16	21:00	2
14-04-16	22:00	3
14-04-16	23:00	4
14-04-17	0:00	3
14-04-17	1:00	4
14-04-17	2:00	1

14-04-17	3:00	0
14-04-17	4:00	3
14-04-17	5:00	3
14-04-17	6:00	11
14-04-17	7:00	11
14-04-17	8:00	9
14-04-17	9:00	5
14-04-17	10:00	2
14-04-17	11:00	0
14-04-17	12:00	0
14-04-17	13:00	0
14-04-17	14:00	0
14-04-17	15:00	0
14-04-17	16:00	0
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14-04-17	19:00	0
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14-04-17	23:00	7
14-04-18	0:00	6
14-04-18	1:00	13
14-04-18	2:00	3
14-04-18	3:00	8
14-04-18	4:00	0
14-04-18	5:00	0
14-04-18	6:00	2
14-04-18	7:00	4
14-04-18	8:00	9
14-04-18	9:00	2
14-04-18	10:00	1
14-04-18	11:00	0
14-04-18	12:00	0
14-04-18	13:00	0
14-04-18	14:00	0
14-04-18	15:00	0
14-04-18	16:00	0
14-04-18	17:00	1
14-04-18	18:00	0
14-04-18	19:00	1
14-04-18	20:00	0
14-04-18	21:00	4
14-04-18	22:00	24
14-04-18	23:00	8
14-04-19	0:00	2
14-04-19	1:00	3
14-04-19	2:00	0
14-04-19	3:00	1
14-04-19	4:00	0
14-04-19	5:00	3
14-04-19	6:00	1
14-04-19	7:00	6
14-04-19	8:00	10
14-04-19	9:00	10
14-04-19	10:00	0
14-04-19	11:00	2
14-04-19	12:00	2
14-04-19	13:00	0
14-04-19	14:00	1
14-04-19	15:00	0
14-04-19	16:00	3
14-04-19	17:00	0
14-04-19	18:00	0
14-04-19	19:00	0
14-04-19	20:00	0

14-04-17	3:00	0
14-04-17	4:00	1
14-04-17	5:00	3
14-04-17	6:00	1
14-04-17	7:00	5
14-04-17	8:00	1
14-04-17	9:00	2
14-04-17	10:00	0
14-04-17	11:00	0
14-04-17	12:00	0
14-04-17	13:00	0
14-04-17	14:00	0
14-04-17	15:00	0
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14-04-17	20:00	1
14-04-17	21:00	1
14-04-17	22:00	2
14-04-17	23:00	2
14-04-18	0:00	0
14-04-18	1:00	1
14-04-18	2:00	6
14-04-18	3:00	0
14-04-18	4:00	2
14-04-18	5:00	2
14-04-18	6:00	3
14-04-18	7:00	4
14-04-18	8:00	1
14-04-18	9:00	0
14-04-18	10:00	0
14-04-18	11:00	0
14-04-18	12:00	0
14-04-18	13:00	1
14-04-18	14:00	0
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14-04-18	16:00	0
14-04-18	17:00	0
14-04-18	18:00	0
14-04-18	19:00	0
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14-04-18	21:00	4
14-04-18	22:00	1
14-04-18	23:00	2
14-04-19	0:00	1
14-04-19	1:00	0
14-04-19	2:00	1
14-04-19	3:00	0
14-04-19	4:00	2
14-04-19	5:00	0
14-04-19	6:00	0
14-04-19	7:00	0
14-04-19	8:00	2
14-04-19	9:00	2
14-04-19	10:00	1
14-04-19	11:00	0
14-04-19	12:00	0
14-04-19	13:00	0
14-04-19	14:00	0
14-04-19	15:00	1
14-04-19	16:00	0
14-04-19	17:00	0
14-04-19	18:00	0
14-04-19	19:00	0
14-04-19	20:00	0

14-04-19	21:00	5
14-04-19	22:00	4
14-04-19	23:00	1
14-04-20	0:00	5
14-04-20	1:00	7
14-04-20	2:00	2
14-04-20	3:00	0
14-04-20	4:00	1
14-04-20	5:00	1
14-04-20	6:00	6
14-04-20	7:00	3
14-04-20	8:00	5
14-04-20	9:00	3
14-04-20	10:00	0
14-04-20	11:00	1
14-04-20	12:00	0
14-04-20	13:00	1
14-04-20	14:00	0
14-04-20	15:00	0
14-04-20	16:00	0
14-04-20	17:00	1
14-04-20	18:00	0
14-04-20	19:00	0
14-04-20	20:00	0
14-04-20	21:00	8
14-04-20	22:00	5
14-04-20	23:00	3
14-04-21	0:00	3
14-04-21	1:00	2
14-04-21	2:00	1
14-04-21	3:00	4
14-04-21	4:00	0
14-04-21	5:00	0
14-04-21	6:00	2
14-04-21	7:00	3
14-04-21	8:00	14
14-04-21	9:00	7
14-04-21	10:00	0
14-04-21	11:00	0
14-04-21	12:00	3
14-04-21	13:00	0
14-04-21	14:00	1
14-04-21	15:00	0
14-04-21	16:00	0
14-04-21	17:00	2
14-04-21	18:00	2
14-04-21	19:00	2
14-04-21	20:00	1
14-04-21	21:00	0
14-04-21	22:00	9
14-04-21	23:00	22
14-04-22	0:00	21
14-04-22	1:00	5
14-04-22	2:00	1
14-04-22	3:00	0
14-04-22	4:00	0
14-04-22	5:00	0
14-04-22	6:00	2
14-04-22	7:00	1
14-04-22	8:00	6
14-04-22	9:00	566
14-04-22	10:00	973
14-04-22	11:00	882
14-04-22	12:00	1103
14-04-22	13:00	303
14-04-22	14:00	556

14-04-19	21:00	0
14-04-19	22:00	0
14-04-19	23:00	1
14-04-20	0:00	2
14-04-20	1:00	1
14-04-20	2:00	0
14-04-20	3:00	0
14-04-20	4:00	0
14-04-20	5:00	0
14-04-20	6:00	0
14-04-20	7:00	0
14-04-20	8:00	1
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14-04-20	11:00	0
14-04-20	12:00	0
14-04-20	13:00	0
14-04-20	14:00	0
14-04-20	15:00	0
14-04-20	16:00	0
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14-04-20	18:00	0
14-04-20	19:00	0
14-04-20	20:00	0
14-04-20	21:00	0
14-04-20	22:00	1
14-04-20	23:00	3
14-04-21	0:00	0
14-04-21	1:00	0
14-04-21	2:00	2
14-04-21	3:00	1
14-04-21	4:00	0
14-04-21	5:00	0
14-04-21	6:00	0
14-04-21	7:00	2
14-04-21	8:00	4
14-04-21	9:00	3
14-04-21	10:00	0
14-04-21	11:00	0
14-04-21	12:00	0
14-04-21	13:00	0
14-04-21	14:00	0
14-04-21	15:00	0
14-04-21	16:00	0
14-04-21	17:00	0
14-04-21	18:00	1
14-04-21	19:00	0
14-04-21	20:00	0
14-04-21	21:00	2
14-04-21	22:00	0
14-04-21	23:00	1
14-04-22	0:00	0
14-04-22	1:00	4
14-04-22	2:00	4
14-04-22	3:00	0
14-04-22	4:00	0
14-04-22	5:00	0
14-04-22	6:00	0
14-04-22	7:00	1
14-04-22	8:00	3
14-04-22	9:00	3
14-04-22	10:00	321
14-04-22	11:00	703
14-04-22	12:00	1163
14-04-22	13:00	313
14-04-22	14:00	506

14-04-22	15:00	65
14-04-22	16:00	0
14-04-22	17:00	0
14-04-22	18:00	0
14-04-22	19:00	0
14-04-22	20:00	0
14-04-22	21:00	0
14-04-22	22:00	0
14-04-22	23:00	0
14-04-23	0:00	0
14-04-23	1:00	0
14-04-23	2:00	0
14-04-23	3:00	0
14-04-23	4:00	0
14-04-23	5:00	0
14-04-23	6:00	9
14-04-23	7:00	27
14-04-23	8:00	21
14-04-23	9:00	20
14-04-23	10:00	884
14-04-23	11:00	582
14-04-23	12:00	174
14-04-23	13:00	2
14-04-23	14:00	7
14-04-23	15:00	4
14-04-23	16:00	372
14-04-23	17:00	988
14-04-23	18:00	10
14-04-23	19:00	3
14-04-23	20:00	1
14-04-23	21:00	2
14-04-23	22:00	1
14-04-23	23:00	0
x	x	x

14-04-22	15:00	96
14-04-22	16:00	0
14-04-22	17:00	0
14-04-22	18:00	0
14-04-22	19:00	0
14-04-22	20:00	0
14-04-22	21:00	0
14-04-22	22:00	0
14-04-22	23:00	0
14-04-23	0:00	0
14-04-23	1:00	0
14-04-23	2:00	0
14-04-23	3:00	0
14-04-23	4:00	0
14-04-23	5:00	0
14-04-23	6:00	3
14-04-23	7:00	14
14-04-23	8:00	6
14-04-23	9:00	10
14-04-23	10:00	781
14-04-23	11:00	499
14-04-23	12:00	200
14-04-23	13:00	1
14-04-23	14:00	0
14-04-23	15:00	0
14-04-23	16:00	308
14-04-23	17:00	1032
14-04-23	18:00	3
14-04-23	19:00	2
14-04-23	20:00	0
14-04-23	21:00	0
14-04-23	22:00	0
14-04-23	23:00	0
14-04-24	0:00	0
14-04-24	1:00	0
14-04-24	2:00	0
14-04-24	3:00	0
14-04-24	4:00	0
14-04-24	5:00	60
14-04-24	6:00	422
14-04-24	7:00	61
14-04-24	8:00	158
14-04-24	9:00	114
14-04-24	10:00	104
14-04-24	11:00	130
14-04-24	12:00	125
14-04-24	13:00	116
x	x	x

Table C-2 Monthly Average Daily Traffic (ADT) on Tłı̨chǫ Winter Roads (sorted by road)

Winter Road	Year	Opening Date	Closing Date	Days Open	Monthly Average Daily Traffic					ADT
					Dec	Jan	Feb	Mar	Apri	
Gamètì	2016	29-02-2016	12-04-2016	43			29	39	43	40
	2015	16-02-2015	15-04-2015	58			47	38	44	42
	2014	18-02-2014	22-04-2014	63			22	35	31	31
	2013	13-02-2013	21-04-2013	67			39	59	55	53
	2012	17-02-2012	19-04-2012	62			32	42	55	44
	2011	5-02-2011	8-04-2011	62			21	33	43	30
	2009	21-02-2009	14-04-2009	52				46	34	42
	2008	28-02-2008	11-04-2008	43				43	55	46
	2007	28-02-2007	12-04-2007	43				43	55	46
	1997	7-02-1997	25-03-1997	46			170	152		160
Whatì	2016	5-02-2016	12-04-2016	67			487	473	339	456
	2015	19-01-2015	15-04-2015	86		87	85	115	108	100
	2014	24-01-2014	22-04-2014	88		75	233	385	183	259
	2013	22-01-2013	21-04-2013	89		66	98	299	175	182
	2012	25-01-2012	19-04-2012	85			38	38	53	42
	2011	14-01-2011	8-04-2011	84		78	78	104	77	87
	2010	20-01-2010	11-04-2010	81		95	72	120	165	106
	2009	23-01-2009	14-04-2009	81			81	142	111	113
	2008	8-02-2008	11-04-2008	63			100	163	148	135
	2007	3-02-2007	12-04-2007	68			64	115	188	107
	1997	20-01-1997	25-03-1997	64		31	45	64		47
	1996	15-01-1996	20-03-1996	65						
	1995	13-01-1995	29-03-1995	75						
	1994	18-02-1994	18-04-1994	59						
	1993	27-01-1993	2-04-1993	65				16	14	15
Wekweètì	2016	14-03-2016	12-04-2016	29				38	48	41
	2015	7-03-2015	15-04-2015	39				23	13	20
	2014	7-03-2014	22-04-2014	46			4	20	20	14
	2013	7-03-2013	9-04-2013	33			52	126	23	82
	2012	6-03-2012	10-04-2012	35				59	77	63
	2011	14-02-2011	7-04-2011	52			24	46	60	38

Note: Blanks may indicate insufficient data to calculate monthly ADT, road closed, or counter not installed.

* Data came from Northwest Territories 2015 Highway Traffic Report

Table C-3. Licensed Drivers from 2010 - 2015 for Behchokǫ̀, Whatì , Gamètì and Wekweètì

	2010				2011				2012				2013				2014				2015			
Class	Behchokǫ̀	Whatì	Gamètì	Wekweètì	Behchokǫ̀	Whatì	Gamètì	Wekweètì	Behchokǫ̀	Whatì	Gamètì	Wekweètì	Behchokǫ̀	Whatì	Gamètì	Wekweètì	Behchokǫ̀	Whatì	Gamètì	Wekweètì	Behchokǫ̀	Whatì	Gamètì	Wekweètì
1	31	5	8	1	32	5	6	1	31	5	5	0	28	5	5	1	32	5	5	1	33	4	5	0
1 & 6	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0
2	14	0	0	0	14	0	0	0	14	0	0	0	15	0	0	0	14	0	0	0	14	0	0	0
2 & 6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	38	18	18	3	34	21	5	2	35	23	3	2	30	25	4	2	38	24	4	2	44	25	4	2
3 & 6	1	1	1	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0
4	35	6	6	5	29	6	0	5	30	6	0	4	33	7	0	4	30	4	0	3	32	4	0	3
4 & 6	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
5	483	67	86	21	513	70	51	21	526	70	52	22	495	71	53	17	510	76	60	26	539	78	60	29
5 & 6	9	2	2	0	8	2	0	0	6	0	0	0	8	0	0	0	10	0	0	0	11	0	0	0
5P	66	16	18	2	49	15	11	3	35	6	10	5	50	14	12	4	42	11	6	3	41	9	1	2
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	58	28	32	9	56	24	17	12	54	20	21	6	55	17	11	7	81	21	25	6	88	21	30	4
Total	736	143	171	41	736	144	90	44	732	130	91	39	714	141	85	35	757	142	100	41	804	141	100	40

Table C-4. Registered Vehicles by Type 2010 - 2015 for Behchokǫ̀, Whatì, Gamètì and Wekweètì

	2010				2011				2012				2013				2014				2015			
Vehicle Type	Behchokǫ̀	Whatì	Gamètì	Wekweètì	Behchokǫ̀	Whatì	Gamètì	Wekweètì	Behchokǫ̀	Whatì	Gamètì	Wekweètì	Behchokǫ̀	Whatì	Gamètì	Wekweètì	Behchokǫ̀	Whatì	Gamètì	Wekweètì	Behchokǫ̀	Whatì	Gamètì	Wekweètì
Passenger Car	235	36	19	13	208	34	21	18	212	36	21	13	225	35	22	13	228	13	23	14	251	41	27	17
Mini Van	48	8	4	2	43	7	4	3	44	7	4	2	47	7	4	2	48	3	4	2	53	9	5	2
Light Utility Vehicle	70	11	5	3	62	10	6	5	63	11	6	4	67	11	6	4	68	4	6	4	75	13	7	5
Pickup Truck	253	38	22	13	223	37	23	19	231	41	22	13	245	40	25	13	250	14	27	14	276	44	34	18
Full Size Van	23	3	2	1	21	3	2	2	21	3	2	1	22	3	2	1	22	1	2	1	24	3	2	1
Ambulance	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Truck/Van <= 4536 kg	1	0	0	0	6	1	1	0	6	1	1	0	6	1	1	0	6	0	1	0	7	0	1	0
Unit Truck > 4536 kg	10	2	0	1	10	2	1	1	10	2	1	1	11	2	1	1	11	1	1	1	12	3	1	1
Road Tractor	20	8	3	2	14	2	1	1	14	2	1	1	15	2	1	1	15	1	1	1	17	3	1	1
School Buses	5	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0
All Other Buses	3	1	0	0	3	0	0	0	3	0	0	0	3	0	0	0	3	0	0	0	3	0	0	0
Motorcycle	5	0	0	0	16	3	2	1	16	3	2	1	17	3	2	1	17	1	2	1	19	3	2	1
Limited Speed Motorcycle	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0
All-Terrain Vehicle (ATV)	6	0	0	0	16	3	2	1	16	3	2	1	17	3	2	1	17	1	2	1	19	3	2	1
Motorhome	1	0	0	0	4	1	0	0	4	1	0	0	4	1	0	0	4	0	0	0	4	0	0	0
Farm Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction Equipment	18	5	1	2	17	3	2	1	17	3	2	1	18	3	2	1	18	1	2	1	20	3	2	1
Fire Engine	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
All Trailers	82	9	3	1	116	19	12	9	118	20	12	7	125	20	13	7	127	7	13	7	140	22	15	8
Total	782	123	59	38	761	125	77	61	777	133	76	45	824	131	81	45	836	47	84	47	922	147	99	56

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APPENDIX D

GNWT Department of Transportation Environmental Performance Record

Table D-1: Summary of Inspection Reports for the Deh Cho Bridge

Licence/Permit	Scope	Date	Regulator	Findings
MV2003L8-0007	For the water use associated with construction of the Deh Cho Bridge at the crossing of YK Hwy 3. Associated with LUP MV2012X0015. Associated with LUP MV2004X0020.	14-Aug-08 26-Aug-08	INAC/DOL	At the time of visit Golder Associates Ltd. were actively collecting water quality data, and no violations of the water licence conditions were observed.
		27-Oct-08	INAC/DOL	Monthly reports containing SNP data have been submitted in a punctual manner by Golder Associates Ltd. No violations to the water licence conditions were observed at the time of the inspection. All equipment being used for pier construction and supplying material via the temporary bridge appeared to be clean and free of contaminants. During our inspection there was no observation of foreign material or contamination of any kind entering the water from the construction site.
		06-Jul-09	INAC/DOL	Contractor waiting for Transport Canada approval to extend the temporary bridge into the navigable water channel. As a result of the above noted events there has been essentially no construction work done yet at the bridge site this summer.
		17-Aug-09	INAC/DOL	No violations to the water licence conditions were observed at the time of the inspection.
		21-Oct-09	INAC/DOL	No violations to the water licence conditions were observed at the time of the inspection. During inspection there was no observation of foreign material or contamination of any kind entering the water from the construction site.
		19-Sep-10	INAC/DOL	Golder Associates Ltd. continue to provide surveillance network program monitoring and reports are submitted frequently to MVLWB.
		14-Sep-11	INAC/DOL	There is a small oil spill at the camp that requires cleanup. Refuelling nozzles on the fuel tanks at the camp also require containment. Overall the camp was well organized and clean. No non-compliance/violations of act or licence.
MV2004X0020	For 5 locations and quarry permits for 7 locations for work associated with the construction of the Deh Cho Bridge. Associated with WL MV2003L8-0007.	20-Apr-09	INAC/DOL	Conditions 16, 30, 31 & 34 - With the snow melting, small amounts of garbage (paper cups, pieces of wood, paper, plastic, tins, etc) located around the camp and the fuelling area are being uncovered. This should be picked up and properly disposed of. The lid on the large red garbage bin in the bulk fuel area should be closed to prevent wildlife from accessing the garbage. Please note that Condition 16 of the Land Use Permit MV2004X0020 requires that the land use area is kept clean at all times. Condition 44: There is some hydrocarbon contaminated soil and a pile of contaminated snow, as well as some garbage on the ground located across the highway from the camp location. The source of the contaminated soil appears to be from a piece of equipment that is parked in this area. There is oil on the ground by the generators, the camp water tank and the two storage sea cans. There is a small pile of dirt located near the large water tank that appears to have some hydrocarbon contamination. The oil and garbage in these areas should be cleaned up, as well any hydrocarbon contaminated snow and soil should be cleaned up and disposed of at an approved facility. Please provide a letter indicating the disposal location to the Inspector.
		02-Jul-09	INAC/DOL	Condition 16: There is some garbage that has been pushed over the edge of a gravel pad located across the highway from the camp. This must be picked up and properly disposed of. Cardboard, spill pads and hydrocarbons have been cleaned up. Hydrocarbon contaminated snow, soil and garbage have been cleaned up.

Table D-1: Summary of Inspection Reports for the Deh Cho Bridge (cont'd)

Licence/Permit	Scope	Date	Regulator	Findings
MV2004X0020 (cont'd)	For 5 locations and quarry permits for 7 locations for work associated with the construction of the Deh Cho Bridge. Associated with WL MV2003L8-0007. (contd)	11-Sep-09	INAC/DOL	Condition 55: Both the east and west access roads that goes to the top of the rock quarry is starting to slump and should be repaired or removed if they are no longer required. Condition 16: Leftover concrete is being dumped into the clay quarry pit area. This concrete shall be removed and properly disposed of. The quarry area is not a disposal site for leftover concrete. Condition 16: Garbage that has been pushed over the edge of a gravel pad located across the highway from the camp still requires removal and proper disposal. This was identified in the previous inspection report, please rectify this situation immediately.
		13-Aug-10	INAC/DOL	All aspects of your land use operation appeared satisfactory and no environmental concerns were noted at the time of inspection.
		05-Oct-10	INAC/DOL	All aspects of your land use operation appeared satisfactory and no environmental concerns were noted at the time of inspection.
		19-Aug-11	INAC/DOL	All aspects of your land use operation appeared satisfactory and no environmental concerns were noted at the time of inspection.
		09-Oct-12	INAC/DOL	KM 188.5 (limestone quarry): A number of concerns were noted with the limestone quarry which must be addressed by the Permittee. The concerns requiring the Permittee's attention are: 1. The height of the working face was observed to be greater than 2m higher than the reach of the loading equipment. The working face must be benched as the height of the working face exceeds 10m. 2. All loose rock must be scaled from the side of the working face. It was observed that this work has yet to be done. 3. Sections of the working face were observed to have an overhang. Benching the working face will address this concern. 4. Reclamation of the east and west access is required. The side cut must be sloped to a 2:1 horizontal/vertical ratio to permit proper drainage. Other erosion control measures such as cross ditching or berms may be required. Items 1, 2, and 3 must be completed in accordance with the Mine Health and Safety Regs. KM 188.5 (gravel pit): The pit remains active where restoration work is not required at this time. Prior to the expiry date of the land use permit (MV2012X0015), all embankments and excavations must be sloped to a horizontal/vertical ration of 2:1. All aspects of the pit appeared satisfactory and no environmental concerns were noted. KM 188.5 (Section 3a, b & c): Permittee has done a very good job in contouring the embankments to a horizontal/vertical ratio of 2:1. A small amount of contouring will have to be done prior to the expiry date of the new land use permit. This pit appeared satisfactory in all aspects. If the timber is not salvaged for firewood prior to the expiry date of the LUP (MV2012X0015), it must be totally disposed of through burning. KM 23 (south borrow pit): This operation continues under the authority of LUP MV2012X0015 which was issued on July 5, 2012 for a five year term.
		16-Jul-15	INAC/DOL	The Board grants final clearance of LUP MV2004X0020.

Table D-2: Summary of Inspection Reports for the Inuvik to Tuktoyaktuk Highway

Licence/ Permit	Scope	Date	Regulator	Findings
ILA13TE017	Land use permit A & public right of way for the construction of the Inuvik to Tuktoyaktuk Highway	30-Apr-14	ILA	Material Stockpile adjacent to water crossings
		03-Dec-14	ILA	Excess material along ROW, accumulated granular material on ice bridge at A3, geomembrane tubes and collision debris
		15-Dec-14	ILA	Excess material along ROW, accumulated granular material on ice bridge at A3
		05-Feb-15	ILA	Waste and debris on land
		17-Mar-15	ILA	Drip trays are to be used as required
		14-Apr-15	ILA	Use drip trays as required, stabilize water crossings with silt fences and rip rap, v notch or remove snow fill/ice bridge, remove fuel storage tanks
		24-Apr-15	ILA	General clean-up, drip trays to be used consistently, accumulated granular material from ice bridge/snow fills, stabilize water course crossings prior to freshet
		10-Jun-15	ILA	Culverts impacting permafrost, debris at KP 15 camp pad
		02-Feb-16	ILA	Discontinue use and add snow to access trail to zed creek, waste on the land, bent culvert, clean up spills and remove all items at sleigh camp KP 87.5
		18-Mar-16	ILA	Debris/waste on land, clean up remaining spills at camp pad 87.5, remove accumulated material on ramps/approaches, consistent use of drip trays
		13-Apr-16	ILA	Remove granular material from ramps/approaches, stabilize and restore bends and banks of water crossings, v-notch or remove snow fills and/or ice bridges, clean up of debris and waste items along the ITH
		18-May-16	ILA	Maintain natural drainage and prevent the ponding of water, permafrost damage, damaged culverts, erosion of land and deposition of granular material on vegetation, debris/waste on the land, granular material on ramps/approaches
		22-Jun-16	ILA	Maintain natural drainage and prevent the ponding of water, permafrost damage, damaged culverts, Debris/waste on the land
		16-Jul-16	ILA	Ponded water, lagoon at culvert outlet, damaged culverts, rutting, sedimentation on vegetation, excessively cleared off vegetation, debris/waste on land
N2013E0018	Road Construction, Inuvik to Tuktoyaktuk Highway	31-Mar-15	DOL	During the inspection it was noticed that work on the embankment is currently being conducted in non-compliance with the following conditions: B.1 The permittees field supervisor shall contact or meet with a land use inspector…at least 48 hours prior to the commencement of this land use operation. M.3 the permittee shall at all times comply with and conform to the requirements of all other applicable federal, territorial or local acts, regulations, ordinances or bylaws
		15-Apr-15	DOL	Overall all aspects were satisfactory at the time of the inspection
		20-Apr-15	DOL	No environmental concerns were observed in regards to the road embankments
		21-May-15	DOL	All aspects with regards to the road embankment were satisfactory at the time of inspection.
		30-Nov-15	DOL	On this date, the contractor was expecting to have a small crew hauling gravel but could not start due to warmer than normal temperatures, so the only work that has been done is the access road from the embankment into Borrow Source PW-10 around KM 16 & flooding of the lake below KM 16.
		10-Dec-15	DOL	No hauling has been done this season

Table D-2: Summary of Inspection Reports for the Inuvik to Tuktoyaktuk Highway (cont'd)

Licence/ Permit	Scope	Date	Regulator	Findings
N2013E0018 (contd)	Road Construction, Inuvik to Tuktoyaktuk Highway (cont'd)	16-Dec-15	DOL	No environmental concerns were observed in regards to the road embankments
		05-Jan-16	DOL	No environmental concerns were observed during the inspection
		05-Jan-16	DOL	Work on the embankment is currently at approximately km 24. A total of 7 end dumps were observed hauling from PW10 ciao to the embankment. No environmental concerns were observed during this inspection
		07-Jan-16	DOL	No work was ongoing at this time
		26-Jan-16	DOL	No environmental concerns were observed during the inspection. Please note that the signage is important to indicate which lands the road embankment goes through
		03-Feb-16	DOL	Other than an oil spill on the embankment from a packer at approximately km 73+620, the inspector has no other environmental concerns for the project
		05-Feb-16	DOL	During the inspection all aspects were satisfactory.
		24-Feb-16	DOL	Overall no environmental concerns were observed in relation to the ITH road embankment. It was very good to see that the boundary markers were in place along the road to indicate which jurisdiction we are in.
		15-Mar-16	DOL	During this inspection along the embankment at approximately km 64-65 at a nearby lake it was observed that culverts and other material are being stored at this location and is in contravention of the following term and condition: D.1. It was further observed at the shop pad along the embankment by source 312 the following was also in non-compliance. At the refuel station the connection from the fuel tank it is evident that leaking is occurring and is in contravention of: K.4 &K.8. Further at this location the contaminated soil is left on the ground in two plastic bags, these items can be very easily ripped and spread throughout from vehicles if not secured in a proper container. Beside the contaminated soils is a contained wooden box that shows leakage a substance and there is also plastic oil containers that are stacked up and no secondary containment that these items are to be removed as per condition: G.2. Also observed were 3-45 gallon drums that do not have any secondary containment. This also is in contravention of the above condition.
		21-Mar-16	DOL	All aspects were satisfactory at time of the inspection
		01-Apr-16	DOL	No environmental concerns were observed and all aspects were satisfactory at the time of the inspection
		21-Apr-16	DOL	Embankment was satisfactory with no environmental concerns observed.
		28-Apr-16	DOL	Work on the embankment was extended from April 15 to April 22. During the inspection there were no environmental concerns. Along the embankment there are two different locations where the contractor left trailers, equipment, and fuel.
		18-May-16	DOL	No environmental concerns
		25-May-16	DOL	Our main concern with the embankment at this time of the year are the culverts and bridges and how well they aid in the natural drainage of water to avoid washouts
		08-Jun-16	DOL	No environmental concerns were observed at the time of inspection

Table D-2: Summary of Inspection Reports for the Inuvik to Tuktoyaktuk Highway (cont'd)

Licence/ Permit	Scope	Date	Regulator	Findings
N2013E0018 (cont'd)	Road Construction, Inuvik to Tuktoyaktuk Highway (cont'd)	09-Aug-16	DOL	During this inspection it was observed that grading and road based compacting of constructed road is currently being done on both the north and south ends. During this inspection no environmental concerns was observed in regards to the embankment project.
		17-Aug-16	DOL	During this inspection it was observed that the road based compacting and grading is being continued on the road. No environmental concerns was observed with the embankment.
		14-Nov-16	DOL	During this inspection it was observed that one grader was operating on the south end and by Hans Creek. No environmental concerns was observed during this inspection.
		07-Dec-16	DOL	During the inspection it was observed that one packer and cat was working on the embankment as well culverts were being installed. Ice road access to source 312 was also observed. No concerns were observed at the time of the inspection.
N2013s0001	Geotechnical drilling/access between Inuvik and Tuktoyaktuk	20-May-14	DOL	No environmental concerns were observed for boreholes inspected

Notes:
na = not applicable; INAC = IndDOL = Department of Lands; ILA = Inuvialuit Land Administration

An investigation is underway by Environment Canada on the Inuvik Tuktoyaktuk Highway. As this is an on-going investigation, details cannot be provided at the time of publication.

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APPENDIX E

Engagement Record

TASR Engagement and Consultation Log[1]

The Tłı̨chǫ Government, Whatì Community Government and Department of Transportation have done their best in populating the following engagement log. It is expected that there have been additional public sessions and meetings left unmentioned as Whatì consults on an ongoing basis about the proposed TASR and 30 years' worth of consultation is difficult to track after the fact. As some discussions for this project have occurred prior to the 2013 Engagement Guidelines, some of the older engagement material may not be available or in the same standardized format as is now required. Previous engagement would have followed the guidelines and legislation required at that time.

New materials added to Log

2015/2016 INDIGENOUS GOVERNMENT AND ORGANIZATION ENGAGEMENT AND CONSULTATION							
Date	**Attendees**	**Engagement Activity Type** (e.g. written notification, face-to-face, workshop, etc.)	**Issue(s) Raised by Affected Party**	**Recommendation from Affected Party**	**Proponent Response to issue(s) – Indicate if issue(s) were resolved or not**	**Information materials provided to affected party (Y/N)**	**Written correspondence, meeting notes, and/or minutes (Y/N)**
05/21/15 06/12/15 11/29/15 03/29/16	Acho Dene Koe First Nation	Written notification from DOT	N/A – No response	N/A	N/A	Y	Y
05/21/15 06/12/15 09/08/15 03/29/16	Dehcho First Nations	Written notification from DOT	N/A – No response	N/A	N/A	Y Same as ADKFN	Y
05/21/15 06/12/15 09/08/15 03/29/16	Mountain Island Métis	Written notification from DOT	N/A – No response	N/A	N/A	Y Same as ADKFN	Y
05/21/15 06/12/15 09/08/15 03/29/16	Northwest Territories Métis Nation	Written notification from DOT	N/A – No response	N/A	N/A	Y Same as ADKFN	Y
05/21/15	North Slave Métis Alliance	Written notification from DOT	N/A – No Response	N/A	N/A	Y Same as ADKFN	Y
06/12/15	North Slave Métis Alliance	Written notification from DOT	June 26, 2015 response letter (see attached).	Would like to be consulted. Would like to receive all materials on the topic including meeting notes from Whatì Special Inter-Agency Meeting from June 24, 2015.	Sent response letter July 13, 2015	Y	Y
07/22/15	North Slave Métis Alliance	Email correspondence from DOT	July 27, 2015 and July 29, 2015 response emails (see attached)	Clarify if this presentation is considered consultation or if it is an info session. Provide additional material on top of meeting notes from Whatì.	Sent response emails July 28, 2015 and July 29, 2015	Y Notes from Special Inter-Agency Meeting	Y
07/29/15	North Slave Métis Alliance	Email meeting invite from DOT	July 29, 2015 response email (see attached)	Declined meeting invite as Board members not available.	Sent meeting cancellation email July 31, 2015	N	Y

[1] Please note that this log includes both engagement and consultation efforts by the GNWT. Any steps included in the log may be taken into account when assessing adequacy of section 35 consultation and accommodation.

07/31/15	North Slave Métis Alliance	Written notification with follow up email from DOT	July 31, 2015 response email (see attached).	Thanked DOT for the material and looks forward to consultation.	Waiting for further correspondence from NSMA to continue with next steps.	Y Draft PDR	Y
08/04/15	North Slave Métis Alliance	Email correspondence from NSMA	Requesting PDR digitally. Aug 4, 2015 emails identifying document downloads and additional email confirming receipt.	Provide digital copies of PDR.	Sent response email Aug 4, 2015 with attachments.	Y Electronic PDR	Y
08/26/15	North Slave Métis Alliance	Email correspondence from DOT	Sept 4, 2015 response email but was not received until it was FW on Sept 21, 2015 (wrong addressee; see attached)	Asking for consultation funding		N	Y
09/08/15	North Slave Métis Alliance	Written notification from DOT	Sept 18, 2015 response letter and Sept 21, 2015 FW email from Sept 4 (was originally sent from NSMA to NSMA when it should have been sent to DOT; see attached)	Asking for consultation funding	Sent response email Sept 21, 2015 re: not receiving Sept 4 email and asked to resend. Sent response email Sept 26, 2015 asking for an informal face to face meeting to discuss funding request.	N	Y
09/27/15	North Slave Métis Alliance	Email correspondence from NSMA	Agreed to informal face to face lunch meeting on Sept 29, 2015	Asking for consultation funding	Face to face meeting occurred. Sent response letter Jan 27, 2016. (Delay in sending letter as a result of requiring legal counsel to draft response due to the requests during the meeting).	N	Y
02/16/16	North Slave Métis Alliance	Email correspondence from NSMA	Requesting electronic PDR to be sent again. Reply email Feb 16, 2016 requesting old documents now and new later Download receipts from Shin Shinga and Kate Gower Feb 16, 2016	Provide digital copy of PDR from August 2015 Provide new digital copies Feb 25	Sent response email Feb 16, 2016 re: providing old Aug 2015 version or waiting for new final draft on Feb 25, 2016. Sent additional response email providing Aug 2015 digital PDR and to send new version Feb 25	Y August 2015 Electronic PDR	Y
02/19/16	North Slave Métis Alliance	Written correspondence from NSMA	Response to DOT's Jan 27/16 letter	Continue with engagement and provide updated PDR on Feb 25	As per Feb 16, 2016 email, DOT will provide updated PDR on Feb 25. Updated PDR provided on Feb 25/16.	Y February 2016 Electronic PDR	Y
03/19/16	North Slave Métis Alliance	Written correspondence from DOT	March 24, 2016 response letter	Described next steps (4 points) to undertake deep consultation	DOT, in consultation with applicable GNWT departments will draft a letter in reply. It is expected that a response will only be able to be provided to NSMA in April (at the earliest). The level of detail required to respond to NSMA's letter will require time as a result of the number of GNWT departments that will need to be consulted internally. The engagement and consultation process with NSMA will continue. **DOT response letter sent: May 26, 2016**	N	Y
03/29/16	North Slave Métis Alliance	Written notification from DOT (application submission date)				N	Y
05/26/16	North Slave Métis Alliance	Written correspondence from GNWT – DOT TO NSMA	Response to letter from March 24 and review of NSMA of TASR PDR				Y
07/27/16	North Slave Métis Alliance	Written correspondence from GNWT	GNWT invitation to discuss concerns not specific to TASR expressed by NSMA in June 2, 2016 letter to WLWB	Set up meeting to discuss non-TASR concerns	GNWT extended offer to meet with NSMA to discuss concerns not specific to TASR	N	Y On EA Registry PR# 76
08/10/16	North Slave Métis Alliance	Written correspondence from NSMA to GNWT-DAAIR	NSMA reply to GNWT July 27 letter. Preliminary assessment of NSMA members' Aboriginal rights as Métis vis a vis the proposed Tłįchǫ All-season Road. To discuss concerns not specific to TASR.	Agreement to setting up meeting, provided possible meeting dates		N	Y On EA Registry PR# 76
08/17/16	North Slave Métis Alliance	Written correspondence from Canadian Northern Economic Development Agency	Re: Participation in the TASR EA1617-01[2016}				Y On EA Registry PR# 14

10/07/16	North Slave Métis Alliance	Written correspondence from NSMA to GNWT-DAAIR	Requesting meeting with GNWT re: NSMA Member's Strength of Claim Preliminary Assessment. GNWT hadn't replied to NSMA's Aug 10 letter.	Requested meeting, provided possible meeting dates	GNWT-DAAIR responded via email Oct 7/16 stating will reply by following week	N	Y On EA Registry, PR# 53
10/20/16	North Slave Métis Alliance	Written correspondence from GNWT-DAAIR to NSMA	NSMA Member's Strength of Claim Preliminary Assessment – GNWT DAAIR response to NSMA August 10th and October 6th letter Letter from GNWT to NSMA providing an update on GNWT's NSMA Member's Strength of Claim Preliminary Assessment, intention to meet and encouragement of TASR participation. A few more months required to complete assessment.	GNWT offered to meet with NSMA to discuss the results of the NSMA Member's Strength of Claim Preliminary Assessment once complete	Ongoing – GNWT will provide results to preliminary assessment once available	N	Y On EA Registry PR# 62
11/16/16	North Slave Métis Alliance	Written correspondence from NSMA to GNWT- DAAIR	NSMA Members' Strength of Claim Preliminary Assessment –NSMA request to receive results as soon as possible in response to GNWT-DAAIR's letter of October 20, 2016	Provide results of NSMA Members' Strength of Claim Preliminary Assessment	Ongoing – GNWT will provide results to preliminary assessment once available	N	Y On EA Registry PR #82
12/16/16	North Slave Métis Alliance	Written Correspondence from GNWT –DAAIR to NSMA	NSMA Members' Strength of Claim Preliminary Assessment –GNWT response to NSMA request to receive results as soon as possible Update on the timeline to release results of the GNWT's preliminary assessment of the members of the NSMA rights Restated commitment to meet with NSMA representatives to discuss results following after being disclosed to NSMA in writing	Provide results of preliminary assessment of strength of claim	Ongoing – GNWT will provide results to preliminary assessment once available		Y On EA Registry PR #88
12/16/16	North Slave Métis Alliance	Written correspondence from GNWT-DAAIR to NSMA	NSMA's involvement in the TASR EA - encouraged NSMA's continued participation in the MVEIRB EA process. GNWT will rely on the environmental assessment process by MVEIRB and WLWB to learn about the nature of concerns of Section 35 rights relating to TASR.		Ongoing – GNWT will provide results to preliminary assessment once available	N	Y On EA Registry PR #88

2016 STAKEHOLDER ENGAGEMENT

Date	Attendees	Engagement Activity Type (e.g. written notification, face-to-face, workshop, etc.)	Issue(s) Raised by Affected Party	Recommendation from Affected Party	Proponent Response to issue(s) – Indicate if issue(s) were resolved or not	Information materials provided to affected party (Y/N)	Written correspondence, meeting notes, and/or minutes (Y/N)
01/05/16	Fortune Minerals Ltd.	Written notification from DOT	Jan 15, 2016 response email Jan 18, 2016 email requesting link again	Requesting digital copy of PDR	Sent response emails Jan 15, 2016 re: link to electronic PDR. Resent electronic links Jan 18, 2016	Y Draft PDR	Y
01/18/16	Fortune Minerals Ltd.	Email correspondence from Fortune	Jan 18, 21, 22, 25, 26, 2016 emails	Providing suggested changes to PDR	Sent response emails Jan 18, 24, 26, 2016 accepting suggested changes. Resolved.	N	Y
01/05/16	Tłįchǫ Investment Corporation	Written notification from DOT	N/A – No Response			Y Draft PDR	Y

01/05/16	Northwest Territories Power Corporation	Written notification from DOT	N/A – No Response			Y Draft PDR	Y
01/05/16	Wek'èezhìı Renewable Resources Board	Written notification from DOT	Jan 22, 2016 sent response email Feb 2, 2016 sent response email acknowledging receipt of DOT email	Provided comments regarding the draft PDR	Sent response email Feb 2, 2016 re: incorporating comments. Resolved.	Y Draft PDR	Y
01/05/16	NWT & Nunavut Chamber of Mines	Written notification from DOT	Jan 20, 2016 sent response email Jan 20, 2016 download receipt of electronic documents	Asking for draft PDR documents electronically	Sent response emails Jan 20, 2016 re: attaching PDR documents and responding re: sharing info. Resolved.	Y Draft PDR	Y
02/25/16	GNWT (all departments)	Written notification from DOT	Provided in-depth review of draft application material. See Compiled Reviewer Comments Table TASR (Mar 2016)		Addressed reviewer comments and inserted changes into PDR.	Y Draft PDR	Y
02/25/16	Federal Government (group of departments)	Written notification from DOT	Provided in-depth review of draft application material. See Compiled Reviewer Comments Table TASR (Mar 2016)		Addressed reviewer comments and inserted changes into PDR.	Y Draft PDR	Y
03/11/16	Federal Government (group of departments)	Face-to-face presentation with Q&A session	No alarming issues or concerns raised		Provided appropriate answers when posed during presentation. Socioeconomic mitigations are being effectively mitigated.	Y PowerPoint Presentation	Y
03/21/16	MVEIRB	Face-to-face presentation with Q&A session	No alarming issues or concerns raised	Ensure socioeconomic concerns are effectively mitigated	Provided appropriate answers when posed during presentation. Socioeconomic mitigations are being effectively mitigated.	Y PowerPoint Presentation (same as above)	N

Engagement Records from Tłįchǫ Government

Date	Attendees	Engagement Activity Type (e.g. written notification, face-to-face, workshop, etc.)	Issue(s) Raised by Affected Party	Recommendation from Affected Party	Proponent Response to issue(s) – Indicate if issue(s) were resolved or not	Information materials provided to affected party (Y/N)	Written correspondence, meeting notes, and/or minutes (Y/N)
07/24/06	DOT North Slave Region	Briefing Note	Tłįchǫ Road Access Improvements				Y
05/02/08	Whatì Chief, Whatì Municipal Employee, DOT, Tłįchǫ government, Whatì community members, Kavik AXYS (consultant)	Tłįchǫ Winter Road Realignment Whatì Community Meeting, February 5, 2008, Whatì NT	Safety - Some areas might be subject to overflow which can create dangerous conditions for travel. Bridges and culverts will be needed for these areas.	Change of route	Resolved	Y	Yes Maps
05/02/08	Whatì Chief, Whatì Municipal Employee, DOT, Tłįchǫ government, Whatì community members, Kavik AXYS (consultant)	Tłįchǫ Winter Road Realignment Whatì Community Meeting, February 5, 2008, Whatì NT	Inflation - inflation in the community is a concern as stores can charge high prices due to a lack of competition with other stores outside of the community	Socio-economic study	Resolved	Y	Y
05/02/08	Whatì Chief, Whatì Municipal Employee, DOT, Tłįchǫ government, Whatì community members, Kavik AXYS (consultant)	Tłįchǫ Winter Road Realignment Whatì Community Meeting, February 5, 2008, Whatì NT	Contracts for Tłįchǫ Business - Contracting opportunities for Tłįchǫ residents will be very important for the new road project. For work occurring on Tłįchǫ lands, Tłįchǫ companies should have the priority to obtain contracts.	Socio-economic study	Resolved	Y	Y
05/02/08	Whatì Chief, Whatì Municipal Employee, DOT, Tłįchǫ government, Whatì community members, Kavik AXYS (consultant)	Tłįchǫ Winter Road Realignment Whatì Community Meeting, February 5, 2008, Whatì NT	Impacts to youth – Decisions regarding the new road realignment should consider impacts to the youth of the community. The youth will be most impacted by whatever is decided and should be fully informed and involved in any decisions made on the road project.	Socio-economic study	Under continuous review – consultation will be ongoing by the Whatì Interagency committee	Y	Y
08/04/08	Behchokǫ̀ Chief, Behchokǫ̀ Senior Admin officer, Behchokǫ̀ Community Members, Tłįchǫ	Tłįchǫ Winter Road Realignment Behchokǫ̀ Community Meeting, April 8,	Buffer zone – inquired why 2 km buffer zone would be required along the road route.	Route review with maps	Resolved	Y	Y

	Government, DOT, GNWT Department of the Executive, Kavik AXYS (consultant)	2008, Behchokǫ̀ NT					
08/04/08	Behchokǫ̀ Chief, Behchokǫ̀ Senior Admin officer, Behchokǫ̀ Community Members, Tłı̨chǫ Government, DOT, GNWT Department of the Executive, Kavik AXYS (consultant)	Tłı̨chǫ Winter Road Realignment Behchokǫ̀ Community Meeting, April 8, 2008, Behchokǫ̀ NT	Buffer zone – Tłı̨chǫ Government considering how to grant land use approval for a 2 km buffer zone along the new road realignment.	Route review with maps	Resolved	Y	Y
08/04/08	Behchokǫ̀ Chief, Behchokǫ̀ Senior Admin officer, Behchokǫ̀ Community Members, Tłı̨chǫ Government, DOT, GNWT Department of the Executive, Kavik AXYS (consultant)	Tłı̨chǫ Winter Road Realignment Behchokǫ̀ Community Meeting, April 8, 2008, Behchokǫ̀ NT	Buffer zone – What consultation would be required with the DOT from other proponents who might want to access granular materials within the 2 km buffer zone.	Route review with maps	Resolved	Y	Y
08/04/08	Behchokǫ̀ Chief, Behchokǫ̀ Senior Admin officer, Behchokǫ̀ Community Members, Tłı̨chǫ Government, DOT, GNWT Department of the Executive, Kavik AXYS (consultant)	Tłı̨chǫ Winter Road Realignment Behchokǫ̀ Community Meeting, April 8, 2008, Behchokǫ̀ NT	Route selection – inquired if route selection has been finalized by the DOT.	Route review with maps	Resolved	Y	Y
08/04/08	Behchokǫ̀ Chief, Behchokǫ̀ Senior Admin officer, Behchokǫ̀ Community Members, Tłı̨chǫ Government, DOT, GNWT Department of the Executive, Kavik AXYS (consultant)	Tłı̨chǫ Winter Road Realignment Behchokǫ̀ Community Meeting, April 8, 2008, Behchokǫ̀ NT	Land use approvals - Noted that new road route could pass through Tłı̨chǫ community boundaries and might require specific land use approvals from the community government.	Route review with maps and Land Use Plan	Resolved	Y	Y
08/04/08	Behchokǫ̀ Chief, Behchokǫ̀ Senior Admin officer, Behchokǫ̀ Community Members, Tłı̨chǫ Government, DOT, GNWT Department of the Executive, Kavik AXYS (consultant)	Tłı̨chǫ Winter Road Realignment Behchokǫ̀ Community Meeting, April 8, 2008, Behchokǫ̀ NT	Environmental monitoring - Rivers along the route will have to be monitored for environmental and fisheries impacts. Baseline data will also have to be collected. Tłı̨chǫ people should be hired to do this work.	Environmental monitoring approach review	Resolved	Y	Y
08/04/08	Behchokǫ̀ Chief, Behchokǫ̀ Senior Admin officer, Behchokǫ̀ Community Members, Tłı̨chǫ Government, DOT, GNWT Department of the Executive, Kavik AXYS (consultant)	Tłı̨chǫ Winter Road Realignment Behchokǫ̀ Community Meeting, April 8, 2008, Behchokǫ̀ NT	Salvageable timber – During road construction, salvageable timber or wood should be set aside for use by Tłı̨chǫ residents.	Environmental and construction plan review	Resolved	Y	Y
08/04/08	Behchokǫ̀ Chief, Behchokǫ̀ Senior Admin officer, Behchokǫ̀ Community Members, Tłı̨chǫ Government, DOT, GNWT Department of the Executive, Kavik AXYS (consultant)	Tłı̨chǫ Winter Road Realignment Behchokǫ̀ Community Meeting, April 8, 2008, Behchokǫ̀ NT	Spills and environmental risk – Environmental risks from a fuel spill on ice surfaces of winter roads are significant for water resources of the Tłı̨chǫ, Land based route would reduce the risk as spills are much easier to clean up.	Environmental monitoring approach review	Resolved	Y	Y
08/04/08	Behchokǫ̀ Chief, Behchokǫ̀ Senior Admin officer, Behchokǫ̀ Community Members, Tłı̨chǫ Government, DOT, GNWT Department of the Executive, Kavik AXYS (consultant)	Tłı̨chǫ Winter Road Realignment Behchokǫ̀ Community Meeting, April 8, 2008, Behchokǫ̀ NT	Mining development – The new road realignment will benefit mining exploration activities within the Tłı̨chǫ region by providing longer and more reliable road access into exploration areas.	Review of Fortune Minerals plan	Resolved	Y	Y
08/04/08	Behchokǫ̀ Chief, Behchokǫ̀ Senior Admin officer, Behchokǫ̀ Community Members, Tłı̨chǫ Government, DOT, GNWT	Tłı̨chǫ Winter Road Realignment Behchokǫ̀ Community Meeting, April 8, 2008, Behchokǫ̀ NT	Hydroelectric facilities – The new road realignment will help power corporation operations with the Tłı̨chǫ region by providing longer and more reliable road access for resupply of hydroelectric facilities.	Discussion of hydro options	Resolved	Y	Y

	Department of the Executive, Kavik AXYS (consultant)						
15/04/08	Gamètì Chief, Gamètì Community members, DOT, Kavik AXYS (consultant)	Tłı̨chǫ Winter Road Realignment Gamètì Community Meeting, April 15, 2008, Gamètì NT	Caribou migration – Caribou migrate through the area of the proposed road realignment and was not sure if caribou would continue to migrate if new road realignment is constructed. More studies should be undertaken on caribou migration through the proposed project areas.	Environmental monitoring approach plan	Resolved and under continuous review	Y	Y
15/04/08	Gamètì Chief, Gamètì Community members, DOT, Kavik AXYS (consultant)	Tłı̨chǫ Winter Road Realignment Gamètì Community Meeting, April 15, 2008, Gamètì NT	Caribou migration – Caribou start migrating in May and that their migration route is usually west of Gamètì.	Environmental monitoring approach plan	Resolved and under continuous review	Y	Y
15/04/08	Gamètì Chief, Gamètì Community members, DOT, Kavik AXYS (consultant)	Tłı̨chǫ Winter Road Realignment Gamètì Community Meeting, April 15, 2008, Gamètì NT	Over hunting from better access – It is important that the new road realignment does not result in people abusing the animals from over hunting from the new road.	Environmental monitoring approach plan	Resolved and under continuous review	Y	Y
15/04/08	Gamètì Chief, Gamètì Community members, DOT, Kavik AXYS (consultant)	Tłı̨chǫ Winter Road Realignment Gamètì Community Meeting, April 15, 2008, Gamètì NT	Environmental monitoring – If the project is reviewed, wildlife and fisheries issues will have to be considered and monitoring of the environmental impacts from the road will be needed.	Environmental monitoring approach plan	Resolved and under continuous review	Y	Y
15/04/08	Gamètì Chief, Gamètì Community members, DOT, Kavik AXYS (consultant)	Tłı̨chǫ Winter Road Realignment Gamètì Community Meeting, April 15, 2008, Gamètì NT	Tłı̨chǫ employment – When construction of the new road begins, Tłı̨chǫ people need jobs and training to be employed in the construction of the road.	Socio-economic plan	Resolved and under continuous review	Y	Y
15/04/08	Gamètì Chief, Gamètì Community members, DOT, Kavik AXYS (consultant)	Tłı̨chǫ Winter Road Realignment Gamètì Community Meeting, April 15, 2008, Gamètì NT	Contracts for Tłı̨chǫ business – It is important that Tłı̨chǫ people receive contracting and employment opportunities for road construction.	Socio-economic plan	Y	Y	
12/05/08	Wekweètì Chief, Wekweètì Community members, Wek'èezhìı Land and Water Board, DOT, Kavik AXYS (consultant)	Tłı̨chǫ Winter Road Realignment Wekweètì Community Meeting, May 12, 2008, Wekweètì NT	Impacts to communities – The new road realignment could also bring more drugs and alcohol into the community.	Socio-economic study	Under continuous review – consultation will be ongoing by the Whatì Interagency committee	Y	Y
10/06/08	Behchokǫ̀ Chief, Gamètì Chief, DOT, GNWT Department of the Executive, Kavik AXYS (consultant)	Tłı̨chǫ Winter Road Realignment Public Community Meeting, June 10, 2008, Yellowknife NT	Accidents/Emergencies - Pointed out the danger of the ice road presently used by the communities by bringing attention to the many lives that have been lost on it and also recalled a fatal accident.	Socio-economic study	Under continuous review – consultation will be ongoing by the Whatì Interagency committee	Y	Y
2009-2013	Tłı̨chǫ Executive Council	Chief Executive Council Meeting	The roads issues have been a standing agenda item for every CEC meeting through this period. The progress of the PDR planning has been on the agenda for the CEC who meet every 6 weeks.	Ongoing information	Ongoing engagement with the Tłı̨chǫ Government	Y	Y
21/03/13	Tłı̨chǫ Executive Council	Chief Executive Council Meeting, March 21-22 2013, Edmonton AB	Loss of land - if there are lands taken away for a road, what do we get for it? Will there be an exchange?	Land Swap being reviewed	Ongoing engagement with the Tłı̨chǫ Government	Y	Y
21/03/13	Tłı̨chǫ Executive Council	Chief Executive Council Meeting, March 21-22 2013, Edmonton AB	Loss of land - What does the Tłı̨chǫ Agreement say about this question? Does it mean we have less land now? Will we lose Tłı̨chǫ lands? It is vital to ensure that Tłı̨chǫ lands are not less than before.	Land Swap being reviewed	Ongoing engagement with the Tłı̨chǫ Government	Y	Y
21/03/13	Tłı̨chǫ Executive Council	Chief Executive Council Meeting, March 21-22 2013, Edmonton AB	Easements - What will the easements be for the Tłı̨chǫ Government	Land Swap being reviewed	Ongoing engagement with the Tłı̨chǫ Government	Y	Y
21/03/13	Tłı̨chǫ Executive Council	Chief Executive Council Meeting, March 21-22 2013, Edmonton AB	Compensation - Will new lands be allocated in the case of loss of land for a road?	Land Swap being reviewed	Ongoing engagement with the Tłı̨chǫ Government	Y	Y
23/08/13	Community Government of	Whatì Community	Road route – want to be sure the route is not in a culturally significant	Traditional Use Study	Ongoing engagement with the Tłı̨chǫ	Y	Y

	Whatì, DOT, Tłı̨chǫ Government,	Government meeting, August 23 2013, Whatì NT.	area.		Government		
04/09/13	Whatì Chief, Tłı̨chǫ Government, GNWT, Aurora College, Whatì community members	Whatì Road Community Consultation Meeting, September 4 2013, Whatì NT.	Feasibility - What's it going to take, cost, and what is the feasibility of it.	Review of PDR approach	Resolved	Y	Y
04/09/13	Whatì Chief, Tłı̨chǫ Government, GNWT, Aurora College, Whatì community members	Whatì Road Community Consultation Meeting, September 4 2013, Whatì NT.	Timeline for community to make decisions - There is going to be a lot of confusion before we take time to work things out; but the mine is ready to go ahead. Look at it as fast as we can. There is a lot of confusion for the community here.	Review of PDR approach	Resolved	Y	Y
04/09/13	Whatì Chief, Tłı̨chǫ Government, GNWT, Aurora College, Whatì community members	Whatì Road Community Consultation Meeting, September 4 2013, Whatì NT.	Impacts to youth - There are more young people; even though as elders we say we can't do this and that, there's more impact on the young people. They have more to say and there is a lot more young people than the old ones. Confused what the impact might be on road options.	Socio-economic study	Under continuous review – consultation will be ongoing by the Whatì Interagency committee	Y	Y
04/09/13	Whatì Chief, Tłı̨chǫ Government, GNWT, Aurora College, Whatì community members	Whatì Road Community Consultation Meeting, September 4 2013, Whatì NT.	NR impacts - The NR costs more and is more damaging: blasting the land and with the water				
04/09/13	Whatì chief, Tłı̨chǫ Government, GNWT, Aurora College, Whatì community members	Whatì Road Community Consultation Meeting, September 4 2013, Whatì NT.	Communities need to be informed - We would need more information on what information you need to sort out and whatever you find you need to share with community here	Socio-economic study	Under continuous review – consultation will be ongoing by the Whatì Interagency committee	Y	Y
04/09/13	Whatì chief, Tłı̨chǫ Government, GNWT, Aurora College, Whatì community members	Whatì Road Community Consultation Meeting, September 4 2013, Whatì NT.	Impacts from any road - Lots of problems, accidents, loss of lives, many other impacts.	Socio-economic study	Under continuous review – consultation will be ongoing by the Whatì Interagency committee	Y	Y
04/09/13	Whatì chief, Tłı̨chǫ Government, GNWT, Aurora College, Whatì community members	Whatì Road Community Consultation Meeting, September 4 2013, Whatì NT.	Individual involvement of community members - Want questionnaires again at your expense. Go around town and ask about this road. A lot of mixed feelings among the youth and elders.	Socio-economic study	Under continuous review – consultation will be ongoing by the Whatì Interagency committee	Y	Y
04/09/13	Whatì chief, Tłı̨chǫ Government, GNWT, Aurora College, Whatì community members	Whatì Road Community Consultation Meeting, September 4 2013, Whatì NT.	Impacts to wildlife - Impacts on the animals	Environmental monitoring approach plan	Resolved and under continuous review	Y	Y
04/09/13	Whatì chief, Tłı̨chǫ Government, GNWT, Aurora College, Whatì community members	Whatì Road Community Consultation Meeting, September 4 2013, Whatì NT.	Impacts from construction – Every time we speak about this, there always seems to be some measurements of impact. I don't want our land to be destroyed. I don't want the machine to tear up my land or pull up trees. To get things done with too much impact. They did a lot of cut lines for highway 3 and I did a lot of work on that. I can share more with you. This road is a very heavy impact for one of the communities here.	Environmental monitoring approach plan	Resolved and under continuous review	Y	Y
04/09/13	Whatì Chief, Tłı̨chǫ Government, GNWT, Aurora College, Whatì community members	Whatì Road Community Consultation Meeting, September 4 2013, Whatì NT.	Consideration of Whatì input - So when we discuss certain things here, are they going to be written down so someone else might get the hang of it and keep it? Are they going to follow what we say and do?	Consultation plan	Resolved and will be ongoing	Y	Y
04/09/13	Whatì Chief, Tłı̨chǫ Government, GNWT, Aurora College, Whatì community members	Whatì Road Community Consultation Meeting, September 4 2013, Whatì NT.	Impacts to youth - How are we planning to live through it? Even though we don't have a year round road, we come to some problems with the young people here.	Socio-economic study	Under continuous review – consultation will be ongoing by the Whatì Interagency committee	Y	Y
04/09/13	Whatì chief, Tłı̨chǫ Government, GNWT, Aurora College, Whatì community members	Whatì Road Community Consultation Meeting, September 4 2013, Whatì NT.	Impacts to community - We have to ask ourselves these questions – children and the future and ask what it might be like for them. If we decide to build a road to the community, we might see a lot of problems with our community	Socio-economic study	Under continuous review – consultation will be ongoing by the Whatì Interagency committee	Y	Y
04/09/13	Whatì chief, Tłı̨chǫ Government, GNWT, Aurora College, Whatì community members	Whatì Road Community Consultation Meeting, September 4 2013, Whatì NT.	Cost of road - NR where they might be lots of lakes and hills and ponds so those kinds of research, it might cost five times more, there is also a big question mark about where to go, and when they look at impacts like that it might cost more or less, but a new road will be costly	Environmental monitoring approach plan	Resolved and under continuous review	Y	Y

04/09/13	Whatì chief, Tłı̨chǫ Government, GNWT, Aurora College, Whatì community members	Whatì Road Community Consultation Meeting, September 4 2013, Whatì NT.	Impact to community from the mine - Another big question that came up what's going to happen once the mine is open, what's the community going to look like, are we going to be ready?	Environmental monitoring approach plan	Resolved and under continuous review	Y	Y
04/09/13	Whatì chief, Tłı̨chǫ Government, GNWT, Aurora College, Whatì community members	Whatì Road Community Consultation Meeting, September 4 2013, Whatì NT.	Involvement of young people - Need young people here to hear what they think. They are the ones that are going to be impacted down the road and those minerals aren't going anywhere.	Socio-economic study	Under continuous review – consultation will be ongoing by the Whatì Interagency committee	Y	Y
04/09/13	Whatì chief, Tłı̨chǫ Government, GNWT, Aurora College, Whatì community members	Whatì Road Community Consultation Meeting, September 4 2013, Whatì NT.	Involvement of young people - How come there is no young people here? What happened? They didn't get the message or is this the norm that young people do not come to meetings?	Socio-economic study	Under continuous review – consultation will be ongoing by the Whatì Interagency committee	Y	Y
04/09/13	Whatì chief, Tłı̨chǫ Government, GNWT, Aurora College, Whatì community members	Whatì Road Community Consultation Meeting, September 4 2013, Whatì NT.	Involvement of young people - Very important to young people to express what they think about it and how they think about it. So this is just the research that we might be doing.	Socio-economic study	Under continuous review – consultation will be ongoing by the Whatì Interagency committee	Y	Y
04/09/13	Whatì chief, Tłı̨chǫ Government, GNWT, Aurora College, Whatì community members	Whatì Road Community Consultation Meeting, September 4 2013, Whatì NT.	Emergencies/Accidents - What will happen if there is an accident on the OAR because it is so far out? Would it be Behchokǫ̀ or Whatì? It's not in anyone's jurisdiction.	Socio-economic study	Under continuous review – consultation will be ongoing by the Whatì Interagency committee	Y	Y
04/09/13	Whatì chief, Tłı̨chǫ Government, GNWT, Aurora College, Whatì community members	Whatì Road Community Consultation Meeting, September 4 2013, Whatì NT.	Need for more community meetings - We need to know this is not the only meeting we are going to have here. We are going to have more meetings. Then we can get the young people involved. So that they are aware of what's coming ahead of them.	Consultation plan	Resolved and will be ongoing	Y	Y
04/09/13	Whatì chief, Tłı̨chǫ Government, GNWT, Aurora College, Whatì community members	Whatì Road Community Consultation Meeting, September 4 2013, Whatì NT.	Emergencies/Accidents - there have been a lot of accidents from sharp turns from YK to Providence. Those are the kinds of things we need to look at.	Consultation plan	Resolved and will be ongoing	Y	Y
Ongoing	Tłı̨chǫ Community Governments and Tłı̨chǫ Government	Ongoing	Standing agenda item to review any issues that emerge from the road. The GNWT works with the TG to bring issues forward, jointly briefs the leadership and then works together to resolve issues or information gather	Consultation plan	Resolved and will be ongoing	Y	Y
06/24/15	Whatì Interagency Committee with GNWT and Tłı̨chǫ Government	Whatì Road Community Consultation Meeting, June 24, 2015, Whatì NT.	Meet to review all plans associated with the roads planning.	Consultation plan	Resolved and will be ongoing	Y	Y
06/24/15	Whatì Interagency Committee with GNWT and Tłı̨chǫ Government	Whatì Road Community Consultation Meeting, June 24, 2015, Whatì NT.	Community Government of Whatì has recognized that the growing of the community also means more housing is required.	Housing infrastructure needed	Planning will be ongoing	Y	Y
06/24/15	Whatì Interagency Committee with GNWT and Tłı̨chǫ Government	Whatì Road Community Consultation Meeting, June 24, 2015, Whatì NT.	Whatì reviewed all plans completed for managing all season road, including new Community Emergency Management Plan Developed a service contract to bridge local housing administration in Whatì until a Local Housing Organization (LHO) can be formed this year. Actively assisting with efforts of maintaining and growing a Community Garden (not as big as Gamètì yet). ALL CG Council attended governance training in 2013 and 2015. Completed the 1st Volunteer Firefighter training in Whatì in 10 years. Completed Whatì's first Land Use Plan (with planned areas designated for future growth - residential, commercial, industrial). Completed 99% of the land transfers into the name of the Community Government of Whatì (should have been completed in 2005). Completed a Resiliency Plan (first in Canada's North).Completed a 5 Year Strategic Plan (and almost updated for 2015).Completed a 5 Year Capital Plan (required by MACA). Complete renovations on the Culture Centre, Youth Centre, Arena, and Water Treatment Plant. Completed a Micro-Economic Study for Whatì. Accountability Framework - Above Average Report	Consultation plan	Ongoing	Y	Y
01/18/16	Wekweètì	Community Meeting	See full spreadsheet of issues that were listed		Ongoing	Y	Y

01/18/16	Gamètì	Community Meeting	See full spreadsheet of issues that were listed		Ongoing	Y	Y
01/19/16	Whatì	Community Meeting	See full spreadsheet of issues that were listed		Ongoing	Y	Y
01/20/16	Behchokǫ̀	Community Meeting	Sell full spreadsheet of issues that were listed		Ongoing	Y	Y
02/25/16	Tłı̨chǫ Government	Written notification from DOT	Provided in-depth review of draft application material. See Compiled Reviewer Comments Table TASR (Mar 2016)		Addressed reviewer comments and inserted changes into PDR.	Y PDR	Y
06/05/16	Whatì	Whatì Interagency Community Meeting	Whatì Interagency minutes		Ongoing	Y Newsletters & PowerPoint	Y See attached
Correspondence with Wek'èezhìı Land and Water Board							
Date	**Attendees**	**Engagement Activity Type** (e.g. written notification, face-to-face, workshop, etc.)	**Issue(s) Raised by Affected Party**	**Recommendation from Affected Party**	**Proponent Response to issue(s) – Indicate if issue(s) were resolved or not**	**Information materials provided to affected party (Y/N)**	**Written correspondence, meeting notes, and/or minutes (Y/N)**
03/24/16	WLWB	Written correspondence from DOT	TASR – Access to Tłı̨chǫ Lands	Advising that the GNWT and TG may be submitting an application to the WLWB for Land Use Permit and Water License		N	Y
06/02/16	WLWB	Written correspondence from NSMA	Consultation Regarding proposed TASR				Y
07/8/16	WLWB to DOT	Written notification	NSMA correspondence about GNWT TASR engagement and consultation	NSMA's concerns to be further considered	Jul 26/16 reply letter from DOT: GNWT responded to concerns and engagement, consultation and accommodation has been appropriate.	N	Y
12/16/16	WLWB	Written correspondence from DOT	December 13, 2016 NSMA Letter regarding Consultation on Land use Permit Application W2016S0009 Design Phase Geotechnical investigations along Proposed Tłı̨chǫ All-Season Road Corridor				Y See Attached
Environmental Assessment Process							
Date	**Attendees**	**Engagement Activity Type** (e.g. written notification, face-to-face, workshop, etc.)	**Issue(s) Raised by Affected Party**	**Recommendation from Affected Party**	**Proponent Response to issue(s) – Indicate if issue(s) were resolved or not**	**Information materials provided to affected party (Y/N)**	**Written correspondence, meeting notes, and/or minutes (Y/N)**
08/18/16	Hosted by MVEIRB	Whatì Community Scoping Session	Details on MVEIRB Registry				
08/24/16	Hosted by MVEIRB	Yellowknife Technical Scoping Session	Details on MVEIRB Registry				
10/07/16	Deninu K'ue First Nation	Written notification of environmental assessment of the Project and potential impacts on Aboriginal rights.	GNWT-DOL notification of TASR EA			Y Web Link	Y On EA registry PR# 49

10/07/16	Deh Cho First Nations Deh Gah Got'ie Dene Band Fort Providence Metis Local Fort Simpson Metis Local Jean Marie River First Nation Ka'a'ge Tu First Nation Liidlii Kue First Nation Pehdzeh Ki First Nation Sambaa K'e Dene Band Nahanni Butte First Nation West Point First Nation	GNWT consultation letters notifying Aboriginal groups of EA1617-01, the Tłįchǫ All-Season Road, and request for identification of asserted and/or established s. 35 rights that would occur as a result of the Project.	GNWT-DOL notification of TASR EA			Y MVEIRB Web Link	Y On EA registry PR#56
10/20/16	Deh Gah Got'ie Dene Band		Until unless DGGFN had consented otherwise, according to extend of Treaty 11, the proposed Tłįchǫ All Season road is of interest to us because : 1) we believe we still have land use and hunting rights in the area 2) as party to Treaty 11, our interest in area demands that a full environmental assessment be conducted. 3) further issues concerns will be forth at future DGGFN Council meeting	A full environmental assessment be conducted	In your email, the DGGFN expressed an interest in the environmental assessment for the proposed project based on your Treaty 11 rights, especially land use and hunting rights in the area of the proposed project area. The GNWT and Government of Canada share the responsibility for the duty to consult regarding any potential adverse impacts to Aboriginal and/or Treaty rights resulting from the proposed Tłįchǫ All-season Road. The GNWT will be relying on both the consultative processes of the Mackenzie Valley Environmental Impact Review Board (Review Board), and as the proponent of this project, the GNWT will also rely on its own bilateral consultation with Aboriginal governments and organizations, to fulfill its duty to consult. We encourage the Deh Gáh Got'ie First Nation to participate in the environmental assessment of the proposed Project to ensure the GNWT is able to fully understand any potential adverse impacts to your established Treaty rights and accommodate them as appropriate.	Y MVEIRB Web Link	Y On EA registry PR# 60, PR #59, PR #61, PR #56
10/07/16	Łutselk'e Dene First Nation	Written notification of EA1617-01, the Tłįchǫ All-Season Road, and request for identification of asserted and/or established s. 35 rights that would occur as a result of the Project.	GNWT-DOL notification of TASR EA			Y MVEIRB Web Link	Y On EA registry PR# 49
10/07/16	Mountain Island Métis	Written notification of EA1617-01, the Tłįchǫ All-Season Road, and request for identification of asserted and/or established s. 35 rights that would occur as a result of the Project.	GNWT-DOL notification of TASR EA			Y MVEIRB Web Link	Y On EA registry PR# 49
10/07/16	North Slave Métis Alliance	Written notification of EA1617-01, the Tłįchǫ All-Season Road, and request for identification of asserted and/or established	GNWT-DOL notification of TASR EA			Y MVEIRB Web Link	Y On EA registry PR# 49

		s. 35 rights that would occur as a result of the Project.					
10/07/16	Northwest Territories Métis Nation Hay River Métis Council Fort Smith Métis Nation Fort Resolution Métis Council	Written notification of EA1617-01, the Tłı̨chǫ All-Season Road, and request for identification of asserted and/or established s. 35 rights that would occur as a result of the Project.	GNWT-DOL notification of TASR EA			Y MVEIRB Web Link	Y On EA registry PR# 49
10/07/16	Tłı̨chǫ Government	Written notification of EA1617-01, the Tłı̨chǫ All-Season Road, and request for identification of asserted and/or established s. 35 rights that would occur as a result of the Project.	GNWT-DOL notification of TASR EA			Y MVEIRB Web Link	Y On EA registry PR# 49
10/07/16	Yellowknives Dene First Nation (Dettah and Ndilǫ)	Written notification of EA1617-01, the Tłı̨chǫ All-Season Road, and request for identification of asserted and/or established s. 35 rights that would occur as a result of the Project.	GNWT-DOL notification of TASR EA			Y MVEIRB Web Link	Y On EA registry PR# 49

2016 TŁĮCHǪ COMMUNITY CONSULTATIONS

Jan 18/16 Lunch Meeting Wekweètì
Jan 19/16 Dinner Meeting Gamètì
Jan 20/16 Dinner Meeting Whatì
Jan 21/16 Dinner Meeting Behchokǫ̀
Summary table of results from community consultations attached. Identified community member issues and proponent's response to address concerns.
Presentation material during meetings: 11x17 map of road; PowerPoint presentation; TASR project summary in English and Tłı̨chǫ; attendance sheet; comment cards; agenda (see attached).
Posters and advertisement material for meetings attached.

TASR DISCUSSIONS in the MEDIA

06/26/15	CBC North (online): Whatì all-weather road discussed by government, First Nations leaders http://www.cbc.ca/news/canada/north/whati-all-weather-road-discussed-by-government-first-nations-leaders-1.3127799
01/11/16	CBC North (online): Tłı̨chǫ winter road builders face 'challenges' this year, say NWT officials http://www.cbc.ca/news/canada/north/tlicho-winter-road-construction-1.3399302
01/21/16	CBC Radio Tłı̨chǫ Hour: Interview with Chief Alfonz between 1pm and 2pm. *No transcript available as it was spoken in Tłı̨chǫ language.
01/21/16	Tłı̨chǫ Youth Revolution (Facebook): Open discussion re: TASR
01/21/16	CBC Radio Transcript: DOT Wraps Up Talks with Tłı̨chǫ about All-Season Road
01/22/16	CBC Radio Transcript: DOT Wraps Up Talks with Tłı̨chǫ about All-Season Road
01/29/16	CBC North (online): NWT gov't to move forward this spring on Whatì highway http://www.cbc.ca/news/canada/north/tlicho-whati-road-permit-1.3424835
01/29/16	CBC Radio Transcript: Planning for All-Weather Road from Behchokǫ̀ to Whatì
03/01/16	News Release: Mackenzie Valley Corridor, Tłı̨chǫ All Season Road, Hay River dredging
04/06/16	CBC Radio Transcript: Not Everyone In Whatì Wants All-Season Road to the Community
04/06/16	CBC North (online): NWT continues down $150M road to Whatì http://www.cbc.ca/news/canada/north/whati-winter-road-permit-tlicho-1.3522499 (with public comments attached)
04/11/16	News/North NWT: GNWT pitches feds for road funds; Territorial government seeks millions for the Mackenzie Valley Highway project and Tłı̨chǫ all-weather route
04/11/16	CBC North (online): Tłı̨chǫ gov't to build 8-room hotel in Whatì this summer http://www.cbc.ca/news/canada/north/whati-hotel-tlicho-government-1.3528000
04/11/16	Fortune Minerals announces permitting underway for public highway to Whatì
04/12/16	Julie Green MLA Yellowknife Centre online blog: If I had $150 million dollars…
04/18/16	Fortune Minerals announcement: Public highway to the community of Whatì advancing

04/18/16	News/North NWT: Build road to diamonds; Territory needs to focus on keeping existing mines alive before supporting new ones (editorial)
04/26/16	Messenger Service: Tłı̨chǫ Government and GNWT hold first Intergovernmental Meeting of 18th Assembly
06/09/16	CBC North (online): Whatì road not a subsidy to mining industry, says N.W.T. minister (with public comments attached)
07/29/16	CBC North (online): Proposed road to Whatì, NWT, to get environmental review
Summer 2016	Aboriginal Business Quarterly: Next Up: The Tłı̨chǫ road
08/08/16	News/North NWT: Bumpy ride for Tłı̨chǫ Road
09/14/16	CBC North (online): Quest for federal Mackenzie Valley Highway money hits speed bump
01/16/17	News/North NWT: Roads aren't a good investment
01/16/17	News/North NWT: Feds commit to partly fund road to Whatì
01/23/17	News/North NWT Whatì all-season road creates opportunities
01/23/17	Messenger Service: Fortune Minerals and Chamber of Mines fire back in response to 'condescending' remarks by MLA Julie Green
OTHER	
01/12/16	Constructing and Maintaining the Tłı̨chǫ Winter Road: presentation by Michael Conway at Edzo classroom. Included Q&A which led to a discussion on climate change and alternatives to winter road. Proposed TASR was then discussed as a possible solution.
03/19/16	Tłı̨chǫ All-season Road webpage up and running: http://tlicho.ca/all-season-road Updates (such as the newsletter section and flyover videos) conducted on a regular basis.
01/12/17	Presentation: Public Private Partnerships (P3)
02/07/17	HANDARD: Minister's Statement 118-18(2): Tłı̨chǫ All-Season Road
03/09/17	Behchokǫ̀ Community Regional Economic Development Presentation

<u>TASR Engagement Record – New Materials not yet Posted to Public Registry</u>

(Updated March 28, 2017)

Engagement Records from the Tłı̨chǫ Government:

1. Whatì Interagency Community Meeting (email summary from June 5, 2016)

Correspondence with Wek'èezhìı Land and Water Board

2. Written correspondence from DOT to WLWB dated December 16, 2016

TASR Discussions in the Media

3. CBC North (online): Proposed road to Whatì, NWT, to get environmental review (07/29/16)
4. Aboriginal Business Quarterly: Next Up: The Tłı̨chǫ road (Summer 2016)
5. News/North NWT: Bumpy ride for Tłı̨chǫ Road (08/08/16)
6. CBC North (online): Quest for federal Mackenzie Valley Highway money hits speed bump (09/14/16)
7. News/North NWT: Roads aren't a good investment (01/16/17)
8. News/North NWT: Feds commit to partly fund road to Whatì (01/16/17)
9. News/North NWT Whatì all-season road creates opportunities (01/23/17)
10. Messenger Service: Fortune Minerals and Chamber of Mines fire back in response to 'condescending' remarks by MLA Julie Green (01/23/17)

Other

11. TASR Nov 2016 Vol 1 No 4 Newsletter
12. Presentation: Public Private Partnerships (P3) (January, 2017)
13. HANSARD: Minister's Statement 118: 18 (2): Tłı̨chǫ All-Season Road
14. Behchokǫ̀ Community Regional Economic Development Presentation

Community Government of Whatì
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June 5, 2016

Meeting Summary
Special Inter-Agency Meeting
In Preparation for the Tłįchǫ All Season Road into Whatì

On May 4, 2016, approximately 80 people gathered in Whatì to discuss the social and economic impacts of the Tłıchǫ All Season Road being constructed and providing year-round road access from Highway 3 to Whatì. Mr Jim Stauffer, Adult Education Instructor at the Whatì Campus of Aurora College, was selected as the Moderator.

Invited representatives at the meeting included:

- Community Government of Whatì Chief, Council, & Administration;
- Tłįchǫ Government Grand Chief, Executive Officers & Community Directors;
- Tłįchǫ Government Departments, including Planning, Economic Development, Training & Development Facilitation, Mines Liaison, Lands & Resources
- TCSA, including Education, Health, Social Services, Income Security, Career Development, Early Childhood Programming;
- GNWT Departments, including Government Services, Transportation, Airports, MACA, Housing;
- Tłįchǫ Investment Corporation;
- RCMP;
- Aurora College;
- Air Tindi;

Due to meeting size, general members of the public moved in and out of the Whatì Culture Centre during the session. At the end of the meeting, four elders spoke ... all in support of the road.

Three charter flights were booked for the meeting, along with the morning & afternoon Air Tindi flights scheduled for the day. Due to fires in Fort McMurray, Summit Air had to redirect some of their aircraft for emergency evacuation. They spread the passengers over two smaller charters, causing one of the flights to land in Whatì well after the meeting had started.

During his welcome, Chief Alfonz Nitsiza noted it was a perfect example of some of the challenges of living in an isolated community.

A short summary of the 2013 & 2015 Special Inter-Agency Meetings was provided by the Community Government.

Department of Transportation provided a short presentation on the current status of the Tłıchǫ All Season Road, including a historical component.

The Tłı̨chǫ & Community Governments jointly made a presentation on social and resource issues that have been determined as being a concern, and then discussed mitigation actions either planned or already underway.

Mr Stauffer opened a round-table discussion and invited the representatives to speak about their areas of responsibility.

Areas of concern:

- Need for more Heavy Equipment Operator training for the Tłı̨chǫ Region. TG is arranging an initial session starting in July 2017 in Whatì.

- According to a Territorial formula, Mezi Community School has a capacity of 220 students, therefore they are only at 65% capacity.
  - Although some questioned that estimation, it was noted that a contingency plan could involve portable classrooms should it be required.
  - There was also question about increased students creating the need for more teachers, and whether there was adequate housing for the teachers.

- The Whatì RCMP Detachment is already at capacity, and there is no opportunity for growth in the current structure. Locating a site for another detachment has not been included in the Whatì Land Use Plan.
  - There are currently two RCMP residences and one temp RCMP residence in Whatì.
  - There is currently no plans for detachment expansion or additional residence construction.
  - In the interim, assistance with community-sponsored security patrols is very important.

- Lac La Martre Development Corporation reminded everyone that while an All Season Road will assist on the availability of product delivery, the reality is that new housing and building construction takes 2 years or more. *Note: Whatì currently has less than 20 subdivided but undeveloped residential building lots, and less than 10 lots that can be re-developed for new residences.*

- NWT Housing Corporation advised everyone that their normal cycle is 3 years from the time that the decision is made to proceed to the time they can move someone into the completed residence.

- Tłı̨chǫ Investment Corporation expressed their concerns that they would like to see more collaboration in training opportunities.

- TCA was asked about proving increased health care services in Whatì, including ambulance services. TCSA noted that Whatì is one of the few communities in the north that has a retired ambulance, currently used for medevac transport, and it could be pressed into service and they would be prepared to train local residents as EMTs.

- It was noted that two important partners were apparently over-looked and should have been extended invitations to be at the table: NorthwesTel and NTPC.
  - Internet services are currently questionable at certain times in the morning as demand increases.
  - Similarly, although the Community Government is investing in several energy and environmental alternatives, there is the potential for a significant increase on demands in the existing diesel-generation system.

Chief Alfonz Nitsiza thanked everyone for attending, and that it was a learning experience for many as Whatì proactively prepares for growth and change, and he looked forward to another similar meeting next year.

Please Note Also Attached:

a. *Chief Alfonz Nitsiza's opening & closing comments are attached separately.*

b. *Letter from Whatì to WLWB in support of the All Season Road*

c. *Attendance sheet with contact information.*

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Violet Camsell-Blondin, Chair
Wek'èezhìi Land and Water Board (WLWB)
#1, 4905 48th Street
Yellowknife, NT
X1A 3S3

May 30, 2016

Dear Ms. Camsell-Blondin:

RE: Tłı̨chǫ All-Season Road Project, W2016E0004/W2016L8-0001 - GNWT-DOT

The Community Government of Whatì has been an active agent in the move to consider the Tłıchǫ All-Season Road (TASR) to our community. We are very proud of a range of programs and strategies we have developed over the years to make Whatì a strong and resilient community.

When it became apparent that there may be the possibility of the all-season road into the community, we used the existing Inter-Agency Committee as a special forum to advance our preparation. In 2013, 2015 and again in 2016, we brought not only the local agency representatives together, but their supervisors and regional managers.

These meetings bring together all agencies that have a role in delivering and strengthening programs in our community. Attached is a summary of the most recent meeting here, and recommend the breadth of organizations attending be noted.

As a result of these meetings, policies, programs and strategies have been identified and completed, such as:

- In 2013 (with the assistance of the Conference Board of Canada, the Justice Institute of BC, and Royal Roads University), the Community Government of Whatì completed the first Resiliency Study in Northern Canada. That Study indicated both strengths and weaknesses in the resiliency of our community, and that information was rolled into our long-term community strategic planning;
- In 2014, we completed our first five year Strategic Plan (2014-2019).
- In 2014, we also completed the first Land Use Plan for Whatì;
- In 2013/2014, we updated of our Community Emergency Management Plan and completed table-top exercises ... which proved to be useful during the adjacent wildland fires of 2014;

- In 2015, we partnered with the other Tłı̨chǫ communities & the Tłı̨chǫ Government to form the Tłı̨chǫ Regional Economic Development Working Group, and developed a local/regional economic development strategy including the revival of the dormant local community futures, which will develop and grow economic and tourism opportunities in the region;
- In March 2016, Council completed the Whatì Strategic Plan (2016-2021), which is annually reported on and updated.

Notably, the Strategic Plan addresses the TASR, and every other goal in our plan promotes strong and resilient community development. For 2016, the Ten Top Goals are:

1. Professional Development
2. Prepare for All-Season Road
3. Hotel and Café
4. Arena - Gymnasium addition
5. Arena - Research artificial ice option
6. Strategically placed landfill berms and natural screening
7. Revive Community Futures
8. Daycare
9. Tłı̨chǫ Regional Economic Development Working Group
10. Form separate Economic Development Entity

Whatì is an active and vibrant Community Government recognized across Canada as a leader in promoting sustainable community development and growth. We are proud of our achievements, and look forward to many interesting and challenging years in which we put our plans into action.

The TASR has been on our Community Government agenda as a standing item since in the early 1990s, and we are not unaware of the risks and benefits it holds. The approach our government has taken is one which does not shy away from the risks. Instead, we actively plan for them to change them into opportunities.

We look forward to the outcomes of your Board's deliberations.

In Tłı̨chǫ Unity,

Chief Alfonz Nitsiza

cc: Jackson Lafferty, MLA - Monfwi
Laura Duncan, Executive Officer, Tłı̨chǫ Government
Chief and Council, Community Government of Behchokǫ̀
Chief and Council, Community Government of Gamètì
Chief and Council, Community Government of Wekweètì

May 4, 2016 - Special Inter-Agency Meeting
Chief Alfonz Nitsiza's Opening comments

As at June 5, 2016

Good morning. Thank you, Elder, for the opening prayer.

I would like to welcome all of you here, as you know we still have another plane delay, so they will be here momentarily but that goes to show that we rely heavily on the plane here in Whati, not only here but other communities in the north where we don't have the connections to the highway systems. It is normal for us to delay or juggle things around so that everything works out okay. The people that are coming will do their presentations later on today. So, we will start.

Today we are here to talk about the intergovernmental ***Tłı̨chǫ All Season Road****. We have been talking about, thinking about and researching this road for many years. We have been working together in partnership with all the agencies that serve the people of Whatì to prepare for this All Season Road. It is in our partnerships that build the trust we need to keep working together.*

Let me give you an example: It was in 2013 when we heard through the Intergovernmental Agency that it was noted that Whatì needed a full-time local social worker, a full-time local mental health worker, a local housing organization, a hotel & restaurant, and more attention for seniors accommodation. Our work together has helped us to make great steps forward on all these goals.

The ***Wek'èezhìi Land and Water Board*** *is reviewing the application for the proposed road and will decide what to do next. We have brought you all here together today to talk about how to be prepared for this road. This is the single most incredible crowd of people. You all work so hard on all of your programs, policies and you serve our people well.*

Once the road is built, Whatì will have access year round. There will be benefits, but we must also be prepared for the changes it will bring. We have been preparing. We have studied how the road could impact our community. We have asked our people what their concerns are and where the road should go. We have a socio-economic study already completed on how the road could affect our community. The study shows that the road will bring jobs and economic opportunities for our community. Yes, there are concerns. That is why we have been getting our community prepared. The Whatì government has been working with the interagency working group since 2012. We are working with the RCMP, MACA, and the Tłı̨chǫ Government to make sure our community is ready. The Whatì government is committed to implement programs and measures to promote community health and resilience.

If we want this road now, it is our job now to say we want it. There is a lot that goes into this effort, a lot of planning, a lot of review, and we are going to need the funding to pay for this road. We are not asking for something we do not understand. We have studied this, our people have talked about this, we have listened to our Elders. As a community we have to show them what we want. If you want the road we must advocate for it. I am proud of our agencies, and welcome you all to our community today.

And there lots of people in departments, in our Tłı̨chǫ Government departments, the Community Governments, as well as the Territorial Government, who done extra to make that this road happens. It's not there yet, but we know that the application is in front of the review board, and so we must continue to be prepared.

And I'd like to take this time to personally thank the local Department of Transportation Superintendent, Michael Conway for his support. He has been one person that has really pushed for this road for Whatì. I want to acknowledge him, and give him a round of applause for his contribution to this very important project.

There are many others as well, and that goes to show what can be accomplished through partnerships and working together. I've sat in a lot of meetings where we say 'Let's work together' and soon as the meeting is over, you walk out, and working together never happens. But it is true that in building relationships, relationships turns into trust, that's when things start happening. And that's what I saw with this Inter-Agency work, getting the people together, and good things will happen.

With that, I'd like to turn this over to my Grand Chief of the Tłįchǫ Government. Again, we are very grateful to have so many people here from different departments of governments and companies, people that want to know and see for themselves what this is all about. It is a great time. With that, I'll turn this over the Grand Chief. Mahsi.

Mahsi. Thank you.

It was a great gathering here. This was our third time and the last count I received was that there were over 80 people here. When we first did this in 2013, there was about 40. And 2015 there was a little over 40 as well, so this time we doubled that. It shows that there is a lot of interest.

And, as Chief, I am very proud of this community and all of you, the agencies and how you serve our people here. We don't know how long the review of this road will take. It is at the review board right now, and they are looking at it. The public still has time to comment on that review until the end of this month. And today as I listened to everybody as they made their presentations and comments and here is what I've heard today:

- *The road has the ability to build capacity in the community.*
- *We need to have a real focus on economic development.*
- *There are strong foundations and plans in place now.*
  For example, there is training, with partnerships with hope and new training strategies. We all have a part in training.
- *In Housing, we are happy that we now have a local presence (Local Housing Organization).*
- *For families, there are parenting programs and many new services, such as community garden.*
- *In economic development our Tłįchǫ Investment Corporation and our local businesses are working. They will be required and relied upon heavily when we build the road.*
- *While Air Tindi services may be reduced, maybe we will become a Tłįchǫ force in north aviation.*
- *For education and services as good, our schools and daycares are not at capacity.*
- *And we know our ambulance service is growing and we will need to respond on the highway.*
- *It is good to hear that the RCMP is committed to working in our communities.*

We still have needs and we have learned about them today. For example, we have heard:
- *that justice needs a probation officer,*
- *housing needs three year lead time for (new) housing to plan ahead and needs lands and family-size structures.*
- *Internet services (need to be enhanced).*
- *There needs to be stronger collaboration between agencies, and we want you to come and support us building it together.*

Thank you for coming today. And we will see you next year to continue this conversation.

I mentioned how important economic development is, because over many years, all the small communities were disadvantaged because we rely heavily on outside for everything. Programming dollars, either in municipal or education elsewhere. Never, never do we have enough money.

We as a Tłįchǫ Government also talk and advocate for our language and cultural way of life. Ten years into the Tłįchǫ Government and I see that there is limited improvement in those areas. We have limited resources, and that probably will not go away for some time yet. The only way I know *that we talk, the elder talk(ed) about the alcohol and drugs coming into every community, it's all over, we cannot lock everybody up. That's almost impossible. The social envelope in the Territorial Government is about $300 Million a year. The money that goes to people at a lock-up in jail: One inmate costs over a $100,000 per year. If a person gets sick because of drinking to excess or drugs and ends up in the hospital, it is a $150 to $170 a night for one bed. Those things are going up. And we talk about alcohol, drugs: I've heard it all. The stories behind it, for the last forty years that I've been in meetings. So what do you do? You know, we hear on the radio about homelessness. I think it's time for front-line agencies to think about how do we deal with these issues?*

And as our leaders in the Tłı̨chǫ Government we truly believe that our language is slowly dying, right in front of us. And, the way out of this is through economic development. We have to educate our people so they can have jobs and try to fit into mainstream society. If the parents are working, the kids will grow up to see their parents working instead of on welfare. Now, some may not agree, but if we depend on somebody for everything, someday that service will be cut and what do you do?

So, I think just for a thought before you travel home, we need to do more in the communities, not only here (in Whati) but in all our regions. We've got lots of 'smarts' around the table, and we can share and I think that we can have a healthy community and a healthy people. And we will save the government money, and everybody benefits.

Mahsi Cho.

Recorded Attendance at the 2016-May-04 Special Inter-Agency Meeting

as at June 5, 2016

	Name	Representing	Position	Email
1.	Acosta, Dan	Community Government of Whatì	(Recreation Programmer)	recprogram@whati.ca
2.	Alexis, April	Tłı̨chǫ Government - Whatì	(A/Community Director)	aprilalexis@tlicho.com
3.	Angel, Grace	NWT Housing Corp - Whatì	(LHO Manager)	grace_angel@govt.nt.ca
4.	Arrowmaker, Carol	Tłı̨chǫ Government - Wekweètì	(Ec Dev Officer)	carolarrowmaker@tlicho.com
5.	Baran, Larry	Community Government of Whatì	(Deputy SAO)	deputysao@whati.ca
6.	Barnett-Aikman, Shannon	Tłı̨chǫ Community Service Agency	(Education)	shannon_aikmann@tlicho.net
7.	Batchelor, Rhonda	Department of Transportation	(Director, Environment Affairs)	Rhonda_Batchelor@gov.nt.ca
8.	Beaverho, Pierre	(Community Elder)	()	(None)
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Note: Attendance counts were completed throughout the meeting, to gauge public attendance along with people that signed the attendance form. At 1:34pm, there was 79 people. 2:59pm there was a count of 82 people.

Government of Northwest Territories | Gouvernement des Territoires du Nord-Ouest

DEC 1 6 2016

BY EMAIL

Ryan Fequet
Executive Director
Wek'èezhìi Land and Water Board
#1-4905 48th St.
YELLOWKNIFE NT X1A 3S3

Dear Mr. Fequet:

December 13, 2016 NSMA Letter regarding Consultation on Land Use Permit Application W2016S0009 - Design Phase Geotechnical Investigations along Proposed Tlicho All-Season Road Corridor

The Department of Transportation (DoT) carefully reviewed the December 13, 2016 North Slave Métis Alliance (NSMA) letter to the Wek'èezhìi Land and Water Board (WLWB) pertaining to Land Use Permit Application W2016S0009, alleging that DoT has not fulfilled the duty to consult, and writes to clarify a few points.

DoT remains open to meeting with the NSMA to further discuss the details of the Geotechnical permit application and will be communicating this option directly to the NSMA. A full summary of the consultation undertaken to date is provided as an attachment.

The activities applied for in Land Use Permit Application W2016S0009 (Project), while not wholly unrelated, constitute a separate project from the Tlicho All Season Road (TASR). This Project will be of very limited duration and magnitude and consequently will have a very low potential impact on the asserted Aboriginal rights of the NSMA.

Paragraphs 122 to 125 of the *West Moberly First Nations v. British Columbia (Chief Inspector of Mines)*[1] decision, cited by NSMA, do not support the proposition advanced by NSMA, that this Project must be regarded as part of the TASR for purposes of consultation. In those

.../2

1. 2011 BCCA 247.

paragraphs, Mr. Justice Hinkson of the British Columbia Court of Appeal, in concurring with Chief Justice Finch, held that the chambers judge committed no error in considering the impacts of a potential future full coal mining operation within the scope of the duty to consult for a proposed bulk coal sampling project and that the proponent needed to consider the impact of a potential future full coal mining operation following the bulk sampling to provide meaningful consultation. Mr. Justice Hinkson did not hold that the proposed bulk coal sampling project was inseparable from and should be treated in the same manner as a potential future full coal mining operation following the bulk coal sampling in determining where along the spectrum the duty to consult fell, or that exploration and investigatory projects in all contexts cannot be treated separately for the purposes of consultation from the larger project to which they bear some degree of connection.

A key factor that distinguishes this context from that in *West Moberly First Nations* is that water licence and land use permit applications for the TASR were previously submitted to WLWB and an environmental assessment process resulting from those applications is ongoing. The potential impacts of the larger project are therefore receiving full consideration. This Project will not increase the potential impacts of the TASR on the asserted Aboriginal rights of the NSMA.

Given the very low potential impact of this Project on NSMA's asserted Aboriginal rights, regardless of the strength of NSMA's claim, the duty to consult will fall at the low end of the spectrum for this Project. This low end duty to consult can be fulfilled by providing notice to NSMA, an opportunity to comment and giving due consideration to any comments submitted by NSMA. This is precisely what NSMA will be provided with through the DoT consultation to date and the WLWB process. Receipt of the GNWT's preliminary strength of claim assessment would make no difference to NSMA's ability to fully participate in the WLWB process for this Project. The WLWB consequently does not require the GNWT's preliminary strength of claim assessment to process Land Use Permit Application W2016S0009, nor does NSMA require the preliminary strength of claim assessment to provide comments by the December 23, 2016 deadline.

.../3

In light of the foregoing, DoT respectfully requests that the WLWB maintain the December 23, 2016 deadline for comments and not grant any extension requested by NSMA on the basis of having not received the preliminary strength of claim assessment from the GNWT.

Sincerely,

Michael Conway
Regional Superintendent
North Slave Region
Department of Transportation

Attachment

c Mr. Bill Enge, President
North Slave Métis Alliance

Ms. Laura Duncan, Tłįchǫ Executive Officer
Tłįchǫ Government

Mr. Russell Neudorf, Deputy Minister
Department of Transportation

Ryan Fequet, Executive Director
Wek'èezhìı Land and Water Board

Attachment:
A full summary of the consultation undertaken to date for the geotechnical investigations LUP application W2016S0009 is provided in the table below.

Table 1

Nov 4/16	1st email with attached letter and brief project description – No response from NSMA. Read receipt available.
Nov 18/16	2nd email updating everyone when application is expected to be submitted and again indicating comments and questions were welcome. No response from NSMA. Read receipt available.
Nov 23/16	3rd email informing everyone application was submitted to WLWB and application should appear on ORS for public review after application deemed complete.
Nov 24/16	Follow-up email letting everyone know they can receive an advanced copy of the application if anyone wanted to review material prior to it being deemed complete and posted to public registry. Email also highlighted the reason why the application package was so large (MSDS and read receipts as part of engagement record) and that the application itself was small.
Nov 24/16	NSMA emailed requesting a copy of the application and indicated the MSDS were not required.
Nov 25/16	DOT sent entire application package to NSMA.
Nov 25/16	NSMA indicated material was received.
Dec 7/16	As per engagement plan, notice of RFP was provided to distribution list.

Proposed road to Whati, N.W.T., to get environmental review

Review board cites concerns with road's potential impact on caribou populations, crime rates, alcohol abuse

By Guy Quenneville, CBC News Posted: Jul 29, 2016 6:00 AM CT Last Updated: Jul 29, 2016 6:00 AM CT

The N.W.T. government's next major highway project will go under the microscope for its potential effects on the environment and crime in the remote community of Whati.

The North Slave Métis Alliance requested an environmental assessment of the proposed 95-kilometre all-weather road from Highway 3 near Behchoko to the community of Whati, in the territory's Tlicho region. And the Mackenzie Valley Environmental Impact Review Board agreed one is warranted.

The board cites concerns about a potential increase in crime and drug and alcohol abuse in the community, where the sale, possession and consumption of alcohol is prohibited. It also says the road will give hunters longer winter access to the imperilled Bathurst and Bluenose East caribou populations.

Timeline, funding TBD

It's unclear what the environmental assessment will do to the construction timeline, as the N.W.T. Department of Transportation has not said specifically when it hopes to begin construction.

But the department has said it expects the road — with an estimated price tag of up to $150 million — will take four years to build.

How the territorial government plans to finance the project also remains unclear, though it is seeking some money from the federal government.

The Tlicho Government, which strongly advocated for the road, is now providing its members monthly updates on the project.

Here's the board's full reasoning for the assessment.

Corrections

- A previous version of this story said no group had requested an environmental assessment. In fact, the North Slave Métis Alliance did.
  Jul 29, 2016 12:03 PM CT

News & Notes

Next Up: The Tłįchø Road

» The $152M highway project could improve life in communities while sustaining Tłįchø workers, businesses though lean times

To paraphrase prominent Tłįchø leader John B. Zoe's comments during the public hearing phase of the environmental assessment of Ekati's Jay Pipe, during hard times of few caribou in the past, the Tłįchø people sustained themselves on the other animals abundant on their lands.

With the diamond mines nearing the end of their producing lives, one of those "other animals" is now squarely in the sights of the Tłįchø – and they don't intend to miss.

The Wek'eezhii Land and Water Board (WLWB), a creation of the Tłįchø Land Claim and Self-government Agreement, is now considering a joint application from the GNWT and the Tłįchø Government for permits to construct a 94-km all-weather road from Highway 3 to Whati.

"The Tłįchø Government intends to grant GNWT access ... This authorization includes temporary access to potential borrow sources and their respective access roads," the two entities wrote jointly in a letter to the WLWB. Under Chapter 18 of the Tłįchø Agreement, the two also indicate they would then negotiate a "land swap" – meaning the highway would end up under the authority of the GNWT though it is being built on what are currently Tłįchø lands.

Why this Road?

Examining the documents already filed with the WLWB, many benefits of the project have been detailed.

Project economic evaluation documents prepared for the GNWT Department of Transportation in March 2015 show the Tłįchø road has an estimated construction cost of $152 million. That amount would be directly injected into the territorial economy and stay there if the work can be done extensively by Northern contractors.

If built, the road would enhance access leading to increased efficiency for business and government work as well as reducing medical travel costs and reducing cost of living for Whati residents. Another economic cost benefit analysis shows the economic benefits associated with the Tłįchø road exceed costs by $12 million.

NICO Would Advance

Construction of the road would also enable construction and development of the already approved Fortune Minerals-owned NICO Cobalt-Bismuth-Gold-Copper project located 160 km northwest of Yellowknife and 50 km north of Whati, NWT, and the related refinery near Saskatoon, Sask.

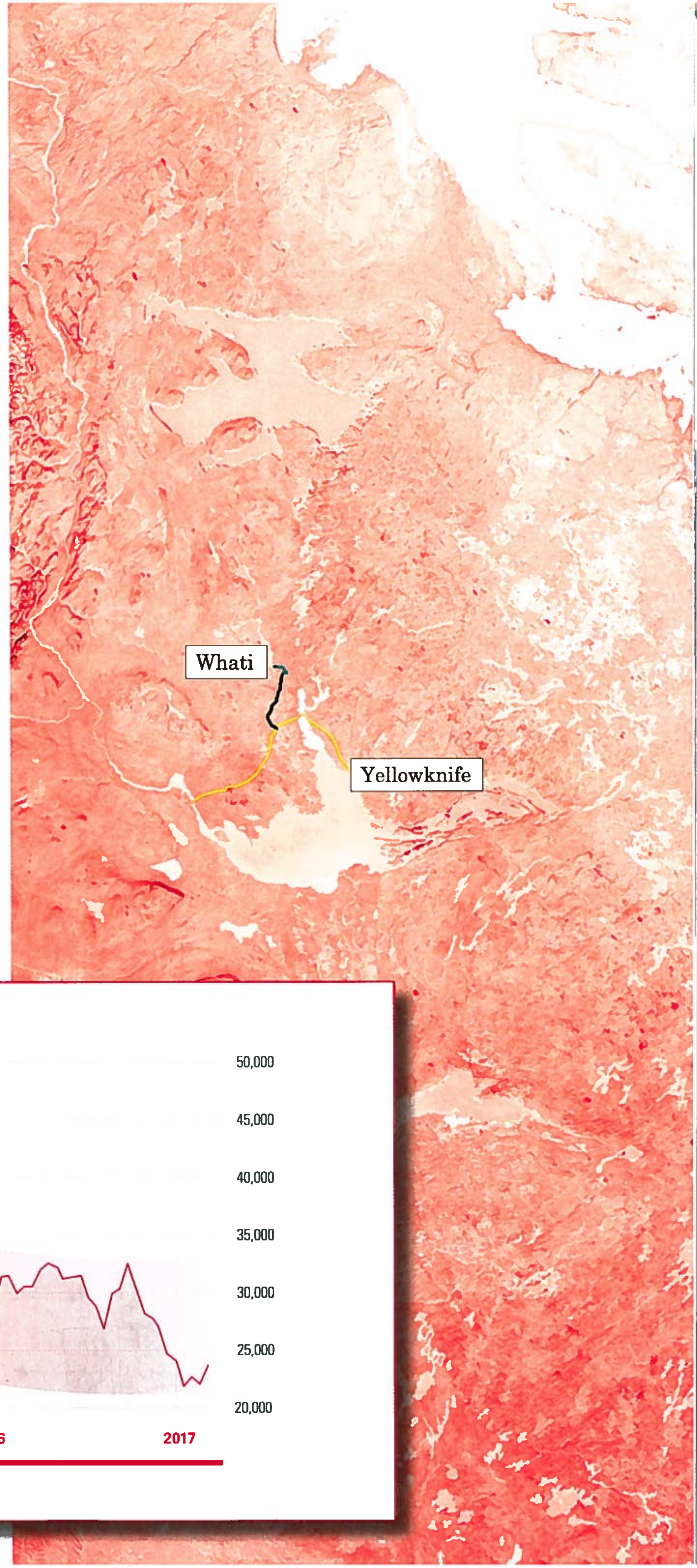
The NICO project has already been assessed in a positive feasibility study and has received its environmental assessment authorizations in the Northwest Territories and Saskatchewan. The NICO mineral reserves will support a 21-year mine life at a mill feed rate of 4,650 tonnes of ore per day to produce 180 wet tonnes of concentrate per day for shipment to the refinery in Saskatchewan. Life of mine average annual production is projected to be 41,300 ounces of gold, 1,615 tonnes of cobalt contained in a battery grade cobalt sulphate heptahydrate, 1,750 tonnes of bismuth contained in ingots, needles and oxide, and 265 tonnes of copper.

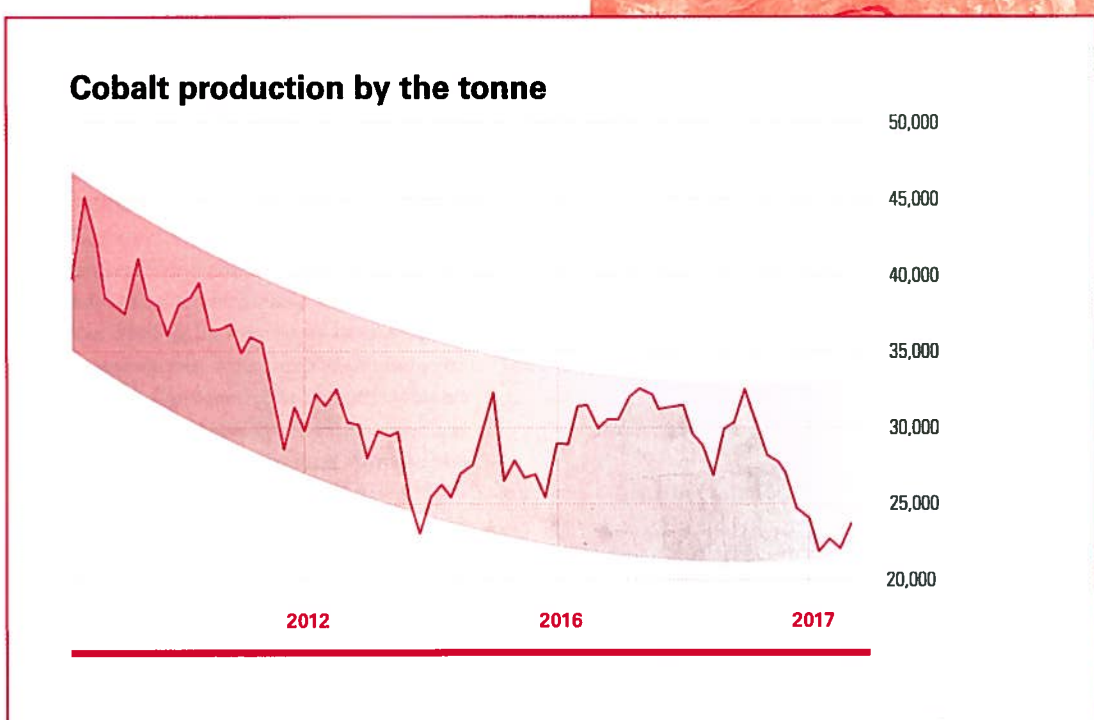
Fortune reported during the environmental assessment of the mine that there would be 288 full-time-equivalent jobs created within the NWT during construction; 480 full-time-equivalent jobs during the two-year underground and open pit phase at the beginning of operations; 297 full-time-equivalent jobs during the rest of the operations phase; and 150 full-time-equivalent jobs during the 20-year closure and post-closure phase.

Where Tesla Motors and Fortune Minerals Intersect: Cobalt

Cobalt is the key metal in the NICO mix at this point and the dominant output from the mine. Cobalt price forecasts in early May predict the current price of US$23,750 will rise to hit US$27,300 per tonne by 2020.

The cobalt market has had compound annual growth of 5 to 6 per cent for the past





Follow the Cobalt Highway – This dirt road could be an all-weather highway to the proposed Fortune Minerals mine site.
Photo courtesy of GNWT

two decades and in 2015 grew by 5.4 per cent, more than double global GDP growth of 2.4 per cent for the same period. Market growth has been driven primarily by the demand for cobalt in to make lithium-ion rechargeable batteries. Battery constituent demand increased nearly 12 per cent in 2015 and now accounts for approximately half of the world's annual cobalt production.

Double-digit percentage growth of cobalt used in rechargeable batteries is expected to continue for the foreseeable future.

Fortune has already produced a premium battery-grade cobalt sulphate sample from NICO ore. This premium grade ultra-pure sample exceeds the chemical specifications for cobalt sulphate heptahydrate received from several large manufacturers of lithium ion batteries, according to the company. The sample provided product for testing by a potential off-take customer. It was also produced to test minor changes to the process flow sheet the company plans to utilize at its proposed refinery near Saskatoon. Fortune continues to advance discussions for off-take agreements for its cobalt product with potential customers to support project financing.

> "Having a reliable Canadian solution to the impending supply deficit for cobalt will be critical."

One such potential customer could be Tesla Motors.

The darling of the global automotive scene said it was stepping up production plans for its upcoming Model 3 mass-market sedan and would build a total of 500,000 all-electric vehicles in 2018, two years ahead of schedule.

Lead Tesla entrepreneur and chief executive Elon Musk has indicated capital spending would rise about 50 per cent more than previously forecast this year, to around $2.25 billion.

Tesla, which produces the luxury Model S sedan and Model X sport utility vehicle, aims to become a high-volume automaker in a matter of years and already is valued on par with some of the biggest car companies in the world.

"The key thing we need to achieve in the future is to also be the leader in manufacturing," Musk said during the launch announcement. "It's the thing we obviously have to solve if we are going to scale and scale profitably."

The cobalt market is now approximately 100,000 tonnes per annum and has had a compound average annual growth rate of approximately 6 per cent over the past two decades. Most of this increase in consumption is attributed to the use of cobalt in high performance rechargeable batteries for portable electronic devices, electric vehicles and stationary storage cells. Batteries now account for 46 per cent of cobalt demand – having increased from only 1 per cent of the market in the mid-1990s.

The battery market continues to expand with wider usage of portable electronic devices and growing popularity of electric vehicles. Significant growth in the market is also expected from stationary storage cells connected to intermittent energy sources such as wind and solar generators, and off-peak charging from the electrical grid. The Paris Agreement on climate change at COP21 and other environmental initiatives support the shift to electrification to reduce carbon-based greenhouse gas emissions.

The NICO deposit also contains a significant gold co-product and 12 per cent of global bismuth reserves... a key ingredient in Pepto-Bismol and a safe alternative to lead in many applications.

Fortune Names Ramsay to Board

In an effort to ensure better understanding and communications with the North, Fortune Minerals announced recently the appointment of former GNWT Minister David Ramsay to the company's Board of Directors.

"I am very excited to join the Fortune Minerals team at a critical stage in the development of the NICO project," said Ramsay. "Having a reliable Canadian solution to the impending supply deficit for cobalt will be critical to global electronics companies that need cobalt to make lithium-ion batteries used to power portable electronic devices, electric vehicles and stationary storage cells."

Ramsay has more than 20 years of elected public office experience in the NWT, and held prominent cabinet positions such as Minister of Industry, Tourism and Investment that includes the pre-eminent mining portfolio, accounting for about 50 per cent of private sector GDP in this jurisdiction. Ramsay has also served as Minister of Justice, Attorney General, Minister of Transportation and the Minister Responsible for the Public Utilities Board for the GNWT. He brings important political experience and business acumen to the Board while Fortune works with three levels of government on road and power infrastructure initiatives that are important to the success of the Company's NICO gold-cobalt-bismuth-copper project.

"It is gratifying to be part of a solution to air quality concerns and climate change by reducing our dependence on fossil fuels with the growth of automotive industry electrification," Ramsay added. ABQ

Northern News Services ONLINE

Bumpy ride for Tlicho road

North Slave Metis Alliance says road threatens caribou

Kassina Ryder
Northern News Services
Monday, August 8, 2016

TLICHO
The president of the North Slave Metis Alliance (NSMA) says the Tlicho all season road threatens the only caribou herd they can still hunt.

"We're going to have year-round access to this particular herd. That really causes us concern because now the North Slave Metis people are going to have their only bush meat supply cut off," Bill Enge said.

The proposed roadway would provide a year-round connection between Whati and Highway 3.

Enge said it would also provide year-round access to the Bluenose East caribou herd. There is currently a ban on harvesting Bathurst caribou to the east and Enge said the NSMA is concerned the road will put additional stress on the Bluenose East herd.

"If the Bluenose East caribou herd population declines similar to that of the Bathurst caribou herd, then the Government of the Northwest Territories will have no choice but to put a 100 per cent harvesting ban on the Bluenose East herd, just like they've done with the Bathurst caribou herd," he said. "That's a serious concern to us."

There were between 35,000 and 40,000 Bluenose East caribou in 2015, according to population estimates from the Department of Environment. The herd had 68,000 animals in 2013.

There is a ban on commercial and resident hunting, but a limited aboriginal harvest is still allowed.

"That's a highway straight to the Bluenose East herd," Enge said. "It's quite likely, when the road goes through, the maximum amount of harvesting of the Bluenose East herd will occur and it will put additional strains on the herd."

Predators will also have better access to caribou, he added.

"We're also going to have increased predation on the herd because now the wolves and the bears can use the road as a highway to get right to the herd that is right now too difficult to get to, except for the winter road."

Enge said while the NSMA is not opposed to development, the group is not being properly consulted about the project.

"I am saying that the Government of the Northwest Territories, acting as the Crown in this context, has a duty to consult and, if need be, accommodate the North Slave Metis people no differently than the First Nations like the Tlicho are being consulted and accommodated respecting the Tlicho all season road project," he said. "That is inherently wrong because it's treating two aboriginal peoples that have the same rights differently."

Enge said a strength of claim assessment should be undertaken to determine the the impact the road will have on the NSMA's aboriginal rights.

News/North asked DOT for comment regarding the NSMA's claims that they were not properly consulted about the Tlicho all-season road project and the department emailed a response.

"We have filed our consultation record and it is on the board's public registry," wrote spokesperson Ioana Spiridonica.

In the meantime, the NSMA has requested the Mackenzie Valley Environmental Impact Review Board to perform an environmental assessment on the project.

"We have no choice but to ensure our aboriginal rights are respected and we're going to bring our concerns through the environmental assessment because they sure weren't being heard through a so-called consultation with the Department of Transportation," Enge said.

The Yellowknives Dene First Nation also had concerns, said Alan Ehrlich, the board's environmental impact assessment manager.

"The North Slave Metis Alliance and the Yellowknives Dene First Nation identified a number of concerns that they thought needed to be considered further," he said.

One of the board's first steps is to visit Whati on Aug. 18 to get input from residents. The board will also host a meeting in Yellowknife on Aug. 24, which Enge said he will be attending.

The assessment will not only look at impact on caribou and wildlife, but the impact on communities as well, Ehrlich said.

“Ready for a permanent road”

"One of the socio-economic and cultural impacts the Tlicho identified in its work on this proposal was a concern about changes in access to drugs and alcohol," he said. "The Mackenzie Valley Resource Management Act defines impact on the environment in a broad way that includes impacts on people, so things that affect the well-being of people will be considered as part of this environmental assessment."

Whati Chief Alfonz Nitsiza says he believes his community is ready for a permanent road.

"We are preparing ourselves if the road comes in," he said. "We still have work to do but we are not going to be caught off-guard."

The 94-kilometre road is expected to take about four years to construct, according to the DOT. It isn't known exactly when work could start.

Nitsiza said the road will have an immediate economic benefit to Whati. Residents have already begun training for possible jobs to construct the road.

"It's all preparation for the jobs that may be available," Nitsiza said.

Once finished, the road would bring down the cost of living and provide a more reliable route in and out of the community, Nitsiza said.

Whati is currently on the Tlicho winter road system, which is becoming unpredictable as winter temperatures warm.

"Right now we have to rely on ice road," Nitsiza said. "In the last few years, the road has been opening later and closing earlier, so that interrupts our winter road resupplies of fuel and goods for the stores."

It cost nearly $5,000 to construct one kilometre of the Tlicho winter road system in 2014 compared to $1,050 per kilometre in 2004, according to the DOT's Tlicho all-season road project description report.

The road is open an average for 77 days a year.

But in addition to its benefits, residents are also concerned about what else the road might bring into the community, particularly drugs and alcohol.

Nitsiza said the community has been preparing mitigation measures, such as having two permanent drug and alcohol counsellors in Whati.

He said he believes the advantages of the road will balance the costs.

"A lot of work has been done, I think overall the benefit is there," he said. "Certainly it would mean jobs for people and maybe potential businesses. Overall I think the benefits outweigh the impact."

The road is estimated to cost about $150 million, said Michael Conway, DOT regional superintendent for the North Slave Region.

The government has applied for funding through the federal P3 Canada Fund.

It's not yet known how much the project would be eligible to receive through the fund or when funding would be announced, Conway said.

"We're working closely with P3 Canada and we're optimistic," he said.

The Mackenzie Valley Environmental Review Board has 16 months to complete its assessment, but Ehrlich said he believes it will be finished before deadline.

"The board is legally required to be timely in its duties and it will run an efficient environmental assessment," he said. "I expect it will take less than the 16 months it's allowed to take."

Quest for federal Mackenzie Valley Highway money hits speed bump

N.W.T.'s deputy minister of transportation says funding review 'has basically been put on hold'

By Guy Quenneville, CBC News Posted: Sep 14, 2016 6:00 AM CT Last Updated: Sep 14, 2016 6:00 AM CT

After two years of lobbying, the N.W.T. government's effort to secure $700 million in federal funding for the Mackenzie Valley Highway has hit a speed bump.

On Monday, Russell Neudorf, the territory's deputy minister of transportation, told Yellowknife city councillors that Infrastructure Canada's review of the funding request "has basically been put on hold."

The setback was met Tuesday with disappointment from some regular MLAs, who appeared surprised at the news.

Kieron Testart
@KieronTestart
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First I've heard of this! Disappointing for the people of the #Sahtu & all Northerners @gq_in_yk @GNWT_DOT #nwtpoli twitter.com/gq_in_yk/statu…

3:42 PM - 13 Sep 2016

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@juliegreenMLA
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3:44 PM - 13 Sep 2016

The proposed highway would stretch from Wrigley all the way to the Dempster Highway, finally carving a complete transportation artery through the Northwest Territories.

But Neudorf said the Trudeau government is taking a fresh look at the project, which was originally pitched to the previous Harper government.

"Before they made their decision, the election came, so everything was put on hold," said Neudorf.

"We have had some discussions with the new Liberal government. But we hear the project has basically been put on hold while they do some more consultations and more definitions around federal infrastructure programs."

Oil and gas slowdown downgrading project?

Asked for further clarity on those "consultations and more definitions," Sonya Saunders, the director of planning, policy and communications for N.W.T.'s Department of Transportation, pointed to the federal government's "long-term infrastructure funding plan."

"The federal government is currently implementing Phase 1, which was announced in the federal Budget 2016," said Saunders.

"Phase 2" — which is expected to total $48 billion — will be announced in next year's federal budget, and it's hoped that budget contains money for the Mackenzie Valley Highway.

But other comments made by Neudorf Monday suggest a political downgrading of the project.

He said the territorial government has yet to assign "the appropriate resources" for the proposed highway's environmental assessment, which has been stalled since early 2015.

And when asked by councillor Linda Bussey which of the territorial government's many infrastructure projects ranks as the highest priority, Neudorf said they're all priorities, but added, "In the past, I think there's been a lot of political priority over the Mackenzie Valley Highway. It's got a strong community connection.

"But there was lots of oil and gas development there and that's dried up. I'm not sure when that's going to come back.

"There's certainly big discussions about what this government can do to help encourage the economy of the N.W.T. now. So I do see [the proposed corridor into the mineral-rich] Slave Geological Province as a bit more of a desire to move forward to be doing something in that regard."

The Slave Geological Province, where N.W.T.'s diamond mines operate, is currently accessed by air or winter road.

Whati road project most advanced

Neudorf also gave brief updates on the Inuvik to Tuktoyaktuk highway and the proposed all-weather road to Whati.

The $300-million highway to Tuktoyaktuk is still expected to open in the fall of 2017, after some summer 2017 construction work to finalize the grading and install the road's gravel surface.

Neudorf characterized the Whati road as the most "advanced" infrastructure project besides the Tuk highway. The territorial government submitted a public-private partnership (P3) proposal to P3 Canada six months ago.

Neudorf also appeared to express disappointment with one recent setback to the Whati project.

"We had been making lots of good progress on that and then, on July 27, we were referred to environmental assessment," he said.

He said the Wek'eezhii Land and Water Board thinks the assessment could take as little as six months, but called that timeline "pretty ambitious."

Still, he said his department is hopeful the assessment could wrap up by the end of this year or by early 2017.

"That might line up well with getting some funding from P3 Canada and our own government making a decision about support for this project," he said.

Roads aren't a good investment

The federal and territorial governments announced Jan. 11 their plan to spend tens of millions of taxpayer dollars on a 97-kilometre all-season road from Highway 3 outside of Yellowknife to Whati.

Ottawa will pay up to 25 per cent and the territorial government will pay an unknown amount until the details of the estimated $150 million public-private partnership are known.

GUEST Comment

Julie Green *is MLA for Yellowknife Centre*

I realize that Chief Alfonz Nitsiza and the Tlicho Government support this road and believe that it will do great things for the community but I think they have been sold a bill of goods.

First, significant economic activity related to the road will only come if and when Fortune Minerals develops its NICO deposit located 50 kilometres northwest of Whati.

One mining industry veteran described the mining project to me last week as "sub-economic" – meaning while its shares are trading at 14 cents each (on the afternoon of the announcement), the prospect of raising the $589 million required for development is dim.

Without the mine, the road is just another short-term make work project. The economic lift of road construction will be intense.

There will be dozens of jobs available over the four-year construction period. If Tlicho companies partner with a southern contractor to obtain the P3 contract, Tlicho residents may be the ones who get these jobs.

But after construction, only a handful of people will be required to provide ongoing maintenance. Government is perpetuating the boom and bust economy by building this road, and not investing in sustainability.

The GNWT's investment in this project is $6.7 million dollars this fiscal year and next to cover start up costs. What could that money buy instead?

For a start, it could buy at least dozen houses in a community that has one of the territories' highest numbers of houses that are overcrowded or in need of major repairs. Or it could buy The Tlicho Community Services Agency a reprieve on having to make cuts to schools in the region in order to help government pay for the implementation of junior kindergarten.

Or it could buy a greater investment in education at all grade levels to bring Whati's graduation rate up from 43 per cent to the territorial average of 73 per cent (2014 numbers). Or establish an Aurora College learning centre. Whati also needs a half-million dollar upgrade to its sewage lagoon.

The GNWT assures us that the road will reduce the cost of living in Whati.

Would investment in hydro-electric power generation have the same effect if NTPC customers didn't have to pay for diesel generation? About 10 years ago, there was a huge effort to develop a community-based plan for mini hydro on the La Martre River near Whati. This development would get the community off diesel forever.

And when people drive to Yellowknife regularly to shop, will the cost of the vehicles and gas be offset by the savings on goods they buy at the big box stores?

Shane Magee/NNSL photo

***Moise Nitsiza, left,** James Laboline, Jimmy Rabesca and George Mantla opened the Whati road funding announcement with drumming and prayer on Jan. 11.*

Chief Nitsiza recently told the committee of regular MLAs that the community expects challenges from the road as well as the benefits access will bring. I encourage him to talk to other small communities that have year-round road access to assess what those benefits are.

Fort Resolution is a community of the same size, and it's on a road. Its employment rate is 68 per cent while in Whati it's 61 per cent. Its average employment income is just $1,500 more than it is Whati (2014 numbers). The food price index, which compares communities to a Yellowknife baseline, shows that costs are only slightly higher in Whati than in Fort Resolution using 2015 numbers.

The evidence is clear: roads are not an efficient engine of economic growth in and of themselves. Look no further than the $300 million road from Inuvik to Tuk. Now that the Beaufort Sea is closed to exploration, the direct economic benefits of the road are limited to the construction period that is almost over.

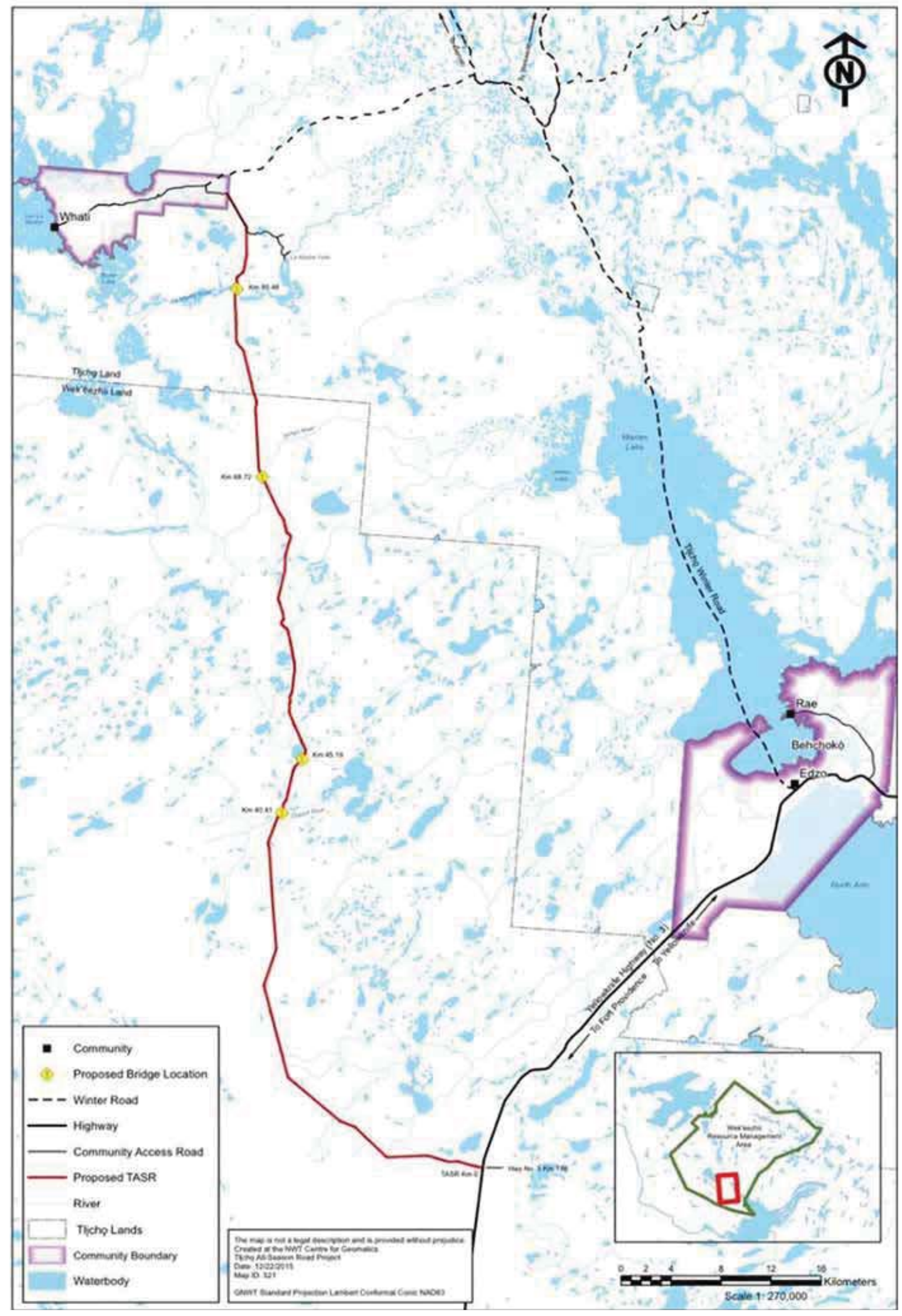
Today there's no reason to believe the road to Whati will be any more sustainable as an engine of economic growth. It's time to rethink our investments and choose projects that have better and longer-lasting returns for our people.

Given the choice, I will always spend money on people over roads.

News/North NWT, Monday, January 16, 2017

Feds commit to partly fund road to Whati

Link to community continuing through environmental assessment



map courtesy of the GNWT

The all-season road to Whati is proposed *to run 97 kilometres linking the community to Highway 3 south of Behchoko.*

by Shane Magee
Northern News Services
Whati/Lac La Martre

The federal government plans to cover 25 per cent of the cost to build an all-season road to Whati through a public-private partnership.

Whati has sought for three decades to replace a winter road typically only open three months per year with a road open to vehicles year-round.

The federal funds hinge on the project clearing an environmental assessment and inclusion in the territorial budget.

Federal, territorial and Tlicho leaders were in Whati on Jan. 11 to make the announcement at the Johnny Nitsiza Cultural Centre in front of three-dozen people, many recording the speeches on cell phones.

"This is infrastructure that will make a real difference in the life of Whati residents," Northwest Territories MP Michael McLeod said.

Tlicho Grand Chief Eddie Erasmus said the community will benefit from cheaper food, easier travel as well as opening up economic opportunities. He said the Tlicho and Whati Community Governments are preparing people to have the skills to work on building the road.

'Build and maintain'

"We have companies ready to build and maintain the road," he said. "We are ready to put our people to work."

A public-private partnership (or P3) means a company, or group of companies, will be selected through a competitive process as the proponent to finance and build the road. A 25-year maintenance contract is also expected to be awarded as an enticement to the private sector to put up the initial funding, which will be paid off over the long-term by the GNWT.

Premier Bob McLeod said there will likely be criteria used to select the bidder that could include requiring a certain number of local employees to work on the project and use of local contractors.

The cost of the two-lane gravel roadway has been pegged at $150 million. The premier wouldn't say last week if the figure is still accurate, citing the planned bidding process. The premier expects the territory will pay for the remaining 75 per cent of the cost.

Transportation Minister Wally Schumann said he'd like to see work begin next winter pending environmental approval and the bidding process, with construction over four years.

"In the P3 process, all the onus, all the risk, is put on the proponent so they're going to want to get that thing done as soon as possible," Schumann said.

The two-lane gravel all-season road would branch off Highway 3 between Fort Providence and Behchoko at kilometre marker 197. It would require building four new bridges and installing a large arched culvert to cross waterways along its 97-kilometre route.

The project was sent for environmental assessment by the Mackenzie Valley Environmental Impact Review Board in July to examine impacts that may result from changes to access to the community, on social services, caribou and uncertainty about mitigation measures. The GNWT hopes the review can be completed in June or July this year.

Not all MLAs have expressed support. Yellowknife Centre MLA Julie Green has repeatedly questioned the government's focus on highway spending and suggested money would be better used on housing and social programs.

"It's time to rethink our investments and choose projects that have better and longer-lasting returns for our people," Green stated in a guest column in this edition of *News/North*.

The premier said there needs to be a balanced approach.

"I think that each has its place and if we spend all of our money on social programs, we wouldn't have any infrastructure and vice versa. I think that it's a balance, it's fine art of budget making," Bob McLeod said.

Two surveys of residents have found about 80 per cent support the road, according a 2014 report by Alistair MacDonald for the Tlicho Government.

Marlene Wedawin, a career development officer with the Tlicho Government, sat at the back of the hall and called it an exciting development. Through her job she sees the limited employment opportunities in the community. She said they're trying to get people ready for road construction jobs.

Dry community

There could be "hundreds" of construction-related jobs over several years, with about 10 to 12 people hired for maintenance work, said deputy minister of Transportation Russell Neudorf.

Wedawin's excitement comes with hesitation.

"(I'm) kind of scared in terms of substance abuse for our young people," she said.

Whati is a dry community, meaning alcohol is prohibited. The ban hasn't kept alcohol sold by bootleggers out, though.

The social impacts of the road are part of the environmental assessment by the review board, which could put forward recommendations.

"The project proponents will have to respond, to deal with those recommendations," the premier said.

The Community Government of Whati wants to review the prohibition ban in favour of a more proactive strategy for managing alcohol and drug consumption, MacDonald's socio-economic study noted.

Alfred Flunkie, a member of the community government council for four years who works as a foreman, said there are older residents in the community who are concerned about more alcohol and drugs if the road is built.

Recreation opportunities

Some younger people, especially those with a lot of children, are hoping a road will come and bring down prices for things like food, he said.

He hopes it will increase recreation opportunities for youth.

"We would like to take those kids out (of Whati) for sports like volleyball and floor hockey," he said, adding a chartered round-trip flight on a Twin Otter to Yellowknife can cost about $5,000.

Early on, Doreen Nitsiza said she had a mixed view of road. But Nitsiza, the community's recreation co-ordinator, also said youth would benefit.

"It will be good to send kids out for sports. We hardly send kids out," she said.

Residents typically head out to other communities like Yellowknife when the winter road is open to buy enough heavy products such as cleaning supplies or sugar in bulk to last a year, Flunkie said. The road could change that. He also said boating to Behchoko in the summer is becoming harder because of lower water levels.

A mining project stands to benefit from the road. Fortune Minerals Ltd. plans to mine cobalt, gold bismuth and copper near the community.

The company already has an environmental assessment approval and mine construction permits. But it needs the road to help secure millions needed to finance construction of the mine.

"With cobalt and gold prices firming, and greater certainty of an all-season road, Fortune is well-positioned to secure the financing needed to begin construction of the NICO mine," David Massola, Fortune's vice-president of finance and chief financial officer, stated in a company news release.

The NICO mine, if built, is projected to operate for 21 years with a processing facility. Material would be shipped to Saskatchewan where Fortune plans to build a refinery.

Speeches in Whati by the premier and other politicians repeatedly pointed to the road helping boost mining potential for the region and the jobs that could follow.

Gary Vivian, president of the NWT and Nunavut Chamber of Mines welcomed the federal announcement in a news release.

Shane Magee/NNSL photo

Premier Bob McLeod arrives *in Whati on Jan. 11 for an announcement about a federal commitment to cover 25 per cent of the cost of an all-season road to the community*

Shane Magee/NNSL photo

NWT MP Michael McLeod *announced the federal government will fund 25 per cent of the cost to build an all-season road to Whati during a ceremony at the Johnny Nitsiza Cultural Centre in the community on Jan. 11.*

Cece floats some ideas on barging

Northern News Services

So the NTCL is no more!

What went wrong?

I remember when the government put up NTCL for sale. Both the Dene Nation and the Inuvialuit were bidding for the company.

NORTHERN Notes

Cece Hodgson-McCauley *is the founding chief of the Inuvik Dene band and will remain honorary chief for life. She can be reached at fax (867) 587-3003 or by phone (867) 587-3037*

I thought for sure the Dene along the Mackenzie River would win the bid because they were captains and deckhands for years.

But the Inuvialuit got the bid. We heard the Inuvialuit used to take the boats out on the Beaufort Sea. What went wrong anyway?

I think the only thing to do now is to approach Cooper Barging Services Ltd. They have been barging to Norman Wells for years and are very, very reliable. Cooper is a well respected company. At least the GNWT should ask them for their advice on what they would do.

Or make them an offer they cannot refuse! The government probably should put a few "guards" on the NTCL's property in Hay River. It is huge. And to be ready for thieves.

In the *News/North* there was a story about protecting elders, ("Breaking the silence, Jan. 16). We must thank women like Annie Gordon and her friends who are organized, speaking out, and teaching a program to help older adults protect the elders!

A program translated from the University of Western Ontario's senior (older adults and elders) abuse program into Gwich'in teaches older adults to get the information to their communities.

There should be a women's group in each town looking out for the elders. Shame on those abusing the elders.

You know, I have said this before. It may sound crazy to the white people: Oh, oh, mustn't say that. I mean people from the south, people who think everyone has a great life in the NWT. Half the population is aboriginal.

They are scattered in more than 30 or so little communities with the bare necessities. There is nowhere to go if you want advice on where to find information to better your life.

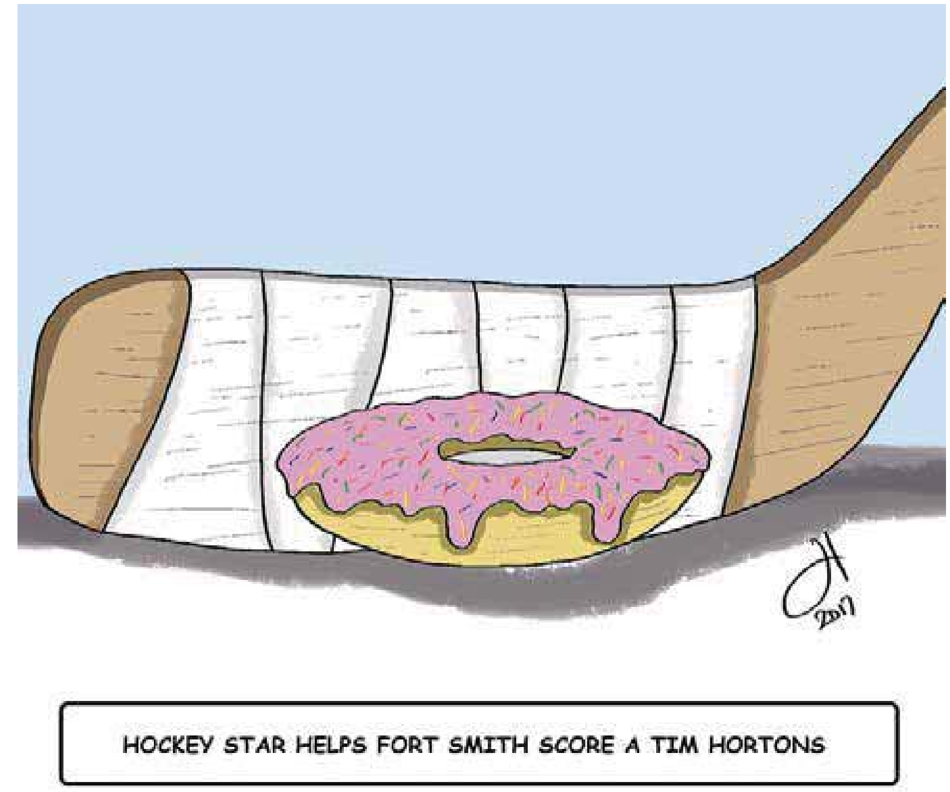
The majority of grassroots people have no clue of where or how to go about finding help. Sure, there are government offices scattered here and there. But the average grassroots people have no clue.

People in the small scattered towns in the NWT all need a place to call their own – an information center. A place to hang out with coffee and they can get information on everything: jobs; upgrading; education; information on trades; and info on anything and everything that will help people in the communities to improve their education and lifestyle.

Well, I see young people in the Sahtu are going to publish a book on heroes to celebrate some notable folks from the Sahtu region, ("Library of heroes," *News/North*, Jan. 16).

I hate to be negative but we are still in isolation after almost 60 years of government. What the young people should be expressing is, "What they would like the government to build and create on their behalf and what is their vision of the future?"

Young people must let the GNWT know what they want and need in the Sahtu. Let's hope things change for the better in 2017.



HOCKEY STAR HELPS FORT SMITH SCORE A TIM HORTONS

Lack of respect in Trudeau's green crusade

Northern News Services

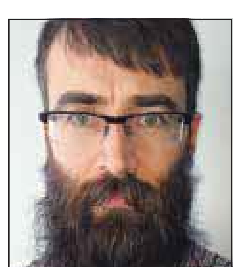
'Twas the week before Christmas, and Prime Minister Justin Trudeau and now-former U.S. President Barack Obama gave Nunavut Premier Peter Taptuna a surprise early Christmas present. Unfortunately, it was more a lump of coal than a stocking full of presents.

If our recent report was any indication, the surprise ban on oil and gas exploration in the Arctic Ocean put a damper on the holiday spirit for Nunavut's leader, who was himself a member of the first all-Inuit oil rig drilling crew, an ex-miner and director of the Nunavut Development Corporation. Over the years, he has proven to be pro-development.

On one hand, Taptuna is right to be annoyed. Nunavut's economic development options are already limited.

On the other hand, the ban is not really a surprise. The sentiment in southern Canada and the United States is that the Arctic Ocean needs to be protected.

But nowhere in the world are people more concerned about a potential oil spill in Arctic waters than right here in Nunavut. Memories of the 1989 Exxon Valdez tanker spill and the 2012 Kulluk rig's near-disastrous grounding – both in Alaska – show the dangers of such industry but also how little we know about the risks.



CASEY Lessard

Casey Lessard *is editor of Nunavut News/North*

In 2014, the US National Research Council said there are many concerns that need to be addressed, including the lack of research into how a spill might look, a lack of up-to-date nautical charts, insufficient presence of first responders (such as the Coast Guard), and no plan for how to rescue and treat bowhead whales, polar bears, or other victims of a spill.

These things are not a surprise. The surprise is Trudeau's inability or lack of desire to read the lay of the land. Minus Hunter Tootoo as his minister of Fisheries and Oceans – someone with Nunavut's interests in mind – Trudeau ignored the history of colonialism and took another option off the table.

Perhaps he has mistaken Clyde River's objection to seismic testing as a rejection of oil and gas development. This is not what former mayor Jerry Natanine has told us repeatedly. He has said the hamlet supports development but development done right.

The hamlet's objection is the lack of consultation with indigenous groups, and considering the fact that the Supreme Court is deliberating on this exact issue, Trudeau's similar lack of consultation on banning development in the Arctic comes at an odd time.

That is, unless one considers the fact that Obama is on his way out and such a deal would never come to pass with President Donald Trump.

It's unlikely Nunavut would have seen any oil drilling in the next five years anyway, considering how even big oil is loathe to support Arctic drilling lately. Knowing this, Trudeau's siding with Obama is a smoke-and-mirrors trick that enhances his green credentials while cloaking the same old colonial attitude carried by governments past.

The choice to develop or not develop in Inuit lands and waters should be made by Inuit. At the very least Nunavummiut should be consulted.

The lack of respect shown by the prime minister will leave Nunavummiut wondering whether they can trust any federal promises to improve the situation on the ground here.

Same old, same old?

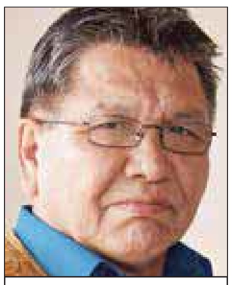
Whati all-season road creates opportunities

In her recent Guest comment ("Roads aren't a good investment," *News/North*, Jan. 16,) Yellowknife Centre MLA Julie Green questioned whether the all-season road to Whati is what our community needs and whether it is a good investment for our people.

The Tlicho people negotiated a land claims and self-government agreement to attain self-reliance and independence. That agreement means that we are able to chart our way forward for ourselves and our communities.

For 250 years we were told to be on a path that did not recognize our own governance, where others told us how to live and did not recognize our relationship with the land. That time has passed. The Tlicho agreement recognizes that Tlicho people are in the best position to make decisions on what will bring about the best future for our people and communities.

The community of Whati has been working with the GNWT for close to 30 years to advance the construction of an all-season road to our community. An all-season road is a solution that will help advance our people on the journey to self-reliance and independence.



GUEST Comment

Alfonz Nitsiza *is chief of Whati community*

We are considering all of the issues of the all-season road, based on in-depth research, technical review, and consultation. There is a full public environmental assessment of the all-season road occurring to which the Tlicho Government will act as a party and a decision maker.

MLA Green's comments raised a number of issues about social conditions in our communities. We are well aware of these issues. We live with them every day.

Current limitations to building more housing units in Whati include the lack of available skilled labour and trades, the high costs of bringing in trades and building materials, and the seasonality of accessing building materials. The all-season road would help address these limitations.

Recent statistics released by the federal government show a wide gap in employment rates between indigenous and non-indigenous people in the NWT. We do not seek to continue a scenario where government continues providing social services to our people in isolated communities through subsidies for housing, food and utilities.

All-season road access to Whati creates an opportunity for our youth to have employment in their communities by supporting the development of local businesses that wouldn't be possible in fly-only communities.

Jobs will be created on the construction and maintenance of the road, our people will be trained for new opportunities. We still have hundreds of people flying into the NWT from the south every day to work at mines; if our people are trained and have the skills to succeed they can be put to work.

There are many benefits from an all-season road including jobs, economic development, and a reduced cost of living. The cost of freight into Whati is 90 cents per pound. This means 200 pounds of freight costs $180. Providing our community members with the ability to travel year-round by vehicle is a benefit that cannot be understated. The all-season road is a means of connecting the community of Whati to cheaper goods and services that many residents of the NWT have had for years and take for granted.

Roads themselves will not make money, any more than building houses themselves will make money. However, having a network of roads to connect communities, reduces the cost of living and having the infrastructure to facilitate resource development creates an opportunity for revenue, jobs, careers, and self-sufficient lifestyles. Certainly, without roads, economic development and growth stagnate.

Simply put – investing in the road is investing in our people.

We recently met with Yellowknife MLA Green in Behchoko, though she remained silent with us on this issue until she returned to her computer. Rather than telling us what our community needs, we invite MLA Green to our community to meet with our leadership, youth and community to understand the desire for the all-season road and the many opportunities it will bring.

Bumpy road to Whati

Fortune Minerals and Chamber of Mines fire back in response to 'condescending' remarks by MLA Julie Green

Shane Magee/NNSL photo

***A road in the community of Whati**, photographed on the day federal funding was announced for an all-season road through the Tlicho region. Yellowknife Centre MLA Julie Green's comments in* News/North *(Jan. 16, "Roads aren't a good investment"), sparked responses from proponents of the project.*

by Jessica Davey-Quantick
Northern News Services
Whati/Lac la Marte

Fortune Minerals Ltd., and the NWT and Nunavut Chamber of Mines are defending the planned road to Whati after Yellowknife Centre MLA Julie Green questioned the government's investment.

In a guest column published last week in *News/North*, Green questioned if the $150-million project was the right place for the territorial and federal governments to be spending in the North.

"It's time to rethink our investments and choose projects that have better and longer-lasting returns for our people," she wrote. "Given the choice, I will always spend money on people over roads."

Tom Hoefer, executive director of the NWT and Nunavut Chamber of Mines, and Robin Goad, president of Fortune Minerals Ltd., aren't having it. On Jan. 19 they sent a joint letter to all MLAs addressing their concerns with Green's statement.

***JULIE GREEN:** Yellowknife MLA says road money could be better spent.*

"It's a little bit disappointing when the government's already committed to it in their mandate, so they've already wrestled with it, and Julie's been part of that discussion in the legislature. So to come out now and say that she doesn't believe it's the right choice is kind of sour grapes," said Hoefer in an interview with *News/North*.

The federal government plans to cover 25 per cent of the cost to build the all-season road to Whati, with the territory expected to pick up the rest of the tab. The two-lane gravel roadway span 97 kilometres, branching off Highway 3 between Fort Providence and Behchoko at kilometre marker 197 and requiring four new bridges to be built, as well as the installation of a large arched culvert to cross waterways.

Cheaper food, easier travel and jobs

Tlicho Grand Chief Eddie Erasmus said the community will benefit from cheaper food, easier travel and jobs thanks to the road on Jan. 11 when federal, territorial and Tlicho leaders gathered in Whati to announce the plan.

Fortune Minerals Ltd., also stands to benefit. The company plans to mine cobalt, gold bismuth and copper in the area at the NICO mine.

"The road was a critical enabler for our project. Without the road there's basically nothing more we can do," said Goad, adding that the company has already spent $116 million on the project.

"Governments need to invest in basic infrastructure ... One of the critical aspects that's impacting future investment in the northwest territories is something we collectively refer to as the infrastructure deficit, where much higher costs are incurred by the mining industry in the North because of the lack of basic public infrastructure."

He added the high cost of doing business in the North "sterilizes a lot of important discoveries."

Goad describes the joint letter issued on Jan 19 as a "rebuttal" to Julie Green, focused on the community, economic and industrial benefits of the road in bright red type, inserted into her original column.

"Ms. Green's statement that the Tlicho have been, 'sold a bill of goods,' is condescending and implies the Tlicho don't understand the importance of socio-economic connectivity to the public highway system, or the economics of roads, power development, and resources, or the benefits they bring," the letter states.

***TLICHO GRAND CHIEF EDDIE ERASMUS:** Road will benefit community.*

Chief Alfonz Nitsiza also fired back, with a guest column in this edition of *News/North*.

"Simply put – investing in the road is investing in our people," he wrote.

NICO isn't the only industrial project that will potentially benefit from the road.

"That whole part of the territories has got some really good mineral potentials, so in the long run it'll help open that up to more development, which we need," said Hoefer.

Describing it as foremost a community road, Goad doesn't see a problem with territorial and federal funding going to a project that will directly benefit individual businesses.

"Much of the existing infrastructure in the NWT was either funded partially or entirely by the mining industry, including the road to Yellowknife, its airport, and most of the power dams and distribution. This provides a critical legacy for public benefit long after the minerals of economic interest have been extracted and is the basis for private-public partnerships," he wrote in the letter he co-authored.

Green doesn't agree.

"Without the mine, the road is just another short-term make work project. The economic lift of road construction will be intense. There will be dozens of jobs available over the four-year construction period," she wrote in her column.

'Not investing in sustainability'

"If Tlicho companies partner with a southern contractor to obtain the P3 contract, Tlicho residents may be the ones who get these jobs. But after construction, only a handful of people will be required to provide ongoing maintenance

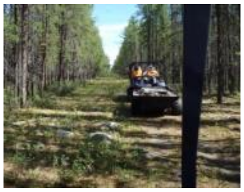
"Government is perpetuating the boom and bust economy by building this road, and not investing in sustainability."

She points to the road from Inuvik to Tuktoyaktuk in her column, writing that since the Beaufort Sea closed for exploration, the direct economic benefits of the road are limited to the construction period, which is almost completed.

"The evidence is clear: roads are not an efficient engine of economic growth in and of themselves," she wrote.

Transportation Minister Wally Schumann said he'd like to see work begin next winter, pending environmental approval and the bidding process, with construction over the next four years. Neither Goad nor Hoefer are concerned that Green might have thrown a wrench in that timeline.

"We believe that Julie Green has little or no support in the legislative assembly," said Goad.

This newsletter, by the GNWT Department of Transportation and the Tłı̨chǫ Government, is one in a series about the proposed Tłı̨chǫ All-season Road (TASR). It is meant to provide Tłı̨chǫ community members with information about the project. Each newsletter focuses on a different topic and highlights the various processes that will limit environmental and social impacts to the surrounding area from the construction of the road.

Project Referred to Environmental Assessment (EA)

Tasks Completed to Date

- July 21: Mackenzie Valley Environmental Impact Review Board (Review Board) referred the TASR project to Environmental Assessment (EA) based on possible biophysical and social impacts.

  Key areas of concern:
    - Changes to access – new all-season access to the community of Whatì
    - Impacts on existing social services
    - Impacts on caribou
    - Uncertainty regarding the effectiveness of mitigation measures
- Aug 18: Review Board held community scoping session in Whatì to document community's thoughts.
- Aug 24: Review Board hosted technical scoping session in Yellowknife.
- Sept 23: Review Board released a draft Terms of Reference (dToR) and Adequacy Statement (dAS) for public review. Documents were created based on a review of all the material currently available.
- October: Public, including Tłı̨chǫ Government, and GNWT submitted comments on dToR and dAS. Review Board then met to discuss submitted material.
- Oct 28: Review Board published final Terms of Reference, Adequacy Statement, Reasons for Decision, Information Requests to AGOs, comment and response table for dToR and dAS, and draft Work Plan.

Next Steps

The Aboriginal governments and organizations (AGOs) that were issued Information Requests by the Review Board have until December 21, 2016 to submit their material. The Developer (GNWT) will then produce a report (Adequacy Statement Response) that addresses the topics in the final Terms of Reference and Adequacy Statement and incorporates the additional material provided by the AGOs. The GNWT projects the report will be ready for submission by the end of March 2017. This process will enhance the understanding of the project and will ensure that the EA can produce useful mitigation measures that protect the environment and limit negative social impacts.

An estimated timeline for the remaining EA process was released by the Review Board in its draft Work Plan. Anticipated next steps include information requests and responses from the Developer; a technical session in Behchokǫ̀; and subsequent public hearings, if required. The Review Board will then analyze all material provided during the EA process and will release a Report of Environmental Assessment and Reasons for Decision outlining their recommendation on the proposed project.

The GNWT is hopeful that the entire process could be completed by June or July 2017. Information on the EA can be found at www.reviewboard.ca.

Public Private Partnerships (P3s)

Department of Transportation

January, 2017

Government of
Northwest Territories

GNWT P3 Policy & Framework

1. Total threshold exceeds $50M
2. Risk sharing
3. Agreement extends beyond construction
4. Clear benefit

What is a P3?

- When government (GNWT) joins with private sector (company) in a business relationship to achieve a shared goal that benefits both.

Risk
- Financing
- Construct
- Timelines

Entire project lifecycle
- Design
- Planning
- Build
- Maintain

Long-term contract
- 25-30 years
- Over entire project lifecycle

Long Term Investment

- A P3 can be compared to building and financing a house
- 25 year ‘mortgage’
- Good design + good construction (more $ capital upfront) = less maintenance costs long-term
- Company has incentive to keep the highway in good condition over the entire project lifespan
- Penalties for not meeting high standards – not on time or up to standard, company does not get full payment

P3 Roles - Summary

-Define P3 scope and objectives

-Selects operator, awards contract

-Pays for service

-Owns the infrastructure (TASR)

Private Sector

-Design and Build infrastructure

-Finance project

-Operate/maintain infrastructure

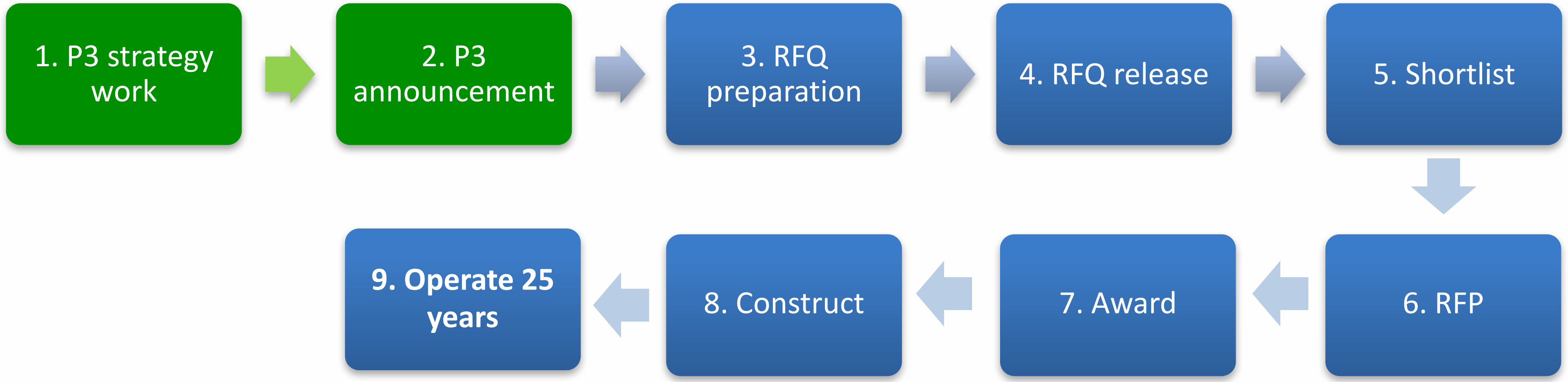
-Provides service on behalf of GNWT

How can local communities benefit from P3s?

- Help generate local jobs
- Opportunities for local businesses
- Opportunities for training
- Subcontracts with local trades and business

  e.g. food preparation, surveying, camp supplies
- On-going employment throughout project lifespan (20+ years)

Timeline



- GNWT will ensure local involvement is **mandatory requirement** to **maximize local business** and resident participation during construction and operations phases of the project.

Work to do

- Complete Environmental Assessment
- Competitive, fair, transparent process
- P3 Canada to review/comment on RFQ/RFP process
- Must reach interim land access agreement with Tłı̨chǫ Government
- Complete geotechnical work, cost estimate updates

Questions?

Mr. Nakimayak
Mr. O'Reilly
Mr. Testart
Hon. Wally Schumann
Hon. Louis Sebert
Mr. Simpson
Mr. Thompson
Mr. Vanthuyne

Prayer

Ministers' Statements

Minister's Statement 118-18(2): Tlicho All-Season Road

HON. WALLY SCHUMANN:

Mr. Speaker, early in the new year, an important milestone was achieved with the announcement of conditional federal funding to construct the Tlicho all-season road. This represents a critical step towards fulfilling the mandate of the 18th Legislative Assembly to capture opportunities for investment in transportation infrastructure in the Northwest Territories.

This milestone was achieved through the strength of our partnership with Canada and the Tlicho Government. Together, we recognize the importance of strategic infrastructure investments for improving the standard of living in remote northern communities.

With the construction of the Tlicho all-season road, many of the opportunities that those of us living in connected communities take for granted will become available to the residents of Whati. The project will help build economic stability across the region and contribute to sustainable and self-sufficient communities.

Mr. Speaker, transportation affects the cost of every component of household expenditure, meaning that any improvements to the transportation system help reduce the cost of living. An all-season connection to Whati will eliminate the community's dependence on the existing winter road, which is increasingly challenged by the impacts of climate change. Replacing the southern section of the winter road will also increase the window of access to Gameti and Wekweeti, improving the resiliency and reliability of the transportation system for all Tlicho communities.

All-season access results in efficiencies, including lower travel time and shipping costs, which will translate into savings for consumers. Reducing the cost of freight helps to improve the standard of life in communities by making it more affordable to deliver a diverse range of essential goods from food and fuel to building materials for local houses and construction projects. Lowering operating costs for local businesses will allow them to be more competitive in territorial markets. In addition, the road will connect Tlicho residents to a larger selection of services such as education and healthcare, which may become more affordable with improved access.

The project will also contribute to new employment opportunities for residents in a variety of sectors. Job creation helps support the self-sufficiency of all Northerners by providing the resources necessary to access the amenities we need.

Construction of the Tlicho all-season road will result in significant employment and allow Northerners to benefit from the kind of training and experience that forges life-long skills. Through the development of a strong northern workforce, residents will also be better positioned to take advantage of future economic opportunities when they arise.

All-season access will also support key industries operating in the Tlicho region. Improved access will likely attract increased numbers of tourists interested in exploring this culturally unique region of our territory. Lands for recreational and cultural purposes will become more readily accessible, creating opportunities for businesses interested in promoting the natural beauty of the region.

Year-round access will also result in further interest from industry to develop and explore for natural resources in the area. Enabling such development is critical, not only because the resource industry remains the top contributor to territorial GDP, but also because it is responsible for providing a significant amount of employment, education, and training opportunities in the NWT. By increasing access into the Tlicho region, there is the potential to continue resource development and consequently provide jobs and training to residents for generations.

Improved transportation infrastructure gives people the tools to live strong, healthy, and successful lives. The Tlicho all-season road will contribute to vibrant communities and help capture opportunities that support economic prosperity in the NWT.

The Department of Transportation will continue to work closely with the Tlicho Government to advance the project through the environmental assessment and construction phases.

Finally, the Department of Transportation continues to work with the Department of Finance on preparing project procurement. The departments anticipate the release of a request for qualifications in the very near future, which will position us for the development of a request for proposals pending a decision on the environmental assessment for the project. We look forward to hearing from the bidders request for proposals pending a decision on the environmental assessment for the project. We look forward to hearing from the bidders and working together on a successful plan for construction at that time. Thank you, Mr. Speaker.

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MR. SPEAKER:

Masi. Ministers' statements. Minister responsible for the Northwest Territories Housing Corporation.

back to top

Minister's Statement 119-18(2): Milestone Statement – Housing Strategies

HON. CAROLINE COCHRANE:

Thank you, Mr. Speaker. Mr. Speaker, in order to address the priorities of the 18th Legislative Assembly, the Northwest Territories Housing Corporation has made the commitment to work in partnership with other orders of government to address affordable housing requirements in support of their service delivery to Northwest Territories' residents.

The Northwest Territories Housing Corporation is addressing this priority through its mandate commitment to develop northern solutions for northern housing as part of its strategic plan, Building for the Future. Today, I want to provide Members with an update on this collaborative work.

There has also been strong collaboration with the other two northern territories around our common goal of increased federal engagement. Given our unique economic and geographical conditions, Canada's three territories face greater challenges and levels of housing needs than our country's southern jurisdictions. To that end, the Yukon, Nunavut, and the Northwest Territories worked together to develop a pan-territorial business case outlining the key housing priorities that we all share.

The increased support for northern housing in the 2016 federal budget is a product of that work: $100 million for the North, and specifically over $35 million for the Northwest Territories; $15 million of the Northwest Territories' allocation is going directly to the Inuvialuit Regional Corporation to address housing issues in the Inuvialuit Settlement Region. The Northwest Territories Housing Corporation is working on an agreement with the Inuvialuit Regional Corporation to coordinate the delivery of housing programs with this money. Discussions have been productive, and I am looking forward to a productive partnership.

Supporting the housing aspirations of Aboriginal and local governments is one of our commitments to support safe and affordable housing. The Northwest Territories Housing Corporation has also been working with the K'atlodeeche First Nation to support the development of social housing on the Hay River Reserve.

This work has led to the completion of the land designation process for ten lots, which will allow for federal leases on reserve land. It is anticipated the Public Housing Program will be delivered on these lots. The parties are working to complete the land designation process for six more lots.

I have also been approached by the Akaitcho First Nations, the Hamlet of Aklavik, the Salt River First Nations, and the K'asho Got'ine of Fort Good Hope about partnering in housing projects, which demonstrates the commitment of community governments to working in partnership to meet the needs of their community members.

Additionally, my territorial colleagues and I successfully obtained a commitment from the federal government to include addressing northern housing issues as a major pillar in the national housing strategy that is under development. Work has now been initiated with our federal, provincial, and territorial counterparts to translate these broad goals, priorities, and outcomes into a multilateral agreement that will lead to greater federal involvement in northern housing.

Mr. Speaker, good progress has been made in achieving these milestones. I expect that, in the near future, we will be close to delivering on most of the areas related to our mandate commitments. This will be perfect timing, as the results of our housing engagement survey will help to inform us on the future direction of housing. Thank you, Mr. Speaker.

back to top

MR. SPEAKER:

Masi. Ministers' statements. Minister of Industry, Tourism and Investment.

back to top

Minister's Statement 120-18(2): Developing NWT Agriculture

HON. WALLY SCHUMANN:

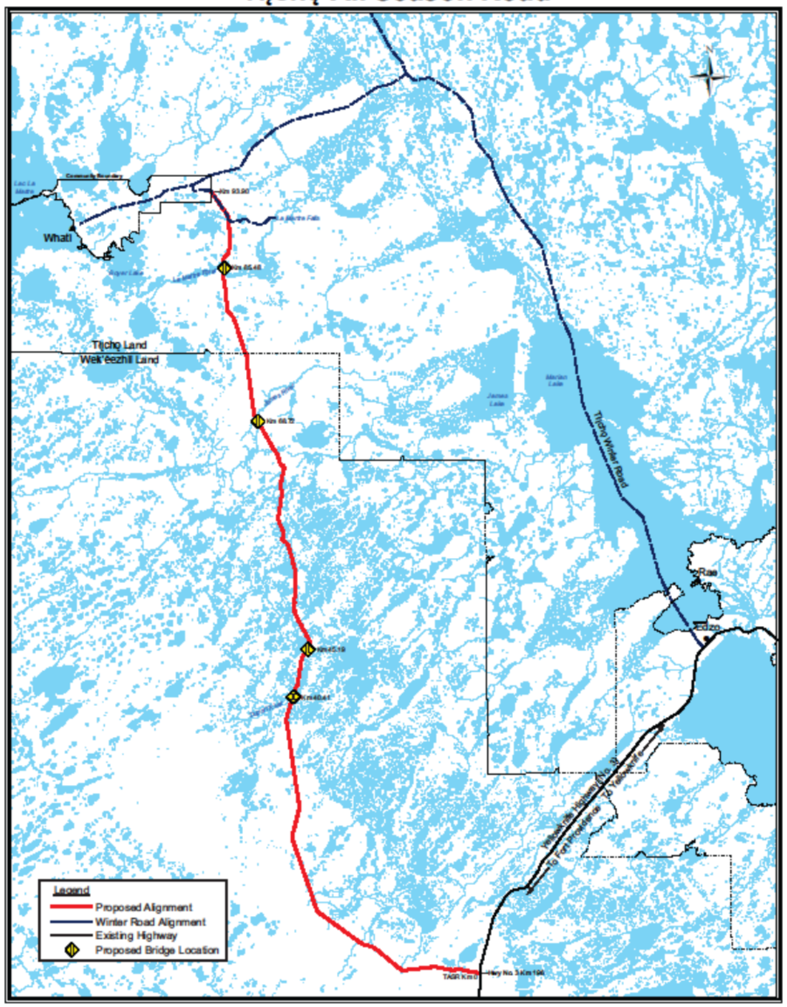
Mr. Speaker, residents of the NWT have told us they want to advance food production in their regions and communities. With the support of federal government and the Government of the Northwest Territories funding, community-based gardens, greenhouses, farmer's markets, and other food-related businesses and associations are flourishing across the NWT.

Tłı̨chǫ All-Season Road Project
Behchokǫ Economic Development

March 9, 2017

Government of
Northwest Territories

Tłįchǫ All Season Road



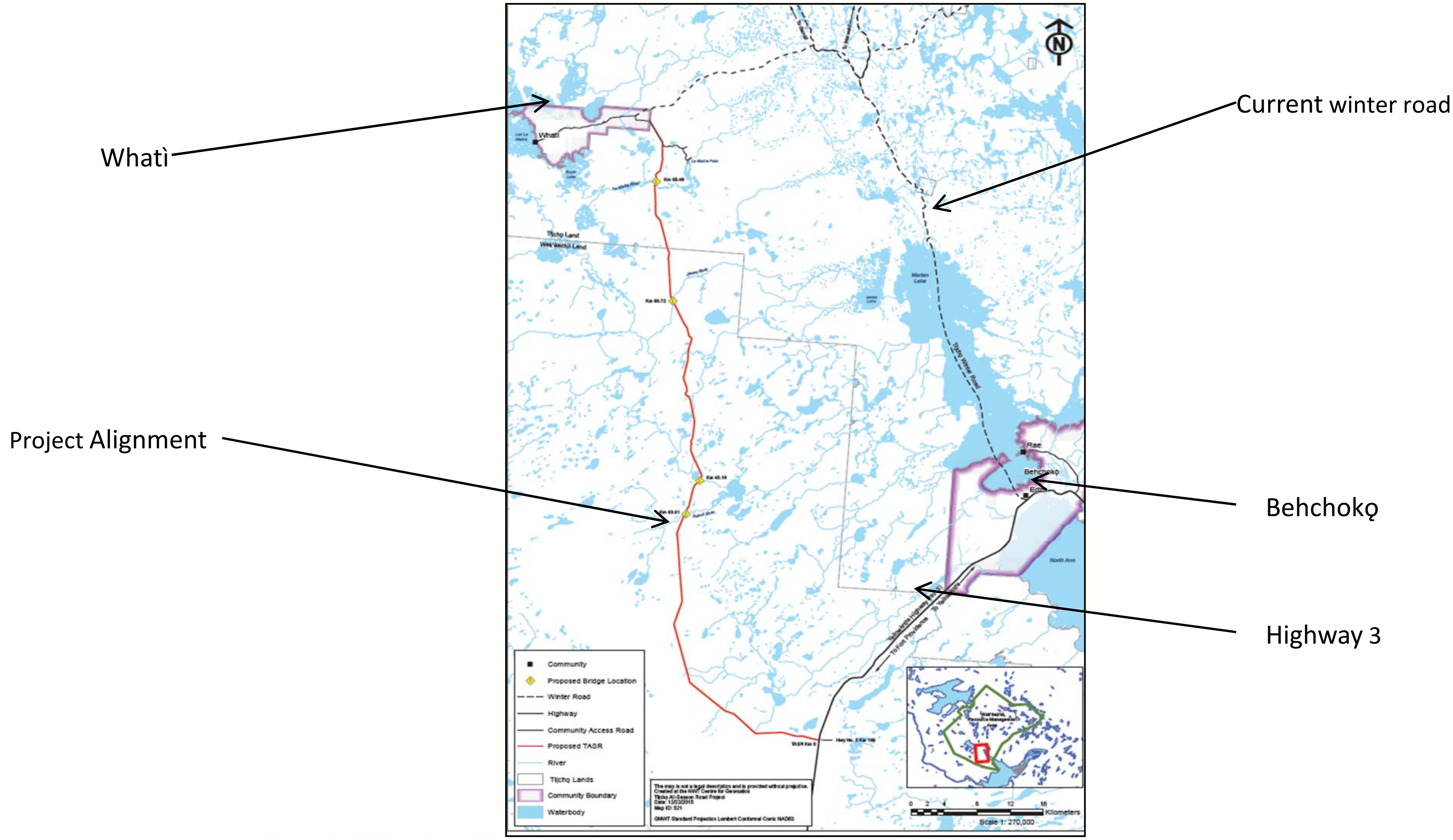
Project History

- GNWT and Tłįchǫ Government (TG) partnership (Working Group)
- Tłįchǫ considering road since 1980s
- Project Description Report (PDR) work began in 2012
- TG Studies: traditional knowledge, socioeconomic feasibility, consultations
- DOT Studies: environmental baseline and engineering

Project Description - Background

- Tłı̨chǫ
  - Approximately 3,000 residents
  - comprises communities of Behchokǫ̀, Gamètì, Wekweètì, Whatì
- DOT currently operates and maintains the winter road system in the Tłı̨chǫ, approximately 480km in length
  - Open for 78 days a year on average for Whatì, or 21% of year
  - Only Behchokǫ̀ has year round access to Yellowknife
- Lack of access impacts upon
  - Quality of life in communities
  - Economic development
- Situation is being compounded by climate change – winter road seasons becoming more variable and more difficult to construct and maintain

Route Alignment and Geographic Context



Design - Summary

- Design Criteria Produced
- RLU (low volume road 8.5 meters wide)
- Design speed 80 km/h. (Posted 70 km/h)
- Length 97 km. Width 8.5 meters
- Embankment height 1.5 meters average
- 4 Bridges ranging in length from 24m – 100m
- Require:
  - Geotechnical Information
  - Thermal Analysis
  - Refinement of Design

What is a P3?

- When government (GNWT) joins with private sector (company) in a business relationship to achieve a shared goal that benefits both.

Risk
- Financing
- Construct
- Timelines

Entire project lifecycle
- Design
- Planning
- Build
- Maintain

Long-term contract
- 25-30 years
- Over entire project lifecycle

Long Term Investment

- A P3 can be compared to building and financing a house
- 25 year 'mortgage'
- Good design + good construction = less maintenance costs long-term
- Company has incentive to keep the highway in good condition over the entire project lifespan
- Penalties for not meeting high standards – not on time or up to standard, company does not get full payment

P3 Roles - Summary

-Define PPP scope and objectives

-Selects operator, awards contract

-Pays for service

-Owns the infrastructure (TASR)

Private Sector

-Design and Build infrastructure

-Finance project

-Operate/maintain infrastructure

-Provides service on behalf of GNWT

How can local communities benefit from P3s?

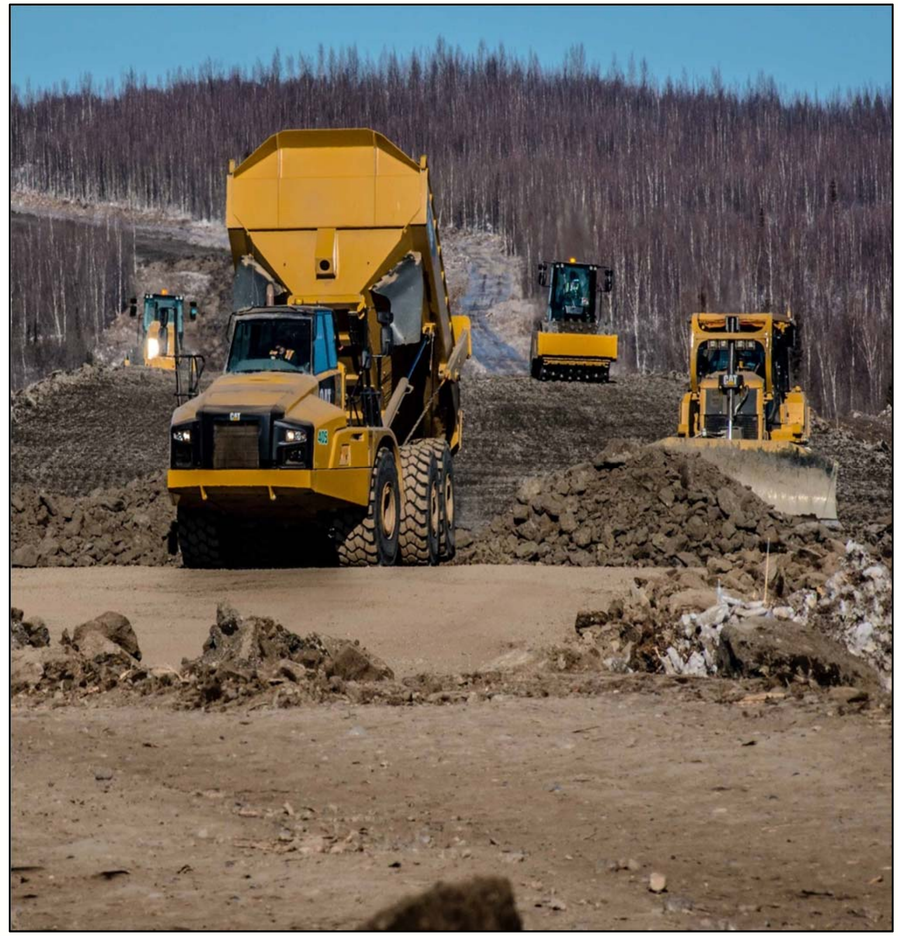
- Help generate local jobs
- Opportunities for local businesses
- Opportunities for local expertise and skills
- Subcontracts with local trades and business

What type of services will be required?

- Heavy Equipment Operators
- General labour
- Catering
- Wildlife monitoring
- Water delivery
- Sewage & other waste services
- Expediting
- Surveying
- Commercial and/or charter flights
- Helicopter Charters
- Medical services (including medics)
- Environmental Monitoring

What type of services will be required?

- Bussing or other local transportation
- Drill Blasting
- Bridge construction
- Accommodations
- Design
- Engineering
- Geotechnical Analysis
- Transportation (trucking)
- Material sampling and analysis
- Snow removal
- Brushing & clearing
- Mechanical repair and maintenance
- Welding
- Highway Maintenance



What types of goods/equipment will be required?

- Vehicles
- ATVs and/or snowmobiles
- Light equipment
- Heavy equipment
- Safety equipment and supplies
- Lumber, stakes, other construction supplies and materials
- Signage
- Culverts, geotextile, guardrails
- Fuel, oils, lubricants
- Small electronics (phones, radios, etc.)
- Erosion control products (Geotextile, silt fence, etc.)
- Building materials
- Food

Employment Opportunities

- Truck Drivers
- Heavy equipment operators
- Environmental monitors
- Cooks, Chefs, Cooking Assistants
- Welders
- Administration Managers
- Safety Officers
- Communication Personal
- Highway Design Engineers
- Surveyors
- Estimators
- Environmental Analysts
- Drillers & Blasters
- Crusher Operators
- Custodial & Housekeeping
- Engineering Technologies
- Project Managers & Officers
- General Laboures
- Medical Workers

Current Project Status

1. RFQ Release → 2. Industry Day → 3. Shortlist → 4. RFP → 5. Road Construction

- Request for Proposal release date scheduled for mid March 2017
- GNWT will ensure local involvement is mandatory requirement to maximize local business and resident participation during construction and operations phases of the project.

Industry Day

- GWNT will be hosting an Industry Day in late March 2017 in Yellowknife
- An time for businesses to discuss opportunities with interested RFQ bidders
- A chance for all businesses to get more information on the project

Questions?

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APPENDIX F

GNWT Commitments

Most mitigation is outlined within the ASR effects pathway tables. Table F-1 lists additional mitigation not already mentioned in the ASR pathway tables. All mitigation described in the ASR and Table F-1 will be implemented by the GNWT, unless otherwise indicated.

Table F-1: GNWT Commitments to Mitigate Environmental Effects Relevant to the TASR

Document Source	Subject	Discipline	Commitment
Section 4.7 PDR	Equipment	Fish	All materials stored within the ROW will be located a minimum of 30 m from the ordinary high water mark of all adjacent waterbodies and well outside of the tree line to avoid damage to riparian habitat
ORS Comments Table Row 76	In-Field Water Analysis Plan	Fish	Water quality grab samples upstream and downstream of the four major water crossings can be added to the In-Field Water Analysis Plan to demonstrate best water quality management practices.
ORS Comments Table Row 89	ECCC #1 - Monitoring Plan In-Field Water Analysis	Fish	The plan will be updated to include grab samples of TSS at select sites/time periods over the course of construction to ensure turbidity testing remains comparable
ORS Comment Table Row 91	ECCC #2 - Baseline Data In-Field Water Analysis	Fish	Baseline data will be collected upstream of the construction activity at the same time as the downstream samples to provide surety of any difference in turbidity levels
ORS Comment Table Row 95	ECCC#4 -Turbidity sampling	Fish	The In-Field Analysis Plan can be updated to indicate the management actions that would be implemented depending on the difference between the upstream and downstream turbidity levels (including immediate response triggers such as more frequent monitoring and assessment of mitigation measure)
ORS Comment Table Row 103	ECCC#8 - Surface Water Management	Fish	The Quarry Operations Plan will follow Lands' Guidelines. Should pit drainage be planned, appropriate management techniques will be utilized. This includes designing and constructing the quarry to drain naturally without ponding or the requirement for pumping, ensuring water exists naturally through diffuse flow back into the natural environment with the avoidance of distinct run-off channels and ensuring buffer zones of undisturbed land and vegetation for water to flow exists.
ORS Comment Table Row 107	ECCC#10 - Sampling and Testing for ML/ARD	Fish	A consultant will be hired to analyze laboratory results and will indicate what parameters should be analyzed prior to sending samples to the laboratory during in-field geotechnical investigations
ORS Comments Table Row 89	ECCC #1 - Monitoring Plan In-Field Water Analysis	Fish	The In-Field Water Analysis Plan will be updated to include an appendix with the locations of the watercourse crossings and associated station numbers to be set up at the commencement of construction.
ORS Comment Table Row 97	ECCC#5 -Turbidity Regression Curve	Fish	The In-Field Water Analysis Plan will be updated to include one set of confirmatory TSS (during construction around immediate water crossing) to identify the ballpark relationship of TSS and turbidity at each site

Table F-1: GNWT Commitments to Mitigate Environmental Effects Relevant to the TASR (cont'd)

Document Source	Subject	Discipline	Commitment
ORS Comment Table Row 99	ECCC#6 - Erosion and Sediment Control Plans	Fish	DOT will be using the DOT ESC Manual as guidance in the development of an ESC plan, including monitoring, reporting and adaptive management. These plans will be finalized by the contractor ensuring the contractor is fully aware and capable of the requirements in that plan, while DOT provides oversight while remaining accountable
ORS Comment Table Row 93 & 94	ECCC #3 - Mitigation Measures for Water Quality	Fish	■ Ammonia management best practices will be implemented during use, storage, transport, and loading of ammonia explosives to mitigate impacts on water quality should AN explosives be selected by the contractor for blasting operations. ■ Should concrete be required (and cannot be precast), un-cured/partly cured concrete will be isolated from watercourses.. ■ Areas for cleaning equipment (including equipment used in concrete work) will be a minimum 30 m away (and 100 m where possible) from watercourses and will not drain into or toward watercourses In instances where fuel storage does not already incorporate 110% containment (such as drums and jerry cans vs. the larger double-walled storage tanks), containment pads will be provided for all fuel storage, dispensing and transfer sites
Section 7.1.2 PDR	Traditional Knowledge Study	Socio-Ec	Verify that the cabin sites near the Project footprint are at least 50 m away. May need to double check coordinate locations with TG prior to construction and ensure that the two cabins that will be rebuilt (burnt as a result of 2014 fire) are far enough away.
Section 5.1.2 PDR	Concerns and Mitigation	Socio-Ec	Maintain safe access to T'oohdeèhoteè, an important portage site at the La Martre River
Section 5.1.2 PDR	Concerns and Mitigation	Socio-Ec	■ Install roadside pullouts and/or snowmobile crossing signs along the TASR in areas identified as a concern. ■ During final design phase, consideration will be taken to ensure a safe snowmobile crossing is established near bridge near km 45.2. ■ Make sure other important crossings have suitable and safe crossings for snowmobiles
ORS Comments Table Row 58	Wildlife - Boreal Caribou	Wildlife	Gentle moving of caribou during construction activities will be considered when deemed safe and effective by ENR and will involve the slow approach of environmental monitors to the caribou encourage them to move. If caribou are unwilling to leave the area, operations should be suspended and people should leave the area. This may only be done when the safety of the caribou, workers or equipment are at imminent risk, otherwise operations should be suspended to allow caribou to move away on their own accord.
ORS Comments Table Row 61	Wildlife - Harvest Monitoring Barren-Ground Caribou	Wildlife	The GNWT (via ENR) will approach the Barren-Ground Caribou Technical Working Group, regarding possible approaches for monitoring wildlife harvest in relation to TASR.
OSR Comment Table Row 121	ECCC#16 Wood Bison	Wildlife	The Wildlife Management and Monitoring Plan will be updated to be consistent with the proposed Wood Bison recovery strategy to the extent feasible.

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APPENDIX G

Duplicate Figures

LEGEND

- EXISTING MINE
- POPULATED PLACE
- ALL-SEASON ROAD
- WINTER ROAD
- TREELINE
- WATERCOURSE
- PROVINCIAL/TERRITORIAL BOUNDARY
- TŁĮCHQ LAND
- WATER BODY
- PROJECT FOOTPRINT
- WEK'ÈEZHÌI RESOURCE MANAGEMENT AREA

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REFERENCE(S)

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CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
TŁĮCHQ ALL-SEASON ROAD

TITLE
LOCATION OF THE TŁĮCHQ ALL-SEASON ROAD PROJECT

CONSULTANT
Golder Associates

YYYY-MM-DD	2017-04-13
DESIGNED	DC
PREPARED	LMS
REVIEWED	DP
APPROVED	DP

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FIGURE 1.1-1

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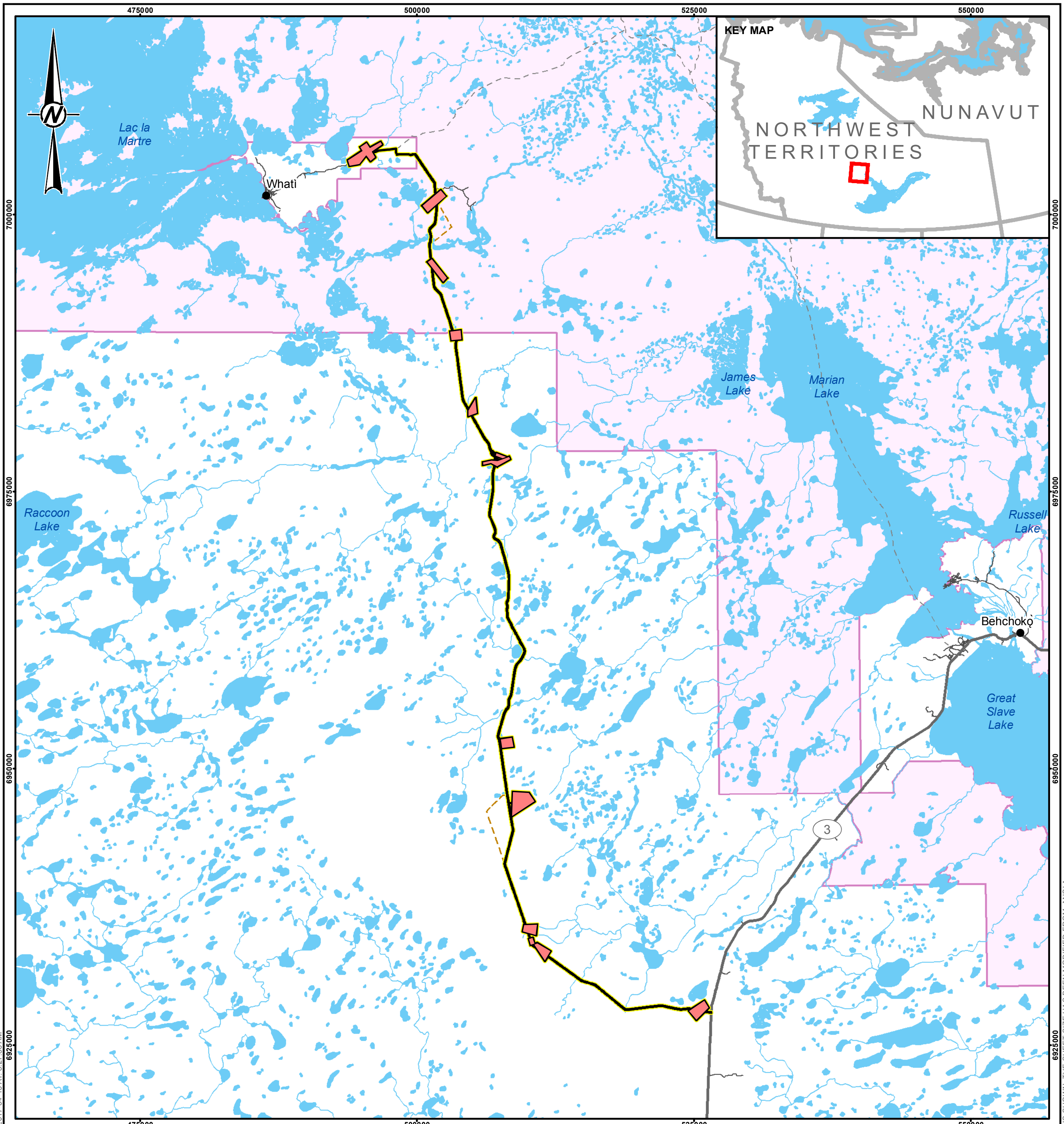

LEGEND

- ● POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- OLD AIRPORT ROAD
- WATERCOURSE
- TŁĮCHǪ LAND
- WATER BODY
- PROJECT FOOTPRINT - BORROW SOURCE
- PROJECT FOOTPRINT - ROAD

0 10 20

1:500,000 KILOMETRES

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
TŁĮCHǪ ALL-SEASON ROAD

TITLE
PROPOSED TŁĮCHǪ ALL-SEASON ROAD PROJECT FOOTPRINT

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-04-13
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PREPARED	LMS
REVIEWED	DP
APPROVED	DP

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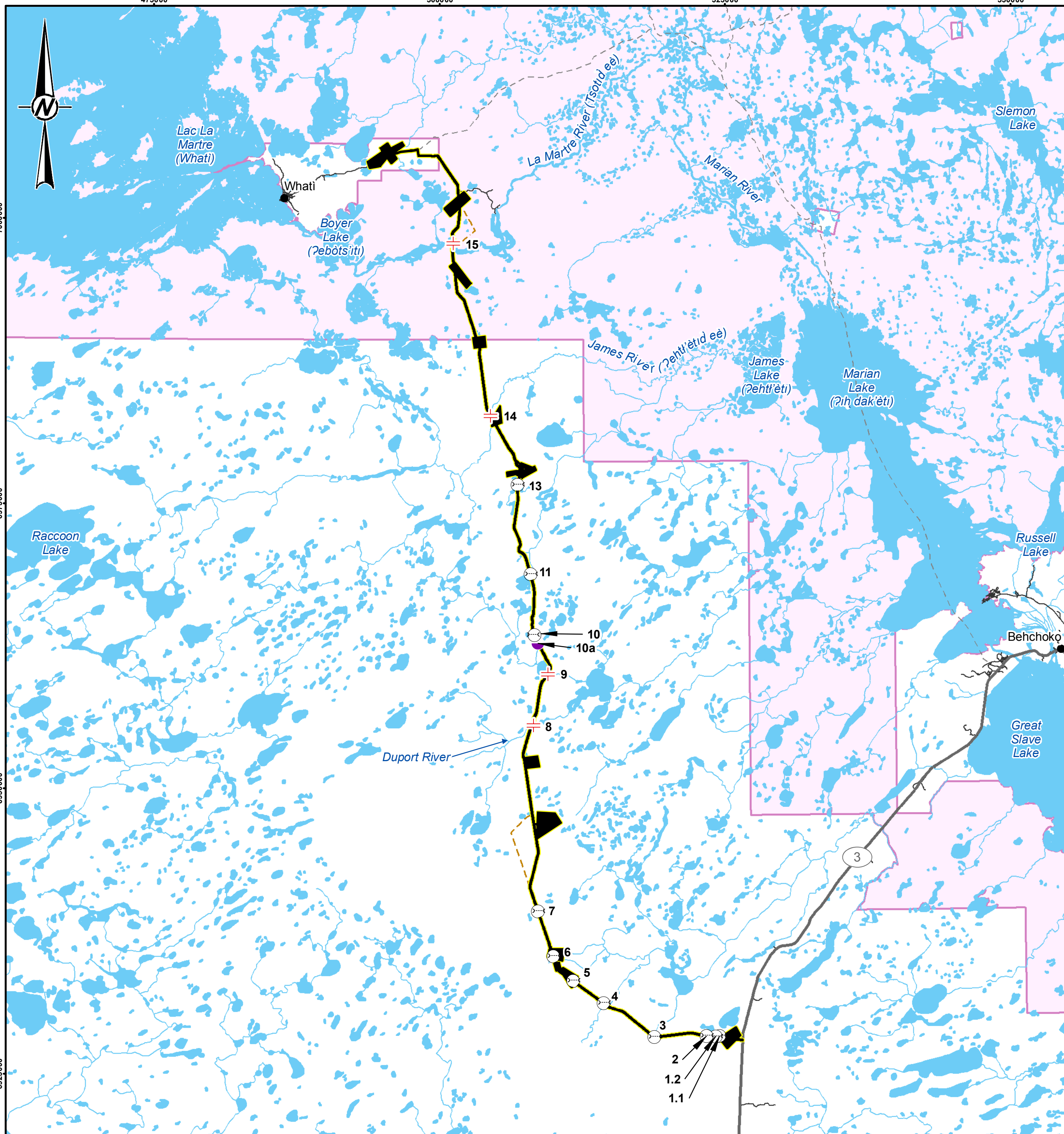

LEGEND

- ● POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- OLD AIRPORT ROAD
- WATERCOURSE
- TŁĮCHǪ LAND
- WATER BODY

PROPOSED CROSSING STRUCTURES

- PROPOSED BRIDGE
- PROPOSED ARCHED (OPEN BOTTOM) CULVERT
- PROPOSED CLOSED BOTTOM CULVERT
- PROJECT FOOTPRINT

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1:500,000 KILOMETRES

REFERENCE(S)

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PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT

GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT

TŁĮCHǪ ALL-SEASON ROAD

TITLE

PROPOSED TASR ALIGNMENT AND WATER CROSSINGS

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-04-11
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APPROVED	DP

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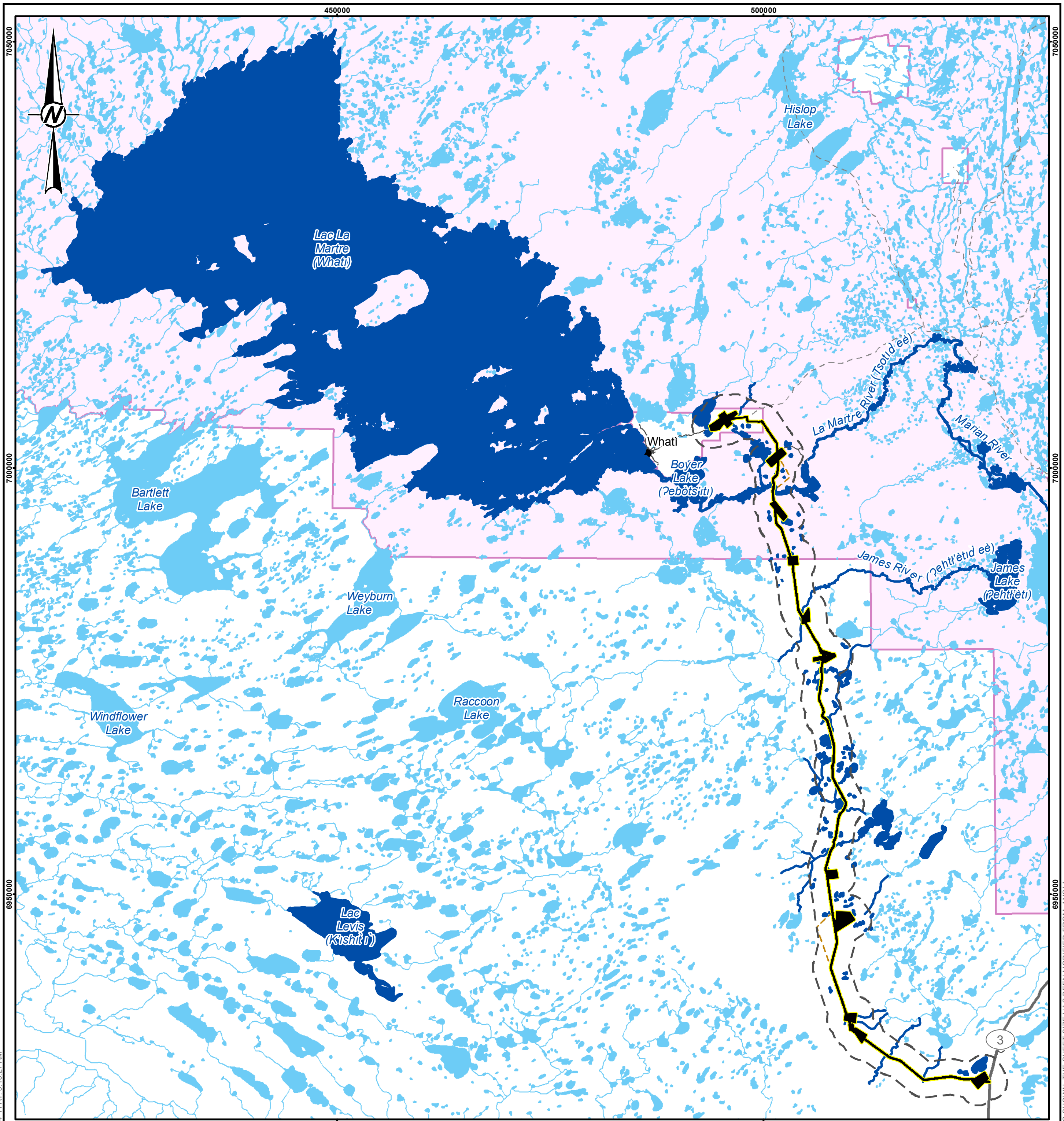

LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- OLD AIRPORT ROAD
- WATERCOURSE
- TŁĮCHQ LAND
- WATER BODY
- 2 KM FROM EDGE OF PROJECT FOOTPRINT
- FISH REGIONAL STUDY AREA
- PROJECT FOOTPRINT

0 15 30

1:650,000 KILOMETRES

REFERENCE(S)

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PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
TŁĮCHQ ALL-SEASON ROAD

TITLE
REGIONAL STUDY AREA FOR FISHERIES

CONSULTANT

Golder Associates

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PREPARED	LMS
REVIEWED	DP
APPROVED	DP

PROJECT NO.	REV.	FIGURE
1665943	0	3.1-2

PATH: I:\2016\1665943\Mapping\MXD\3000_Fish\1665943_RSA_Fish.mxd PRINTED ON: 2017-04-11 AT: 9:10:27 AM

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

25mm

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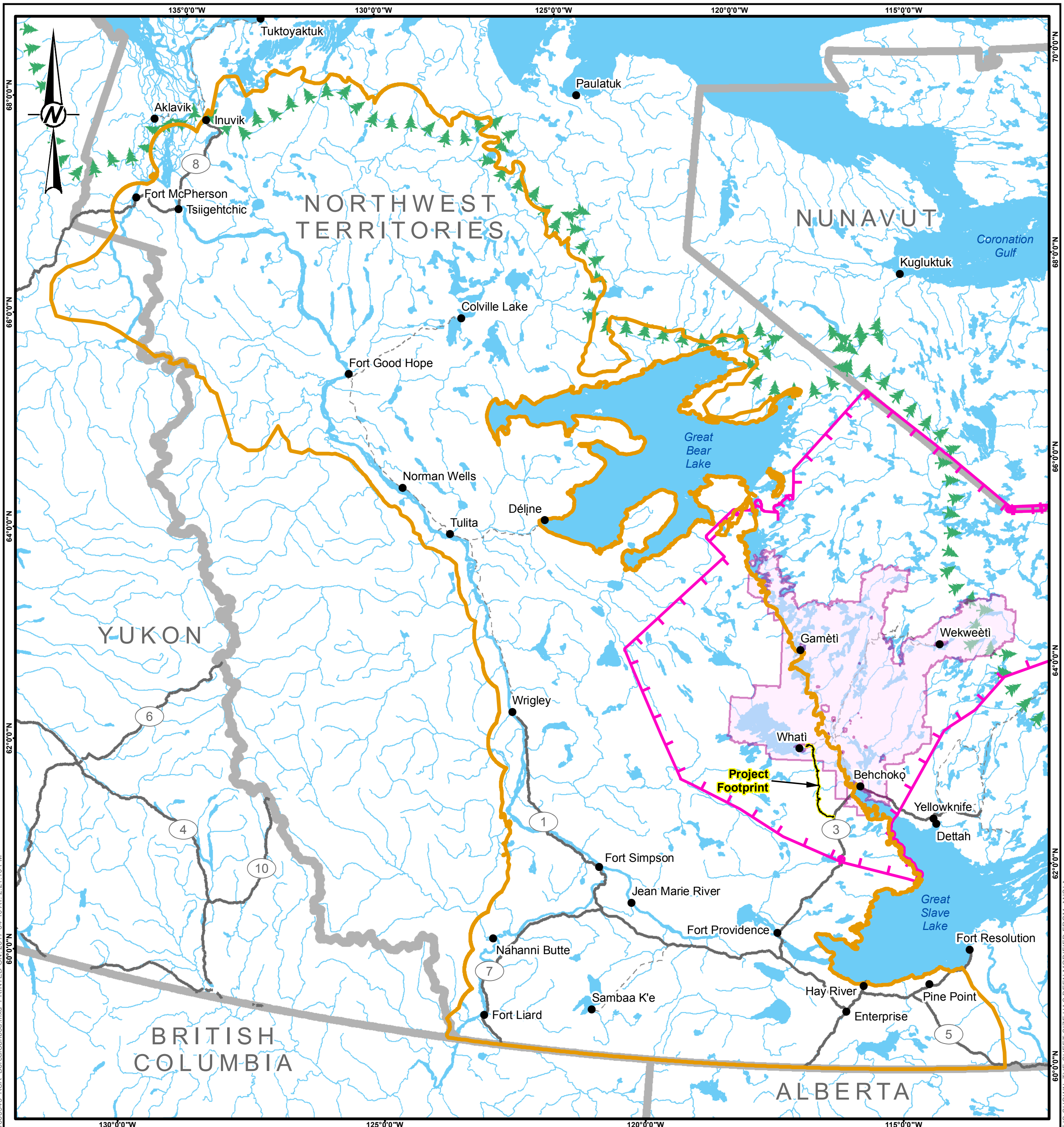


LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- WINTER ROAD
- TREELINE
- WATERCOURSE
- PROVINCIAL/TERRITORIAL BOUNDARY
- TŁĮCHǪ LAND
- WATER BODY
- BOREAL CARIBOU RSA
- PROJECT FOOTPRINT
- WEK'ÈEZHÌI RESOURCE MANAGEMENT AREA

0 120 240

1:6,000,000 KILOMETRES

REFERENCE(S)

1. ADMINISTRATIVE REGIONS OBTAINED FROM GOVERNMENT OF NORTHWEST TERRITORIES.
2. BOREAL CARIBOU RANGE OBTAINED FROM ENVIRONMENT CANADA, 2012.
3. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.

PROJECTION: CANADA LAMBERT CONFORMAL CONIC

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
TŁĮCHǪ ALL-SEASON ROAD

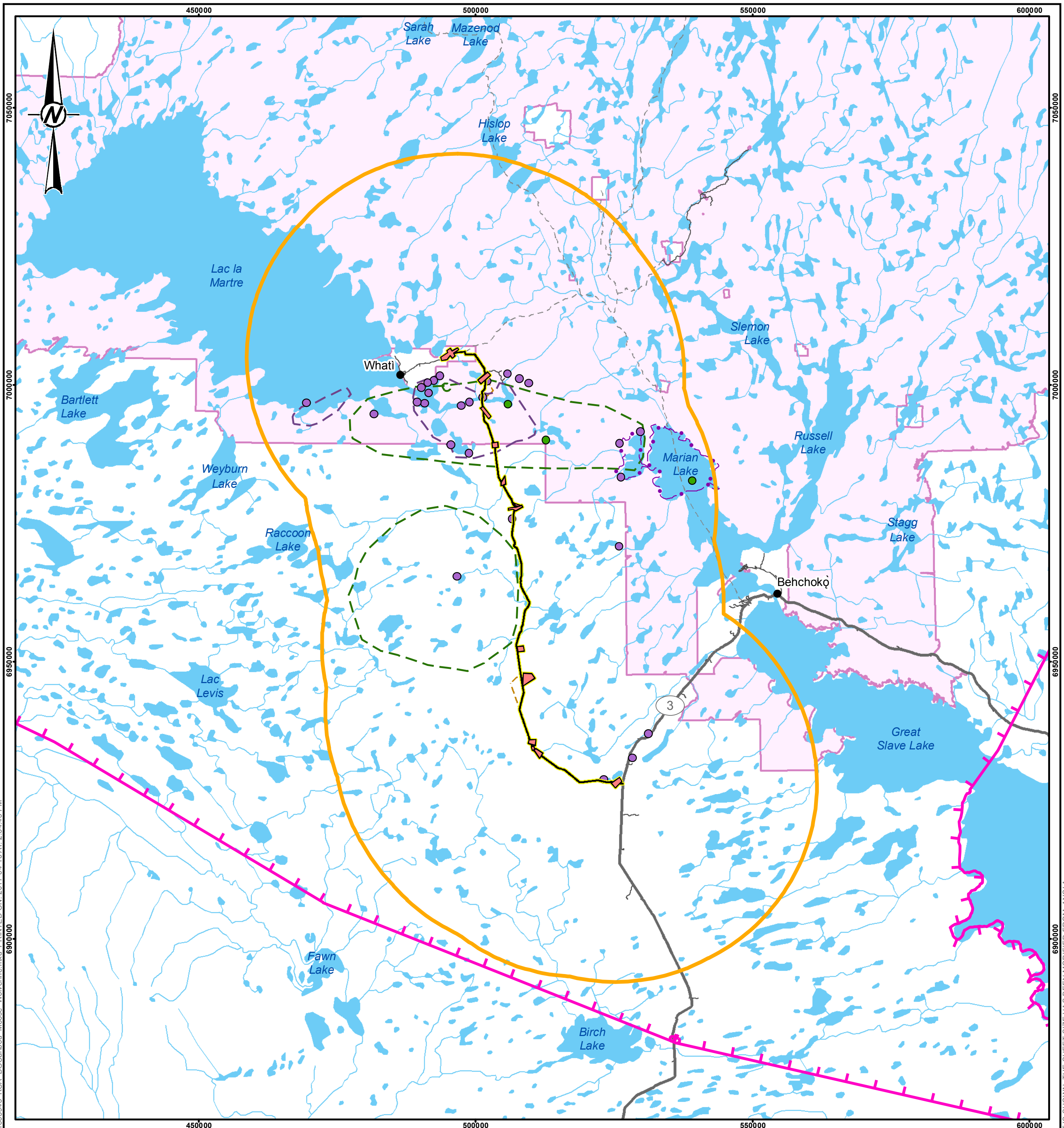
TITLE
RSA FOR BOREAL CARIBOU

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-04-10
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO.	REV.	FIGURE
1665943	0	4.1-1



LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- OLD AIRPORT ROAD
- WATERCOURSE
- TŁĮCHǪ LAND
- WATER BODY
- BARREN-GROUND CARIBOU, MOOSE, AND WOLVERINE RSA
- PROJECT FOOTPRINT - BORROW SOURCE
- PROJECT FOOTPRINT - ROAD
- WEK'ÈEZHÌI RESOURCE MANAGEMENT AREA

TRADITIONAL KNOWLEDGE DATA

- BARREN-GROUND CARIBOU HUNTING/KILL SITE
- MOOSE HUNTING/KILL SITE
- MOOSE HUNTING
- BARREN-GROUND CARIBOU HABITAT
- MOOSE HABITAT

0 20 40

1:1,000,000 KILOMETRES

REFERENCE(S)

1. TRADITIONAL KNOWLEDGE DATA OBTAINED FROM THE TLICHO GOVERNMENT, 2016 .
2. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.

PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
TŁĮCHǪ ALL-SEASON ROAD

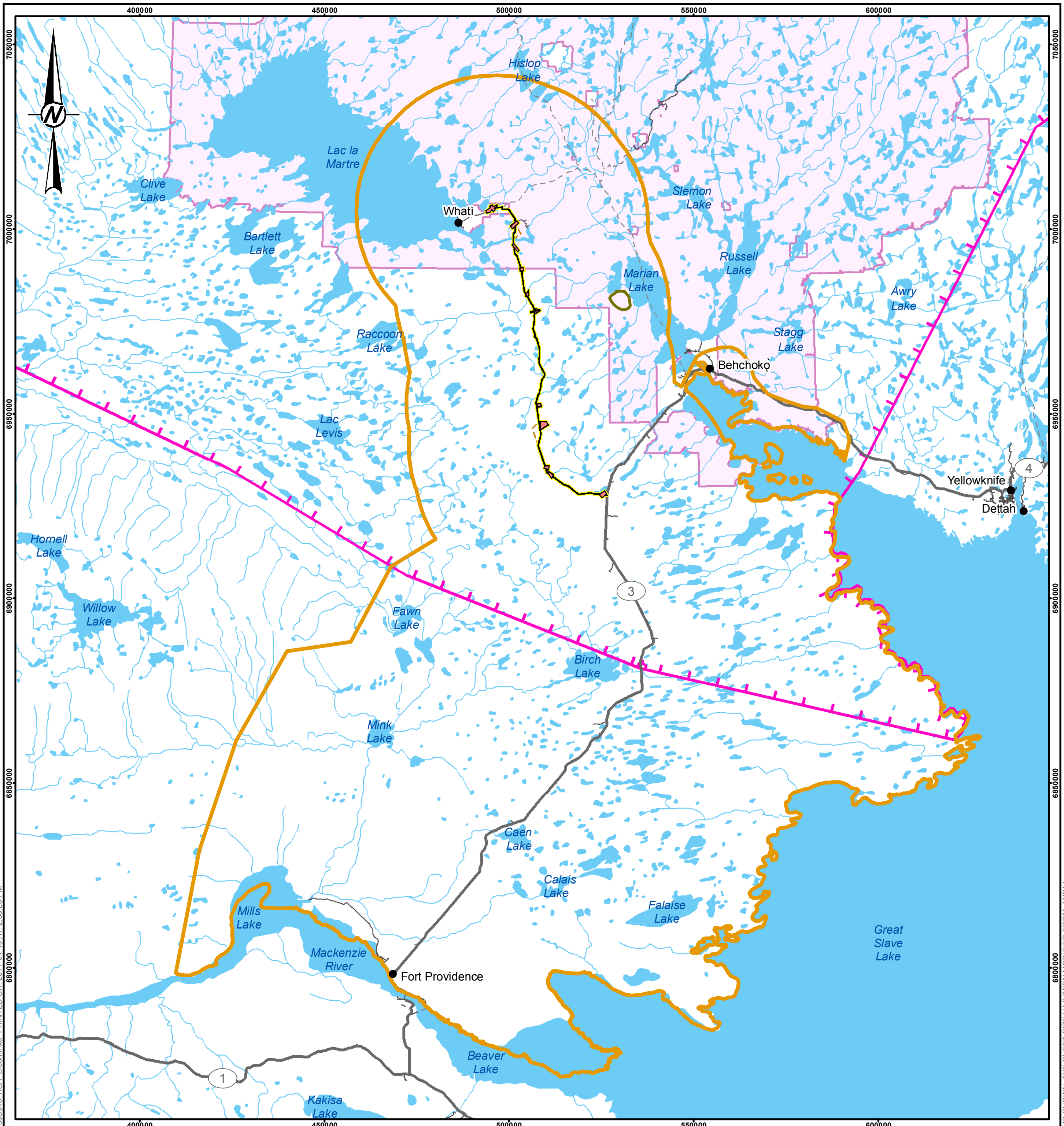
TITLE
RSA FOR BARREN-GROUND CARIBOU, MOOSE, AND WOLVERINE

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-04-10
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO.	REV.	FIGURE
1665943	0	4.1-2



LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- OLD AIRPORT ROAD
- WATERCOURSE
- TŁĮCHQ LAND
- WATER BODY
- BISON RSA
- PROJECT FOOTPRINT - BORROW SOURCE
- PROJECT FOOTPRINT - ROAD
- WEK'ÈEZHÌI RESOURCE MANAGEMENT AREA

TRADITIONAL KNOWLEDGE DATA

- BISON HABITAT

0 30 60

1:1,500,000 KILOMETRES

REFERENCE(S)

1. TRADITIONAL KNOWLEDGE DATA OBTAINED FROM THE TLICHO GOVERNMENT, 2016 .
2. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.

PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

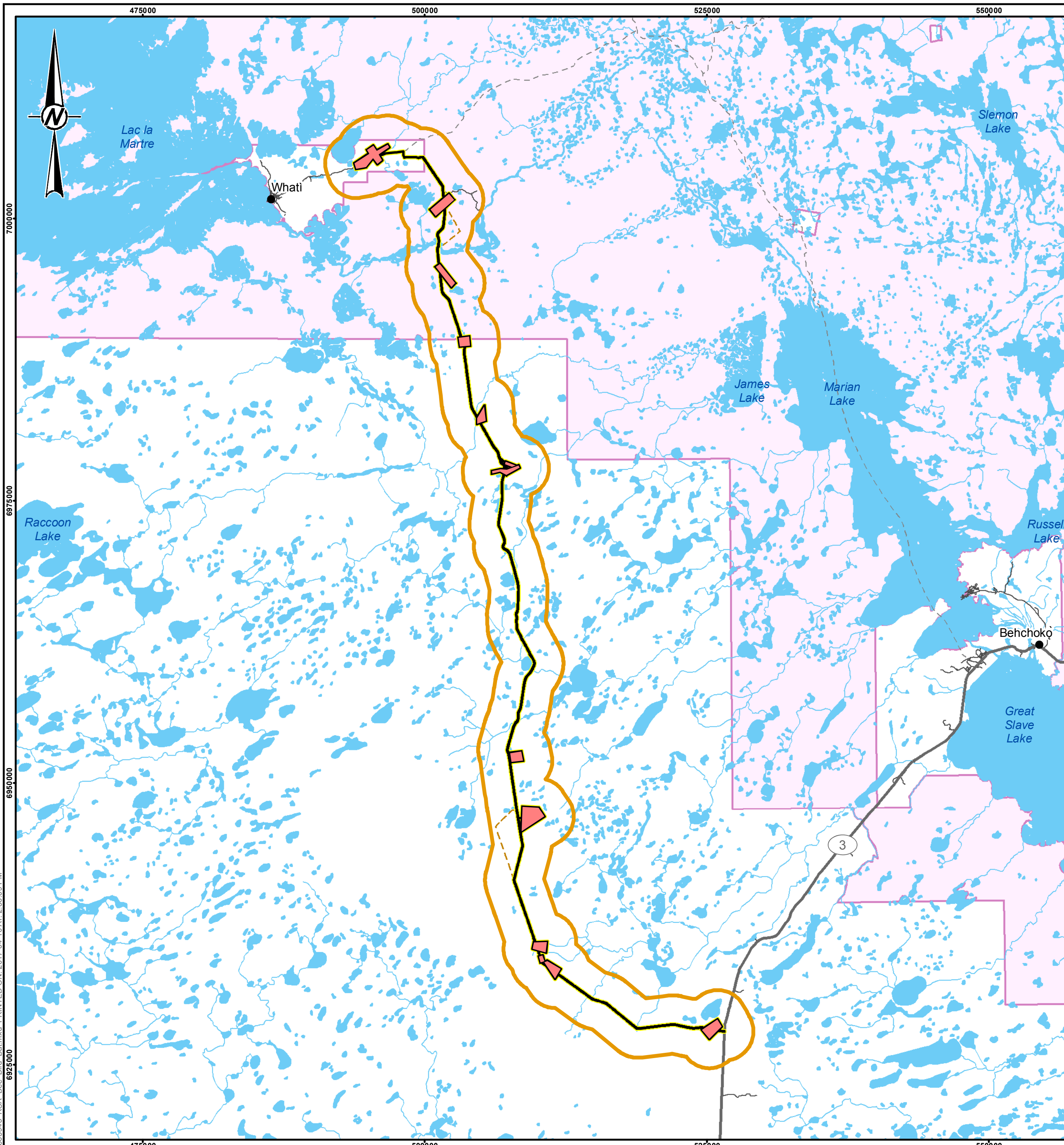
PROJECT
TŁĮCHQ ALL-SEASON ROAD

TITLE
RSA FOR BISON

CONSULTANT
Golder Associates

YYYY-MM-DD	2017-04-10
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO. 1665943 REV. 0 FIGURE 4.1-3



LEGEND

- ● POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- OLD AIRPORT ROAD
- WATERCOURSE
- TŁĮCHǪ LAND
- WATER BODY
- BUMBLE BEE, BIRD, AND BAT RSA
- PROJECT FOOTPRINT - BORROW SOURCE
- PROJECT FOOTPRINT - ROAD

0 10 20

1:500,000 KILOMETRES

REFERENCE(S)

1. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
TŁĮCHǪ ALL-SEASON ROAD

TITLE
RSA FOR BUMBLE BEES, BIRDS AND BAT VALUED COMPONENTS

CONSULTANT
Golder Associates

YYYY-MM-DD	2017-04-10
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO.	REV.	FIGURE
1665943	0	4.1-4

25mm

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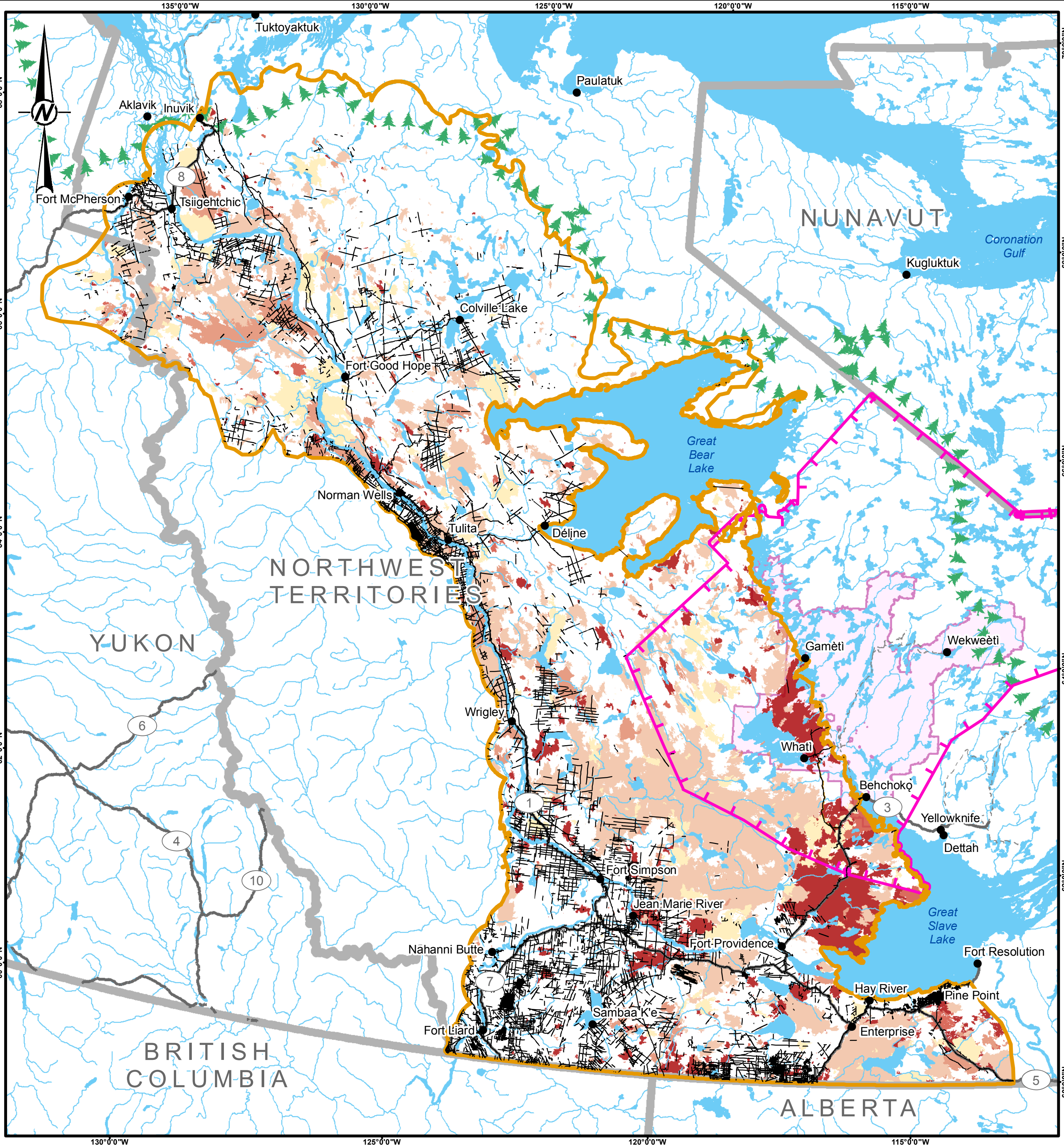


LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- WINTER ROAD
- TREELINE
- WATERCOURSE
- PROVINCIAL/TERRITORIAL BOUNDARY
- TŁĮCHǪ LAND
- WATER BODY
- DEVELOPMENT
- BOREAL CARIBOU RSA
- WEK'ÈEZHÌI RESOURCE MANAGEMENT AREA

FIRE HISTORY

- 0 - 5 YEARS
- 6 - 10 YEARS
- 11 - 20 YEARS
- 21 - 40 YEARS
- >40 YEARS

0 120 240

1:6,000,000 KILOMETRES

REFERENCE(S)

1. ADMINISTRATIVE REGIONS OBTAINED FROM GOVERNMENT OF NORTHWEST TERRITORIES.
2. BOREAL CARIBOU RANGE OBTAINED FROM ENVIRONMENT CANADA, 2012.
3. FIRE HISTORY OBTAINED FROM GOVERNMENT OF NWT WITH PERMISSION.
4. CIMP INVENTORY OF LANDSCAPE CHANGE, OBTAINED FROM THE NWT CENTRE FOR GEOMATICS.
4. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.

PROJECTION: CANADA LAMBERT CONFORMAL CONIC

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

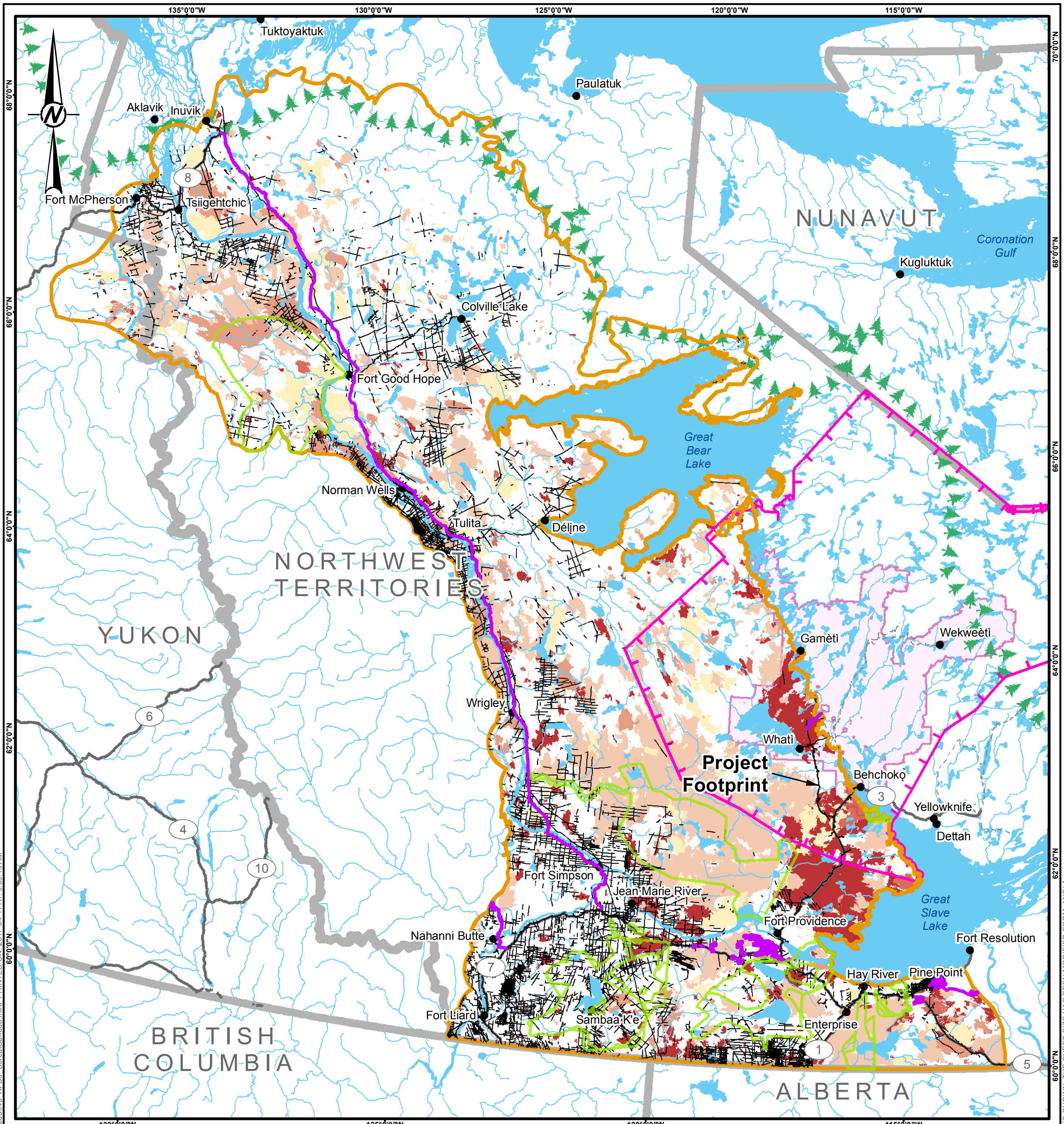
PROJECT
TŁĮCHǪ ALL-SEASON ROAD

TITLE
PREVIOUS AND EXISTING DEVELOPMENTS IN THE BOREAL CARIBOU RSA

CONSULTANT
Golder Associates

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO.	REV.	FIGURE
1665943	0	4.2-1



LEGEND

- ● POPULATED PLACE
- ALL-SEASON ROAD
- WINTER ROAD
- TREELINE
- WATERCOURSE
- PROVINCIAL/TERRITORIAL BOUNDARY
- TŁĮCHǪ LAND
- WATER BODY
- CANDIDATE PROTECTED AREA
- DEVELOPMENT
- RFD
- BOREAL CARIBOU RSA
- WEK'ÈEZHÌI RESOURCE MANAGEMENT AREA

FIRE HISTORY

- 0 - 5 YEARS
- 6 - 10 YEARS
- 11 - 20 YEARS
- 21 - 40 YEARS
- >40 YEARS

0 120 240

1:6,000,000 KILOMETRES

REFERENCE(S)

1. ADMINISTRATIVE REGIONS OBTAINED FROM GOVERNMENT OF NORTHWEST TERRITORIES.
2. BOREAL CARIBOU RANGE OBTAINED FROM ENVIRONMENT CANADA, 2012.
3. FIRE HISTORY OBTAINED FROM GOVERNMENT OF NWT WITH PERMISSION
4. CIMP INVENTORY OF LANDSCAPE CHANGE, OBTAINED FROM THE NWT CENTRE FOR GEOMATICS.
5. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.

PROJECTION: CANADA LAMBERT CONFORMAL CONIC

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
TŁĮCHǪ ALL-SEASON ROAD

TITLE
RFDS IN THE BOREAL CARIBOU RSA

CONSULTANT
Golder Associates

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

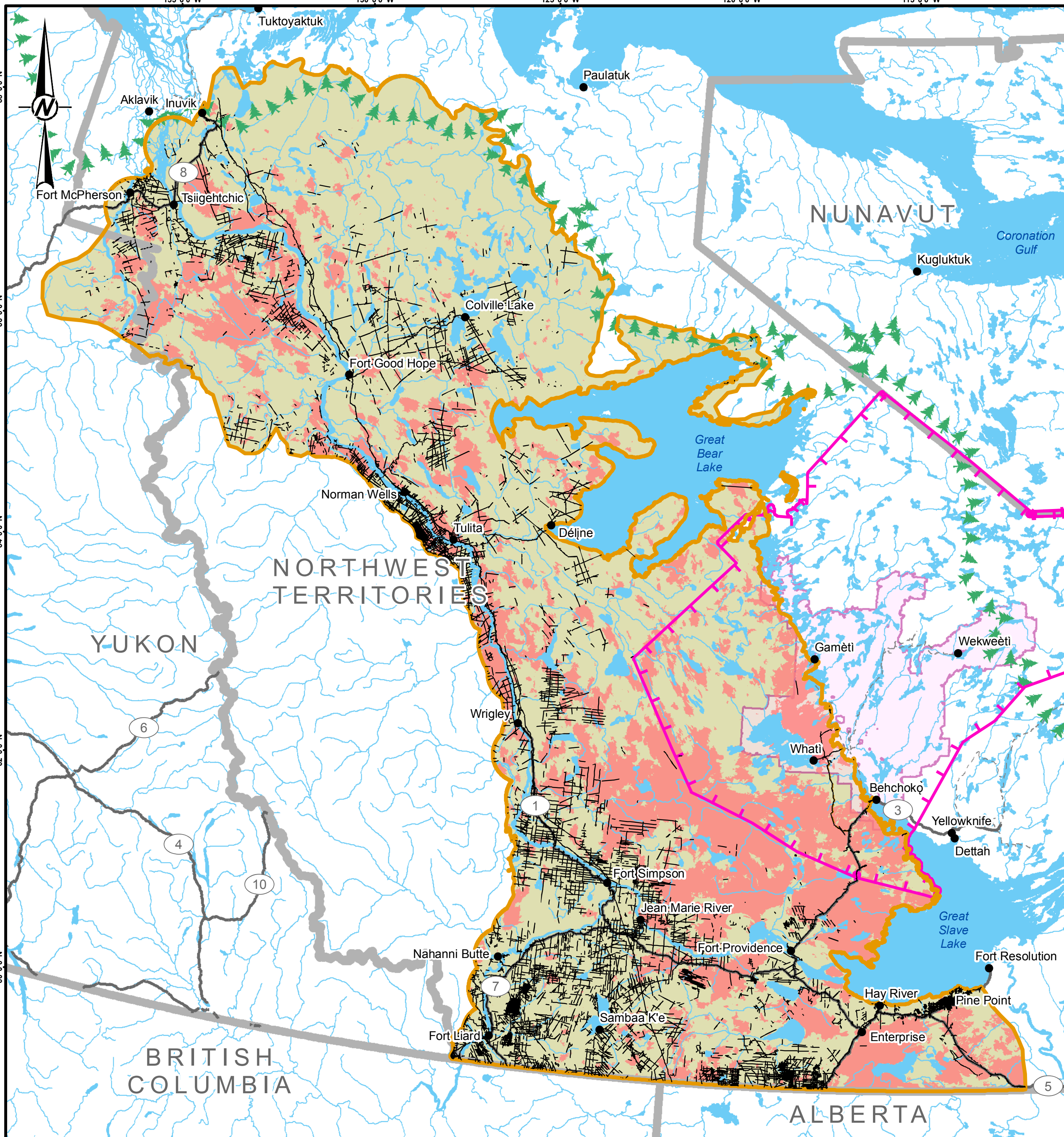
PROJECT NO.	REV.	FIGURE
1665943	0	4.2-2

PATH: I:\2016\1665943\Mapping\MXD\Wildlife\10_2 DO NOT OPEN WITH 10_4\FIG4_2-2_1665943_RFDs_BorealCaribou.mxd PRINTED ON: 2017-04-11 AT: 9:39:19 AM

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

25mm

0



LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- WINTER ROAD
- TREELINE
- WATERCOURSE
- PROVINCIAL/TERRITORIAL BOUNDARY
- TŁĮCHǪ LAND
- WATER BODY
- DEVELOPMENT
- FIRE HISTORY (LESS THAN 40 YEARS OLD)
- UNDISTURBED HABITAT
- BOREAL CARIBOU RSA
- WEK'ÈEZHÌI RESOURCE MANAGEMENT AREA

0 120 240

1:6,000,000 KILOMETRES

REFERENCE(S)

1. ADMINISTRATIVE REGIONS OBTAINED FROM GOVERNMENT OF NORTHWEST TERRITORIES.
2. BOREAL CARIBOU RANGE OBTAINED FROM ENVIRONMENT CANADA, 2012.
3. CIMP INVENTORY OF LANDSCAPE CHANGE, OBTAINED FROM THE NWT CENTRE FOR GEOMATICS.
4. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.

PROJECTION: CANADA LAMBERT CONFORMAL CONIC

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

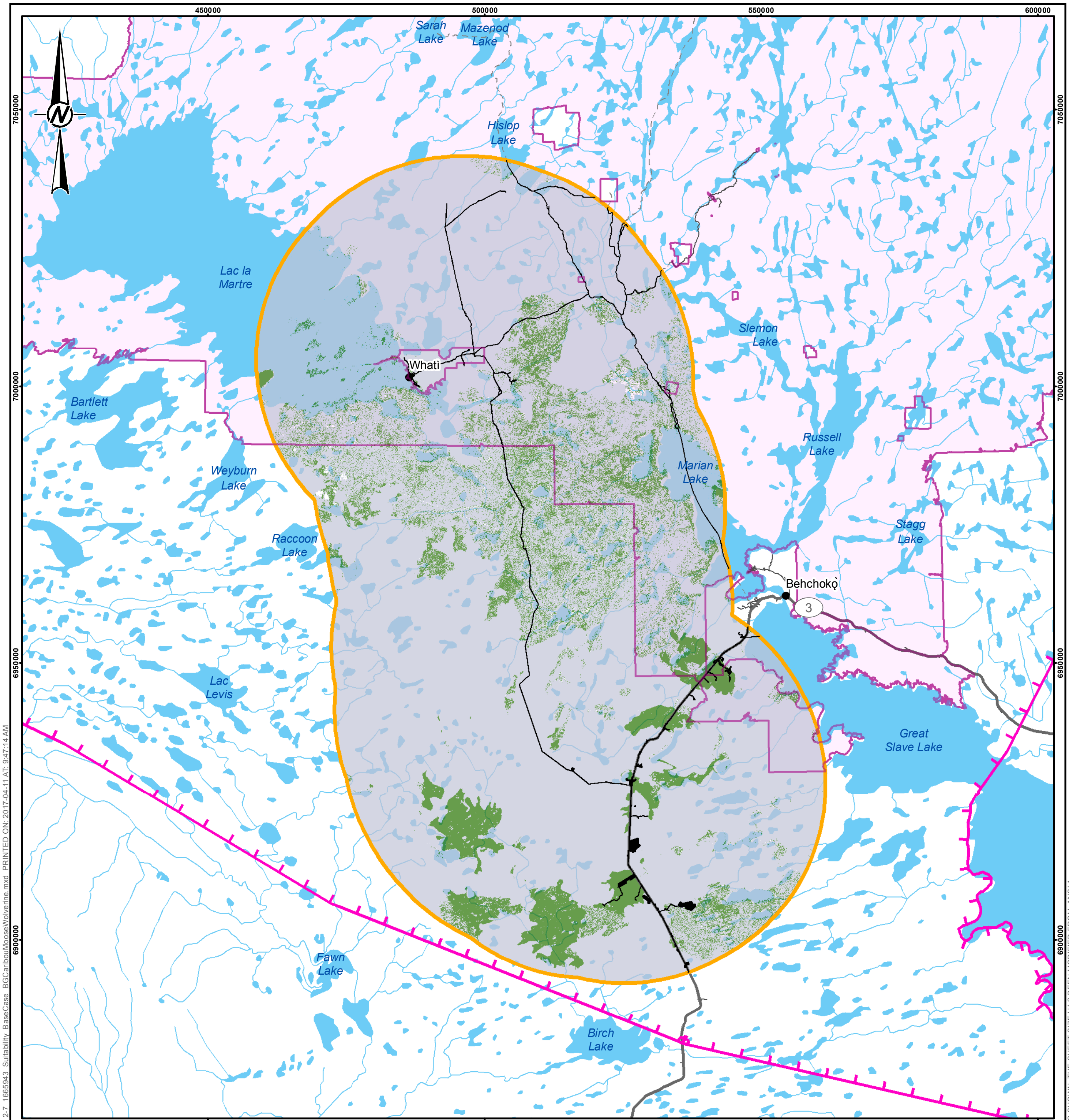
PROJECT
TŁĮCHǪ ALL-SEASON ROAD

TITLE
DISTRIBUTION OF BOREAL CARIBOU HABITAT AT BASE CASE

CONSULTANT
Golder Associates

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO.	REV.	FIGURE
1665943	0	4.2-3



LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- WATERCOURSE
- TŁĮCHǪ LAND
- WATER BODY
- DEVELOPMENT
- BARREN-GROUND CARIBOU, MOOSE, AND WOLVERINE RSA
- WEK'ÈEZHÌI RESOURCE MANAGEMENT AREA

HABITAT SUITABILITY

- MODERATE TO HIGH
- NIL TO LOW

0 20 40

1:1,000,000 KILOMETRES

REFERENCE(S)

1. ADMINISTRATIVE REGIONS OBTAINED FROM GOVERNMENT OF NORTHWEST TERRITORIES.
2. CIMP INVENTORY OF LANDSCAPE CHANGE, OBTAINED FROM THE NWT CENTRE FOR GEOMATICS.
3. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.

PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
TŁĮCHǪ ALL-SEASON ROAD

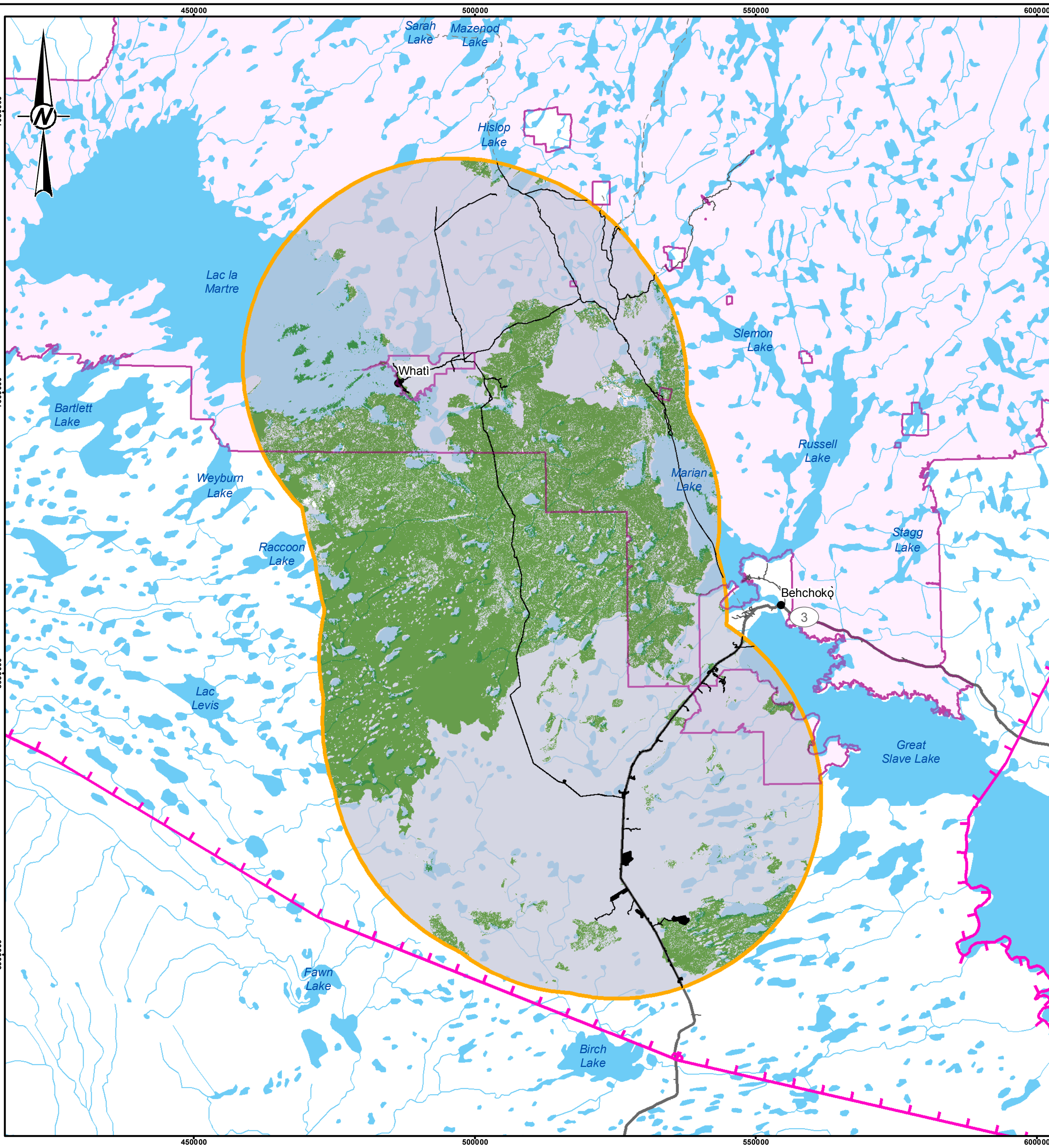
TITLE
DISTRIBUTION OF SUITABLE BARREN-GROUND CARIBOU HABITAT AT BASE CASE

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO.	REV.	FIGURE
1665943	0	4.2-4



LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- WATERCOURSE
- TŁĮCHǪ LAND
- WATER BODY
- DEVELOPMENT
- BARREN-GROUND CARIBOU, MOOSE, AND WOLVERINE RSA
- WEK'ÈEZHÌI RESOURCE MANAGEMENT AREA

HABITAT SUITABILITY

- MODERATE TO HIGH
- NIL TO LOW

0 20 40

1:1,000,000 KILOMETRES

REFERENCE(S)

1. ADMINISTRATIVE REGIONS OBTAINED FROM GOVERNMENT OF NORTHWEST TERRITORIES.
2. CIMP INVENTORY OF LANDSCAPE CHANGE, OBTAINED FROM THE NWT CENTRE FOR GEOMATICS.
3. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.

PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

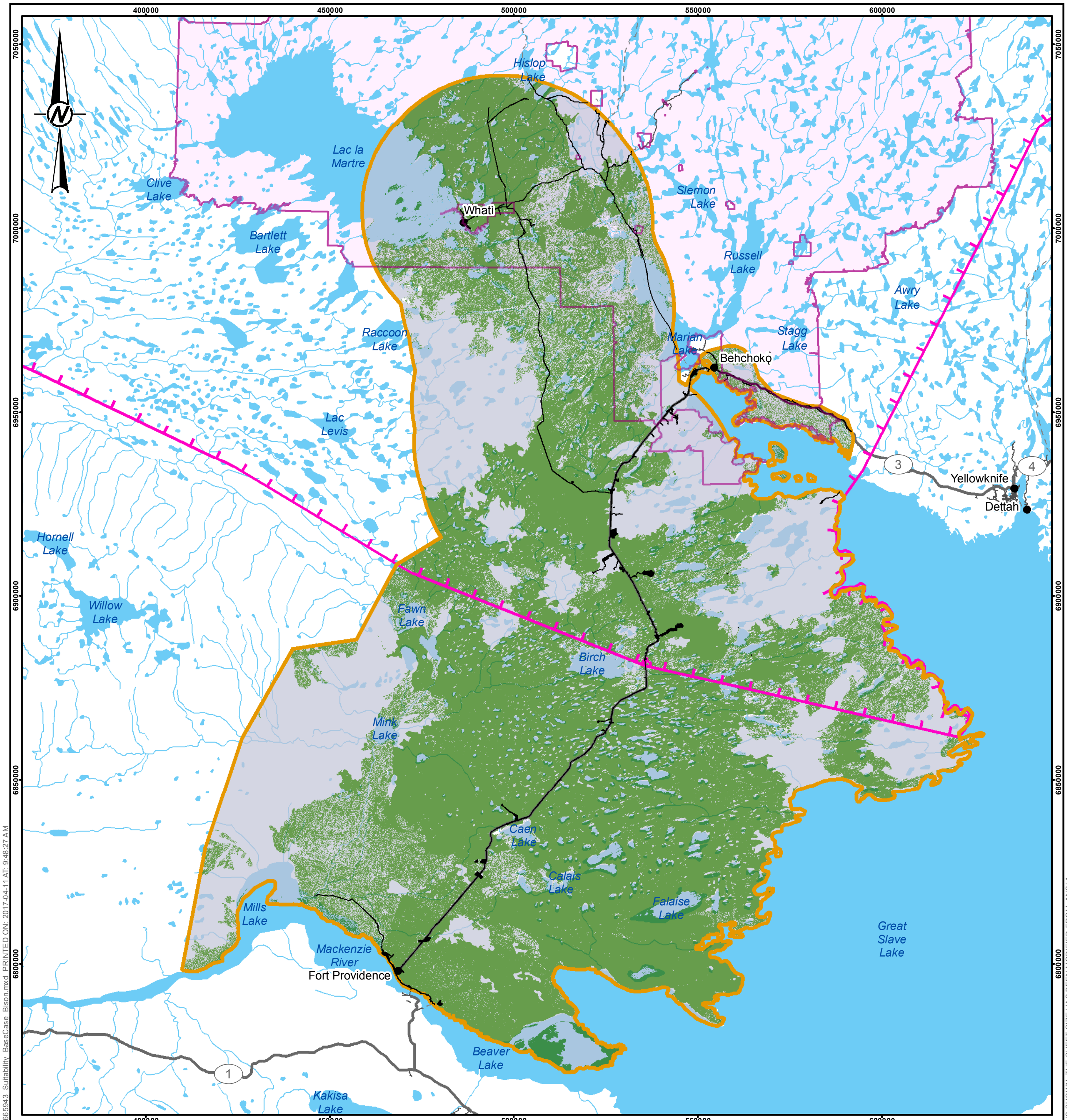
PROJECT
TŁĮCHǪ ALL-SEASON ROAD

TITLE
DISTRIBUTION OF SUITABLE MOOSE HABITAT AT BASE CASE

CONSULTANT

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO.	REV.	FIGURE
1665943	0	4.2-5



LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- WATERCOURSE
- TŁĮCHǪ LAND
- WATER BODY
- DEVELOPMENT
- BISON RSA
- WEK'ÈEZHÌI RESOURCE MANAGEMENT AREA

HABITAT SUITABILITY

- MODERATE TO HIGH
- NIL TO LOW

0 30 60

1:1,500,000 KILOMETRES

REFERENCE(S)

1. ADMINISTRATIVE REGIONS OBTAINED FROM GOVERNMENT OF NORTHWEST TERRITORIES.
2. CIMP INVENTORY OF LANDSCAPE CHANGE, OBTAINED FROM THE NWT CENTRE FOR GEOMATICS.
3. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.

PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
TŁĮCHǪ ALL-SEASON ROAD

TITLE
DISTRIBUTION OF SUITABLE BISON HABITAT AT BASE CASE

CONSULTANT

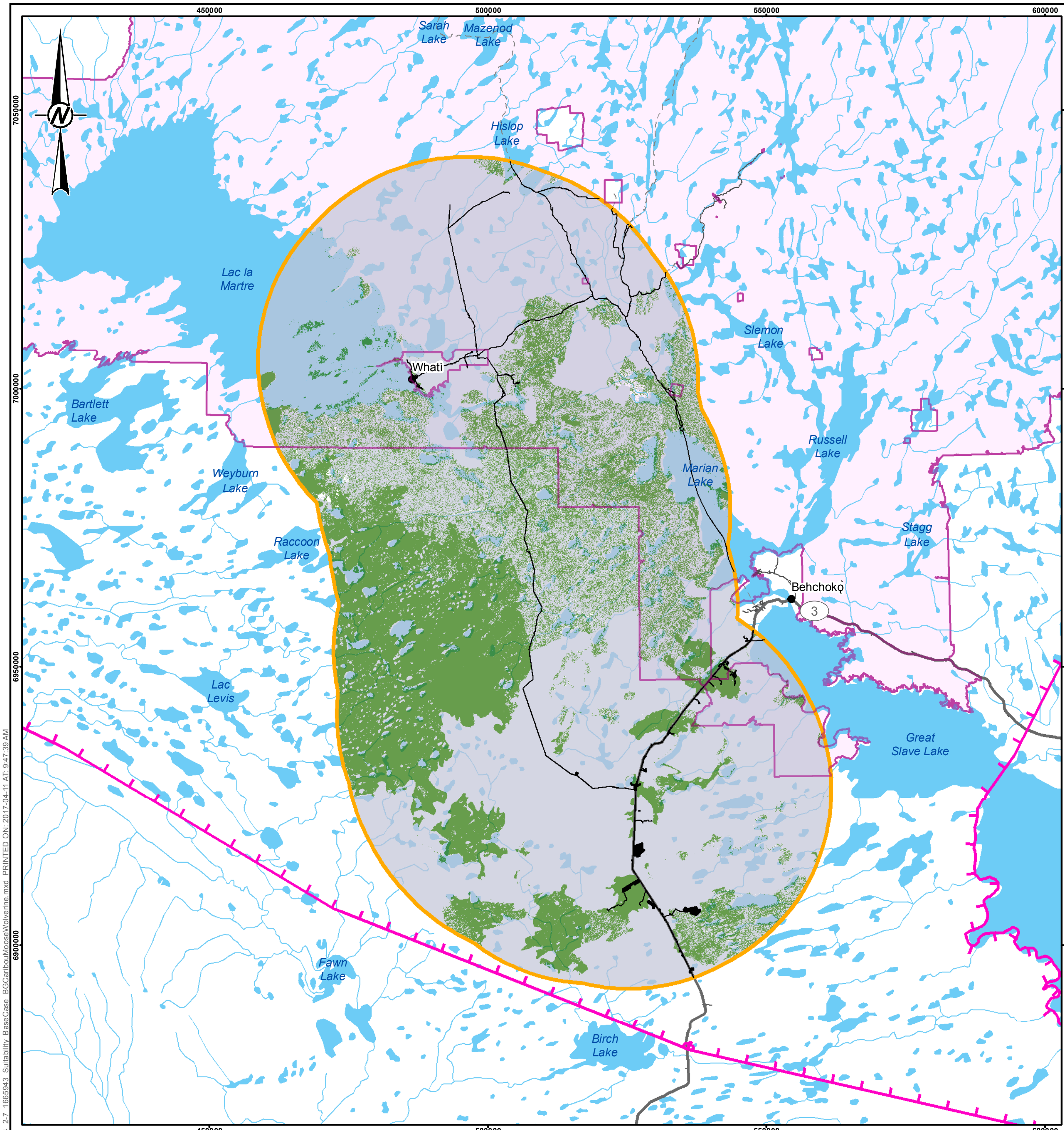
Golder Associates

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO.	REV.	FIGURE
1665943	0	4.2-6

PATH: I:\2016\1665943\Mapping\MXD\Wildlife\10_2_DO_NOT_OPEN_WITH_10_4\FIG4_2-6_1665943_Suitability_BaseCase_Bison.mxd PRINTED ON: 2017-04-11 AT: 9:48:27 AM

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A



LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- WATERCOURSE
- TŁĮCHǪ LAND
- WATER BODY
- DEVELOPMENT
- BARREN-GROUND CARIBOU, MOOSE, AND WOLVERINE RSA
- WEK'ÈEZHÌI RESOURCE MANAGEMENT AREA

HABITAT SUITABILITY

- MODERATE TO HIGH
- NIL TO LOW

0 20 40

1:1,000,000 KILOMETRES

REFERENCE(S)

1. ADMINISTRATIVE REGIONS OBTAINED FROM GOVERNMENT OF NORTHWEST TERRITORIES.
2. CIMP INVENTORY OF LANDSCAPE CHANGE, OBTAINED FROM THE NWT CENTRE FOR GEOMATICS.
3. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.

PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
TŁĮCHǪ ALL-SEASON ROAD

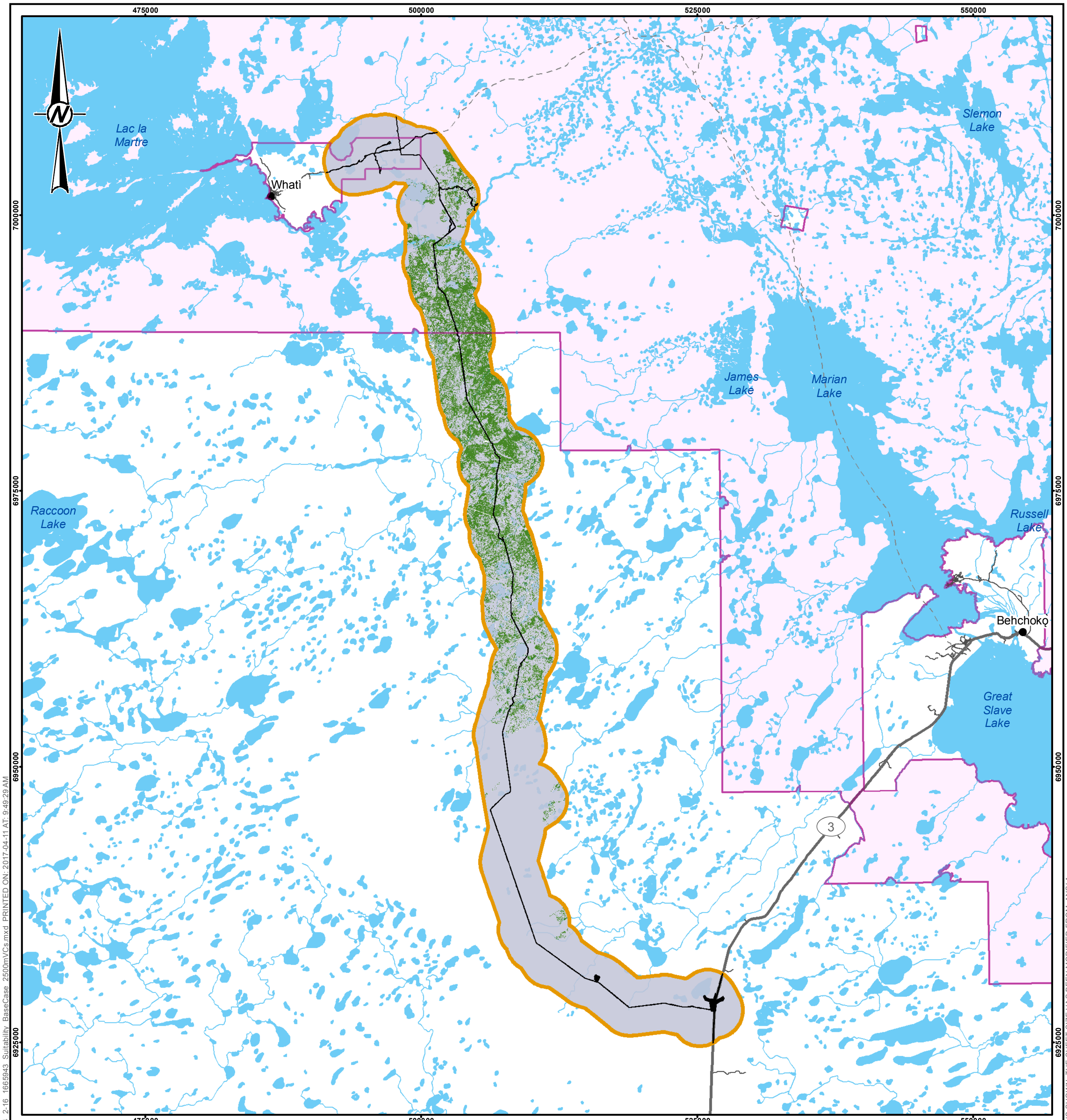
TITLE
DISTRIBUTION OF SUITABLE WOLVERINE HABITAT AT BASE CASE

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO. 1665943 REV. 0 FIGURE 4.2-7



LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- WATERCOURSE
- TŁĮCHǪ LAND
- WATER BODY
- DEVELOPMENT
- BUMBLE BEE, BIRD, AND BAT RSA

HABITAT SUITABILITY

- MODERATE TO HIGH
- NIL TO LOW

0 10 20

1:500,000 KILOMETRES

REFERENCE(S)

1. CIMP INVENTORY OF LANDSCAPE CHANGE, OBTAINED FROM THE NWT CENTRE FOR GEOMATICS.
2. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.

PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT

GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT

TŁĮCHǪ ALL-SEASON ROAD

TITLE

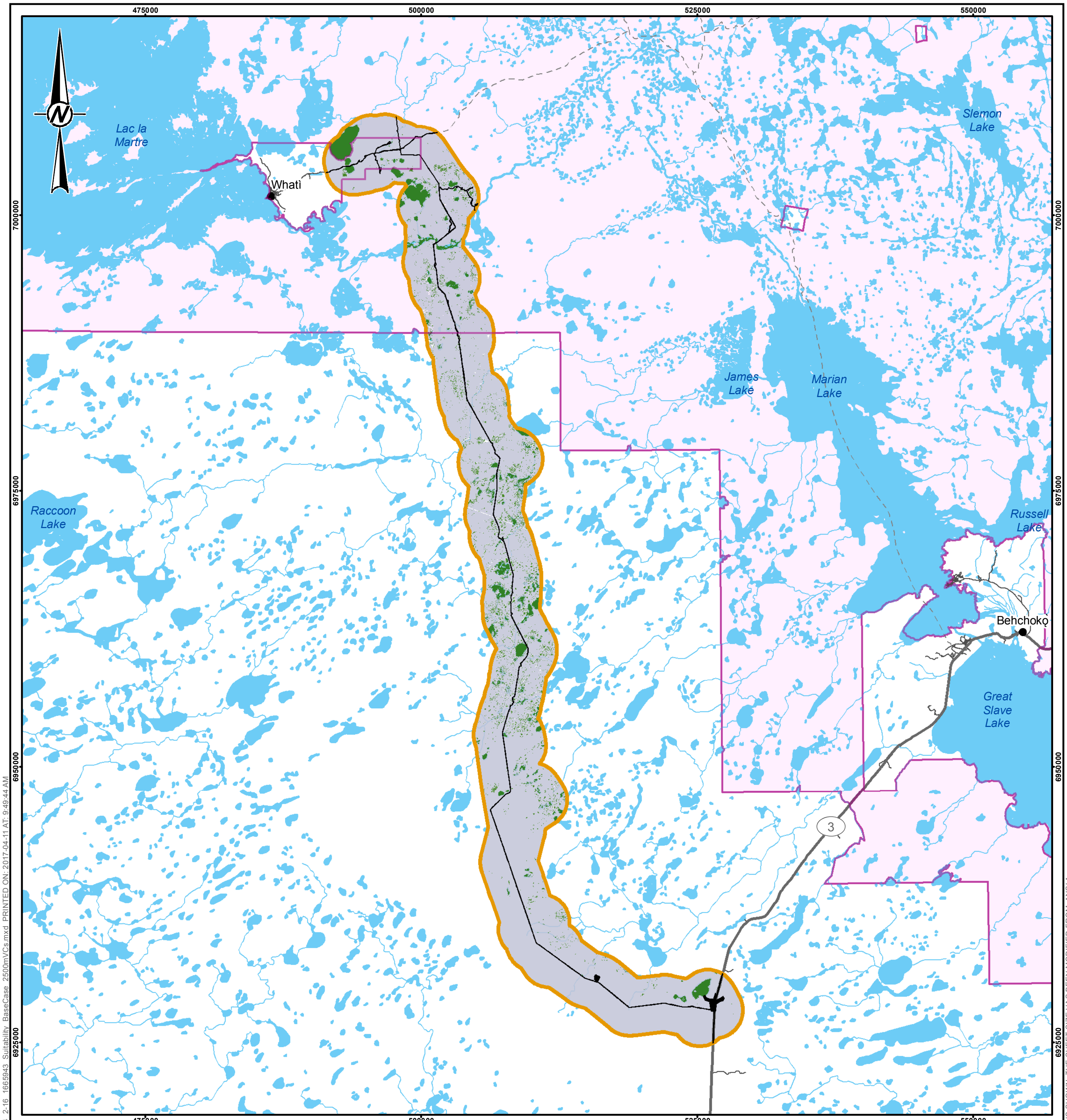
DISTRIBUTION OF SUITABLE LITTLE BROWN MYOTIS HABITAT AT BASE CASE

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO. 1665943 | REV. 0 | FIGURE 4.2-8



LEGEND

- ● POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- WATERCOURSE
- TŁĮCHǪ LAND
- WATER BODY
- DEVELOPMENT
- BUMBLE BEE, BIRD, AND BAT RSA

HABITAT SUITABILITY

- MODERATE TO HIGH
- NIL TO LOW

0 10 20

1:500,000 KILOMETRES

REFERENCE(S)

1. CIMP INVENTORY OF LANDSCAPE CHANGE, OBTAINED FROM THE NWT CENTRE FOR GEOMATICS.
2. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.

PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

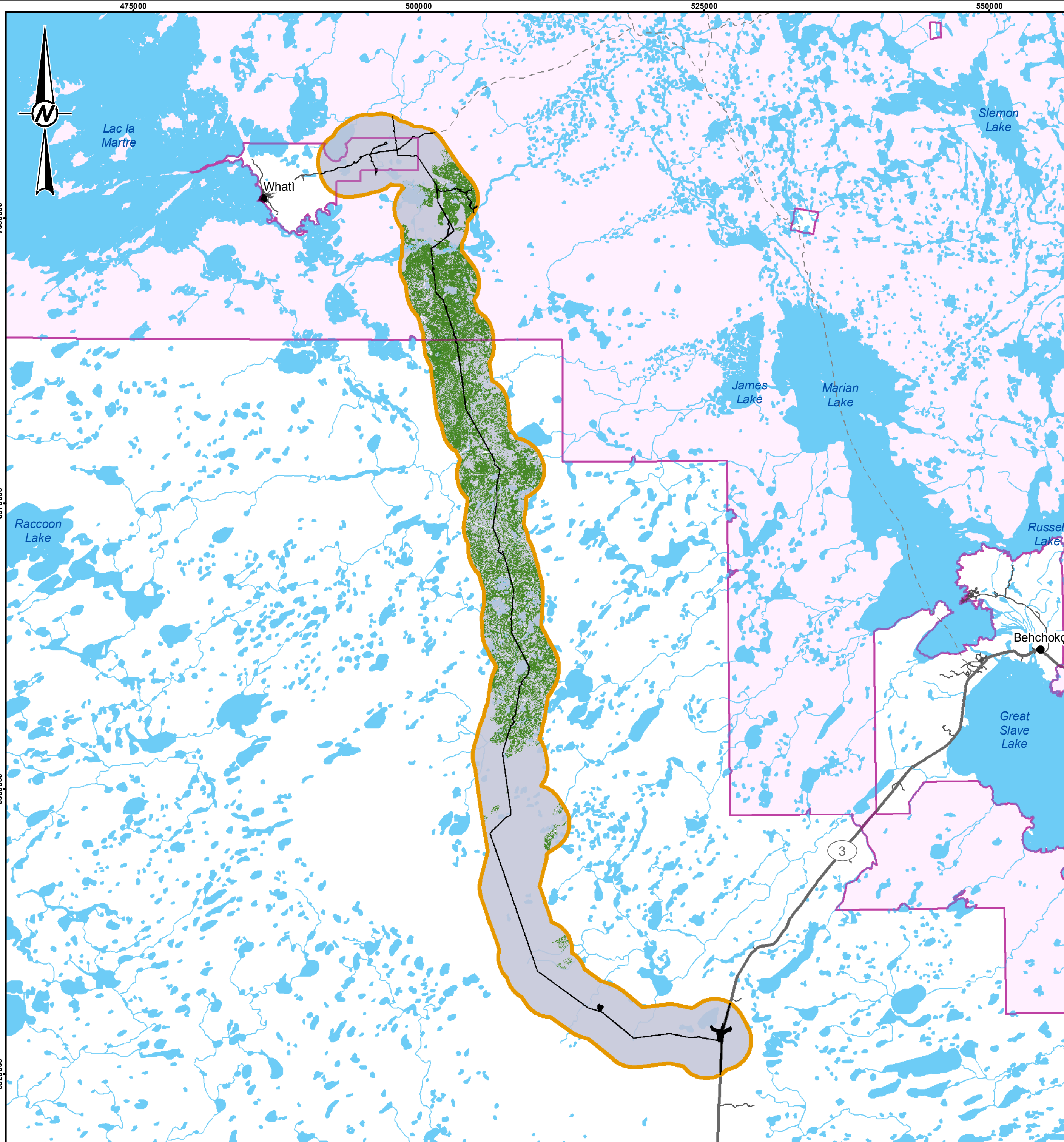
PROJECT
TŁĮCHǪ ALL-SEASON ROAD

TITLE
DISTRIBUTION OF SUITABLE BARN AND BANK SWALLOW HABITAT AT BASE CASE

CONSULTANT
Golder Associates

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO.	REV.	FIGURE
1665943	0	4.2-9



LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- WATERCOURSE
- TŁĮCHǪ LAND
- WATER BODY
- DEVELOPMENT
- BUMBLE BEE, BIRD, AND BAT RSA

HABITAT SUITABILITY

- MODERATE TO HIGH
- NIL TO LOW

0 10 20

1:500,000 KILOMETRES

REFERENCE(S)

1. CIMP INVENTORY OF LANDSCAPE CHANGE, OBTAINED FROM THE NWT CENTRE FOR GEOMATICS.
2. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.

PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
TŁĮCHǪ ALL-SEASON ROAD

TITLE
DISTRIBUTION OF SUITABLE BUMBLE BEES HABITAT AT BASE CASE

CONSULTANT

Golder Associates

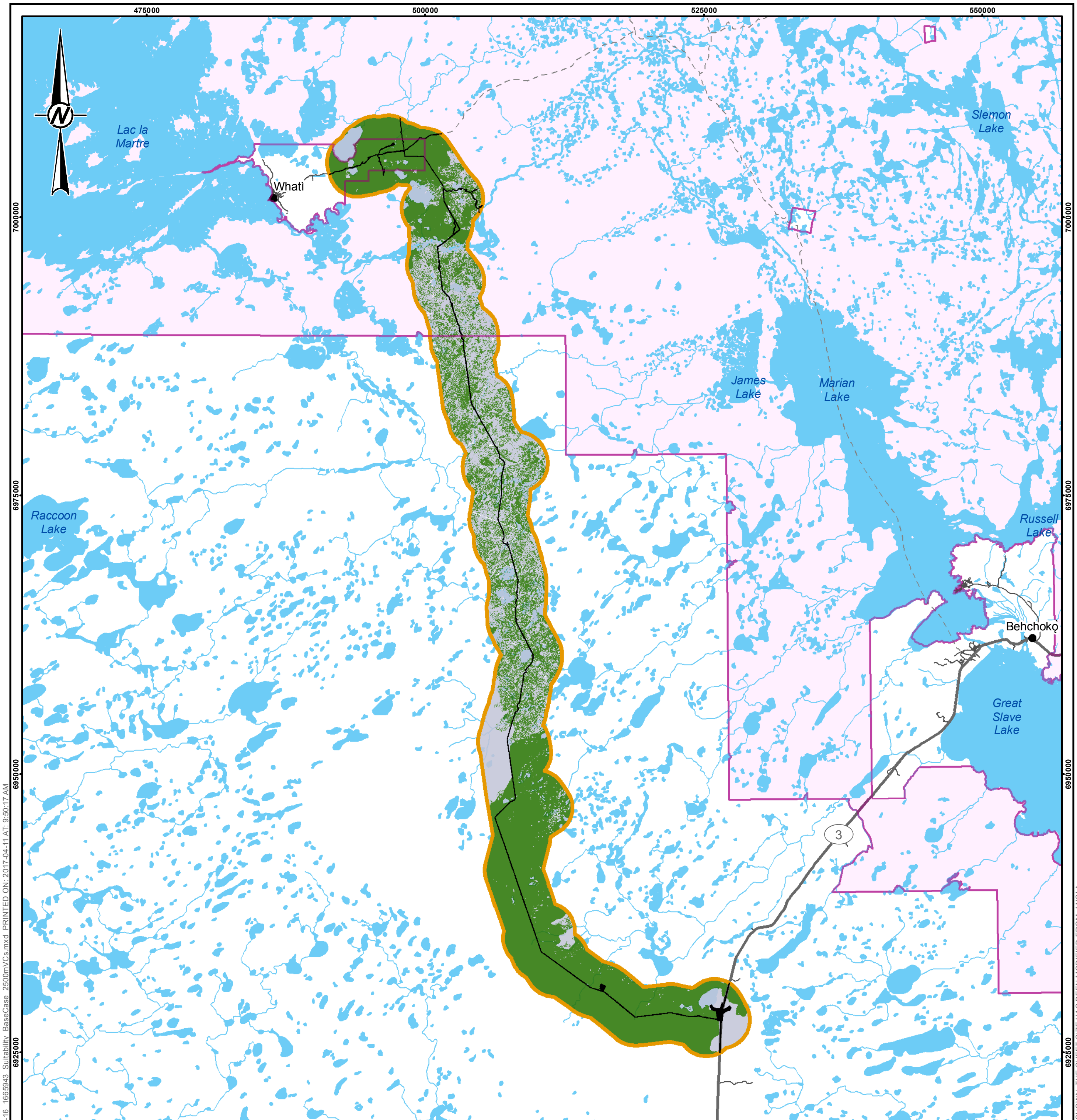
YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO.	REV.	FIGURE
1665943	0	4.2-10

PATH: I:\2016\1665943\Mapping\MXD\Wildlife\10_2_DO_NOT_OPEN_WITH_10_4\FIG4_2-8to4_2-16_1665943_Suitability_BaseCase_2500mVCs.mxd PRINTED ON: 2017-04-11 AT: 9:50:01 AM

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

25mm



LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- WATERCOURSE
- TŁĮCHǪ LAND
- WATER BODY
- DEVELOPMENT
- BUMBLE BEE, BIRD, AND BAT RSA

HABITAT SUITABILITY

- MODERATE TO HIGH
- NIL TO LOW

0 10 20

1:500,000 KILOMETRES

REFERENCE(S)

1. CIMP INVENTORY OF LANDSCAPE CHANGE, OBTAINED FROM THE NWT CENTRE FOR GEOMATICS.
2. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.

PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT

GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT

TŁĮCHǪ ALL-SEASON ROAD

TITLE

DISTRIBUTION OF SUITABLE COMMON NIGHTHAWK HABITAT AT BASE CASE

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO.	REV.	FIGURE
1665943	0	4.2-11

PATH: I:\2016\1665943\Mapping\MXD\Wildlife\10_2_DO_NOT_OPEN_WITH_10_4\FIG4_2-8to4_2-16_1665943_Suitability_BaseCase_2500mVCs.mxd PRINTED ON: 2017-04-11 AT: 9:50:17 AM

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

25mm

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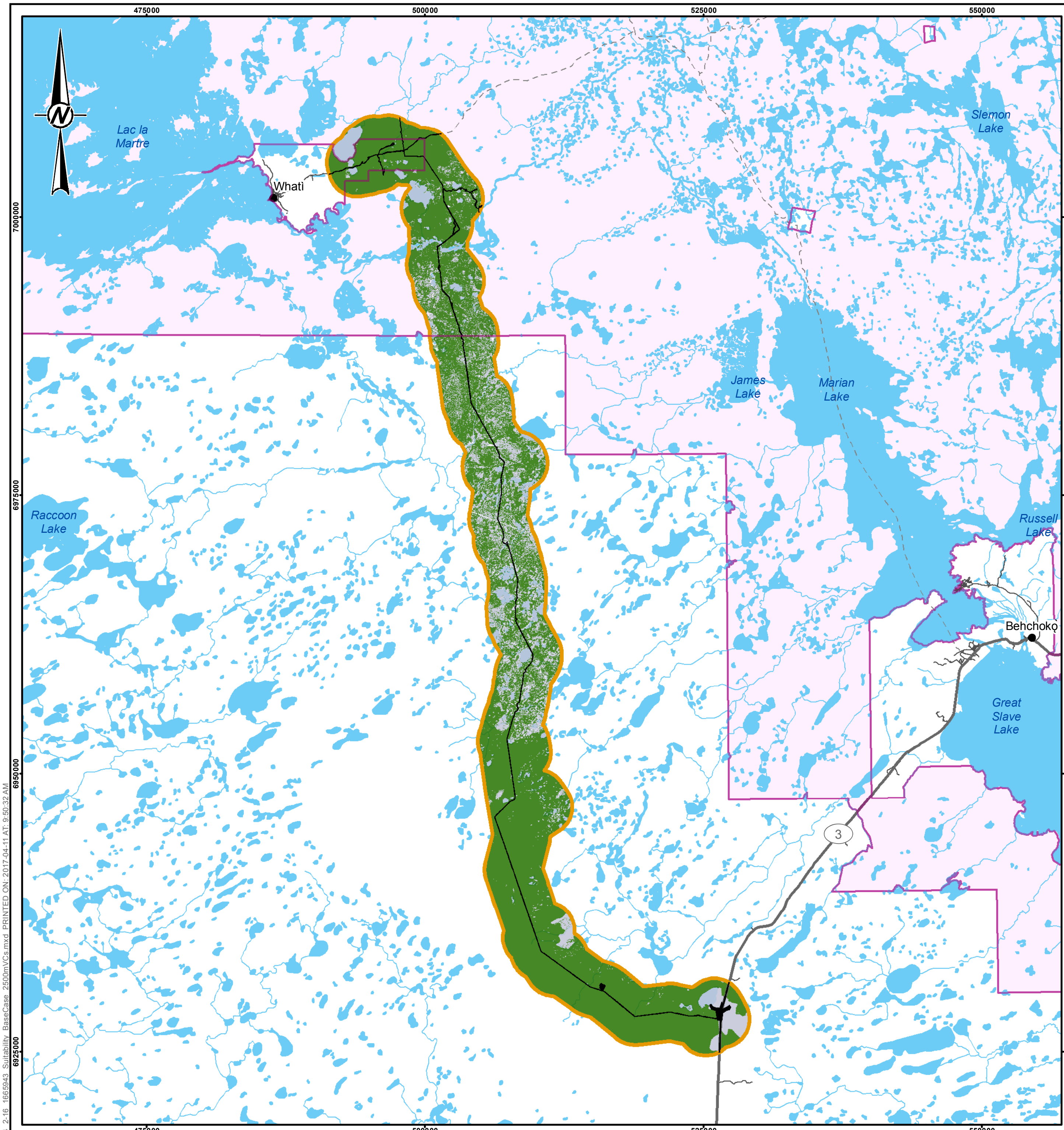

LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- WATERCOURSE
- TŁĮCHǪ LAND
- WATER BODY
- DEVELOPMENT
- BUMBLE BEE, BIRD, AND BAT RSA

HABITAT SUITABILITY

- MODERATE TO HIGH
- NIL TO LOW

0 10 20

1:500,000 KILOMETRES

REFERENCE(S)

1. CIMP INVENTORY OF LANDSCAPE CHANGE, OBTAINED FROM THE NWT CENTRE FOR GEOMATICS.
2. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.

PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
TŁĮCHǪ ALL-SEASON ROAD

TITLE
DISTRIBUTION OF SUITABLE OLIVE-SIDED FLYCATCHER HABITAT AT BASE CASE

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO.	REV.	FIGURE
1665943	0	4.2-12

PATH: I:\2016\1665943\Mapping\MXD\Wildlife\10_2 DO NOT OPEN WITH 10_4\FIG4_2-8to4_2-16_1665943_Suitability_BaseCase_2500mVCs.mxd PRINTED ON: 2017-04-11 AT: 9:50:32 AM

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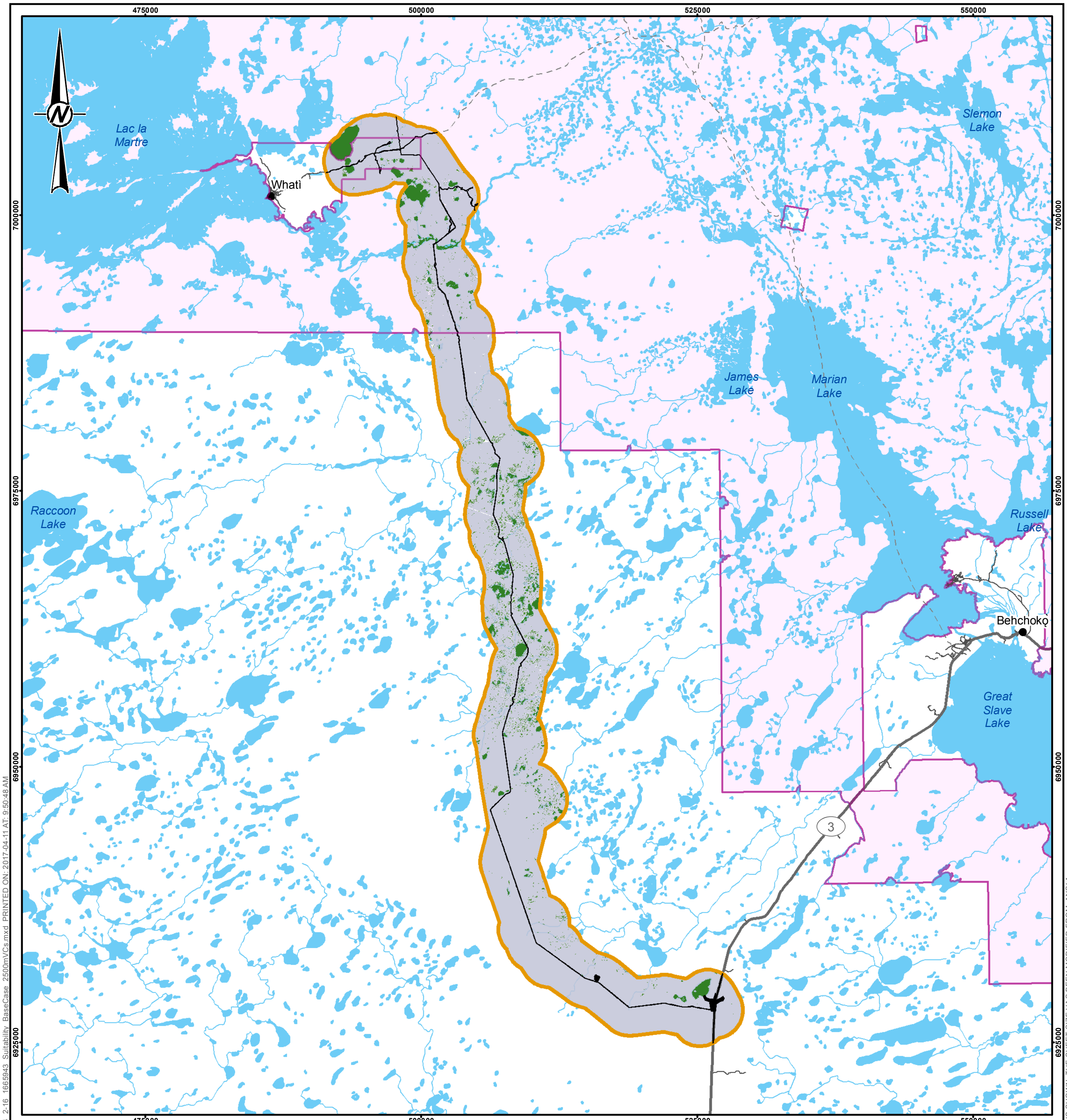
25mm



LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- WATERCOURSE
- TŁĮCHǪ LAND
- WATER BODY
- DEVELOPMENT
- BUMBLE BEE, BIRD, AND BAT RSA

HABITAT SUITABILITY

- MODERATE TO HIGH
- NIL TO LOW

0 10 20

1:500,000 KILOMETRES

REFERENCE(S)

1. CIMP INVENTORY OF LANDSCAPE CHANGE, OBTAINED FROM THE NWT CENTRE FOR GEOMATICS.
2. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.

PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
TŁĮCHǪ ALL-SEASON ROAD

TITLE
DISTRIBUTION OF SUITABLE HORNED GREBE, YELLOW RAIL AND RED-NECKED PHALAROPE HABITAT AT BASE CASE

CONSULTANT
Golder Associates

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO. 1665943
REV. 0
FIGURE 4.2-13

PATH: I:\2016\1665943\Mapping\MXD\Wildlife\10_2_DO_NOT_OPEN_WITH_10_4\FIG4_2-8to4_2-16_1665943_Suitability_BaseCase_2500mVCs.mxd PRINTED ON: 2017-04-11 AT: 9:50:48 AM

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

25mm

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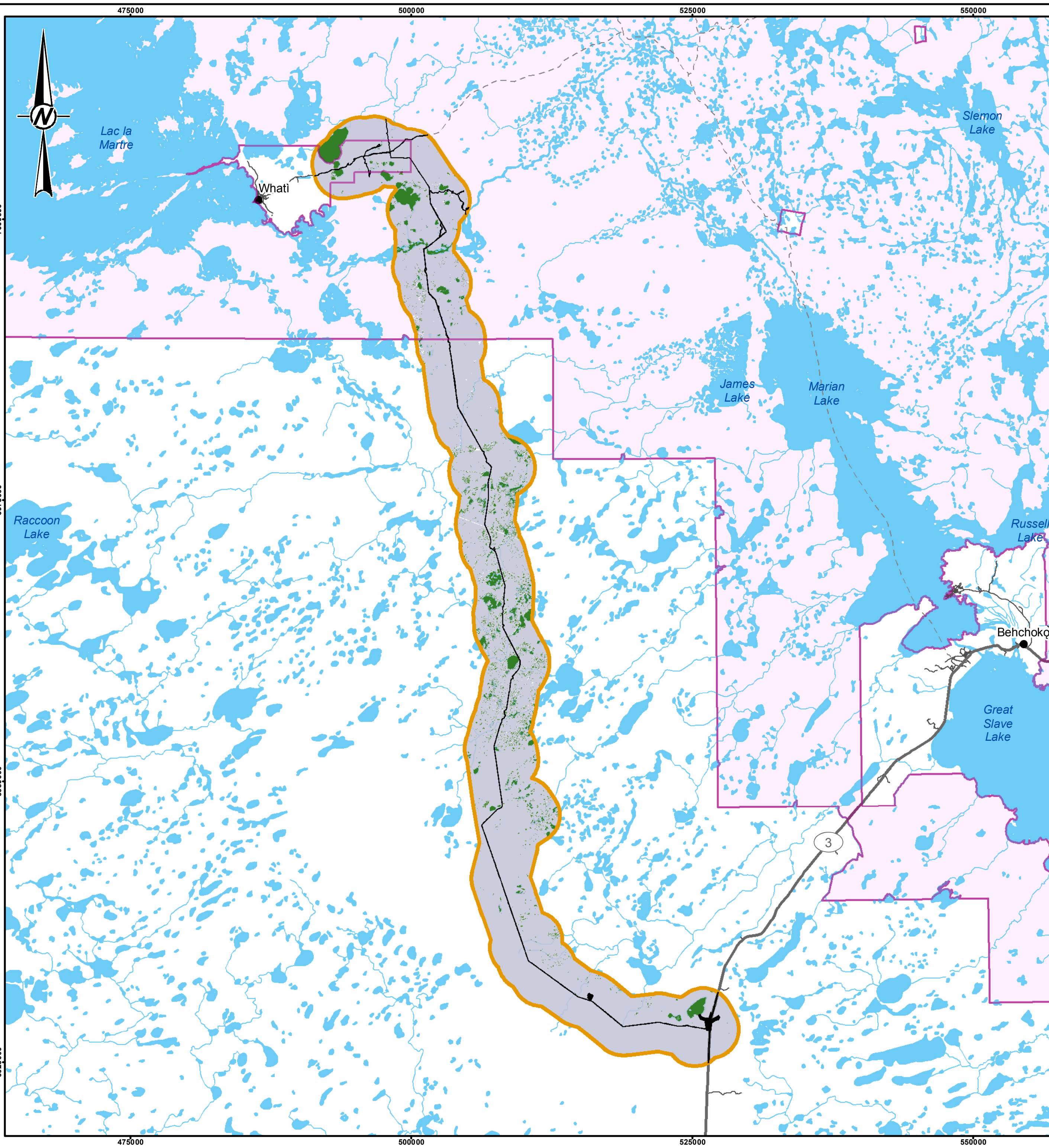


LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- WATERCOURSE
- TŁĮCHǪ LAND
- WATER BODY
- DEVELOPMENT
- BUMBLE BEE, BIRD, AND BAT RSA

HABITAT SUITABILITY

- MODERATE TO HIGH
- NIL TO LOW

0 10 20

1:500,000 KILOMETRES

REFERENCE(S)

1. CIMP INVENTORY OF LANDSCAPE CHANGE, OBTAINED FROM THE NWT CENTRE FOR GEOMATICS.
2. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.

PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
TŁĮCHǪ ALL-SEASON ROAD

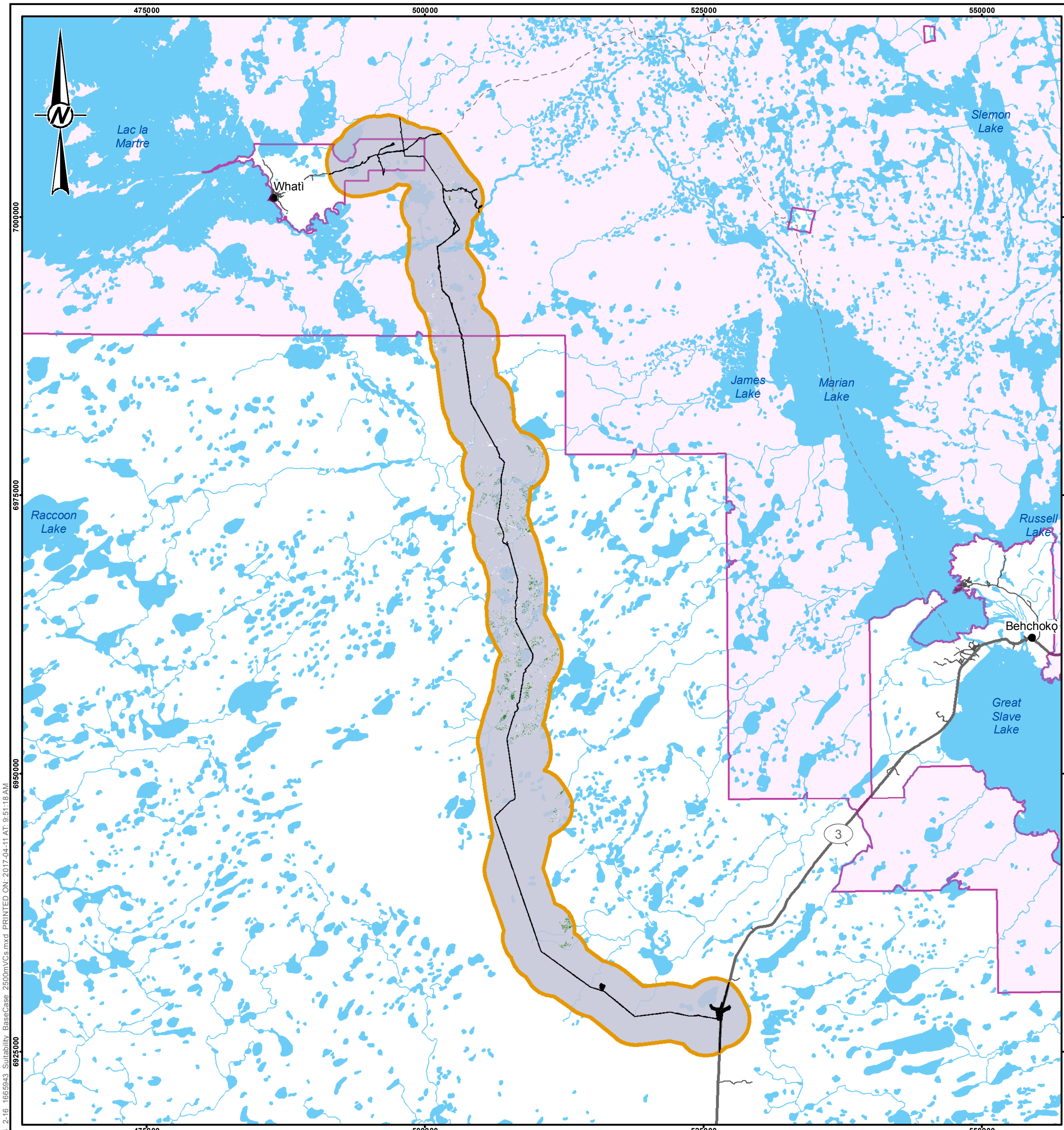
TITLE
DISTRIBUTION OF SUITABLE RUSTY BLACKBIRD HABITAT AT BASE CASE

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO.	REV.	FIGURE
1665943	0	4.2-14



LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- WATERCOURSE
- TŁĮCHǪ LAND
- WATER BODY
- DEVELOPMENT
- BUMBLE BEE, BIRD, AND BAT RSA

HABITAT SUITABILITY

- MODERATE TO HIGH
- NIL TO LOW

0 10 20

1:500,000 KILOMETRES

REFERENCE(S)

1. CIMP INVENTORY OF LANDSCAPE CHANGE, OBTAINED FROM THE NWT CENTRE FOR GEOMATICS.
2. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.

PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

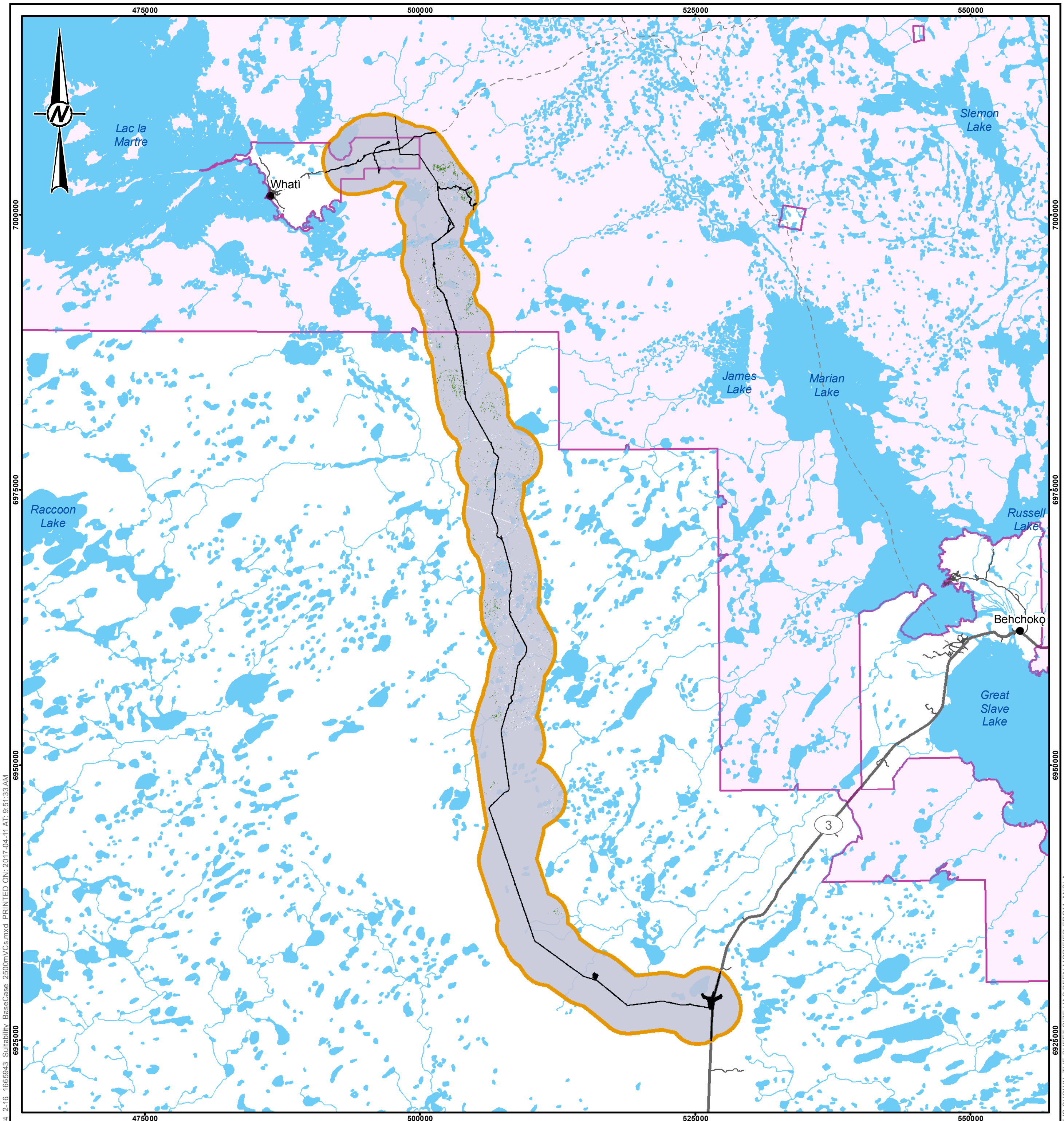
PROJECT
TŁĮCHǪ ALL-SEASON ROAD

TITLE
DISTRIBUTION OF SUITABLE PEREGRINE FALCON HABITAT AT BASE CASE

CONSULTANT

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO. 1665943 REV. 0 FIGURE 4.2-15



LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- WATERCOURSE
- TŁĮCHǪ LAND
- WATER BODY
- DEVELOPMENT
- BUMBLE BEE, BIRD, AND BAT RSA

HABITAT SUITABILITY

- MODERATE TO HIGH
- NIL TO LOW

0 10 20

1:500,000 KILOMETRES

REFERENCE(S)

1. CIMP INVENTORY OF LANDSCAPE CHANGE, OBTAINED FROM THE NWT CENTRE FOR GEOMATICS.
2. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.

PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT

GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT

TŁĮCHǪ ALL-SEASON ROAD

TITLE

DISTRIBUTION OF SUITABLE SHORT-EARED OWL HABITAT AT BASE CASE

CONSULTANT

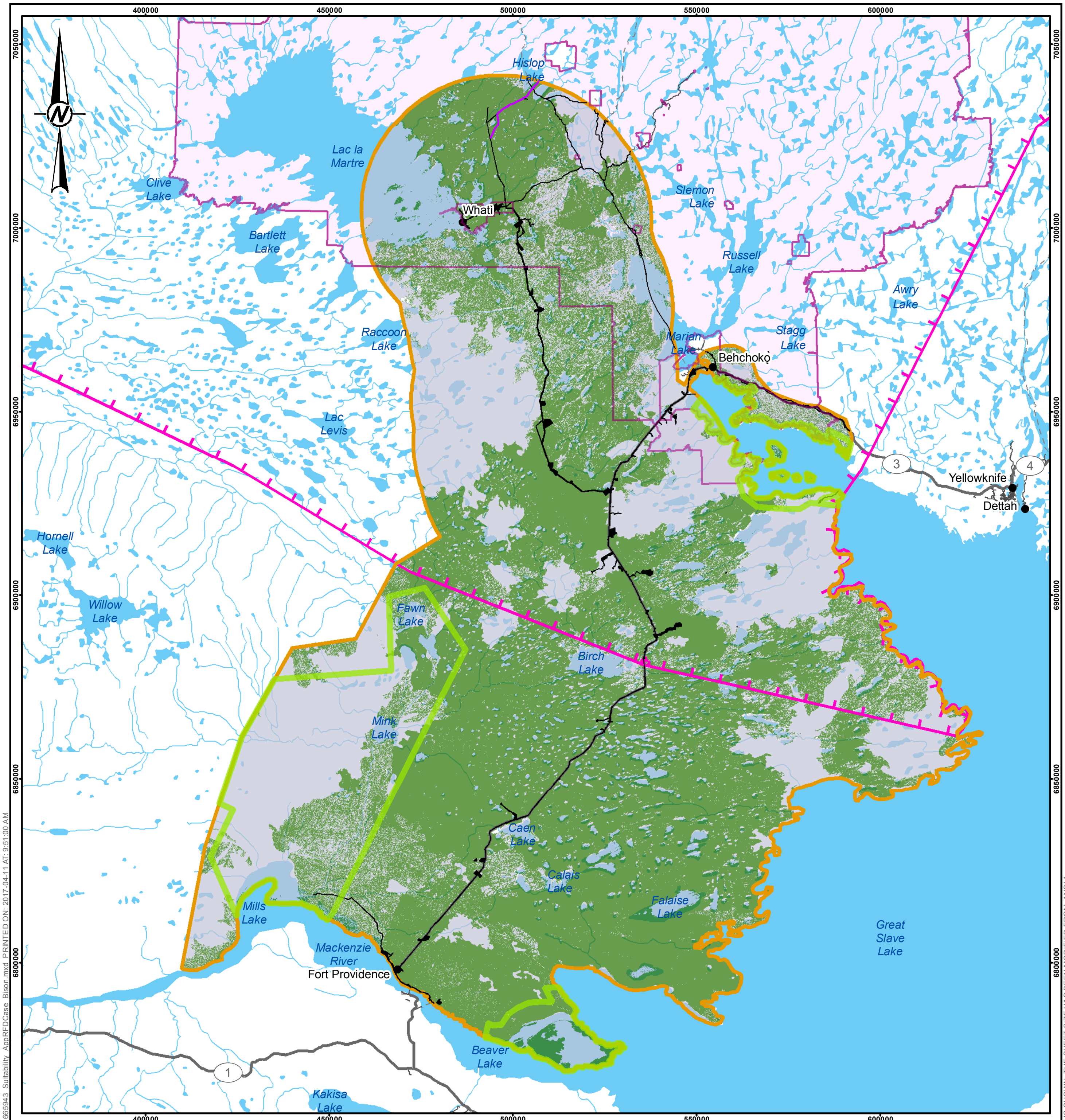
Golder Associates

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO. 1665943

REV. 0

FIGURE 4.2-16



LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- WATERCOURSE
- TŁĮCHǪ LAND
- WATER BODY
- CANDIDATE PROTECTED AREA
- DEVELOPMENT
- RFD
- BISON RSA
- WEK'ÈEZHÌI RESOURCE MANAGEMENT AREA

HABITAT SUITABILITY

- MODERATE TO HIGH
- NIL TO LOW

0 30 60

1:1,500,000 KILOMETRES

REFERENCE(S)

1. ADMINISTRATIVE REGIONS OBTAINED FROM GOVERNMENT OF NORTHWEST TERRITORIES.
2. CIMP INVENTORY OF LANDSCAPE CHANGE, OBTAINED FROM THE NWT CENTRE FOR GEOMATICS.
3. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.

PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
TŁĮCHǪ ALL-SEASON ROAD

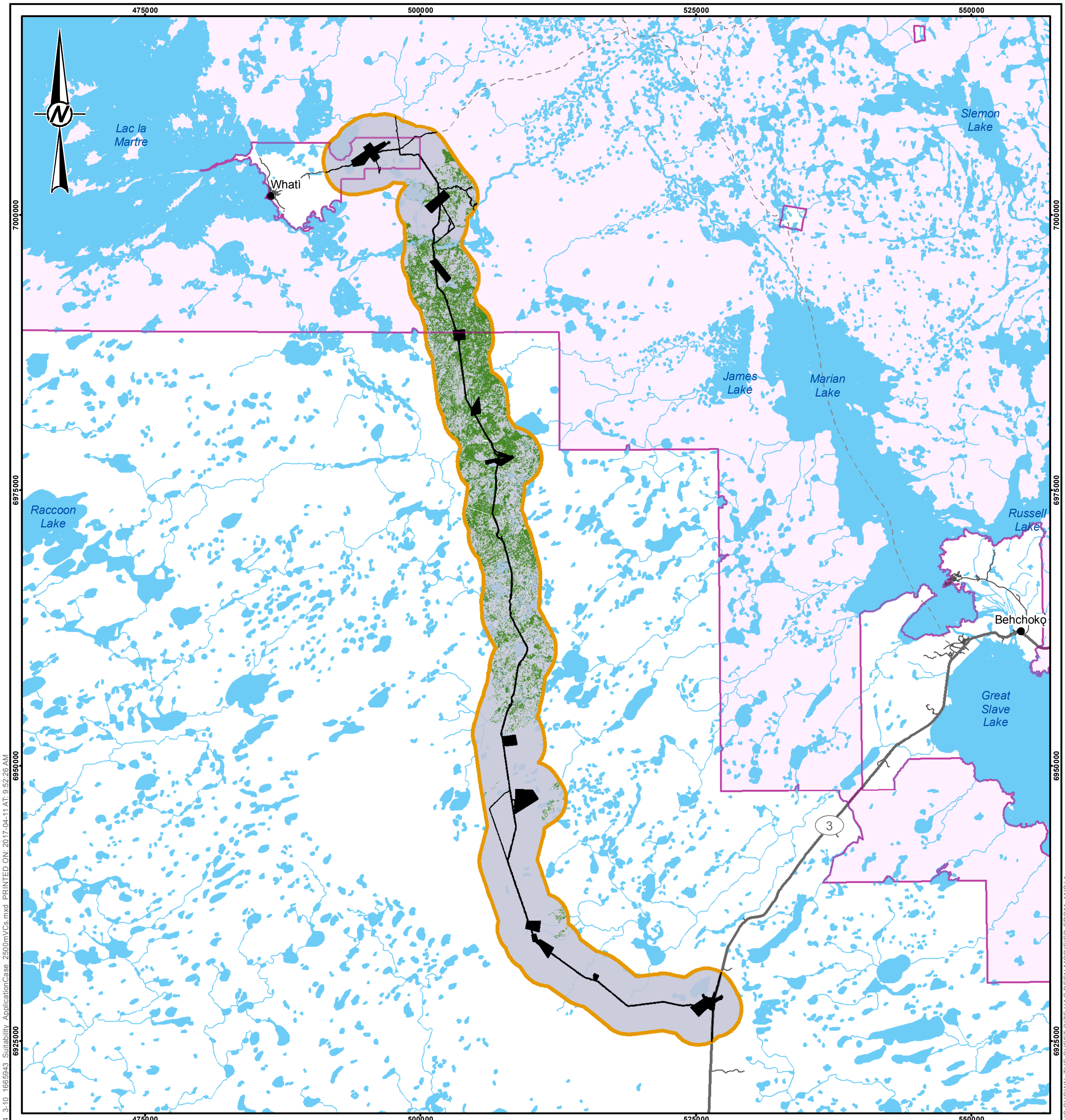
TITLE
DISTRIBUTION OF SUITABLE BISON HABITAT AT APPLICATION CASE AND RFD CASE

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO.	REV.	FIGURE
1665943	0	4.3-1



LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- WATERCOURSE
- TŁĮCHǪ LAND
- WATER BODY
- DEVELOPMENT
- BUMBLE BEE, BIRD, AND BAT RSA

HABITAT SUITABILITY

- MODERATE TO HIGH
- NIL TO LOW

0 10 20
1:500,000 KILOMETRES

REFERENCE(S)

1. CIMP INVENTORY OF LANDSCAPE CHANGE, OBTAINED FROM THE NWT CENTRE FOR GEOMATICS.
2. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.

PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

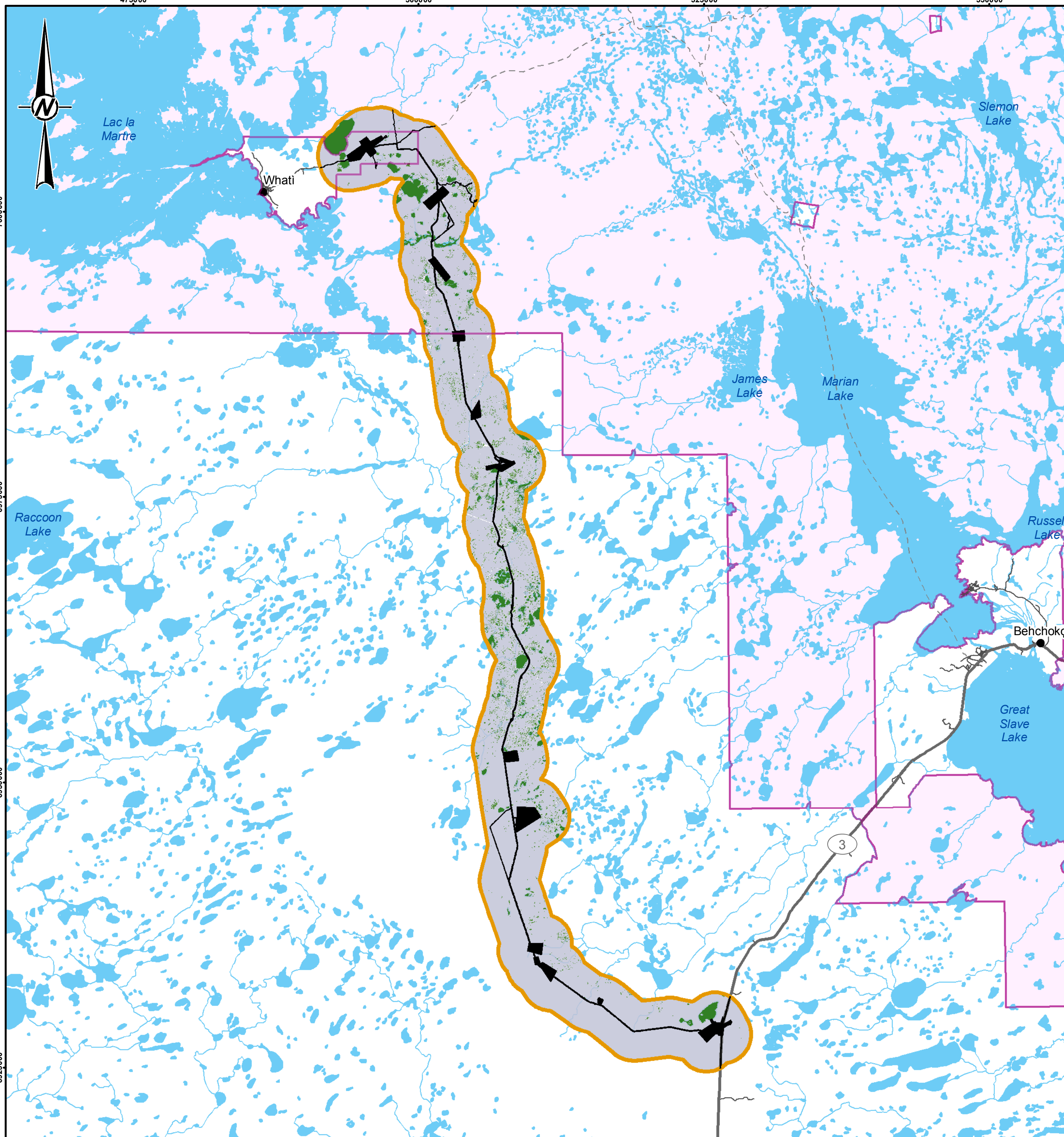
PROJECT
TŁĮCHǪ ALL-SEASON ROAD

TITLE
DISTRIBUTION OF SUITABLE LITTLE BROWN MYOTIS HABITAT AT APPLICATION CASE

CONSULTANT
Golder Associates

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO.	REV.	FIGURE
1665943	0	4.3-2



LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- WATERCOURSE
- TŁĮCHǪ LAND
- WATER BODY
- DEVELOPMENT
- BUMBLE BEE, BIRD, AND BAT RSA

HABITAT SUITABILITY

- MODERATE TO HIGH
- NIL TO LOW

0 10 20

1:500,000 KILOMETRES

REFERENCE(S)

1. CIMP INVENTORY OF LANDSCAPE CHANGE, OBTAINED FROM THE NWT CENTRE FOR GEOMATICS.
2. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.

PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
TŁĮCHǪ ALL-SEASON ROAD

TITLE
DISTRIBUTION OF SUITABLE BANK AND BARN SWALLOW HABITAT AT APPLICATION CASE

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

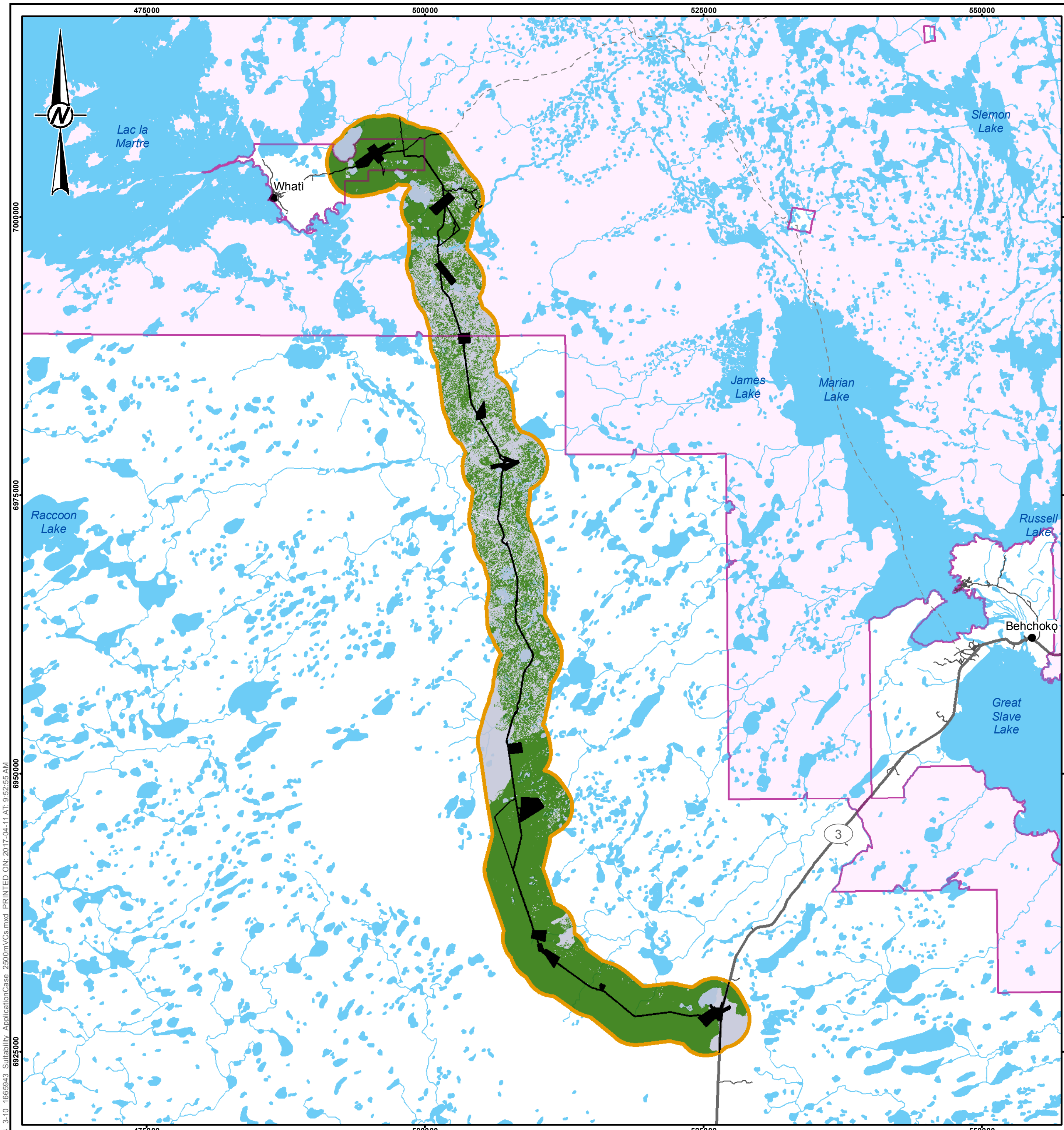
PROJECT NO.	REV.	FIGURE
1665943	0	4.3-3

PATH: I:\2016\1665943\Mapping\MXD\Wildlife\10_2_DO_NOT_OPEN_WITH_10_4\FIG4_3-2to4_3-10_1665943_Suitability_ApplicationCase_2500mVCs.mxd PRINTED ON: 2017-04-11 AT: 9:52:41 AM

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

25mm

0



LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- WATERCOURSE
- TŁĮCHǪ LAND
- WATER BODY
- DEVELOPMENT
- BUMBLE BEE, BIRD, AND BAT RSA

HABITAT SUITABILITY

- MODERATE TO HIGH
- NIL TO LOW

0 10 20

1:500,000 KILOMETRES

REFERENCE(S)

1. CIMP INVENTORY OF LANDSCAPE CHANGE, OBTAINED FROM THE NWT CENTRE FOR GEOMATICS.
2. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.

PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT

GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT

TŁĮCHǪ ALL-SEASON ROAD

TITLE

DISTRIBUTION OF SUITABLE COMMON NIGHTHAWK HABITAT AT APPLICATION CASE

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO. 1665943 REV. 0 FIGURE 4.3-4

PATH: I:\2016\1665943\Mapping\MXD\Wildlife\10_2_DO_NOT_OPEN_WITH_10_4\FIG4_3-2to4_3-10_1665943_Suitability_ApplicationCase_2500mVCs.mxd PRINTED ON: 2017-04-11 AT: 9:52:55 AM

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

25mm

LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- WATERCOURSE
- TŁĮCHǪ LAND
- WATER BODY
- DEVELOPMENT
- BUMBLE BEE, BIRD, AND BAT RSA

HABITAT SUITABILITY

- MODERATE TO HIGH
- NIL TO LOW

0 10 20

1:500,000 KILOMETRES

REFERENCE(S)

1. CIMP INVENTORY OF LANDSCAPE CHANGE, OBTAINED FROM THE NWT CENTRE FOR GEOMATICS.
2. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.

PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT

GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT

TŁĮCHǪ ALL-SEASON ROAD

TITLE

DISTRIBUTION OF SUITABLE OLIVE-SIDED FLYCATCHER HABITAT AT APPLICATION CASE

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO.	REV.	FIGURE
1665943	0	4.3-5

PATH: I:\2016\1665943\Mapping\MXD\Wildlife\10_2_DO_NOT_OPEN_WITH_10_4\FIG4_3-2to4_3-10_1665943_Suitability_ApplicationCase_2500mVCs.mxd PRINTED ON: 2017-04-11 AT: 9:53:12 AM

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

25mm

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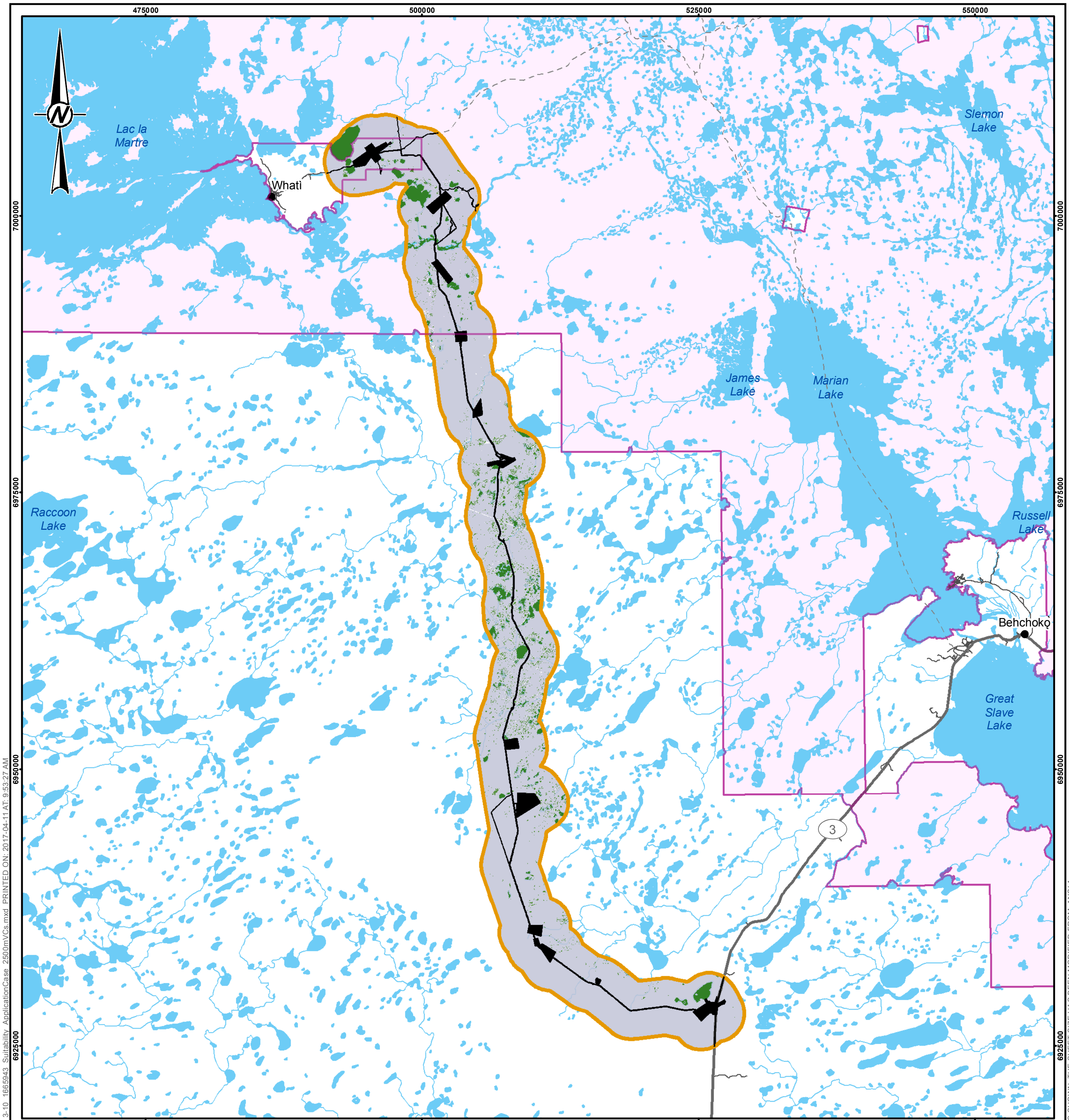


LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- WATERCOURSE
- TŁĮCHǪ LAND
- WATER BODY
- DEVELOPMENT
- BUMBLE BEE, BIRD, AND BAT RSA

HABITAT SUITABILITY

- MODERATE TO HIGH
- NIL TO LOW

0 10 20
1:500,000 KILOMETRES

REFERENCE(S)

1. CIMP INVENTORY OF LANDSCAPE CHANGE, OBTAINED FROM THE NWT CENTRE FOR GEOMATICS.
2. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.

PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

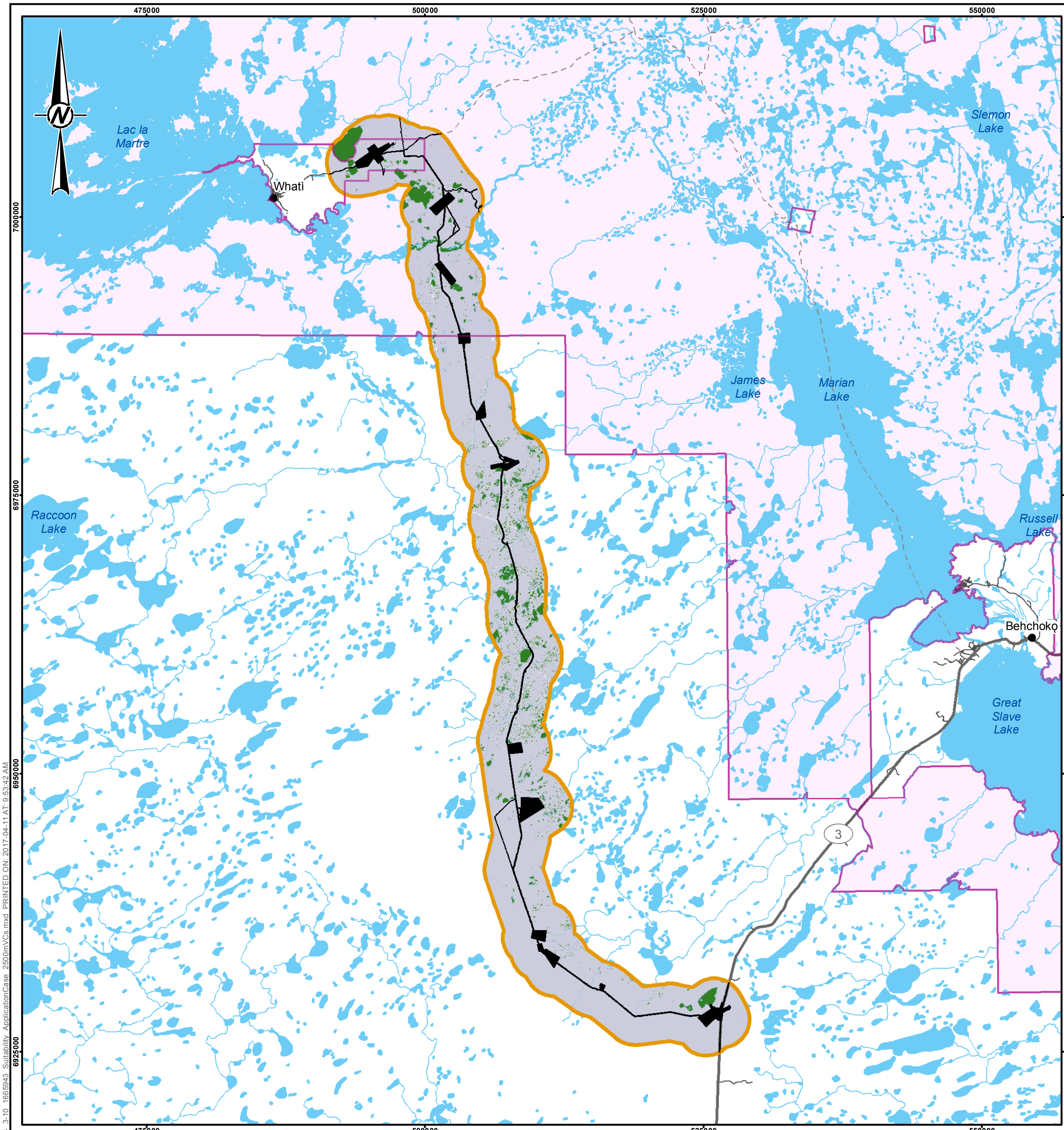
PROJECT
TŁĮCHǪ ALL-SEASON ROAD

TITLE
DISTRIBUTION OF SUITABLE RUSTY BLACKBIRD HABITAT AT APPLICATION CASE

CONSULTANT
Golder Associates

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO.	REV.	FIGURE
1665943	0	4.3-6



LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- WATERCOURSE
- TŁĮCHǪ LAND
- WATER BODY
- DEVELOPMENT
- BUMBLE BEE, BIRD, AND BAT RSA

HABITAT SUITABILITY

- MODERATE TO HIGH
- NIL TO LOW

0 10 20

1:500,000 KILOMETRES

REFERENCE(S)

1. CIMP INVENTORY OF LANDSCAPE CHANGE, OBTAINED FROM THE NWT CENTRE FOR GEOMATICS.
2. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.

PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
TŁĮCHǪ ALL-SEASON ROAD

TITLE
DISTRIBUTION OF SUITABLE HORNED GREBE, YELLOW RAIL AND RED-NECKED PHALAROPE HABITAT AT APPLICATION

CONSULTANT
Golder Associates

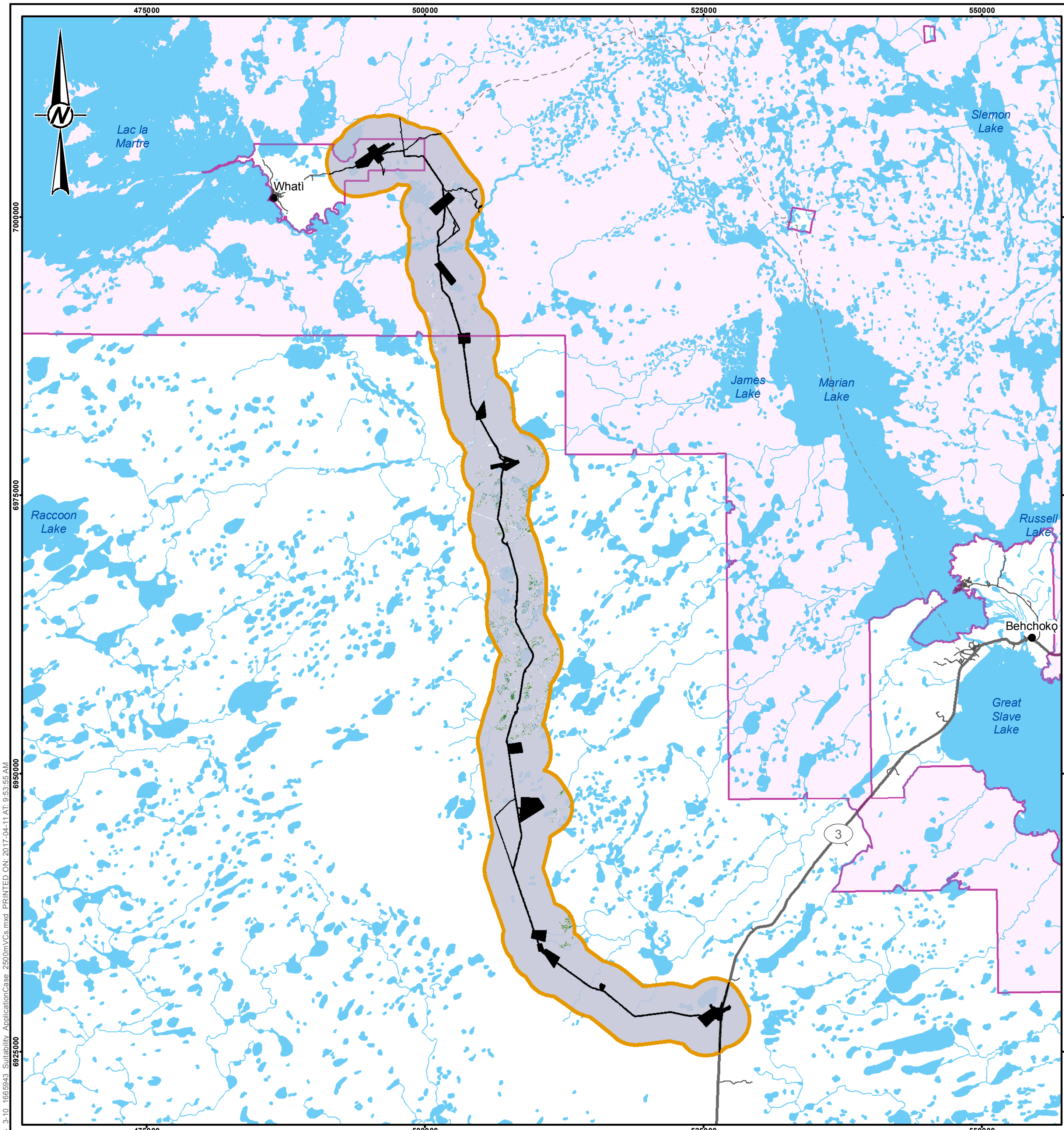
YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO.	REV.	FIGURE
1665943	0	4.3-7

PATH: I:\2016\1665943\Mapping\MXD\Wildlife\10_2_DO_NOT_OPEN_WITH_10_4\FIG4_3-2to4_3-10_1665943_Suitability_ApplicationCase_2500mVCs.mxd PRINTED ON: 2017-04-11 AT: 9:53:42 AM

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

25mm



LEGEND

- ● POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- WATERCOURSE
- TŁĮCHǪ LAND
- WATER BODY
- DEVELOPMENT
- BUMBLE BEE, BIRD, AND BAT RSA

HABITAT SUITABILITY

- MODERATE TO HIGH
- NIL TO LOW

0 10 20

1:500,000 KILOMETRES

REFERENCE(S)

1. CIMP INVENTORY OF LANDSCAPE CHANGE, OBTAINED FROM THE NWT CENTRE FOR GEOMATICS.
2. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.

PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
TŁĮCHǪ ALL-SEASON ROAD

TITLE
DISTRIBUTION OF SUITABLE PEREGRINE FALCON HABITAT AT APPLICATION CASE

CONSULTANT: Golder Associates

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO.	REV.	FIGURE
1665943	0	4.3-8

PATH: I:\2016\1665943\Mapping\MXD\Wildlife\10_2_DO_NOT_OPEN_WITH_10_4\FIG4_3-2to4_3-10_1665943_Suitability_ApplicationCase_2500mVCs.mxd PRINTED ON: 2017-04-11 AT: 9:53:55 AM

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

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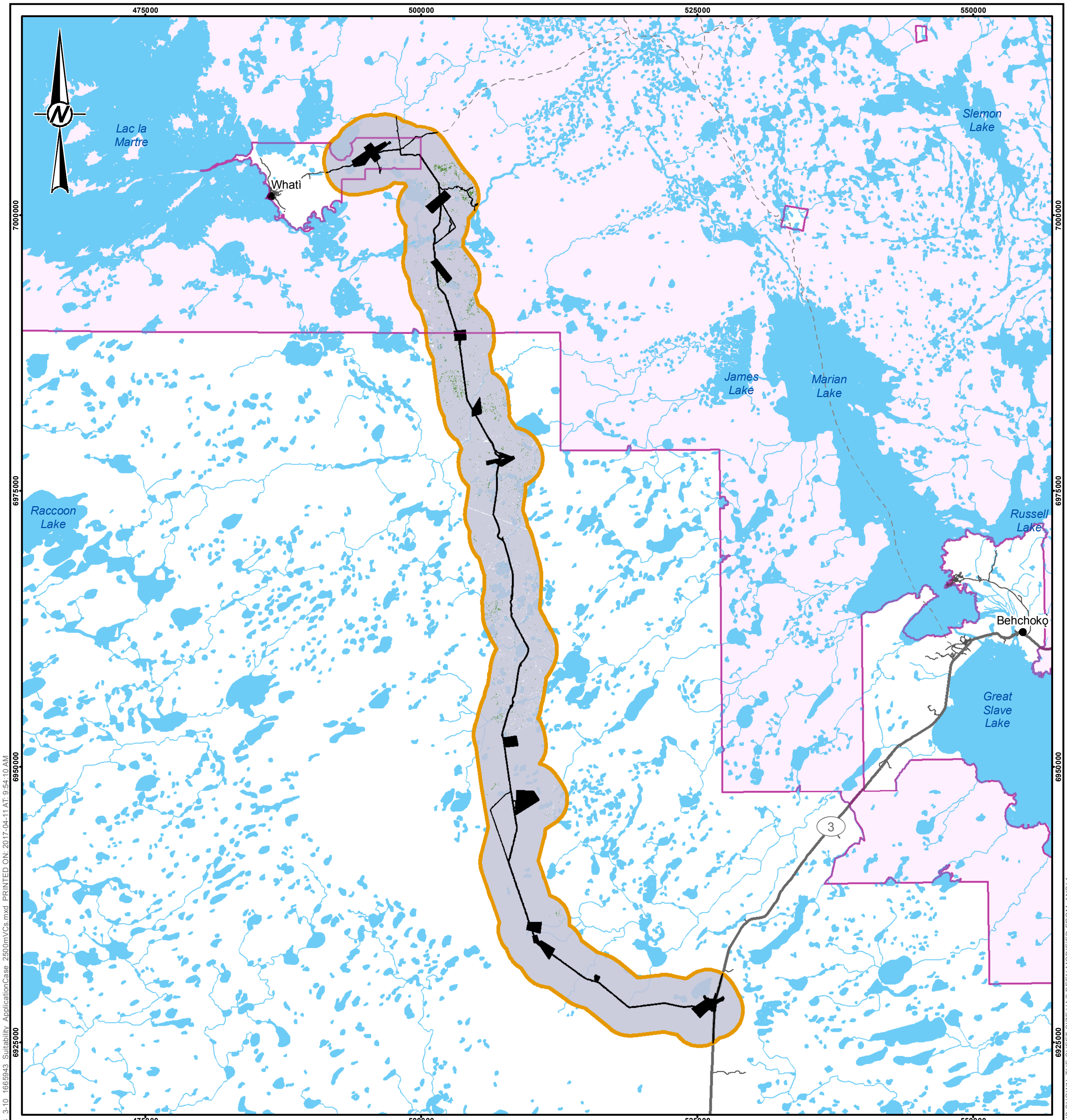


LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- WATERCOURSE
- TŁĮCHǪ LAND
- WATER BODY
- DEVELOPMENT
- BUMBLE BEE, BIRD, AND BAT RSA

HABITAT SUITABILITY

- MODERATE TO HIGH
- NIL TO LOW

0 10 20

1:500,000 KILOMETRES

REFERENCE(S)

1. CIMP INVENTORY OF LANDSCAPE CHANGE, OBTAINED FROM THE NWT CENTRE FOR GEOMATICS.
2. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.

PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
TŁĮCHǪ ALL-SEASON ROAD

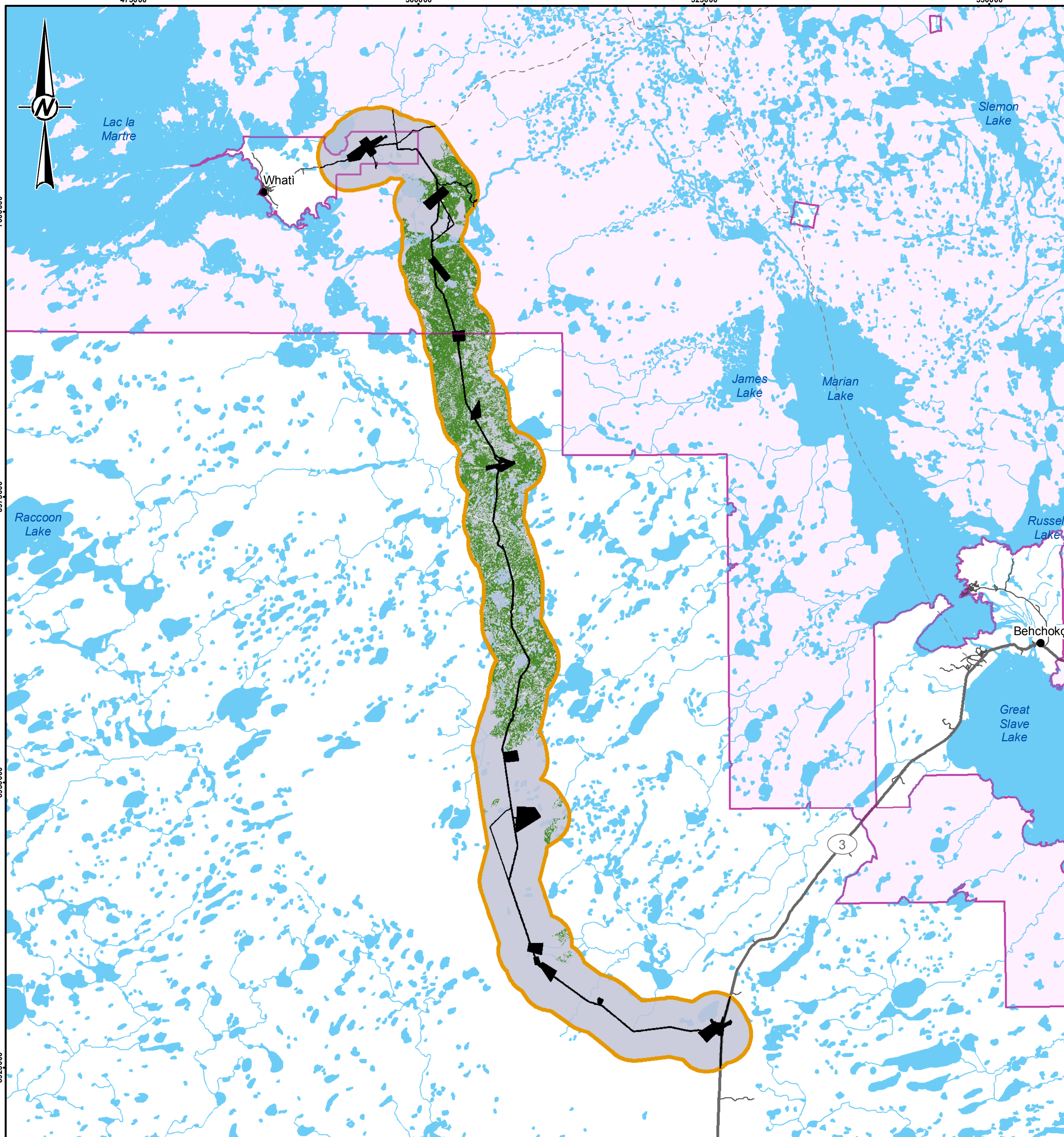
TITLE
DISTRIBUTION OF SUITABLE SHORT-EARED OWL HABITAT AT APPLICATION CASE

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO.	REV.	FIGURE
1665943	0	4.3-9



LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- WATERCOURSE
- TŁĮCHǪ LAND
- WATER BODY
- DEVELOPMENT
- BUMBLE BEE, BIRD, AND BAT RSA

HABITAT SUITABILITY

- MODERATE TO HIGH
- NIL TO LOW

0 10 20

1:500,000 KILOMETRES

REFERENCE(S)

1. CIMP INVENTORY OF LANDSCAPE CHANGE, OBTAINED FROM THE NWT CENTRE FOR GEOMATICS.
2. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.

PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

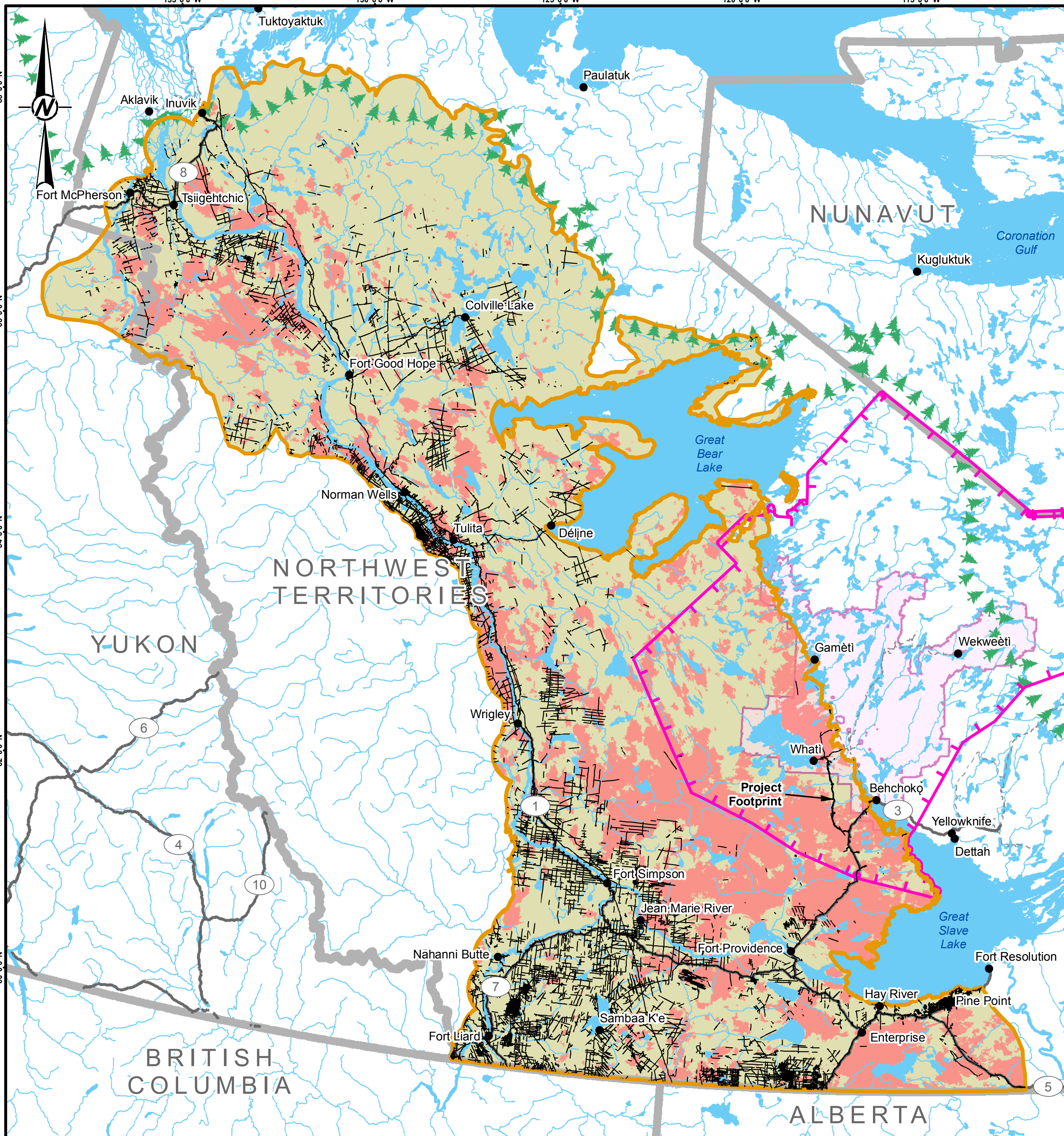
PROJECT
TŁĮCHǪ ALL-SEASON ROAD

TITLE
DISTRIBUTION OF SUITABLE BUMBLE BEE HABITAT AT APPLICATION CASE

CONSULTANT
Golder Associates

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO.	REV.	FIGURE
1665943	0	4.3-10



LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- WINTER ROAD
- TREELINE
- WATERCOURSE
- PROVINCIAL/TERRITORIAL BOUNDARY
- TŁĮCHǪ LAND
- WATER BODY
- DEVELOPMENT
- FIRE HISTORY (LESS THAN 40 YEARS OLD)
- UNDISTURBED HABITAT
- BOREAL CARIBOU RSA
- WEK'ÈEZHÌI RESOURCE MANAGEMENT AREA

0 120 240

1:6,000,000 KILOMETRES

REFERENCE(S)

1. ADMINISTRATIVE REGIONS OBTAINED FROM GOVERNMENT OF NORTHWEST TERRITORIES.
2. BOREAL CARIBOU RANGE OBTAINED FROM ENVIRONMENT CANADA, 2012.
3. CIMP INVENTORY OF LANDSCAPE CHANGE, OBTAINED FROM THE NWT CENTRE FOR GEOMATICS.
4. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.

PROJECTION: CANADA LAMBERT CONFORMAL CONIC

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

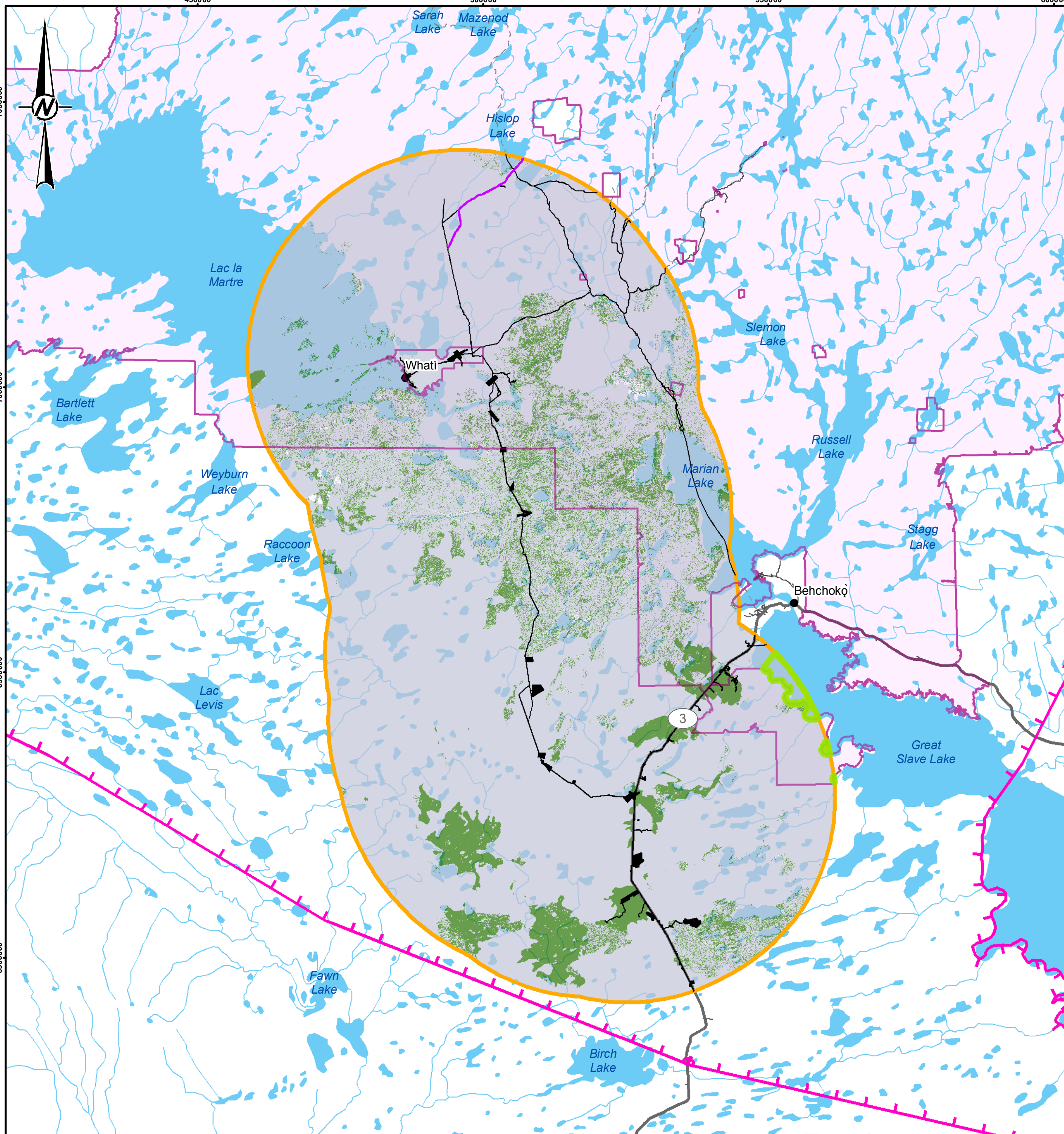
PROJECT
TŁĮCHǪ ALL-SEASON ROAD

TITLE
DISTRIBUTION OF BOREAL CARIBOU HABITAT AT APPLICATION CASE

CONSULTANT
Golder Associates

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO. 1665943 REV. 0 FIGURE 4.4-1



LEGEND

POPULATED PLACE	BARREN-GROUND CARIBOU, MOOSE, AND WOLVERINE RSA
ALL-SEASON ROAD	WEK'ÈEZHÌI RESOURCE MANAGEMENT AREA
LOCAL ROAD	**HABITAT SUITABILITY**
WINTER ROAD	MODERATE TO HIGH
WATERCOURSE	NIL TO LOW
TŁĮCHǪ LAND	
WATER BODY	
CANDIDATE PROTECTED AREA	
DEVELOPMENT	
RFD	

0 20 40

1:1,000,000 KILOMETRES

REFERENCE(S)

1. ADMINISTRATIVE REGIONS OBTAINED FROM GOVERNMENT OF NORTHWEST TERRITORIES.
2. CIMP INVENTORY OF LANDSCAPE CHANGE, OBTAINED FROM THE NWT CENTRE FOR GEOMATICS.
3. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.

PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
TŁĮCHǪ ALL-SEASON ROAD

TITLE
DISTRIBUTION OF SUITABLE BARREN-GROUND CARIBOU HABITAT AT APPLICATION CASE AND RFD CASE

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO.	REV.	FIGURE
1665943	0	4.4-2

PATH: I:\2016\1665943\Mapping\MXD\Wildlife\10_2_DO_NOT_OPEN_WITH_10_4\FIG4_4-2.bt4_4-5_1665943_Suitability_AppRFDCase_BGCaribouMooseWolverine.mxd PRINTED ON: 2017-04-11 AT: 9:53:50 AM

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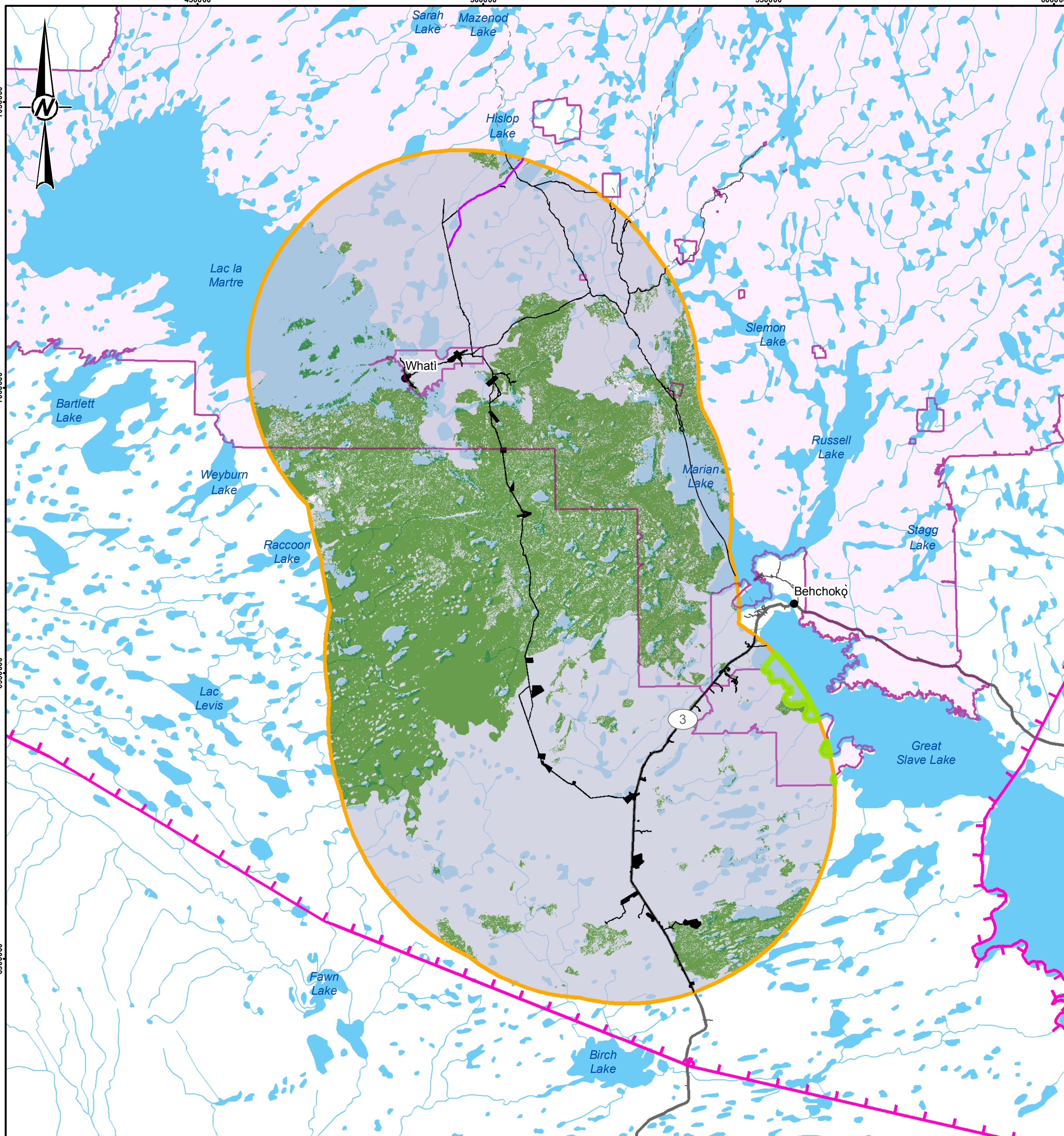
25mm



LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- WATERCOURSE
- TŁĮCHǪ LAND
- WATER BODY
- CANDIDATE PROTECTED AREA
- DEVELOPMENT
- RFD
- BARREN-GROUND CARIBOU, MOOSE, AND WOLVERINE RSA
- WEK'ÈEZHÌI RESOURCE MANAGEMENT AREA

HABITAT SUITABILITY

- MODERATE TO HIGH
- NIL TO LOW

0 20 40

1:1,000,000 KILOMETRES

REFERENCE(S)

1. ADMINISTRATIVE REGIONS OBTAINED FROM GOVERNMENT OF NORTHWEST TERRITORIES.
2. CIMP INVENTORY OF LANDSCAPE CHANGE, OBTAINED FROM THE NWT CENTRE FOR GEOMATICS.
3. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.

PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
TŁĮCHǪ ALL-SEASON ROAD

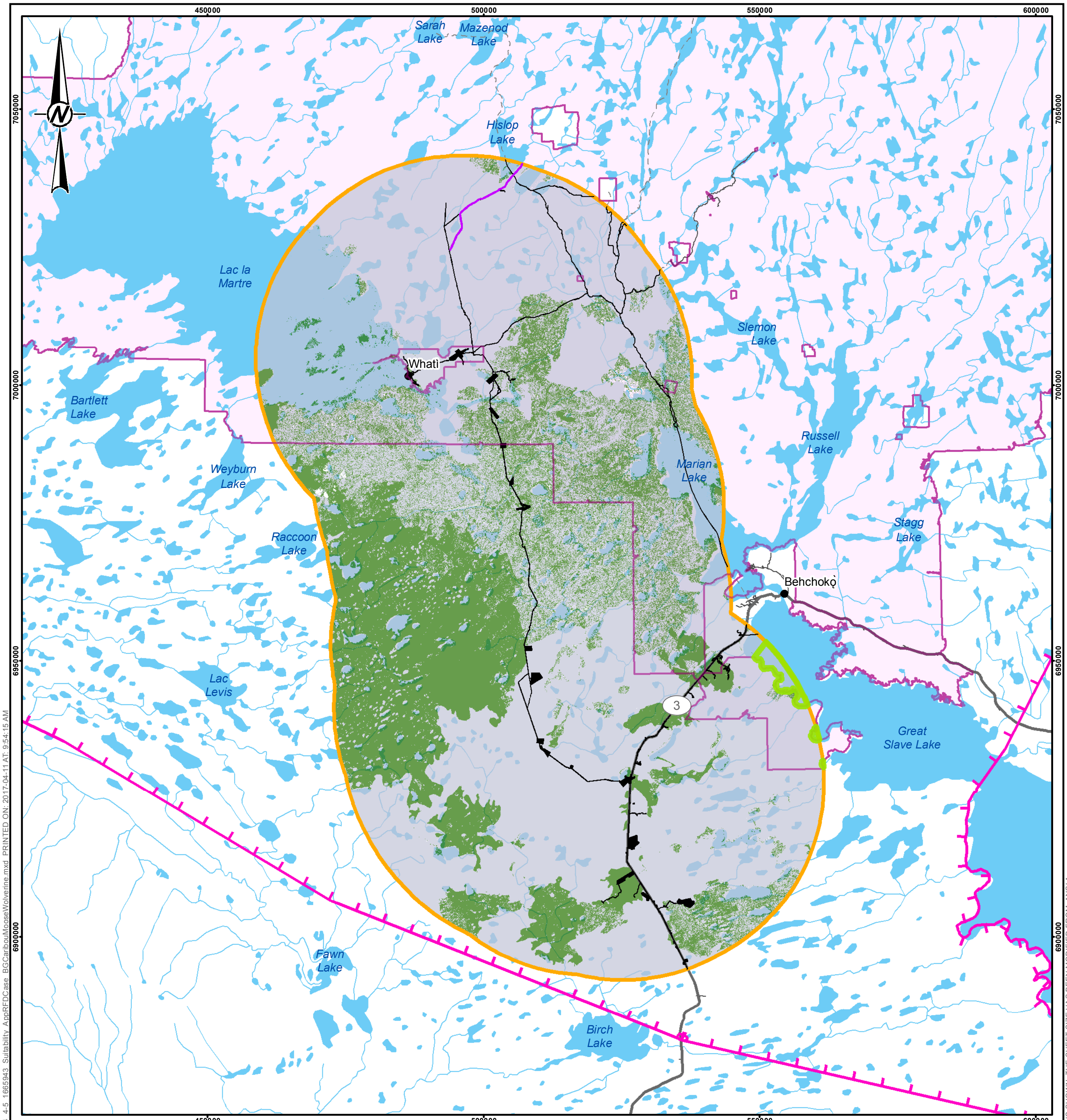
TITLE
DISTRIBUTION OF SUITABLE MOOSE HABITAT AT APPLICATION CASE AND RFD CASE

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO.	REV.	FIGURE
1665943	0	4.4-4



LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- WATERCOURSE
- TŁĮCHǪ LAND
- WATER BODY
- CANDIDATE PROTECTED AREA
- DEVELOPMENT
- RFD
- BARREN-GROUND CARIBOU, MOOSE, AND WOLVERINE RSA
- WEK'ÈEZHÌI RESOURCE MANAGEMENT AREA

HABITAT SUITABILITY

- MODERATE TO HIGH
- NIL TO LOW

0 20 40

1:1,000,000 KILOMETRES

REFERENCE(S)

1. ADMINISTRATIVE REGIONS OBTAINED FROM GOVERNMENT OF NORTHWEST TERRITORIES.
2. CIMP INVENTORY OF LANDSCAPE CHANGE, OBTAINED FROM THE NWT CENTRE FOR GEOMATICS.
3. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.

PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
TŁĮCHǪ ALL-SEASON ROAD

TITLE
DISTRIBUTION OF SUITABLE WOLVERINE HABITAT AT APPLICATION CASE AND RFD CASE

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO.	REV.	FIGURE
1665943	0	4.4-5

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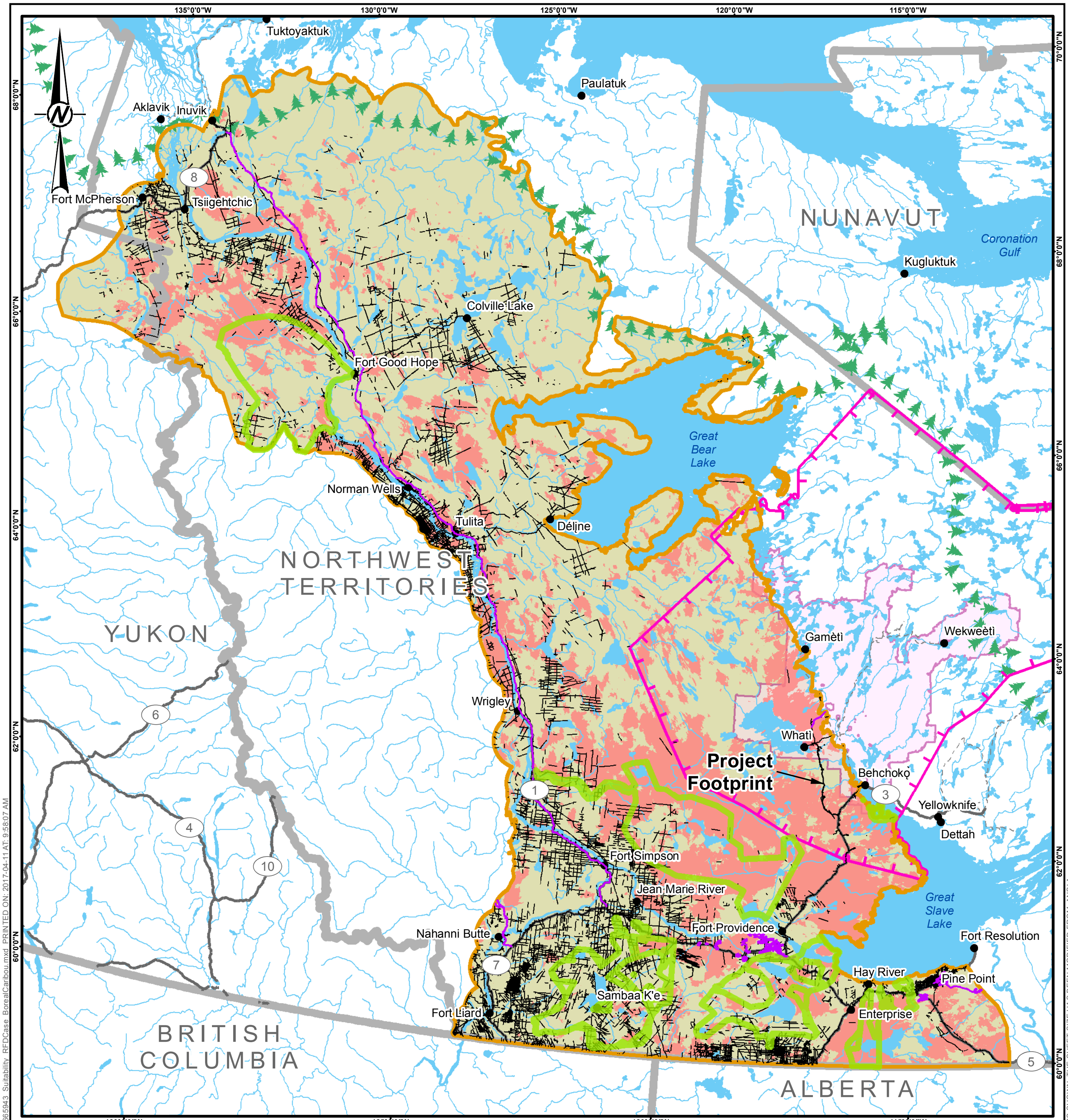


LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- WINTER ROAD
- TREELINE
- WATERCOURSE
- PROVINCIAL/TERRITORIAL BOUNDARY
- TŁĮCHǪ LAND
- WATER BODY
- CANDIDATE PROTECTED AREA
- DEVELOPMENT
- RFD
- FIRE HISTORY (LESS THAN 40 YEARS OLD)
- UNDISTURBED HABITAT
- BOREAL CARIBOU RSA
- WEK'ÈEZHÌI RESOURCE MANAGEMENT AREA

0 120 240

1:6,000,000 KILOMETRES

REFERENCE(S)

1. ADMINISTRATIVE REGIONS OBTAINED FROM GOVERNMENT OF NORTHWEST TERRITORIES.
2. BOREAL CARIBOU RANGE OBTAINED FROM ENVIRONMENT CANADA, 2012.
3. CIMP INVENTORY OF LANDSCAPE CHANGE, OBTAINED FROM THE NWT CENTRE FOR GEOMATICS.
4. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.

PROJECTION: CANADA LAMBERT CONFORMAL CONIC

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
TŁĮCHǪ ALL-SEASON ROAD

TITLE
DISTRIBUTION OF BOREAL CARIBOU HABITAT AT RFD CASE

CONSULTANT
Golder Associates

YYYY-MM-DD	2017-04-11
DESIGNED	DC
PREPARED	LMS
REVIEWED	DC
APPROVED	JV

PROJECT NO.	REV.	FIGURE
1665943	0	4.4-6

Annual Ranges of Bathurst and Bluenose East Barren-ground Herds

With respect to barren-ground caribou, please find attached two maps:

a) Bathurst Annual Density Based on Data from 1996-2015
b) Bluenose East Annual Density Based on Data 2005-2015

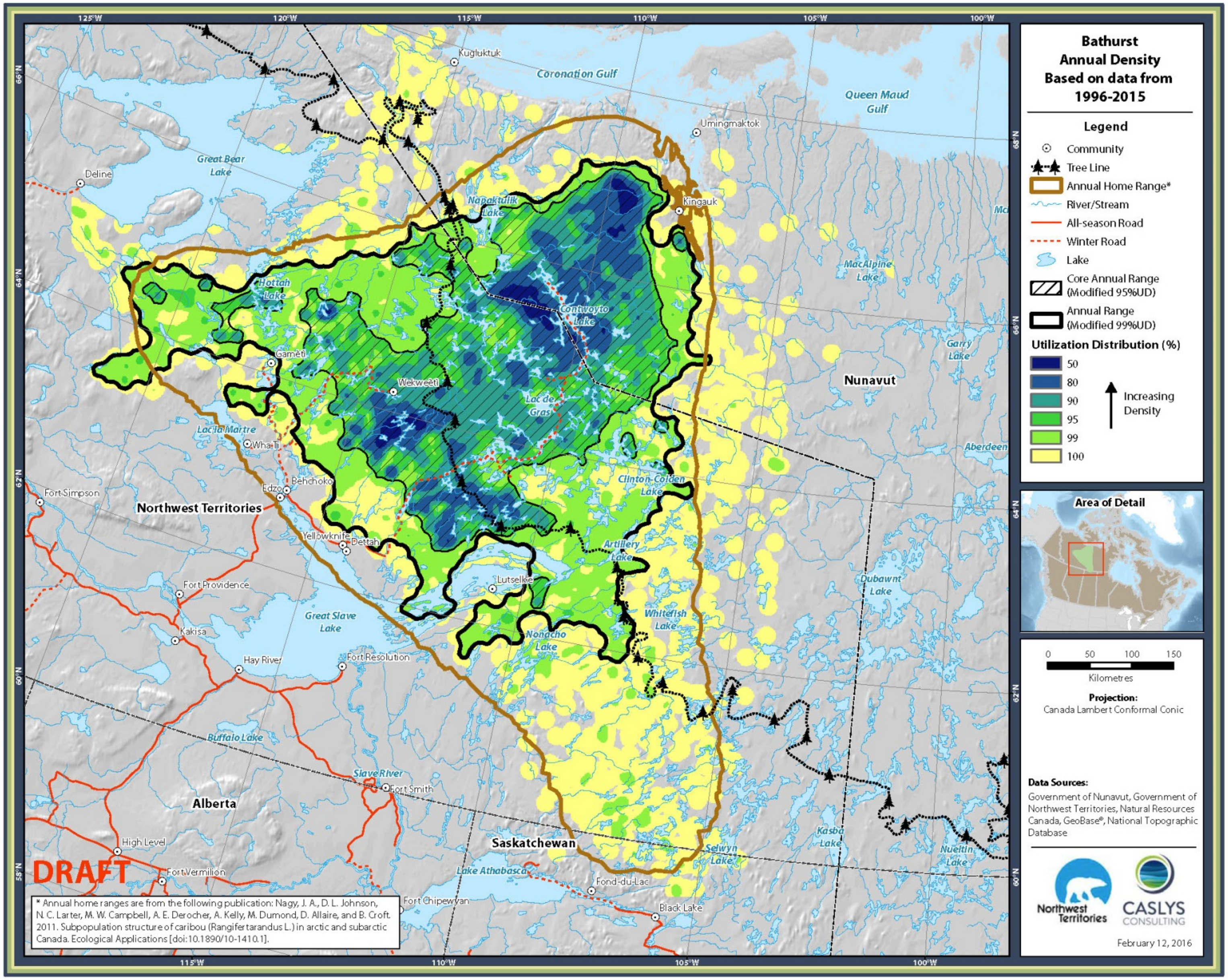
Each map depicts annual herd ranges based on caribou collaring data that have been derived from two main sources.

1) Nagy et al. 2011. Subpopulation structure of caribou (*Rangifer tarandus* L.) in arctic and subarctic Canada. Ecological Applications 21:2334–2348. http://dx.doi.org/10.1890/10-1410.1

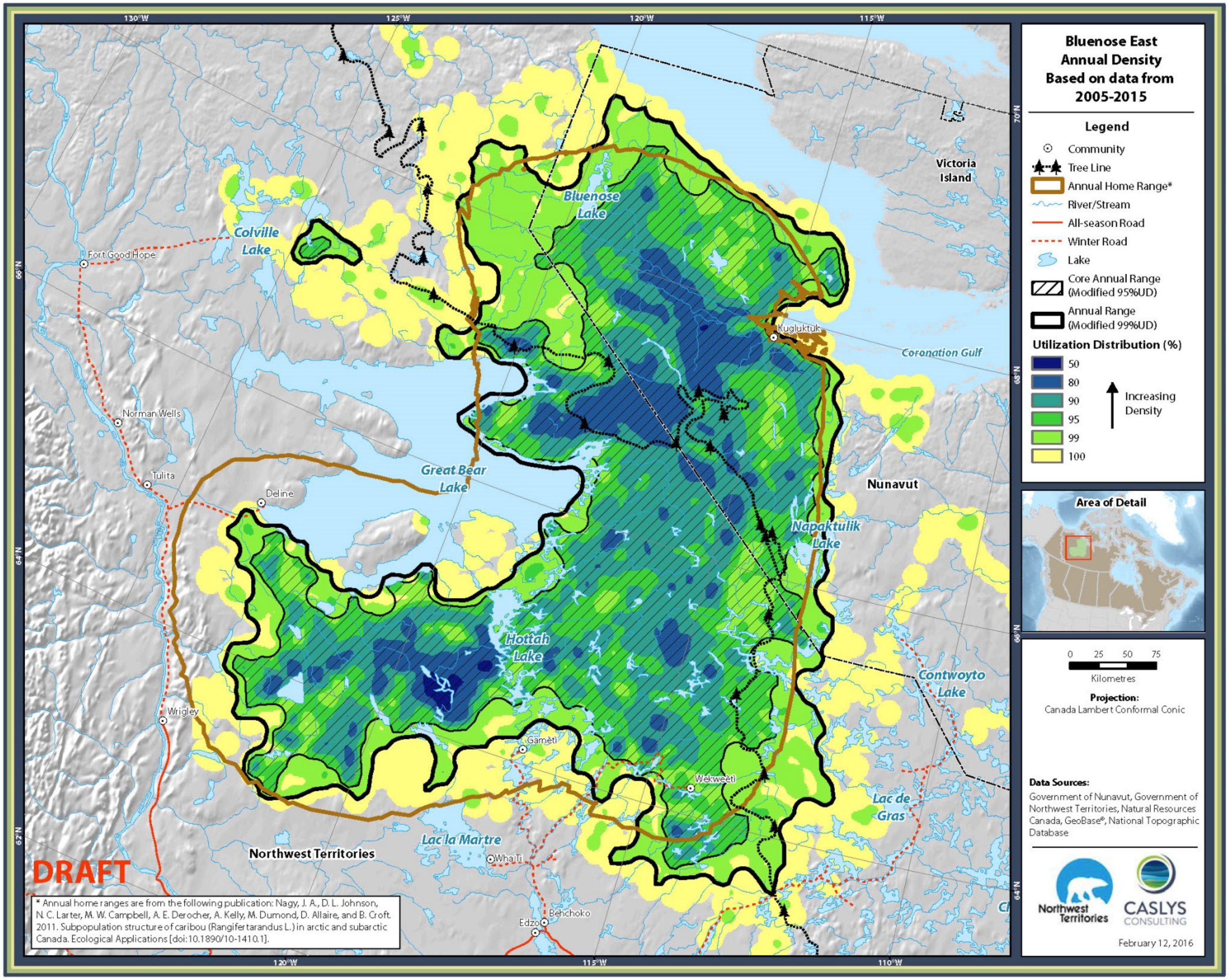
- The annual range developed by Nagy et al. 2011 is shown by the brown outline in both maps, and captures the ranges at a time of relatively high population.
- This analysis was based on collared caribou telemetry data from 1996 to 2009 only. They used a hierarchical and fuzzy clustering analysis approach to generate a 90% utilization distributions, which they defined as the core range.

2) Caribou Map Atlas produced by Caslys Consulting Ltd for the Government of Nunavut, Department of Environment and the Government of Northwest Territories, Department of Environment and Natural Resources.

- The telemetry data used for this analysis is more current and ranges from 2002 to 2015.
- Satellite and GPS telemetry locations were used in a kernel density analysis to develop a Utilization Distribution (UD) which shows the density and distribution of the telemetry locations for these herds over time. The percentages associated with the UD indicate the probability of finding a caribou within the range over the specified time period and can be considered an indication of the concentration of use within the range. The maps display areas with colour gradations ranging from dark blue depicting areas that were used more frequently by collared caribou to yellow depicting areas that were less frequently used. The 100% class encompasses the full extent of all caribou locations, whereas the classes with lower percentage values are all nested within the higher classes (i.e., the 100% class contains the full extent of the 90% class, which in turn contains the full extent of all classes beneath it). Areas with a higher utilization distribution are less critical because they encompass a larger extent of the landscape. For example, within a home range there is a 100% probability of caribou being present but much of the range is not being heavily utilized at any given time. Higher use key habitat are those with lower probabilities of caribou being present relative to the whole range.
- The annual range was defined at the 99% utilization distribution.



Bathurst
Annual Density
Based on data from
1996-2015
Legend
Community
Tree Line
Annual Home Range*
River/Stream
All-season Road
Winter Road
Lake
Core Annual Range
(Modified 95%UD)
Annual Range
(Modified 99%UD)
Utilization Distribution (%)
50
80
90
95
99
100
Increasing
Density
Area of Detail
0 50 100 150
Kilometres
Projection:
Canada Lambert Conformal Conic
Data Sources:
Government of Nunavut, Government of Northwest Territories, Natural Resources Canada, GeoBase®, National Topographic Database
Northwest Territories
CASLYS CONSULTING
February 12, 2016
DRAFT
* Annual home ranges are from the following publication: Nagy, J. A., D. L. Johnson, N. C. Larter, M. W. Campbell, A. E. Derocher, A. Kelly, M. Dumond, D. Allaire, and B. Croft. 2011. Subpopulation structure of caribou (Rangifer tarandus L.) in arctic and subarctic Canada. Ecological Applications [doi:10.1890/10-1410.1].
125°W
120°W
115°W
110°W
105°W
100°W
Kugluktuk
Coronation Gulf
Queen Maud Gulf
Umingmaktok
Great Bear Lake
Deline
Napaktulik Lake
Kingauk
Hottah Lake
MacAlpine Lake
Contwoyto Lake
Gamèti
Garry Lake
Wekweètì
Nunavut
Lac de Gras
Lac la Martre
Whatì
Aberdeen
Behchokò
Fort Simpson
Edzo
Clinton-Colden Lake
Northwest Territories
Yellowknife
Dettah
Artillery Lake
Lutselk'e
Dubawnt Lake
Fort Providence
Whitefish Lake
Great Slave Lake
Kakisa
Nonacho Lake
Hay River
Fort Resolution
Buffalo Lake
Slave River
Fort Smith
Alberta
Saskatchewan
Kasba Lake
Nueltin Lake
Selwyn Lake
High Level
Fort Vermilion
Lake Athabasca
Fond-du-Lac
Fort Chipewyan
Black Lake


Bluenose East
Annual Density
Based on data from
2005-2015
Legend
Community
Tree Line
Annual Home Range*
River/Stream
All-season Road
Winter Road
Lake
Core Annual Range
(Modified 95%UD)
Annual Range
(Modified 99%UD)
Utilization Distribution (%)
50
80
90
95
99
100
Increasing
Density
Area of Detail
0 25 50 75
Kilometres
Projection:
Canada Lambert Conformal Conic
Data Sources:
Government of Nunavut, Government of Northwest Territories, Natural Resources Canada, GeoBase®, National Topographic Database
February 12, 2016
Victoria Island
Bluenose Lake
Colville Lake
Fort Good Hope
Kugluktuk
Coronation Gulf
Norman Wells
Tulita
Great Bear Lake
Deline
Nunavut
Napaktulik Lake
Hottah Lake
Contwoyto Lake
Wrigley
Gamètì
Wekweètì
Lac de Gras
Lac la Martre
Northwest Territories
Whatì
Behchoko
Edzo
DRAFT
130°W
125°W
120°W
115°W
110°W
70°N
68°N
66°N
64°N
62°N
* Annual home ranges are from the following publication: Nagy, J. A., D. L. Johnson, N. C. Larter, M. W. Campbell, A. E. Derocher, A. Kelly, M. Dumond, D. Allaire, and B. Croft. 2011. Subpopulation structure of caribou (Rangifer tarandus L.) in arctic and subarctic Canada. Ecological Applications [doi:10.1890/10-1410.1].

As a global, employee-owned organisation with over 50 years of experience, Golder Associates is driven by our purpose to engineer earth's development while preserving earth's integrity. We deliver solutions that help our clients achieve their sustainable development goals by providing a wide range of independent consulting, design and construction services in our specialist areas of earth, environment and energy.

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