APPENDIX B

Wildlife Species at Risk Assessment

REPORT

August 2017

WILDLIFE SPECIES AT RISK ASSESSMENT

Pikangikum Distribution Line Project

Submitted to:
Wataynikaneyap Power L.P.

Report Number: 1657738

Distribution:

1 e-copy - Wataynikaneyap L.P.
1 e-copy - Ministry of Natural Resources and Forestry
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ATTACHMENT A

1.0 INTRODUCTION

Wataynikaneyap Power Limited Partnership (Wataynikaneyap) is proposing to construct, operate and maintain a 44 kV and 25 kV distribution line, the Pikangikum Distribution Project (the Project). The Project will provide a distribution connection between Pikangikum First Nation and an existing distribution line at Red Lake. The Project is located in northwestern Ontario (Figure 1). Connection to First Nation remote communities, including Pikangikum First Nation, is identified in Ontario's *Long Term Energy Plan* (LTEP) (Ministry of Energy 2013).

The Pikangikum First Nation successfully completed a federal environmental screening assessment under the previous *Canadian Environmental Assessment Act* (CEAA) (1992); and a screening under the Ministry of Natural Resources and Forestry Class Environmental Assessment Resource Stewardship and Facility Development (RSFD) screening under Category B in 2009. The 2009 federal screening environmental assessment (EA) concluded no significant impacts and received approval under Section 16 of CEAA. The Project has not yet commenced. Wataynikaneyap, as the new Project proponent, has developed a revised Project design, based on engagement results, First Nation community preference and design engineering.

More than five (5) years have elapsed since the Statement of Completion was issued by the Ministry of Natural Resources in August 20, 2009. Therefore, under the MNRF RSFD Class EA there is a requirement to provide an updated Project Description (PD). In addition, the Project crosses provincial parks and dedicated protected areas that were not identified or in force in the 2009 EA. Therefore, the MNRF Class EA Provincial Parks and Conservation Reserves (PPCR) applies and requirements of the PPCR Class EA have been included in this updated PD.

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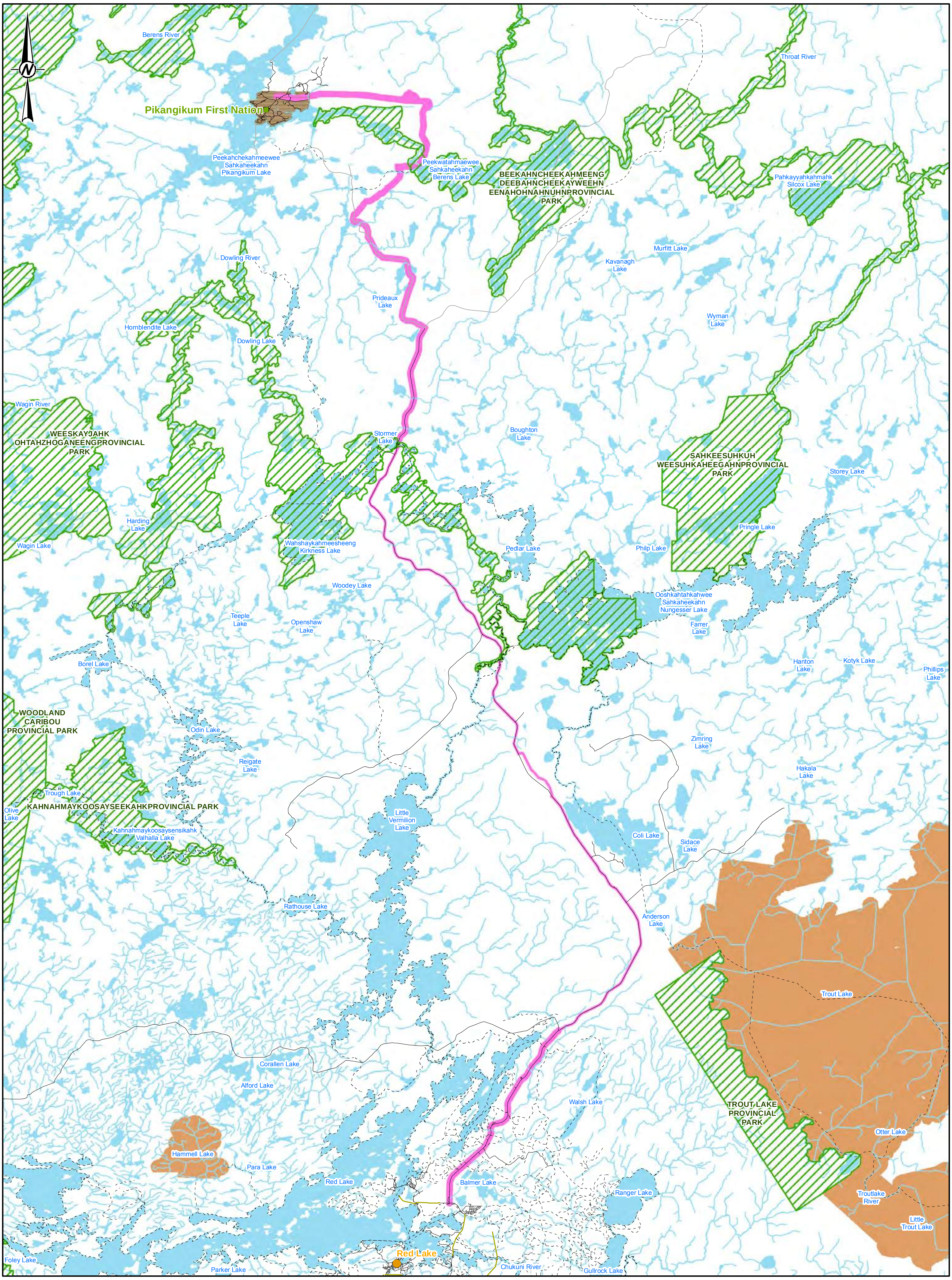

LEGEND

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- Wataynikaneyap Power Community
- Major Roads and Highways
- Winter Road
- Trail
- Existing Electrical Transmission Line
- Watercourse
- First Nation Reserve Land
- Waterbody
- Conservation Reserve
- Provincial Parks
- Project Limits of Work

REFERENCE(S)

1. BASE DATA - MNR LIO, OBTAINED 2016, NTDB
2. TRANSMISSION ROUTES - PROVIDED BY WATAYNIKANEYAP POWER L.P.
3. FIRST NATION COMMUNITIES FROM INDIGENOUS AND NORTHERN AFFAIRS CANADA (WWW.AINC-INAC.GC.CA)
4. PRODUCED BY GOLDER ASSOCIATES LTD UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2016
5. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 15

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1:280,000 Kilometers

CLIENT
WATAYNIKANEYAP POWER L.P.

PROJECT
PIKANGIKUM DISTRIBUTION LINE PROJECT

TITLE
GENERAL PROJECT LOCATION

CONSULTANT

Wataynikaneyap Power

Golder Associates

YYYY-MM-DD	2017-03-08
DESIGNED	JMC
PREPARED	JMC/PR
REVIEWED	LD
APPROVED	AE

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As identified in the letters submitted by the MNRF on April 6, 2016 and October 16, 2016, there is a requirement to complete an assessment of effects to Species at Risk (SAR) as there have been several changes to the provincial *Endangered Species Act, 2007* (ESA) since the Statement of Completion was filed in 2009. The terrestrial species or SAR specifically identified by the MNRF to be addressed include:

- Woodland caribou;
- Eastern whip-poor-will;
- Wolverine;
- Bank swallow;
- Little brown myotis; and
- Northern myotis.

The following additional SAR were also assessed:

- Bald eagle;
- Horned grebe;
- Common nighthawk;
- Olive-sided flycatcher; and
- Canada warbler.

The rationale for selection of the criteria is provided in Section 3.2. This document represents a standalone SAR Report for the updated Project. The report includes baseline characterization and effects assessment and mitigation for the above identified SAR criteria.

2.0 PROJECT DETAILS

The Project includes the construction, operation and maintenance of a 44 kV and 25 kV power line that will connect Pikangikum to the provincial power grid. The line will originate from an existing 44kV feeder on the Nungesser Road, approximately 2 km from its intersection with Highway 125, and travel north to Pikangikum First Nation community. Construction is anticipated to begin in August 2017, after acquisition of required permits and approvals; and may take up to 14 months depending on environmental conditions and restrictions, and equipment procurement lead times.

The following main project components will be constructed, operated and maintained:

Power Line and Associated Structures

The power line includes approximately 96.3 km of 44 kV and 17.8 km of 25 kV of overhead single circuit line and associated components. The northern approximately 91 km of the 44 kV portion of the line will be designed and built to be able to operate at 115 kV in the future should separate approvals be obtained for such higher voltage operation. Line structures will be single-pole, double-pole (H-frame), triple-pole (possible at sharp corners, water crossings, or long spans) or a combination. Poles may be wood, metal, concrete, resin, or a concrete-steel hybrid.

Subject to surveying, geotechnical analysis, preliminary design, and a land rights assessment, approximately 32 km of the southern-most section of line is expected to be constructed on single poles in and/or adjacent to the existing Nungesser Road right-of-way (ROW). A significant portion of the power line structures and associated conductors and anchors will be installed within or adjacent to the road ROWs. The limits of work for the power line are identified in Figure 1. Any requirements for poles or anchors outside of the ROW will be appropriately dealt with as they occur in the field during detailed design.

The limits of work were identified taking into account environmental constraints (e.g., known woodland caribou habitat use areas), available traditional land and resource use information and engagement input.

Access Roads

Existing access options are relatively abundant and their utilization will be maximized in the project design as a means of minimizing Project impact. Primary access will be from Nungesser Road, the Pikangikum All Season Road, and any newly cleared portions of all-season roads that are planned to be constructed under the Whitefeather Forest Management Plan. Approved Whitefeather Forest Management Plan all-season roads or clearings will be utilized (if constructed) to access the existing utility clearing on the north side of the Berens River and the proposed substation area. An ice crossing across the Berens River may also be utilized should ice conditions permit. No new access apart from the Project ROW clearing are anticipated to be constructed for the Project.

Substation

A distribution station (substation) is proposed to be located south of the Berens River (Figure 1). The location is proposed to avoid having to transport materials and equipment across the Berens River and/or along the existing utility clearing running east out of Pikangikum First Nation; and therefore reduce environmental effects to the river, the challenge in responding to maintenance needs, and risks to the Project construction schedule. The substation will have an approximately 70 m x 80 m footprint.

Helicopter Landing Pad and Staging Area

A helicopter landing pad and a permanent equipment staging area may be required at the substation location. A helicopter landing pad would have a minimum area of approximately 30 m x 30 m, subject to terrain and vegetation conditions as well as aeronautical approval requirements. In total, the staging area and helicopter pad require approximately 100 m x 100 m of cleared area in addition to the substation fenced area above.

Additional Temporary Project Components

Additional temporary Project components will be required during construction, which will include the following:

- **Aggregate Sources** – subject to geotechnical and engineering analysis, substation foundations and pole foundation backfill may consist of either native soil (if deemed suitable), or contain concrete and/or aggregate. Aggregate will be sourced from either local existing facilities, or will be taken from a new hole dug near the pole foundation hole for the purposes of swapping subgrade with the pole foundation hole. Concrete will likely be sourced from supplier(s) in Red Lake, or will be brought to the site in dry format and mixed in small quantity near each foundation hole using water provided from off-site delivery trucks.

- **Construction Worker Housing** – Construction workers may be housed in existing private accommodations such as the Stormer Lake Camp owned by Pikangikum First Nation, and /or in the Municipality of Red Lake, and/or in Pikangikum First Nation.

  If necessary, temporary accommodations may be established and separately permitted by the selected constructor. Should this be the case, the following activities are assumed:

  - Power source is anticipated to be a portable diesel generating station;
  - Water will be sourced from either off-site delivery trucks or separately permitted local source
  - All liquid and solid waste will be appropriately stored onsite and transported to facilities licensed to dispose of the waste. There will be no discharge of liquid waste from the temporary accommodation unless separately permitted and approved.

  All applicable permits and approvals will be acquired for any temporary accommodation, should it be required.

- **Laydown Areas** – apart from the substation area, temporary laydown areas for the storage of materials and equipment will be located on existing cleared areas within the limits of work, or areas reachable by existing roads originating within the limits of work, with appropriate set back distances from sensitive environmental features.

- **Watercourse Crossing** – It is anticipated that there will not be a requirement for new watercourse crossings for power line construction as the ROW follows existing and planned roads or existing ROW area. If the planned Whitefeather Forest Management Plan roads are not constructed prior to construction timing of the Project, or the Whitefeather Forest Community Resource Management Authority is unable to construct the roads in accordance with their approvals; there may be a requirement for new watercourse crossings. If required, mitigation measures including minimizing removal of bank stabilizing vegetation where possible, will be employed during construction of the watercourse crossings considering MNRF's Environmental Guideline for Access Roads and Water Crossings (1990).

- **Refueling Areas** – refuelling areas will be located in the Municipality of Red Lake, the Pikangikum First Nation community, or other private facility unless separate permits are obtained for a temporary construction camp.

Additional information on project details is provided in Section 5.0 Project Details of the Project Description document.

3.0 EFFECTS ASSESSMENT METHOD

3.1 Overall Approach

The overall approach to the EA includes the following main steps:

- Describing the Project (Section 2.0 above and updated PD Section 5.0);
- Identifying components of the environment (including criteria, assessment endpoints and indicators) that may interact with the Project to focus the assessment, done in engagement with Aboriginal people, government agencies, and other interested parties;
- Defining the spatial and temporal boundaries for the assessment of criteria, and the assessment cases used to evaluate the effects of the Project;
- Describing existing conditions (Base Case);
- Identifying potential Project-environment interactions and screening effects pathways by completing an analysis of Project components and activities and the environment interactions, including consideration of mitigation, to focus those Project environment interactions that could create a net effect (referred to in this report as primary effect pathways);
- Predicting and characterizing net effects from the Project (Project Case);
- Predicting and characterizing cumulative effects from the Project Case in combination with past, present and reasonably foreseeable future activities (Reasonably Foreseeable Development Case [RFD Case]);
- Determining the significance of the net effects of the Project Case and the RFD Case;
- Identifying key factors influencing confidence in effects predictions and how uncertainty is managed so that effects are not underestimated; and
- Identifying monitoring and follow-up to test effects predictions and the effectiveness of mitigation, and address uncertainty.

3.2 Criteria, Assessment Endpoints, and Indicators

Criteria are components of the environment that are considered to have economic, social, biological, conservation, aesthetic and/or ethical value by participants in the public review process (Beanlands and Duinker 1983). The selection of appropriate criteria allows the assessment to be focused on those aspects of the natural and human environment that are of greatest importance to society and which will provide understanding of the significance of the effects of a project. SAR criteria species that were assessed in this report are listed in Table 1.

Table 1: Rationale for Selected SAR Criteria

Criteria	SARO[(a)] Status	COSEWIC[(b)] Status	SARA[(c)] Status	Rationale for Selection
Forest dwelling woodland caribou	Threatened	Threatened	Threatened	■ federally and provincially listed ■ regional connectivity is an issue of concern ■ social/cultural importance ■ relies on large areas of well-connected mature coniferous forest and bog-fen habitats ■ considered an umbrella species to support conservation of other wildlife and regional biodiversity
Wolverine	Threatened	Special Concern	No Status	■ provincially listed ■ social/cultural importance ■ requires large tracts of undisturbed habitat ■ considered an umbrella species to support conservation of other wildlife and regional biodiversity
Little brown myotis	Endangered	Endangered	Endangered	■ provincially and federally listed ■ dependent on standing dead and live trees for maternity roosts in mature deciduous and mixed stands ■ represents a species that requires open forest/edge habitat in wetter areas ■ surrogate for other provincially and federally listed bats (e.g., northern myotis)
Bald eagle	Special Concern	Not at Risk	No Status	■ provincially listed ■ important for continued ecological function of boreal ecosystems ■ social/cultural importance ■ breeding habitat is limited ■ sensitive to noise and human activity during nesting ■ considered a keystone species1

[1] A keystone species is a species that has a disproportionately large effect on its environment relative to its abundance (Paine 1995).

Table 1: Rationale for Selected SAR Criteria

Criteria	SARO[a] Status	COSEWIC[b] Status	SARA[c] Status	Rationale for Selection
Horned grebe	Special Concern	Special Concern	Special Concern	■ federally and provincially listed ■ important for continued ecological function of boreal ecosystems ■ represents a species that requires wetland and open water habitats
Eastern whip-poor-will	Threatened	Threatened	Threatened	■ federally and provincially listed ■ threatened by habitat loss and degradation ■ aerial insectivore that requires open forest/edge habitat in drier deciduous and coniferous habitats
Bank swallow	Threatened	Threatened	No Status	■ provincially listed ■ threatened by habitat loss and degradation and incidental take from aggregate extraction and erosion control projects
Common nighthawk	Special Concern	Threatened	Threatened	■ federally and provincially listed ■ important for continued ecological function of boreal ecosystems ■ aerial insectivore that forages and nests in open habitats
Olive-sided flycatcher	Special Concern	Threatened	Threatened	■ federally and provincially listed species ■ important for continued ecological function of boreal ecosystems ■ aerial insectivore indicator that requires coniferous forest, edges and openings near meadows and ponds
Canada warbler	Special Concern	Special Concern	Special Concern	■ federally and provincially listed ■ important for continued ecological function of boreal ecosystems ■ threatened by habitat loss ■ represents a species that requires coniferous, deciduous, moist mixed forest and regenerating habitats

a) Government of Ontario (2007),

b) COSEWIC (2016),

c) Government of Canada (2002),

Assessment endpoints represent the key properties of each criterion that should be protected. Maintenance of self-sustaining and ecologically effective populations represents the assessment endpoints for the SAR criteria species. 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 (Fahrig 2001; Nicholson et al. 2006; Ruggiero et al. 1994; With and Crist 1995). Achieving and maintaining self-sustaining woodland caribou populations are goals of the Recovery Strategy for Woodland Caribou in Canada (Environment Canada 2012) and Ontario's Woodland Caribou Conservation Plan (MNR 2009a). Similarly, the goal of Ontario's Cervid Ecological Framework is to ensure ecologically sustainable cervid (e.g., caribou and moose) populations and the ecosystems on which they rely, for the cultural and socio-economic benefits of people (MNR 2009b).

Achieving viable populations may not be sufficient to meet conservation objectives for other species or ecosystems that interact with the criteria being assessed (Soulé et al. 2005). For highly interactive SAR criteria that have strong effects on ecosystem structure and function, the concept of ecologically effective populations was applied as an assessment endpoint. 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 SAR criteria assessment is described in Section 5.3.

Indicators represent attributes of the environment that can be used to characterize changes to criteria and the assessment endpoints in a meaningful way. The indicators for the SAR criteria 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 (e.g., linear feature density), 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.

3.3 Assessment Cases

Assessment cases are used to analyze and characterize existing conditions, and predict the incremental net effects from the Project and the cumulative effects from past, present and reasonably foreseeable developments (including the Project).

- **Base Case** – This scenario represents existing conditions and characterizes cumulative changes associated with past and present developments. The Base Case includes information from the baseline field studies to better understand the existing physical, biological, and socio-economic conditions that may be influenced by the Project. The Base Case therefore reflects the effects of existing human disturbances, such as forestry, power, mining, transportation, municipal, residential and recreational development, and also natural factors (e.g., fire). The Base Case is used to provide ecological context for the assessment of the Project and potential reasonably foreseeable developments on SAR criteria; there is no formal assessment of the Base Case.

- **Project Case** – This scenario represents predictions of the existing conditions in the Base Case combined with the effects that may result from the Project. This case is also used to identify incremental changes that are predicted to occur from the Project.
- **Reasonably Foreseeable Development Case (RFD Case)** – This scenario characterizes cumulative effects associated with past and present developments, the Project Case plus additional reasonably foreseeable developments in the region that have not yet been approved or are approved but not yet constructed. Developments and activities that are currently under application review or have officially entered a regulatory application process are considered reasonably foreseeable.

3.4 Assessment Boundaries

3.4.1 Temporal Boundaries

The Project is planned to occur during two phases:

- construction stage: the period from the start of construction to the start of operation (approximately 14 months); and,
- operation stage: 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 considered sufficient to capture the effects of the Project.

3.4.2 Spatial Boundaries

The wildlife assessment used the following spatial boundaries:

- a baseline study area (used in the description of Base Case only);
- the limits of work, which contains the Project footprint area; and
- a criterion-specific regional study area (RSA).

Baseline field surveys for the Wataynikaneyap Power Phase 2: Connecting 17 Remote First Nation Communities Project, which included the area of the Pikangikum Project, were completed in 2016. Surveys were completed within a 2 km corridor around the proposed corridor alignment (baseline study area).

The precise locations of some Project footprints were unknown at the time of this assessment, such as the power line ROW centreline and the laydown areas. Therefore, for the purposes of the assessment, the Project footprint is defined as the limits of work of a 200 to 500 m corridor, which includes the alignment ROW, distribution station [substation]) and the laydown areas. This limits of work provides flexibility in routing of the ROW and the location of other Project infrastructure during detailed design. Using the limits of work as the Project footprint provides a conservative estimate of Project effects as the limits of work is 4,355 ha and the actual up to 40 m alignment ROW will be approximately 478 ha and the distribution station is anticipated to be approximately 2 ha, which includes a helicopter landing pad and an equipment staging area. No additional clearing, outside of that required for the alignment ROW are anticipated for the Project. No vegetation clearing is anticipated to be required for new access roads, laydown areas and construction camps (see Section 2 for details).

Specific RSAs for SAR criteria or groups of criteria were intended to capture and assess the significance of incremental and cumulative effects from the Project and other previous, existing and reasonably foreseeable developments (RFDs). The RSAs are the scale at which cumulative effects are most appropriately assessed. For caribou, the population can be reasonably defined based on existing data. However, no information is available to delineate the population boundaries for wolverine, little brown myotis, and bird criteria. Due to the length of the Project (approximately 128 km), a number of populations of each of these criteria 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. For SAR criteria with small to moderate breeding home ranges (i.e., all SAR criteria except caribou and wolverine), the RSA was defined by a 5.5 km buffer around the limits of work (Figure 2). The assessment area is anticipated to be large enough to contain important cumulative effects on populations of bat and bird criteria 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 and 5 km, respectively (Benítez-López et al. 2010).

The forest dwelling woodland caribou RSA, hereafter referred to as the caribou RSA, was defined by the Berens Range (Figure 3). The assessment area is based on provincial range management boundaries and population distribution data, which is ecologically appropriate for determining the significance of cumulative effects from the Project and other developments. A small portion of the Project (approximately 11 km from the Red Lake airport north to the Berens Range) intersects the Sydney Range. However, effects on the Sydney Range are not assessed because the portion of the Project in the Sydney Range is routed along the Nungesser Road. Additionally, there is low probability for caribou occurrence (0.1 to 0.2) in this area (MNRF 2014a). There is also a large amount of historical human disturbance in this area (MNRF 2014a).

Wolverine were assessed at the scale of the caribou RSA (Figure 3). This spatial scale was deemed appropriate because of this species' large home ranges and dispersal distances. Wolverine also depend on caribou carrion as a food source.

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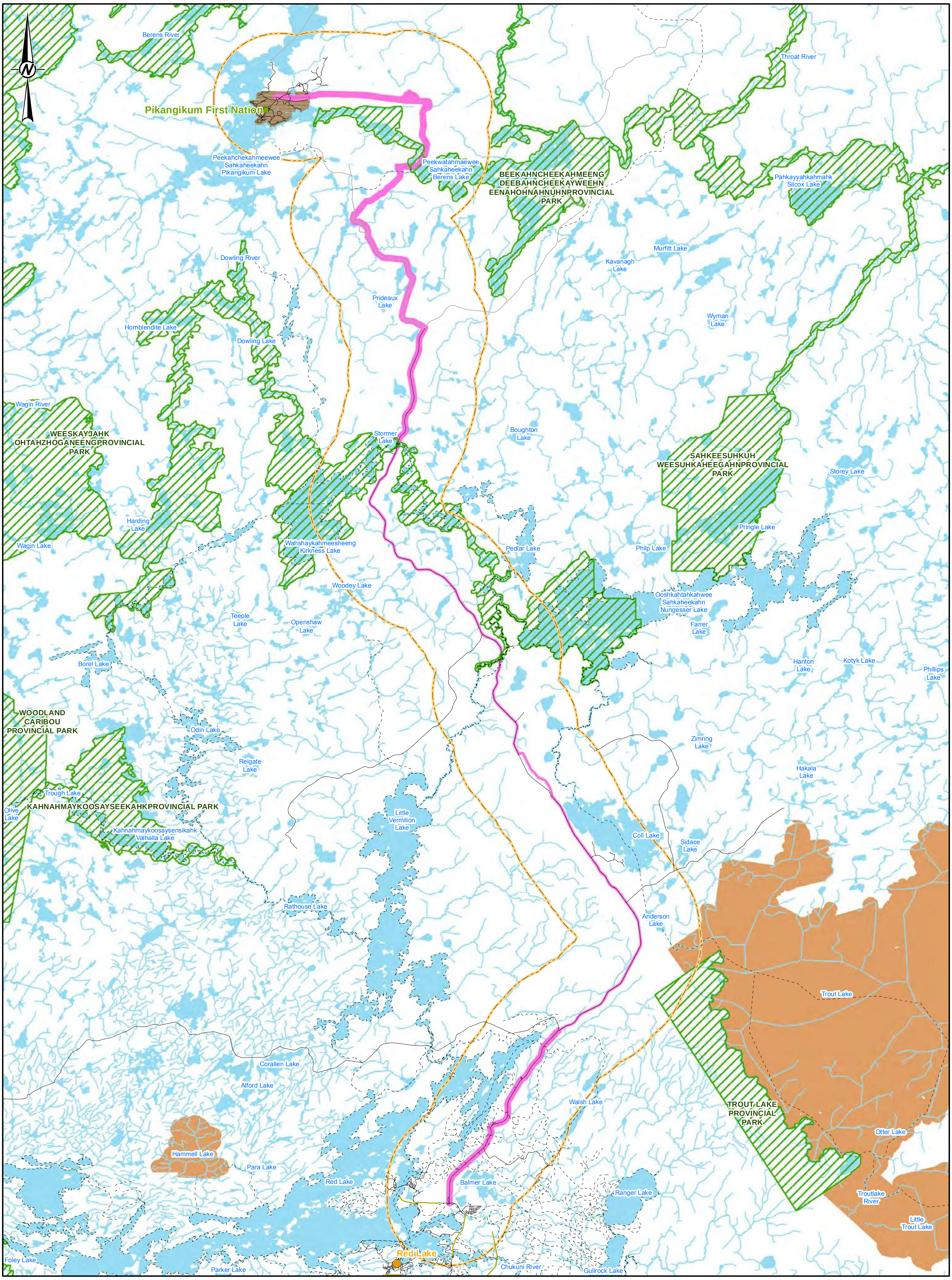

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- Regional Study Area

REFERENCE(S)

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1:280,000 Kilometers

CLIENT
WATAYNIKANEYAP POWER L.P.

PROJECT
PIKANGIKUM DISTRIBUTION LINE PROJECT

TITLE
REGIONAL STUDY AREA FOR BAT AND BIRD CRITERIA

CONSULTANT

Wataynikaneyap Power

Golder Associates

YYYY-MM-DD	2017-03-08
DESIGNED	JMC
PREPARED	JMC/PR
REVIEWED	LD
APPROVED	AE

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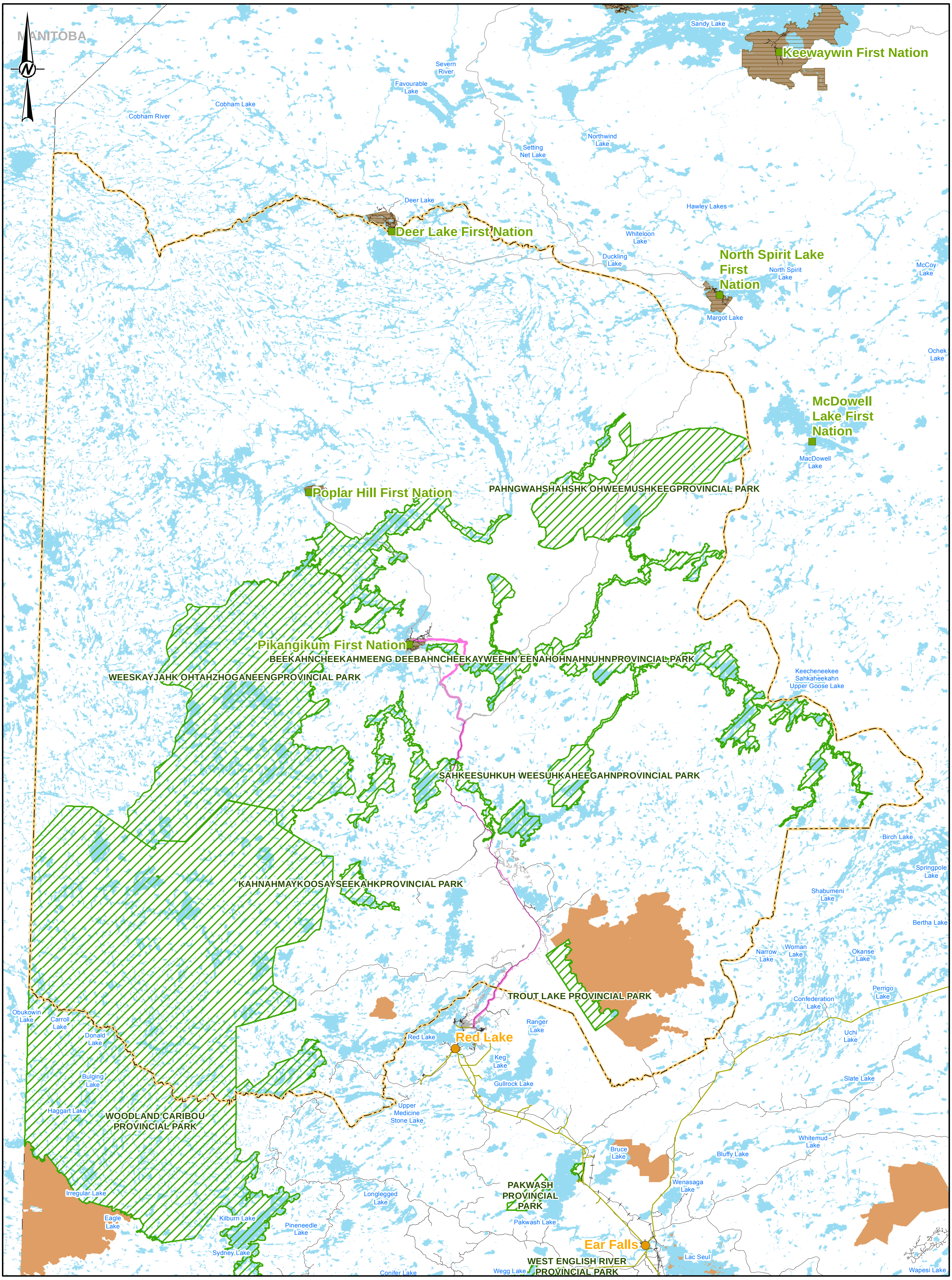

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CLIENT
WATAYNIKANEYAP POWER L.P.

PROJECT
PIKANGIKUM DISTRIBUTION LINE PROJECT

TITLE
REGIONAL STUDY AREA FOR WOODLAND CARIBOU AND WOLVERINE

CONSULTANT

Wataynikaneyap Power

Golder Associates

YYYY-MM-DD	2017-03-08
DESIGNED	JMC
PREPARED	JMC/PR
REVIEWED	LD
APPROVED	AE

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4.0 DESCRIPTION OF THE EXISTING ENVIRONMENT (BASE CASE)

4.1 Methods

4.1.1 Existing Data and Information

Existing conditions were described to provide context for the wildlife assessment. Information used to characterize existing conditions was compiled from the following sources, as available and appropriate for each SAR criteria:

- historic scientific literature and information about SAR and their habitats in the criterion-specific RSAs;
- historic population inventory data to assess current abundance and recent population trends for SAR criteria;
- sensitive species data from the MNRF;
- Whitefeather, Red Lake, and Trout Lake Forest Management Plans (FMPs);
- findings of baseline field surveys for the Wataynikaneyap Phase 2: Connecting 17 Remote First Nation Communities Project;
- current (Base Case) land disturbance (e.g., settled areas, roads etc.); and
- Provincial Land Cover 2000 data.

4.1.2 Field Surveys

Baseline field surveys were completed in the baseline study area in 2016. Particular attention was given to searching for species of conservation concern. Species of conservation concern are defined as those that are either federally or provincially listed as “Special Concern,” “Threatened” or “Endangered”.

Five field surveys included an aerial reconnaissance survey, remote camera surveys, upland breeding bird surveys, waterbird aerial surveys, and nightjar (i.e., eastern whip-poor-will [*Antrostomus vociferus*] and common nighthawk [*Chordeiles minor*]) acoustic surveys. Targeted SAR criteria, number of sampling areas within the Pikangikum Distribution baseline study area and survey dates are provided in Table 2.

Table 2: Wildlife Field Surveys Completed in 2016

Survey Type	Targeted SAR	Number of Sampling Sites/Areas	Date of Completion
Remote camera deployment		9	May 16 to 21, 2016
Upland breeding birds		20	June 6 and 7, 2016
Nightjar surveys		42	June 22 to 24, 2016
Waterbird aerial surveys (raptor stick nests incidentally recorded; remote camera retrieval completed in conjunction)		4	September 13 to 23, 2016
Bat hibernacula survey		37	May 1 to 3, 2017

Remote camera surveys were completed to identify the presence and relative abundance of large mammals. They also provided information about trail use by large mammals. Nine Reconyx PC800 HyperFire Professional Semi-Covert IR cameras were deployed in a 2 km corridor around the centerline of the Project from May 17 to 22, 2016 and retrieved from September 13 to 23, 2016. Cameras were deployed on trails (e.g., wildlife trails, roads, and other linear features) near a pre-selected location. Cameras were placed in all habitat types, but were focused on habitats that are more likely to be used by woodland caribou (i.e., treed bogs and fens). Data were analyzed using the number of photographs of individuals of each species obtained by a camera at a particular location. When multiple photographs of the same individual were taken in succession, that individual was only counted once. Consecutive photographs of the same species were considered different individuals when the time lapse between the photographs exceeded one hour.

Upland breeding bird surveys were completed using point count methods described in the Forest Bird Monitoring Program Survey Instructions (Canadian Wildlife Service 2008). Survey locations consisted of a 50 m radius circular plot with an additional 50 m radius buffer (i.e., 100 m radius was surveyed). Plot centres were established with a minimum separation distance of 250 m in forested habitats and 400 m in open habitats. The surveys began approximately 30 minutes after sunrise (because of safety issues with flying a helicopter in low-light conditions) and ended no later than 10:00 a.m. (Ralph 1993). Two observers each surveyed two plots at each helicopter landing location. The first of the two plots to be surveyed were established a minimum of 300 m from helicopter landing locations. This distance took observers a minimum of ten minutes to walk and this time was considered adequate to allow birds to resume their normal activities after disturbance from the helicopter. At each point count station, the observer waited for two minutes to allow the birds to adjust to the observers' presence. A 10-minute survey period followed, and all species heard or observed within 100 m were recorded. Twenty point count survey plots were completed in 12 broad habitat types, but were focused on habitats that were more likely to support SAR. All breeding bird surveys in the baseline study area were completed on June 6 and 7, 2016.

Biologists completed surveys for listed nightjar species along the southern third of the baseline study area during the full moon period on June 22 and 23, 2016. The surveys followed the Bird Studies Canada (2014) survey guidelines and recommendations outlined in MNRF (2016a). Surveys were three minutes in duration. Survey locations were spaced 1 to 2 km apart from the south end of Nungesser Road at Red Lake north to where Nungesser Road became a winter road as suggested by MNRF (2016a). Approximately 83 km was surveyed along the Nungesser Road using 42 survey sites.

Waterbird surveys were completed to identify important fall migration staging areas and to obtain data on the species occurrence and community composition of waterbirds in the study area. Observers also recorded large concentrations of waterbirds that were incidentally observed in the study area during the surveys. During the surveys, observers recorded transect number, waypoints, waterbody type, waterbird species, and number of individuals. The waterbird fall staging aerial surveys in the 2 km corridor around the Project centerline were completed on September 15, 2016 and surveys were flown between dawn and 4:30 pm. Four wetlands in the baseline study area were surveyed. One preselected lake in the Beekahncheekahmeeng Deebahncheekyaweehn Eenahohnahnuhn Dedicated Protected Area was not surveyed in 2016 because a research permit to complete work in the park was not received at the time of the survey.

Suitable hibernacula habitat for little brown myotis were identified within the limits of work. A Light Detection and Ranging (LiDAR) survey was completed along the limits of work in November 2016. A helicopter equipped with a LiDAR camera collected topography and orthoimagery data within the limits of work. Using the high resolution orthoimagery, potential suitable habitat for bat hibernacula was identified as rock outcrops that formed a rise or hill, and cliffs. In addition, the Abandoned Mines Information System (AMIS) database was searched for known abandoned mine features, and each record was evaluated to determine if it could be a hibernaculum (i.e., abandoned and underground). Thirty-seven potential hibernacula features were identified from aerial imagery and LiDAR data. A Golder biologist, accompanied for a period by an MNRF biologist, surveyed all 37 features from May 1 to 3, 2017 to determine if the features met the following criteria (from the U.S. Fish and Wildlife Service and Pennsylvania Game Commission's Protocol for Assessing Bat Use of Potential Hibernacula) for exclusion as a candidate hibernacula:

- There is only one horizontal opening, and it is less than 15 cm in diameter, and no or very little airflow is detected.
- The opening is a vertical shaft less than 0.3 m in diameter.
- The opening/passage shows evidence of frequent and/or complete flooding, collapses are completely sealed, for example with fine soil, or the opening/passage is completely sealed or otherwise inaccessible to bats; or
- It is a "new" opening, which has occurred recently (less than 1 year old) due to subsidence.

4.1.3 Habitat Suitability Modelling

4.1.3.1 Woodland Caribou

Habitat categorization for caribou followed that provided in the *General Habitat Description for the Forest-dwelling Woodland Caribou (Rangifer tarandus caribou)* (MNRF 2013b). The MNRF (2013b) classified habitat into three categories:

- **Category 1:** features or areas that have the lowest tolerance to alteration before their function or usefulness is compromised;
- **Category 2:** features or areas that have moderate tolerance to alteration before their function or usefulness is compromised; and,
- **Category 3:** features or areas with the highest tolerance to alteration before their function or usefulness is compromised.

Category 1

Nursery Areas

Nursery areas are defined as generalized features that an individual or a group of adult female caribou select to give birth and raise their calves during spring, summer, and early fall (MNRF 2013b). According to MNRF (2013b) nursery habitat features typically comprise “lakes and wetland complexes dominated by bog and fens, particularly those interspersed with upland islands and peninsulas (Carr et al. 2011).” Nursery areas delineated by the MNRF include female caribou observations between May 1 and September 15. This date range presumably excludes animal observations associated with large individual movements of adult females made prior to calving and those that occur in fall or early winter (MNRF 2013b). Nursery areas were identified using the following three information sources:

- Existing spatial delineations from LIO (LIO 2012).
- Female caribou collar location data (MNRF, unpublished data) from May 1 to September 15 (MNR 2013b). The Kernel Density tool in ArcGIS 10.4 was used to create a density surface of nursery points using pooled location data for all collared individuals. The density surface was created by applying ArcGIS’ default search radius algorithm, which considers the mean centre of input points, the distance between mean centre and all points, the median of these distances, and the standard distance (i.e., dispersion of points around mean centre) (ESRI 2017). Nursery area polygons were then delineated using the isopleth representing the 95% utilization distribution as identified using the Geospatial Modelling Environment (GME) platform.
- Calving and nursery area descriptions from the Integrated Range Assessment (IRA) for the Berens Range (MNRF 2014b). Nursery areas identified through the IRA were a qualitative description of geographical areas and typically included whole lakes or wetland complexes. Lakes associated with calving and/or nursery function identified through this literature review were included on habitat maps but their areas were excluded from quantitative habitat metrics due to a high degree of uncertainty associated with the spatial extent that actually supports calving and/or nursery function.

Winter Use Areas

As described in MNRF (2013b), winter use areas typically provide an abundance of ground lichen for winter forage and have lower than average snow depth, which can facilitate easier movement than in surrounding areas. Lichen-rich habitats tend to contain lower amounts of deciduous browse and therefore tend to support lower densities of alternate prey species and predators (MNRF 2013b). Winter use areas may provide refuge from predators. Areas of lower snow depth (e.g., wind-swept areas or dense forest) may be selected more frequently in late winter, depending on the annual snow depth conditions. Individual fidelity to specific winter use areas is typically lower than for nursery areas (Cumming et al. 1996; Ferguson and Elkie 2004; Hazell and Taylor 2011). Winter use areas were identified using the following three information sources:

- Existing spatial delineations from LIO (LIO 2012).
- Caribou collar location data (MNRF, unpublished data) from December 1 to March 31 (MNR 2013b). Similar to nursery areas, the Kernel Density tool in ArcGIS 10.4 was used to create a density surface of winter use points using pooled location data for all collared individuals. The density surface was created by applying ArcGIS’ default search radius algorithm (ESRI 2017). Nursery area polygons were then delineated using the isopleth representing the 95% utilization distribution as identified using the GME platform.

- Winter use area descriptions from the Integrated Range Assessment (IRA) for the Berens Range (MNRF 2014b). Winter use areas identified through the IRA were a qualitative description of geographical areas and typically included whole lakes or wetland complexes. As with nursery areas, lakes associated with winter use function identified through the literature review were included on habitat maps but were excluded from quantitative habitat metrics due to a high degree of uncertainty associated with the spatial extent that actually supports winter use function.

Travel Corridors

Travel corridors are the habitat features used by caribou to move between nursery areas and winter use areas in spring and fall (MNRF 2013b). The habitat features of travel corridors are variable and less distinct than other Category 1 habitats. They are typically delineated using telemetry data from collared individuals observed during long-distance movements in April and November.

Travel corridors were described using:

- Caribou collar location data (MNRF, unpublished data) from April and November (MNR 2013b). Locations of collared individuals were connected based on chronology to create movement paths for each individual. Due to the sensitivity of caribou location data (i.e., species at risk), movement paths were converted to a coarse-scale raster format by overlaying a 1 km by 1 km grid and assigning movement function to individual grid cells if a movement path was intersected.
- Existing spatial delineations for “caribou migration routes” from LIO (LIO 2012).
- Travel corridor descriptions from the IRA for the Berens Range (MNRF 2014b).
- Visual inspection of mapped nursery and winter use areas to identify potential movement paths between habitat types.

The spatial extent of known travel corridors were mapped to support a qualitative discussion of movement patterns.

Category 2

Seasonal Ranges

The MNRF (2013b) defines seasonal ranges as “large subrange habitat features that encompass the majority of current caribou distribution during all seasons within the range.” These areas tend to be large tracks of mature conifer dominated forests interspersed with lakes and wetlands. Seasonal ranges are relatively undisturbed and not fragmented, typically do not support high densities of moose, and therefore provide refuge from predators such as wolves and black bears (MNRF 2013b).

Seasonal ranges were mapped conservatively as all areas inside the Berens range, excluding areas of Category 1 habitat and all natural and anthropogenic disturbances.

In areas with no Forest Resource Inventory (FRI) coverage, Category 2 habitat also included Land Cover 2000 classes for “Other (Undefined)” and “Cloud and Shadow”. The spatial extent of the class “Other (Unknown)” covers 47,568 ha (2%) of the Berens Range, which was deemed a considerable amount of potential caribou habitat to exclude due to missing classification. The spatial extent of the “Cloud and Shadow” was limited, covering 8,954 ha (0.3%) of the Berens Range

Category 3

Remaining Areas in the Range

Areas in the Berens Range not identified as Category 1 or 2 habitat were considered Category 3 habitat. These areas generally have the biophysical features and forest composition consistent with seasonal ranges but are currently young or disturbed (MNRF 2013b). Disturbance types considered as Category 3 habitat included natural disturbances (i.e., fires) and temporary anthropogenic disturbances (e.g., cutblocks <36 years). All other disturbances were considered permanent disturbances and were not included as caribou habitat. The spatial extent of blowdown disturbances (i.e., natural disturbance) was not available at the time of report preparation. Consequently, blowdown areas were considered as Category 2 habitat unless GPS collar data indicated that the areas supported Category 1 habitat function.

Range-scale Disturbances

A Base Case disturbance inventory was compiled from available provincial databases, including LIO, Land Cover 2000, and FRI for the Trout River and Red Lake forests. The inventory incorporated anthropogenic disturbances from LIO, the “settlements/infrastructure” land cover class from Land Cover 2000, cut blocks 36 years and younger from FRI, and the “Cuts” land cover type from Land Cover 2000. The inventory also incorporated wildfire disturbances 36 years of age or younger. Fire disturbances were compiled from the provincial wildfire inventory (i.e., LIO) for disturbances since 2000 and from Land Cover 2000 for fires that occurred prior to 2000. Fire disturbances from the provincial inventory were intersected with water land cover classes from Land Cover 2000 to avoid overestimating the spatial extend of burned area.

Using the approach from Environment Canada (2011, 2012) and the MNRF (2014c), a 500 m buffer was applied to all anthropogenic disturbances and no buffer was applied to natural disturbances. The proportion of the Berens Range that is disturbed was then calculated by dividing the area of disturbance by the total area of the range.

Although the disturbance calculation approach applied is similar to that used by the MNRF, there will be small differences between disturbance metrics presented in this EA and those reported by the MNRF in the Integrated Range Assessment for the Berens Range (i.e., MNRF 2014b) due to the use of one different data source. In addition to FRI and Land Cover 2000, the MNRF used 2012 Provincial Satellite Derived Disturbance Mapping to quantify some burns and a relatively small area of cutblocks (MNRF 2014b). The satellite derived data were not available at the time of report preparation. Although the disturbance metrics are not identical, the data in the EA provide ecologically relevant and confident effects predictions across the assessment cases.

4.1.3.2 Wolverine

Wolverines use a wide range of habitat types within their large home ranges, but appear to show a preference for undisturbed areas of coniferous forest (Pasitschniak-Arts and Larivière 1995). Wright and Ernst (2004) reported wolverines in boreal forests in northwestern Alberta preferred mature stands of black spruce or diverse mixed-wood stands with conifers intermixed with dead aspen and poplar for food cache and resting sites. Boles (1977) suggested that wolverines use trees to escape from wolves and so availability of wooded areas may be important for avoiding predation. However, other studies indicate that wolverines do not avoid natural openings and their density may be more closely linked to food accessibility and proximity to humans than to specific habitat attributes (Petersen 1997; Krebs et al. 2007).

Wolverine are sensitive to human disturbance and generally avoid disturbed areas (Banci 1994; Magoun and Copeland 1998: May et al. 2006). Wolverines appear to be most sensitive to disturbance during denning, with reports of adult females moving kits within hours of detecting humans or human disturbance (Magoun and Copeland 1998). Radio-collared wolverines in British Columbia showed avoidance of disturbed areas in occupied habitats (May et al. 2006). Both May et al. (2006) and Krebs et al. (2007) showed that habitat selection by wolverines was negatively influenced by human activity including roads, winter recreation areas, and recently logged landscapes.

As wolverine habitat selection is more closely linked to food accessibility and proximity to humans than to specific habitat attributes, a full HSI model would not be an effective tool for assessing the effects of the Project on this species. Due to the apparent sensitivity of wolverines to human disturbance, a Core Security Model was developed to estimate the amount of habitat that may be affected by disturbance zones of influence (ZOIs), as well as the habitat far enough from development that it can be considered core security habitat. Core security habitat refers to areas where the probability of contact with humans, and the associated risk of mortality, is minimized. Areas outside of ZOIs are classified as moderate to high suitability, areas within ZOIs are classified as low suitability, and disturbed areas are assumed to have no value for wolverines (nil suitability).

There is a lack of literature regarding disturbance ZOIs for wolverine. However, for the prairie and northern region Environment Canada recommends minimum setback distances from various levels of disturbance during the winter denning season (Environment Canada 2009; Table 3). Existing features not associated with noise disturbance (e.g., inactive quarries) were not buffered, as doing so would underestimate the effects of the Project in the Project Case.

Table 3: Zone of Influence Buffers Applied for Various Levels of Disturbance for the Wolverine Core Security Model

Disturbance Type	Feature Type	Zone of Influence Buffer (m)[a]
Rural freeway, 4-lane divided highway	Linear	1000
Rural arterial undivided highway	Linear	1000
Rural collector undivided road, ramp	Linear	1000
Rural local undivided road, street	Linear	500
Rural resource road	Linear	500
Recreation road	Linear	500
Service road	Linear	500
Forestry road	Linear	500
Winter road	Linear	500
Railway	Linear	500
Aggregate site (active)	Polygon	500
Building, cottage, residential site, recreation camp, recreation point	Point[b]	500
Work camp	Point[c]	500
Airport	Polygon	500
Forest processing facility	Point[d]	500
Waste management site	Polygon	500
Dam and barrier	Point[e]	250
Communication/fire towers	Point[f]	250
Trapper cabin	Point[b]	250
Utility site	Point[g]	250
Utility line	Linear	250
Waterpower generation station	Point[h]	250
Tourism establishment area	Polygon	250

a) A buffer was applied to point and polygon features and a corridor was applied to linear features.

b) Point feature was buffered by 5 m, as per mean area of this feature inferred from imagery, to estimate a footprint.

c) Point feature was buffered by 100 m, as per mean area of this feature inferred from imagery, to estimate a footprint.

d) Point feature was buffered by 310 m, as per mean area of this feature inferred from imagery, to estimate a footprint.

e) Point feature was buffered by 50 m, as per mean area of this feature inferred from imagery, to estimate a footprint.

f) Point feature was buffered by 21 m, as per mean area of this feature inferred from imagery, to estimate a footprint.

g) Point feature was buffered by 77 m, as per mean area of this feature inferred from imagery, to estimate a footprint.

h) Point feature was buffered by 37 m, as per mean area of this feature inferred from imagery, to estimate a footprint.

4.1.3.3 Little Brown Myotis

4.1.3.3.1 General Habitat Model

The habitat requirements of the little brown myotis (*Myotis lucifugus*), also known as the little brown bat, vary by season (COSEWIC 2013a). In winter, little brown myotis hibernate in caves or abandoned 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. In summer, maternity colonies are formed in trees, rock crevices, buildings, bat houses or under bridges. The trees that this species use are often large, sometimes partly dead (called snags or wildlife trees), features that 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 tremuloides*), 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*).

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*]). It is tolerant of anthropogenic disturbance, often favouring man-made structures, and prefers to forage over open areas including ponds, rivers, forest gaps, forest edges or along trails and roads (Segers and Broders 2014).

Habitat mapping for this criterion considered both winter (hibernacula) and summer (maternity roosting) habitat. Habitat mapping does not fully capture foraging habitat. Foraging habitat is discussed qualitatively as appropriate. Potential hibernacula were identified as areas of bedrock habitat (due to the possibility that these could have spaces of unknown depth that may be suitable as caves). Critical habitat is the habitat that is necessary for the survival or recovery of the species. The SARA requires that recovery strategies for threatened and endangered species include an identification of the species' critical habitat, to the extent possible. Critical habitat was partially identified for hibernacula in the 2015 draft recovery strategy for little brown myotis (Environmental Canada 2015a). An approximate 50 km² grid was used to identify general geographic areas containing critical habitat. Critical habitat is discussed qualitatively as appropriate.

Potential maternity roosting and winter hibernacula habitat were identified using Land Cover 2000 data. Land cover types that were considered potential suitable (high or moderate quality) bat maternity habitat were dense deciduous forest and dense mixed forest. Exposed bedrock was considered potential suitable winter hibernacula habitat. All other land cover types were assigned nil to low quality habitat for potential maternity roost or winter hibernacula.

4.1.3.3.2 Desktop Characterization of Suitable Summer and Winter Habitat

Suitable summer (maternity roosting) and winter (hibernacula) habitat for little brown myotis was identified within the limits of work (250 to 500 m corridor). A Light Detection and Ranging (LiDAR) survey was completed along the limits of work in November 2016. A helicopter equipped with a LiDAR camera collected topography and aerial imagery within the limits of work. The potential maternity roost habitat was delineated in a GIS platform. Based on the surveyor's best approximation of snag density in mixed and deciduous habitats (maternal roost habitat quality) the following categories were developed:

- **None:** Open areas, clearings or treed habitat where no large deciduous snags were noticed, or these were very sparsely distributed.

- **Low:** Infrequent large deciduous snags present that could be suitable for bat maternity roosts.
- **Moderate:** Snags frequently observed.
- **High:** Extensive mature deciduous trees with visible dead trees and in high density above the forest canopy.

Potential suitable habitat for bat hibernacula was identified as rock outcrops that formed a rise or hill and cliffs using the aerial imagery captured during the aerial survey. In addition, the Abandoned Mines Information System (AMIS) database was searched for known abandoned mine features, and each record was evaluated to determine if it could be a hibernaculum (i.e., abandoned and underground). These potential hibernacula were field surveyed during May 1 to 3, 2017 (Section 4.1.2).

4.1.3.4 Bald Eagle

Bald eagles (*Haliaeetus leucocephalus*) in eastern Canada are short distance migrants that breed in eastern Canada in the summer, and may migrate farther south for the winter (Wright 2016). The Project is located in breeding habitat for the bald eagle, and this habitat is the focus of this assessment. Bald eagles are found near major lakes or rivers (Armstrong 2014), often using perches within approximately 500 m of open water when foraging at or near the surface of the water (Buehler 2000). Shallow water and nearshore emergent vegetation increase the likelihood that live fish prey will be available near the surface (Buehler 2000; Armstrong 2014). Foraging area quality may also be higher in areas without human development and disturbance (Buehler 2000). Bald eagle home range sizes vary from 7 km² in Saskatchewan to 21.6 km² in Oregon (Buehler 2000); assuming circular home ranges, this corresponds to home range radius of 1.5 to 2.6 km.

Bald eagle breeding territories tend to be within 2 km of water near lakes greater than 1,000 ha with more than 11 km of shoreline (Armstrong 2014). Bald eagles nest in mature or old growth forest with some edge, in the largest available trees, typically 20 to 60 m in height (Buehler 2000). In northwestern Ontario, 64% to 74% of nests are in white pine (*Pinus strobus*) and 19% to 24% of nests are in trembling aspen (Armstrong 2014). In Ontario between 1883 and 2013, 80% of bald eagle nests with recorded tree species or tree genera were in: white pine, *Populus* spp., trembling aspen, eastern cottonwood (*Populus deltoides*), *Pinus* spp., American elm (*Ulmus americana*), red oak (*Quercus rubra*), red pine (*Pinus resinosa*), or silver maple (*Acer saccharinum*) (Armstrong 2014). Conifers are preferentially used where they are dominant in the canopy; deciduous trees are used when large conifers are absent (Buehler 2000). While bald eagles have clear nest tree preferences, they are also flexible in nest site selection (Grier and Gunn 2003).

Suitable (high or moderate quality) bald eagle nesting habitat in the RSA was mapped with Land Cover 2000 classes of dense deciduous, dense coniferous, and dense mixed forest within 2.6 km of major waterbodies (i.e., greater than 1,000 ha), and stream order 7 or higher watercourses using the Strahler method in the MNRF waterbody dataset.

4.1.3.5 Eastern Whip-Poor-Will

Eastern whip-poor-wills (*Caprimulgus vociferus*) breed in semi-open or patchy forests; wide open spaces and dense forests are avoided (COSEWIC 2009). Forest structure seems to be more important than forest composition, but whip-poor-will are found in dry deciduous or mixed-wood forests throughout most of the species' range (Cink 2002). Whip-poor-wills are also commonly found in rock or sand barrens with scattered trees, old burns, other disturbed sites with early forest succession, and pine plantations (Cink 2002; COSEWIC 2009). This species prefers even-aged successional habitats and is uncommon in mature forests, although individuals may use openings in mature forest areas (Bushman and Therres 1988; Government of Ontario 2015a). Nests require tree cover, shade, and sparse ground cover, and need to be in close proximity to open areas used for foraging (MNR 2013a). Transmission line ROWs and road corridors may provide suitable foraging habitat for this species (COSEWIC 2009).

The following Land Cover 2000 habitats were determined to be suitable for whip-poor-will:

- bedrock;
- sparse forest;
- forest depletion – cuts;
- forest depletion – burns; and
- edge areas: 50 m into dense coniferous, dense deciduous, and dense mixed forest land cover classes that border one or more of the following:
  - water;
  - bedrock;
  - sparse forest;
  - forest depletion – cuts; and
  - forest depletion – burns.

4.1.3.6 Common Nighthawk

Common nighthawks (*Chordeiles minor*) breed in open habitats, such as recently logged and burned areas, open forests, open bogs and fens, and rock barrens (COSEWIC 2007a; Brigham et al. 2011). Nesting areas are chosen in association with large trees for roosting and vegetation for the production of flying insect prey (Brigham et al. 2011). This species avoids areas of dense, intact forest (Brigham et al. 2011).

The following Land Cover 2000 habitats were determined to be suitable (high or moderate quality) for common nighthawk:

- bedrock;
- sparse forest;
- forest depletion – cuts;
- forest depletion – burns;

- forest regenerating depletion; and
- edge areas: 50 m into dense coniferous, dense deciduous, and dense mixed forest land cover classes that border one or more of the following:
  - water;
  - bedrock;
  - sparse forest;
  - forest depletion – cuts;
  - forest depletion – burns; and
  - forest regenerating depletion.

4.1.3.7 Olive-sided Flycatcher

Olive-sided flycatchers (*Contopus cooperi*) breed in forested areas in Canada and parts of the United States and overwinter in central and south America. The Project is located in breeding habitat for this species, which is, therefore, the focus of this assessment. Olive-sided flycatchers prefer tall trees and snags adjacent to open areas, which provide individuals with perches from which to hunt flying insects. Olive-sided flycatchers 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 (COSEWIC 2007b; Altman and Sallabanks 2012). As a result, their abundance is correlated with landscapes containing fragmented late seral stage forest with high-contrast edges, mature trees and large numbers of dead trees (McGarigal and McComb 1995; Altman and Sallabanks 2012). In Ontario, olive-sided flycatchers commonly nest in conifers such as white and black spruce, jack pine and balsam fir (Government of Ontario 2015b).

The following Land Cover 2000 habitats were determined to be suitable for olive-sided flycatcher:

- dense coniferous forest;
- dense mixed forest;
- treed bog;
- treed fen; and
- edge areas: 50 m into coniferous or mixed forest that is adjacent to the following:
  - water;
  - treed fen;
  - open fen;
  - treed bog;
  - open bog;
  - forest depletion – cuts; and
  - forest depletion – burns.

4.1.3.8 Canada Warbler

Throughout their range, Canada warblers (*Cardellina canadensis*) nest in a range of usually wet, forest types, with a well-developed, dense shrub layer (COSEWIC 2008; Environment Canada 2016a). This species is commonly found in shrub marshes, swamps dominated by black spruce (*Picea mariana*) and tamarack (*Larix laricina*), and riparian woodlands (COSEWIC 2008). In the eastern portion of their range, which includes the RSA, Canada warblers are associated with wet mixedwood forests and early successional forests (6 to 30 years) created by forest harvesting or natural disturbance (Ball and Bayne 2014; Environment Canada 2016a).

The following Land Cover 2000 habitats were determined to be suitable (high or moderate quality) for Canada warbler:

- dense mixed forest;
- treed bog;
- treed fen;
- regenerating depletion forest;
- forest depletion – cuts;
- forest depletion – burns; and
- riparian areas: all land cover types (except mine tailings and bedrock) within 60 m from a watercourse edge for stream orders greater than 5 and all land cover types (except mine tailings and bedrock) within 30 m of the watercourse edge for stream orders less than 5.

4.2 Results

4.2.1 Woodland Caribou

4.2.1.1 Habitat Availability

As described in Section 2.4.2, the caribou RSA is the Berens Range. At large spatial scales such as the RSA, woodland caribou habitat typically includes large undisturbed areas of mature coniferous forest dominated by jack pine and/or black spruce (MNR 2013a). Caribou use habitat at multiple spatial and temporal scales and refuge from predation is considered to be a key driver of habitat selection across scales (Bergerud 1974; Rettie and Messier 2000; Racey and Arsenault 2007; Environment Canada 2012; MNRF 2013b).

The highest concentrations of year-round caribou activity occur in the southern portion of the range from Woodland Caribou Provincial Park to the eastern range boundary near Upper Goose Lake (MNRF 2014b). One woodland caribou was recorded on a remote camera in dense coniferous forest near Naylor Lake during baseline surveys in 2016.

Nursery Areas

In the RSA, calving and nursery functions are provided primarily by large lakes with islands and complex shorelines or by large peatland complexes (MNRF 2014b) (Figure 4). Potential and confirmed nursery areas (i.e., Category 1 habitat) are located on the Nungesser, Trout, Stout, Trough, Cherrington, Cairns, Roderick, Mamakwash, Goose, McInnes and Valhalla lakes (MNRF 2014b). In particular, Stout Lake and the islands of Trout Lake and Nungesser Lake are recognized as regionally significant nursery areas (MNRF 2014b). The peatland complexes around Sampson and Matchett lakes are also thought to be regionally significant because they support year-round use by caribou (MNRF 2014b).

Winter Use Areas

The Valhalla-Bigshell-Woody Lake areas represent the largest and most concentrated areas of caribou occurrence in winter (MNRF 2014b). As previously described, the regionally important Sampson and Matchett Lake peatland complexes support year-round caribou use. Other known winter use areas include the northern portion of Woodland Caribou Provincial Park and the area between Trout Lake and Mamakwash Lake (MNRF 2014b).

Seasonal Ranges

Seasonal ranges represent the most common habitat type in the Berens Range (Figure 4). Using habitat mapping methods described in Section 4.1.3.1, 318,007 ha of nursery areas, 289,206 ha of winter use areas, and 366,082 ha of overlapping nursery and winter use areas are available in the RSA at Base Case (Table 4; Figure 4). Nursery areas account for 24.4% of the Berens range while winter use areas cover 23.4% of the range (note: 13.1% of the RSA functions as both nursery and winter use areas; Table 4). Approximately 1,497,116 ha (53.4%) Category 2 habitat (seasonal ranges) and 328,716 ha (11.7%) of Category 3 habitat (remaining habitat areas in range) are available in the RSA at Base Case (Table 4; Figure 4).

Table 4: Woodland Caribou Habitat Availability in the Regional Study Area at Base Case

Habitat Category[(a)]	Regional Study Area	
	Area (ha)	Percent (%)
Category 1 (nursery areas)	318,007	11.3
Category 1 (winter use areas)	289,206	10.3
Category 1 (overlapping nursery areas and winter use areas	366,082	13.1
Category 2 (seasonal ranges)	1,497,116	53.4
Category 3 (remaining areas in the range)	328,716	11.7
Permanent disturbance [(b)]	2,787	0.1

a) Habitat categories as described in MNRF (2013b).

b) As described in Section 4.1.3.1 mapping for Category 1 habitat was based on caribou location data and habitat polygons delineated by the MNRF, which did not exclude disturbances because of demonstrated use by caribou. The permanent disturbance category therefore does not represent a complete inventory of permanent anthropogenic disturbances in the Berens Range.

Note: Numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values. Caribou habitat mapping was completed using raster file formats, which may introduce small differences in reported areas as compared to other SAR criteria that were completed using vector format files.

ha = hectare; = not applicable.

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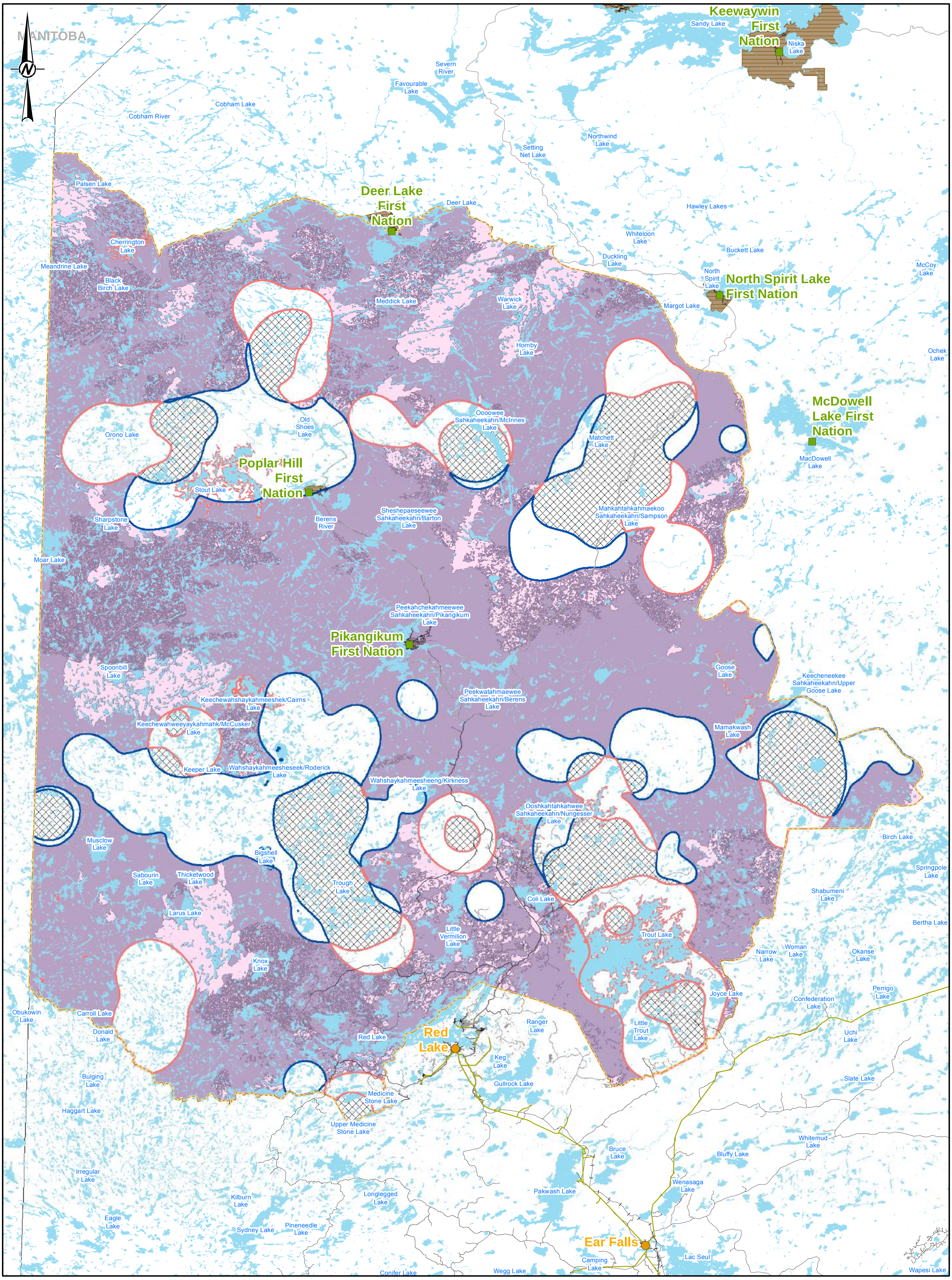

LEGEND

- City
- Town
- First Nation Community
- Wataynikaneyap Power Community
- Major Roads and Highways
- Winter Road
- Existing Electrical Transmission Line
- Railway
- First Nation Reserve Land
- Waterbody
- Regional Study Area
- Category 1 - Nursery Areas
- Category 1 - Lakes Supporting Nursery Function (MNRF 2014b)
- Category 1 - Winter Use Area
- Category 1 - Lakes Supporting Winter Use Function (MNRF 2014b)
- Category 1 - Overlapping Nursery and Winter Use Areas
- Category 2 - Seasonal Ranges
- Category 3 - Remaining Areas in the Range
- Base Case Disturbance

REFERENCE(S)

1. BASE DATA - MNR LIO, OBTAINED 2016, NTDB
2. TRANSMISSION ROUTES - PROVIDED BY WATAYNIKANEYAP POWER L.P.
3. FIRST NATION COMMUNITIES FROM INDIGENOUS AND NORTHERN AFFAIRS CANADA (WWW.AINC-INAC.GC.CA)
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CLIENT
WATAYNIKANEYAP POWER L.P.

PROJECT
PIKANGIKUM DISTRIBUTION LINE PROJECT

TITLE
WOODLAND CARIBOU HABITAT IN THE REGIONAL STUDY AREA AT BASE CASE

CONSULTANT		
Wataynikaneyap Power / Golder Associates	YYYY-MM-DD	2017-03-22
	DESIGNED	JMC
	PREPARED	JMC/PR
	REVIEWED	LD
	APPROVED	AE

PROJECT NO.	CONTROL	REV.	FIGURE
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Disturbance Footprint

Prior to European settlement and development, the availability of habitat in the Berens range was affected primarily by an aggressive fire regime (MNRF 2014b). During this time period, the Nishnabe people created small-scale disturbances such as planting and tending medicinal plants and controlled some vegetation communities using fire. The current availability of habitat likely represents a decline in suitable habitat relative to what was historically available for this species, as large-scale development activities have influenced the amount and quality of habitat since the late 1890s when the community of Pikangikum was established (MNRF 2014b). Mining and mineral exploration have been ongoing around the Red Lake area since 1926, and horse logging began in 1930 (MNRF 2014b). Hunting and fishing lodges were established in the mid-1900s, and the expansion of logging operations was supported by the construction of new roads (MNRF 2014b).

Previously, small low intensity fires were likely common across the RSA; however, larger less frequent high intensity fires likely have had more of an influence to the structure of the landscape than small fires. Fire suppression over the last 60 years has prolonged the forest fire return cycle leading to changes in the average age of the forest. Before fire suppression, the boreal forest complex of northwestern Ontario was approximately 30 years younger than it was during the 1970s (based on comparisons from Pikangikum to Pickle Lake between 1915 and 1974) (Carleton 2001). Climate change may also exacerbate this scenario because longer summers favour the persistence of broad-leaved species and limits invasion by conifers (Carleton 2001).

At Base Case, existing disturbances in the RSA include forestry, fire, linear infrastructure (e.g., roads, transmission lines and rail lines), mining, and communities. The primary disturbance in the RSA is fire (MNRF 2014b). Linear features (roads and trails) and forestry are dominant anthropogenic disturbances, both of which are concentrated in the southern portion of the RSA (MNRF 2014b). In addition to direct loss of habitat over the past 130 years, caribou have been affected by indirect habitat loss. That is, 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 (CPAWS Wildlands League 2013), season (Dyer et al. 2001, 2002; Eftestøl et al. 2016; Polfus et al. 2011), and can occur at multiple spatial scales (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 (*Rangifer tarandus*; a subspecies of caribou that occurs in Europe) reduced their use of areas within approximately 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). Zones of influence identified around different disturbance types are summarized in Table 5.

Table 5: Reported Zones of Influence for Caribou

Location	Disturbance Type	Zone of Influence	Source
British Columbia	Urban development	3 to 9 km (magnitude of avoidance was season-specific)	Polfus et al. 2011
British Columbia	Mine	up to 2 km (2 km in summer; negligible in winter)	Polfus et al. 2011
British Columbia	Cabins and camps	up to 1.5 km (1.5 km in summer; negligible in winter)	Polfus et al. 2011
Norway	Ski resorts and cabins	15 km	Nellemann et al. 2010
British Columbia	Oil and gas	4.25 km	Johnson et al. 2015
British Columbia	Mines	3.0 km	Johnson et al. 2015
Alberta	Oil and gas wells	1.0 km	Dyer et al. 2001
Alberta	Cutblocks	1.2 km	Smith et al. 2000
Quebec	Cutblocks	0.7 to 3.4 km	Courtois et al. 2008
British Columbia	Cutblocks	5.5 km	Johnson et al. 2015
Quebec	Roads	1.25 km from active roads 0.75 km from derelict roads	Leblond et al. 2011
Alberta	Roads and seismic lines	250 m	Dyer et al. 2001
British Columbia	Various linear	1.75 km from roads 2.5 km from pipelines 2.5 km from seismic lines	Johnson et al. 2015
Northern Canada	Seismic lines	400 m	Nagy 2011
Quebec	Highway	5 km	Leblond et al. 2013
British Columbia	Roads	2 km from high use roads 1 km for low use roads	Polfus et al. 2011
Norway	Transmission line	6 km during calving 3.5 km during summer and fall negligible after construction	Eftestøl et al. 2016

km = kilometre.

At Base Case, the MNRF estimates that as of 2012, 28.7% of the RSA is disturbed, with natural and human disturbances accounting for 19.4% and 9.3%, respectively (MNRF 2014b). These estimates include the application of a 500 m buffer around all anthropogenic disturbances. The proportion of disturbance in the Berens Range calculated by Wataynikaneyap for this EA is 26.0%, which is similar to the value estimated by the MNRF. The area within the limits of work is currently 74.9% disturbed.

4.2.1.2 Habitat Distribution

As described in Section 4.2.1.1, calving and nursery areas in the Berens Range occur on Trout, Nungesser, Cairns, Roderick, Stout, Cherrington, Mamakwash, Goose, and McInnes lakes as well as the Sampson and Matchett lakes peatland complexes (MNRF 2014b). Additional nursery areas occur around Wavell Lake (i.e., the easternmost nursery polygon, Figure 4), the lake complexes south of Trout Lake, lake/wetland complexes in and around Woodland Caribou Provincial Park, around Gammon Lake, and around Medicine Stone Lake (Figure 4). The distribution of winter use areas is similar to that of nursery areas, with larger habitat patches occurring in Woodland Caribou Provincial Park and extending eastwards outside the park, around Stout Lake, and around Sampson Lake (Figure 4). Overall, nursery areas and winter use areas are relatively well distributed across the RSA, though there is a notable absence of these habitats across the central portion of the Berens Range. Category 2 habitat is well distributed across the Berens Range (Figure 4).

Travel corridors (i.e., Category 1 habitat) are used to travel between nursery areas and winter use areas in the spring and fall (MNR 2013b). Identified travel corridors (Figure 5) occur in the following areas:

- around Stout Lake;
- around Sampson Lake;
- between the Sampson Lake area and McInnes Lake;
- between the Trout Lake area and the lake/wetland complexes of Woodland Caribou Provincial Park;
- around Nungesser Lake;
- between the Trout Lake area and Wavell Lake area;
- around Gammon Lake; and
- around Medicine Stone Lake.

The areas between key nursery and winter use areas (i.e., Trout Lake and Nungesser Lake, Sampson Lake and Matchett Lake, and the Valhalla-Bigshell-Woody Lake areas) are presumably of great importance for the maintenance of habitat connectivity in the Berens Range (MNRF 2014b) and likely function as travel corridors. There appears to be an important east-west movement corridor from wintering areas in the northeast corner of Woodland Caribou Provincial Park and around Valhalla Lake, across the Nungesser Road, to summering areas near Nungesser and Trout lakes (MNRF 2014b). High use areas (travel corridors, nursery and winter use areas) have not been identified in the central portion of the Berens Range (Figures 4 and 5), which suggests limited north-south movement across the RSA at Base Case.

The Berens Range is considered to function as one large range with the Atikaki-Berens Range in Manitoba (MNRF 2014b), highlighting the importance of regional connectivity. There is some level of connectivity between the Berens and Atikaki-Berens populations. Evidence from collared cows suggests that caribou from the Atikaki-Berens Range enter and stay in the Berens Range for more than a year before returning to Manitoba (MNRF 2014b). An important connectivity linkage between the Atikaki-Berens and Berens ranges appears to be present near Aikens Lake (MNRF 2014b). It is thought that movement between the Berens Range and Sydney Range is limited because of the large band of mixedwood forest that is present along the Gammon and Bloodvein rivers (MNRF 2014b). Data from collared caribou suggests some connectivity with the Sydney Range around Medicine Stone Lake (Figure 5).

The distribution of existing disturbances is believed to influence caribou movement at Base Case. The arrangement of winter and refuge habitat in the Berens Range is below the simulated range of natural variability (SRNV), suggesting that the landscape is fragmented relative to modeled estimates of the natural landscape (MNRF 2014b). The south-central portion of the range is considered to be highly disturbed by human infrastructure and development, such as industrial sites, mineral exploration, linear infrastructure and forest harvesting (MNRF 2014b). The remainder of the Berens Range is largely devoid of anthropogenic disturbance, with the exception of the First Nations communities of Pikangikum and Poplar Hill located in the north-central portion of the range. The southern portion of the Berens Range therefore has experienced the greatest impacts to habitat connectivity. Caribou movement patterns in the RSA are thought to be primarily east-west (MNRF 2014b). Existing linear infrastructure is predominantly oriented in a north-south orientation, presumably affecting some east-west movement.

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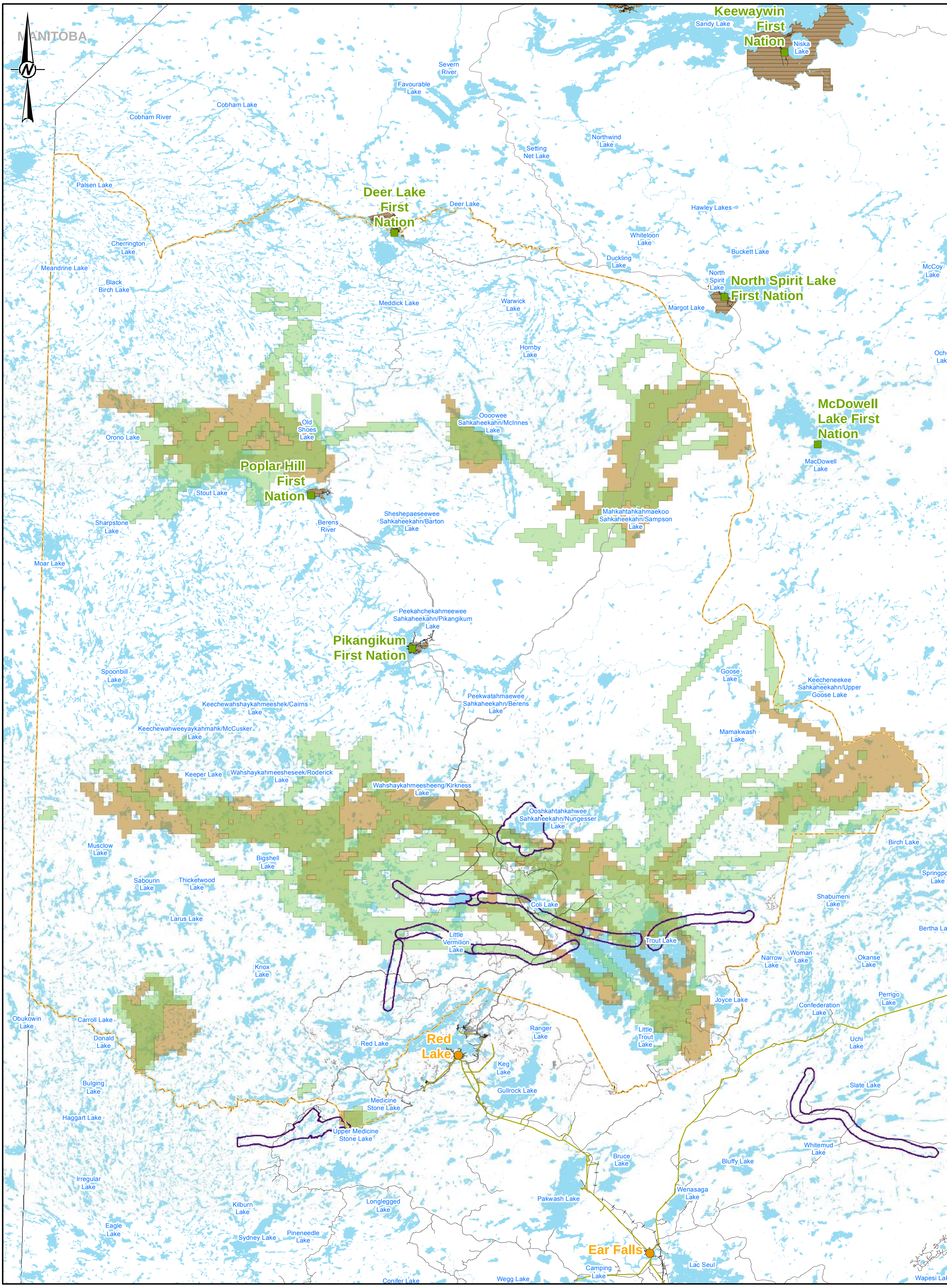

LEGEND

- City
- Town
- First Nation Community
- Wataynikaneyap Power Community
- Major Roads and Highways
- Winter Road
- Existing Electrical Transmission Line
- Railway
- First Nation Reserve Land
- Waterbody
- Regional Study Area
- Category 1 - Travel Corridor (MNRF)
- Category 1 - Spring Travel Corridor
- Category 1 - Fall Travel Corridor
- Base Case Disturbance

REFERENCE(S)

1. BASE DATA - MNR LIO, OBTAINED 2016, NTDB
2. TRANSMISSION ROUTES - PROVIDED BY WATAYNIKANEYAP POWER L.P.
3. FIRST NATION COMMUNITIES FROM INDIGENOUS AND NORTHERN AFFAIRS CANADA (WWW.AINC-INAC.GC.CA)
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CLIENT
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PROJECT
PIKANGIKUM DISTRIBUTION LINE PROJECT

TITLE
WOODLAND CARIBOU TRAVEL CORRIDORS IN THE REGIONAL STUDY AREA AT BASE CASE

CONSULTANT

Wataynikaneyap Power

Golder Associates

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DESIGNED	JMC
PREPARED	JMC/PR
REVIEWED	LD
APPROVED	AE

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4.2.1.3 Survival and Reproduction

The woodland caribou, boreal population, is listed as threatened on the provincial ESA, and as threatened and on Schedule 1 of the federal SARA due to interacting factors (primarily habitat loss and predation), which have resulted in population declines throughout their distribution.

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 (i.e., Category 1 nursery areas) are unavailable, inadequate, or degraded (Thomas and Gray 2002; McCarthy et al. 2011; Environment Canada 2012; Pinard et al. 2012). Habitat suitability is strongly influenced by the habitat's capacity to provide refuge from predation (Bergerud 1974; Rettie and Messier 2000; Racey and Arsenault 2007; Environment Canada 2012; MNRF 2013b; Hornseth and Rempel 2015). Caribou spatially separate themselves from predators and alternate prey (e.g., moose [*Alces alces*] and white-tailed deer [*Odocoileus virginianus*]) as an anti-predator strategy, and maintain low population densities across their range (Bergerud, 1988, 1996; Johnson et al. 2001; Environment Canada 2008, 2012). 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 woodland caribou populations (Bergerud 1986; Seip 1992; Stuart Smith et al. 1997; James 1999; James and Stuart Smith 2000), 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.

Caribou are sensitive to changes in predation rate because they have a low reproductive capacity 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 declining caribou populations, the proportion of calves that survive to one year of age is usually low and insufficient to compensate for annual adult mortality (Bergerud 1974; Stuart-Smith et al. 1997; DeMars et al. 2011). In 2013, the calf recruitment estimate for the Berens Range was 23.9 calves per 100 adult females; this is lower than the identified threshold of 28.9 calves per 100 adult females for maintaining a stable population (Environment Canada 2008, 2011; MNRF 2014b).

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). The boundaries of WMUs 1C, 2, and 3 overlap the Berens Range. Moose density is 0.09 moose/km² in WMU 1C (MNRF 2014c). Moose density in WMUs 2 is 0.17 moose per km² and WMU 3 has a density of 0.22 moose per km² (MNRF 2014d,e).

Local and regional-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 high density road areas; females whose calves survived demonstrated stronger avoidance of these areas.

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 space out from 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. 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 (Kuck et al. 1985; Yarmoloy et al. 1988; Wolfe et al. 2000; Eftestøl et al. 2016). 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 (1986) 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.

At Base Case, the Berens population has a minimum animal count of 237 and a corresponding population estimate that is likely above 500 individuals (MNRF 2014b). Adult female survival, measured between 2012 and 2013, was 0.87 (95% confidence interval = 0.75-1.0) (MNRF 2014b). Calf recruitment (4.8 and 23.9 calves per 100 adult females in 2012 and 2013, respectively) is below the 28.9 calves per 100 adult females threshold required to maintain a stable population, assuming a mean adult female survival rate of 0.85 (Environment Canada 2008, 2011). Recruitment estimates from 2011-2012 were also low in the neighbouring Sydney and Churchill Ranges, suggesting that it was a poor recruitment year across ranges (MNRF 2014b). The estimated mean annual population growth rate (λ) is 0.93 (range = 0.89-0.98) (MNRF 2014b), which indicates a declining population trend (i.e., λ = 1.0 indicates a stable population, values below 1.0 indicate decline and values above 1.0 indicate increase). The proportion of the range that is disturbed is 28.7% (MNRF 2014b) (note: Wataynikaneyap calculated this proportion as 26.0% using data and methods described in Section 4.1.3.1). Based on the available evidence, the MNRF determined that it is uncertain if the current range condition is sufficient to sustain the Berens caribou (MNRF 2014b). The estimated population status and amount of habitat disturbance in the RSA may be approaching the limits of resilience and adaptive capacity of caribou at Base Case.

4.2.2 Wolverine

4.2.2.1 Habitat Availability

Wolverine is a generalist species that uses a wide variety of forested habitat types (COSEWIC 2014). The most important factor in habitat selection is likely prey abundance (COSEWIC 2014). Wolverines consume a wide variety of prey including rodents, snowshoe hares, and the carcasses of large ungulates such as moose and caribou. Females den under snow-covered rocks, logs, or in snow tunnels and are thoughts to require the snow cover to persist into April (COSEWIC 2014). However, a recent study in the boreal forest of Alberta suggests that wolverine are less reliant on snow cover than previously thought (Webb et al. 2016).

Home ranges for wolverines near Red Lake encompassed both logged and unlogged areas, but 95% of radio collar tracking observations were made in unlogged habitat types (Magoun et al. 2005). This result is supported by other studies that show wolverine may occasionally travel through harvested areas but generally avoid young clearcut areas (Hornocker and Hash 1981; Weir 2004). Although no investigations have studied wolverine response to fire, wolverine likely avoid recently burned areas.

Wolverines are found at low densities throughout their range (1 individual per 40 to 800 km^2) and have large home ranges (100 to 900 km^2), which varies in size based on food abundance (Banci 1994). Wolverines in the Red Lake area were found to have average home range sizes of 1,450 km^2 (males) and 525 km^2 (females) (Magoun et al. 2005).

Availability of wolverine habitat was estimated at Base Case using a Core Security Model, which estimated the amount of habitat that may be affected by disturbance ZOIs. Suitable habitat is estimated to compose approximately 2,706,379 ha (96.6%) of the RSA at Base Case (Table 6). This likely represents a decline in suitable habitat relative to what was historically available for this species because the amount of undisturbed forest has decreased during the 20th century. Overall, the changes in habitat availability at Base Case are predicted to be within the adaptive capacity and resilience limits of this criterion.

Table 6: Wolverine Habitat Availability in the Regional Study Area at Base Case

Habitat Suitability	Area (ha)	Proportion (%)
Moderate to High	2,706,379	96.6
Nil to Low	95,535	3.4
Total	**2,801,914**	**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.
ha = hectare; % = percent.

4.2.2.2 Habitat Distribution

Genetic evidence suggests that wolverine populations are sensitive to habitat fragmentation from human disturbance. Cegelski et al. (2003) found that gene flow among wolverine populations in Montana is becoming increasingly fragmented due to human development and disturbance and that Montana wolverines are not part of a contiguous population. Instead at least three wolverine subpopulations occur in the state, even though subpopulations are separated by approximately 300 km, which is within annual movement ranges for individuals (Cegelski et al. 2003). This contrasts dramatically with wolverine populations in Canada and Alaska, which showed little genetic structure differences across distances of 1,000 to 2,000 km (Kyle and Strobeck 2001, 2002). Human disturbance of the landscape is thought to be the reason for the difference in genetic structure between wolverine populations in Montana and Canada/Alaska (Cegelski et al. 2003).

Natural barriers such as lakes and mountain ranges do not appear to limit wolverine movements (Kyle and Strobeck 2001, 2002). Wolverines generally do not tolerate human disturbances that permanently alter natural habitat, such as agriculture, human settlements, roads, and mining activities (Banci 1994; Carroll et al. 2001; Copeland et al. 2007; May et al. 2012). Wolverine behaviour was significantly different between study areas in the Rocky Mountains of Alberta with 0.0005% and 1.47% human disturbance footprint versus study areas with 8.09% human disturbance (Stewart et al. 2016). Differences in behaviour may be due to wolverine perception that human disturbance is a risk and changes to wolverine behaviour in highly disturbed landscapes may be influencing wolverine population declines (Stewart et al. 2016).

However, a recent study in the boreal forest of Alberta observed regular movements of wolverines throughout areas with dense industrial infrastructure, although roads were avoided by at least 300 m (Scrafford and Boyce 2014). Similarly, linear corridors that have a compacted snow layer (e.g., snowmobile trail) were used 100% of the time, when encountered, by wolverines accessing winter food caches in northwestern Alberta and northeastern British Columbia (Wright and Ernst 2004). Wolverines have also been observed to use transmission corridors as travel corridors in northern British Columbia (Harriman and Baker 2003).

Wolverine populations in Manitoba and Ontario currently show signs of genetic isolation from other populations in western Canada (MNR 2013c). Although the factors causing this genetic isolation are unknown, it is thought that habitat fragmentation from major highways and transmission corridors may impede wolverine movements, which would influence gene flow and population persistence (COSEWIC 2003). Landscape fragmentation from historical human developments may have contributed to the northward range contraction of wolverine in Ontario (COSEWIC 2014). Wolverine were historically distributed across all of northern Ontario but current range estimates show wolverine appear to be confined to the central and western portions of the far north (MNR 2013c; COSEWIC 2014).

There is little habitat fragmentation present in the RSA at Base Case. Linear disturbance features in the RSA includes the Nungesser Road and the Pikangikum All-Season Road. Linear feature density is 0.2 km/km^2 in the RSA at Base Case. Large, contiguous patches of habitat are still present throughout the RSA (Figure 6) and likely provide suitable habitat for wolverine. Habitat distribution in the RSA at Base Case is considered to be within the resilience and adaptability limits for wolverine.

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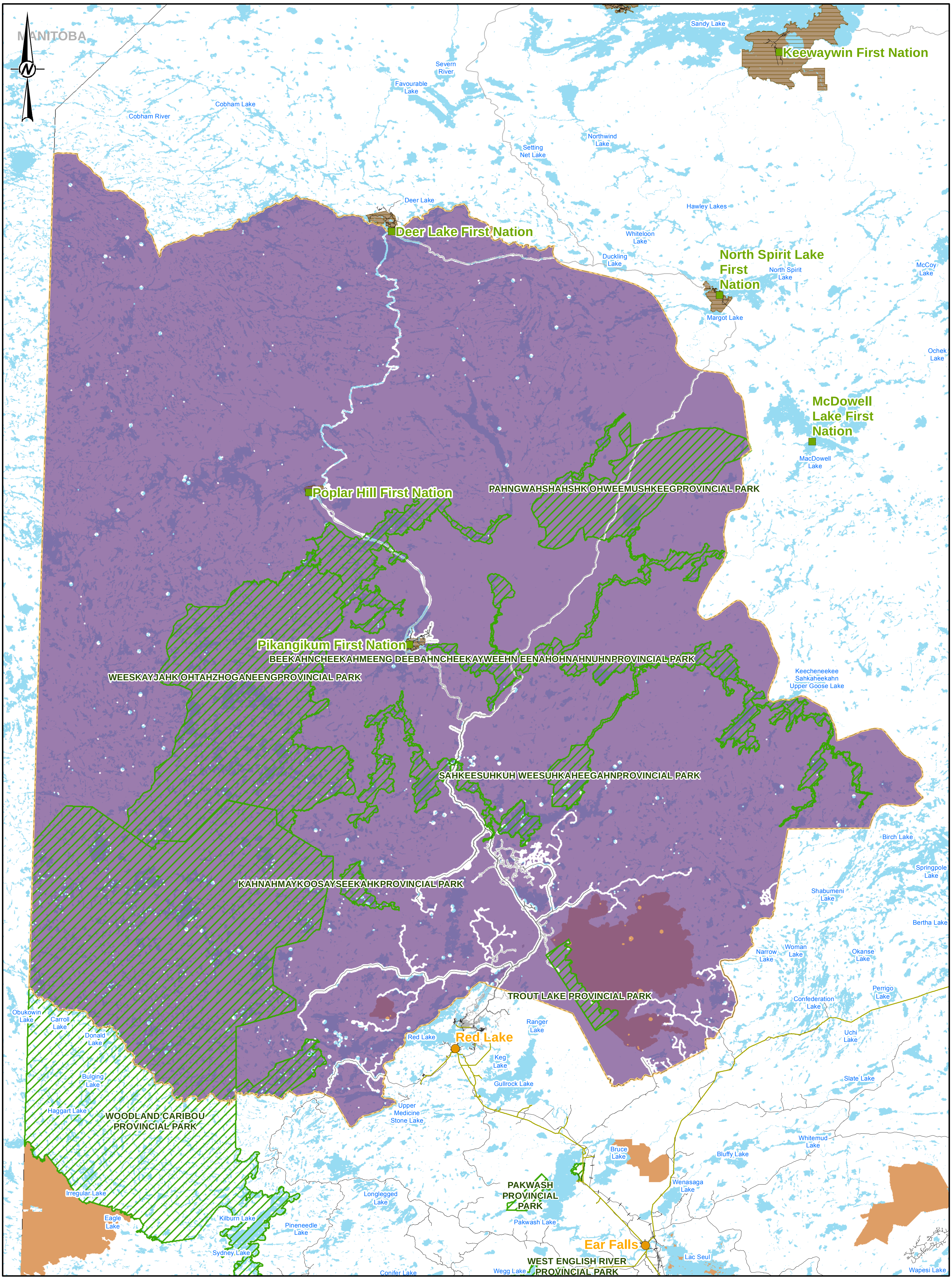

LEGEND

- City
- Town
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- Wataynikaneyap Power Community
- Major Roads and Highways
- Winter Road
- Existing Electrical Transmission Line
- Railway
- First Nation Reserve Land
- Waterbody
- Conservation Reserve
- Provincial Parks
- Regional Study Area
- Base Case Disturbance
- Wolverine Habitat

REFERENCE(S)

1. BASE DATA - MNR LIO, OBTAINED 2016, NTDB
2. TRANSMISSION ROUTES - PROVIDED BY WATAYNIKANEYAP POWER L.P.
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PROJECT
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TITLE
WOLVERINE HABITAT IN THE REGIONAL STUDY AREA AT BASE CASE

CONSULTANT

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APPROVED	AE

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4.2.2.3 Survival and Reproduction

Information on wolverine population trends and sizes is largely unknown because wolverines are sparsely distributed on the landscape and occupy large home ranges. Best estimates suggest that there are greater than 300 wolverines in Ontario (MNRF 2016c). The wolverine populations in northern Ontario may be increasing as aerial surveys have shown an eastward range reoccupation towards James Bay and Quebec (Magoun et al. 2005; COSEWIC 2014).

Wolverine are threatened by previous hunting and trapping, climate change, and habitat loss, degradation, and fragmentation (MNR 2013c). Adult wolverines in trapped populations have a much lower survival rate than adults in untrapped populations (less than 0.75 versus greater than 0.84, respectively; Krebs et al. 2004). Factors that limit wolverine populations include this species low population resiliency and specific habitat requirements during the denning season (MNR 2013c).

Wolverine have low reproductive potential and are relatively short lived with a life expectancy of eight to ten years in the wild (MNR 2013c). Wolverines reach sexual maturity at 12 to 15 months of age, although most females do not successfully give birth until they are an average 3.4 years old. Females breed once annually (from May to August) and give birth in early spring when there is greater ungulate carrion availability and snow cover (MNR 2013c). Not all females that breed will give birth in a given year (Magoun 1985). Female body condition is thought to be the most important factor influencing successful births (Banci 1994; Persson 2005).

Average litter size is two to three kits (MNR 2013c); studies in Sweden, Norway, Alaska, and Yukon report a range of one to six kits per litter (Pasitchinak-Arts and Larivière 1995). Young females have a higher likelihood of becoming pregnant and giving birth to larger litters than older females (MNR 2013c). Females older than six years of age have lower probability of breeding successfully than females two to three years of age and the probability of older females successfully breeding is correlated with summer primary production (MNR 2013c). Wolverines have low birth rates, with 0.6 to 0.7 young per female per year reported in Alaska (Magoun 1985) and 0.84 young per female per year reported in Sweden (MNR 2013c).

Spring snow cover is thought to be key for successful natal denning (Banci 1994; Magoun and Copeland 1998; Persson 2005; Aubry et al. 2007). Deep snow insulated females and kits from extreme weather and provides protection from predators. High snow accumulation may also result in more winter-killed ungulate carrion. Climate change is likely to negatively influence wolverine reproduction and survival by reducing spring snow cover. However, a recent study in the boreal forest of Alberta captured eight females, including five lactating individuals, at camera traps within townships that were predicted to have no spring snow cover (Webb et al. 2016). This suggests that wolverines may be more flexible in their spring snow requirements than previously thought (Webb et al. 2016).

Wolverine have low resilience to changes in survival and reproduction because of their low reproductive potential and their denning requirements for spring snow cover. However, this species may have more flexible natal denning requirements than previously thought (Webb et al. 2016), which would increase resilience to landscape change. The wolverine populations in northern Ontario may be increasing as aerial surveys have shown an eastward range reoccupation towards James Bay and Quebec (COSEWIC 2014). Based on this information, it is expected that historical changes in survival and reproduction present at Base Case are within the resilience and adaptability limits for this criterion.

No wolverines were recorded on remote cameras in the baseline study area in 2016. However, wolverines are known to occur and den in areas around Red Lake (Magoun et al. 2005). Sensitive species data received from the MNRF shows wolverine observations are distributed throughout the RSA.

4.2.3 Little Brown Myotis

4.2.3.1 Habitat Availability

Availability of summer maternity roosting habitat is not likely a limiting factor for little brown myotis in the Base Case. While loss of forests due to human developments has probably reduced maternity roosting habitat availability in the RSA relative to what may have been available historically, the majority of the RSA remains forested in the Base Case. Little brown myotis are not habitat specialists and have been documented in a wide variety of coniferous and deciduous forest types (COSEWIC 2013a). Moreover, little brown myotis are well adapted to human disturbance and will use buildings, bat houses, and bridges for maternity roosts indicating that they are resilient to changes in summer habitat. Bats that roost in tree cavities have less fidelity to roost sites, than species that roost in buildings or caves (Lewis 1995).

Fire suppression has generally resulted in older, broadleaved dominated forests replacing the conifer dominated forest (Carleton 2001). Fire suppression has likely had a positive effect on little brown myotis, 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 2013a), and has demonstrated a preference for broadleaved forest (e.g., poplar [*Populus* spp.] and birch [*Betula* spp.] species). Full fire suppression around the community of Pikangikum has been practiced since 2012 to protect wood supply opportunities (MNR 2013d).

Effects from forest harvesting activities on little brown myotis are likely adverse (Patriquin and Barclay 2003; Taylor 2006). It is thought that even small-scale forestry activities can negatively affect bats by removing snags (roosting habitat) and decreasing canopy closure (Jung et al. 1999). In addition, forestry and other industrial activities in close proximity to hibernacula can degrade the habitat by altering its microclimatic characteristics (USFWS 2007). The effects of edges and corridors on little brown myotis are unclear but a number of studies suggest that forest fragmentation may be beneficial for little brown myotis (Broders and Forbes 2004; Broders et al. 2006; Ethier and Fahrig 2011; Jantzen and Fenton 2013; Segers and Broders 2014). Other studies have found that little brown myotis prefer closed and cluttered canopy areas and avoid edges (Kalcounis and Brigham 1995; Jung et al. 1999; Morris et al. 2010).

There is contradictory evidence regarding preferred foraging habitat for little brown myotis. Some studies suggest that this species uses edge habitat for foraging (COSEWIC 2013a), while other studies suggest that little brown myotis prefer to forage in areas with dense vegetation (i.e., cluttered canopies) (Kalcounis and Brigham 1995). The size of the clearing, as well the size of the bat, may influence the use of edge habitat for foraging. Large clearings have more wind and may inhibit efficient foraging by small bats. Large clearings also have different prey species and lower prey abundance than the forest interior (Kalcounis and Brigham 1995). Little brown myotis may prefer to forage in areas with cluttered canopies, but heavy individuals (i.e., with high wing loads) are less maneuverable than small individuals and so may be prevented from foraging in areas with dense vegetation (Kalcounis and Brigham 1995). Edges not be used as foraging habitat and instead may be used by little brown myotis as travel corridors between roosting sites and foraging areas (Kalcounis-Ruepell et al. 2013).

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 Ontario, mines harbour the greatest concentrations of hibernating little brown myotis. The location of abandoned mines in the RSA is well understood but their occupancy by bats is not well understood. Those that have been identified as important hibernacula have occasionally been protected through gates and other means of restricting public access (e.g., signage). 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 (WNS), a deadly fungal disease that has wiped out most of the northeastern North American populations. In Canada, 192 hibernacula were identified 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 2015a).

Sensory disturbance may temporarily result in avoidance of maternity roosting habitat by little brown myotis. Noise frequencies that overlap with the little brown myotis frequency range (i.e., approximately 40 to 70 kilohertz [kHz]) are expected to have the greatest effect on this species. Harrison (1965) found that little brown myotis did not respond to frequencies above 40 kHz when in torpor. A study by Luo et al. (2014) found that bats were more sensitive to noise when it occurred closer to sunset as opposed to earlier in the daily roosting period and responded least to traffic noise and most to vegetation noise (e.g., rustling of leaves), possibly because traffic noise was at a lower frequency than their hearing range. Bats may rapidly become habituated to repeated and prolonged noise exposure (e.g., bats roosting under bridges) (Luo et al. 2014).

Noise has been found to negatively impact foraging by passive-listening bat species, especially when noise frequencies occur at the same frequency as prey noises (Jones 2008; Schaub et al. 2008; Siemers and Schaub 2011). Consequently, passive-listening bats have been found to avoid areas with high noise levels (e.g., adjacent to highways) (Schaub et al. 2008). However, echo-locating species, such as little brown myotis, can adapt the amplitude and duration of their calls to the ambient noise level of an environment (Luo and Wiegrebe 2016).

One high potential and four moderate potential hibernacula features were identified during the field survey; the remaining 32 features identified from aerial imagery and LiDAR data were determined to have low to very low potential (Figure 7). The high potential site is a fractured granite cliff feature and is located on the east side of Nungesser Road, approximately 140 m from the road. Moderate potential features include a fractured granite feature in a road cut, natural fractured granite features, and rock cliff features. Cliff features that could not be clearly observed while completing the field visit were identified as moderate potential features. Three of the moderate potential features are also located along the east side of the Nungesser Road (Figure 7). The fourth moderate hibernacula potential feature is located at the alternate crossing of the Berens River.

Using the general habitat model, there are 19,414 ha (17.0%) of the potential moderate to high maternity roosting habitat available in the RSA, at Base Case (Table 7). In the RSA, 264 ha (0.2%) of habitat that could include suitable winter hibernacula is estimated to be present (Table 7).

Table 7: Little Brown Myotis Habitat Availability in the Regional Study Area at Base Case, Based on the General Habitat Model

Habitat Suitability	Area (ha)	Proportion (%)
Summer Habitat (Maternity Roost)		
Moderate to High	19,414	17.0
Nil to Low	94,806	83.0
Total	**114,220**	**100.0**
Winter Habitat (Hibernacula)		
Moderate to High	264	0.2
Nil to Low	113,956	99.8
Total	**114,220**	**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.
% = percent; ha = hectare.

4.2.3.2 Habitat Distribution

The little brown myotis is widely distributed across Canada and in Ontario; its range extends across the province to just south of James Bay. Little brown myotis 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). Most of the known hibernating bats of a region are found in only a few hibernacula. In Ontario, many more little brown myotis hibernate in abandoned mines than caves (Fenton and Barclay 1980). Because of the congregatory (i.e., grouping) nature of this species, disturbance of hibernacula can have a disproportionate effect on local populations.

Results from the general habitat model using Land Cover 2000 data (Section 3.1.3.3.1) show that natural habitat features with potential to provide hibernacula for bats (i.e., exposed bedrock) are clustered in the extreme southern portion of the RSA in the vicinity of Red Lake (Figure 7). The AMIS database indicated that there are two abandoned mines with the potential to provide suitable hibernacula in the RSA; these mines are located approximately 15 and 20 km northeast of Red Lake and are approximately 300 and 700 m from the centerline of the Project. These two mines do not appear to have underground features and so are not likely to be suitable hibernacula habitat. If these abandoned mines are hibernacula, they may harbour smaller concentrations of bats and may have the potential to play a critical role in the recovery of the population from WNS. The 50 km² grid squares identified as critical habitat by Environment Canada (2015a) do not contain the abandoned mines in the RSA. All critical habitat 50 km² grid squares identified in Environment Canada (2015) are south of the RSA.

Based on the habitat modelling completed using Land Cover 2000 data (Section 3.1.3.3.1), suitable maternity roosting habitat is present in larger quantities in the southern and northern thirds of the RSA (Figure 7). The middle third of the RSA between Coli Lake and Kirkness Lake has little suitable maternity habitat (Figure 7).

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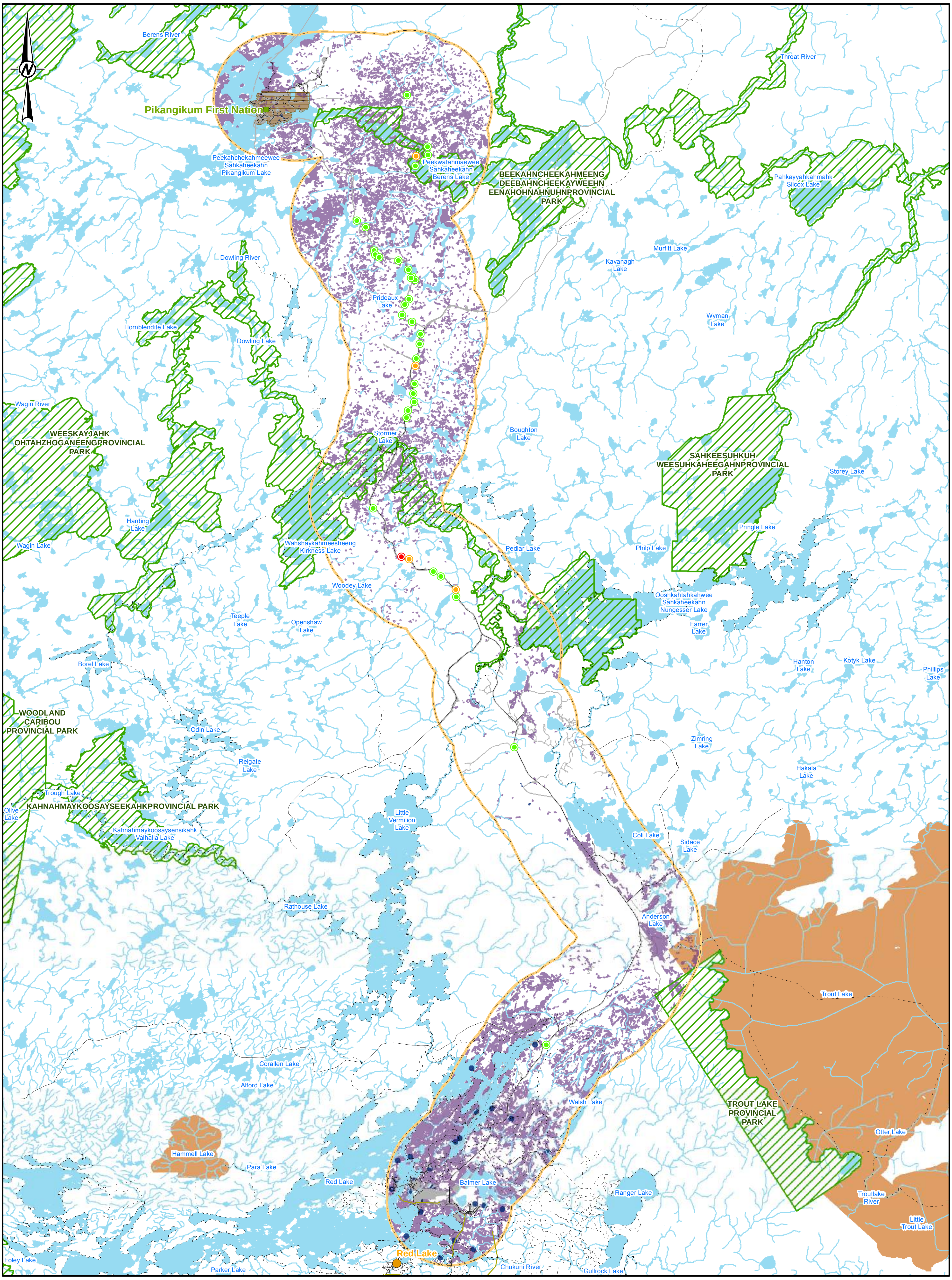

LEGEND

- City
- Town
- First Nation Community
- Wataynikaneyap Power Community
- Major Roads and Highways
- Winter Road
- Trail
- Existing Electrical Transmission Line
- Watercourse
- First Nation Reserve Land
- Waterbody
- Conservation Reserve
- Provincial Parks
- Regional Study Area
- Base Case Disturbance

Bat Hibernacula Field Survey

- High Potential
- Moderate Potential
- Low Potential

General Habitat Model Results

- Little Brown Myotis Summer Habitat
- Little Brown Myotis Winter Habitat

REFERENCE(S)

1. BASE DATA - MNR LIO, OBTAINED 2016, NTDB
2. TRANSMISSION ROUTES - PROVIDED BY WATAYNIKANEYAP POWER L.P.
3. FIRST NATION COMMUNITIES FROM INDIGENOUS AND NORTHERN AFFAIRS CANADA (WWW.AINC-INAC.GC.CA)
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5. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 15

0 5 10
1:280,000 Kilometers

CLIENT
WATAYNIKANEYAP POWER L.P.

PROJECT
PIKANGIKUM DISTRIBUTION LINE PROJECT

TITLE
LITTLE BROWN MYOTIS SUMMER AND WINTER HABITAT IN THE REGIONAL STUDY AREA AT BASE CASE, AS PREDICTED FROM THE GENERAL HABITAT MODEL AND HIBERNACULA FIELD SURVEY

CONSULTANT

Wataynikaneyap Power

Golder Associates

YYYY-MM-DD	2017-06-01
DESIGNED	JMC
PREPARED	JMC/PR
REVIEWED	LD
APPROVED	AE

PROJECT NO.	CONTROL	REV.	FIGURE
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Bats that roost in tree cavities have less fidelity to roost sites, than individuals and species that roost in buildings or caves (Lewis 1995). This may allow little brown myotis to be flexible when selecting roost sites in the RSA, especially in recently disturbed forested areas.

Bats will 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). The effects of edges and corridors on little brown myotis are unclear but a number of studies suggest that forest fragmentation may be beneficial for little brown myotis (Broders and Forbes 2004; Broders et al. 2006; Ethier and Fahrig 2011; Jantzen and Fenton 2013; Segers and Broders 2014). Other studies have found that little brown myotis prefer closed and cluttered canopy areas and avoid edges (Kalcounis and Brigham 1995; Jung et al. 1999; Morris et al. 2010).

Linear disturbance features may act as barriers to bats because some species are reluctant to cross open ground and some species avoid areas with lights (e.g., road and vehicle lights) (Altringham and Berthinussen n.d). Bats that forage in open space, such as little brown myotis, appear to be less sensitive to barrier effects from linear disturbances than species that glean prey from vegetation (Kerth and Melber 2009; Fensome and Mathews 2016). However, little brown myotis is a clutter-adapted, low-flying species that may experience higher barrier effects than faster, open-edge-adapted species (Fensome and Mathews 2016). Roads are thought to have greater barrier effects on bats than other linear disturbance such as rail lines and transmission lines because roads are usually wider than transmission lines and railways and there is more vehicle traffic (sensory disturbance) on roads (Altringham and Berthinussen no date). Barrier effects are higher in exposed areas than in areas with vegetation alongside the ROW (Fensome and Mathews 2016).

Overall, the habitat mapping and field survey results and an understanding of this species' biology indicate a clustered distribution of habitat in the RSA during the winter and a broader distribution in the RSA in the summer. The limited amount of existing disturbances in the RSA should prevent or restrict dispersal for this species in the Base Case because bats are highly mobile. Therefore, changes to habitat distribution in the Base Case have likely not exceeded the resilience or adaptability limits of the little brown myotis.

4.2.3.3 Survival and Reproduction

Little brown myotis is listed as endangered on the provincial ESA, and as endangered and on Schedule 1 of the federal SARA due to dramatic population declines resulting from a devastating fungal disease, WNS. Prior to the introduction of WNS, little brown myotis was probably the most common bat in Canada (Environment Canada 2015a). White nose syndrome has reduced populations by more than 75% in infected hibernacula (Frick et al. 2010). Mortality rates at infected sites in eastern Ontario were 92% after two years of exposure (COSEWIC 2012). White nose syndrome has been estimated to travel at an average rate of 200 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 WNS has not yet been reported in the RSA, WNS was confirmed in Atikokan in 2015 (USFWS 2016). This is the furthest west confirmed site for WNS in Canada. Atikokan is approximately 300 km southeast of Red Lake. The presence of WNS in the RSA is uncertain because there is limited information related to the hibernacula in northern Ontario (Environment Canada 2015a). Regardless, there is an imminent threat to little brown myotis populations that overlap the RSA from WNS. Therefore, changes to little brown myotis abundance in the Base Case may have exceeded the resilience and adaptability limits of this criterion due to the mortality associated with WNS. 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; Kunz 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 (Kunz 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). Mean annual survival of little brown myotis in Ontario was 0.82 for males and 0.71 for females (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, disturbance during hibernation, and declining insect populations. Little brown myotis are vulnerable to persecution because of their tendency to use anthropogenic structures (Environment Canada 2015a). 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 2015a). 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). Echolocating species may be less sensitive to sensory disturbance than passive-listening species, as they can adjust the amplitude and duration of their calls to the ambient noise level of an environment (Luo and Wiegrebe 2016).

4.2.4 Bald Eagle

4.2.4.1 Habitat Availability

Bald eagles are found in association with aquatic habitats (e.g., coastal areas, rivers, lakes and reservoirs) with forested shorelines or cliffs throughout North America (Buehler 2000; Armstrong 2014). Bald eagles often use perches within approximately 500 m of open water when foraging at or near the surface of the water (Buehler 2000). Shallow water and near shore emergent vegetation increase the likelihood that live fish prey will be available near the surface (Buehler 2000; Armstrong 2014).

The MNR (2000) Significant Wildlife Habitat Technical Guide identifies bald eagle winter habitat as "seasonal concentration areas" and bald eagle nesting, foraging and perching habitat as "rare or specialized habitats for wildlife." Areas identified as SWH receive an approximate 120 m buffer (MNR 2000) in addition to recommended activity setbacks (MNR 2010).

The main disturbances in the RSA at Base Case are forestry, fire and fire suppression activities, and linear development. Bald eagle typically nest in areas of low human disturbance. In northwestern Ontario, lakes with bald eagle nests were significantly farther from roads than lakes without nests (Jones 1995). However, more recent evidence indicates that some bald eagles are becoming tolerant of human modifications to the landscape and will nest closer to urban areas (Armstrong 2014).

Suitable bald eagle nesting habitat is estimated to compose 25.4% (28,968 ha) of the RSA at Base Case (Table 8).

Table 8: Bald Eagle Habitat Availability in the Regional Study Area at Base Case

Habitat Suitability	Area (ha)	Proportion (%)
Moderate to High	28,968	25.4
Nil to Low	85,252	74.6
Total	**114,220**	**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.
ha = hectares; % = percent.

Shoreline urban and industrial development has the greatest potential to limit habitat availability because it overlaps with the highest quality habitat for bald eagles (Buehler 2000). Large scale harvest operations target fast-growing tree species and do not generally allow the forest to reach the old growth stage. In contrast, selective harvesting of high quality timber products (i.e., tall, straight trees) may have increased the proportion of trees on the landscape that provide high quality eagle nesting habitat, such as those with large tree forks (i.e., bifurcation in the trunk) that are considered low quality timber product (Packham 2005).

Overall, the changes from natural and anthropogenic disturbance and activities in the RSA at Base Case have likely resulted in less bald eagle habitat availability relative to historical conditions. However, most changes to habitat suitability have occurred in the southern third of the RSA with forest harvesting in the Red Lake and Trout Lake forests, and human development around Red Lake, including Nungesser Road.

There is little industrial and urban shoreline development in the central and northern portions of the RSA. Wildfires in areas defined as the Bak Lake sub-zone, which covers the north portion of the RSA, have been suppressed since 2004 to protect wood supply opportunities (WFMC 2012; MNR 2013d). Fire suppression has resulted in an increase in average forest age and possibly more suitable bald eagle habitat in the RSA. Additionally, commercial forest harvesting has not been undertaken in the Whitefeather Forest.

Bald eagles have some flexibility in their selection of breeding habitat (Grier and Gunn 2003) and there is increasing evidence of them becoming tolerant of habitat disturbed by humans (Armstrong 2014). Available evidence does not suggest that habitat availability is a limiting factor for this species in the RSA at Base Case. Therefore, changes to habitat availability in the Base Case appear to be within the adaptability and resilience limits of bald eagle populations that overlap with the RSA.

4.2.4.2 Habitat Distribution

In Ontario, the highest concentration of bald eagle nests is centered on Lake of the Woods in northwestern Ontario, which is outside the RSA (Armstrong 2014). Bald eagle habitat is patchily distributed in the RSA. Large patches of habitat are present around Red Lake, Trout Lake, Coli Lake, Pine Lake, Kirkness Lake, Berens Lake, and Pikangikum Lake at Base Case (Figure 8). The MNRF sensitive species data indicates that Trout Lake, Coli Lake, Little Vermillion Lake, and Berens Lake are important nesting areas for bald eagles in the Red Lake area.

Forests have become more fragmented in recent years due to policies that favour creating several smaller clear-cut areas that are scattered throughout the forest. Bald eagle are likely not negatively influenced by fragmentation as they are a highly mobile species and forest tract size may be unimportant if the tract is isolated from human development (Buehler 2000). Nest trees are more accessible in areas with habitat discontinuity, or edge, or relatively open canopies (McEwan and Hirth 1979; Anthony and Isaacs 1989; Livingston et al. 1990; Buehler 2000).

Existing disturbances in the RSA do not likely function as a dispersal barrier for this species in the Base Case as this species is highly mobile. Bald eagle populations that overlap with the RSA are considered to be within the resilience and adaptability limits of this criterion.

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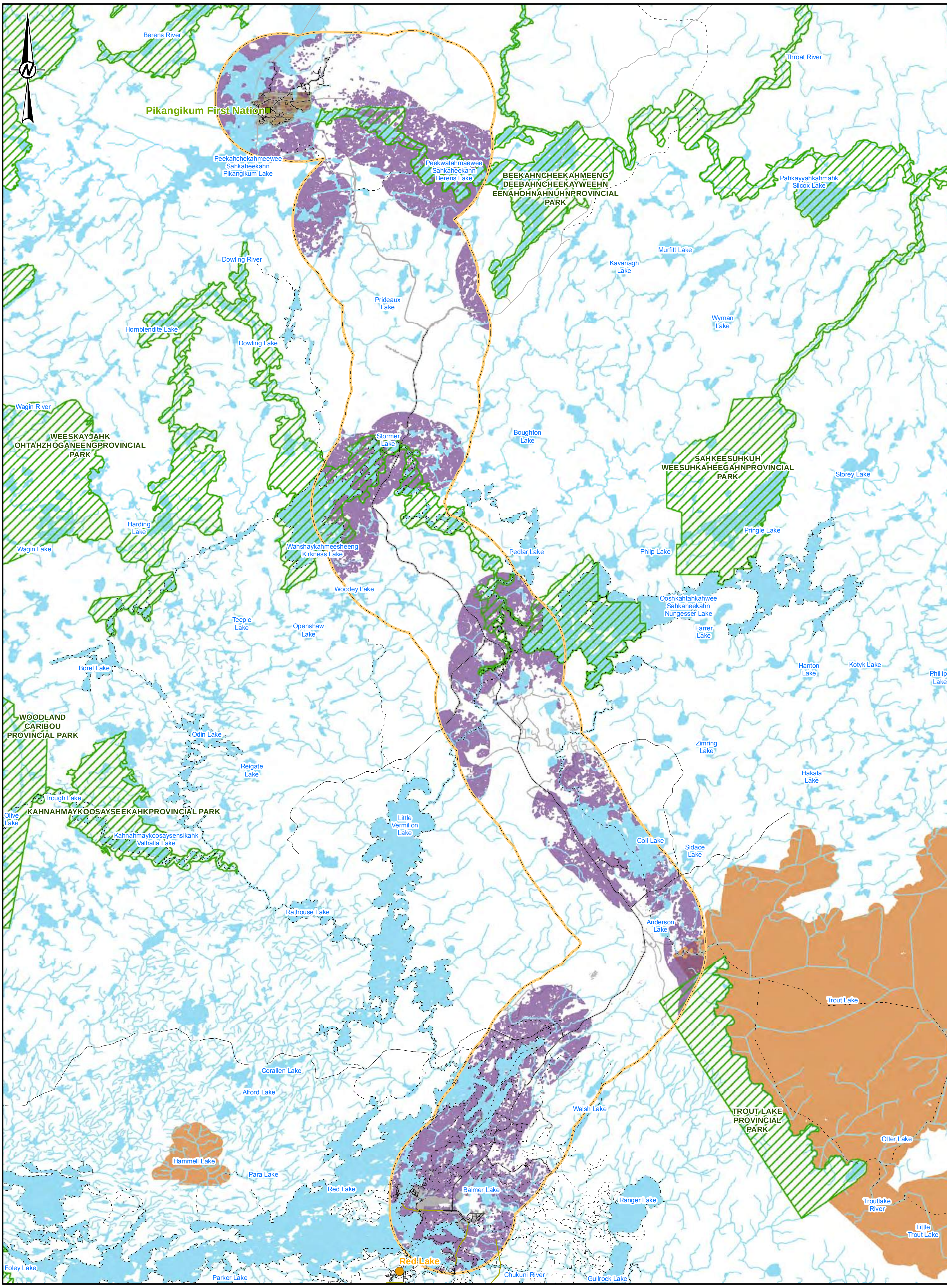

LEGEND

- City
- Town
- First Nation Community
- Wataynikaneyap Power Community
- Major Roads and Highways
- Winter Road
- Trail
- Existing Electrical Transmission Line
- Watercourse
- First Nation Reserve Land
- Waterbody
- Conservation Reserve
- Provincial Parks
- Regional Study Area
- Base Case Disturbance
- Bald Eagle Habitat

REFERENCE(S)
1. BASE DATA - MNR LIO, OBTAINED 2016, NTDB
2. TRANSMISSION ROUTES - PROVIDED BY WATAYNIKANEYAP POWER L.P.
3. FIRST NATION COMMUNITIES FROM INDIGENOUS AND NORTHERN AFFAIRS CANADA (WWW.AINC-INAC.GC.CA)
4. PRODUCED BY GOLDER ASSOCIATES LTD UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2016
5. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 15

0 5 10
1:280,000 Kilometers

CLIENT
WATAYNIKANEYAP POWER L.P.

PROJECT
PIKANGIKUM DISTRIBUTION LINE PROJECT

TITLE
BALD EAGLE HABITAT IN THE REGIONAL STUDY AREA AT BASE CASE

CONSULTANT
Wataynikaneyap Power
Golder Associates

YYYY-MM-DD	2017-03-21
DESIGNED	JMC
PREPARED	JMC/PR
REVIEWED	LD
APPROVED	AE

PROJECT NO.	CONTROL	REV.	FIGURE
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4.2.4.3 Survival and Reproduction

Bald eagle populations are estimated at 100,000 individuals in North America (Buehler 2000). Bald eagles declined drastically in the early 1900s because chemicals such as dichloro-diphenyl-trichloroethane (DDT) and polychlorinated biphenyls (PCBs) accumulated through the food chain and weakened egg shells leading to low reproductive success (Armstrong 2014). Bald eagles were also historically shot as pests or trophies (Armstrong 2014). Bald eagles are long-lived and slow to mature, capable of breeding at five years, but often not until they reach six or seven years of age (Armstrong 2014). Bald eagle clutch sizes are small (1 to 3 eggs) and their incubation time is long (34 to 46 days) such that if their nest tree is blown down, the affected pair may not breed for a year (Armstrong 2014). Slight shifts in adult bald eagle survival, for example from illegal shooting, accidental trapping, or collisions with wind turbines, can markedly affect population trends (Armstrong 2014).

Bald eagles in Ontario have shown a large recent increase after recovering from historical threats (Blancher et al. 2009; Wright 2016). However, bald eagles in Ontario still have vulnerabilities and face some threats, and are designated as a species of Special Concern in Ontario (MNRF 2015a). After DDT was banned in the 1970s, bald eagles in the Great Lakes region rebounded more slowly than more inland Ontario populations because of the more contaminated fish populations in that region (Armstrong 2014). Wright (2016) also found that numbers of bald eagles breeding in the north in summer (North Carolina to eastern Canada) increased more slowly than numbers of bald eagles breeding in the south in winter (Texas to North Carolina) based on migration counts from 1991 to 2015. As top predators that feed primarily on fish, bald eagles continue to face threats from pollution, residual chemical contamination, and heavy metal poisoning from lead and mercury (Armstrong 2014).

Collision with electrical lines is recognized as contributing to avian mortality, particularly for raptors that are known to have blind areas when in flight (Martin and Shaw 2010). Bald eagle collision risk with electrical lines is increased when lines are less than 1 km from shoreline and not surrounded by vegetation (Watts et al. 2009).

Forest harvesting can have adverse effects on bald eagle survival and reproduction. Isaacs et al. (2005) noted a negative correlation between the extent of forestry operations and bald eagle productivity. In general, clear cutting within approximately 400 m of an active nest may result in nest abandonment. However, timber harvest or road building within approximately 800 m of bald eagle nests did not result in nest abandonment or reduced productivity (Isaacs et al. 2005). Road density, proximity, and level of use does not appear to affect bald eagle productivity (MNR 2010).

Population data are not available for the RSA. Four bald eagles were incidentally observed along the Project corridor during wildlife field surveys in 2016; no bald eagle nests were observed. One raptor nest site was identified near the Project ROW in the Whitefeather FMP (WFMC 2012). The raptor nest site was on the east shore of Red Lake, near Nungesser Road. Sensitive species data from the MNRF shows bald eagles have been recorded at Kirkness Lake and Coli Lake in the RSA.

The RSA likely overlaps with several distinct but interbreeding bald eagle sub-populations. Based on the population status and trends for the Province, bald eagle populations that overlap with the RSA are likely smaller relative to those historically present, but Ontario populations are experiencing positive growth rates in the Base Case (MNR 2010). Therefore, changes to survival and reproduction are predicted to be within the resilience or adaptability limits of this criterion at Base Case.

4.2.5 Horned Grebe

4.2.5.1 Habitat Availability

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 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 regions that have occurred in the Base Case have not likely contributed measurably to broad population declines.

A habitat model was not developed for horned grebe because the Project is not anticipated to result in measurable effects on horned grebe populations that overlap the RSA (see Section 4.2.2).

4.2.5.2 Habitat Distribution

Although a habitat model was not developed for horned grebe, suitable habitat for this species (wetlands) is patchily distributed in the RSA. Existing disturbances in the RSA do not likely function as a dispersal barrier for this species in the Base Case as this species is highly mobile. Horned grebe populations that overlap with the RSA are considered to be within the resilience and adaptability limits of this criterion.

4.2.5.3 Survival and Reproduction

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). Horned grebe is an irregular, rare breeder in Ontario (COSEWIC 2009). Population estimates in Ontario from the first OBBA were 10 pairs or less per year (COSEWIC 2009). However, most of this species' range is in remote areas in northwestern Ontario and so this species may be more common than is suggested by OBBA results (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).

Horned grebe was not recorded during field surveys in the baseline study area in 2016. Horned grebe was documented as a confirmed breeder in three squares within the OBBA Region 44 (Big Trout Lake) during the second OBBA (Cadman et al. 2007).

4.2.6 Eastern Whip-Poor-Will

4.2.6.1 Habitat Availability

Eastern whip-poor-will breed in forested landscapes in parts of central and eastern Canada and the eastern United States and overwinter in the southern United States and Central America. In Ontario, whip-poor-will are found from the Manitoba border, east to Kenora, with a northern limit roughly following the northern shore of Lake Superior, south to the United States border, and lower Great Lakes (COSEWIC 2009). Eastern whip-poor-will were found infrequently in several isolated locations near Red Lake and Lake Nipigon during the second Ontario Breeding Bird Atlas survey from 2001 to 2005 (COSEWIC 2009). Five whip-poor-will were recorded at two survey locations in the baseline study area during species-specific surveys in 2016. The two locations were approximately 12 m and 14 m from the proposed centerline of the limits of work.

The main disturbances in the RSA at Base Case include wildfire and wildfire suppression activities and linear developments. Disturbances have likely resulted in positive changes to whip-poor-will habitat as road ROWs and utility corridors can create habitat for this species (Cink 2002; COSEWIC 2009). Larger disturbance areas, such as laydown areas, may provide suitable foraging habitat, especially areas surrounded by suitable nesting habitat (e.g., semi-open mixed-wood forest) (MNR 2013b). Fire suppression can improve habitat for whip-poor-will by creating a juxtaposition of early and late seral forests (COSEWIC 2009).

Forestry activities are common throughout the southern third of the RSA, and have likely had positive and negative changes on habitat in the Base Case. Microclimate and vegetation features near the nest are important, and disturbance within 20 m of the nest may disrupt these parameters, making the area unsuitable for nesting (MNR 2013b). Timber harvesting practices that occur at a small scale and selectively remove individual trees likely increase whip-poor will-habitat (MNR 2013b). Developments that result in large scale alteration or clearing of vegetation are not compatible with whip-poor-will habitat requirements (MNR 2013b). Smaller clear cuts that are scattered throughout the forest have been favoured forest management policies in recent years (Domtar 2009) and have therefore likely increased suitable eastern whip-poor-will habitat relative to historical conditions. Post-harvest areas may be suitable for whip-poor will-within 0 to 15 years following disturbance (i.e., while the areas have sparse to moderate shrub and herbaceous vegetation cover) (Environment Canada 2015b). Suitable habitat is estimated to compose 43.2% (49,332 ha) of the RSA at Base Case (Table 9). This likely represents a decrease in suitable habitat relative to what was historically available for this species because fire suppression activities have increased the forest age in the RSA.

Table 9: Eastern Whip-Poor-Will Habitat Availability in the Regional Study Area at Base Case

Habitat Suitability	Area (ha)	Proportion (%)
Moderate to High	49,332	43.2
Nil to Low	64,887	56.8
Total	114,220	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.
ha = hectares; % = percent.

Overall, whip-poor-will habitat availability remains high in the RSA at Base Case and is not considered a limiting factor for this species. Therefore, the positive and negative changes to the amount of suitable habitat available in the Base Case are predicted to be within the adaptability and resilience limits of the whip-poor-will populations that may overlap with the RSA.

4.2.6.2 Habitat Distribution

Studies suggest whip-poor-will may avoid small, isolated woodlands and distance from forest tracts may be an important factor influencing the presence of whip-poor-will (Bushman and Therres 1988; COSEWIC 2009). Whip-poor-will abundance in southern Ontario was found to be positively correlated with anthropogenic linear disturbance density (English et al. 2016). Forest management policies that favour the development of smaller clear-cuts scattered throughout the forest have been implemented in recent years in the FMUs that intersect with the RSA. These practices may have increased whip-poor-will habitat availability and consequently habitat distribution relative to historical conditions (MNR 2013b).

Eastern whip-poor-will habitat distribution in the RSA at Base Case is shown in Figure 9. Based on habitat modelling, suitable habitat occurs in numerous discrete patches that are well distributed throughout the RSA. The occurrence map developed by the MNRF sensitive species data indicates eastern whip-poor-will is distributed sporadically in northern Ontario and has been observed in the RSA near Red Lake (Government of Ontario 2015a). This was confirmed by field studies in 2016.

Overall, habitat distribution is patchy and not well connected across the RSA, but the species has high mobility and existing disturbances in the RSA may have increased habitat distribution compared to Base Case conditions by creating open areas in the forested landscape.

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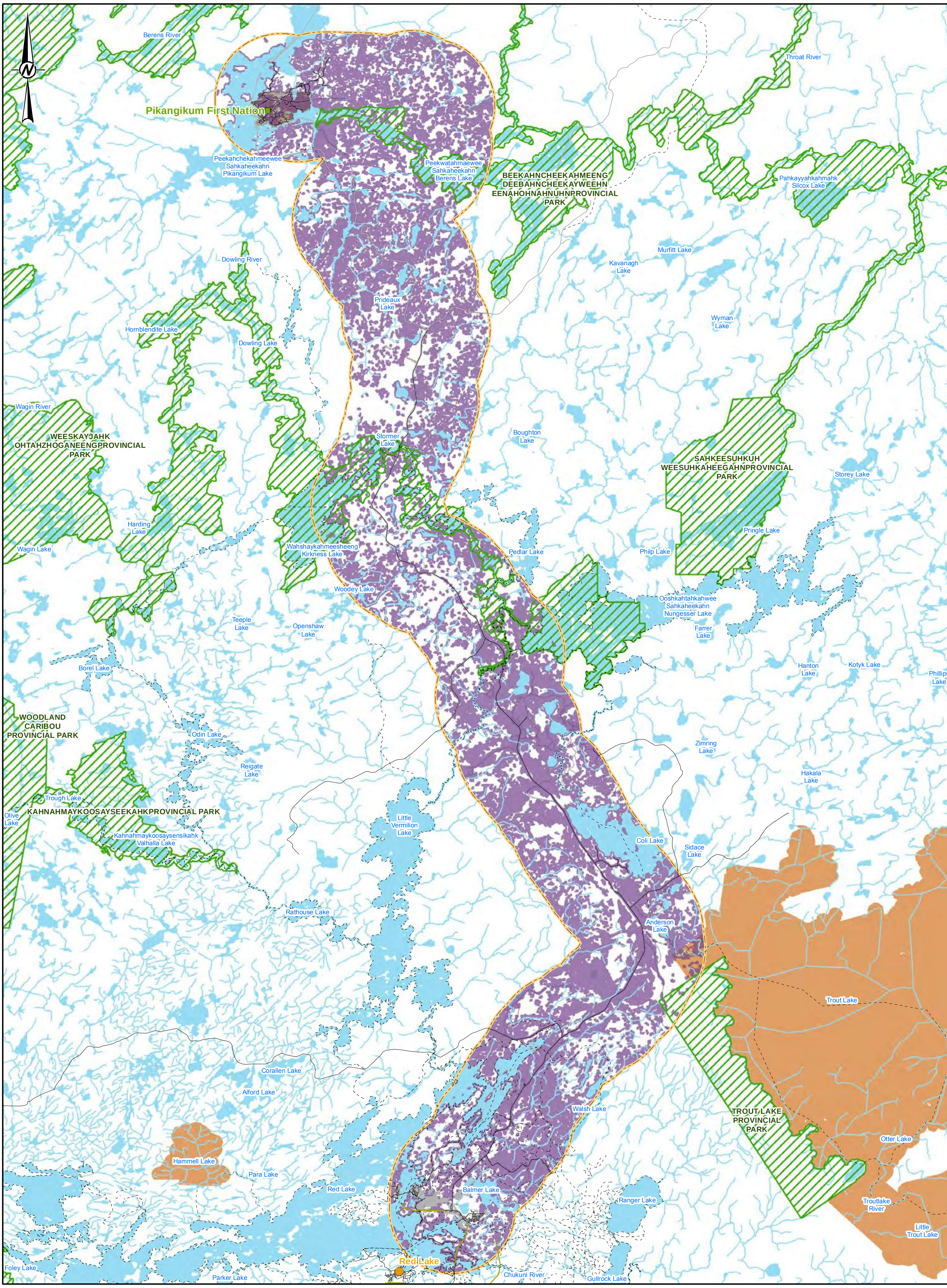

LEGEND

- City
- Town
- First Nation Community
- Wataynikaneyap Power Community
- Major Roads and Highways
- Winter Road
- Trail
- Existing Electrical Transmission Line
- Watercourse
- First Nation Reserve Land
- Waterbody
- Conservation Reserve
- Provincial Parks
- Regional Study Area
- Base Case Disturbance
- Eastern Whip-poor-will Habitat

REFERENCE(S)

1. BASE DATA - MNR LIO, OBTAINED 2016, NTDB
2. TRANSMISSION ROUTES - PROVIDED BY WATAYNIKANEYAP POWER L.P.
3. FIRST NATION COMMUNITIES FROM INDIGENOUS AND NORTHERN AFFAIRS CANADA (WWW.AINC-INAC.GC.CA)
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0 5 10

1:280,000 Kilometers

CLIENT
WATAYNIKANEYAP POWER L.P.

PROJECT
PIKANGIKUM DISTRIBUTION LINE PROJECT

TITLE
EASTERN WHIP-POOR-WILL HABITAT IN THE REGIONAL STUDY AREA AT BASE CASE

CONSULTANT

Wataynikaneyap Power

Golder Associates

YYYY-MM-DD	2017-03-21
DESIGNED	JMC
PREPARED	JMC/PR
REVIEWED	LD
APPROVED	AE

PROJECT NO.	CONTROL	REV.	FIGURE
1657738	####	####	9

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4.2.6.3 Survival and Reproduction

Canada is estimated to contain 6% of the global eastern whip-poor-will population (120,000 individuals) (Environment Canada 2015b). Data from breeding bird surveys indicated a Canada-wide population decline of 3.19% per year from 2002 to 2012, or 75% loss of the population over this time period (Environment Canada 2015b). Between the first (1981 to 1985) and second (2001 to 2005) Ontario Breeding Bird Atlas periods, whip-poor-will declined by 37% (Cadman et al. 2007; Environment Canada 2015b).

Because the eastern whip-poor-will population in Canada has declined by 75% from 1968 to 2007, they are considered a priority species under the Bird Conservation Strategy with the objective of doubling current abundance (Environment Canada 2013). The eastern whip-poor-will was designated as threatened by COSEWIC in 2008 and was listed on Schedule 1 of SARA as a threatened species in 2011. It is also listed as threatened on the provincial ESA. Despite concerning population trend data, Environment Canada (2015b) states that individuals that are capable of reproduction are available to sustain the population and improve its abundance. The population objectives for Canada as identified in the final federal recovery strategy are to halt the national decline by 2025, with no more than a 10% population decline during this time, maintain an area of occupancy at 3,000 km² or more, and ensure a 10-year positive population trend thereafter, while gradually recolonizing areas in the southern portion of the breeding distribution (Environment Canada 2015b).

The primary threats to eastern whip-poor-will include reduced availability of insect prey, habitat conversion for agriculture on breeding and wintering ranges, and predation (Environment Canada 2015b). Eastern whip-poor-will feed on many types of flying insects (Cink 2002). Insect populations are declining worldwide and these declines may be contributing to whip-poor-will population decline (COSEWIC 2009; Environment Canada 2015b). Many aerial-foraging insectivorous birds, such as whip-poor-will, have experienced large declines since the 1980s (Blancher et al. 2009; NABCIC 2012). Forest and non-forest aerial-foraging birds have experienced drastic population declines, which suggests the major cause of the declines is decreased insect abundance (Blancher et al. 2009; Nebel et al. 2010; Nocera et al. 2012; Paquette et al. 2014). Wagner (2012) noted declines for many nocturnal moth species, which are the preferred prey for eastern whip-poor-will (Cink 2002). Potential causes of reduced availability of insects include habitat loss, climate change resulting in a temporal mismatch between reproduction and peak food abundance, and pesticide use, which can reduce the abundance and diversity of flying insects (Nebel et al. 2010; Nocera et al. 2012; Paquette et al. 2014). Insect and bird populations that are distributed within and likely extend outside the RSA have likely been affected by all of these factors at Base Case. Eastern whip-poor-will may be susceptible to these factors because they are primarily aerial insectivores and they have low annual productivity (average of two eggs per brood, with up to two broods per year reported; Cink 2002).

Forest harvesting can result in positive and negative changes to whip-poor-will habitat, and ultimately survival and reproduction in the Base Case (Bushman and Therres 1988; Wilson and Watts 2008; Environment Canada 2015b). Forest harvesting is not likely the leading cause of whip-poor-will declines (Environment Canada 2015b). Early successional habitats are preferred by this species, but high shrub density at 10- to 15-year post-harvest reduces habitat suitability (Environment Canada 2015b). Regenerating areas were found to have high densities of foraging individuals (Wilson and Watts 2008). Clear-cuts may increase the occupancy and abundance of breeding whip-poor-wills (Tozer et al. 2014).

Fire suppression has likely had negative effects on whip-poor-will in the Base Case. Fire suppression may keep forest stands at a more mature stage, which is less suitable for whip-poor-will. In Ontario, fire suppression has been identified as a cause of whip-poor-will population decline, especially in northern Ontario (Cadman et al. 2007; Tozer et al. 2014).

Nest parasitism by brown-headed cowbirds has not been reported for eastern whip-poor-will; an increase in edge density is not likely to decrease whip-poor-will survival and reproduction.

Eastern whip-poor-will were likely never abundant in the RSA due to a historical limited amount of naturally available suitable habitat. Despite declining population trends, Environment Canada (2015b) states that individuals that are capable of reproduction are available to sustain the population and increase abundance. Therefore, changes to whip-poor-will survival and reproduction in the Base Case are expected to be within the resilience and adaptability limits of this criterion that has populations overlapping the RSA.

4.2.7 Common Nighthawk

4.2.7.1 Habitat Availability

Common nighthawks are associated with a variety of open or semi-open habitats, including forest clearings, burned areas, grassy meadows, rocky outcrops, sandy areas, grasslands, pastures, peat bogs, marshes, lake shores, quarries, mines, and urban areas (Peck and James 1983; COSEWIC 2007a; Brigham et al. 2011). Wetlands and open water are often used as foraging locations (Brigham et al. 2011). Forested areas with low canopy closure may also provide habitat for the common nighthawk (COSEWIC 2007a). Critical habitat has not yet been identified for common nighthawk due to the diversity of nesting, roosting and foraging habitats that have been reported (Environment Canada 2016c). Nighthawks eat a wide variety of insects but most commonly consume queen ants, beetles, caddisflies, moths, and true bugs (Brigham et al. 2011). Common nighthawks are generally crepuscular, foraging under low light conditions at dusk and dawn, and often forage in large groups at particular times of the year (Brigham et al. 2011).

Suitable habitat covers 50,910 ha (44.6%) of the RSA, at Base Case (Table 10). This likely represents a decrease in suitable habitat relative to what was historically available for this species because fire suppression activities limit the number of open habitats (COSEWIC 2007a).

Table 10: Common Nighthawk Habitat Availability in the Regional Study Area at Base Case.

Habitat Suitability	Area (ha)	Proportion (%)
Moderate to High	50,910	44.6
Nil to Low	63,309	55.4
Total	**114,220**	**100.0**

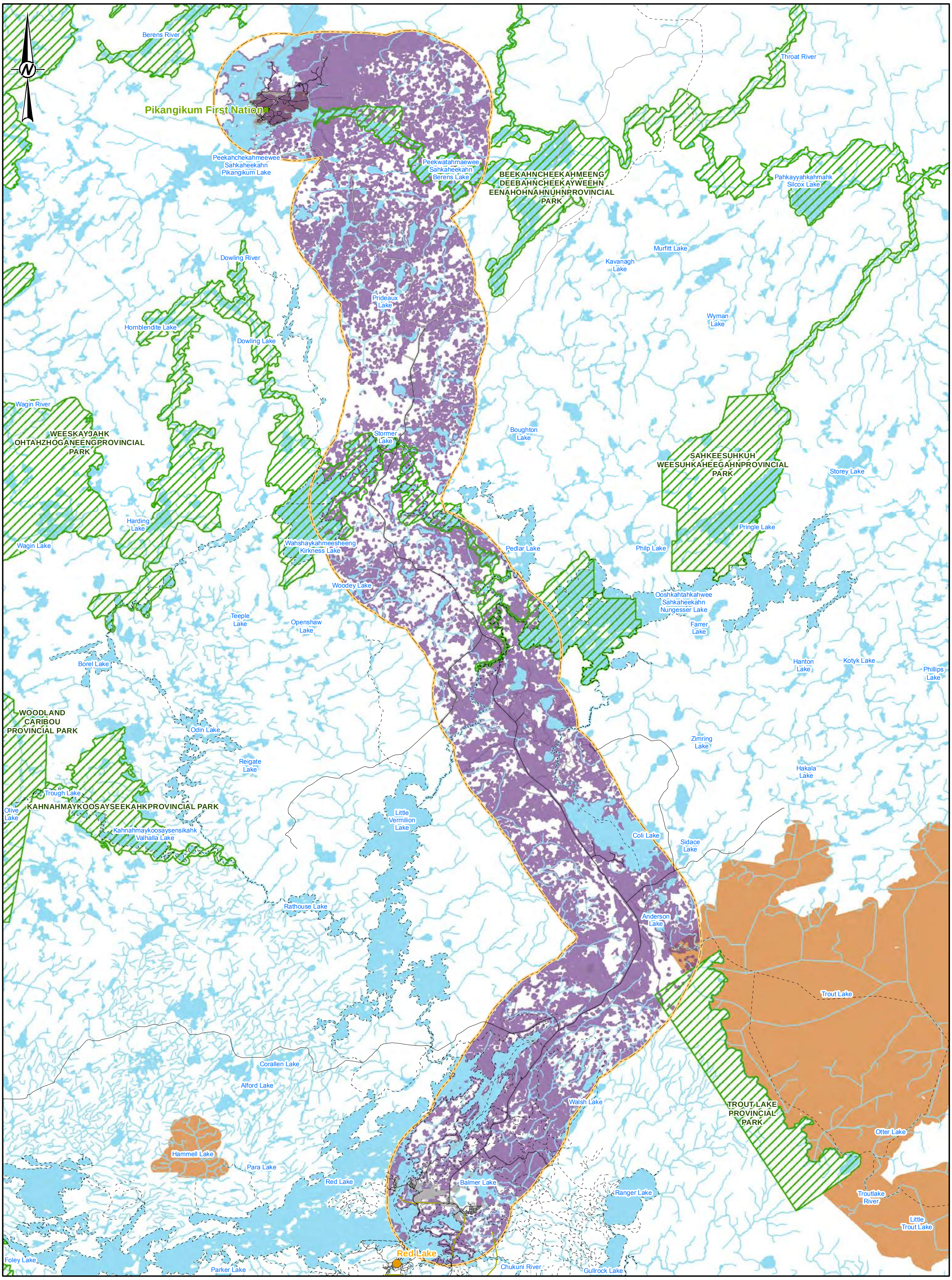
Note: Numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.
ha = hectares; % = percent.

Although little is known about habitat trends for the common nighthawk in Canada, it is thought that the extensive deforestation that followed European settlement increased suitable habitat for this species (COSEWIC 2007a). Recent changes to forestry practices that favour limiting the size of clear-cuts and scattering cuts throughout the forest, along with extensive reforestation, have contributed to the decline in the quantity and quality of common nighthawk habitat (COSEWIC 2007a). Fire suppression activities are also thought to have contributed to the decline in suitable habitat for nighthawk by limiting the number of open habitats (COSEWIC 2007a).

It is currently unknown whether breeding habitat is limiting Canadian populations of common nighthawk (Environment Canada 2016c). Results of the habitat mapping in the RSA indicate that approximately 45% of the RSA is suitable breeding habitat for nighthawk, which does not consider existing disturbances (i.e., roads) that may provide additional suitable breeding habitat. As such, the predicted amount of suitable breeding habitat is likely an underestimate. The results suggest that breeding habitat is not a limiting factor for common nighthawk populations that overlap with the RSA at Base Case and that changes in habitat availability have not exceeded the adaptability or resilience limits of this criterion. Disturbances can have both positive and negative effects on common nighthawk habitat availability. Forest harvesting, for example, creates openings that may actually benefit common nighthawk through increased habitat available for nesting (Environment Canada 2016c).

4.2.7.2 Habitat Distribution

Based on habitat modelling, suitable habitat occurs in numerous discrete patches that are well distributed throughout RSA (Figure 10). Habitat fragmentation from mineral exploration and linear disturbances present at Base Case is not likely to have negatively affected common nighthawk habitat distribution because this species uses recently disturbed, open areas for nesting. Nest fidelity of common nighthawk has been documented in urban habitats (Dexter 1961). However, this species is highly mobile and can nest in a variety of different types of habitats; therefore, it is expected that breeding habitat is not limiting.



LEGEND

- City
- Town
- First Nation Community
- Wataynikaneyap Power Community
- Major Roads and Highways
- Winter Road
- Trail
- Existing Electrical Transmission Line
- Watercourse
- First Nation Reserve Land
- Waterbody
- Conservation Reserve
- Provincial Parks
- Regional Study Area
- Base Case Disturbance
- Common Nighthawk Habitat

REFERENCE(S)

1. BASE DATA - MNR LIO, OBTAINED 2016, NTDB
2. TRANSMISSION ROUTES - PROVIDED BY WATAYNIKANEYAP POWER L.P.
3. FIRST NATION COMMUNITIES FROM INDIGENOUS AND NORTHERN AFFAIRS CANADA (WWW.AINC-INAC.GC.CA)
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CLIENT
WATAYNIKANEYAP POWER L.P.

PROJECT
PIKANGIKUM DISTRIBUTION LINE PROJECT

TITLE
COMMON NIGHTHAWK HABITAT IN THE REGIONAL STUDY AREA AT BASE CASE

CONSULTANT

Wataynikaneyap Power

Golder Associates

YYYY-MM-DD	2017-03-21
DESIGNED	JMC
PREPARED	JMC/PR
REVIEWED	LD
APPROVED	AE

PROJECT NO.	CONTROL	REV.	FIGURE
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4.2.7.3 Survival and Reproduction

The common nighthawk is federally listed as threatened by COSEWIC (2007a) and "Schedule 1: Threatened" by SARA 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). Breeding Bird Survey data from Environment Canada (2014) does not cover the RSA. Sauer et al. (2014) analyzed BBS data and estimated that common nighthawk populations in Ontario have declined by 0.7% per year from 1966 to 2013. However, breeding bird survey data are not designed for detecting common nighthawks, and the accuracy of trends estimated from those data are therefore unknown. Seventeen common nighthawks were recorded at eight locations in the baseline study area during species-specific surveys in 2016. There are no common nighthawk observations in the RSA according to MNRF sensitive species data.

Population data are not available in the RSA. The RSA likely overlaps with several distinct but interbreeding common nighthawk populations. The number of individuals in the RSA was roughly estimated based on data from the Ontario Breeding Bird Atlas (Region 39: English River and Region 44: Big Trout Lake). Estimates were averaged across the two survey regions and assumed a 100 m radius (0.0314 km^2) was sampled at each point count station. Point counts for the Breeding Bird Atlas are unlimited distance (Cadman et al. 2007) but assuming an approximately 100 m sampling radius provides a conservative estimate of bird abundance. The abundance estimate for Region 39 is 0.07 individuals/km^2. Abundance estimates for common nighthawk were not available for Region 44. Applying an abundance estimate of 0.07 individuals/km^2 to the amount of suitable habitat present at Base Case (Table 10) corresponds to an abundance estimate of approximately 36 individuals in the RSA.

Reasons for the apparent decline of common nighthawk populations are not well understood, but may be due in part to diminishing populations of insect prey due to habitat loss, changes to timing of peak food abundance from climate change, and pesticide use (COSEWIC 2007a; Brigham et al. 2011). Insect and bird populations in the wintering range and breeding range (e.g., RSA) have likely been affected by these factors at Base Case. Nighthawks may be susceptible to these factors because their residency on breeding grounds is brief compared to other landbirds. Common nighthawk is one of the last species to arrive on breeding grounds and one of the first species to leave in the fall (COSEWIC 2007a). This behaviour reduces the possibility for raising more than one clutch per year, as well as limits adaptive capability in regards to climate change (Environment Canada 2016a).

The main threat to common nighthawk populations in North America is suggested to be the loss and alteration of suitable breeding habitat (COSEWIC 2007a). For example, fire suppression and changes in harvesting practices have reduced the number of open areas in forested regions (COSEWIC 2007a).

Common nighthawk primarily feed on queen ants, beetles, caddisflies, moths, and true bugs. Insect populations are declining worldwide and may be contributing to the decline of common nighthawk populations (Environment Canada 2016a). Many aerial-foraging insectivorous birds 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).

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).

4.2.8 Olive-sided Flycatcher

4.2.8.1 Habitat Availability

Anthropogenic disturbances can result in positive and negative changes to olive-sided flycatcher habitat. Vegetation clearing can improve habitat around the disturbance perimeter by creating edge habitats that are positively associated with this species' abundance (McGarigal and McComb 1995). However, vegetation clearing can also result in a net loss of habitat when the edge to open area ratio is small. Overall, disturbances tend to have positive effects when they result in small forest openings and tend to have negative effects when the disturbance is large. In general, human developments have likely had a net negative change to olive-sided flycatcher habitat availability in the RSA, relative to historical conditions. Olive-sided flycatchers are more abundant in landscapes with a large amount of fragmentation (i.e., patchily distributed habitat) (McGarigal and McComb 1995).

Fire suppression has likely resulted in opposing changes to habitat in the RSA. Several studies report higher densities of olive-sided flycatchers in early post-burn communities (Lowe et al. 1978; Hutto and Young 1999). Fire suppression in the RSA has probably resulted in less high-quality burned habitat, relative to historical conditions. However, increased amount and age of forests can create habitat conditions suitable for this species, especially where variable canopy height is created. In areas with no young post-fire habitat, olive-sided flycatchers are primarily found in late-successional forests with low canopy cover (Verner 1980; Scott and Crouch 1988). Overall, fire suppression has likely reduced the amount of suitable olive-sided flycatcher habitat in the RSA, relative to what was historically present for this species.

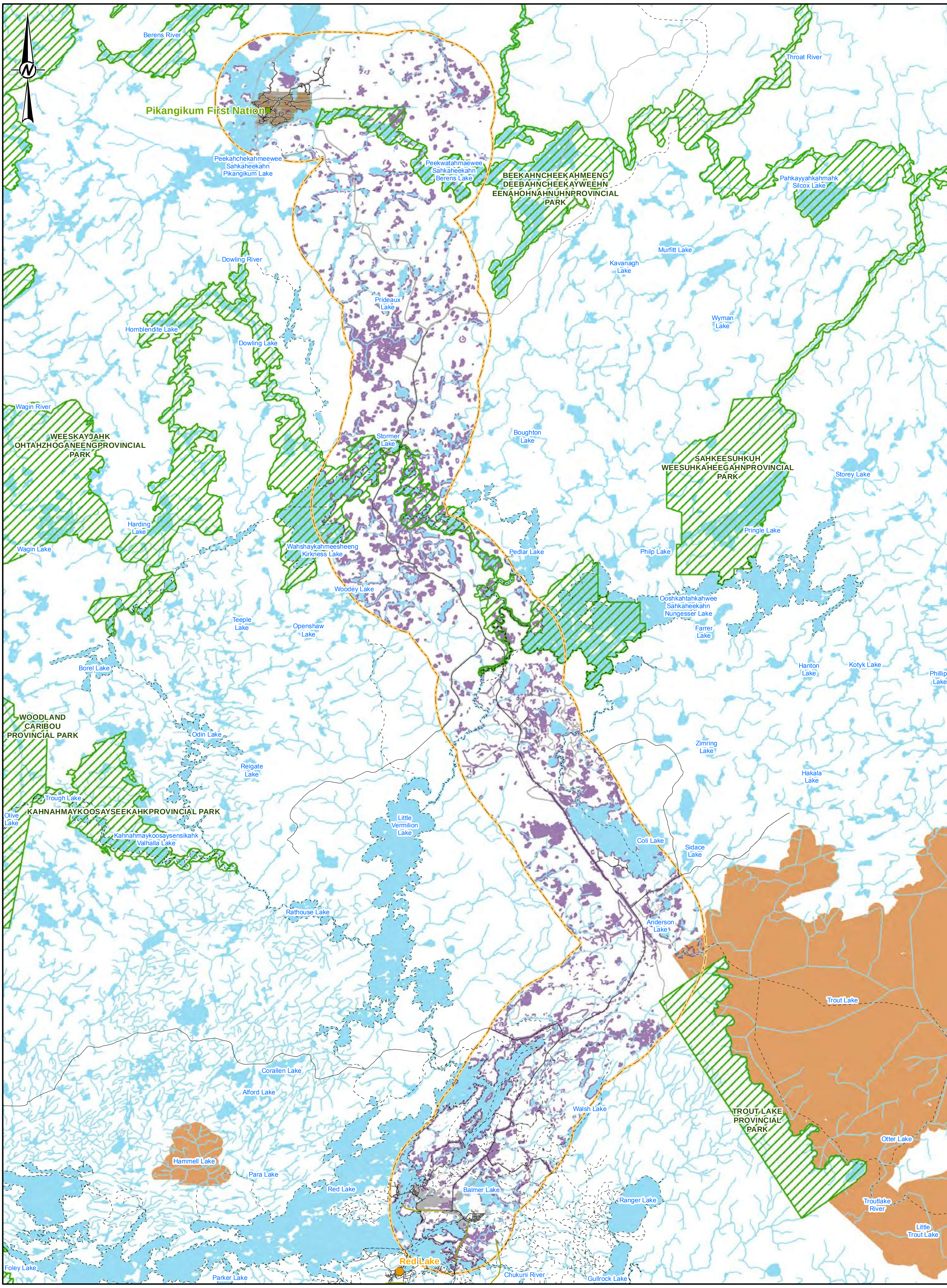
Olive-sided flycatcher was recorded at two breeding bird survey plots during baseline surveys in 2016. One individual was detected in sparse forest and one individual was detected in dense coniferous forest habitat.

The RSA contains 13,068 ha (11.4%) of suitable olive-sided flycatcher habitat at Base Case (Table 11). Overall, the changes in habitat availability at Base Case are predicted to be within the adaptive capacity and resilience limits of this criterion. Habitat is naturally patchy and sparsely distributed in the RSA (Figure 11); olive-sided flycatchers are well adapted to patchily distributed habitat as this species is more abundant in highly fragmented landscapes than undisturbed landscapes (McGarigal and McComb 1995). Additionally this species is not a mature or old growth forest obligate and edge habitat can increase habitat suitability.

Table 11: Olive-sided Flycatcher Habitat Availability in the Regional Study Area at Base Case

Habitat Suitability	Area (ha)	Proportion (%)
Moderate to High	13,068	11.4
Nil to Low	101,152	88.6
Total	**114,220**	**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.
ha = hectares; % = percent.



LEGEND

- City
- Town
- First Nation Community
- Wataynikaneyap Power Community
- Major Roads and Highways
- Winter Road
- Trail
- Existing Electrical Transmission Line
- Watercourse
- First Nation Reserve Land
- Waterbody
- Conservation Reserve
- Provincial Parks
- Regional Study Area
- Base Case Disturbance
- Olive-sided Flycatcher Habitat

REFERENCE(S)

1. BASE DATA - MNR LIO, OBTAINED 2016, NTDB
2. TRANSMISSION ROUTES - PROVIDED BY WATAYNIKANEYAP POWER L.P.
3. FIRST NATION COMMUNITIES FROM INDIGENOUS AND NORTHERN AFFAIRS CANADA (WWW.AINC-INAC.GC.CA)
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1:280,000 Kilometers

CLIENT
WATAYNIKANEYAP POWER L.P.

PROJECT
PIKANGIKUM DISTRIBUTION LINE PROJECT

TITLE
OLIVE-SIDED FLYCATCHER HABITAT IN THE REGIONAL STUDY AREA AT BASE CASE

CONSULTANT

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Golder Associates

YYYY-MM-DD	2017-03-22
DESIGNED	JMC
PREPARED	JMC/PR
REVIEWED	LD
APPROVED	AE

PROJECT NO.	CONTROL	REV.	FIGURE
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4.2.8.2 Habitat Distribution

Habitat fragmentation is thought to improve olive-sided flycatcher habitat by providing edge habitat; however, Haché et al. (2014) found that the density of olive-sided flycatchers was negatively affected by linear disturbances on the landscape. Suitable breeding habitat for olive-sided flycatcher is patchily distributed throughout the RSA, with larger patches of contiguous habitat located in the vicinity of Kirkness Lake and Coli Lake (Figure 11). The small amount of existing disturbances in the RSA do not likely function as movement or dispersal barriers for this species in the Base Case.

4.2.8.3 Survival and Reproduction

Olive-sided flycatchers are found throughout most of Canada, with the latest population estimate indicating there are approximately 900,000 individuals in Canada (Environment Canada 2016b). Olive-sided flycatcher are found in lower abundance in northwestern Ontario compared to other parts of their range (Environment Canada 2016b). This is corroborated by the low detection rate of this species during baseline surveys (i.e., detected at 2 of 20 plots in the baseline study area in 2016). One olive-sided flycatcher was also incidentally observed during nightjar surveys in the baseline study area in 2016.

Data from the Ontario Breeding Bird Atlas (Cadman et al. 2007) (Region 39: English River and Region 44: Big Trout Lake) were used to estimate the number of individuals in the RSA. Using the same methods applied to estimate the number of common nighthawk in the regions (Section 3.2.7.3), abundance estimates for Region 39 and 44 are 1.02 and 1.36 individuals/km², respectively, which averages to 1.19 individuals/km² over the two regions. Applying this abundance estimate to the amount of suitable habitat present at Base Case (Table 11) corresponds to a rough abundance estimate of 156 individuals in the RSA.

An analysis of Breeding Bird Survey data by Environment Canada (2014) indicates an average annual population decline of 2.1% in Ontario from 1970 to 2012, suggesting an overall 88% decline during that time period. Because the olive-sided flycatcher population may have declined by more than 50%, they are considered a priority species under the Bird Conservation Strategy with the objective of doubling current abundance (Environment Canada 2013b). More recent analyses completed by the Boreal Avian Monitoring Project found no evidence for a decline in olive-sided flycatcher density across Canada between 1997 and 2013 (Haché et al. 2014).

Nevertheless, olive-sided flycatcher is designated as threatened by COSEWIC (2007) and has the same status under Schedule 1 of SARA. In Ontario it is designated as Special Concern under the ESA. Environment Canada (2016b) states that “there are currently adequate numbers of individuals to sustain the species in Canada or increase its abundance with the implementation of proper conservation actions.” The population objective for olive-sided flycatcher identified in the federal recovery strategy is to halt the national decline by 2025, with no more than a 10% decline during this time, and ensure a 10-year positive population trend thereafter (Environment Canada 2016b).

The abundance of olive-sided flycatcher appear to be positively related with the amount of old-growth, forest edge, and fragmentation (McGarigal and McCombs 1995). The main threats to olive-sided-flycatcher populations include habitat loss or degradation, fire suppression, and reduced availability of insect prey (Environment Canada 2016b). Several studies have suggested that deforestation on the wintering grounds in South and Central America may also be a primary factor in the decline of this species (Altman and Sallabanks 2000; Petit et al. 1993).

Olive-sided flycatcher abundance is often higher in early post-fire communities than in other habitat types (Lowe et al. 1978; Hutto and Young 1999). Altman and Sallabanks (2012) report that nest success for olive-sided flycatcher was highest in early post-fire habitat. Robertson and Hutto (2007) found nest success to be twice as high in a burned plot compared to a selectively forested one and suggest that nests in logged areas are subject to higher rates of predation. In contrast Meehan et al. (2003) reported higher reproductive success in logged habitat.

Similar to the common nighthawk, the olive-sided flycatcher is limited by insect populations which may be influenced by a number factors such habitat loss, pesticide use, and climate change (Both et al. 2006; Environment Canada 2016b). Changes in prey availability may also related to a temporal mismatch between reproduction and peak food availability. The RSA has likely been affected by these factors at Base Case. Olive-sided flycatcher may be particularly susceptible to these factors because they have low reproductive potential and the longest migration distance of all flycatchers (Environment Canada 2016b). Even though habitat is patchily distributed in the RSA at Base Case, olive-sided flycatchers are well-adapted to this naturally patchily distribution of habitat; olive-sided flycatchers are more abundant in highly fragmented landscapes than undisturbed landscapes (McGarigal and McComb 1995), As such, changes in survival and reproduction at Base Case are expected to be within the resilience and adaptive capacity limits for this species.

4.2.9 Bank Swallow

4.2.9.1 Habitat Availability

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 2013). 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 2013). However, sand and gravel excavation and road cuts have likely increased nesting habitat suitability for bank swallow (COSEWIC 2013). 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 2013).

A habitat model was not developed for bank swallow because the Project is not anticipated to result in measurable effects on bank swallow populations that overlap the RSA (see Section 4.2.2).

4.2.9.2 Habitat Distribution

In Ontario the bank swallow occurs most commonly in the lower Great Lakes, St. Lawrence Valley and the Abitibi-Témiscamingue and Lac-Saint-Jean regions. This species is sparsely distributed throughout the Canadian Shield and most commonly occur in aggregate pits and large river corridors (COSEWIC 2013). Suitable habitat for bank swallow is likely patchily distributed in the RSA due to the reliance of this species on particular soil types and vertical banks near water sources.

4.2.9.3 Survival and Reproduction

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 2013). The population estimate of barn swallows in Ontario was approximately 200,000 individuals in 2007 (COSEWIC 2013).

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 2013). In Ontario, bank swallow populations decreased by 4.99% per year from 2001 to 2011 (COSEWIC 2013). This species it 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 2013). The barn swallow was designated as threatened by COSEWIC in 2013 but has yet to be listed under SARA.

Bank swallow was recorded in five squares in OBBA Region 44 during the second OBBA and is noted as a confirmed breeder in the region (Cadman et al. 2007). Bank swallow was not observed in the baseline study area during field surveys in 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 band 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).

4.2.10 Canada Warbler

4.2.10.1 Habitat Availability

Throughout their range, Canada warblers (*Cardellina canadensis*) nest in a variety of usually wet, forest types, with a well-developed, dense shrub layer (COSEWIC 2008; Environment Canada 2016c). This species is commonly found in shrub marshes, swamps dominated by black spruce (*Picea mariana*) and tamarack (*Larix laricina*), and riparian woodlands (COSEWIC 2008). In the eastern portion of their range, which includes the RSA, Canada warblers are associated with wet mixedwood forests and early successional forests (6 to 30 years) created by forest harvesting or natural disturbance (Ball and Bayne 2014; Environment Canada 2016c).

The RSA contains 29,642 ha (26.0%) of suitable Canada warbler habitat at Base Case (Table 12).

Table 12: Canada Warbler Habitat Availability in the Regional Study Area at Base Case.

Habitat Suitability	Area (ha)	Proportion (%)
Moderate to High	29,642	26.0
Nil to Low	84,577	74.1
Total	**114,220**	**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.
ha = hectares; % = percent.

Forestry can have both positive and negative effects on Canada warbler habitat. Initially forestry activities remove suitable habitat; Canada warbler are generally absent from recently disturbed areas (0 to 5 years post-disturbance) (Norton et al. 2000; Schieck and Song 2006). In the eastern part of their range, Canada warbler are most abundant in areas 6 to 30 years post-harvest that contained residual live trees (Hagan et al. 1997; Hobson and Schieck 1999; Schieck and Hobson 2000; Lambert and Faccio 2005; Hallworth et al. 2008; Environment Canada 2016c). Canada warbler do not use harvested areas where residual mature tree retention is low. Canada warbler were absent in harvested stands when retention was 6% but were present when mature tree retention was 30% to 40% and retention was aggregated into larger patches (Norton and Hannon 1997; Schieck and Hobson 2000).

Fire suppression activities have increased the average forest age in northern Ontario by approximately 30 years, compared to 1915. Shrub density is highest in young regenerating (0 to 24 years) and mature forests (>100 years) because light levels are limited in closed-canopy stands of 25 to 100 years (Alaback 1982; McKenzie et al. 2000). The direction of the effect on Canada warbler habitat from fire suppression activities (i.e., positive or negative) is likely related to the density of the shrub layer in old forests. If old forests have a dense shrub layer, fire suppression activities have likely increased Canada warbler habitat from what was historically available for this species. Conversely, if the shrub layer in old forests is sparse, fire suppression activities have likely decreased the amount of habitat that is available in the RSA, from historical conditions, by decreasing the amount early regenerating habitat.

It is currently unknown whether breeding habitat is limiting Canadian populations of Canada warbler (Environment Canada 2016c). Approximately 50% of the Canadian population may reside in Ontario and results of the habitat mapping in the RSA indicate that 26% of the RSA is suitable breeding habitat for Canada warbler. This suggests that breeding habitat is not a limiting factor for Canada warbler populations that overlap with the RSA at Base Case and that changes in habitat availability have not exceeded the adaptability or resilience limits of this criterion.

4.2.10.2 Habitat Distribution

Changes to forest composition have been greatly influenced by forest harvesting operations. Overall, forests have become more fragmented over the past 60 years, with policies providing direction to limit the size of clearcuts and scatter cuts throughout the forest. Effects from habitat fragmentation on Canada warbler are unclear. Some studies suggest that fragmentation has negative effects on Canada warbler because they are an interior-forest nesting bird that avoids edge habitat (Askins and Philbrick 1987; Hobson and Bayne 2000). Other studies suggest that Canada warbler are resilient to habitat fragmentation from logging activities as the species uses early successional habitat (Schmiegelow et al. 1997; Schmiegelow and Monkkonen 2002).

Habitat fragmentation from linear disturbances present in the RSA at Base Case may have negatively affected Canada warbler habitat distribution. However, habitat does not appear to be a limiting factor for Canada warbler at Base Case, and this species is highly mobile and can establish territories in areas below carrying capacity. 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.

At Base Case, suitable Canada warbler habitat is distributed throughout the RSA, with relatively less habitat being present between Coli Lake and Kirkness Lake (Figure 12). Baseline surveys for the Project did not recorded Canada warbler in the baseline study area in 2016. Information from the MNRF (2015b) indicates that Canada warbler breed from the Mixedwood Plains north to the Hudson Plains, with the highest densities of this species occurring in the Southern Shield.

Overall, habitat is well distributed and connected across the RSA. Existing disturbance in the RSA do not likely function as dispersal barriers for this species in the Base Case and habitat conditions at Base Case are predicted to be well within the resilience and adaptive capacity limits for this criterion.

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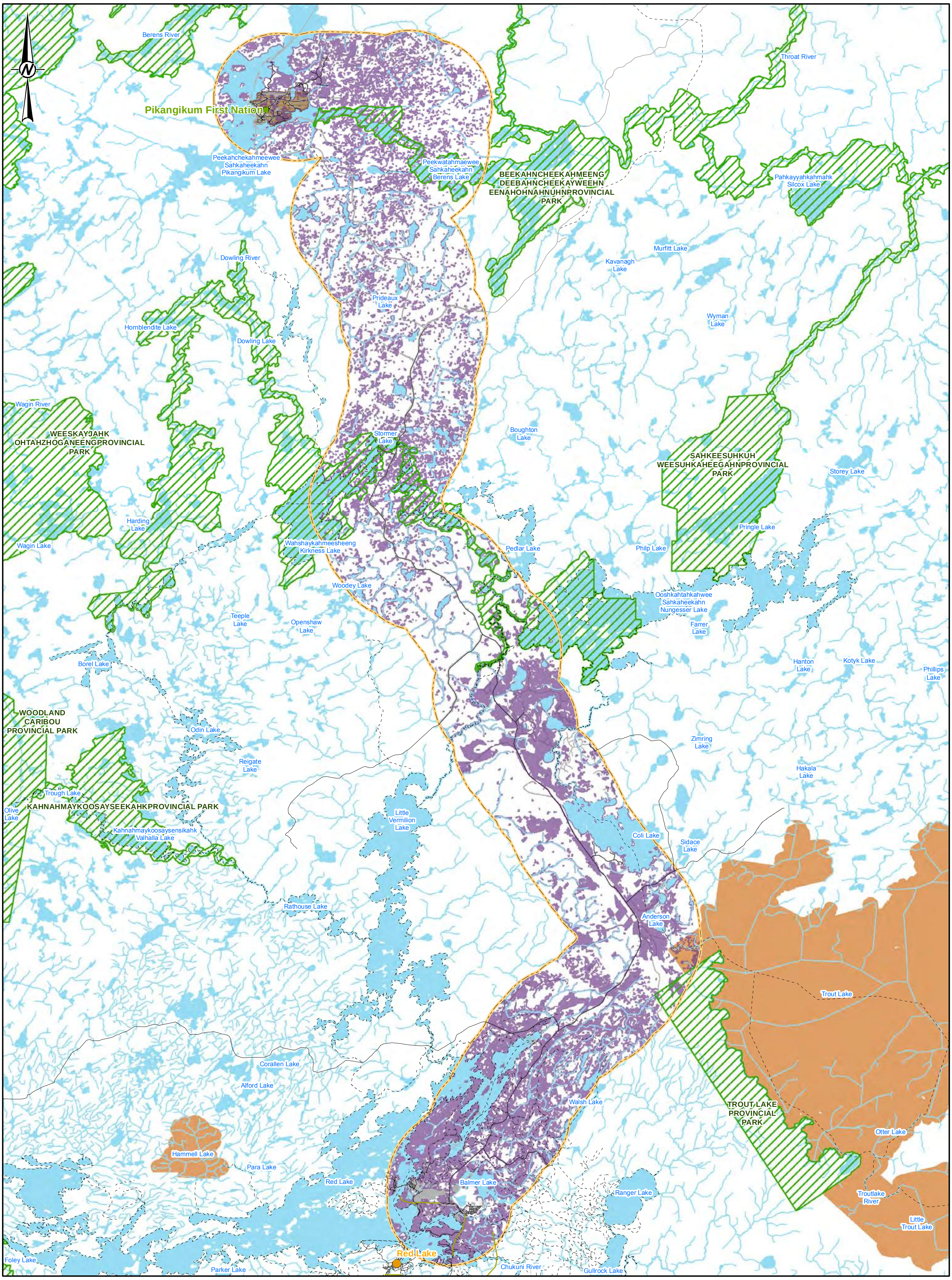

LEGEND

- City
- Town
- First Nation Community
- Wataynikaneyap Power Community
- Major Roads and Highways
- Winter Road
- Trail
- Existing Electrical Transmission Line
- Watercourse
- First Nation Reserve Land
- Waterbody
- Conservation Reserve
- Provincial Parks
- Regional Study Area
- Base Case Disturbance
- Canada Warbler Habitat

REFERENCE(S)

1. BASE DATA - MNR LIO, OBTAINED 2016, NTDB
2. TRANSMISSION ROUTES - PROVIDED BY WATAYNIKANEYAP POWER L.P.
3. FIRST NATION COMMUNITIES FROM INDIGENOUS AND NORTHERN AFFAIRS CANADA (WWW.AINC-INAC.GC.CA)
4. PRODUCED BY GOLDER ASSOCIATES LTD UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2016
5. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 15

0 5 10

1:280,000 Kilometers

CLIENT
WATAYNIKANEYAP POWER L.P.

PROJECT
PIKANGIKUM DISTRIBUTION LINE PROJECT

TITLE
CANADA WARBLER HABITAT IN THE REGIONAL STUDY AREA AT BASE CASE

CONSULTANT

YYYY-MM-DD	2017-03-21
DESIGNED	JMC
PREPARED	JMC/PR
REVIEWED	LD
APPROVED	AE

PROJECT NO.	CONTROL	REV.	FIGURE
1657738	####	####	12

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4.2.10.3 Survival and Reproduction

Approximately 82% of the Canada warbler breeding range occurs in Canada (Environment Canada 2016a). The Canadian population of this species is estimated to be three million individuals (Environment Canada 2016a). Abundance estimates of Canada warbler in Ontario suggest a population of 900,000 individuals or approximately 33% of the Canadian population (COSEWIC 2008). In Ontario, the Ontario Breeding Bird Atlas showed an annual population trend of -0.8% between the first (1981 to 1985) and second (2001 to 2005) atlas periods. Long-term breeding bird survey data show a decline of Canada warbler abundance of 4.5% per year from 1968 to 2007 (overall 83% decline) (Environment Canada 2016a). Population trends for eastern Canada (Ontario, Quebec, and the Maritimes) show long- (1968 to 2007) and short- (1997 to 2007) term declines (COSEWIC 2008).

Because the Canada warbler population in Canada has declined by 83% from 1968 to 2007, they are considered a priority species under the Bird Conservation Strategy with the objective of doubling current abundance (Environment Canada 2013b). The Canada warbler was designated as threatened by COSEWIC in 2008 and was given the same status under Schedule 1 of SARA in 2010. Despite concerning population trend data, Environment Canada (2016a) states that "there are currently adequate numbers of individuals to sustain the species in Canada or increase its abundance with the implementation of proper conservation actions." The population objective for Canada as identified in the final federal recovery strategy is to halt the national decline by 2025, with no more than a 10% decline during this time, and ensure a 10-year positive population trend thereafter (Environment Canada 2016a).

Data from the Ontario Breeding Bird Atlas (Cadman et al. 2007) (Region 39: English River and Region 44: Big Trout Lake) were used to estimate the number of individuals in the RSA. Using the same methods applied to estimate the number of common nighthawk in the regions (Section 3.2.7.3), abundance estimates for Region 39 and 44 are 0.79 and 0.21 individuals/km², respectively, which averages to 0.50 individuals/km² over the two regions. Applying this abundance estimate to the amount of suitable habitat (Table 12) corresponds to a rough abundance estimate of 148 individuals in the RSA.

The abundance of Canada warbler is positively related to shrub density (Norton and Hannon 1997; Hallworth et al. 2008). The primary threats to Canada warbler habitat include conversion of land for agriculture, removal of the shrub layer (e.g., from forest harvesting or silviculture), forest harvesting, and accidental mortality from collisions with infrastructure (Environment Canada 2016a). Several theories have been suggested as the cause of Canada warbler population decline, including habitat loss and degradation (Ball and Bayne 2014), predation on breeding grounds (Bohning-Gaese et al. 1993), and spruce budworm declines (Sleep et al. 2009). A cause-effect relationship has not been established between loss and degradation of wintering habitat and Canada warbler population decline but loss of primary forest on the wintering grounds is still considered to be a key potential cause of this species decline (Environment Canada 2016a). It is currently unknown whether breeding habitat is limiting in Canada (Environment Canada 2016a).

Canada warbler primarily feeds on flying insects and spiders. Although Canada warbler is not considered a spruce budworm specialist, it has been found to feed heavily on spruce budworms during outbreaks. Insect populations are declining worldwide and spruce budworm outbreaks in eastern forests have decreased since 1970; both factors may be contributing to Canada warbler decline (Environment Canada 2016a). Many aerial-foraging insectivorous birds, such as Canada warbler, 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 wintering range and breeding range (e.g., RSA) have likely been affected by these factors at Base Case. Canada warblers may be susceptible to these factors because their residency on breeding grounds is brief compared to other warblers. Canada warblers are one of the last species to arrive on breeding grounds and one of the first species to leave in the fall (COSEWIC 2008). This behaviour reduces the possibility for raising more than one clutch per year, as well as limits adaptive capability in regards to climate change (Environment Canada 2016a).

Changes to Canada warbler habitat from forest harvesting may have positive and negative effects on this species' survival and reproduction. Canada warbler have been found to tolerate a degree of forest harvesting, especially in the eastern portion of its range (Hagan et al. 1997; Environment Canada 2016a). Canada warbler habitat in eastern Canada could potentially be maintained by rotating harvests that leave residual trees and create dense shrub understories (Hallworth et al. 2008).

Canada warbler nests typically contain four or five eggs, though as few as two and as many as six eggs have been observed (Reitsma et al. 2009). Brown-headed cowbirds have been reported to parasitize Canada warbler nests although the degree that nest parasitism contributes to Canada warbler survival and reproduction is not known (Reitsma et al. 2009). Brown-headed cowbirds prefer edge habitat (Lowther 1993) and the density of brown-headed cowbirds may increase with an increase in edge habitat. Canada warbler is an interior-forest nesting species. Therefore, although habitat availability may decrease within increasing edge, the risk of nest parasitism is not expected to increase as Canada warbler avoid edge habitats (Lambert and Faccio 2005).

Despite declining population trends, Environment Canada (2016a) states that "there are currently adequate numbers of individuals to sustain the species in Canada or increase its abundance with the implementation of proper conservation actions." Therefore, changes to Canada warbler survival and reproduction in the Base Case are expected to be within the resilience and adaptability limits of this criterion that has populations overlapping the RSA.

5.0 EFFECTS ASSESSMENT AND MITIGATION

5.1 Project-Environment Interactions and Pathway Analysis

The linkages between Project components and activities and potential effects to SAR criteria are identified and assessed through a pathway analysis. Potential effect pathways were identified by reviewing the Project Description, existing environmental conditions and knowledge from similar projects and activities. Effect pathways after the implementation of mitigation (or net effects) are screened to determine if net effects are likely. The screening process classifies potential effect pathways into the following categories:

- **No pathway:** the pathway is removed (i.e., effect is avoided) by implementation of mitigation practices and policies or actions. The pathway is not expected to result in a measurable change relative to the Base Case and, therefore, would not have a net effect on a criterion's assessment endpoint.
- **Secondary:** the pathway could result in a measurable environmental change relative to the Base Case but would have a negligible net effect on a criterion's assessment endpoint. The pathway is, therefore, not expected to additively or synergistically contribute to effects of other past, previous or reasonably foreseeable projects.
- **Primary:** the pathway is likely to result in an environmental change relative to the Base Case that could contribute to net effects on a criterion's assessment endpoint.

Potential pathways for effects to SAR criteria species and mitigation are presented in Table 13. Classification of effects pathways to SAR species criteria are also presented in Table 13, and detailed descriptions are provided in the following sections. It should be noted that much of the mitigation to address potential indirect effects (e.g., surface water) are provided in the INAC 2009 Screening Report; and therefore not completely repeated in the table below.

Table 13: Potential Effect Pathway for Effects for SAR Criteria

Project Component or Activity	Effect Pathway	Mitigation	Pathway Type
Project activities that generate air emissions and fugitive dust. During the construction stage: ■ clearing, grading earth moving, grubbing of vegetation, and stockpiling of materials along the ROW and other access and construction areas, and construction infrastructure (e.g., laydown areas); operation of vehicles and construction equipment; and ■ transportation of personnel, materials and equipment. During the operations and maintenance stage: ■ operation and maintenance of the new ROW, fencing, power line, conductors, tower foundations and permanent access roads.	Dust and air emissions, and subsequent deposition can change soil quality and vegetation, which can affect wildlife habitat availability and distribution	■ Watering of access roads and use of dust suppressants. ■ Regular maintenance of vehicles and equipment. ■ Speed limits will be defined and enforced to limit fugitive dust. ■ Salvaged soil stockpiles will be seeded, where necessary, to reduce wind erosion.	Secondary
Project activities that result in the loss or alteration of vegetation and topography. During the construction stage: ■ clearing, grading earth moving, grubbing of vegetation, and stockpiling of materials along the ROW and other access and construction areas, and construction infrastructure (e.g., laydown areas); and ■ surface water management and erosion control. During the operation and maintenance stage: ■ vegetation maintenance along ROW at an appropriate height to protect the facility and improve public and worker safety.	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	■ Limit the Project footprint. ■ Use of existing access roads. ■ Selective clearing and retention of shrub vegetation, trees, wildlife trees, and coarse woody debris as much as practical. ■ Known sensitive ecological features would be clearly marked (e.g., wetlands and significant wildlife habitat) with associated setbacks, as feasible. ■ Engage with applicable government agency (Ministry of Natural Resources and Forestry and Environment and Climate Change Canada) if sensitive ecological features are encountered or cannot be avoided. ■ Salvage/rescue cut timber; limit disturbance to other areas; employ tree protection measures (INAC 2009). ■ Disturbance to the LFH soil layer will be limited to the extent possible to facilitate natural regeneration in cleared areas.	■ Primary (woodland caribou, wolverine, little brown myotis, bald eagle, Canada warbler, eastern whip-poor-will, common nighthawk, and olive-sided flycatcher) ■ Secondary (bank swallow and horned grebe)
	Vegetation clearing will result in an increase in edge habitat, which could increase nest parasitism risk for forest breeding birds.	■ Selective clearing and retention of shrub vegetation, trees, wildlife trees, and coarse woody debris in areas where safe operation practices can still be achieved.	■ Primary (Canada warbler) ■ Secondary (eastern whip-poor-will, common nighthawk, and olive-sided flycatcher)

Table 13: Potential Effect Pathway for Effects for SAR Criteria

Project Component or Activity	Effect Pathway	Mitigation	Pathway Type
Project activities that result in the loss or alteration of vegetation and topography. During the construction stage: ■ clearing, grading earth moving, grubbing of vegetation, and stockpiling of materials along the ROW and other access and construction areas, and construction infrastructure (e.g., laydown areas); and ■ surface water management and erosion control. During the operation and maintenance stage: ■ vegetation maintenance along ROW at an appropriate height to protect the facility and improve public and worker safety.	Site preparation, construction and maintenance of the power line ROW may result in the destruction of nests, eggs, and individuals of migratory birds (incidental take)	■ Manage, to the extent possible, the incremental removal of vegetation so that removal occurs outside of the migratory bird nesting period of April 15 to August 31 of each year to avoid disturbing active migratory bird nests (Environment Canada 2014). ■ If vegetation clearing or other construction activities that may result in the incidental take of non-SAR birds is required during the nesting season, activities will be managed to comply with the SARA (Government of Canada 2002) and the MBCA (Government of Canada 1994). Pre-construction nest surveys will be completed and in the event that a nest is found, the MNRF and ECCC will be contacted to determine appropriate impact management measures. ■ No clearing within 100 m of an identified bald eagle nest.	Secondary
	Site preparation, construction and maintenance of the power line ROW may result in the destruction of wolverine dens (incidental take)	■ Manage, to the extent possible, the incremental removal of vegetation so that removal occurs outside of the wolverine denning period of January 1 to March 30 of each year to avoid disturbing denning wolverine. ■ If vegetation removal cannot be avoided during the wolverine denning period, then engage with MNRF and First Nation communities for knowledge of active denning sites that have not been identified in the SAR Report. If active dens sites observed during this period at or near the Project construction area, work will stop and the MNRF will be notified. If work is to continue during this period, Project activities will need to be 500 m from the identified den.	Secondary
	Site preparation, construction and maintenance of the power line ROW may result in the destruction of roosting and hibernating bats (incidental take)	■ Clearing activities during construction for the Project will be managed so that vegetation removal will occur outside of the maternal roosting period (June 1 to July 31). ■ Hibernation period: Avoid construction between potential hibernacula and a boundary being the lesser of: ▪ a 200 m radius of contiguously-treed area, or ▪ the distance to the nearest existing road right of way (ROW); ■ Implement a restricted timing window (October 1 to April 30) for any construction within 200 m of potential hibernacula.	Secondary
Project activities that result in changes to surface water flow. During the construction stage: ■ clearing, grading earth moving, grubbing of vegetation, and stockpiling of materials along the ROW and other access and construction areas, and construction infrastructure (e.g., laydown areas); operation of vehicles and construction equipment; and ■ surface water management and erosion control	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	■ Fording of watercourses is not permitted outside the winter period freeze-up. ■ Follow best management practices for the installation, maintenance, removal and reclamation of ice crossings if needed.	No Pathway

Table 13: Potential Effect Pathway for Effects for SAR Criteria

Project Component or Activity	Effect Pathway	Mitigation	Pathway Type
Project activities that could result in invasive species introduction. During the construction stage: ■ surveying and flagging; ■ clearing, grading earth moving, grubbing of vegetation, and stockpiling of materials along the ROW and other access and construction areas, and construction infrastructure (e.g., laydown areas); operation of vehicles and construction equipment; and ■ transportation of personnel, materials and equipment During the operation and maintenance stage: ■ operation and maintenance of new ROW, fencing, power line, conductors, tower foundations, and permanent access roads; and ■ transportation of personnel, materials and equipment	Introduction and spread of noxious and invasive plant species can affect plant community composition, which can affect wildlife habitat availability and distribution	■ Implement the mitigation to limit effects of noxious and invasive plants on natural vegetation, which would include: ▪ cleaning and inspection of vehicles and equipment at dedicated cleaning area prior to Project site entry; ▪ re-cleaning vehicles and equipment if an area of weed infestation is encountered, prior to advancing to a weed-free area; ▪ locating and managing cleaning locations on the Project site; and core areas requiring re-vegetation following the completion of the Project, use seed mixes and/or tree saplings of native species of plants which are adapted to the local climate and conditions that will further enhance the plant community (INAC 2009).	No pathway
Project activities that could result in sensory disturbance. During the construction stage: ■ clearing, grading earth moving, grubbing of vegetation, and stockpiling of materials along the ROW and other access and construction areas, and construction infrastructure (e.g., laydown areas);surface water management and erosion control ■ transportation of personnel, materials and equipment During the operation and maintenance stage: ■ operation and maintenance of new ROW, fencing, power line, conductors, tower foundations ■ transportation of personnel, materials and equipment	Sensory disturbance (lights, smells, noise, dust, human activity, corona-related noise and light emissions, viewscape) can change wildlife habitat availability, use and connectivity (movement and behaviour), which can lead to changes in wildlife abundance and distribution	■ Use of existing access roads will limit the area disturbed and minimize the quantity of new sensory disturbances. ■ Selective clearing and retention of shrub vegetation, trees, wildlife trees, and coarse woody debris in areas where safe operation practices can still be achieved. ■ Within a caribou range, avoid all activities in high use areas as identified by the MNRF (Attachment A) during the following periods: ▪ Nursery areas: May 1 to July 14; and ▪ Travel Corridors: April and November. ■ Within a caribou range, minimize sensory disturbance within 10 km of known high use areas during sensitive periods (Attachment A): ▪ Nursery areas: July 15 to September 15 ■ Wildlife always have the right-of-way. ■ Speed limits will be defined and enforced on access roads. ■ Environmental awareness and sensitivity training will be provided to Project field employees and key contractor staff. ■ Recreational use of off-road vehicles by employees and contractors is prohibited.	■ Primary (woodland caribou, wolverine, little brown myotis, bald eagle, Canada warbler, eastern whip-poor-will, common nighthawk, and olive-sided flycatcher) ■ Secondary (bank swallow and horned grebe)
	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 caribou	Use existing access roads to avoid and minimize additional linear development and habitat conversion.	Primary

Table 13: Potential Effect Pathway for Effects for SAR Criteria

Project Component or Activity	Effect Pathway	Mitigation	Pathway Type
Project activities that could result in sensory disturbance. During the construction stage: ■ clearing, grading earth moving, grubbing of vegetation, and stockpiling of materials along the ROW and other access and construction areas, and construction infrastructure (e.g., laydown areas);surface water management and erosion control ■ transportation of personnel, materials and equipment During the operation and maintenance stage: ■ operation and maintenance of new ROW, fencing, power line, conductors, tower foundations ■ transportation of personnel, materials and equipment	Collisions with Project vehicles during construction and operation may cause injury or mortality to individual animals	■ Speed limits will be defined and enforced on access roads. ■ Wildlife always have the right-of-way. ■ Drivers have standard safety training and are provided with environmental awareness training. ■ Post signs warning drivers of high use wildlife areas. ■ Employees in vehicles encountering large mammals (e.g., caribou, moose, black bear, and wolf) on roads are required to communicate the presence of wildlife on the roads to other employees working in the area. ■ Recreational use of off-road vehicles by employees and contractors is prohibited. ■ Wildlife-vehicle collisions would be monitored and reported, which provides feedback for adaptive management.	Secondary
	Collisions with the power line causing injury or mortality to bat and birds criteria	■ Bird deterrents or visibility enhancements (e.g., spinning reflectors) will be installed on the power line in areas of concern (e.g., near waterbodies known to represent staging areas). ■ Installation of reflectors where the line is in areas with no vegetation cover and within 1 km of large waterbodies.	■ Primary (bald eagle) ■ Secondary (little brown myotis, horned grebe, bank swallow, common nighthawk, eastern whip-poor-will, Canada warbler, olive-sided flycatcher)
	Increase in public access could affect wildlife survival and reproduction through vehicle strikes, and/or legal and illegal hunting	■ Use of existing roads. ■ Selective clearing and retention of shrub vegetation, trees, wildlife trees, and coarse woody debris in areas where safe operation practices can still be achieved to limit access for hunting. ■ Hunting by Project employees and contractors will be prohibited	No Pathway
Project activities that could require waste management. During the construction stage: ■ hazardous materials, solid and liquid waste handling; ■ re-fuelling, service and maintenance of vehicles and construction equipment; and ■ discharges of wastewater from construction, vehicle and equipment wash, and domestic activities.	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	■ Manage attractants (e.g., bear-proof containers, garbage removed frequently) to limit interactions between people and wildlife. ■ Implement a policy that prohibits feeding wildlife to minimize habituation. ■ Provide training to staff and contractors to reinforce the importance of not feeding wildlife and carrying out proper waste management practices. ■ Monitor waste management practices for improvement through adaptive management, when necessary.	Secondary
	Chemical or hazardous material stored on the Project site, or spills (e.g., petroleum products, ammonium nitrate) on site or along access roads can affect wildlife survival and reproduction	■ Spills will be contained locally and disposed of at an approved industrial waste disposal facility in accordance with all Provincial regulations. ■ Storage facilities for hazardous materials and waste will meet regulatory requirements and would be designed to protect the environment and workers from exposure ■ Equipment for containing spills would be maintained on-site. Emergency spill kits would be available near fuel and hazardous materials handling locations (e.g., spill kits at the main service areas) and in vehicles. ■ Refueling and lube stations are not to occur within 100 m of waterbody, watercourse or wetland, and include secondary containment structures. ■ Construction equipment, machinery, and vehicles would be regularly maintained to limit mitigate risk of leaks. ■ Train individuals working on-site and handling hazardous materials about best practices for the transportation of dangerous goods to minimize adverse effects on plants and wildlife through introduction of hazardous materials into the environment.	No Pathway

Table 13: Potential Effect Pathway for Effects for SAR Criteria

Project Component or Activity	Effect Pathway	Mitigation	Pathway Type
Project activities that require blasting: During the construction stage: ■ use of explosives and blasting to create level areas of transmission structures and for foundation excavations	Fly rock from blasting may result in injury or mortality to wildlife	■ Wataynikaneyap will use explosives if excavation to remove materials for foundation systems is not feasible. ■ Check the blast zone for wildlife before a blast.	No pathway
Project activities related to electricity transmission During the operation and maintenance stage: ■ electricity transmission	Electrocution causing injury or mortality to birds	■ Industry standards to avoid minimize risk of electrocutions would be incorporated in tower design. ■ Maintain minimum clearance of 2.3 m between the lines to reduce the risk of electrocutions.	Secondary
	Electromagnetic fields from the power line may cause changes to wildlife survival and reproduction.	None	No Pathway

5.2 Pathway Screening

5.2.1 No Pathway

- **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 power line can create the type of habitat favoured by invasive plant species. Newly cleared areas 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 [*Cirsium arvense*]) 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.

Preventing noxious and invasive species from entering an area is often more efficient and cost effective than dealing with their removal once established (Clark 2003; Polster 2005; Carlson and Shepard 2007). Wataynikaneyap will implement a mitigations to avoid and minimize the introduction and spread of noxious and invasive plants during construction and operations. Additional mitigation would include cleaning and inspection of vehicles and equipment prior to Project site entry, re-cleaning vehicles and equipment if an area of weed infestation is encountered, prior to advancing to a weed-free area.

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 no to negligible ecological changes to wildlife habitat availability and distribution relative to Base Case conditions.

- **Fly rock from blasting may result in injury or mortality to wildlife**

Explosives may be used to remove bedrock for the placement of towers. Use of explosives produces fly rock, which has potential to cause wildlife injury and mortality. However, the use of explosives will be limited to Project construction and to specific geological conditions that do not allow for an alternative method of removing material for the anchoring of towers. The blast zone will be checked for wildlife prior to the blast.

Blasting would occur infrequently and over a short duration in small, localized areas, and considering the high level of activity that would be occurring in the area prior to the blast, animals are expected to avoid the immediate area, which should result in no to negligible changes to wildlife abundance due to mortality from fly rock.

- **Increase in public access could affect wildlife survival and reproduction through vehicle strikes, and/or legal and illegal hunting**

Primary access for construction of the Project will be from Nungesser Road, the Pikangikum All-Season Road, and any newly cleared portions of all-season roads that are planned to be constructed under the Whitefeather Forest Management Plan. Approved Whitefeather Forest Management Plan all-season roads or clearings will be used (if constructed) to access the existing utility clearing on the north side of the Berens River and the proposed substation area. No new access roads are anticipated to be constructed for the Project. As such, this pathway is expected to result in no net effect on wildlife abundance.

- **Chemical or hazardous material stored on the Project site, or spills (e.g., petroleum products) on-site or along access roads may affect wildlife survival and reproduction**

Spills have the potential to change soil quality. Spills that occur in high enough concentrations could contaminate soils and 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 will be carefully managed by Wataynikaneyap. Storage facilities for hazardous materials and waste will meet regulatory requirements and will be designed to protect the environment and workers from exposure. Emergency spill kits will be available at transfer locations for toxic materials and fuel. Construction equipment, machinery, and vehicles would be regularly maintained to mitigate risk of leaks. Employees will respond to, report, and monitors spills involving hazardous materials. Spills will be contained locally and disposed of at an approved industrial waste disposal facility in accordance with all Provincial regulations. Individuals working on-site and handling hazardous materials will be trained in best practices related to the transportation and handling of dangerous goods.

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. Therefore, spills on the Project site or along access roads are expected to result in no measurable changes to wildlife habitat, survival and reproduction.

5.2.2 Secondary Pathway

- **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 (horned grebe and bank swallow only).**

- **Sensory disturbance (lights, smells, noise, dust, human activity, corona-related noise and light emissions, viewscape) can change wildlife habitat availability, use and connectivity (movement and behaviour), which can lead to changes in wildlife abundance and distribution (horned grebe and bank swallow only)**

The availability and distribution of habitat for horned grebe is predicted to not change as the Project will avoid wetlands or waterbodies. The power line will span large waterbodies and a riparian buffer (30 m) regrowth will be left around large waterbodies. Support tower structures are anticipated to be set back from wetlands, as much as practical. Additionally, baseline surveys in 2016 recorded low abundance of waterbirds in the baseline study area. Two individuals from 2 waterbird species (pied-billed grebe [*Podilymbus podiceps*] and green-winged teal [*Anas crecca*]) were observed on the five lakes that were surveyed in the baseline study area. Three of the five lakes had no waterfowl present during the survey. Large concentrations of waterbirds were not observed at other waterbodies while completing the waterbird aerial survey. No horned grebe or other listed waterbird species were observed during baseline surveys in 2016. No waterbodies were identified as being important duck hunting areas during engagement sessions and no waterfowl staging areas are identified in the RSA (MNRF 2017).

Bank swallows require vertical or near-vertical banks composed of unconsolidated substrates (e.g., silty fine sands) for constructing nesting colonies (COSEWIC 2013b). Bank swallows nest in a wide variety of habitat that contain suitable banks including river banks, sand and gravel pits, roadcuts, and piles of sand (COSEWIC 2013b). Construction of the Project is not anticipated to disturb bank swallow nesting colonies. Aggregate that is required for construction of the Project will be sourced from active, permitted aggregate pits that are in close proximity to the Project. Aggregate is anticipated to be extracted only outside of the bank swallow nesting period (April 15 to August 31).

Wetlands in the baseline study area appear to support low densities of waterbirds and the Project will avoid wetlands or waterbodies. Additionally suitable habitat for bank swallow in the baseline study area will be avoided to the extent possible; aggregate required for the Project will be sourced from active, permitted aggregate pits outside of the bank swallow nesting season. As such, this pathway is determined to result in localized and small changes to habitat availability and distribution, and a negligible net effect on horned grebe and bank swallow.

- **Changes in 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 alterations 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).

Mitigations have been included in the Project design to limit loss of soils, and include not permitting the fording of watercourses outside the winter period freeze-up., and installing culverts or temporary bridges using best management practices and following environmental approval conditions. 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.

The effects predicted in the 2009 federal screening report and the MNRF screening table are not predicted to change with the implementation of mitigation measures identified in the 2009 federal screening report and in this section. Overall, small and local changes in the abundance and distribution of soils and plant communities are predicted to result in minor changes in the availability and distribution of wildlife habitat relative to Base Case conditions. Therefore, this pathway was determined to have a negligible net effect on SAR criteria.

- **Vegetation clearing will result in an increase in edge habitat, which could increase nest parasitism risk for forest breeding birds (eastern whip-poor-will, common nighthawk, and olive-sided flycatcher).**

The Project may increase predation risk by increasing the amount of edge habitat in the RSA. Ground-nesting species (e.g., eastern whip-poor-will and common nighthawk) are particularly vulnerable to nest predation (Cink 2002; Brigham et al. 2011) and many predators will use habitat edges as movement corridors (Chalfoun et al. 2002). The Project will be routed along existing disturbance as much as possible and is predicted to result in a small increase in linear disturbance density from Base Case to Project Case. The linear disturbance density in the RSA at Base Case is 0.2 km/km^2 and is predicted to remain the same at Project Case. As such, there is not anticipated to be a measurable change to predation risk on little brown myotis, bald eagle, eastern whip-poor-will, common nighthawk, olive-sided flycatcher, bank swallow, and horned grebe.

An increase in edge habitat may also increase the risk of nest parasitism to songbirds. Fragmentation of forests has increased accessibility for brown-headed cowbirds (*Molothrus ater*), which prefer more open habitats (Lowther 1993). However, cowbirds are generally more dispersed and have lower densities in forested areas in the Canadian Shield than south of the Canadian Shield where agricultural land is more common (Lowther 1993). Cowbird densities in southern Ontario are around 10 cowbirds per km^2; brown-headed cowbird density in OBBA Region 39 (English River) is 0.14 individuals/km^2. One cowbird was recorded in OBBA Region 44 (Trout Lake) during the first OBBA Atlas (1981-1985) and no cowbirds were recorded in OBBA Region 44 during the second OBBA Atlas (2001-2005) (Cadman et al. 2007). Additionally, eastern whip-poor-will, common nighthawk, and olive-sided flycatcher are not particularly vulnerable to brood parasitism (Cink 2002; Brigham et al. 2011; Altman and Sallabanks 2012). Therefore, nest parasitism risk to these species is not anticipated to increase with construction of the Project.

Increases in edge habitat are not predicted to affect the maintenance of self-sustaining and ecologically effective eastern whip-poor-will, common nighthawk, olive-sided flycatcher, and bank swallow populations that overlap the RSA.

- **Collisions with Project vehicles during construction and operation may cause injury or mortality to individual animals**

There is potential for an increase in the risk of injury or death to wildlife through collisions with Project vehicles and equipment. The predominant factors that contribute to road-related wildlife deaths are traffic volume, vehicle speed, and animal crossing 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).

The following mitigations are expected to limit the risk from vehicle and equipment collisions with wildlife:

- wildlife always have the right-of-way;
- speed limits will be defined and enforced on access roads;
- drivers will have standard safety training and will be provided with environmental awareness training;
- post signs warning drivers of high use wildlife areas;

- employees in vehicles encountering large mammals (e.g., caribou, moose, and black bear) will be required to communicate the presence of wildlife on the roads to others working in the area;
- recreational use of off-road vehicles by employees and contractors will be prohibited; and
- wildlife-vehicle collisions would be monitored and reported, and used to provide feedback for adaptive management.

Mitigation implemented for the Project is anticipated to limit wildlife mortality from vehicle collisions relative to Base Case conditions. The largest risk to wildlife from collisions with vehicles would occur when traffic volumes are highest during construction, and predicted to decrease during operations. Subsequently, mortality from vehicle collisions is expected to have a negligible net effect on wildlife abundance.

- **Collisions with the power line causing injury or mortality (little brown myotis, horned grebe, bank swallow, common nighthawk, eastern whip-poor-will, and olive-sided flycatcher and Canada warbler)**

The Project would cause injury or mortality to horned grebe, and nightjar (i.e., common nighthawk and eastern whip-poor-will), and songbird criteria, and possibly bats, through collisions with conductors and shield wires. Shield wires, which protect the power line from lightning strikes, are suspected to be the cause of most bird collisions because shield wires are thinner and less visible than the conductor lines (Bevanger and Brøseth 2001; APLIC 2012). Higher power lines may increase bird collision rates, especially during bird migrations. To date, no research has been completed on the potential for bat collisions with transmission lines but it is thought that echolocating species have a low potential for collisions with wires. For example, big brown bats (*Eptesicus fuscus*) were found to be able to avoid colliding with wires that were spaced 20 to 30 cm apart (Sändig et al. 2014).

Transmission lines carry 50 kilovolts (kV) or higher to load centres, while distribution lines carry lower loads of electricity (1 to 50 kV) from the centre to peripheral users (APLIC 2012). Birds are generally more vulnerable to collisions with transmission lines than distribution lines (Rioux et al. 2013). It has been estimated that 2.5 million to 25.6 million birds may be killed by transmission lines in Canada each year (Rioux et al. 2013). Distribution lines are conservatively estimated to kill 377,764 to 3.9 million birds per year (Rioux et al. 2013). The poor manoeuverability of waterfowl and other waterbirds (e.g., grebes, cranes) appears to increase these species vulnerability to collisions with power lines, especially when power lines are located near wetlands (Erickson et al. 2005; Calvert et al. 2013; Rioux et al. 2013). Songbirds seem to be the most vulnerable to collisions with power lines in upland areas (Erickson et al. 2005). All bird groups are more vulnerable to collisions with power lines during migration periods (Rioux et al. 2013). This may be due to flocking behaviour or inexperience of young birds (during fall migration).

The differences in the documented results of collision rates may vary among studies because power line collisions are a function of the following factors (Avery 1979; Bevanger 1995; Bevanger and Brøseth 2004; APLIC 2012):

- awareness of the presence of power lines;
- wind and weather (especially fog);
- time of day (collisions are more frequent at dawn and dusk);
- disturbance or distractions (e.g., mating);

- cable size (smaller gauge wires have higher collision rates);
- use of a shield wire to protect against lightning strikes (the shield wire is smaller in diameter and so increases collision rates);
- age of birds (increased collision frequency among juvenile birds); and,
- line location (lines near wetlands or above tree tops are more hazardous to birds).

Wataynikaneyap will install bird deterrent or visibility increasing devices on wires (e.g., spinning reflectors or wire collars) where it is routed near known flight corridors and waterbird staging areas. The distance between conductors (i.e., 6 m) may also reduce the collision rate of bat, nightjar, and songbird criteria with the power lines, and result in a negligible net effect to the abundance of bat and bird populations.

- **Site preparation, construction and maintenance of the power line ROW may result in the destruction of nests, eggs, and individuals of migratory birds (incidental take)**

The *Migratory Birds Convention Act, 1994* (Government of Canada 1994) prohibits the destruction of migratory bird nests (e.g., passerines and waterfowl) during the breeding season. Some bird species (e.g., eastern whip-poor-will) and their nests are protected under the SARA (Government of Canada 2002), which prohibits the damage or destruction of the residence (e.g., nest) of individuals of a species listed in Schedule 1 as endangered, threatened, or extirpated on Federal lands. The Ontario ESA (Government of Ontario 2007) prohibits the harming of a species that is listed as extirpated, endangered, or threatened.

Bird nests, eggs, and/or birds could be destroyed during construction of the power line ROW and maintenance of the power line ROW during operations. To limit incidental take of bird species that nest in vegetated habitat, clearing activities during construction and operation for the Project will be managed so that vegetation removal will occur outside of the migratory bird nesting period (April 15 to August 31) for SAR bird species. Some species, such as common nighthawk and eastern whip-poor-will, nest in recently disturbed or cleared areas. As such, construction activities, such as driving on existing access roads, may result in the incidental take of these species and their nests. If vegetation clearing or other construction activities that may result in the incidental take of non-SAR birds is required during the nesting season, activities will be managed to comply with the SARA (Government of Canada 2002) and the MBCA (Government of Canada 1994). Pre-construction nest surveys will be completed and in the event that a nest is found, the MNRF and ECCC will be contacted to determine appropriate impact management measures.

Mitigation policies and practices for construction activities are expected to limit incidental take of migratory birds and nests. As such, this pathway is predicted to have localized and negligible net effects on migratory birds.

- **Site preparation, construction and maintenance of the power line ROW may result in the destruction of wolverine dens (incidental take)**

Section 8(2) of the Ontario *Fish and Wildlife Conservation Act, 1997* (Government of Ontario 1997) prohibits the intentional damage or destruction of a den or habitual dwelling of a furbearing mammal other than a fox or skunk, unless the person holds a licence to trap furbearing mammals. The wolverine is listed in Schedule 1 of the Ontario FWCA (Government of Ontario 1997) as a furbearing mammal. Wolverine habitat is also protected under the *Endangered Species Act*.

Wolverine dens could be destroyed during construction of the power line ROW and maintenance of the power line ROW during operations. Wolverines typically use dens from mid-February to the end of April (MNR 2013c). Clearing activities during construction will be primarily completed during the winter (i.e., wolverine denning period). Pre-clearing discussion with local First Nations and MNRF will be completed to identify any known active wolverine dens not available to date that may be affected by Project activities. Should denning sites be identified during construction activities, work would cease and MNRF would be notified. Mitigation policies and practices for construction activities are expected to limit incidental take of wolverine dens. As such, this pathway is predicted to have negligible net effects on denning wolverine.

- **Site preparation, construction and maintenance of the power line ROW may result in the destruction of roosting or hibernating bats (incidental take)**

Little brown myotis is listed as endangered on the provincial ESA, and as endangered and on Schedule 1 of the federal SARA due to dramatic population declines resulting from a fungal disease called white-nose syndrome (WNS).

A potential effect of the Project during construction is the removal or alteration of maternity roosts or hibernacula that are occupied. Because little brown myotis is a congregatory species loss of these habitat features has the potential to result in the mortality of many individuals. Clearing activities during construction for the Project to avoid incidental take of roosting bats will be managed so that vegetation removal will occur outside of the maternal roosting period (generally June 1 to July 31).

Wataynikaneyap will avoid construction between potential hibernacula and a boundary being the lesser of (a) a 200 m radius of contiguously-treed area, or (b) the distance to the nearest existing road ROW. Wataynikaneyap will also implement a restricted timing window (October 1 to April 30) for any construction within 200 m of potential hibernacula. As such, this pathway is predicted to have a negligible net effect on bat populations that overlap the RSA.

- **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; Beckmann and Lackey 2008). 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. However, attraction of wildlife to the Project is anticipated to be restricted to the construction phase as no to little food garbage and other attractants should be present during operations. To reduce the number of carnivores and predatory birds that are attracted to the Project during construction, the following management practices and policies will be implemented:

- manage attractants (e.g., bear-proof containers, garbage removed regularly) to limit interactions between people and wildlife;
- prohibit feeding of wildlife;
- training will be provided to staff and contractors to reinforce the importance of not feeding wildlife and carrying out proper waste management practices; and
- monitoring waste management practices for improvement through adaptive management, when necessary.

Mitigations implemented for the Project are anticipated to limit the attraction of wildlife to the site and result in minor changes in survival and reproduction from problem wildlife and altered predator-prey relationships relative to Base Case conditions. Subsequently, this pathway is expected to have a negligible net effect on wildlife abundance.

- **Electrocution causing injury or mortality to birds**

Raptors are vulnerable to electrocution from power lines because of their large wingspan and perching behaviour (Bevanger 1998; Manville 2005; Dwyer and Mannon 2007; Lehman et al. 2010). Birds are most commonly electrocuted when they come in contact with two adjacent conductors (i.e., phase-to-phase electrocution). The Avian Powerline Interaction Committee (APLIC 2006) provides a summary of issues and solutions to avoid electrocutions. In general, electrocutions can occur on structures with the following (APLIC 2006):

- phase conductors separated by less than the wrist-to-wrist, head-to-foot, or flesh-to-flesh distance of a bird; or
- distance between grounded hardware (e.g., grounded wires and metal towers) and any energized phase conductor that is less than the flesh-to-flesh distance of a bird.

Electrocutions are usually associated with municipal distribution lines, which have complicated wiring and shorter distances between phases, rather than transmission lines (Harron 2003). Industry standards for transmission line construction have been developed (APLIC 2006), and will be considered in the tower design. Although avian-safe construction reduces electrocution risk, electrocutions can never be completely eliminated. Bird feathers do not conduct electricity well and so contact must usually be made with fleshy parts, such as the skin, feet, or bill

(APLIC 2006). However, wet feathers may conduct electricity and larger birds may be electrocuted when their wings span conductors or grounded hardware.

The tower structures proposed for the Project are single-pole, double-pole (H-frame), triple-pole (possible at sharp corners, water crossings, or long spans). A 1.5 m spacing between transmission lines is sufficient to accommodate a bald eagle (APLIC 2006). Based on the smallest structure for the towers, conductors for the Project would be a minimum of 2.3 m apart (Section 1.3.2.1; Figure 1.3-3). None of the bird species likely to encounter the line are large enough to span two conductors. Phase-to-ground distances for the proposed transmission towers would be small enough that larger birds may span the distance between the conductor and the tower, but the orientation of the lines (either hanging below or suspended on an insulator) reduces the likelihood of phase-to-ground contact. Tower design will adhere to the Standards for Overhead Systems (CSA-C22.3, CSA 2010a).

Studies in the NWT have indicated that nests in contact with or near insulators may cause phase-to-phase flashover (Poole 1985). Birds that build nests on H-frame structures are more susceptible to electrocution if nests are built above the center energized wire (center phase) (Dwyer and Leiker 2012). Management of nests during the non-breeding season, such as trimming nest materials, insulating conductors, moving nests to alternate structures, and removing unoccupied nests can minimize the risk of avian mortality from electrocution (APLIC 2006). Wataynikaneyap will consider implementing these management practices, or placing nest diverters on the poles, to limit risk of electrocution to nesting birds (Dwyer and Leiker 2012). Subsequently, the Project design is expected to result in minor changes to the abundance of birds (particularly raptors) from mortality due to electrocution.

- **Electromagnetic fields from the power line may cause changes to wildlife survival and reproduction.**

Electric and magnetic fields (EMFs) surround electrical equipment that carry electricity, such as power lines and power cords. Electric and magnetic fields are strongest when close to their source and is expected that wildlife would have highest exposure to EMFs when right beside the transmission line (e.g., perched on transmission lines and poles or standing under the transmission line) (Government of Canada 2016b). The strength of EMFs fades rapidly and objects such as trees and buildings can block EMFs (Government of Canada 2016b).

A review of peer-reviewed studies that looked at the effects of EMFs on wildlife found that there was no clear dose-effect relationship (Cucurachi et al. 2013). Doherty and Grubb (1998) found that tree swallows (*Tachycineta bicolor*) had significantly lower reproductive success under powerlines than at reference areas but this effect was not noted for house wrens (*Troglodytes aedon*). A study completed on cows suggests that some individuals are radiation-sensitive, while other are not sensitive to EMF radiation (Hässig et al. 2014). Rats that were exposed to EMFs were found to have equal litter sizes to rats that were not exposed to EMFs (Rommereim et al. 1989). Similarly, rats and chicken embryos exposed to EMFs did not have greater malformation rates than non-exposed rates (Rommereim et al. 1990; Koch and Koch 1991).

Based on the above information, it is expected that wildlife exposure to EMFs would be low and would occur sporadically when animals are standing directly underneath the transmission line or perched on transmission lines or poles as the strength of EMFs decreases rapidly with distance from the line. Exposure to EMFs may result in minor changes to the survival and reproduction of some wildlife species.

- **Dust and air emissions, and subsequent deposition can change soil quality and vegetation, which can affect wildlife habitat availability and distribution**

Construction and operation of the Project will generate air and dust emissions such as carbon monoxide (CO), oxides of sulphur (SO_x includes sulphur dioxide [SO_2]), oxides of nitrogen (NO_x), particulate matter ($PM_{2.5}$), and total suspended particulates (TSP). Air emissions such as SO_x and NO_x can result from the use of fossil fuels in generators, vehicles, machinery, and the use of explosives used during the Project. Wataynikaneyap will use explosives if excavation to removee material for tower foundationsis not feasible. The dominant contributor to dust emissions (TSP) is from vehicles travelling on roads (Farmer 1993; Harrison et al. 2003; Peachey et al. 2009; Liu et al. 2011).

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 NO_x 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.

Mitigation planned for the Project to further reduce the effects of air emissions includes practices to control dust and other air emissions (maintenance of vehicles and equipment, use of water and/or dust suppressants on roads, vegetating soil stockpiles) (Table 13). Overall, air and dust emissions and subsequent deposition are expected to result in minor and local alterations to soil quality and vegetation communities relative to Base Case conditions. Therefore, this pathway was determined to result in minor changes to wildlife habitat availability and distribution, and negligible net effects on SAR criteria.

5.2.3 Primary Pathways

The following primary pathways were assessed in detail, and net and cumulative effects were characterized and significance determined for woodland caribou, wolverine, little brown myotis, bald eagle, eastern whip-poor-will, common nighthawk, olive-sided flycatcher, and Canada warbler in the subsequent sections.

- **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, corona-related noise and, viewscape) can change wildlife habitat availability, use and connectivity (movement and behaviour), which can lead to changes in wildlife abundance and distribution**

The following primary pathway was also assessed for caribou.

- **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 caribou**

The following primary pathway was also assessed for bald eagle.

- **Collisions with the transmission line causing injury or mortality to bald eagle**

The following primary pathway was also assessed for Canada warbler.

- **Vegetation clearing will result in an increase in edge habitat, which could increase nest parasitism risk for Canada warbler.**

6.0 EFFECTS ASSESSMENT METHODS

This section outlines the methods used to predict and characterize net effects to SAR criteria from primary pathways (i.e., those pathways predicted to result in net effects after incorporation of mitigation).

6.1 Project Case Net Effects Classification

This section outlines the methods used to predict and describe net effects of the Project on each wildlife criterion, and to put these effects in the context of interacting cumulative effects from previous, existing, and reasonably foreseeable developments. Net effects were measured for the Project ROW and contextualized using three assessment cases, Base Case, Project Case, and RFD Case. The specific application of the assessment cases to wildlife is described in the following sections. Wildlife specific methods for describing net effects using the effects characteristics (Table 14) and methods for determining significance for SAR criteria are also presented below.

Table 14: Definitions of Effects Characteristics Used to Describe Predicted Net Effects on Criteria

Effects Characteristic	Definition	Description
Direction	The direction of change in the effect relative to the current value or state	■ Positive – net gain or positive effect ■ Neutral – no change ■ Negative – net loss or adverse effect
Magnitude	Magnitude is the intensity of the effect or a measure of the degree of change from existing (baseline) conditions expected to occur in the criterion.	■ Narrative or numeric quantification of effects
Geographic extent	Geographic extent refers to the spatial area over which an effect will occur/can be detected (distance covered or range).	■ Project footprint – effect is limited to the direct physical disturbance from the Project ■ Local – the effect includes the Project footprint and immediate indirect effects from sensory disturbance ■ Regional – the effect extends beyond the local scale, but is confined to the RSA ■ Beyond regional – the effect extends beyond the RSA boundary

Table 14: Definitions of Effects Characteristics Used to Describe Predicted Net Effects on Criteria

Effects Characteristic	Definition	Description
Duration/reversibility	■ Duration is the period of time over which the environmental effect will be present. The amount of time between the start and end of an activity or stressor (which relates to Project development phases), plus the time required for the effect to be reversed. Duration and reversibility are functions of the length of time a criterion is exposed to activities. ■ Reversibility characterizes the potential for recovery of the criterion from an effect. Reversible implies that the effect will not influence the criterion at a future predicted period in time. For effects that are permanent, the effect is determined to be irreversible.	■ Short-term – the effect is reversible before the end of construction ■ Medium-term – the effect occurs during construction and/or operation and is reversible soon after operation begins ■ Long-term – the effect occurs during construction and/or operation and persists into operations, but is reversible ■ Permanent – the effect occurs during construction and/or operation and is irreversible
Frequency/timing	■ Frequency refers to the occurrence of the environmental effect over the duration of the assessment. ■ Discussions on seasonal considerations are made when they are important in the evaluation of the effect.	■ Infrequent – the effect is expected to occur rarely ■ Frequent – the effect is expected to occur intermittently ■ Continuous – the effect is expected to occur continually
Probability of occurrence	Probability of occurrence is a measure of the likelihood that an activity will result in an environmental effect.	■ 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

Net effects of the Project are measured and described in the Project Case. Net effects are the Project-specific residual effects measured as the incremental change from existing conditions (i.e., Base Case). The description of net effects focuses on primary pathways, which are those pathways predicted to result in effects that remain after mitigation (Section 4.2.3).

Changes in indicators for each criterion were estimated relative to the Base Case to describe net effects, as follows:

- Changes in habitat availability and animal use were estimated quantitatively by calculating differences in the amount of different types of suitable habitat for each criterion, 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 size and distribution of habitat patches within the relevant criterion-specific RSAs, 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 (e.g., changes to carrying capacity). Predictions of change were made using data collected in the relevant criterion-specific RSAs, where possible, and supported by scientific literature.

Net effects on SAR criteria considered expected magnitude (e.g., number of hectares lost or gained, change in abundance), geographic extent (i.e., spatial extent 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 probability of occurrence (e.g., how likely is the effect). Direction of effects described herein are conservatively assumed to be negative, although edge habitat may provide suitable habitat for some species at risk (e.g., olive-sided flycatcher, eastern whip-poor-will).

Duration and frequency were described categorically but were also described more precisely using months or years. The more precise definition was applied to avoid confusion or misinterpretation of the effects assessment that sometimes accompanies broad categories. Effects from forest harvesting are considered reversible in the long-term because harvested areas are allowed to regenerate, which reverses effects on SAR criteria from habitat loss. In contrast, effects created by habitat loss due to infrastructure that will operate indefinitely (e.g., transmission lines and permanent roads) are considered permanent (i.e., irreversible) because vegetation within the disturbance footprints for these developments will be permanently removed for use by some wildlife species. For example, the vegetation within a power line ROW must be maintained below a certain height (e.g., 2 to 3 m) so to not interfere with the safe operation of the power line. Reclamation of this habitat will not occur as the power line will exist in perpetuity so habitat within the ROW is permanently removed for use by some wildlife species.

Magnitude was not described categorically. Characterizing magnitude using an ordinal scale (i.e., low, moderate, or high) in a manner meaningful for SAR criteria requires that the effect size be placed in the ecological context of the criterion, incorporating resilience, adaptability, and amount of historic disturbance. Universal effect size boundaries, such as a 20% change at the criterion-specific RSA scale used to define a high magnitude effect, work poorly because they fail to consider ecological context. A 20% additional habitat loss from existing conditions in the criterion-specific RSAs may be required to cause a high magnitude effect on some criteria, whereas a 2% habitat 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 criterion 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 numeric quantification). The ecological context of the predicted effect size is discussed in a reasoned narrative for the determination of significance.

The precise locations of some Project footprints were unknown at the time of this assessment, such as the power line ROW and the laydown areas. Therefore, to be conservative, the Project footprint is defined as the limits of work of a 200 to 500 m corridor, which includes the alignment ROW, distribution station [substation]) and the laydown areas. Using the limits of work as the Project footprint provides a conservative overestimate of Project effects as the limits of work is 4,355 ha and the actual up to 40 m alignment ROW will be approximately 478 ha and the distribution station is anticipated to be approximately 2 ha, which includes a helicopter landing pad and an equipment staging area. The limits of work is approximately nine times larger than the anticipated Project ROW.

6.2 Reasonably Foreseeable Development Case Effects Classification

The RFD Case measures and describes cumulative effects of adding the incremental changes from the Project Case, and certain/planned and reasonably foreseeable developments (RFDs) to the Base Case. The RFD Case also determines the significance of cumulative effects from the Project and past, present and RFDs. Subsequently, the cumulative effects assessment is completed at the regional scale (i.e., criterion-specific RSA or beyond RSA). The RFD Case effects assessment for each wildlife criterion is primarily qualitative and describes how the interacting effects of developments and natural factors are predicted to affect indicators for each criterion. The assessment is presented as a reasoned narrative describing the outcomes of cumulative effects for each wildlife criterion. The relative contribution of the Project to the total cumulative effect is clearly described in the RFD Case effects assessment section for each wildlife criterion.

All certain/planned and RFD projects are described in detail in Table 15. Reasonably foreseeable developments were categorized into Tier 1 and Tier 2 based on the level of project information available, their status within the regulatory process, and their anticipated development schedule. Tier 1 Developments include reasonably foreseeable developments that have been formally proposed and for which details on the location and physical footprint are available. Tier 2 Developments are reasonably foreseeable developments have not yet been formally proposed and/or do not have detailed information that is publicly available.

Table 15: Summary of RFD Case Interactions for Wildlife

Project/Activity	Description	Potential Cumulative Effect	Quantified in the RFD Case
Certain/Planned Projects and Activities			
Wataynikaneyap Power Phase 2: Connecting 17 Remote First Nation Communities Project	The Project is the construction, operation, maintenance and retirement of a 115 kV, 44 kV, and 25 kV alternating current transmission system, located north of Red Lake and Pickle Lake, to connect to 17 remote First Nation communities.	■ Loss or alteration of vegetation and topography that may change habitat availability, use, and connectivity and contribute to cumulative effects on wildlife abundance and distribution. ■ Sensory disturbance may contribute to cumulative changes in wildlife habitat availability, use and connectivity, which can lead to changes in wildlife abundance and distribution. ■ 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	Yes
Reasonably Foreseeable Projects and Activities			
Tier 2 Developments			
Commercial Forestry	Forest harvesting and forestry road developments in the Whitefeather, Red Lake, and Trout Lake forests	■ Loss or alteration of vegetation and topography that may change habitat availability, use, and connectivity and contribute to cumulative effects on wildlife abundance and distribution. ■ Sensory disturbance may contribute to cumulative changes in wildlife habitat availability, use and connectivity, which can lead to changes in wildlife abundance and distribution. ■ 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	No

6.3 Determination of Significance

For each wildlife criterion, a determination of significance was made based on an assessment of combined effects of previous and existing developments described in the Base Case and the addition of the Project (i.e., for the Project Case), as well as the addition of RFDs (i.e., for the RFD Case).

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 populations of wildlife criterion would remain self-sustaining and ecologically effective was assessed by combining the effects identified in the Base Case with the net effects identified for the Project Case and the RFD Case to assess the total predicted combined effect. If a significant effect was identified, the contribution of the Project to the combined effect was described.

Significance was predicted as a binary response, with effects classified as significant or not significant. Net (Project Case) and cumulative (RFD Case) effects were determined to be significant if a criterion population is expected to no longer be: (1) self-sustaining, or (2) ecologically effective. Specifically:

- A criterion population was considered to be no longer self-sustaining where cumulative net effects were expected to place the abundance of a criterion, whether an open or closed population, on a declining trajectory that is not predicted to recover or stabilize. Part of being self-sustaining, in this context, was that a criterion 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 also be considered significant.
- A criterion population 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 SAR criteria 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).

7.0 NET EFFECTS ASSESSMENT RESULTS

7.1 Forest-Dwelling Woodland Caribou

7.1.1 Assessment of Project Effects (Project Case)

7.1.1.1 Habitat Availability

The Project is expected to affect caribou habitat availability in the Berens Range by causing an incremental increase in the amount of disturbance. The proportion of disturbance in the Berens Range, measured by applying a 500 m buffer around human disturbances and no buffer around burns, is expected to increase from 26.0% to 26.2%, with the application of the limits of work, which is conservatively estimated as nine times larger than the anticipated Project ROW. There are approximately 366 ha of nursery areas in the limits of work, representing less than 0.1% of available nursery area habitat in the RSA at Base Case (Table 16; Figure 13). No winter use areas occur inside the limits of work. Category 2 habitat (seasonal ranges) and Category 3 habitat (remaining habitat areas) in the limits of work cover 2,518 ha and 518 ha, respectively (Table 16). These amounts of Category 2 and 3 habitats represent both represent 0.2% of the availability of each habitat in the RSA at Base Case. Habitat changes summarized in Table 16 result from a conversion of higher value caribou habitats (i.e., Category 1 and 2) and moderate value habitat (i.e., Category 3) to permanent disturbances.

The limits of work will directly impact one known nursery area (i.e., Category 1 habitat). One additional nursery area and five winter use areas are also located within 10 km of the Project footprint (Figure 13).

In addition to direct habitat loss, caribou habitat suitability around the Project may be reduced if animals avoid areas near the Project footprint. As described in Section 4.2.1.1 (Table 5), zones of influence around development (i.e., where caribou exhibit avoidance behaviour) vary considerably; however, the majority of reported values are typically within 5 km of development (Courtois et al. 2008; CPAWS Wildlands League 2013; Dyer et al. 2001; Eftestøl et al. 2016; Johnson et al. 2015; Leblond et al. 2011, 2013; Nagy 2011; Polfus er al. 2011; Smith et al. 2000; Vistes and Nellman 2008). Indirect habitat loss may therefore extend to areas up to 5 km from the development footprint. This estimate is considered conservative because the effects of power lines on caribou habitat use are not well understood and the studies that have been completed often reach different conclusions. Disparity in the results among studies may be due to different survey methods, survey duration, inclusion of different environmental variables, and the interaction of effects from power lines with other human disturbances (e.g., roads) (Reimers and Colman 2003; Vistnes and Nellemann 2008). Resource selection functions for reindeer in Norway showed notable effects related to construction work, habitat quality, elevation and aspect on the area used by reindeer; however, there was no evidence from the study to support the hypothesis that power lines have negative effects on reindeer habitat use, independent of associated human activity during construction (Eftestøl et al. 2016).

Sensory disturbances will be avoided in high use areas, as identified by the MNRF in Attachment A, during sensitive periods (i.e., May 1 to July 14 (nursery areas) and April and November (travel corridors)). In addition, sensory disturbances will be minimized within 10 km of high use areas identified by the MNRF in Attachment A during sensitive periods (i.e., July 15 to September 15 (nursery areas)).

Construction activities are likely to alter caribou movement and behaviour around the Project footprint resulting in a temporary, indirect loss of habitat. Indirect habitat loss, measured by applying a 500 m buffer around the limits of work (Environmental Canada 2012), could remove 1,854 ha of nursery areas, 6,817 ha of Category 2 habitat, and 2,149 ha of Category 3 habitat in the RSA, if these areas are avoided by caribou. This likely represents a considerable overestimate given that the limits of work is nine times larger than the anticipated Project ROW, the Project will largely parallel existing linear developments (i.e., the Nungesser Road and Pikangikum All-Season Road) and the limits of work is 75% disturbed at Base Case. These existing developments are associated with vehicular activity, noise and other sensory disturbances, and therefore, it is unlikely that there will be measurable losses in local habitat from indirect effects where the power line ROW parallel existing disturbances. Indirect habitat loss is more likely to occur in areas where the Project is not adjacent to existing disturbances (i.e., does not occur within approximately 500 m of existing disturbances).

Table 16: Changes to Woodland Caribou Habitat Availability in the Regional Study Area at Project Case

Habitat Category[(a)]	Base Case [ha]	Project Case (Limits of Work) [ha]	Change in Area Using the Limits of Work Footprint[(b)(c)] [ha]	Percent Change Using the Limits of Work Footprint[(c)] [%]
Category 1 (nursery areas)	318,007	317,641	-366	-0.1
Category 1 (winter use areas)	289,206	289,206	0	0
Category 1 (overlapping nursery areas and winter use areas)	366,082	366,082	0	0
Category 2 (seasonal ranges)	1,497,116	1,494,598	-2,518	-0.2
Category 3	328,716	328,197	-518	-0.2
Permanent disturbance [(d)]	2,787	6,189	3,402	122.1

a) Habitat categories as described in MNRF (2013).

b) Changes in habitat area result from a conversion of suitable habitat to lower suitability habitats (i.e., other).

c) The limits of work is approximately nine times larger than the anticipated Project ROW (4,355 ha for the limits of work versus 478 ha for the maximum anticipated Project ROW), but specific areas of disturbance had not been identified at the time of writing.

d) As described in Section 4.1.3.1 mapping for Category 1 habitat was based on caribou location data and habitat polygons delineated by the MNRF, which did not exclude disturbances because of demonstrated use by caribou. The permanent disturbance category therefore does not represent a complete inventory of permanent anthropogenic disturbances in the Berens Range.

Note: Numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.

Note: The percent change is calculated relative to the amount of each habitat category available at Base Case; percent change is not relative to the size of the study area.

ha = hectare; % = percent.

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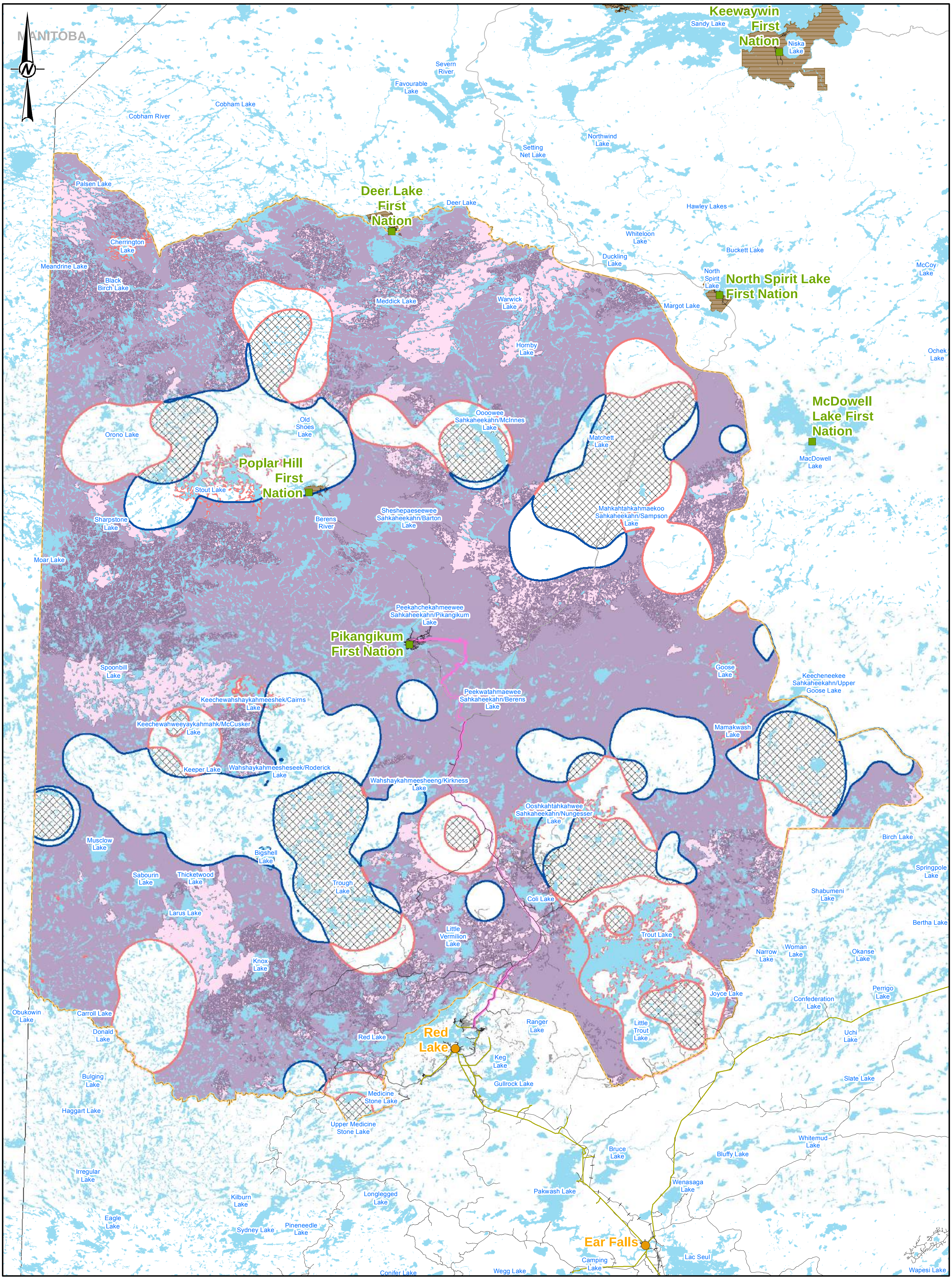

LEGEND

- City
- Town
- First Nation Community
- Wataynikaneyap Power Community
- Major Roads and Highways
- Winter Road
- Existing Electrical Transmission Line
- Railway
- First Nation Reserve Land
- Waterbody
- Project Limits of Work
- Regional Study Area
- Category 1 - Nursery Areas
- Category 1 - Lakes Supporting Nursery Function (MNRF 2014b)
- Category 1 - Winter Use Area
- Category 1 - Lakes Supporting Winter Use Function (MNRF 2014b)
- Category 1 - Overlapping Nursery and Winter Use Areas
- Category 2 - Seasonal Ranges
- Category 3 - Remaining areas in the Range
- Base Case Disturbance

REFERENCE(S)
1. BASE DATA - MNR LIO, OBTAINED 2016, NTDB
2. TRANSMISSION ROUTES - PROVIDED BY WATAYNIKANEYAP POWER L.P.
3. FIRST NATION COMMUNITIES FROM INDIGENOUS AND NORTHERN AFFAIRS CANADA (WWW.AINC-INAC.GC.CA)
4. PRODUCED BY GOLDER ASSOCIATES LTD UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2016
5. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 15

0 20 40
1:800,000 Kilometers

CLIENT
WATAYNIKANEYAP POWER L.P.

PROJECT
PIKANGIKUM DISTRIBUTION LINE PROJECT

TITLE
WOODLAND CARIBOU HABITAT IN THE REGIONAL STUDY AREA AT PROJECT CASE

CONSULTANT

YYYY-MM-DD	2017-03-21
DESIGNED	JMC
PREPARED	JMC/PR
REVIEWED	LD
APPROVED	AE

PROJECT NO.	CONTROL	REV.	FIGURE
1657738	####	####	13

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7.1.1.2 Habitat Distribution

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 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 caribou are expected to be small, particularly where the ROW is parallel to the Nungesser Road and Pikangikum All-Season Road. A contraction in the Berens Range is not expected from localized changes in habitat suitability, although some displacement of animals may result from the Project.

The distribution of available habitat can also change where there are effects to travel corridors (i.e., Category 1 habitat) because these features function as migration corridors that enable access to other Category 1 habitats, such as nursery or winter use areas. The Project will cross one large travel corridor that connects the Trout Lake area to the lake/wetland complexes of Woodland Caribou Provincial Park (Figure 14). This travel corridor is intersected by existing disturbances (Figure 14), namely the Nungesser Road and Pikangikum All-Season Road, which are associated with vehicle traffic at Base Case. The limits of work are also in proximity to an area of caribou movement concentrated around Nungesser Lake (Figure 14).

Power lines are thought to have measurable but minimal and temporary effects on caribou movements and distributions compared to effects from human disturbances that have higher levels of activities (e.g., resorts, roads) (Berger et al. 2000; Vistnes and Nellemann 2008). Some data indicate that reindeer exhibited no observed response to power lines shortly after their construction (i.e., became habituated), when power lines are not accompanied by other human activity (such as roads) (Reimers et al. 2000, 2007). For example, Eftestøl et al. (2016) found no evidence that reindeer habitat use was affected by power lines, independent of associated human activity that occurred during construction. The re-establishment of migration behaviour by woodland caribou in west-central Newfoundland after construction (Mahoney and Schafer 2002) is consistent with previous studies; 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).

Caribou movement may be constrained during the construction period but these effects are expected to be temporary. The ROW largely parallels the Nungesser Road and Pikangikum All-Season Road and is not expected to affect traffic levels beyond the construction period. It is therefore unlikely that the Project will sever travel corridors because caribou cross the Nungesser Road to move between winter and summer habitats at Base Case (MNRF 2014b).The ROW is expected to cause an incremental increase in fragmentation of the RSA by adding another linear disturbance oriented in a generally north-south direction.

The MNRF's assessment of winter and refuge habitat arrangement at Base Case indicates that the Berens Range is fragmented relative to an estimated natural landscape (i.e., SRNV) (MNRF 2014b). The Project will likely cause an incremental change in the arrangement of winter and refuge habitats, which means that the landscape pattern would be further below the SRNV.

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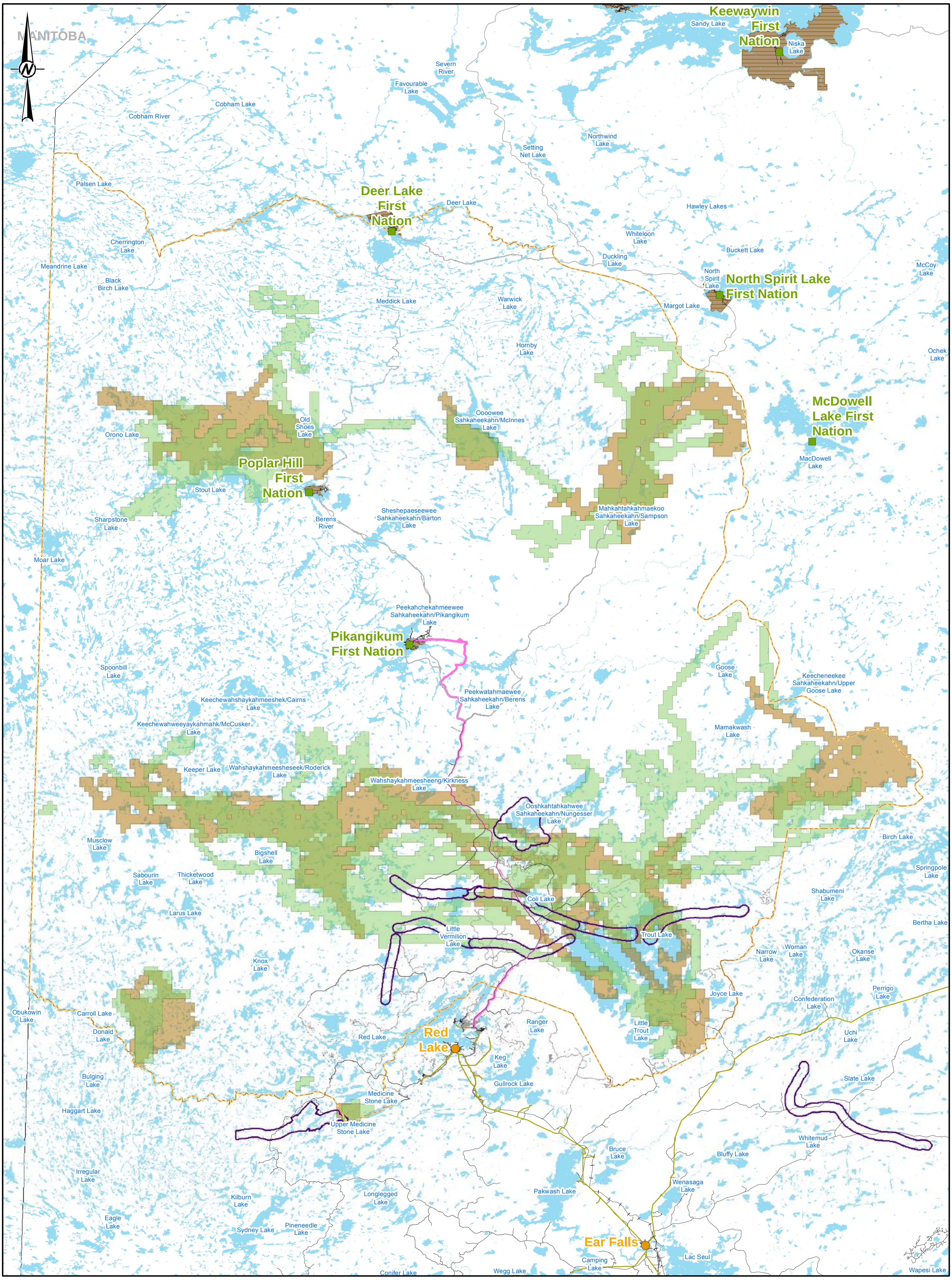

LEGEND

- City
- Town
- First Nation Community
- Wataynikaneyap Power Community
- Major Roads and Highways
- Winter Road
- Existing Electrical Transmission Line
- Railway
- First Nation Reserve Land
- Waterbody
- Project Limits of Work
- Regional Study Area
- Category 1 - Travel Corridor (MNRF)
- Category 1 - Spring Travel Corridor
- Category 1 - Fall Travel Corridor
- Base Case Disturbance

REFERENCE(S)

1. BASE DATA - MNR LIO, OBTAINED 2016, NTDB
2. TRANSMISSION ROUTES - PROVIDED BY WATAYNIKANEYAP POWER L.P.
3. FIRST NATION COMMUNITIES FROM INDIGENOUS AND NORTHERN AFFAIRS CANADA (WWW.AINC-INAC.GC.CA)
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5. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 15

0 20 40

1:800,000 Kilometers

CLIENT
WATAYNIKANEYAP POWER L.P.

PROJECT
PIKANGIKUM DISTRIBUTION LINE PROJECT

TITLE
WOODLAND CARIBOU TRAVEL CORRIDORS IN THE REGIONAL STUDY AREA AT PROJECT CASE

CONSULTANT

Wataynikaneyap Power

Golder Associates

YYYY-MM-DD	2017-03-21
DESIGNED	JMC
PREPARED	JMC/PR
REVIEWED	LD
APPROVED	AE

PROJECT NO.	CONTROL	REV.	FIGURE
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7.1.1.3 Survival and Reproduction

The Project is predicted to affect caribou survival and reproduction through habitat loss (vegetation clearing), sensory disturbance, and increased predation pressure. Habitat loss may reduce local abundance of caribou particularly within the small nursery area west of Nungesser Lake (Figure 13) where impacts could affect calf survival and recruitment. Where the development footprint does not follow existing access roads, clearing will occur outside the sensitive period for nursery areas (i.e., between May 1 and September 15) and effective implementation of mitigation such as selective clearing and retention of shrubs and wildlife trees will minimize these impacts. After implementing mitigation and considering that habitat loss is expected to occur along previously disturbed areas ((i.e., 75% of the limits of works are considered disturbed), the change in abundance as a result of direct habitat loss is predicted to be have little influence on the resilience and adaptive capacity of caribou.

Potential effects from sensory disturbance (noise, lights, and vibrations) may affect caribou survival, particularly in the six high use areas (one nursery areas and five winter use areas; Figure 13) in proximity to the limits of work. These changes would affect caribou occurrence during construction, but are predicted to be reversible shortly after construction (Eftestøl et al. 2016). Similar to effects from habitat loss, sensory disturbances are unlikely to result in a measurable change in caribou survival and reproduction because construction activities are planned to adhere to timing restrictions recommended by the MNRF (Attachment A). During operations, caribou could be affected by corona-related noise and light emissions. Corona is the result of electrical energy in the conductor interacting with surrounding air temperature, humidity, and wind speed and direction. Corona may increase caribou wariness, in particular if corona emissions elicit a predator evasion response (Tyler et al. 2016).

Vegetation clearing along the ROW and for ancillary facilities (i.e., the substation) is expected to create early seral habitat, which is more favourable for moose. Increased moose density can cause an associated increase in wolf abundance, which can increase predation risk for caribou. Once the vegetation grows back along the ROW moose may be attracted to the power line ROW for feeding. It is difficult to quantify by how much this magnitude of habitat alteration will change the density of moose, the density of wolves, and ultimately the predation rate on caribou. Given that the majority of the limits of work (i.e., 75%) is considered disturbed at Base Case, the change in predation risk as a result of the Project is likely to be small. Nevertheless, an incremental increase in predator density could occur as a result of the Project, which would result in an incremental increase in predation risk for caribou. Any increase in predation risk is more likely to affect the portion of the Berens Range caribou population that uses the small nursery area west of Nungesser Lake (Figure 13). In particular, calf survival and recruitment for these individuals could be negatively affected. Effects from an incremental increase in predation risk to caribou making seasonal movements across the RSA are expected to be comparatively lower. Although caribou cross the Nungesser Road to access summer and winter areas, they distance themselves from the road when not travelling (MNRF 2014b). These observations suggest that interactions with the Project will be infrequent and occur over a short duration for individuals making seasonal movements across the power line. Overall, the resulting change in caribou survival may not be measurable given the spatial arrangement of the limits of work along existing disturbances.

7.1.1.4 Characterization of Net Effects

Effects from direct loss of caribou habitat are certain to occur at the Project scale (Table 17). The limits of works overlaps with 366 ha of nursery areas (Category 1 habitat), 2,518 ha of Category 2 habitat and 518 ha of Category 3 habitat. The quantification of habitat loss represents a conservative estimate of magnitude. These effects are assumed to be continuous and permanent given that the Project's operation phase is considered to be indefinite.

Indirect effects to caribou habitat located in proximity to the Project footprint are likely to reduce habitat quality at the local scale due to sensory disturbances and/or perceived predation risk. Indirect effects are assumed to occur continuously over the medium-term because construction-related sensory disturbances will end once operation begins. Habitat loss from avoidance due to sensory disturbance is expected to be reversible within a few months of completion of construction (Eftestøl et al. 2016; Reimers et al. 2000, 2007). Indirect effects to habitat are considered probable (not certain) because the limits of work includes considerable overlap (i.e., 75%) with existing disturbances or within a zone of influence (i.e., 500 m buffer) around existing disturbances, resulting in a small amount of habitat degradation. Caribou may also adapt to sensory disturbance. Sensory disturbance from maintenance activities during operation is expected to be isolated, infrequent, and temporary.

Effects to caribou habitat distribution are expected to occur as a result of an incremental increase in movement constraints, in particular east-west movement between wintering and summering areas. These effects are predicted to be regional and permanent (Table 17). Effects to caribou movement were conservatively predicted as continuous; however, these effects are most likely to be experienced during seasonal movement periods in the spring and fall (i.e., April and November), and will be more important during construction. The magnitude of effects caused by an incremental increase in linear feature density and removal of habitat within potential travel corridors is uncertain due to knowledge gaps regarding caribou movement patterns in the RSA. At a minimum, the limits of work is predicted to directly affect one large travel corridor between the Trout Lake area and the lake/wetland complexes of Woodland Caribou Provincial Park. The Project footprint follows existing roads and available evidence indicates that caribou currently cross the Nungesser Road (MNRF 2014b). Most caribou are likely to continue using established travel corridors; therefore, effects were considered possible to occur.

Changes to survival and reproduction of caribou from the Project may occur as a result of increased predation risk and/or displacement of individuals. Effects to survival and reproduction are predicted to occur at the local scale (i.e., in proximity of areas affected by habitat change). The magnitude of effects is difficult to quantify because the change in predation rate on caribou is difficult to estimate. Increased predation risk would affect a small proportion of the Berens Range caribou population, notably individuals that use habitat west of Nungesser Lake where the limits of work overlap with one known nursery area and are in close proximity to a small winter use area. The magnitude of effects to caribou making seasonal movements across the power line would be comparatively lower because these individuals would presumably interact with the Project infrequently and over a short duration. The resulting change in caribou survival may not be measurable given the spatial arrangement of the limits of work along existing disturbances (i.e., 75% of the limits of works are considered disturbed). Effects to survival and reproduction are predicted to be permanent and probable given the low likelihood of sustained caribou occurrence inside the majority of limits of work, with the exception of the small nursery area west of Nungesser Lake.

Table 17: Description of Effects and Significance in the Project Case for Woodland Caribou

<table>
<tr><th>Indicators</th><th>Effect Pathway</th><th>Characteristic</th><th>Rating/Effect Size</th><th>Significance Determination</th></tr>
<tr><td rowspan="6">Habitat Availability</td><td rowspan="6">■ 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, corona related noise and light emissions, viewscape) can change wildlife habitat availability, use and connectivity (movement and behaviour), which can lead to changes in wildlife abundance and distribution</td><td>Direction</td><td>Negative</td><td rowspan="6">Not Significant</td></tr>
<tr><td>Magnitude</td><td>■ Category 1 (nursery habitat): 266 ha (0.1% of available in the Berns Range); one additional nursery area within 10 km of the limits of work.
■ Category 1 (winter use areas): 0 ha; five winter use areas within 10 km of the limits of work.
■ Category 2 (seasonal ranges): 2,518 ha (0.2% of available in Berens Range).
■ Category 3 (remaining areas in the range): 518 ha (0.2% of available in Berens Range).
■ Possible avoidance of Category 1, 2, and 3 habitats (indirect habitat loss) associated with sensory disturbances in proximity to the limits of work.</td></tr>
<tr><td>Geographic Extent</td><td>■ Project footprint (direct habitat loss)
■ Local (indirect habitat loss)</td></tr>
<tr><td>Duration/Reversibility</td><td>■ Permanent (direct habitat loss)
■ Medium-term (sensory disturbance)</td></tr>
<tr><td>Frequency</td><td>■ Continuous</td></tr>
<tr><td>Probability of Occurrence</td><td>■ Category 1 - nursery areas: certain
■ Category 1 - winter use areas: unlikely
■ Category 2 - seasonal ranges: certain
■ Category 3 - remaining areas in the range: certain
■ Indirect habitat loss: probable</td></tr>
<tr><td rowspan="6">Habitat Distribution</td><td rowspan="6">■ 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, corona related noise and light emissions, viewscape) can change wildlife habitat availability, use and connectivity (movement and behaviour), which can lead to changes in wildlife abundance and distribution</td><td>Direction</td><td>Negative</td><td rowspan="6">Not Significant</td></tr>
<tr><td>Magnitude</td><td>■ One large travel corridor (Category 1 habitat) connecting the Trout Lake Area and lake/wetland complexes of Woodland Caribou Provincial Park directly affected.
■ Caribou habitat remains well connected in identified high-use areas</td></tr>
<tr><td>Geographic Extent</td><td>■ Regional</td></tr>
<tr><td>Duration/Reversibility</td><td>■ Permanent</td></tr>
<tr><td>Frequency</td><td>■ Continuous</td></tr>
<tr><td>Probability of Occurrence</td><td>■ Probable</td></tr>
</table>

Table 17: Description of Effects and Significance in the Project Case for Woodland Caribou

Indicators	Effect Pathway	Characteristic	Rating/Effect Size	Significance Determination
Survival/Reproduction	■ 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, corona related noise and light emissions, viewscape) can change wildlife habitat availability, use and connectivity (movement and behaviour), which can lead to changes in wildlife abundance and distribution 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 caribou	Direction	■ Negative	Not Significant
		Magnitude	■ Incremental increase in predation risk. Effect most important for individuals using small nursery area west of Nungesser Lake. ■ Displacement of a few individuals with home ranges that overlap the limits of work. ■ Resulting change in caribou survival unlikely to be measurable	
		Geographic Extent	■ Local	
		Duration/Reversibility	■ Permanent	
		Frequency	■ Continuous	
		Probability of Occurrence	■ Probable	

a) Value calculated by Wataynikaneyap. There are small differences between disturbance metrics presented in this EA and those reported by the MNRF (MNRF 2014b) due to the use of one different data source (see Section 4.1.3.1). Although the disturbance metrics are not identical, those calculated in this EA provide ecologically relevant and confident predictions across assessment cases.

ha = hectares; RSA = regional study area.

7.1.2 Determination of Significance

The Berens Range caribou population is considered healthy, with a population that is likely more than 500 individuals at Base Case (MNRF 2014b). Adult female survival was recently estimated at 0.87 (95% confidence interval = 0.75-1.0) (MNRF 2014b). Category 1 habitats, which are key components required for caribou survival and reproduction, represent 34.7% (973,294 ha) of the landscape and are well distributed across the Berens Range. Similarly, seasonal ranges (Category 2 habitat) are well distributed across the RSA. However, calf recruitment (23.9 calves per 100 adult females in 2013) is below the 28.9 calves per 100 adult females threshold required to maintain a stable population, assuming a mean adult female survival rate of 0.85 (Environment Canada 2008, 2011). The estimated mean annual population growth rate (λ) is 0.93 (range = 0.89-0.98) (MNRF 2014b), which indicates a declining population trend. The proportion of the range that is disturbed is 28.7% and consists primarily of natural disturbances (i.e., 19.4% of the Berens Range) (MNRF 2014b). The proportion of disturbance in the Berens Range calculated by Wataynikaneyap (26.0%) was similar to the MNRF estimate. Although the cumulative disturbance footprint is below the 35.0% threshold proposed by Environment Canada (2012), the MNRF (2014b) found that the arrangement of habitat was fragmented relative to an estimated natural landscape. Based on the available evidence, the MNRF determined that it is uncertain if the current range condition is sufficient to sustain the Berens caribou (MNRF 2014b). This information suggests that caribou in the RSA are approaching their limits of resilience and adaptability at Base Case, and provides context from the Base Case to which incremental changes in the Project Case are added.

The amount of suitable caribou habitat in the limits of work is 3,402 ha (0.1% of suitable habitat in the RSA, relative to the Base Case), including 366 ha of nursery areas (Category 1 habitat), 2,518 ha of seasonal ranges (Category 2 habitat), and 518 ha Category 3 habitat. These habitat loss estimates are conservative because the limits of work is approximately nine times larger than the anticipated Project ROW and the mapping approach for Category 2 habitat (i.e., all areas of the range not assigned as Category 1 or disturbance) likely overestimated the spatial extent of this habitat. Nevertheless, changes to high use areas, such as nursery areas and winter use areas, can have disproportionally large effects to caribou because these habitats support key functions linked to survival and reproduction. High use areas were avoided to the extent possible by delineating a limits of work that follows existing disturbances. Adhering to timing restrictions recommended by the MNRF around identified high use areas (Attachment A), and selective clearing and retention of shrubs and wildlife trees will help minimize effects from habitat loss. After implementing mitigation and considering that habitat loss is expected to occur along previously disturbed areas (i.e., 75% of the limits of works are considered disturbed at Base Case), the change in caribou abundance as a result of direct habitat loss is predicted to be small. The limits of work will increase the proportion of the Berens Range that is considered disturbed by 0.2% (26% to 26.2%), indicating that the total disturbance in the range will remain below the 35.0% threshold proposed by Environment Canada (2012). These changes are predicted to be within the resilience and adaptive capacity limits of caribou in the RSA because caribou are highly mobile and extensive areas of suitable habitat will remain in the RSA. Habitat loss is not predicted to affect the population’s ecological effectiveness and self-sustainability.

The Project is expected to contribute to reduced habitat quality and functional habitat loss due to sensory disturbance or perceived predation risk from the Project. Project activities will change the availability of Category 1, 2, and 3 habitats in proximity to the limits of work, with the majority of potential indirect habitat loss expected to occur in Category 2 habitat. Sensory disturbance could also affect caribou survival and reproduction, particularly in the six high use areas (one nursery area and five winter use areas; Figure 15) in proximity to the limits of work. Effects of indirect habitat loss are predicted to be negligible because the Project will largely parallel existing linear developments (i.e., the Nungesser Road and Pikangikum All-Season Road) and the limits of work is 75% disturbed at Base Case. These existing developments are associated with vehicular activity, noise and other sensory disturbances, which suggests that caribou using habitats in and around the limits the works have adapted to the current level of disturbance. Avoidance may occur during construction (i.e., during 14 months) when sensory disturbances are higher but negative effects will be minimized adhering to timing restrictions around high use areas, as recommednded by the MNRF (Attachment A). Available information on local caribou occurrence in and around the limits of work suggests that caribou will continue using the area once construction activities have ceased, a prediction supported by Eftestøl et al. (2016) who found no evidence that power lines have negative effects on reindeer habitat use, independent of associated human activity during construction. Some disruptions to caribou may occur during maintenance activities during the Project's operation phase; however, these are expected to be isolated, infrequent, and temporary. It is therefore unlikely that indirect habitat loss/degradation associated with the Project will result in measurable long-term change to caribou abundance and distribution.

The Project is predicted to create small changes in caribou habitat distribution, which are expected to result in an incremental increase in movement constraints across the power line. In particular, the east-west linkage between the Trout Lake area (east of the Project) and the lake/wetland complexes of Woodland Caribou Provincial Park (west of the Project) could be affected. Effects are most likely to be experienced during seasonal movement periods in the spring and fall (i.e., April and November) and will be more important during construction when sensory disturbances associated with the Project are higher. Projects impacts will be minimized by paralleling existing roads (i.e., Nungesser Road and Pikangikum All-Season Road). Most caribou are expected to continue using established travel corridors to cross the power line. No measurable change to habitat connectivity is predicted because caribou cross the Nungesser Road at Base Case (MNRF 2014b) and the Project will not alter long-term traffic levels or sensory disturbances (i.e., beyond the construction phase).

Use of linear corridors and converted habitat (i.e., younger, more productive forest) by moose and wolves could lead to a reduction in caribou survival and reproduction through increased predation pressure. The magnitude of this effect is difficult to quantify. Given the extent of disturbances in the limits of work (i.e., 75%) at Base Case, the change in predation risk to caribou as a result of the Project is likely to be small. Any increase in predation risk is more likely to affect the portion of the Berens Range caribou population that uses the small nursery area west of Nungesser Lake (Figure 15). In particular, calf survival and recruitment for these individuals could be negatively affected. Effects from an incremental increase in predation risk to caribou making seasonal movements across the RSA are expected to be comparatively lower because individuals distance themselves from the road when not travelling (MNRF 2014b). The extent of disturbances within the limits of work suggests that changes to predator-prey dynamics have largely occurred at Base Case. The Project's contribution to alterations in the predator-prey system is likely to have no to little influence on the population survival rate. Changes in predation pressure as a result of the Project are not predicted to alter caribou abundance and distribution.

The small incremental changes in caribou habitat availability, habitat distribution, and survival and reproduction from the Project are not predicted to change the abundance and distribution of caribou in the RSA, relative to the Base Case. The changes are all predicted to be within the resilience and adaptability limits of the population. Consequently, the Project is not anticipated to adversely affect the self-sustainability and ecological effectiveness of the Berens caribou population. Although the self-sustaining status of the population will remain "uncertain" at the Project Case (i.e., it is uncertain if the current range condition is sufficient to sustain the Berens caribou [MNRF 2014b]), the incremental and cumulative effects from the Project and previous and existing developments are predicted to be not significant (Table 17).

7.1.3 Reasonably Foreseeable Development Case (RFD Case)

7.1.3.1 Habitat Availability

Reasonably foreseeable developments including the Project are predicted to reduce habitat for woodland caribou in the RSA relative to the Base Case (Table 15). Cumulative changes associated with the Project (limits of work) and the Wataynikaneyap Phase 2 Project were quantified and are conservatively predicted to result in the loss of approximately 400 ha (0.1%) of nursery areas and 75 ha (less than 0.1%) of winter use areas in the RSA, including 13 ha that support both nursery and winter use function (Table 18). Changes will also remove 2,884 ha (0.2%) of Category 2 habitat (seasonal ranges) and 614 ha (0.2%) of Category 3 habitat (Table 18). The proportion of disturbance in the Berens Range (as calculated by Wataynikaneyap) is expected to increase from 26.0% at Base Case to 26.6% in the RFD Case. The RFDs that did not have footprints available at the time of analysis and reporting (i.e., forest harvesting and forestry road developments) are described in Table 11, and are expected to contribute to additional loss of caribou habitat.

Indirect habitat loss caused by avoidance due to sensory disturbance or perceived predation risk could affect another 2,389 ha (0.8%) of Category 1 habitat (nursery areas), 1,541 ha (0.5%) of Category 1 habitat (winter use areas), 371 ha (0.1%) of overlapping nursery and winter use areas, 16,577 ha (1.1%) of Category 2 habitat, and 4,546 ha (1.4%) of Category 3 habitat in the RSA based on a 500 m zone of influence.

Table 18: Changes to Woodland Caribou Habitat Availability in the Regional Study Area at RFD Case

Habitat Category[(a)]	Base Case [ha]	RFD Case [ha]	Change in Area[(b)] [ha]	Percent Change[(c)] [%]
Category 1 (nursery areas)	318,007	317,620	-387	-0.1
Category 1 (winter use areas)	289,206	289,143	-62	<-0.1
Category 1 (overlapping nursery areas and winter use areas)	366,082	366,069	-13	<-0.1
Category 2 (seasonal ranges)	1,497,116	1,494,232	-2,884	-0.2
Category 3	328,716	328,102	-614	-0.2
Permanent disturbance [(d)]	2,787	6,747	3,960	142

a) Habitat categories as described in MNRF (2013b).

b) Changes in habitat area result from a conversion of suitable habitat to lower suitability habitats (i.e., other).

c) The percent change is calculated relative to the amount of each habitat category available at Base Case; percent change is not relative to the size of the study area.

d) As described in Section 4.1.3.1 mapping for Category 1 habitat was based on caribou location data and habitat polygons delineated by the MNRF, which did not exclude disturbances because of demonstrated use by caribou. The permanent disturbance category therefore does not represent a complete inventory of permanent anthropogenic disturbances in the Berens Range.

Note: Numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.

<-0.1% = approaches zero.

ha = hectare; % = percent; <= less than.

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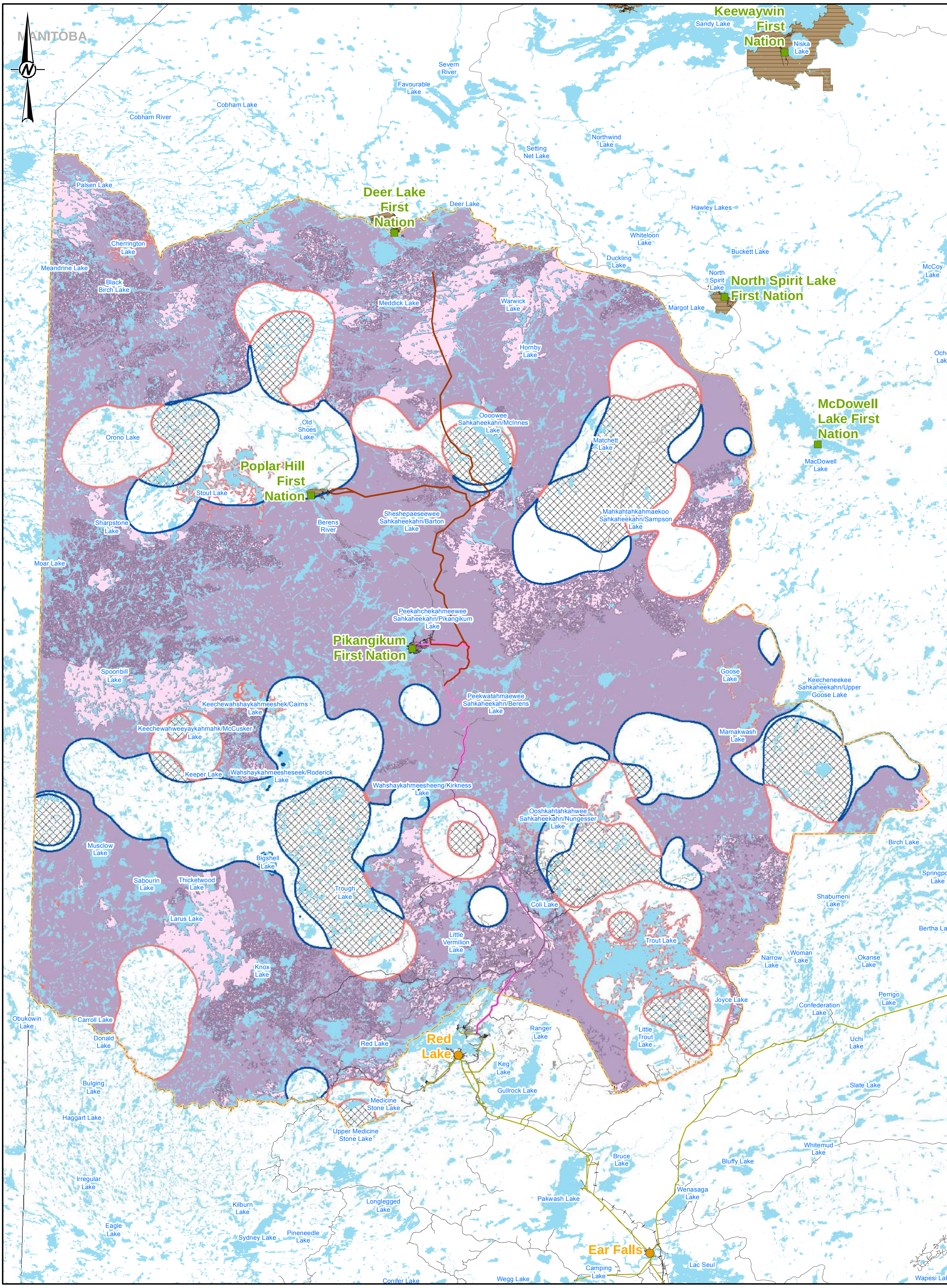

LEGEND

- City
- Town
- First Nation Community
- Wataynikaneyap Power Community
- Major Roads and Highways
- Winter Road
- Existing Electrical Transmission Line
- Railway
- First Nation Reserve Land
- Waterbody
- Project Limits of Work
- Regional Study Area
- Category 1 - Nursery Areas
- Category 1 - Lakes Supporting Nursery Function (MNRF 2014b)
- Category 1 - Winter Use Area
- Category 1 - Lakes Supporting Winter Use Function (MNRF 2014b)
- Category 1 - Overlapping Nursery and Winter Use Areas
- Category 2 - Seasonal Ranges
- Category 3 - Remaining areas in the Range
- Base Case Disturbance
- RFD Case Disturbance

REFERENCE(S)
1. BASE DATA - MNR LIO, OBTAINED 2016, NTDB
2. TRANSMISSION ROUTES - PROVIDED BY WATAYNIKANEYAP POWER L.P.
3. FIRST NATION COMMUNITIES FROM INDIGENOUS AND NORTHERN AFFAIRS CANADA (WWW.AINC-INAC.GC.CA)
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0 20 40
1:800,000 Kilometers

CLIENT
WATAYNIKANEYAP POWER L.P.

PROJECT
PIKANGIKUM DISTRIBUTION LINE PROJECT

TITLE
WOODLAND CARIBOU HABITAT IN THE REGIONAL STUDY AREA AT REASONABLY FORESEEABLE DEVELOPMENT CASE

CONSULTANT

YYYY-MM-DD	2017-03-21
DESIGNED	JMC
PREPARED	JMC/PR
REVIEWED	LD
APPROVED	AE

PROJECT NO.	CONTROL	REV.	FIGURE
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The Project limits of work overlaps with the Trout Lake, Red Lake, and Whitefeather forests. Of these three forest tenures, the Whitefeather Forest covers the largest spatial extent in the Berens Range. The Whitefeather FMP indicates that harvest is planned using Dynamic Caribou Habitat Schedules (DCHS) to maximize the proportion of productive area with conifer dominated forest cover, that is at least 60 years old (WFMC 2012). The short-term target is to maintain more than 40% of the forest in suitable habitat condition within habitat tracts over 20-year planning intervals. As such, large areas of even-aged mature, conifer forest were deferred from harvest until another planning period.

Cutblocks located in high-use areas would have disproportionately larger effects to caribou. In particular, large-scale disturbances around the southern extent of the Whitefeather Forest (near the boundary with Woodland Caribou Provincial Park) or in the northeastern section of the Berens Range (around Sampson Lake), could reduce the availability of nursery areas and winter use areas. On the other hand, Woodland Caribou Provincial Park will provide long-term protection of some high use areas (Figure 15). Using forest harvest blocks from the DCHS, potential RFD impacts to caribou habitat are predicted from:

- Sixteen (16) “A” blocks (i.e., where harvest is scheduled to occur within the next 0-20 years) overlap with the Berens caribou range, including three in the Red Lake Forest, seven in the Trout Lake Forest, and six in the Whitefeather Forest. Six of these blocks will directly remove winter and/or nursery area habitat over the next 20 years, including:
  - Most of the nursery/winter use area polygon that overlaps with the Project limits of works (i.e., north of Little Vermillion Lake; Figure 15);
  - Various portions of nursery/winter use area polygons around Trout Lake. This includes (i) the overlapping area of winter and nursery area south of Trout Lake, (ii) areas along the north shore of Trout Lake (including overlapping nursery and winter use areas), and (iii) areas north of Nungesser Lake (including overlapping nursery and winter use areas) (Figure 15); and
  - Most of the polygon of overlapping nursery and winter use area that overlaps with McInnes Lake (Figure 15).
- Twenty-one (21) “B” blocks (i.e., where harvest is scheduled to occur within the next 20-40 years) overlap with the Berens range, the majority of which are located in the Whitefeather Forest (17). At least fourteen of these blocks will directly remove winter and/or nursery area habitat over the next 40 years, including:
  - Overlapping nursery/winter use areas between Little Trout Lake and Joyce Lake, and nursery areas north of Joyce Lake (Figure 15);
  - Overlapping nursery/winter use areas south of Nungesser Lake and nursery and winter use areas northeast of Nungesser Lake;
  - A considerable portion of the nursery/winter use polygons at the easternmost extent of the range (i.e., southeast of Mamakwash Lake; Figure 15);
  - Part of the nursery area that overlaps with the Project limits of work (i.e., north of Little Vermillion Lake; Figure 15);
  - Portions of overlapping nursery and winter use areas, and winter use area near Trough Lake (Figure 15);

  - Some winter use areas between Poplar Hill First Nation and Stout Lake (Figure 15);
  - Some nursery areas west of McInnes Lake (Figure 15).
- Eight (8) “Z” blocks, which have open timing with no restrictions, overlap with the Berens Range including four in the Red Lake Forest, four in the Trout Lake Forest, and two small blocks in the Whitefeather Forest. Although Z blocks are typically considered unsuitable caribou habitat (due to productive forest cover [mixedwood or hardwood dominant], high fragmentation, or permanent disturbances), cuts in these areas could affect:
  - The small winter use area east of Little Vermillion Lake (Figure 15);
  - Nursery areas south of Little Trout Lake (Figure 15);
  - Small extents of nursery area at the southernmost extent of the range (i.e., near Medicine Stone Lake; Figure 15); and
  - Small extents of nursery area west of Little Vermillion Lake (Figure 15).

If these areas are harvested over the next 40 years, there could be a considerable increase in caribou habitat loss over the next 40 years in the Berens Range. Over the long-term, harvested areas should return to functional caribou habitat.

Within the Berens Range, the Project contributes approximately 3,402 ha (13%) to the quantified loss of caribou habitat in the RFD Case (with the conservative assumption of nine times larger than the anticipated Project ROW), excluding potential losses from forest harvesting. It is assumed that other RFDs will be required to implement caribou mitigation to limit cumulative adverse changes in habitat availability for this species; however, it is unclear if this assumption will apply to future cutblocks in the Berens Range.

Changes in forest composition associated with climate change can also adversely affect caribou habitat availability. For example, a change in forest species composition could decrease habitat suitability if coniferous cover is replaced by mixedwood or deciduous forest cover. Similarly, increased frequency of wildfires could also have an adverse effect on caribou habitat availability.

7.1.3.2 Habitat Distribution

Consistent with the above interpretation of habitat loss, changes to local distributions of caribou are expected to be minor, particularly where the Project and Wataynikaneyap Phase 2 Project overlap with existing disturbances. The density of linear features in the Berens Range is predicted to increase incrementally in the RFD Case. The increase in fragmentation is unlikely to result in a measurable change in caribou movement beyond the construction period because the Project and Wataynikaneyap Phase 2 Project are both transmission lines, they use the same ROW, and neither project is expected to affect long-term traffic levels (locally, and at the RSA scale).

The Project and Wataynikaneyap Phase 2 Project cross two potential east-west travel corridors in the Berens Range. The first is a large connectivity area between the Trout Lake area and lake/wetland complexes of Woodland Caribou Provincial Park (Figure 16). Further north, the projects cross a potential movement area between the McInnes Lake-Matchett Lake area (east) and the Stout Lake area (west (Figure 16). Following construction, there are limited sensory disturbances associated with transmission lines (see Sections 4.2.1.1, 4.2.1.2, and 7.1.1.2). The projects have the potential to affect these travel corridors in the

RFD Case; however, these are currently bisected by disturbances at Base Case and continue to be used by caribou (MNRF 2014b) (Figure 16). Although some displacement of animals may result, the magnitude of this change is expected to be small because at Base Case, caribou distance themselves from the Nungesser road when not travelling (MNRF 2014b). A contraction in the range is not expected from localized changes in habitat suitability.

There is a large amount of uncertainty around potential fragmentation effects that could result from future forestry operations. The magnitude of impacts to caribou from changes in habitat connectivity will ultimately depend on the spatial configuration of these disturbances. If the pattern of forest harvesting over the next 40 years is as described in Section 7.1.3.1, reduced connectivity is expected along the southern boundary of the Berens range, in the south-central portion of the range (i.e., between Little Vermillion Lake and McInnes Lake), between Trout Lake and Nungesser Lake, and southeast of Mamakwash Lake (Figure 16). In particular, cutblocks between regionally important winter use and nursery areas could have important effects at the range scale. Such effects could materialize if forest harvesting occurs between Trout Lake and Nungesser Lake (MNRF 2014b) or between Nungesser Lake/Trout Lake and Woodland Caribou Provincial Park (Figure 16).

Possible effects to regional caribou movement could occur, particularly if forestry-related habitat loss occurs in and around the boundary with Woodland Caribou Provincial Park, in the northeastern section of the Berens Range (around Sampson Lake), or around Stout Lake (Figure 15 and 16). Such landscape changes could constrain connectivity between the Berens Range and other neighbouring caribou ranges, including the Atikaki-Berens Caribou Range in Manitoba (to the west), the Kinloch Range (to the east) and the Spirit Range (to the north). Although the Berens Range is considered fragmented at Base Case (MNRF 2014b) with anthropogenic disturbances concentrated in the southern extent of the RSA, the Berens Range remains well connected with the Atikaki-Berens Range at Base Case. Habitat protection afforded inside Woodland Caribou Provincial Park will maintain some ongoing connectivity across the provincial border in the RFD Case.

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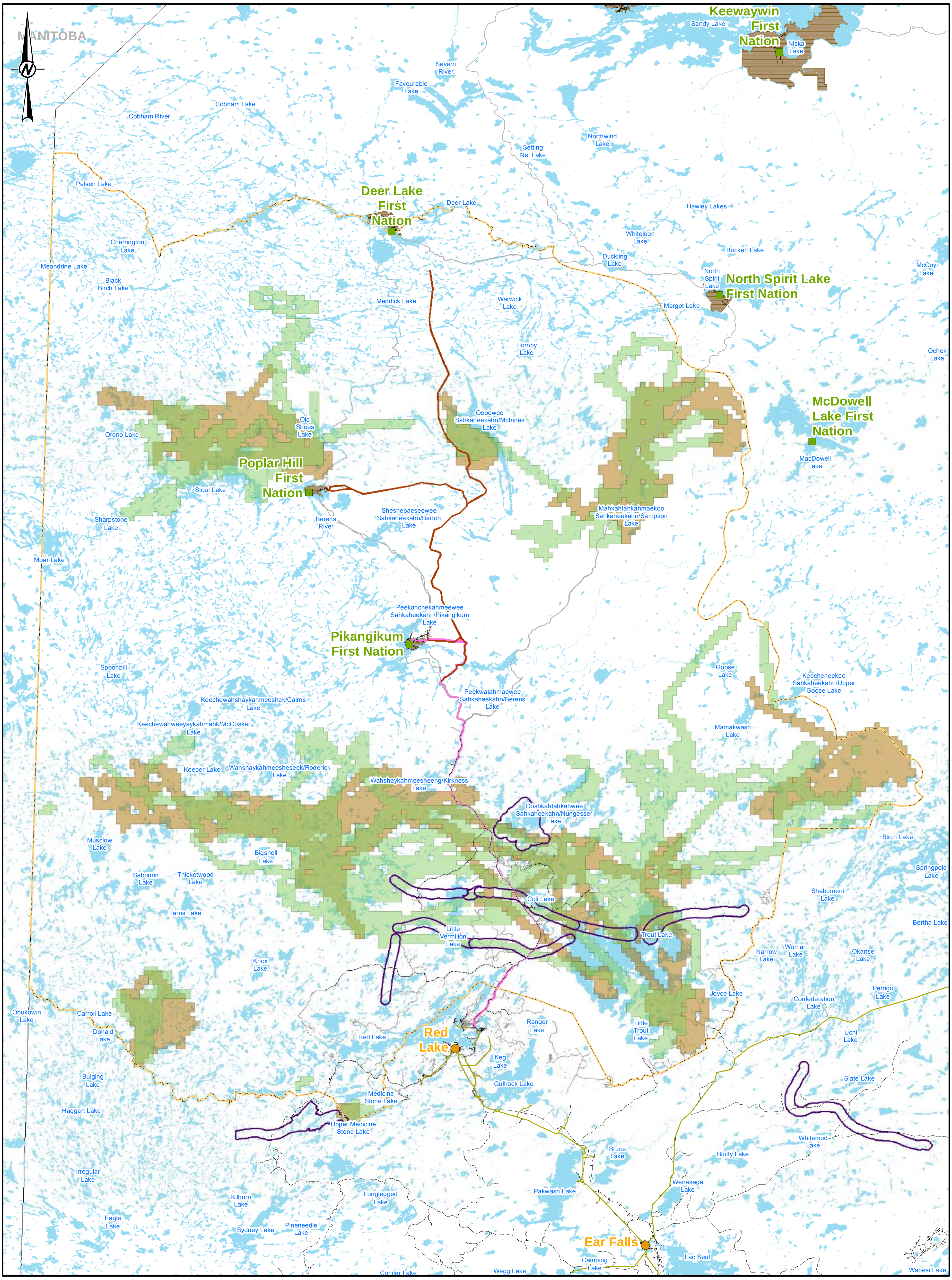

LEGEND

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- Winter Road
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- Project Limits of Work
- Regional Study Area
- Category 1 - Travel Corridor (MNRF)
- Category 1 - Spring Travel Corridor
- Category 1 - Fall Travel Corridor
- Base Case Disturbance
- RFD Case Disturbance

REFERENCE(S)

1. BASE DATA - MNR LIO, OBTAINED 2016, NTDB
2. TRANSMISSION ROUTES - PROVIDED BY WATAYNIKANEYAP POWER L.P.
3. FIRST NATION COMMUNITIES FROM INDIGENOUS AND NORTHERN AFFAIRS CANADA (WWW.AINC-INAC.GC.CA)
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1:800,000 Kilometers

CLIENT
WATAYNIKANEYAP POWER L.P.

PROJECT
PIKANGIKUM DISTRIBUTION LINE PROJECT

TITLE
WOODLAND CARIBOU TRAVEL CORRIDORS IN THE REGIONAL STUDY AREA AT RESONABLY FORESEEABLE DEVELOPMENT CASE

CONSULTANT

Wataynikaneyap Power

Golder Associates

YYYY-MM-DD	2017-03-21
DESIGNED	JMC
PREPARED	JMC/PR
REVIEWED	LD
APPROVED	AE

PROJECT NO.	CONTROL	REV.	FIGURE
1657738	####	####	16

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7.1.3.3 Survival and Reproduction

The Project and RFDs could affect caribou survival and reproduction through habitat loss (vegetation clearing), increased predation risk, and sensory disturbances.

Habitat loss may displace individuals and reduce the local abundance of caribou. Loss of high use areas, particularly nursery areas, could have negative consequences to caribou survival and reproduction if displaced females are forced to rear calves in less suitable habitats (e.g., where predation risk is higher) where calf survival declines. Forest harvesting would account for the majority of these predicted effects.

Vegetation clearing will create early seral habitat, which is more favourable for moose. Increased moose density can cause associated increases in wolf abundance, which can increase predation risk for caribou. Forestry activities are predicted to be the main driver of this disturbance by creating large tracts of early seral habitat. The geographic location of these disturbances will determine the magnitude of impacts because increased predation risk in and around key calving and nursery areas can have disproportionate large effects on calf recruitment (see Sections 7.1.3.1 and 7.1.3.2). These effects could be exacerbated if habitat conversion and changing climatic conditions allow for white-tailed deer range expansion into the Berens Range (Dawe and Boutin 2016). The magnitude of change in predation rate attributable to a combination of forest harvesting and climate change could be considerable. Population monitoring conducted by the MNRF suggests that the Berens Range caribou may be limited by calf survival and recruitment. Although adult survival was above the estimated national average (0.87 versus 0.85 [MNRF 2013b]), recent calf recruitment rates were estimated at 4.8 calves per 100 females in 2012 and at 23.9 calves per 100 females in 2013 (MNRF 2014b). Recruitment estimates from 2011-2012 were also low in the neighbouring Sydney and Churchill Ranges, suggesting that it was a poor recruitment year across ranges (MNRF 2014b). The Berens Range caribou population may therefore be particularly sensitive to changes in calf survival. Young calves are particularly vulnerable to predation (Adams et al. 1995; Rayl et al. 2014; Seip 1992; Whitten et al. 1992). Altered predator-prey dynamics could decrease calf survival, causing a further reduction in calf recruitment that would negatively affect the population growth rate (λ), which is already indicating a population decline at Base Case.

Increased sensory disturbance (noise, light, vibrations) associated with RFDs in the RSA are unlikely to result in a measurable change in caribou survival or reproduction. Sensory disturbance and perceived predation risk effects from the Project and similar types of developments are expected to be reversible following construction activities, while longer term effects are predicted for forestry operations.

Possible effects to regional caribou movement are expected, particularly if forestry-related habitat loss occurs high use areas or along key travel corridors, as discussed above in Sections 7.1.3.1 and 7.1.3.2. Survival and reproduction would be negatively affected if connectivity is constrained (or disrupted/severed) between the Berens Range and other neighbouring caribou ranges (i.e., Spirit Range, Kinloch Range or Atikaki-Berens Caribou Range in Manitoba).

7.1.3.4 Characterization of RFD Case Effects

The loss of caribou habitat in the RSA due to cumulative changes is certain and is predicted to be permanent and continuous because the Project and some other RFDs will operate indefinitely (Table 19). The magnitude of effects will depend on how climate and wildfire change the amount of habitat available in the caribou RSA, as well as on the timing and location of RFDs, particularly forest cutblocks and associated roads. Quantified habitat loss in the RSA includes 400 ha (0.1%) of nursery areas, 75 ha (<0.1%) of winter use areas, 2,884 ha (0.2%) of Category 2 habitat (seasonal ranges) and 614 ha (0.2%) of Category 3 habitat. Loss of Category 1 habitat under the full limits of work analysis includes 13 ha of overlapping area that supports both nursery and winter use function. Forest harvesting could contribute considerably more habitat loss over the next 40 years but these effects were not quantified. Indirect changes to habitat located in proximity to RFDs is likely to reduce habitat quality at the regional scale due to sensory disturbances and/or perceived predation risk. Indirect effects are assumed to occur continuously over the long-term because of anticipated forest harvesting activities. Effects from changes in habitat availability are expected to occur at the beyond regional scale because of potential influences from climate change.

Changes to caribou habitat distribution in the RSA are predicted to be permanent because the Project and some other RFDs will operate indefinitely (Table 19). Consistent with the above interpretation of habitat loss, the magnitude of change to habitat distribution will depend on how climate and wildfire change the amount of habitat available in the caribou RSA, as well as on the timing and location of RFDs, particularly forest cutblocks and associated roads. The density of linear features in the Berens Range is predicted to increase incrementally in the RFD Case. Effects from changes in habitat connectivity are expected to occur as a result of an incremental increase in movement constraints, in particular east-west movement along two identified travel corridors: the linkage between the Trout Lake Area and the lake/wetland complexes of Woodland Caribou Provincial Park and the linkage between the McInnes Lake-Sampson Lake area and the Stout Lake area. Effects to caribou movement are conservatively predicted as continuous; however, effects are most likely to be experienced during seasonal movement periods in the spring and fall (i.e., April and November). Most caribou are expected to continue using established travel corridors across transmission lines but large cutblocks are more likely to cause a disruption. It is therefore possible that disturbances could disrupt regional east-west movement routes through the Berens Range and may even reduce connectivity with neighbouring caribou ranges (i.e., Kinloch, Spirit and Atikaki-Berens Range in Manitoba). Effects are considered probable to occur at the beyond regional scale due to climate change and the potential to affect connectivity with other caribou ranges.

Cumulative changes to caribou survival and reproduction from RFDs may occur as a result of habitat loss, displacement of individuals, altered connectivity and/or increased predation risk. Effects are predicted to be permanent and continuous because the Project and some other RFDs will operate indefinitely. The magnitude of effects on survival and reproduction due to changes in habitat availability and habitat distribution will largely depend on the geographic location of disturbances and climate change. These changes will in turn influence the magnitude of effects expected from increased predation pressure. Transmission line projects are expected to contribute to a small amount change in predation pressure, particularly if RFDs largely align with existing disturbances. The magnitude of change in predation rate attributable to forest harvesting could be considerable. Disruption to regional and beyond regional connectivity (i.e., neighbouring caribou ranges), as described above, would also adversely affect caribou abundance and distribution. Overall, effects are considered probable (not certain) based on uncertainties associated with forest harvesting. Effects are predicted to occur at the beyond regional scale due to climate change and the potential to impact connectivity with other caribou ranges.

Table 19: Description of Effects and Significance in the RFD Case for Woodland Caribou

Indicators	Effect Pathway	Characteristic	Rating/Effect Size	Significance Determination
Habitat Availability	■ 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, corona related noise and light emissions, viewscape) can change wildlife habitat availability, use and connectivity (movement and behaviour), which can lead to changes in wildlife abundance and distribution	Direction	Negative	Significant
		Magnitude	■ Category 1 (nursery habitat): 400 ha (0.1% of available in Berens Range); possible avoidance in proximity to RDFs. ■ Category 1 (winter use areas): 75 ha (<0.1% of available in Berens Range); possible avoidance in proximity to RDFs. ■ Category 2 (seasonal ranges): 2,884 ha (0.2% of available in Berens Range); possible avoidance in proximity to RDFs. ■ Category 3 (remaining areas in the range): 614 ha (0.2% of available in Berens Range); possible avoidance in proximity to RDFs. ■ Potential for considerably more forestry-related habitat loss over the next 40 years based on DCHS. ■ Disturbance: proportion of Berens Range disturbed changes from 26.0% to 26.6%[(a)]	
		Geographic Extent	Beyond regional[(b)]	
		Duration/Reversibility	■ Permanent (direct habitat loss) ■ Long-term (sensory disturbance)	
		Frequency	Continuous	
		Probability of Occurrence	■ Category 1 – nursery areas: certain ■ Category 1 – winter use areas: certain ■ Category 2 – seasonal ranges: certain ■ Category 3 – remaining areas in the range: certain ■ Indirect habitat loss: probable	
Habitat Distribution	■ 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, corona related noise and light emissions, viewscape) can change wildlife habitat availability, use and connectivity (movement and behaviour), which can lead to changes in wildlife abundance and distribution	Direction	Negative	Significant
		Magnitude	■ Two travel corridors (Category 1 habitat), including a large travel corridor connecting the Trout Lake Area and lake/wetland complexes of Woodland Caribou Provincial Park and a linkage between McInnes Lake-Sampson Lake area and Stout Lake area. ■ Caribou habitat remains well connected in identified high-use areas; however, future forestry impacts in Whitefeather Forest are largely unknown, and may influence movement within the Berens Range and among neighbouring ranges.	
		Geographic Extent	Beyond Regional	
		Duration/Reversibility	Permanent	
		Frequency	Continuous	
		Probability of Occurrence	Probable	

Table 19: Description of Effects and Significance in the RFD Case for Woodland Caribou

Indicators	Effect Pathway	Characteristic	Rating/Effect Size	Significance Determination
Survival/Reproduction	■ 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, corona related noise and light emissions, viewscape) can change wildlife habitat availability, use and connectivity (movement and behaviour), which can lead to changes in wildlife abundance and distribution ■ 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 caribou	Direction	Negative	Significant
		Magnitude	■ Displacement of individuals with home ranges that overlap RFDs. Important effects if forestry cutblocks overlap with high use areas as predicted by DCHS. ■ Small incremental increase in predation risk associated with transmission line projects. ■ Potential for considerable increase in predation pressure associated with forestry given the absence of cutblocks in Whitefeather Forest at Base Case. Highly uncertain. ■ Small incremental increase in movement constraints associated with transmission projects. ■ Potential for reduced/severed connectivity within the Berens Range and with neighbouring ranges as a result of forestry cutblocks. Highly uncertain	
		Geographic Extent	Beyond regional	
		Duration/Reversibility	Permanent	
		Frequency	Continuous	
		Probability of Occurrence	Probable	

a) Value calculated by Wataynikaneyap. There are small differences between disturbance metrics presented in this EA and those reported by the MNRF (MNRF 2014b) due to the use of one different data source (see Section 4.1.3.1). Although the disturbance metrics are not identical, those calculated in this EA provide useful insight on relative change across assessment cases.

b) Changes may be beyond regional due to climate change and other natural disturbance factors

ha = hectares; DCHS = dynamic caribou habitat schedules; RSA = regional study area; RFD = reasonably foreseeable development.

7.1.3.5 Determination of Significance

The Berens Range caribou population is considered healthy, with a population that is likely more than 500 individuals at Base Case (MNRF 2014b). Adult female survival was recently estimated at 0.87 (95% confidence interval = 0.75-1.0) (MNRF 2014b). Category 1 habitats, which are key components required for caribou survival and reproduction, represent 34.7% (973,294 ha) of the landscape and are well distributed across the Berens Range. Similarly, seasonal ranges (Category 2 habitat) are well distributed across the RSA. However, calf recruitment (23.9 calves per 100 adult females in 2013) is below the 28.9 calves per 100 adult females threshold required to maintain a stable population, assuming a mean adult female survival rate of 0.85 (Environment Canada 2008, 2011). The estimated mean annual population growth rate (λ) is 0.93 (range = 0.89-0.98) (MNRF 2014b), which indicates a declining population trend. The proportion of the range that is disturbed is 28.7% and consists primarily of natural disturbances (i.e., 19.4% of the Berens Range) (MNRF 2014b). The proportion of disturbance in the Berens Range calculated by Wataynikaneyap (26.0%) was similar to the MNRF estimate. Although the cumulative disturbance footprint is below the 35.0% threshold proposed by Environment Canada (2012), the MNRF (2014b) found that the arrangement of habitat was fragmented relative to an estimated natural landscape. Based on the available evidence, the MNRF determined that it is uncertain if the current range condition is sufficient to sustain the Berens caribou (MNRF 2014b). This information suggests that caribou in the RSA are approaching the limits of resilience and adaptability at Base Case.

Reasonably foreseeable developments including the Project limits of work (conservatively assumed to be approximately nine times larger than the anticipated Project ROW) are predicted to remove approximately 400 ha (0.1%) of nursery areas and 75 ha (less than 0.1%) of winter use areas in the RSA, including 13 ha that support both nursery and winter use function (Table 19). Cumulative changes will also remove 2,884 ha (0.2%) of Category 2 habitat (seasonal ranges) and 614 ha (0.2%) of Category 3 habitat (remaining areas in the range) in the RSA (Table 19). The Project will contribute 3,402 ha (13%) to the quantified loss of caribou habitat in the RFD Case, excluding forest harvest. These estimates likely underestimate the amount of long-term habitat loss at the RFD Case because footprints for forestry related activities were highly uncertain (i.e., no harvest has occurred to date in the Whitefeather Forest at Base Case). Adverse changes to high use areas such as nursery areas and winter use areas as predicted from DCHS “A”, “B” and “Z” blocks (Section 7.1.3.1) could have disproportionally large effects on caribou. The timing, spatial extent and geographic location of future cutblocks will therefore be critical in determining the magnitude of impacts to the Berens Range caribou. If all areas of DCHS “A”, “B” and “Z” blocks are harvested as planned over the next 40 years (Section 7.1.3.1), these large-scale disturbances near Woodland Caribou Provincial Park (i.e., around Trough Lake), Trout Lake, Nungesser Lake, McInnes Lake, and Mamakwash Lake could have considerable effects on the distribution and abundance of caribou due to the loss of nursery and winter use areas, which support key functions linked to survival and reproduction. On the other hand, Woodland Caribou Provincial Park will provide long-term protection of some high use areas in the RFD Case.

The Project and RFD developments are also expected to contribute to reduced habitat quality and functional habitat loss due to sensory disturbance or perceived predation risk, and would adversely influence approximately 25,424 ha of Category 1, 2, and 3 habitats in proximity to RFDs (i.e., within a 500 m zone of influence), with the majority of potential indirect habitat loss expected to occur in Category 2 habitat. Potential effects from sensory disturbance could also influence caribou survival and reproduction, particularly where high use areas are in proximity to the RFDs (Figure 15). Indirect habitat loss effects from transmission line RFDs are predicted to be negligible because these projects are largely expected to parallel existing disturbances. Avoidance may occur during construction when sensory disturbances are higher but negative impacts should be minimized if proponents adhere to the *Best Management Practices for Renewable Energy, Energy Infrastructure and Energy Transmission Activities and Woodland Caribou in Ontario* (MNR no date). Forestry-related activities will contribute to additional indirect habitat loss through avoidance but the magnitude of impacts is difficult to predict given uncertainty around the timing, spatial extent and geographic location of future cutblocks.

Based on the quantified RFD footprints, the proportion of disturbance in the Berens Range is expected to increase from 26.0% at Base Case to 26.6% in the RFD Case, indicating that the total disturbance in the range will remain below the 35.0% threshold proposed by Environment Canada (2012). Although forestry footprints are not included in this estimate, current land use policy (e.g., *Range Management Policy in Support of Woodland Caribou Conservation and Recovery* [MNRF 2014d]) suggests a prudent approach to resource management, such that future activities, including forestry, will need to be balanced and planned in such a way to maintain the Berens Range under the 35% disturbance threshold. The quantified changes in habitat availability at the RFD Case are predicted to be within the resilience and adaptive capacity limits of caribou in the RSA because caribou are highly mobile and extensive areas of suitable habitat would remain in the RSA. This prediction is associated with a high degree of uncertainty owing to information gaps related to forestry activities in the Whitefeather Forest. Habitat alterations from climate change (e.g., conversion to more deciduous forest cover and altered fire regime) could exacerbate these effects and also introduce a moderate amount of uncertainty.

The Project and other RFDs are predicted to alter the distribution of caribou habitat. Consistent with the above interpretation of direct and indirect habitat loss, the magnitude of change to habitat distribution will depend on how climate and wildfire change the amount of habitat available in the RSA, as well as on the timing, extent and location of forest cutblocks and associated roads. The density of linear features in the Berens Range is predicted to increase incrementally from Base Case to RFD Case. An incremental reduction in east-west habitat connectivity is expected as a result of the transmission line RFDs that bisect two identified travel corridors: the linkage between the Trout Lake Area and the lake/wetland complexes of Woodland Caribou Provincial Park and the linkage between the McInnes Lake-Sampson Lake area and the Stout Lake area. Caribou with home ranges in and around these RFDs will be affected year-round; however, the majority of animals will be affected only during seasonal movement periods (i.e., April and November). Most caribou are expected to continue using established travel corridors across transmission lines following the construction phases of the Project and Wataynikaneyap Phase 2 Project. In contrast, large cutblocks are more likely to cause a long-term disruptions, despite their temporary nature, because it can take decades for the functionality of these areas to return (MNRF 2014b; Environment Canada 2012). The most important potential fragmentation effects associated with forestry would be those occurring between Trout Lake/Nungesser Lake and Woodland caribou Provincial Park, and between Trout Lake and Nungesssor Lake.

Depending on the spatial configuration of cutblocks, it is possible that disturbances could disrupt regional east-west movement routes through the Berens Range. Further, disturbances could reduce or disrupt connectivity with neighbouring caribou ranges (i.e., Kinloch, Spirit and Atikaki-Berens Range in Manitoba), which would reduce the population's ecological effectiveness and self-sustainability. Habitat protection afforded inside Woodland Caribou Provincial Park will provide some ongoing connectivity across the provincial border at RFD Case. Changes to habitat distribution are predicted to remain within the resilience and adaptive capacity limits of caribou in the RSA and are not expected to affect the population's ecological effectiveness and self-sustainability. These predictions are based on the quantified RFD changes and an assumption of prudent management of the land base.

The predictions are associated with a high degree of uncertainty owing to information gaps around forestry activities and climate change.

Altered predator-prey dynamics associated with the creation of early seral habitat are expected to cause an increase in predation pressure at the RFD Case. Forestry activities are predicted to be the main driver of this change by creating large tracts of early seral habitat whereas the contribution of transmission line projects is likely to be minimal for reasons previously discussed (Sections 4.2.1.1, 7.1.1.1 and 7.1.1.3). Impacts from forestry could be considerable, especially considering the absence of cutblocks in the Whitefeather Forest at Base Case. These effects could be exacerbated if habitat conversion and changing climatic conditions allow for white-tailed deer range expansion into the Berens Range (Dawe and Boutin 2016). The magnitude of impacts to caribou survival and reproduction will largely depend on the spatial extent and location of cutblocks. Increased predation risk in and around key calving and nursery areas could have disproportionately large effects on calf survival and recruitment (see Sections 7.1.3.1 and 7.1.3.2). As previously described, the Berens Range caribou may be particularly sensitive to changes in calf recruitment as it appears to be a limiting factor for this population (MNRF 2014b). A further reduction in calf recruitment would negatively affect the Berens population growth rate, which is already indicating a population decline at Base Case. Such changes would likely exceed the limits of adaptability and resilience for this criterion.

Changes in caribou habitat availability (i.e., quantity and quality) and habitat distribution (i.e., arrangement and connectivity) are predicted to be within caribou's resilience and adaptability limits, although there is a high degree of uncertainty associated with these predictions. Changes to caribou survival and reproduction are likely to occur as a result of increased predation (i.e., associated with the conversion of habitat to earlier seral stages) which would cause a change to the abundance and distribution of caribou in the RSA. These changes are expected to be driven by a combination of forestry activities and climate change. Given that the Berens caribou are approaching their limits of resilience and adaptability at Base Case (i.e., it is uncertain if the current range condition is sufficient to sustain the Berens caribou), the population may be not likely to be self-sustaining at the RFD Case, but should remain ecologically effective. However, there is a low amount of confidence associated with this prediction given the uncertainty associated with future forestry activities, climate change and population demographic rates. Using a precautionary approach, the cumulative effects from previous, existing and reasonably foreseeable developments are predicted to be significant (Table 19). However, the Project is expected to contribute little to the significance of cumulative effects after mitigation.

7.2 Wolverine

7.2.1 Assessment of Project Effects (Project Case)

7.2.1.1 Habitat Availability

There are 2,468 ha of moderate to high suitability wolverine habitat in the in the limits of work, which is 0.1% of suitable habitat that is present in the RSA at Base Case (Table 20). The limits of work (4,355 ha) is approximately nine times larger than the anticipated Project footprint (478 ha with an additional disturbance area [approximately 2 ha] required for the substation). Sensory disturbance from the Project may reduce habitat quality and cause some individuals to avoid potential suitable habitat at the local scale.

Table 20: Changes to Wolverine Habitat Availability in the Regional Study Area, at Project Case

Habitat Suitability[(a)]	Base Case [ha]	Project Case [ha]	Change in Area Using the Limits of Work Footprint[(a)(b)] [ha]	Percent Change using the Limits of Work Footprint[(b)] [%]
Moderate to High	2,706,379	2,703,910	-2,468	-0.1
Nil to Low	95,535	98,004	2,468	2.6

a) Changes in habitat area result from a conversion of moderate to high suitability habitat to lower suitability habitats (i.e., nil to low).

b) The limits of work is approximately nine times larger than the anticipated Project ROW (4,355 ha for the limits of work versus 478 ha for the maximum anticipated Project ROW), but specific areas of disturbance had not been identified at the time of writing.

Note: Numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.

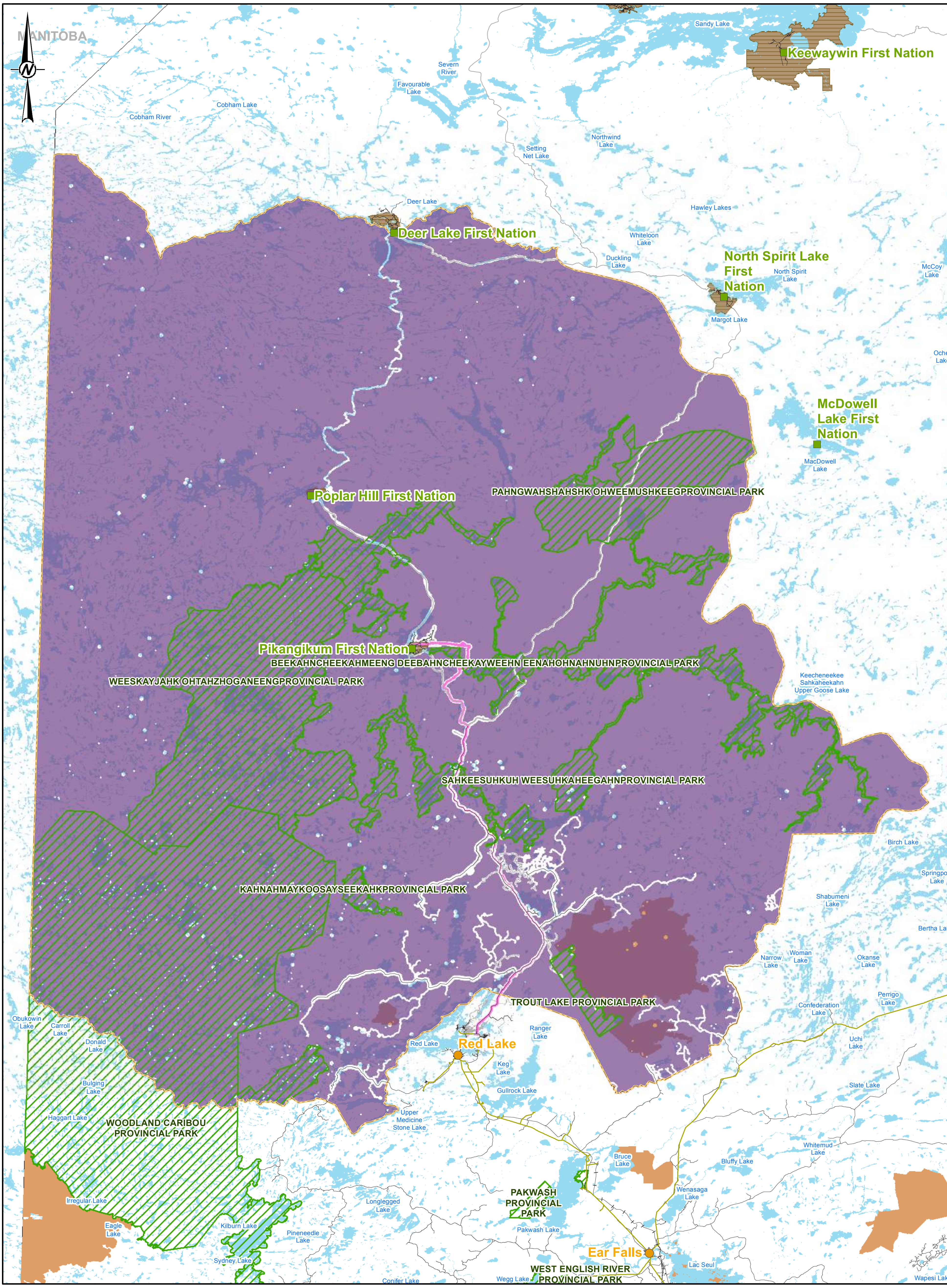
Note: The percent change is calculated using the total amount of moderate to high or nil to low habitat available at Base Case; percent change is not relative to the size of the study area.

ha = hectare; % = percent.

7.2.1.2 Habitat Distribution

Linear features such as roads and transmission lines may alter wolverine movements due to habitat fragmentation effects. The genetic isolation of the Manitoba and Ontario wolverine populations from populations in other provinces is thought to be due to habitat fragmentation from major highways and transmission lines (COSEWIC 2003; MNR 2013c). Wolverines appear to generally avoid areas of dense human disturbance and roads (Banci 1994; Carroll et al. 2001; Copeland et al. 2007). However, avoidance of human disturbance features with low sensory disturbance (e.g., transmission lines) by wolverines is less well understood. Wolverines in northern Alberta and British Columbia were found to use linear corridors with a compacted snow layer (e.g., snowmobile trail) 100% of the time, when individuals encountered these features (Wright and Ernst 2004). Wolverines have also been observed to use transmission corridors as travel corridors in northern British Columbia (Harriman and Baker 2003).

The Project contributes to a negligible increase in linear feature density, when compared to the Base Case as the Project will be routed along existing disturbances (e.g., Nungesser Road and the Pikangikum All-Season Road) as much as possible. Linear feature density in the RSA at Base Case and Project Case is 0.2 km/km^2. Similarly, moderate to high suitability wolverine habitat at Project Case will remain similarly distributed to Base Case conditions (Figure17). As such, wolverine connectivity in the RSA is not predicted to be measurably reduced when the Project Case is compared to Base Case conditions.



LEGEND

- City
- Town
- First Nation Community
- Wataynikaneyap Power Community
- Major Roads and Highways
- Winter Road
- Existing Electrical Transmission Line
- Railway
- First Nation Reserve Land
- Waterbody
- Conservation Reserve
- Provincial Parks
- Project Limits of Work
- Regional Study Area
- Base Case Disturbance
- Wolverine Habitat

REFERENCE(S)

1. BASE DATA - MNR LIO, OBTAINED 2016, NTDB
2. TRANSMISSION ROUTES - PROVIDED BY WATAYNIKANEYAP POWER L.P.
3. FIRST NATION COMMUNITIES FROM INDIGENOUS AND NORTHERN AFFAIRS CANADA (WWW.AINC-INAC.GC.CA)
4. PRODUCED BY GOLDER ASSOCIATES LTD UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2016
5. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 15

0 20 40
1:800,000 Kilometers

CLIENT
WATAYNIKANEYAP POWER L.P.

PROJECT
PIKANGIKUM DISTRIBUTION LINE PROJECT

TITLE
WOLVERINE HABITAT IN THE REGIONAL STUDY AREA AT PROJECT CASE

CONSULTANT

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Golder Associates

YYYY-MM-DD	2017-03-21
DESIGNED	JMC
PREPARED	JMC/PR
REVIEWED	LD
APPROVED	AE

PROJECT NO.	CONTROL	REV.	FIGURE
1657738	####	####	17

7.2.1.3 Survival and Reproduction

The Project is not expected to influence the survival and reproduction of wolverine from increased access as no new access roads will be constructed and so hunter and trapper access will not be improved in the RSA. Wolverine prey abundance is not expected to change as a result of the Project, in particular, no changes to woodland caribou abundance and distribution are predicted (Section 7.1.2). Changes to habitat availability and distribution are not anticipated to affect wolverine survival and reproduction because the Project is predicted to intersect three to five wolverine home ranges (based on home range diameters of 26 to 43 km; Magoun et al 2005). The Project will be routed along existing linear disturbance as much as possible and transmission lines may not remove habitat from use by wolverine (Harriman and Baker 2003; Wright and Ernst 2004). As such, the carrying capacity of the RSA for wolverine is not predicted to be reduced, compared to Base Case.

7.2.1.4 Characterization of Net Effects

Effects from direct habitat loss of moderate to high suitability wolverine habitat in the Project Case are conservatively assumed to be certain to occur at the local scale (Table 21). The operation phase of the Project is considered to be indefinite and thus, for the purposes of this analysis, the direct loss of wolverine habitat availability is conservatively assumed to be continuous and permanent.

Effects from sensory disturbance (avoidance or reduction in habitat quality) are probable because some individuals may adapt to sensory disturbance. Effects from changes to habitat availability from sensory disturbance are expected to occur at the local scale and to be reversible at the end of construction (medium-term) (Table 21). Sensory disturbance effects during construction are conservatively assumed to be continuous because, although construction activities will typically occur during one 10 hour shift per day (from 07:00 to 18:00), night time work may be required in some instances. Sensory disturbance from maintenance activities during operation is expected to be isolated, infrequent, and temporary.

Effects to wolverine from changes to habitat distribution are possible. The connectivity of wolverine populations in the RSA is not likely restricted at Base Case because there are few linear disturbance in the RSA. Effects from changes in habitat distribution will occur continuously at the local scale and are conservatively assumed to be permanent as Project operation is indefinite. Project-related changes in habitat availability and distribution are predicted to not influence survival and reproduction (Table 21). The likelihood of a neutral effect is probable as habitat does not appear limiting, few wolverine home ranges will be disturbed, and the Project will implement mitigation to avoid and limit direct mortality of wolverines during construction activities.

Table 21: Description of Effects and Significance in the Project Case for Wolverine.

Indicators	Effect Pathway	Characteristic	Rating/Effect Size	Significance Determination
Habitat Availability	■ 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, corona-related noise and light emissions, viewscape) can change wildlife habitat availability, which can lead to changes in wildlife abundance and distribution	Direction	Negative	Not Significant
		Magnitude	■ Direct loss of 2,468 ha of suitable habitat (4.4% of the RSA Base Case) ■ Reduced quality of habitat and possible avoidance in close proximity to construction activities from sensory disturbance	
		Geographic Extent	Local	
		Duration/Reversibility	■ Permanent (direct loss) ■ Medium-term (sensory disturbance)	
		Frequency	Continuous	
		Probability of Occurrence	■ Certain (direct loss) ■ Probable (sensory disturbance)	
Habitat Distribution	■ 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, corona-related noise and light emissions, viewscape) can change wildlife habitat availability, which can lead to changes in wildlife abundance and distribution	Direction	Negative	
		Magnitude	Small reduction in movements among habitat patches	
		Geographic Extent	Local	
		Duration/Reversibility	Permanent	
		Frequency	Continuous	
		Probability of Occurrence	Possible	
Survival/Reproduction	■ 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, corona-related noise and light emissions, viewscape) can change wildlife habitat availability, which can lead to changes in wildlife abundance and distribution	Direction	Neutral	
		Magnitude	n/a	
		Geographic Extent	n/a	
		Duration/Reversibility	n/a	
		Frequency	n/a	
		Probability of Occurrence	Probable	

Note: If a net effect was identified as positive or neutral, no additional effects characteristics, other than probability of occurrence, were summarized.

n/a = not applicable. Project effect pathways are predicted to result in no measurable changes to wolverine survival and reproduction rates.

ha = hectares; RSA = regional study area

7.2.1.5 Determination of Significance

Past and existing developments in the Base Case may have adversely affected habitat availability, habitat distribution, and survival and reproduction of wolverine populations that overlap the RSA. Wolverine in Ontario are currently threatened by hunting and trapping and habitat loss, degradation, and fragmentation (MNR 2013c). Habitat is not limiting in the RSA for wolverine at Base Case; high suitability wolverine habitat covers 96.6% of the RSA at Base Case. Although wolverine populations have intrinsically low resilience, because of their low densities, large home range sizes, and relatively low reproductive rates, the wolverine population in northern Ontario appears to be increasing (Magoun et al. 2005; COSEWIC 2014). Additionally, boreal wolverine populations may have more flexible denning habitat requirements than previously thought (Webb et al. 2016). Based on the above information, wolverine populations that overlap the RSA are considered to be self-sustaining and ecologically effective at Base Case.

The amount of suitable wolverine habitat in the limits of work is 2,469 ha (0.1% in the RSA, relative to the Base Case). The limits of work (4,355 ha) is approximately nine times larger than the maximum anticipated Project ROW (478 ha, with an additional disturbance area required for the substation [approximately 2 ha]). Effective implementation of mitigation such as selective clearing and retention of shrubs and wildlife trees along the Project ROW will reduce the magnitude of habitat loss from the Project.

Habitat degradation from noise, dust and other sensory disturbances will be reduced in the operation phase because maintenance activities will be infrequent and of short duration. The Project may restrict wolverine movements and population connectivity however, transmission lines are likely less inhibiting to wolverine movements than roads. Effects from changes due to direct habitat loss and sensory disturbance are unlikely to influence population survival and reproduction rates because wolverines have large home ranges and habitat in the RSA is likely not at carrying capacity for this species. The Project will also implement mitigation to avoid and limit direct mortality to wolverines during construction activities. Changes to wolverine survival and reproduction are not expected as a result of altered prey abundance. For example, the Project is not expected to reduce woodland caribou abundance in the RSA (Section 7.1.2).

The small incremental changes in wolverine habitat availability and distribution from the Project, relative to the Base Case, is predicted to remain within the resilience and adaptability limits of this species. Consequently, wolverine populations that are within or overlap the RSA are anticipated to remain self-sustaining and ecologically effective in the Project Case. Incremental and cumulative effects from the Project and previous and existing developments are predicted to be not significant (Table 21).

7.2.2 Reasonably Foreseeable Development Case (RFD Case)

7.2.2.1 Habitat Availability

The Wataynikaneyap Phase 2 Project, forestry road developments, and forest harvesting in the Trout Lake, Red Lake, and Whitefeather Forests are reasonably foreseeable developments that overlap with the limits of work and the RSA (Figures 17 and 18. The Project and Wataynikaneyap Phase 2 Project are RFDs that were quantified in the habitat modelling for wolverine in the RFD Case. These projects will contribute to a loss of approximately 9,633 ha (0.4%) of moderate to high suitability wolverine habitat in the RSA, relative to Base Case (Table 22). Forestry harvesting and forestry road construction in the Red Lake, Trout Lake, and Whitefeather forests were not quantified but will also remove wolverine habitat in the RFD Case, and create sensory disturbance that would result in avoidance of wolverine near these activities.

In addition to development, natural factors such as climate change may contribute cumulatively to influence habitat availability for wolverine. Climate warming is expected to result in less snow accumulation in Ontario (Thompson et al. 1998), which may result in changes to denning habitat availability (Banci 1994; Magoun and Copeland 1998; Persson 2005; Aubry et al. 2007). However a recent study from the boreal forest of Alberta suggests that wolverines in boreal environments may not be as reliant on spring snow cover as previously thought (Webb et al. 2016).

Table 22: Changes to Wolverine Habitat Availability in the Regional Study Area at Reasonably Foreseeable Development Case

Habitat Suitability[(a)]	Base Case [ha]	RFD Case [ha]	Change in Area[(a)] [ha]	Percent Change [%]
Moderate to High	2,706,379	2,696,745	-9,633	-0.4
Nil to Low	95,535	105,168	9,633	10.1

a) Changes in habitat area result from a conversion of moderate to high suitability habitat to lower suitability habitats (i.e., nil to low).

Note: Numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.

Note: The percent change is calculated using the total amount of moderate to high or nil to low habitat available at Base Case; percent change is not relative to the size of the study area.

ha = hectare; % = percent; RFD = reasonably foreseeable development.

7.2.2.2 Habitat Distribution

Reasonably foreseeable developments occurring in the RSA will remove wolverine habitat and result in additional fragmentation. The effects that the transmission lines will have on wolverine population connectivity is unclear. Wolverine may use (Harriman and Baker 2003; Wright and Ernst 2004) or avoid (COSEWIC 2003; MNR 2013c) transmission line corridors. Other RFDs that are located in the RSA and may alter wolverine habitat distribution and population connectivity are the forestry road construction and forest harvesting in the Red Lake, Trout Lake, and Whitefeather forests. It is assumed the RFDs will use mitigation that avoids and minimizes effects to wolverine habitat and population connectivity.

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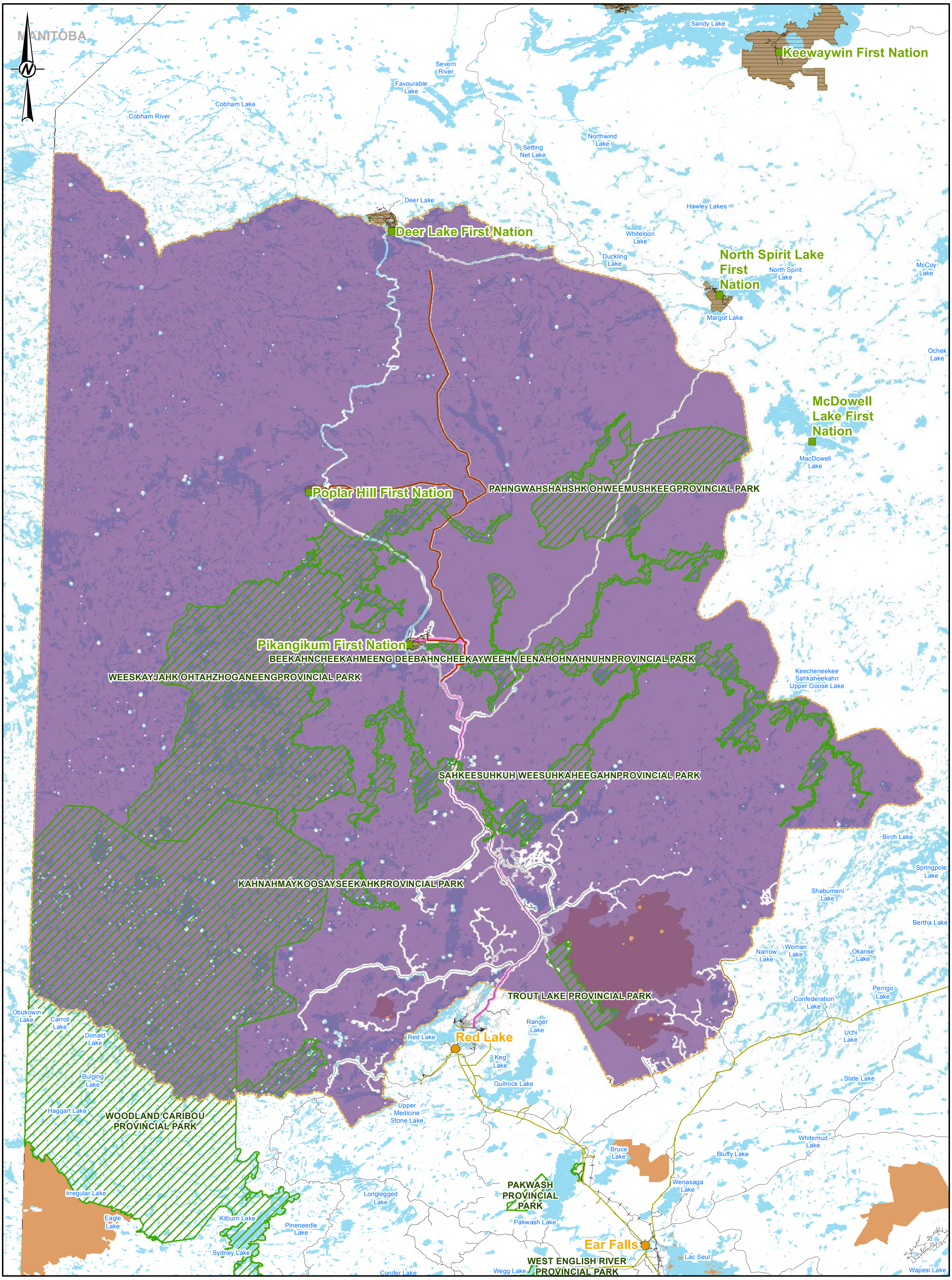

LEGEND

- City
- Town
- First Nation Community
- Wataynikaneyap Power Community
- Major Roads and Highways
- Winter Road
- Existing Electrical Transmission Line
- Railway
- First Nation Reserve Land
- Waterbody
- Conservation Reserve
- Provincial Parks
- Project Limits of Work
- Regional Study Area
- Base Case Disturbance
- RFD Case Disturbance
- Wolverine Habitat

REFERENCE(S)
1. BASE DATA - MNR LIO, OBTAINED 2016, NTDB
2. TRANSMISSION ROUTES - PROVIDED BY WATAYNIKANEYAP POWER L.P.
3. FIRST NATION COMMUNITIES FROM INDIGENOUS AND NORTHERN AFFAIRS CANADA (WWW.AINC-INAC.GC.CA)
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0 20 40
1:800,000 Kilometers

CLIENT
WATAYNIKANEYAP POWER L.P.

PROJECT
PIKANGIKUM DISTRIBUTION LINE PROJECT

TITLE
WOLVERINE HABITAT IN THE REGIONAL STUDY AREA AT RESONABLY FORESEEABLE DEVELOPMENT CASE

CONSULTANT

Wataynikaneyap Power
Golder Associates

YYYY-MM-DD	2017-03-21
DESIGNED	JMC
PREPARED	JMC/PR
REVIEWED	LD
APPROVED	AE

PROJECT NO.	CONTROL	REV.	FIGURE
1657738	####	####	18

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25mm
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As with habitat availability, climate change may contribute cumulatively to changes in the distribution of wolverine habitat. The effects of climate change on wolverines is uncertain. Climate change may result in a loss of conifer cover and reduced snow accumulation, which may alter habitat distribution. Overall, connectivity among wolverine habitat patches is expected to be maintained at the RFD Case despite potential increased fragmentation from natural factors and RFDs.

7.2.2.3 Survival and Reproduction

Mortality from improved hunter and trapper access by development of new roads and trails can affect the survival and reproduction of wolverine. Development of permanent and temporary access roads needed for forest harvesting in the Red Lake, Trout Lake, and Whitefeather forests is likely to increase hunter and trapper access in the RSA. Mitigation that will be implemented to discourage use of permanent forestry roads includes posting signs, avoiding culturally significant areas, gating major river crossings, and using winter roads instead of all-season roads (WFMC 2012). Mitigation implemented for the RFDs is expected to limit cumulative effects to harvest rates of wolverine.

The small cumulative changes in habitat availability and distribution are predicted to have no measurable influence on the abundance (survival and reproduction) of wolverine in the RSA. Habitat is common and well distributed in the RFD Case relative to the Base Case, and it is expected that future developments will implement mitigation to avoid and limit direct mortality to wolverine during vegetation clearing activities.

A change in prey availability could affect wolverine survival and reproduction at the RFD Case. The abundance of woodland caribou is predicted to decrease as a result cumulative effects, primarily as a result of increased predation driven by forestry and climate change (Section 7.1.3.5). The wolverine’s diet is however varied so a reduction in caribou prey availability is not predicted to affect its survival and reproduction because other prey items such as rodents, snowshoe hares and moose carrion are expected to remain widely available at the RFD Case.

Climate change is predicted to contribute to cumulative changes in the survival and reproduction of wolverine. Although climate modelling has not been focussed on wolverine, reduction in spring snow cover may reduce kit survival (Banci 1994; Magoun and Copeland 1998; Persson 2005; Aubry et al. 2007). Wolverines may also be restricted by an upper thermal limit and high summer temperatures may limit the geographic distribution of wolverines (Copeland et al. 2010). Climate change may also result in a loss of conifer cover and reduced snow accumulation, which may alter prey distribution and influence wolverine survival and reproduction (MNR 2013c). However, the magnitude of changes in the RFD Case is uncertain because climate change predictions are based on simulations that can be highly variable.

7.2.2.4 Characterization of RFD Case Effects

Effects from direct habitat loss of suitable wolverine habitat from human developments in the RFD Case are conservatively assumed to be certain to occur at the regional scale (Table 23). Effects from direct loss of habitat in the RFD Case are expected to be continuous and permanent for RFDs such as transmission lines. Effects from forest harvesting are expected to be frequent and reversible over the long-term as harvested areas are allowed to regenerate.

Effects from sensory disturbance (avoidance or reduction in habitat quality) are probable, rather than certain, because some individuals may adapt to sensory disturbance. Effects from habitat loss associated with avoidance is expected to be reversible at the end of construction activities (medium-term) for projects where most sensory disturbance occurs during construction (e.g., transmission lines) or over short periods (e.g., forest harvesting) (Table 23). The spatial extent of effects from sensory disturbance during the RFD Case depends on the temporal overlap of RFDs. Currently, it is anticipated that there will be no temporal overlap between the Project and the Wataynikaneyap Phase 2 Project. The Project is anticipated to be completed construction by the end of October 2018, while the Wataynikaneyap Phase 2 Project is not anticipated to begin construction until the winter of 2018/2019. If there are delays in the construction of the Project, there may be temporal overlap of construction activities between the two transmission line projects. There is also uncertainty about the timing and location of forestry road construction and harvest schedules in the Red Lake, Trout Lake, and Whitefeather forests. With no temporal overlap in activities that result in sensory disturbance (e.g., construction and harvesting), effects from sensory disturbance will likely occur at the local scale. If there is temporal overlap in activities that result in sensory disturbance, effects will occur at the regional scale.

Effects from changes to habitat distribution are conservatively considered probable to occur continuously at the regional scale as there is uncertainty around how transmission line corridors alter wolverine movements and population connectivity. Effects from changes to wolverine population connectivity and habitat distribution from direct habitat loss are expected to be permanent for most the Project and the Wataynikaneyap Phase 2 Project; effects from changes to habitat distribution from forest harvesting are expected to be reversible in the long term (Table 23).

Cumulative effects from changes due to direct habitat loss and sensory disturbance are unlikely to influence population survival and reproduction rates because habitat in the RSA is likely not at carrying capacity for this species, and the Project and RFDs should implement mitigation to avoid and limit direct mortality to wolverine during development activities (i.e., neutral effect). Cumulative effects from changes to wolverine survival and reproduction are considered possible to occur and may occur continuously and indefinitely at the regional scale (Table 23).

Effects to wolverine populations that overlap the RSA from changes to habitat availability, habitat distribution, population connectivity, and survival and reproduction associated with climate change are expected to possibly or probably occur continuously and indefinitely. Effects from other natural factors (e.g., wildfire) would be frequent and reversible in the long-term. Effects from changes to habitat availability and distribution due to wildfire are probable, not certain, because fire suppression is actively carried out throughout most of the RSA. Effects from climate change may occur at the beyond regional scale; effects from other natural factors will likely occur at the regional to beyond-regional scale (Table 23).

Table 23: Description of Effects and Significance in the RFD Case for Wolverine

Indicators	Effect Pathway	Characteristic	Rating/Effect Size	Significance Determination
Habitat Availability	■ 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, corona related noise and light emissions, dust, human activity, viewscape) can change wildlife habitat availability	Direction	Negative	Not Significant
		Magnitude	■ Direct loss of 9,633 ha (0.4%) of suitable habitat in the RSA, from Base Case ■ Reduced quality of habitat and possible avoidance in the RSA from sensory disturbance during construction and reclamation activities at RFDs ■ Magnitude will depend on the influences from climate change	
		Geographic Extent	■ Regional (direct loss)[(a)] ■ Local to Regional (sensory disturbance)[(b)]	
		Duration/Reversibility	■ Long-term to Permanent (direct loss and natural factors) ■ Medium-term (sensory disturbance)	
		Frequency	■ Continuous (sensory disturbance) ■ Frequent to Continuous (direct loss and natural factors)	
		Probability of Occurrence	■ Certain (direct loss) ■ Probable (sensory disturbance and natural factors)	
Habitat Distribution	■ 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, corona-related noise and light emissions, viewscape) can change wildlife habitat availability, which can lead to changes in wildlife abundance and distribution	Direction	Negative	
		Magnitude	■ Small reduction in movements among habitat patches from RFDs ■ Contracted distribution due to climate change	
		Geographic Extent	Regional[(a)]	
		Duration/Reversibility	Long-term to Permanent	
		Frequency	Frequent to Continuous	
		Probability of Occurrence	Probable	
Survival/Reproduction	■ 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, corona related noise and light emissions, dust, human activity, viewscape) can change wildlife habitat availability	Direction	Negative	
		Magnitude	■ No measurable influence on survival and reproduction from direct habitat loss and sensory disturbance from RFDs ■ Small increase in mortality from increased road development from RFDs ■ Reduced spring snow cover and higher summer temperatures from climate change	
		Geographic Extent	Regional[(a)]	
		Duration/Reversibility	Permanent	
		Frequency	Continuous	
		Probability of Occurrence	Possible	

Note: Natural factors include climate change and associated changes, inclement weather (e.g., storms), and wildfire.
a) Some effects may be beyond regional due to climate change and RFDs that occur within and beyond the RSA (i.e., the Wataynikaneyap Power Phase 2: Connecting 17 Remote First Nation Communities Project)
b) Local if no temporal overlap among activities associated with sensory disturbance; regional if temporal overlap among activities associated with sensory disturbance
ha = hectares; RSA = regional study area; RFD = reasonably foreseeable development.

7.2.2.5 Determination of Significance

Suitable habitat for wolverine is wide-spread and abundant in the RSA at Base Case (96.6%) and RFD Case (96.2%). The cumulative direct disturbance to moderate to high suitability wolverine habitat from previous and existing disturbance, the Project, and other RFDs is predicted to be 0.4% (9,633 ha) in the RSA, relative to the amount present at Base Case. Forestry is predicted to further reduce habitat availability; however, fire suppression may partially compensate for this loss.

Wolverines are likely to avoid access roads and areas of forest harvesting in the Red Lake, Whitefeather, and Trout Lake forests (Magoun 2005). However, effects from changes to habitat availability from linear disturbance features with low sensory disturbance (such as transmission lines) are unclear; these features may be used (Harriman and Baker 2003; Wright and Ernst 2004) or avoided (COSEWIC 2003; MNR 2013c). These small changes in habitat availability and distribution are predicted to have no measurable influence on population survival and reproduction rates. It is assumed the RFDs will use mitigation that avoids and reduces effects to wolverine population connectivity and abundance.

Climate change is also predicted to reduce habitat availability, habitat distribution, and survival and reproduction of wolverine in the RFD Case; however, the effects were not quantified in this assessment. In general, the wolverine 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. There is a large amount of uncertainty regarding the potential effects of climate change on wolverine because predictions are based on simulations that can be highly variable and many scenarios are possible. Additionally, wolverines in boreal landscapes may not be as reliant on spring snow cover as previously thought (Webb et al. 2016). Although the abundance of woodland caribou is predicted to decrease as a result cumulative effects (Section 7.1.3.5) this change is not predicted to affect wolverine survival and reproduction because other prey items such as rodents, snowshoe hares and moose carrion are expected to remain widely available at RFD Case.

Overall, the cumulative changes in habitat availability and distribution, and survival and reproduction (i.e., abundance) are expected to be within the resilience and adaptability limits of wolverine populations that are within and overlap the RSA. Wolverine are predicted to remain self-sustaining and ecologically effective in the RFD Case relative to the Base Case, although possibly at a lower abundance. Consequently, cumulative effects on wolverine in the RFD Case are predicted to be not significant (Table 23).

7.3 Little Brown Myotis

7.3.1 Assessment of Project Effects (Project Case)

7.3.1.1 Habitat Availability

Site clearing will result in a loss of winter hibernacula and summer maternity roosting habitat for little brown myotis in the Project footprint. Based on the general habitat model, there are 848 ha (4.4% of the RSA) of potentially suitable maternity roosting habitat in the limits of work (Table 24). The limits of work is approximately nine times larger than the anticipated Project ROW (4,355 ha for the limits of work versus 478 ha for the maximum anticipated Project ROW). For clarity, if it is assumed that the actual Project footprint is constructed through only moderate to high quality (suitable) maternity habitat, the amount of habitat lost would be approximately half as what was predicted in the general habitat model (478 ha for the actual Project ROW compared to 848 ha for the general model results). The predicted loss of 478 ha from the actual Project ROW is also an overestimate as habitat that contains moderate to high snag density is not continuously distributed within the limits of work.

The desktop assessment of bat maternity habitat was similar to results from the general habitat model. Moderate to high snag density (suitable maternity habitat) comprises 1,211 ha (30.2%) of the mapped limits of work as determined from the desktop assessment of suitable bat maternity habitat (Table 25). Approximately 44.8 km (35.1%) of the total length of the centerline of the corridor is comprised of moderate to high snag density (suitable habitat).

Based on the general habitat model, the limits of work contains approximately 4 ha (1.4%) of potentially suitable winter habitat (i.e., bedrock habitat) in the RSA (Table 24). This is a conservative estimate of habitat loss as the entire limits of work will not be disturbed at Project Case and the actual Project footprint will be routed around areas of potential hibernacula. The desktop habitat assessment identified 37 potential hibernacula features (i.e., bedrock that forms a rise or hill and cliffs) within the entire length of the limits of work (Figure 19). One high potential and four moderate potential hibernacula features were identified during the field survey in May 2017; the remaining 32 features were identified as low to very low potential features (Table 25; Figure 19).

Little is known about preferred foraging habitat for little brown myotis. This species may use edge habitat for foraging (COSEWIC 2013a) or may prefer to forage in areas with dense vegetation (i.e., cluttered canopies) (Kalcounis and Brigham 1995). The size of the clearing, as well the size of the bat, may influence the use of edge habitat for foraging. Edges may not be used as foraging habitat, but instead may be used by little brown myotis as travel corridors between roosting sites and foraging areas (Kalcounis-Ruepell et al. 2013). Effects from forest clearing for the Project may have positive or negative effects on little brown myotis.

Sensory disturbance may temporarily result in avoidance of maternity roosting habitat by little brown myotis during construction. The effects of noise on little brown myotis will likely depend on the frequencies generated by the Project. Noise frequencies from the Project that overlap with the little brown myotis frequency range (i.e., approximately 40 to 70 kHz) are expected to have the greatest effect on this species. Noise effects are more likely to interfere with roosting habitat than foraging habitat because bats forage at night and construction activities will typically take place during the day (i.e., one 10-hour shift per day, with normal working hours of 07:00 to 18:00), when bats are roosting. Night time work, which may interfere with bat foraging, may be required to make up for schedule delays caused by weather or other unexpected conditions.

Harrison (1965) found that little brown myotis did not respond to frequencies above 40 kHz when in torpor. A study by Luo et al. (2014) found that bats were more sensitive to noise when it occurred closer to sunset as opposed to earlier in the daily roosting period and responded least to traffic noise and most to vegetation noise (e.g., rustling of leaves), possibly because traffic noise was at a lower frequency than their hearing range. Passive-listening bats have been found to avoid areas with loud noise (e.g., highways) (Schaub et al. 2008; Siemer and Schaub 2011); however, echolocating bats may not be as sensitive to noise because they can adjust the amplitude and duration of their calls to the ambient noise level of an environment (Luo and Wiegrebe 2016). Bats may rapidly become habituated to repeated and prolonged noise exposure (e.g., bats roosting under bridges) (Luo et al. 2014). At present, little is known about the specific effects of noise on habitat avoidance by the little brown myotis.

There are no 50 km^2 grid locations identified as containing critical habitat by Environment Canada (2015a) near the Project limits of work area, and no SWH for little brown myotis has been identified in the RSA by the MNRF. Industrial activities in close proximity to hibernacula can degrade the habitat by altering its microclimatic characteristics (USFWS 2007) and this could hinder the recovery of little brown myotis populations from WNS.

Table 24: Changes to Little Brown Myotis Winter and Summer Maternity Roosting Habitat Availability in the Regional Study Area at Project Case, Based on the General Habitat Model

Habitat Suitability[(a)]	Base Case [ha]	Project Case [ha]	Change in Area Using the Limits of Work Footprint[(a)(b)] [ha]	Percent Change Using the Limits of Work Footprint[(b)] [%]
Summer Maternity Roosting Habitat				
Moderate to High	19,414	18,566	-848	-4.4
Nil to Low	94,806	95,654	848	0.9
Winter Habitat				
Moderate to High	264	260	-4	-1.4
Nil to Low	113,956	113,960	4	<0.1

a) Changes in habitat area result from a conversion of moderate to high suitability habitat to lower suitability habitats (i.e., nil to low).

b) The limits of work is approximately nine times larger than the anticipated Project ROW (4,355 ha for the limits of work versus 478 ha for the maximum anticipated Project ROW), but specific areas of disturbance had not been identified at the time of writing.

Note: Numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.

Note: The percent change is calculated using the total amount of moderate to high or nil to low habitat available at Base Case; percent change is not relative to the size of the study area.

ha = hectare; % = percent; <= less than.

Table 25: Desktop Assessment of Potential Suitable Maternity and Wintering Habitat in the Project Limits of Work

Habitat Category/Type	Limits of Work
Maternity Roosting Habitat	
Moderate to High Snag Density (ha and% of total mapped area)	1,211 (30.2%)
Nil to Low Snag Density (ha and% of total mapped area)	2,798 (69.8%)
Total Area Mapped (ha)	4,008 [(a)]
Length of Centerline that has Moderate to High Snag Density (km and% of total mapped length)	44.8 (35.1%)
Length of Centerline that has Nil to Low Snag Density (km and% of total mapped length)	82.7 (64.9%)
Total Length of Centerline (km)	127.5
Winter Habitat	
Number of Moderate and High Potential Hibernacula	■ 1 (high potential) ■ 4 (moderate potential)

Note: Numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.
a) Area mapped does not equal area of limits of work as some of the limits of work was not surveyed during the LiDAR survey.
ha =hectares; km = kilometres; % = percent.

7.3.1.2 Habitat Distribution

Site clearing and sensory disturbance during construction of the Project could result in adverse changes to the distribution of potential little brown myotis winter hibernating and summer maternity roosting habitat in the RSA. General habitat model results show the direct loss of potential winter habitat due to the Project footprint is primarily associated with the presumed removal of exposed bedrock in the southern portion of the limits of work (Figure 20). Results of the field program identified one high potential and four moderate potential hibernacula features within the limits of work. The one high potential hibernacula feature is on the east side of Nungesser Road, approximately 140 m from the road. Three of the moderate potential features are also located along the east side of the Nungesser Road. The fourth moderate hibernacula potential feature is located at the alternate crossing of the Berens River (Figure 19). The Project is not anticipated to result in a change in the distribution of potential hibernacula habitat after implementation of mitigation. Completing construction outside of the hibernation period (October 1 to April 30) and not completing construction in contiguous treed habitat within 200 m of potential hibernacula is predicted to avoid effects on hibernating bats.

General habitat model results show potential maternity roosting habitat will be more evenly lost throughout the limits of work (Figure 20). The general habitat model and the desktop assessment of potential maternity habitat noted that the southern and northern thirds of the limits of work contain more potential suitable maternity habitat than the central third of the limits of work (Figure 19 and Figure 20). As such, the actual Project ROW will intersect areas of nil to low snag density as well as areas of moderate to high snag density. There is a relatively large patch of moderate to high snag density near Coli Lake (Figure 19).

Occupied habitat is not predicted to be lost after mitigation and the loss of unoccupied habitat is predicted to not have any effect on connectivity among populations that overlap with the RSA because bats are highly mobile and little brown myotis may be flexible in their maternity roost locations (Lewis 1995). Displaced individuals are expected to find alternative suitable roosting habitat nearby because habitat availability is not a limiting factor for this species in the RSA. Changes to the distribution of hibernacula is not anticipated as the Project is will limit the removal of potential hibernacula features to the extent possible and construction in areas containing potential hibernacula habitat will be completed outside of the hibernation period to limit disturbance to hibernating bats.

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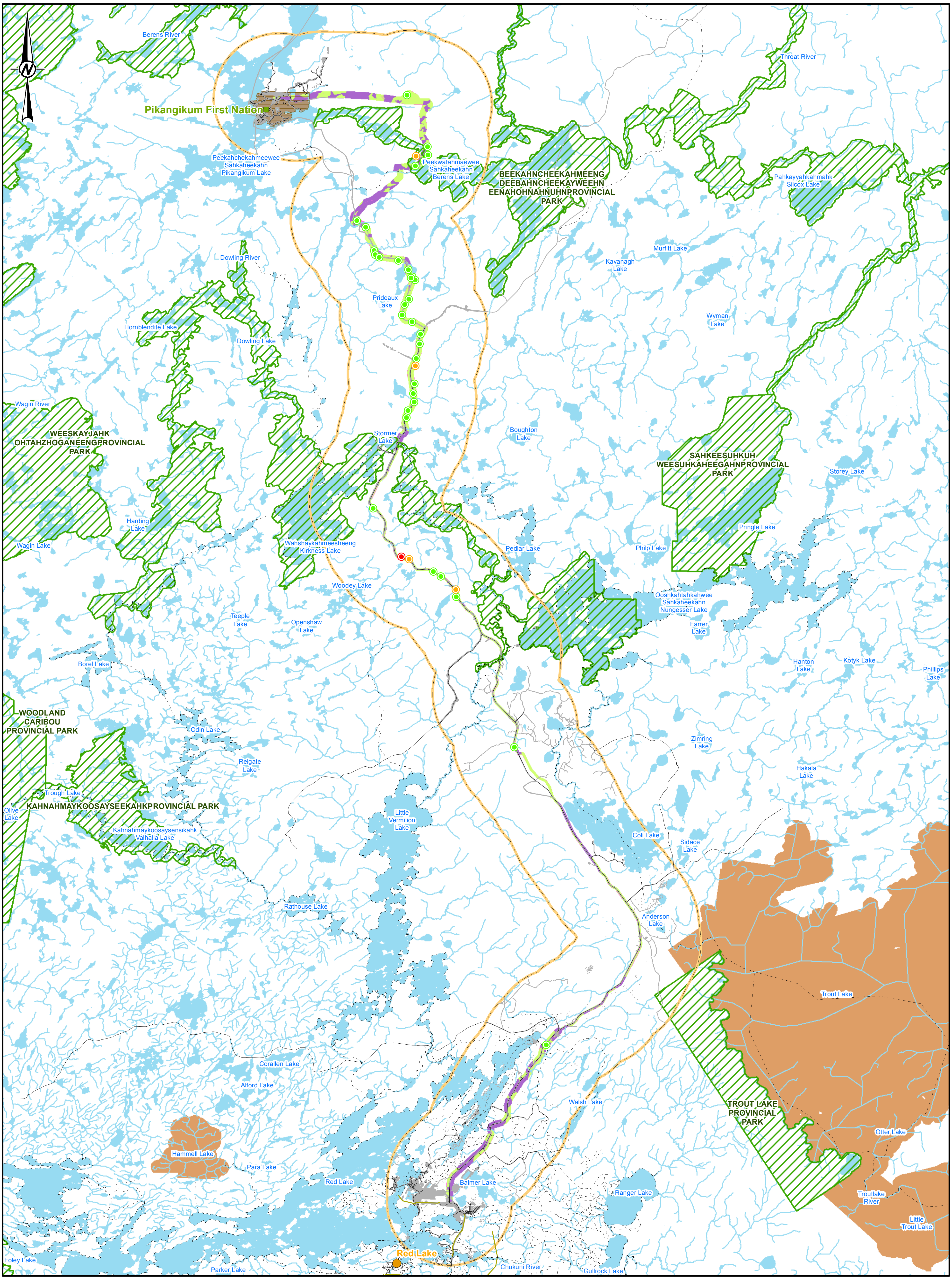

LEGEND

- City
- Town
- First Nation Community
- Wataynikaneyap Power Community
- Major Roads and Highways
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- Trail
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- Conservation Reserve
- Provincial Parks
- Project Limits of Work
- Regional Study Area
- Base Case Disturbance

Bat Hibernacula Potential

- High Potential
- Moderate Potential
- Low Potential

Desktop Assessment Results

- Suitable Maternity Habitat
- Unsuitable Maternity Habitat

REFERENCE(S)

1. BASE DATA - MNR LIO, OBTAINED 2016, NTDB
2. TRANSMISSION ROUTES - PROVIDED BY WATAYNIKANEYAP POWER L.P.
3. FIRST NATION COMMUNITIES FROM INDIGENOUS AND NORTHERN AFFAIRS CANADA (WWW.AINC-INAC.GC.CA)
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5. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 15

0 5 10

1:280,000 Kilometers

CLIENT
WATAYNIKANEYAP POWER L.P.

PROJECT
PIKANGIKUM DISTRIBUTION LINE PROJECT

TITLE
LITTLE BROWN MYOTIS SUMMER AND WINTER HABITAT IN THE LIMITS OF WORK AT BASE CASE AS DETERMINED FROM THE DESKTOP ASSESSMENT AND HIBERNACULA FIELD SURVEY

CONSULTANT

Wataynikaneyap Power

Golder Associates

YYYY-MM-DD	2017-05-30
DESIGNED	JMC
PREPARED	JMC/PR
REVIEWED	LD
APPROVED	AE

PROJECT NO.	CONTROL	REV.	FIGURE
1657738	####	####	19

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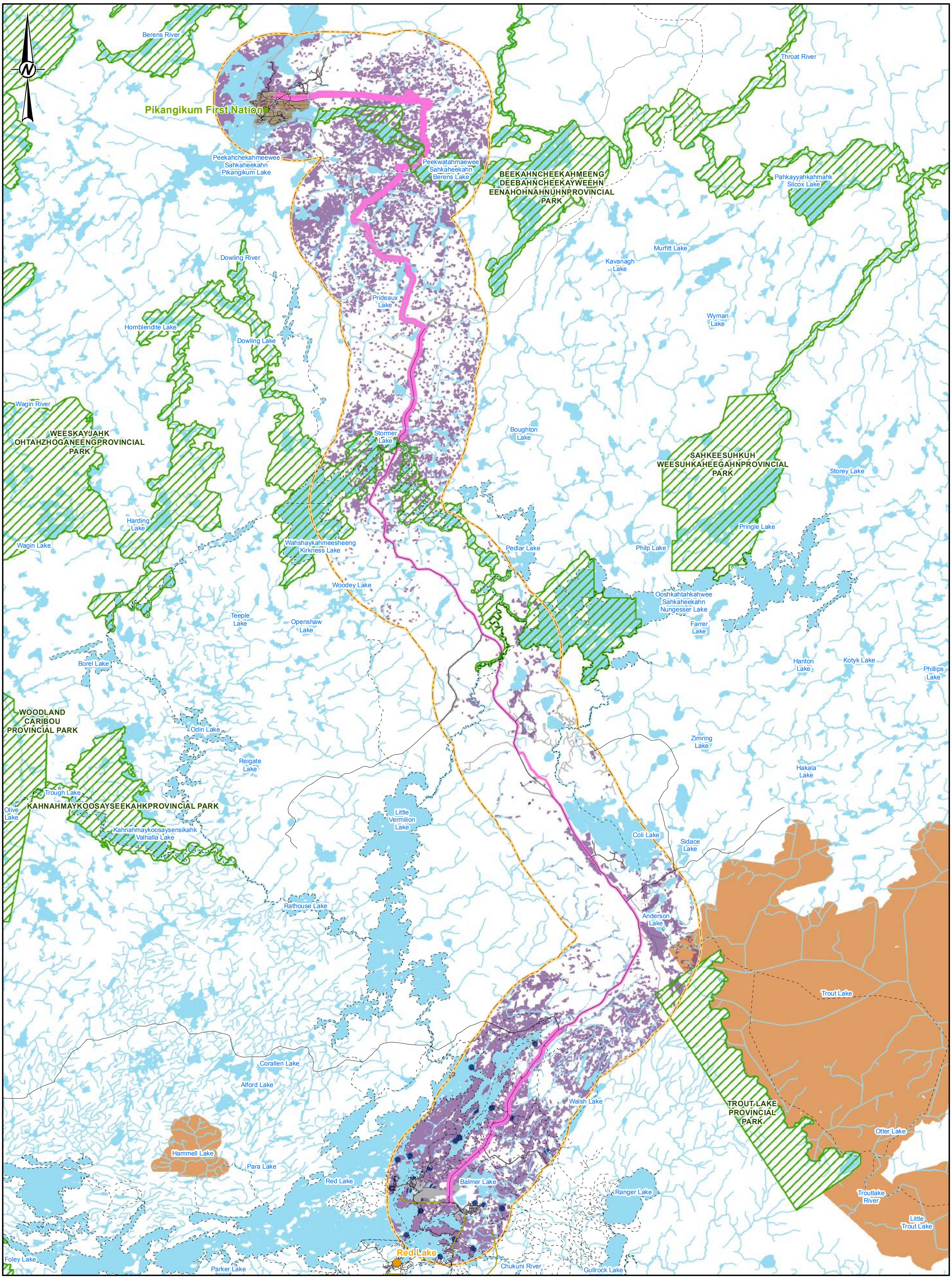

LEGEND

- City
- Town
- First Nation Community
- Wataynikaneyap Power Community
- Major Roads and Highways
- Winter Road
- Trail
- Existing Electrical Transmission Line
- Watercourse
- First Nation Reserve Land
- Waterbody
- Conservation Reserve
- Provincial Parks
- Project Limits of Work
- Regional Study Area
- Base Case Disturbance
- Little Brown Myotis Summer Habitat
- Little Brown Myotis Winter Habitat

REFERENCE(S)

1. BASE DATA - MNR LIO, OBTAINED 2016, NTDB
2. TRANSMISSION ROUTES - PROVIDED BY WATAYNIKANEYAP POWER L.P.
3. FIRST NATION COMMUNITIES FROM INDIGENOUS AND NORTHERN AFFAIRS CANADA (WWW.AINC-INAC.GC.CA)
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5. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 15

0 5 10
1:280,000 Kilometers

CLIENT
WATAYNIKANEYAP POWER L.P.

PROJECT
PIKANGIKUM DISTRIBUTION LINE PROJECT

TITLE
LITTLE BROWN MYOTIS SUMMER AND WINTER HABITAT IN THE REGIONAL STUDY AREA AT PROJECT CASE, AS PREDICTED FROM THE GENERAL HABITAT MODEL

CONSULTANT

YYYY-MM-DD	2017-03-21
DESIGNED	JMC
PREPARED	JMC/PR
REVIEWED	LD
APPROVED	AE

PROJECT NO.	CONTROL	REV.	FIGURE
1657738	####	####	20

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Little brown myotis are predicted to fly directly over or along the Project ROW when dispersing or searching for food and water in the Project Case (Kalcounis-Ruepell et al. 2013). Edge habitat created by the Project may facilitate movement and foraging behaviour but there is some uncertainty with this prediction because some studies suggest that this species prefers closed canopy habitat for foraging (Kalcounis and Brigham 1995; Jung et al. 1999; Morris et al. 2010).

Although positive changes in movement patterns at local scales are possible during operation, the overall net effect of the Project on habitat distribution is considered negative because of uncertainty in how little brown myotis responds to habitat fragmentation. The Project is not expected to reduce the extent of occurrence of little brown myotis, and is therefore compliant with the objectives outlined in the federal recovery strategy (Environment Canada 2015a).

7.3.1.3 Survival and Reproduction

Little brown bat populations in the RSA may be currently affected by WNS and as such are particularly susceptible to other threats because the resilience and adaptability limits of populations that overlap with the RSA may have been exceeded at Base Case. Because little brown myotis congregate during both the summer and winter, avoidance is a key mitigation for this species. In particular, clearing of potential bat maternity roost habitat will be completed outside of the maternity roosting season (June 1 to July 31) and work in contiguous forest habitat within 200 m of potential hibernacula will be avoided during the hibernation season (October 1 to April 30).

Little brown bats that roost in trees may have lower fidelity to their maternity roosting sites than individuals that roost in buildings or caves (Lewis 1995). However, loss of maternal roosting habitat has the potential to displace some breeding individuals at a local scale. Displaced individuals are expected to find alternative suitable roosting habitat nearby because habitat availability is not a limiting factor for this species.

Bats at the northern edge of their range in Canada spend longer periods of time in hibernation and are, therefore, more vulnerable to sensory disturbance because each disturbance event consumes valuable energy reserves required for survival (Fenton and Barclay 1980). A few studies have looked at the effects of blasting on hibernating bats. Some studies found no evidence of bat population declines after exposure to vibration levels ranging from 1.52 to 5.08 millimetres per second (mm/sec) and 6.35 mm/sec during hibernation (West Virginia Department of Environmental Protection 2006). Other studies found that that seismic vibration of 2.54 mm/sec (Besha 1984) and 0.5 mm/sec (Myers 1975) did not disturb hibernating bats. Construction of the Project is not anticipated to alter the survival of hibernating bats as construction will be avoided between potential hibernacula and a boundary being the lesser of (a) a 200 m radius of contiguously-treed area, or (b) the distance to the nearest existing road ROW; and construction within 200 m of potential hibernacula features will not be completed during the hibernation period (October 1 to April 30).

7.3.1.4 Characterization of Net Effects

If occupied habitat is removed, the effect of this loss would be permanent and experienced continuously by little brown myotis because the life of the Project is indefinite. Sensory disturbance during construction is assumed to degrade the quality of roosting habitat for bats in close proximity to the Project; however, the degree to which habitat would be avoided by bats is unknown and the effect is considered to be probable to occur. The effect would be continuous over the medium-term, and is anticipated to be reversible within a few months after the end of construction (Table 26).

The Project could possible influence winter habitat but there is a moderate level of uncertainty associated with the magnitude of the effect because all habitat in the Project footprint is assumed to be lost, whereas in reality this will only occur in areas where incompatible vegetation is removed during construction. Non-vegetated features such as bedrock outcrops, cliffs, and talus slopes (i.e., potential suitable winter habitat for bats) located between transmission-line-structure foundations will not likely be disturbed. Therefore, the loss of winter habitat is likely overestimated.

The predicted net effects of the Project on potential maternity roosting habitat are probable to occur because forested habitat will be cleared along the ROW (Table 26). Compensation for habitat loss has the potential to reverse the effects of habitat loss over the long-term, but is not factored into the characterization of net effects because of uncertainty in the timing and success of these actions.

The Project is expected to result in a small but negative change to bat maternity roosting habitat distribution. Although little brown myotis may alter the location of their maternity roosts, movements of little brown myotis are expected to be similar to Base Case as this species is highly mobile, can occupy fragmented landscapes, and may be flexible in the selection of their roost sites. Effects from changes to habitat distribution will occur continuously and permanently at the local scale (Table 26).

After mitigation, the Project is expected to have a neutral effect on little brown myotis survival and reproduction rates from alterations in habitat availability and distribution. The likelihood of this effect is possible because there is some uncertainty in the effectiveness of mitigation, particularly with respect to avoiding hibernacula potentially associated with small geologic features due to the difficulty associated with locating them on the landscape. There is also uncertainty associated with locating maternity roosts if clearing activities cannot avoid the maternity roosting period of June 1 to July 31.

Table 26: Description of Effects and Significance in the Project Case for Little Brown Myotis.

Indicators	Effect Pathway	Characteristic	Rating/Effect Size	Significance Determination
Habitat Availability	■ 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, corona-related noise and light emissions, dust, human activity, viewscape) can change wildlife habitat availability	Direction	Negative	Significant[a]
		Magnitude	■ Direct loss of approximately 4 ha (17.7%) of potential winter habitat in the RSA Base Case ■ No avoidance of wintering habitat due to sensory disturbance by adhering to setbacks ■ Direct loss of 848 ha of potential maternity roosting habitat (4.4%) of little brown myotis RSA Base Case ■ Potential avoidance of maternity roosting habitat in close proximity to construction activities due to sensory disturbance ■ Potential loss to maternity roost habitat where the Project intersects Federal Crown Land but no loss of hibernacula habitat on these lands.	
		Geographic Extent	Local	
		Duration/Reversibility	■ Permanent (direct loss) ■ Medium-term (sensory disturbance)	
		Frequency	Continuous	
		Probability of Occurrence	■ Unlikely (direct loss of winter habitat) ■ Probable (direct loss of maternity roosting habitat and sensory disturbance)	
Habitat Distribution	■ 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, corona-related noise and light emissions, viewscape) can change wildlife habitat availability, which can lead to changes in wildlife abundance and distribution	Direction	Negative	
		Magnitude	Slight shifts in maternity roost locations due to increased human disturbance	
		Geographic Extent	Local	
		Duration/Reversibility	Permanent	
		Frequency	Continuous	
		Probability of Occurrence	Possible	
Survival/Reproduction	■ 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, corona-related noise and light emissions, dust, human activity, viewscape) can change wildlife habitat availability	Direction	Neutral	
		Magnitude	n/a	
		Geographic Extent	n/a	
		Duration/Reversibility	n/a	
		Frequency	n/a	
		Probability of Occurrence	Possible	

Note: If a net effect was identified as positive or neutral, no additional effects characteristics, other than probability of occurrence, were summarized.

n/a = not applicable. Project effect pathways are expected to result in no measurable changes to little brown myotis survival and reproduction.

a) Little brown myotis in the RSA are considered as not likely to be self-sustaining in the Base Case; therefore, combined effects from the Project and existing developments are predicted to remain significant in the Project Case.

ha = hectares; RSA = regional study area.

7.3.1.5 Determination of Significance

Populations of little brown myotis that overlap with the RSA are highly sensitive to changes in survival and reproduction because WNS has resulted in dramatic declines of this species across the eastern portions of its range. Although WNS has not yet been reported in the RSA, the disease was confirmed in Atikokan in 2015 (USFWS 2016). Atikokan is approximately 300 km southwest of Red Lake and WNS has been observed to spread by 200 to 400 km per year (USFWS 2016). The presence of the disease in the RSA is uncertain because there is limited information related to the hibernacula in northern Ontario (Environment Canada 2015a). Nevertheless, there is an imminent threat to little brown myotis populations that overlap the RSA from WNS. As such, this species is highly vulnerable to additional threats in the future including changes in habitat availability, distribution or other factors affecting population survival and reproduction rates.

Although not confirmed, WNS was conservatively assumed to be present in the RSA at Base Case. As such, rapid declines in abundance may have exceeded the resilience and adaptability limits of this criterion. Therefore, at Base Case, little brown myotis populations that overlap with the RSA are considered as not likely self-sustaining and not ecologically effective (i.e., small populations are likely ineffective at limiting the abundance of insects; therefore changes due to WNS are considered significant at Base Case). Declining populations are largely due to mortality associated with the disease but other sources of mortality (e.g., extermination on private lands, reduced insect populations) and changes to habitat availability and distribution have the potential to accelerate their decline, hinder their recovery, or even limit the ability of populations to develop resistance to the fungus that causes WNS (Environment Canada 2015a).

Habitat is not a limiting factor in the Base Case and little brown myotis is inherently resilient to habitat changes because it is highly mobile and well adapted to human disturbance, using human structures for both hibernation and maternity roosting. The species tends to be tolerant of fragmented forested habitat and uses linear features for movement and foraging. The species' congregatory behaviour does make little brown myotis sensitive to the loss of key habitat features because the removal of such a feature can have a disproportionate effect on local populations.

In the Project Case, the general habitat model predicted that the limits of work would remove 4 ha (1.4%) of potential winter habitat and 848 ha (4.4%) of potential maternity roosting habitat in the RSA. The desktop assessment noted approximately 1,211 ha (30.2%) of potential suitable maternity habitat and five locations of moderate to high potential hibernacula in the limits of work. This is a highly conservative estimate as the limits of work (4,355 ha) was used as the Project footprint. The actual Project footprint will be much smaller; the Project ROW will be 40 m wide (478 ha) with additional disturbance areas for the substation (approximately 2 ha).

Additional roosting habitat in close proximity to construction activities may be temporarily avoided due to sensory disturbance, and bat distributions; this effect is expected to be reversible after construction is completed (medium-term). The Project may result in changes in habitat distribution at a local scale but these changes are not expected to alter the broader spatial extent of occurrence of populations in the RSA because bats are highly mobile and capable of long commute distances.

Habitat is not a limiting factor in the RSA and the Project will likely avoid direct mortality of individuals through the implementation of mitigation measures. Mitigation, such as spanning or avoiding disturbing habitats with compatible vegetation (e.g., bedrock habitat), retaining wildlife trees (snags) were possible, and avoiding construction between potential hibernacula and a boundary being the lesser of: (a) 200 m radius of contiguously-treed area, or (b) the distance to the nearest existing road ROW will limit effects from changes to habitat availability and distribution. There is high confidence that the effects to habitat availability and distribution will not be greater than predicted because conservatism was built into the assessment (e.g., assumed removal of all habitat within the limits of work). There is a moderate level of confidence that the Project will have a neutral effect on bat survival and reproduction because occupancy surveys will be challenging due to the length of the Project and the difficulty of locating natural roosts and hibernacula.

With effective implementation of mitigation, the Project is predicted to have a small but negative effect on habitat availability and distribution for little brown myotis and a neutral effect on their survival and reproduction. Incremental changes due to the Project are predicted to not adversely affect little brown myotis populations that overlap the RSA; however, these populations are expected to continue to decline in the Project Case due to WNS. Subsequently, little brown myotis populations that overlap the RSA continue to be considered as not likely self-sustaining and not ecologically effective in the Project Case (i.e., cumulative effects in the Project Case are predicted to be significant) (Table 26). However, the Project, after mitigation, would have no to little contribution to the combined effects from the Base Case on little brown myotis.

7.3.2 Reasonably Foreseeable Development Case (RFD Case)

7.3.2.1 Habitat Availability

The Wataynikaneyap Phase 2 Project, road developments, and forest harvesting in the Red Lake, Trout Lake, and Whitefeather Forest are RFDs that overlap with the RSA. The Wataynikaneyap Phase 2 Project and the Project were quantified in the RFD Case and will contribute to a loss of approximately 4 ha of potential suitable winter habitat, which is 1.4% in the RSA, relative to the Base Case. However, the potentially affected habitat was derived from the Land Cover 2000 data and suitability of this habitat for hibernating bats has not been confirmed. Wataynikaneyap will conduct pre-construction surveys in suitable habitat affected by the Project and the Wataynikaneyap Phase 2 Project to determine occupancy and will avoid known hibernacula through siting, timing restrictions and activity setbacks. It is assumed that other RFDs will be required to implement similar mitigation to limit the incremental contributions to cumulative effects on habitat availability for this species.

The Project and the Wataynikaneyap Phase 2 Project will contribute to a loss of approximately 855 ha (4.4%) of potential suitable summer maternity habitat in the RSA, relative to Base Case conditions. This is a conservative estimate as the limits of work (4,355 ha) was used as the Project footprint; anticipated Project ROW is anticipated to be 478 ha with an additional area required for the substation. Wataynikaneyap is committed to working with the MNRF to mitigate the incremental contribution from the Project and the Wataynikaneyap Phase 2 Project to the loss of maternity roosting habitat, thereby avoiding direct loss of occupied habitat and minimizing avoidance due to sensory disturbance. Field surveys will be completed in spring/summer 2017 to determine the suitability of potential hibernacula features and wildlife trees (i.e., snags) will be retained in the ROW where possible.

Forestry may further reduce the availability of winter and summer maternity roosting habitat for little brown myotis where clearcut harvesting is practiced. The retention of tree snags and riparian buffers may mitigate the effects of forest harvest to some degree. Further, there has been a recent downturn in the forest sector, which has resulted in reduced harvesting and renewal levels (MNR 2012). Fire suppression and climate change may further mitigate the effects of forestry on habitat availability for the little brown myotis because Ontario's forests are shifting towards mature, broad-leaved forest stands (Carleton 2001), which may favour bats.

Table 27: Changes to Little Brown Myotis Winter and Summer Maternity Roosting Habitat Availability in the Regional Study Area at RFD Case

Habitat Suitability[(a)]	Base Case [ha]	RFD Case [ha] [(a)]	Change in Area [ha]	Percent Change [%]
Winter Habitat				
Moderate to High	264	260	-4	-1.4
Nil to Low	113,956	113,960	4	<0.1
Summer Maternity Roosting Habitat				
Moderate to High	19,414	18,560	-855	-4.4
Nil to Low	94,806	95,660	855	0.9

a) Changes in habitat area result from a conversion of moderate to high suitability habitat to lower suitability habitats (i.e., nil to low).

Note: Numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.

Note: The percent change is calculated using the total amount of moderate to high or nil to low habitat available at Base Case; percent change is not relative to the size of the study area.

ha = hectare; % = percent; RFD = reasonably foreseeable development.

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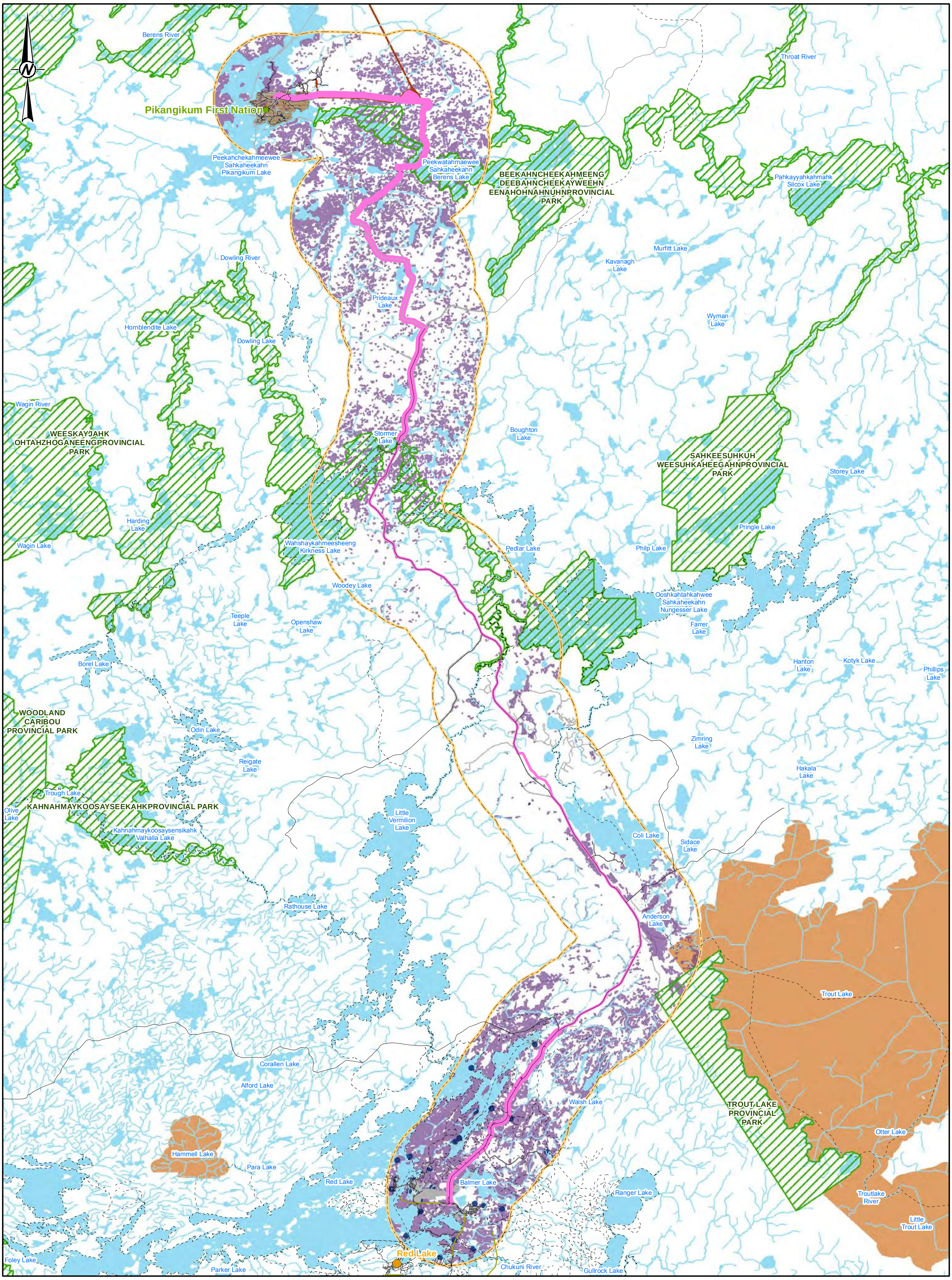

LEGEND

- City
- Town
- First Nation Community
- Wataynikaneyap Power Community
- Major Roads and Highways
- Winter Road
- Trail
- Existing Electrical Transmission Line
- Watercourse
- First Nation Reserve Land
- Waterbody
- Conservation Reserve
- Provincial Parks
- Project Limits of Work
- Regional Study Area
- Base Case Disturbance
- RFD Case Disturbance
- Little Brown Myotis Summer Habitat
- Little Brown Myotis Winter Habitat

REFERENCE(S)
1. BASE DATA - MNR LIO, OBTAINED 2016, NTDB
2. TRANSMISSION ROUTES - PROVIDED BY WATAYNIKANEYAP POWER L.P.
3. FIRST NATION COMMUNITIES FROM INDIGENOUS AND NORTHERN AFFAIRS CANADA (WWW.AINC-INAC.GC.CA)
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0 5 10
1:280,000 Kilometers

CLIENT
WATAYNIKANEYAP POWER L.P.

PROJECT
PIKANGIKUM DISTRIBUTION LINE PROJECT

TITLE
LITTLE BROWN MYOTIS SUMMER AND WINTER HABITAT IN THE REGIONAL STUDY AREA AT RESONABLY FORESEEABLE DEVELOPMENT CASE, AS PREDICTED FROM THE GENERAL HABITAT MODEL

CONSULTANT
Wataynikaneyap Power
Golder Associates

YYYY-MM-DD	2017-03-21
DESIGNED	JMC
PREPARED	JMC/PR
REVIEWED	LD
APPROVED	AE

PROJECT NO.	CONTROL	REV.	FIGURE
1657738	####	####	21

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0 25mm

7.3.2.2 Habitat Distribution

Changes in habitat distribution due to the Project and RFDs are not likely to result in local changes in the distribution of little brown myotis populations that overlap with the RSA (Figures 20 and 21). It is assumed that regulatory approval of RFDs will require proponents to demonstrate that they are meeting the distribution objectives for little brown myotis as outlined in the recovery strategy (Environment Canada 2015a). Based on this assumption, changes in the distribution of occupied habitat are unlikely due to the protection this species and its habitat receives under the provincial ESA and the federal SARA. Climate change also has the potential to expand the distribution of little brown myotis due to the energetic limit for hibernation shifting north (Humphries et al. 2002).

7.3.2.3 Survival and Reproduction

Little brown myotis populations that overlap with the RSA are considered to be particularly sensitive to factors affecting survival and reproduction because populations in Ontario have declined by over 75% in recent years due to the deadly fungal disease, WNS. The little brown myotis is predicted to be functionally extirpated (i.e., less than 1% of existing population) in Canada and the United States within 16 years (COSEWIC 2012), or possibly sooner based on the recent confirmation of the disease in Washington (USGS 2016).

The short term (12 to 18 years) population objective for little brown myotis in areas affected by WNS is to maintain (and increase where feasible) the population compared to the 2015 level. Reasonably foreseeable developments and other factors (e.g., extermination on private lands, climate change) may interfere with this objective if they increase mortality risk or reduce reproductive potential. Reasonably foreseeable developments must be carefully planned to avoid population level effects that would further threaten little brown myotis populations that overlap with the RSA.

Extermination of roosting and hibernating little brown myotis on private lands will likely continue to take place and climate change adds a high level of uncertainty to the recovery of populations because the timing and effects of climate change are largely unknown. Reduced insect abundance is one possible outcome of climate change and this has the potential to limit survival of reproductive females if they are unable to accumulate sufficient winter fat stores following summer reproduction (Frick et al. 2010). Little brown myotis are highly sensitive to changes in adult mortality, and particularly that of adult females because they have low reproductive rates. However, because this species is long-lived, populations of little brown myotis do have the capacity to recover, if released from WNS.

7.3.2.4 Characterization of RFD Case Effects

Effects from direct habitat loss of moderate to high suitability little brown myotis winter habitat are unlikely as the Project and other RFDs will be required to implement mitigation to avoid direct loss of winter habitat. Effects from direct habitat loss of moderate to high suitability little brown myotis habitat summer maternity are possible (Table 28). Little brown myotis that roost in trees may have lower site fidelity than individuals that roost in buildings or caves (Lewis 1995). Effects from changes to habitat availability from direct habitat loss are expected to occur at the regional scale. The direct loss of little brown myotis summer and winter habitat availability is conservatively assumed to be continuous and permanent for RFDs that will operate indefinitely (e.g., transmission lines) and reversible in the long-term for forest harvesting activities.

Effects from sensory disturbance (avoidance or reduction in habitat quality) are conservatively considered probable to occur (Table 28). There is little information on how little brown myotis respond to sensory disturbance but traffic noise may be lower than bat hearing ranges (Luo et al. 2014) and little brown myotis can adjust the amplitude and duration of their calls to the ambient noise level of an environment (Luo and Wiegrebe 2016).

As such, little brown myotis may not be sensitive to sensory disturbance and may not avoid areas with loud noise. Effects due to habitat loss from avoidance are expected to be reversible at the end of construction activities (medium-term) for projects where most sensory disturbance occurs during construction (e.g., pipelines and transmission lines) or are of short duration (e.g., forest harvesting). Habitat avoidance due to sensory disturbance is expected to occur at the local scale if there is not temporal overlap between the construction of the Project and similar activities at other RFDs. However, overlap in the construction of the Project and the Wataynikaneyap Phase 2 Project or road construction and forest harvesting in the Red Lake, Trout Lake, and Whitefeather forests may have regional effects on little brown myotis.

Cumulative effects from changes to little brown myotis habitat distribution from the Project and other RFDs are probable, not certain, as potential roosting habitat may be removed during Project construction but little brown myotis may be flexible in their roost site selection (Lewis 1995). Effects from changes in habitat distribution in the RFD Case will occur continuously at the regional scale (Table 28), will be permanent for projects such as transmission lines, and reversible in the long-term for forest harvesting activities.

Cumulative changes in habitat availability and distribution from the Project and RFDs are anticipated to have no to little influence on survival and reproduction rates in little brown myotis (neutral effect; Table 28). Habitat is not limiting in the RSA and developments are assumed to implement mitigation to avoid and limit direct mortality of little brown myotis during development activities. Alternately, effects from the intentional extermination of individuals on private lands are probable to occur and may occur continuously at the regional scale.

Cumulative effects to little brown myotis from changes in habitat availability, habitat distribution, and survival and reproduction associated with natural factors such as climate change and wildfire are probable to possible to occur (Table 28). Effects from climate change would occur continuously and permanently at the ‘beyond regional’ scale. Effects from changes to habitat availability and distribution due to wildfire and other natural factors (e.g., severe wind storms) would be frequent, possible to occur at the regional to beyond regional scale, and reversible in the long-term. Effects from WNS are considered certain to occur continuously for the indefinite future at the beyond regional scale.

Table 28: Description of Effects and Significance in the RFD Case for Little Brown Myotis.

Indicators	Effect Pathway	Characteristic	Rating/Effect Size	Significance Determination
Habitat Availability	■ 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, corona related noise and light emissions, dust, human activity, viewscape) can change wildlife habitat availability	Direction	Negative	Significant[c]
		Magnitude	■ Direct loss of approximately 4 ha (1.4%) of potential winter habitat in the RSA Base Case ■ No avoidance of wintering habitat due to sensory disturbance by adhering to setbacks ■ Direct loss of 855 ha of potential maternity roosting habitat (4.4%) of little brown myotis RSA Base Case ■ Potential avoidance of maternity roosting habitat in close proximity to construction activities due to sensory disturbance ■ Magnitude depends on the influences from climate change	
		Geographic Extent	■ Regional (direct loss)[a] ■ Local to Regional (sensory disturbance)[b]	
		Duration/Reversibility	■ Long-term to Permanent (direct loss and natural factors) ■ Medium-term (sensory disturbance)	
		Frequency	■ Continuous (sensory disturbance) ■ Frequent to Continuous (direct loss and natural factors)	
		Probability of Occurrence	■ Unlikely (direct loss of winter habitat) ■ Probable (direct loss of maternity roosting habitat, sensory disturbance, and natural factors)	
Habitat Distribution	■ 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, corona-related noise and light emissions, viewscape) can change wildlife habitat availability, which can lead to changes in wildlife abundance and distribution	Direction	Negative	
		Magnitude	■ Slight shifts in maternity roost locations due to increased human disturbance ■ No change to wintering habitat distribution after mitigation ■ Possible range expansion due to climate change	
		Geographic Extent	Regional	
		Duration/Reversibility	Long-term to Permanent	
		Frequency	Frequent to Continuous	
		Probability of Occurrence	Possible	
Survival/Reproduction	■ 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, corona related noise and light emissions, dust, human activity, viewscape) can change wildlife habitat availability	Direction	Neutral	
		Magnitude	n/a	
		Geographic Extent	n/a	
		Duration/Reversibility	n/a	
		Frequency	n/a	
		Probability of Occurrence	Possible	

Note: Natural factors include climate change and associated changes, inclement weather (e.g., storms), and wildfire.

n/a = not applicable. Effect pathways from the Project and RFDs are expected to result in no measurable changes to little brown myotis survival and reproduction.

a) Effects may be beyond regional due to climate change, white-nose syndrome, other natural factors, forestry, and RFDs that occur within and beyond the RSA (i.e., the Wataynikaneyap Power Phase 2: Connecting 17 Remote First Nation Communities Project)

b) Local if no temporal overlap among activities associated with sensory disturbance; regional if temporal overlap among activities associated with sensory disturbance

c) Little brown myotis in the RSA are considered as not likely to be self-sustaining in the Base Case; therefore, combined effects from the Project, previous and existing developments, and confirmed/approved and reasonably foreseeable developments are predicted to remain significant in the RFD Case.

ha = hectares; RSA = regional study area; RFD = reasonably foreseeable development

7.3.2.5 Determination of Significance

In the RFD Case, approximately 4 ha (1.4% of the RSA) of winter habitat and approximately 852 ha (4.4% of the RSA) of summer maternity roosting habitat would be removed, respectively. Forestry is predicted to further reduce habitat availability for little brown myotis; however, ongoing fire suppression may continue to increase the age of forest stands in the RSA, which may increase habitat quality for little brown myotis. It is assumed that regulatory approval of RFDs will require proponents to demonstrate that they are meeting the distribution objectives for little brown myotis as outlined in the recovery strategy (Environment Canada 2015a). Also, that RFDs will be required to implement mitigation that will limit cumulative effects on this species. These small changes in habitat availability and distribution are predicted to have no measurable influence on population survival and reproduction rates.

Incremental changes due to the Project are predicted to not adversely affect the resilience and adaptive capacity of little brown myotis populations that overlap with the RSA. However, these populations are expected to continue to decline in the RFD Case due to WNS, which has likely exceeded the resilience limits of this species. Subsequently, little brown myotis populations that overlap the RSA continue to be considered as not likely self-sustaining and not ecologically effective in the RFD Case, relative to the Base Case (i.e., effects are significant at Base Case due to disease). Therefore, the total combined effects in the RFD Case are predicted to be significant, even though the Project and RFDs would contribute no to little cumulative effects on little brown myotis, after mitigation (Table 28).

7.4 Bald Eagle

7.4.1 Assessment of Project Effects (Project Case)

7.4.1.1 Habitat Availability

Site clearing is predicted to contribute to a measurable loss of nesting habitat for bald eagle in the Project footprint. No loss of bald eagle foraging habitat is predicted because the Project will avoid large lakes and rivers. The limits of work contain approximately 1,091 ha of moderate to high suitability bald eagle nesting habitat (Table 29). This decrease represents 3.8% of suitable habitat in the RSA in the Project Case relative to the Base Case. This is a conservative estimate as the limits of work that was used in the habitat suitability model is much larger than the anticipated Project footprint (4,355 ha for the limits of work versus 478 ha for the Project ROW).

Table 29: Changes to Bald Eagle Habitat Availability in the Regional Study Area at Project Case

Habitat Suitability[(a)]	Base Case [ha]	Project Case [ha]	Change in Area using the Limits of Work footprint [ha] [(a) (b)]	Percent Change using the Limits of Work footprint [%] [(b)]
Moderate to High	28,968	27,877	-1,091	-3.8
Nil to Low	85,252	86,343	1,091	1.3

a) Changes in habitat area result from a conversion of moderate to high suitability habitat to lower suitability habitats (i.e., nil to low).

b) The limits of work is approximately nine times larger than the anticipated Project ROW (4,355 ha for the limits of work versus 478 ha for the maximum anticipated Project ROW), but specific areas of disturbance had not been identified at the time of writing.

Note: Numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.

Note: The percent change is calculated using the total amount of moderate to high or nil to low habitat available at Base Case; percent change is not relative to the size of the study area.

ha = hectare; % = percent.

7.4.1.2 Habitat Distribution

The distribution of bald eagle habitat in the Project Case is similar to Base Case conditions (Figure 22). Habitat fragmentation due to clearing and construction activities associated with the Project ROW would result in minimal changes to the existing distribution of bald eagle habitat in the RSA. Human disturbance may cause this species to increase their territory size or shift their territory or home range away from areas of human disturbance (Fraser et al. 1985; Anthony and Isaacs 1989). However, this species is highly mobile and the corridor alignment is not expected to function as a movement barrier for bald eagle. Therefore, although there may be slight shifts in territory sizes or locations, fragmentation due to the Project is not expected to affect the connectivity of bald eagle populations that overlap the RSA.

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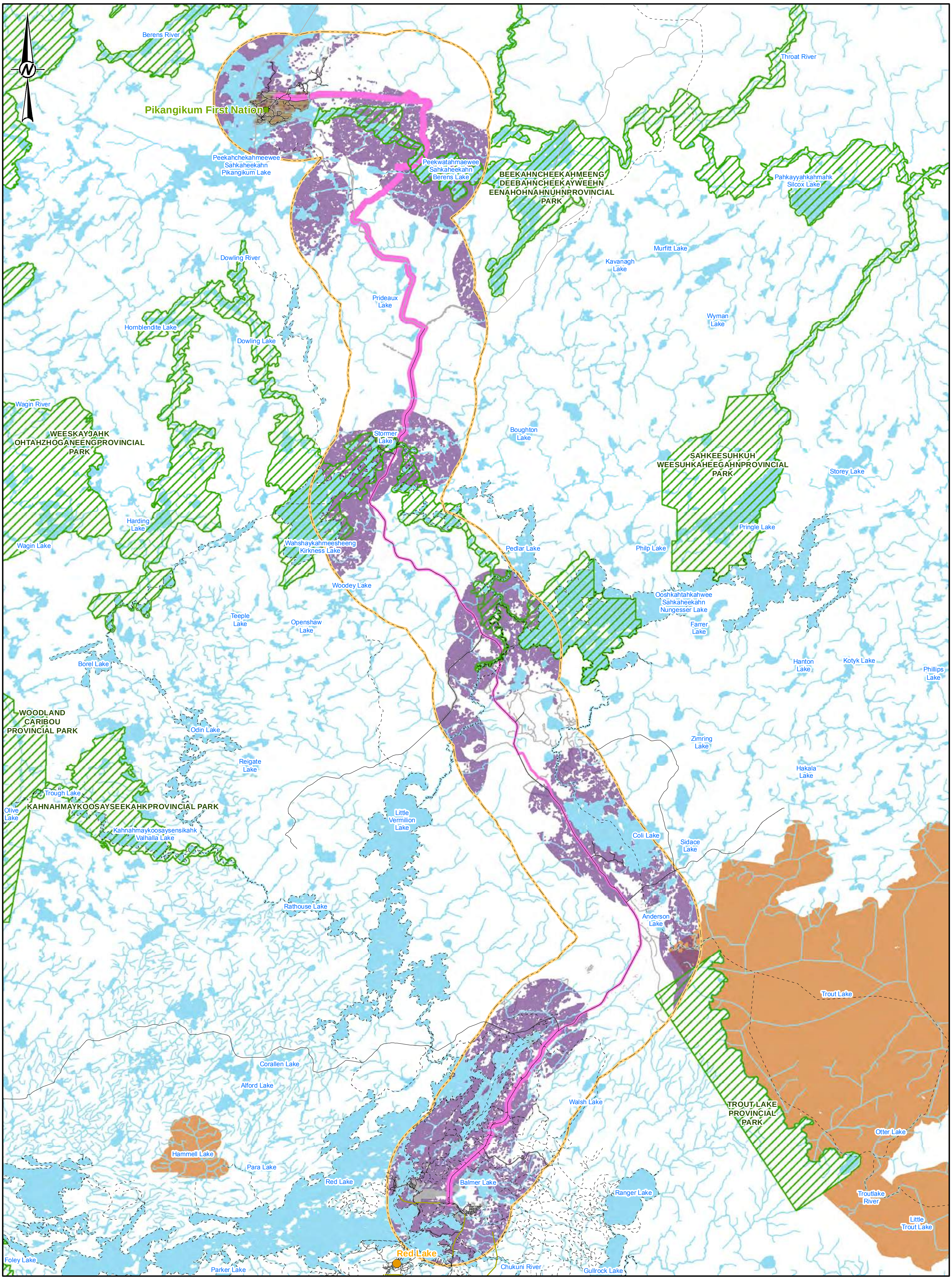

LEGEND

- City
- Town
- First Nation Community
- Wataynikaneyap Power Community
- Major Roads and Highways
- Winter Road
- Trail
- Existing Electrical Transmission Line
- Watercourse
- First Nation Reserve Land
- Waterbody
- Conservation Reserve
- Provincial Parks
- Project Limits of Work
- Regional Study Area
- Base Case Disturbance
- Bald Eagle Habitat

REFERENCE(S)

1. BASE DATA - MNR LIO, OBTAINED 2016, NTDB
2. TRANSMISSION ROUTES - PROVIDED BY WATAYNIKANEYAP POWER L.P.
3. FIRST NATION COMMUNITIES FROM INDIGENOUS AND NORTHERN AFFAIRS CANADA (WWW.AINC-INAC.GC.CA)
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5. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 15

0 5 10

1:280,000 Kilometers

CLIENT
WATAYNIKANEYAP POWER L.P.

PROJECT
PIKANGIKUM DISTRIBUTION LINE PROJECT

TITLE
BALD EAGLE HABITAT IN THE REGIONAL STUDY AREA AT PROJECT CASE

CONSULTANT

Wataynikaneyap Power

Golder Associates

YYYY-MM-DD	2017-03-21
DESIGNED	JMC
PREPARED	JMC/PR
REVIEWED	LD
APPROVED	AE

PROJECT NO.	CONTROL	REV.	FIGURE
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7.4.1.3 Survival and Reproduction

Habitat loss due to the Project footprint is predicted to result in a small reduction in carrying capacity in the RSA. Bald eagle collisions with electrical lines can be expected to increase due to the Project, particularly along areas of the line that span open habitat and are within 1 km of the waterbody shorelines (Watts et al. 2009). Eagle collisions with the conductors will be minimized to the extent possible after implementation of mitigation (e.g., reflectors on conductors or collars on wires near large lakes and open areas), but it is unlikely to be avoided all together. Reduced carrying capacity due to habitat loss, and reduced survival due to collisions are likely to have a small, but measurable adverse effect on bald eagle populations that overlap with the RSA.

7.4.1.4 Characterization of Net Effects

Once suitable habitat for bald eagle is removed, the effect of this loss would be certain to occur, permanent, and continuous at the local scale because the Project will operate indefinitely (Table 30). To reduce effects on bald eagles, there wil be no vegetation clearing within 100 m of a bald eagle nest.

To be conservative, sensory disturbance during construction of the Project is considered to be probable to occur continuously during the construction period (Table 30). Sensory disturbance will be limited in extent to areas of specific construction activities in the Project footprint due to construction being planned to be completed concurrently in multiple segments sequentially along the line (local scale). Effects are anticipated to be reversible a few months after construction is completed (medium-term duration).

Effects from changes to habitat distribution would be probable to occur at the local scale as bald eagles have been observed to shift their nesting territories away from areas of human disturbance (Fraser et al. 1985; Anthony and Isaacs 1989), although there is evidence that some individuals are becoming tolerant of habitat disturbed by humans (Armstrong 2014). These effects will be continuous and permanent because the Project will operate indefinitely (Table 30).

Reduced survival due to collisions with conductors is probable, even after mitigation such as the installation of reflectors on the transmission line in areas within 1 km of large waterbodies that are not surrounded by vegetation cover, and effects will occur continuously and indefinitely at the local scale (Table 30). Potential reductions in survival and reproduction may result from site clearing and sensory disturbance, especially if activities are undertaken during the breeding season. Effects are possible because of the uncertainty associated with forest clearing and productivity of bald eagles with home ranges that are in close proximity to construction activities. Possible mortality or productivity effects from direct habitat loss would be continuous and permanent because the Project will operate indefinitely. Possible changes in productivity from sensory disturbance are anticipated to occur continuously and will be reversible in the medium-term, following cessation of construction activities. Inspection and maintenance of the preferred route ROW during the operation phase may also result in sensory disturbance, but such events will be infrequent, and temporary.

Table 30: Description of Effects and Significance in the Project Case for Bald Eagle.

Indicators	Effect Pathway	Characteristic	Rating/Effect Size	Significance Determination
Habitat Availability	■ 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, corona related noise and light emissions, dust, human activity, viewscape) can change wildlife habitat availability	Direction	Negative	Not Significant
		Magnitude	■ Direct loss of approximately 1,091 ha (3.8%) of suitable nesting habitat in the RSA Base Case ■ Potential avoidance of nesting habitat in close proximity to construction activities due to sensory disturbance	
		Geographic Extent	Local	
		Duration/Reversibility	■ Permanent (direct loss) ■ Medium-term (sensory disturbance)	
		Frequency	Continuous	
		Probability of Occurrence	■ Certain (direct loss) ■ Probable (sensory disturbance)	
Habitat Distribution	■ 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, corona-related noise and light emissions, viewscape) can change wildlife habitat availability, which can lead to changes in wildlife abundance and distribution	Direction	Negative	
		Magnitude	Slight shifts in territory sizes or locations due to increased human disturbance	
		Geographic Extent	Local	
		Duration/Reversibility	Permanent	
		Frequency	Continuous	
		Probability of Occurrence	Probable	
Survival/Reproduction	■ 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, corona related noise and light emissions, dust, human activity, viewscape) can change wildlife habitat availability ■ Collisions with the transmission line causing injury or mortality to bald eagle	Direction	Negative	
		Magnitude	■ Small reduction in carrying capacity of the RSA compared to Base Case; ■ Possible reduction in productivity of home ranges overlapping areas in close proximity to construction activities ■ Reduced survival due to collisions with electrical lines	
		Geographic Extent	Local	
		Duration/Reversibility	■ Permanent (direct loss and collisions with electrical lines) ■ Medium-term (sensory disturbance)	
		Frequency	Continuous	
		Probability of Occurrence	■ Probable (collisions with electrical lines) ■ Possible (direct loss and sensory disturbance)	

ha = hectares; RSA = regional study area

7.4.1.5 Determination of Significance

Populations of bald eagles that overlap with the RSA are not considered sensitive to changes in habitat availability or distribution because habitat is not considered a limiting factor in the RSA. Bald eagles are highly mobile, and demonstrate flexibility in habitat selection including some tolerance of human disturbance (Armstrong 2014). As long-lived, top predators with low reproductive rates, bald eagles are most sensitive to changes in survival and reproduction. Bald eagle populations that overlap with the RSA have recovered from historical threats (e.g., chemical and heavy metal contamination of their food supply) and are increasing in the Base Case (Blancher et al. 2009; Wright 2016). Populations are currently estimated at 100,000 individuals in North America (Buehler 2000). The combined evidence indicates that bald eagle populations that overlap with the RSA are self-sustaining and ecologically effective in the Base Case.

In the Project Case, the limits of work contains 1,091 ha (3.8%) of suitable bald eagle habitat in the RSA. The limits of work used in the habitat model is much larger than the anticipated Project footprint. Additional habitat may be temporarily avoided by individuals due to sensory disturbance during construction. The Project would likely result in slight shifts of territory sizes or locations at local scales but these changes are not expected to alter the connectivity of this criterion in the RSA because bald eagles are highly mobile and transmission lines likely do not act as barriers to their movement.

Mortality due to collisions with the Project's electrical lines is expected, even with the implementation of mitigation such as the installation of reflectors where the line is in areas with no vegetation cover and within 1 km of large waterbodies. In addition, productivity of individuals with breeding ranges that overlap the RSA may decrease slightly. However, this species has been shown to adapt to human disturbance (Armstrong 2014). Overall, the negative incremental effects from the Project are expected to be well within the resilience and adaptability limits of this criterion. Consequently, effects from the Project on bald eagle populations that overlap the RSA are predicted to be not significant (Table 30).

7.4.2 Reasonably Foreseeable Development Case (RFD Case)

7.4.2.1 Habitat Availability

The Wataynikaneyap Phase 2 Project and the Project are predicted to reduce habitat availability for bald eagles in the RSA relative to Base Case. Cumulative effects of the Wataynikaneyap Phase 2 Project and the Project (limits of work) are conservatively predicted to result in the loss of approximately 1,094 ha (3.8%) of suitable breeding habitat in the RSA compared to Base Case (Table 31).

Forestry road development, forest harvesting, and construction of future transmission lines have the potential to reduce bald eagle habitat availability in the RSA through direct habitat loss and avoidance due to sensory disturbance. Fire suppression and climate change may mitigate the effects of forestry on habitat availability for the bald eagle because Ontario's forests are shifting towards mature forest stands (Carleton 2001), which may provide suitable nesting habitat for this species.

Climate change may benefit bald eagle populations by allowing this species to expand its range farther north into areas that currently contain suitable habitat and food conditions but have low eagle densities at Base Case due to a limited ice-free period (Grier et al. 2003). However, there is a large degree of uncertainty regarding the potential effects of climate change because predictions are based on many simulations that can be highly variable.

Table 31: Changes to Bald Eagle Habitat Availability in the Regional Study Area at RFD Case

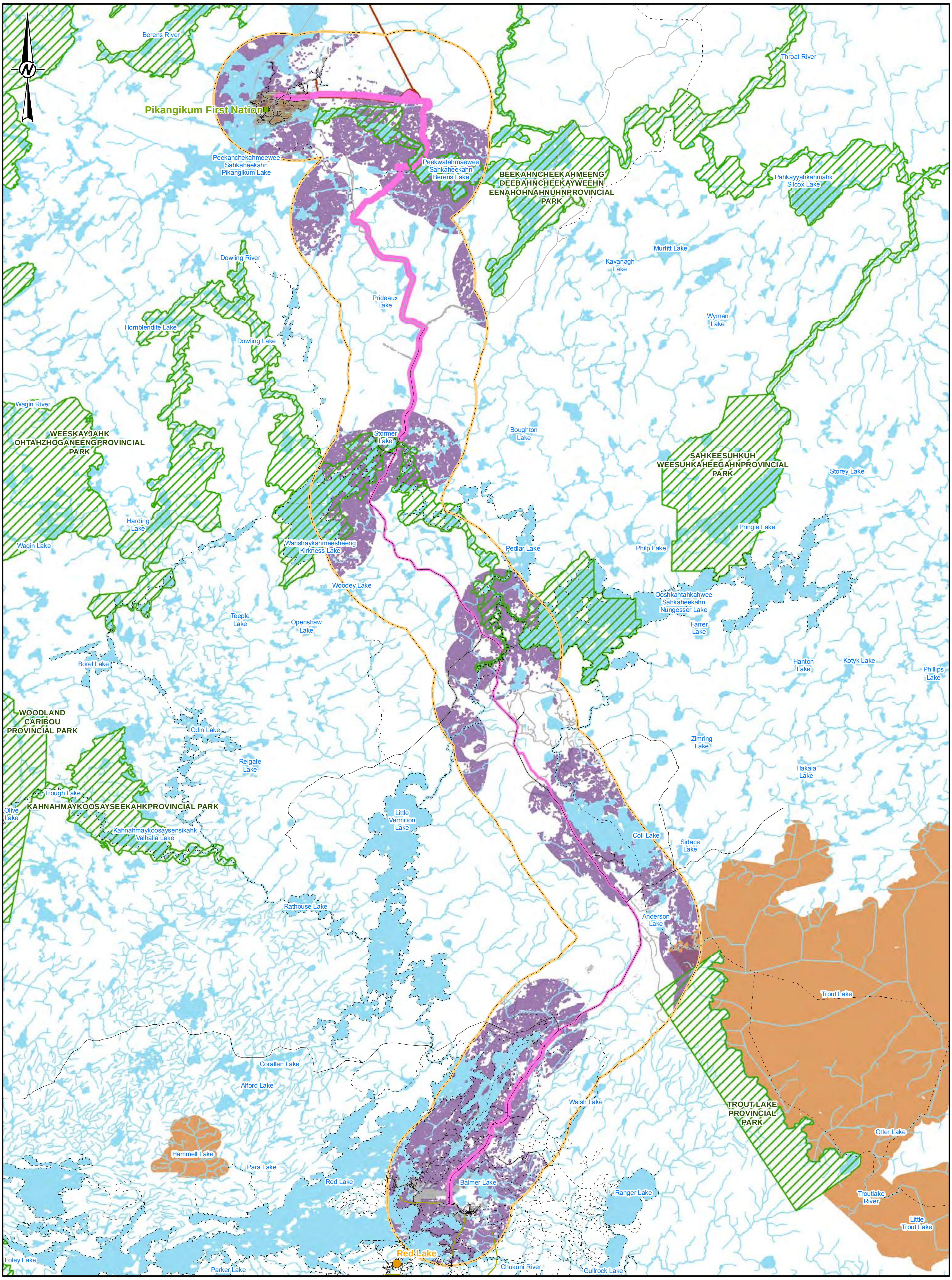
Habitat Suitability[(a)]	Base Case [ha]	RFD Case [ha]	Change in Area [ha] [(a)]	Percent Change [%]
Moderate to High	28,968	27,875	-1,094	-3.8
Nil to Low	85,252	86,345	1,094	1.3

a) Changes in habitat area result from a conversion of moderate to high suitability habitat to lower suitability habitats (i.e., nil to low).

Note: Numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.

Note: The percent change is calculated using the total amount of moderate to high or nil to low habitat available at Base Case; percent change is not relative to the size of the study area.

ha = hectare; % = percent; RFD = reasonably foreseeable development.



LEGEND

- City
- Town
- First Nation Community
- Wataynikaneyap Power Community
- Major Roads and Highways
- Winter Road
- Trail
- Existing Electrical Transmission Line
- Watercourse
- First Nation Reserve Land
- Waterbody
- Conservation Reserve
- Provincial Parks
- Project Limits of Work
- Regional Study Area
- Base Case Disturbance
- RFD Case Disturbance
- Bald Eagle Habitat

REFERENCE(S)

1. BASE DATA - MNR LIO, OBTAINED 2016, NTDB
2. TRANSMISSION ROUTES - PROVIDED BY WATAYNIKANEYAP POWER L.P.
3. FIRST NATION COMMUNITIES FROM INDIGENOUS AND NORTHERN AFFAIRS CANADA (WWW.AINC-INAC.GC.CA)
4. PRODUCED BY GOLDER ASSOCIATES LTD UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2016
5. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 15

0 5 10
1:280,000 Kilometers

CLIENT
WATAYNIKANEYAP POWER L.P.

PROJECT
PIKANGIKUM DISTRIBUTION LINE PROJECT

TITLE
BALD EAGLE HABITAT IN THE REGIONAL STUDY AREA AT RESONABLY FORESEEABLE DEVELOPMENT CASE

CONSULTANT

Wataynikaneyap Power
Golder Associates

YYYY-MM-DD	2017-03-21
DESIGNED	JMC
PREPARED	JMC/PR
REVIEWED	LD
APPROVED	AE

PROJECT NO.	CONTROL	REV.	FIGURE
1657738	####	####	23

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:
25mm
0

7.4.2.2 Habitat Distribution

Reasonably foreseeable developments will alter the distribution of bald eagle habitat in the RSA compared to Base Case (Figures 22 and 23). Changes in habitat distribution from any given project in the RFD Case may alter territory sizes and locations (Fraser et al. 1985; Anthony and Isaacs 1989), but bald eagle populations that overlap with the RSA should remain well connected in the RFD Case. Effects from changes to bald eagle habitat distribution from human developments and natural factors are assumed to occur throughout the RFD Case because forest harvesting, the Project, and the Wataynikaneyap Phase 2 Project are expected to operate indefinitely. Climate change will also continue over the foreseeable future and may allow bald eagles to expand their ranges northward into areas that currently contain adequate food and nesting habitat but have a short ice-free period.

7.4.2.3 Survival and Reproduction

Reasonably foreseeable developments are predicted to reduce the carrying capacity of bald eagle habitat in the RSA. However, there is uncertainty in the conclusions due to a lack of information on the timing and location of forest harvesting and forestry access roads.

Bald eagles are thought to be somewhat resilient to climate change in terms of habitat availability and distribution, but may be less adaptable in terms of effects on food supply (Armstrong 2014). Drying and shrinking wetlands could reduce the availability of foraging habitat, and warm, wet springs may increase mercury levels in fish and bioaccumulation in bald eagles (Armstrong 2014). These adverse effects to bald eagle food supply may be partially offset by expanding ranges of warm water fish species, which may increase prey availability for bald eagles.

The Project and the Wataynikaneyap Phase 2 Project have the potential to increase bald eagle mortality through collisions with conductor lines. These effects are expected to be highest where the transmission lines pass within 1 km of large waterbodies and is not surrounded by forest. Mitigation such as installing reflectors on the line within these areas cover are predicted to reduce adverse changes in survival and reproduction.

7.4.2.4 Characterization of RFD Case Effects

Transmission lines will result in a continuous and permanent removal of suitable bald eagle habitat. Effects from changes to habitat availably from forest harvesting will be continuous and reversible in the long-term (Table 32). Reduced quality of nesting and roosting habitat and possible avoidance in close proximity to construction activities from sensory disturbance is probable to occur (not certain) as some individuals may acclimate to sensory disturbance (Table 32). Effects from sensory disturbance are expected to be continuous and reversible in the medium-term for all RFDs. Habitat avoidance due to sensory disturbance is expected to occur at the local scale if there is no temporal overlap between the construction of the Project and similar activities associated with other RFDs. However, overlap in the construction of the Project and the Wataynikaneyap Phase 2 Project or road construction and forestry harvesting in the Red Lake, Trout Lake, and Whitefeather forests may have regional effects on bald eagle.

Reasonably foreseeable developments may possibly result in a small shift in bald eagle territory sizes or locations (habitat distribution) but populations that overlap the RSA are anticipated to be remain well connected in the RFD Case. Bald eagle may expand their ranges northward with climate warming. Effects from changes to habitat distribution will be permanent and continuous at the regional scale (Table 32).

There may be a small reduction in the carrying capacity in the RSA, compared to Base Case, which could influence population survival and reproduction. Forest clearing and sensory disturbance may effect productivity of bald eagles with home ranges that overlap areas in close proximity to construction activities. Effects from habitat loss on productivity will be permanent for transmission line projects and reversible in the long-term for areas cleared for forestry; effects from sensory disturbance will be reversible in the medium-term for all RFDs. Effects from direct loss and sensory disturbance on productivity are anticipated to be continuous and possible to occur. Effects from direct loss will occur at the regional level, while effects from sensory disturbance may occur at the local or regional level, depending on overlap of sensory disturbance events (Table 32).

The Project and the Wataynikaneyap Phase 2 Project may increase the number of bald eagle mortalities from collisions with the transmission lines. Increases in mortality from collisions with the transmission lines should be reduced by implementing mitigation, such as placing reflectors on the lines in areas within 1 km of large waterbodies that are not surrounded by vegetation. However, mortality risk will not be completely removed and the effect is considered to be probable to occur continuously and permanently as the Project and the Wataynikaneyap Phase 2 Project will operate indefinitely (Table 32).

Effects to bald eagle habitat availability, habitat distribution, and survival and reproduction from climate change are possible to probable to occur. Effects from climate change occur continuously and permanently at the beyond regional scale. Effects from wildfire and other natural factors (e.g., severe storms) will be frequent, reversible in the long-term, and are probable to occur at the regional or beyond regional scale (Table 32).

Table 32: Description of Effects and Significance in the RFD Case for Bald Eagle.

Indicators	Effect Pathway	Characteristic	Rating/Effect Size	Significance Determination
Habitat Availability	■ 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, corona related noise and light emissions, dust, human activity, viewscape) can change wildlife habitat availability	Direction	Negative	Not Significant
		Magnitude	■ Direct loss of approximately 1,094 ha (3.8% of RSA Base Case) ■ Reduced quality of nesting habitat and possible avoidance from sensory disturbance during construction ■ Magnitude depends on the influences from climate change.	
		Geographic Extent	■ Regional (direct loss)[(a)] ■ Local to Regional (sensory disturbance)[(b)]	
		Duration/Reversibility	■ Long-term to Permanent (direct loss and natural factors) ■ Medium-term (sensory disturbance)	
		Frequency	■ Continuous (sensory disturbance) ■ Frequent to Continuous (direct loss and natural factors)	
		Probability of Occurrence	■ Certain (direct loss) ■ Probable (sensory disturbance and natural factors)	
Habitat Distribution	■ 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, corona-related noise and light emissions, viewscape) can change wildlife habitat availability, which can lead to changes in wildlife abundance and distribution	Direction	Negative	
		Magnitude	■ Slight shifts in territory sizes or locations due to increased human disturbance ■ Possible range expansion due to climate change	
		Geographic Extent	Regional [(a)]	
		Duration/Reversibility	Long-term to Permanent	
		Frequency	Frequent to Continuous (direct loss and natural factors)	
		Probability of Occurrence	Probable	
Survival/Reproduction	■ 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, corona related noise and light emissions, dust, human activity, viewscape) can change wildlife habitat availability ■ Collisions with the transmission line causing injury or mortality to bald eagle	Direction	Negative	
		Magnitude	■ Small reduction in carrying capacity in the RSA compared to Base Case ■ Possible reduction in productivity of home ranges overlapping areas in close proximity to construction activities ■ Reduced survival due to collisions with electrical lines	
		Geographic Extent	■ Regional (direct loss, collisions with electrical lines, and natural factors)[(a)] ■ Local to Regional (sensory disturbance)[(b)]	
		Duration/Reversibility	■ Long-term to Permanent (direct loss and natural factors) ■ Permanent (collisions with electrical lines) ■ Medium-term (sensory disturbance)	
		Frequency	■ Continuous (sensory disturbance and collisions with electrical lines) ■ Frequent to Continuous (direct loss and natural factors)	
		Probability of Occurrence	■ Probable (collisions with electrical lines) ■ Possible (direct loss, sensory disturbance, and natural factors)	

Note: Natural factors include climate change and associated changes, inclement weather (e.g., storms), and wildfire.
a) Effects may be beyond regional due to climate change, other natural factors, forestry, and RFDs that occur within and beyond the RSA (i.e., the Wataynikaneyap Power Phase 2: Connecting 17 Remote First Nation Communities Project)
b) Local if no temporal overlap among activities associated with sensory disturbance; regional if temporal overlap among activities associated with sensory disturbance
ha = hectares; RSA = regional study area; RFD = reasonably foreseeable development

7.4.2.5 Determination of Significance

Reasonably foreseeable developments, including the Project, are predicted to have measurable effects on habitat availability, habitat distribution, and survival and reproduction for bald eagles. The Project and other RFDs have the potential to reduce bald eagle habitat availability in the RSA through direct habitat loss and avoidance due to sensory disturbance. Minor changes in habitat distribution in the RFD Case may have effects on territory sizes and locations and habitat use, but bald eagle populations that overlap with the RSA should remain well connected because this species is highly mobile. Reasonably foreseeable developments including the Project may result in a small reduction in bald eagle carrying capacity in the RSA as a result of the loss and degradation of suitable habitat. Mitigation in the Project and Wataynikaneyap Phase 2 Project ROWs, such as the retention of wildlife trees, where possible, should reduce effects from habitat loss.

Climate change is predicted to have varying effects on habitat availability, habitat distribution, and survival and reproduction of bald eagles in the RFD Case. In general, bald eagles are thought to be less vulnerable to climate change than other species with more specialized requirements and more limited distributions (Armstrong 2014). Applying a precautionary approach, climate change was assumed to have negative effects on bald eagle.

Overall, the cumulative effects from changes in habitat availability and distribution, and survival and reproduction in the RFD Case are expected to be within the resilience and adaptive capacity limits of this species. Bald eagle populations that overlap the RSA would continue to be self-sustaining and ecologically effective in the RFD Case, relative to the Base Case. Consequently, cumulative effects from past and present developments, the Project and other RFDs on bald eagles are predicted to be not significant (Table 32).

7.5 Eastern Whip-poor-will

7.5.1 Assessment of Project Effects (Project Case)

7.5.1.1 Habitat Availability

The limits of work contains 2,293 ha of suitable eastern whip-poor-will habitat, which is a loss of 4.6% in the RSA (Table 33). Habitat loss calculated for the Project Case is an overestimate because the limits of work is much larger than the anticipated Project footprint (4,355 ha for the limits of work versus 478 ha for the Project ROW). Additionally, existing roads and other linear disturbance features, including the Project ROW, were not included as suitable habitat for whip-poor-will in the habitat model (Section 3.1.3.5), even though whip-poor-will will use these habitats for nesting and foraging (COSEWIC 2009; English et al. 2016). Furthermore, non-vegetated habitat (i.e., suitable habitat for whip-poor-will, such as bare ground) will not likely need to be cleared for construction and direct habitat loss from the Project in non-vegetated habitat is likely to occur only where support structures, switching stations, and connection facilities will be built in these habitats. Footprints for transmission line poles are generally small (1.5 by 1.5 m), although larger footprints may be required for self-supporting steel structures. Switching stations and connection facilities have large footprints; cleared areas at these locations may provide suitable nesting habitat for eastern whip-poor-will (COSEWIC 2009).

Table 33: Changes to Eastern Whip-poor-will Habitat Availability in the Regional Study Area at Project Case

Habitat Suitability[(a)]	Base Case [ha]	Project Case [ha]	Change in Area Using the Limits of Work Footprint[(a)(b)] [ha]	Percent Change Using the Limits of Work Footprint[(b)] [%]
Moderate to High	49,332	47,040	-2,293	-4.6
Nil to Low	64,887	67,180	2,293	3.5

a) Changes in habitat area result from a conversion of moderate to high suitability habitat to lower suitability habitats (i.e., nil to low).

b) The limits of work is approximately nine times larger than the anticipated Project ROW (4,355 ha for the limits of work versus 478 ha for the maximum anticipated Project ROW), but specific areas of disturbance had not been identified at the time of writing.

Note: Numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.

Note: The percent change is calculated using the total amount of moderate to high or nil to low habitat available at Base Case; percent change is not relative to the size of the study area.

ha = hectare; % = percent.

The Project ROW will be maintained in perpetuity as early to mid-successional vegetation communities, which may continue to provide functional habitat for whip-poor-will. Whip-poor-wills have been observed using transmission line corridors, presumably for foraging (COSEWIC 2009), and may benefit from the creation of forest edges (English et al. 2016) through the development of the ROW.

Sensory disturbance during construction may temporarily reduce whip-poor-will habitat availability close proximity to construction activities through avoidance. Noise levels greater than 50 dBA can negatively affect birds (ECCC 2016). Noise from blasting and construction equipment is expected to exceed 50 dBA. Habitat that is otherwise suitable for whip-poor-wills may be avoided in areas where noise levels exceed 50 dBA.

7.5.1.2 Habitat Distribution

Suitable eastern whip-poor-will breeding habitat is predicted to be removed during site clearing for the Project throughout the limits of work (Figure 24). However, this loss of habitat is likely an overestimate as unvegetated habitat will not need to be cleared for construction, whip-poor-wills use transmission line corridors for foraging (Cink 2002; COSEWIC 2009), and this species' abundance may be positively correlated with linear disturbance density (English et al. 2016).

The loss of suitable breeding habitat in the RSA is not predicted to have a measurable effect on whip-poor-will movement patterns. Although whip-poor-wills can show fidelity to breeding sites (Cink 2002), they are a highly mobile species and are capable of establishing territories in new locations when populations are below carrying capacity, which is likely the situation in the RSA. Individuals that are currently breeding in the limits of work may shift their home range sizes or locations to include the Project ROW (English et al. 2016).

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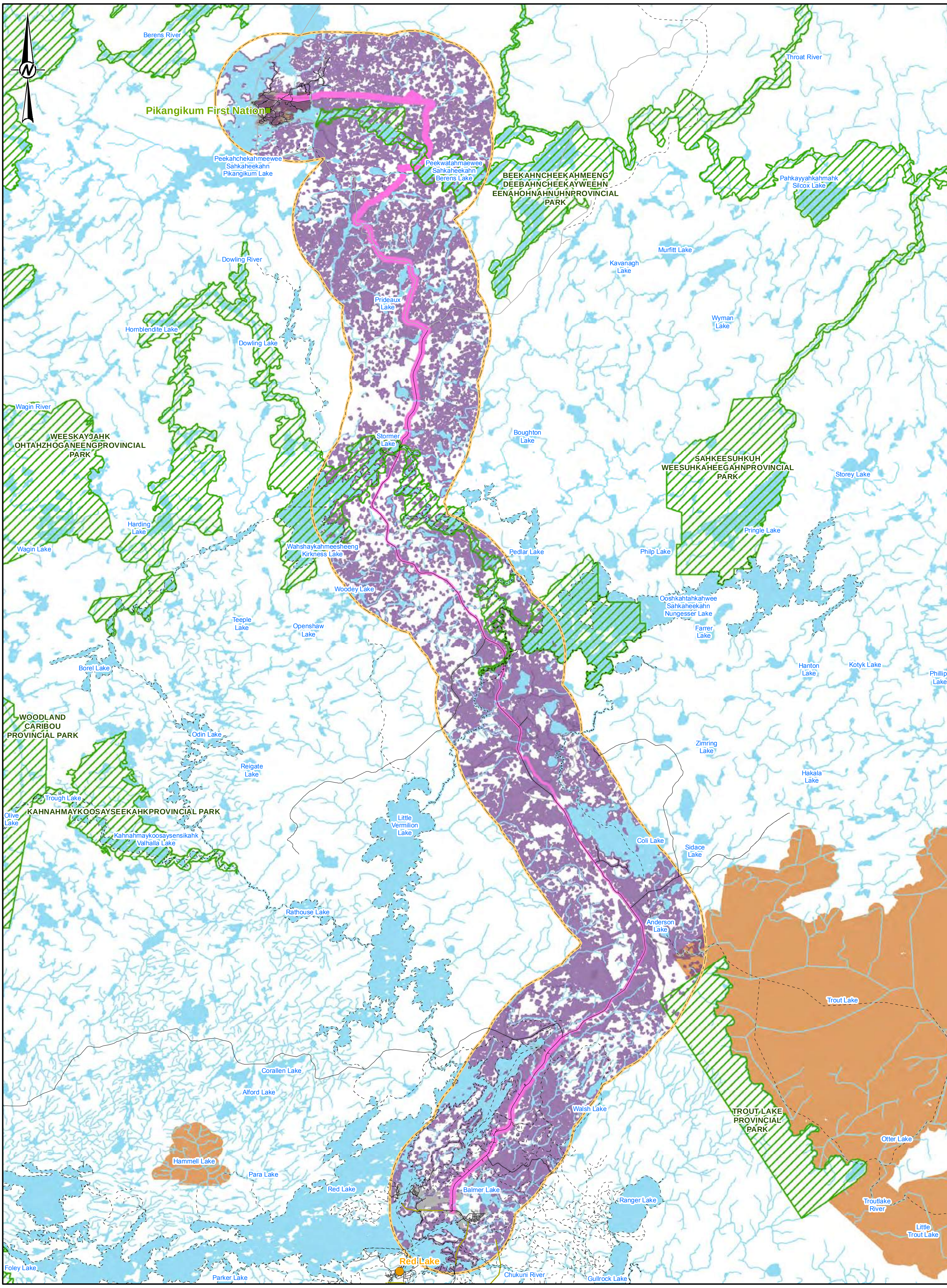

LEGEND

- City
- Town
- First Nation Community
- Wataynikaneyap Power Community
- Major Roads and Highways
- Winter Road
- Trail
- Existing Electrical Transmission Line
- Watercourse
- First Nation Reserve Land
- Waterbody
- Conservation Reserve
- Provincial Parks
- Project Limits of Work
- Regional Study Area
- Base Case Disturbance
- Eastern Whip-poor-will Habitat

REFERENCE(S)

1. BASE DATA - MNR LIO, OBTAINED 2016, NTDB
2. TRANSMISSION ROUTES - PROVIDED BY WATAYNIKANEYAP POWER L.P.
3. FIRST NATION COMMUNITIES FROM INDIGENOUS AND NORTHERN AFFAIRS CANADA (WWW.AINC-INAC.GC.CA)
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5. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 15

0 5 10

1:280,000 Kilometers

CLIENT
WATAYNIKANEYAP POWER L.P.

PROJECT
PIKANGIKUM DISTRIBUTION LINE PROJECT

TITLE
EASTERN WHIP-POOR-WILL HABITAT IN THE REGIONAL STUDY AREA AT PROJECT CASE

CONSULTANT

Wataynikaneyap Power

Golder Associates

YYYY-MM-DD	2017-03-08
DESIGNED	JMC
PREPARED	JMC/PR
REVIEWED	LD
APPROVED	AE

PROJECT NO.	CONTROL	REV.	FIGURE
1657738	####	####	24

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: 25mm

7.5.1.3 Survival and Reproduction

The loss of breeding habitat may affect reproductive success if individuals are displaced or return to breeding grounds to find habitat removed and subsequently are unable to establish a new territory or establish a territory in lower quality habitat. However, this is unlikely to have a measurable effect on whip-poor-will populations that overlap the RSA given the small area of predicted habitat loss (less than 5% of suitable habitat in the RSA). In addition, whip-poor-will habitat in the RSA appears to be abundant but unoccupied and the Project ROW may provide suitable habitat for this species (Cink 2002; COSEWIC 2009; English et al. 2016). As such, the predicted loss of habitat is expected to have no measurable effect on whip-poor-will reproduction and carrying capacity at the population level.

Sensory disturbance such as noise from construction may affect reproductive success and survival for individuals in close proximity to construction activities by raising stress levels and interfering with communications (e.g., reducing ability to hear approaching predators or intraspecific vocalizations) (Ortega 2012). Five whip-poor-will were recorded at two survey locations in the baseline study area during species-specific surveys in 2016. The two locations were approximately 12 m and 14 m from the proposed centerline of the transmission corridor. Mitigation to avoid effects to these areas would involve construction outside of the migratory bird breeding period.

7.5.1.4 Characterization of Net Effects

Negative effects from direct habitat loss of moderate and high suitability eastern whip-poor-will habitat due to the Project are certain to occur because the effect of habitat loss on wildlife populations is well understood and considered adverse (Table 34). However, breeding whip-poor-wills have been found to use powerline and roadway ROWs (COSEWIC 2009) and the abundance of whip-poor-will in southern Ontario was positively correlated with linear disturbance density (English et al. 2016). Effects from sensory disturbance (avoidance or reduction in habitat quality) are probable because some individuals may adapt to sensory disturbance. Effects from changes to habitat availability from direct loss and sensory disturbance are expected to occur continuously at the local scale. Effects from avoidance due to sensory disturbance are expected to be reversible within a few months after the end of construction activities (medium-term), while effects from direct loss will be permanent.

Negative effects from changes to habitat distribution are possible, not certain, as this species may use the Project ROW as nesting and foraging habitat. Individuals may prefer habitat in the ROW and may shift their territory size or location to include the Project ROW in their territory (Table 34). Effects from changes in habitat distribution will occur continuously at the local scale and will be permanent as vegetation in the Project ROW will be maintained in perpetuity as early to mid-successional vegetation communities.

Effects to whip-poor-will from changes to survival and reproduction associated with direct habitat loss and sensory disturbance are possible to occur. Habitat in the RSA is not likely at carrying capacity for this species, and so the Project is anticipated to result in no measurable changes to whip-poor-will reproduction and carrying capacity at the population level. Effects from changes to survival and reproduction due to sensory disturbance and direct habitat loss will occur continuously at the local scale and will likely be reversible in the medium-term and permanent, respectively (Table 34).

Table 34: Description of Effects and Significance in the Project Case for Eastern Whip-poor-will

<table>
<tr><th>Indicators</th><th>Effect Pathway</th><th>Characteristic</th><th>Rating/Effect Size</th><th>Significance Determination</th></tr>
<tr><td rowspan="6">Habitat Availability</td><td rowspan="6">■ 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, corona related noise and light emissions, dust, human activity, viewscape) can change wildlife habitat availability</td><td>Direction</td><td>Negative</td><td rowspan="18">Not Significant</td></tr>
<tr><td>Magnitude</td><td>■ Direct loss of 2,293 ha (4.6%) of suitable nesting habitat in the RSA Base Case
■ Potential avoidance of nesting habitat in close proximity to construction activities due to sensory disturbance</td></tr>
<tr><td>Geographic Extent</td><td>Local</td></tr>
<tr><td>Duration/Reversibility</td><td>■ Permanent (direct loss)
■ Medium-term (sensory disturbance)</td></tr>
<tr><td>Frequency</td><td>Continuous</td></tr>
<tr><td>Probability of Occurrence</td><td>■ Certain (direct loss)
■ Probable (sensory disturbance)</td></tr>
<tr><td rowspan="6">Habitat Distribution</td><td rowspan="6">■ 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, corona-related noise and light emissions, viewscape) can change wildlife habitat availability, which can lead to changes in wildlife abundance and distribution</td><td>Direction</td><td>Negative</td></tr>
<tr><td>Magnitude</td><td>Slight shifts in territory sizes or locations due to increased human disturbance</td></tr>
<tr><td>Geographic Extent</td><td>Local</td></tr>
<tr><td>Duration/Reversibility</td><td>Permanent</td></tr>
<tr><td>Frequency</td><td>Continuous</td></tr>
<tr><td>Probability of Occurrence</td><td>Possible</td></tr>
<tr><td rowspan="6">Survival/Reproduction</td><td rowspan="6">■ 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, corona related noise and light emissions, human activity, viewscape) can change wildlife habitat availability</td><td>Direction</td><td>Negative</td></tr>
<tr><td>Magnitude</td><td>Small reduction in productivity from habitat loss and sensory disturbance</td></tr>
<tr><td>Geographic Extent</td><td>Local</td></tr>
<tr><td>Duration/Reversibility</td><td>■ Permanent (direct loss)
■ Medium-term (sensory disturbance)</td></tr>
<tr><td>Frequency</td><td>Continuous</td></tr>
<tr><td>Probability of Occurrence</td><td>Possible</td></tr>
</table>

ha = hectares; RSA = regional study area.

7.5.1.5 Determination of Significance

The whip-poor-will is a mobile species that will use linear disturbance features for nesting and foraging. These characteristics suggest resilience and adaptive capacity to changes in habitat availability and distribution. Individual whip-poor-wills distributed across their breeding range are capable of sustaining the population or improving its abundance provided sufficient suitable habitat is available (Environment Canada 2015b). Population estimates specific to northern Ontario are unavailable; however, the evidence suggests that the population(s) that overlap the whip-poor-will RSA are likely self-sustaining and ecologically effective at Base Case.

For the primary pathways influencing habitat availability, habitat distribution and survival and reproduction, the net effects are restricted to close proximity to the Project footprint, 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 Project (limits of work) is conservatively predicted to remove 2,293 ha (4.6%) of suitable habitat in the RSA during construction. Additional suitable habitat in close proximity to construction activities may be temporarily avoided due to sensory disturbance. However, the Project ROW may provide more suitable habitat in the RSA, relative to Base Case conditions, as this species abundance was found to be positively correlated with linear disturbance density in southern Ontario (English et al. 2016). Additionally, eastern whip-poor-will nest in open habitats. Small areas of non-vegetated habitats may be removed from use by whip-poor-will if tower structures need to be constructed in this habitat type.

The Project may result in changes in territory sizes or locations at the local scale but these changes are not expected to alter the spatial extent of occurrence of the population(s) that overlap with the RSA because whip-poor-wills are highly mobile and capable of using linear disturbances for breeding. Habitat is not likely limiting in the RSA, and with effective implementation of mitigation, the incremental changes due to the Project are predicted to result in no significant adverse net effects to whip-poor-will (Table 34).

7.5.2 Reasonably Foreseeable Development Case (RFD Case)

7.5.2.1 Habitat Availability

Reasonably foreseeable developments that were quantified in the RFD Case are the Wataynikaneyap Phase 2 Project and the Project. These RFDs will contribute to a loss of approximately 2,309 ha (4.7%) of moderate to high suitability habitat in the RSA relative to the Base Case (Table 35). However, this is likely an overestimate of habitat loss as eastern whip-poor-wills have been observed to use transmission line and road ROWs as foraging habitat (COSEWIC 2009) and abundance of whip-poor-wills is positively correlated with linear disturbance density (English et al. 2016).

In addition to development, natural factors such as climate change and wildfire may contribute cumulatively to influence habitat availability for whip-poor-will. Climate warming is expected to result in drier conditions in Ontario (Thompson et al. 1998), which could increase whip-poor-will habitat availability (Environment Canada 2015b). Fire suppression can improve habitat for whip-poor-will by creating a juxtaposition of early and late seral forests (COSEWIC 2009). The Ontario Wildland Fire Management System (OWFMS) includes managing fire to meet ecological and resource objectives (MNRF 2014f), and it is expected that over the long term, outcomes of OWFMS will change habitat availability for whip-poor-will differently than what might have otherwise occurred naturally.

Table 35: Changes to Eastern Whip-Poor-Will Habitat Availability in the Regional Study Area at RFD Case

Habitat Suitability[(a)]	Base Case [ha]	RFD Case [ha]	Change in Area [ha][(a)]	Percent Change [%]
Moderate to High	49,332	47,023	-2,309	-4.7
Nil to Low	64,887	67,197	2,309	3.6

a) Changes in habitat area result from a conversion of moderate to high suitability habitat to lower suitability habitats (i.e., nil to low).

Note: Numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.

Note: The percent change is calculated using the total amount of moderate to high or nil to low habitat available at Base Case; percent change is not relative to the size of the study area.

ha = hectare; % = percent; RFD = reasonably foreseeable development.

7.5.2.2 Habitat Distribution

Habitat distribution in the RFD Case remains similar to Base Case conditions (Figures 24 and 25). Reasonably foreseeable developments such as forest harvesting, Wataynikaneyap Phase 2 Project, and the Project may increase whip-poor-will habitat as this species requires open and edge habitat for nesting. Additionally, this species has been found to have higher abundance in landscapes with higher linear disturbance density and may shift their territories to include ROWs (English et al. 2016). As such, the Project and other RFDs may result in a positive change in whip-poor-will habitat distribution, relative to the Base Case. It is assumed the RFDs will use mitigation that avoids, minimizes or offsets effects to whip-poor-will habitat and population connectivity.

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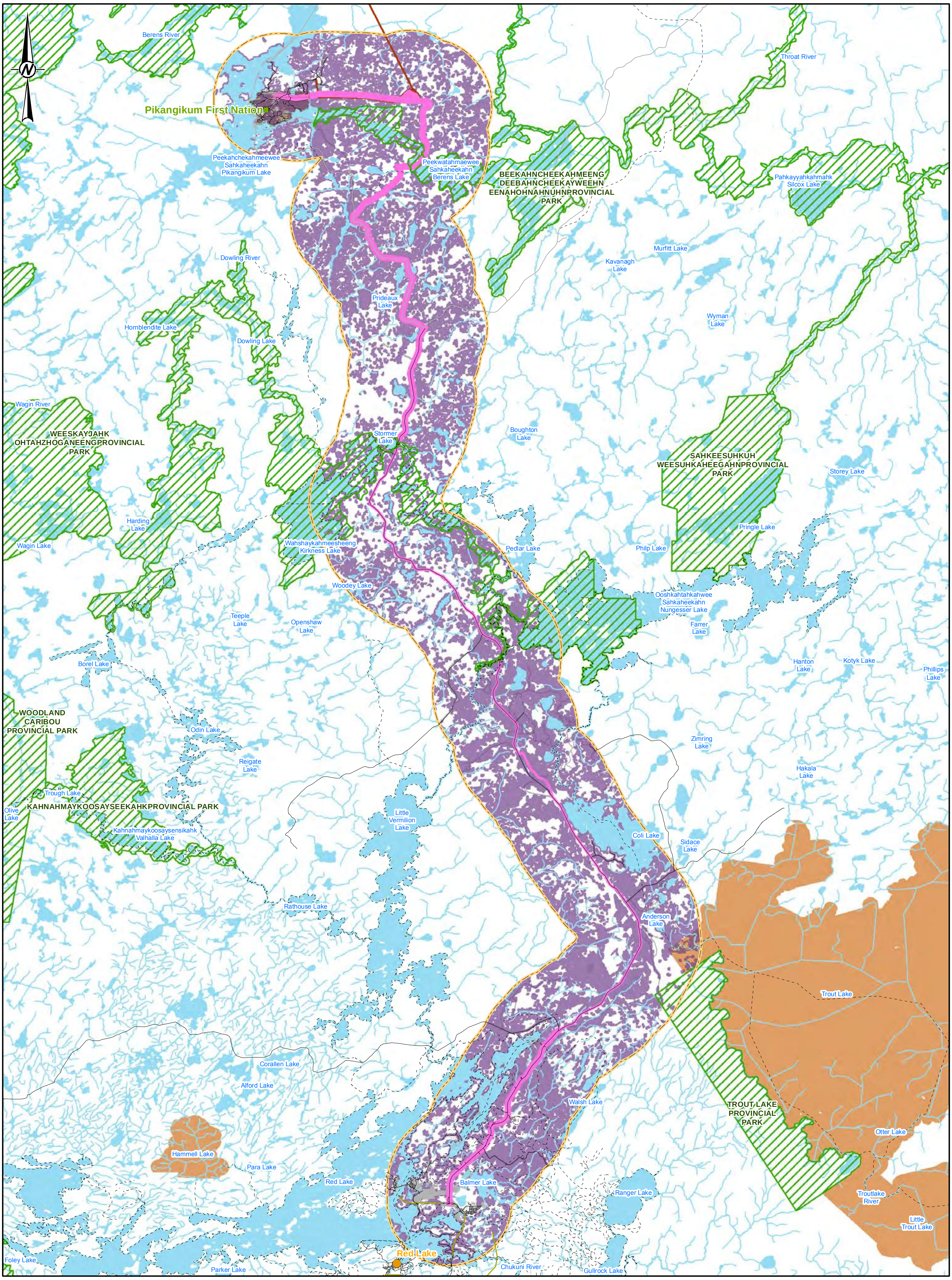

LEGEND

- City
- Town
- First Nation Community
- Wataynikaneyap Power Community
- Major Roads and Highways
- Winter Road
- Trail
- Existing Electrical Transmission Line
- Watercourse
- First Nation Reserve Land
- Waterbody
- Conservation Reserve
- Provincial Parks
- Project Limits of Work
- Regional Study Area
- Base Case Disturbance
- RFD Case Disturbance
- Eastern Whip-poor-will Habitat

REFERENCE(S)

1. BASE DATA - MNR LIO, OBTAINED 2016, NTDB
2. TRANSMISSION ROUTES - PROVIDED BY WATAYNIKANEYAP POWER L.P.
3. FIRST NATION COMMUNITIES FROM INDIGENOUS AND NORTHERN AFFAIRS CANADA (WWW.AINC-INAC.GC.CA)
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5. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 15

CLIENT
WATAYNIKANEYAP POWER L.P.

PROJECT
PIKANGIKUM DISTRIBUTION LINE PROJECT

TITLE
EASTERN WHIP-POOR-WILL HABITAT IN THE REGIONAL STUDY AREA AT RESONABLY FORESEEABLE DEVELOPMENT CASE

CONSULTANT

YYYY-MM-DD	2017-03-21
DESIGNED	JMC
PREPARED	JMC/PR
REVIEWED	LD
APPROVED	AE

PROJECT NO.	CONTROL	REV.	FIGURE
1657738	####	####	25

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25mm
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7.5.2.3 Survival and Reproduction

In northern Ontario, climate change is expected to alter the onset of spring and summer. Spring and summer are expected to begin earlier and the growing season is expected to increase by 41 to 61 days in northern Ontario by the 2050s (Stewart 1990). These changes are likely to have a positive effect on eastern whip-poor-will as a longer growing season may allow for this species to frequently raise more than one clutch per year. However, climate change is also predicted to increase the frequency and intensity of extreme weather events, including droughts and heavy precipitation. Increases in the frequency and intensity of storms are predicted for the Great Lakes region (Stewart 1990). Extreme weather events during the breeding season can result in reduced fecundity and nest success. Individuals may also be susceptible to extreme weather events outside of the breeding season. The frequency and intensity of hurricanes are predicted to increase as a result of climate change, which may negatively affect individuals during fall migration and on wintering grounds.

Warmer and drier conditions in Ontario due to climate change may alter the onset of spring and summer and the timing of insect hatches (Nituch and Bowman 2013). Insectivorous long-distance migrants such as eastern whip-poor-wills often exhibit a strong synchronization between breeding and peak food abundance, and climate change may impact this timing by creating a temporal mismatch between reproduction and optimal foraging conditions for prey (Both et al. 2009; COSEWIC 2009). However, uncertainty is high regarding the potential effects of climate change because predictions are based on simulations that can be highly variable.

7.5.2.4 Characterization of Net Effects

Negative effects from direct habitat loss of moderate and high suitability eastern whip-poor-will habitat are considered certain (Table 36). This is precautionary approach as it assumes complete habitat loss for transmission line ROWs and forestry. However, this species can use powerline and roadway ROWs and clear cuts as breeding habitat (COSEWIC 2009), and whip-poor-will abundance may be positively correlated with linear disturbance density (English et al. 2016). The direct loss of eastern whip-poor-will habitat availability in the RFD Case is conservatively assumed to be continuous and permanent at the regional scale.

Effects from avoidance or reduction in habitat quality from sensory disturbance are probable because some individuals may adapt to sensory disturbance. Effects from habitat avoidance due to sensory disturbance are expected to be reversible at the end of construction activities (medium-term) for projects where most sensory disturbance occurs during construction (e.g., pipelines and transmission lines) or for short durations (e.g., forest harvesting) (Table 36). Habitat avoidance due to sensory disturbance is expected to occur at the local scale if there is no temporal overlap between the construction of the Project and similar activities associated with other RFDs. However, overlap in the construction of the Project and the Wataynikaneyap Phase 2 Project or road construction and forest harvesting in the Red Lake, Trout Lake, and Whitefeather forests may results in regional effects on whip-poor-will.

Negative effects from changes to habitat distribution are considered possible, not certain, to occur as this species is highly mobile and may favour the linear disturbance ROWs and clearcuts for foraging and nesting habitat (Table 36). Effects from RFDs that are expected to exist on the landscape for the foreseeable would occur continuously and indefinitely at the regional scale. Effects from forest harvesting may be reversible in the long-term.

Effects from changes in eastern whip-poor-will survival and reproduction associated with direct habitat loss and sensory disturbance from RFDs are possible to occur and may occur continuously at the regional scale. Effects are reversible in the medium-term for sensory disturbance, while effects from direct loss are permanent (Table 36).

Effects from changes in habitat availability and distribution due to climate change and other natural factors (e.g., declining insect populations) on whip-poor-will populations are predicted to be permanent, continuous, and possible to occur at the beyond regional scale. Effects from changes to habitat availability and distribution due to natural factors such as wildfire will occur frequently at the regional to beyond regional scale (Table 36).

Table 36: Description of Effects and Significance in the RFD Case for Eastern Whip-poor-will.

Indicators	Effect Pathway	Characteristic	Rating/Effect Size	Significance Determination
Habitat Availability	■ 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, corona related noise and light emissions, human activity, viewscape) can change wildlife habitat availability	Direction	Negative	Not Significant
		Magnitude	■ Suitable habitat is predicted to decrease by approximately 2,309 ha (4.7%) in the RSA, relative to Base Case. ■ Magnitude depends on the influences from climate change.	
		Geographic Extent	■ Regional (direct loss and natural factors)[(a)] ■ Local to Regional (sensory disturbance)[(b)]	
		Duration/Reversibility	■ Long-term to Permanent (direct loss and natural factors) ■ Medium-term (sensory disturbance)	
		Frequency	Continuous	
		Probability of Occurrence	■ Certain (direct loss) ■ Probable (sensory disturbance) ■ Possible (natural factors)	
Habitat Distribution	■ 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, corona-related noise and light emissions, viewscape) can change wildlife habitat availability, which can lead to changes in wildlife abundance and distribution	Direction	Negative	
		Magnitude	■ Slight shifts in territory sizes or locations due to increased human disturbance ■ Possible range expansion due to climate change	
		Geographic Extent	Regional[(a)]	
		Duration/Reversibility	Long-term to Permanent	
		Frequency	Frequent to Continuous	
		Probability of Occurrence	Possible	
Survival/Reproduction	■ 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, corona related noise and light emissions, dust, human activity, viewscape) can change wildlife habitat availability	Direction	Negative	
		Magnitude	■ Small reduction in productivity from habitat loss and sensory disturbance ■ Magnitude depends on the influences from climate change	
		Geographic Extent	■ Regional (direct loss and natural factors)[(a)] ■ Local to Regional (sensory disturbance)[(b)]	
		Duration/Reversibility	■ Permanent (direct loss and natural factors) ■ Medium-term (sensory disturbance)	
		Frequency	■ Frequent to Continuous (direct loss and natural factors) ■ Continuous (sensory disturbance)	
		Probability of Occurrence	Possible	

Note: Natural factors include climate change and associated changes, inclement weather (e.g., storms), and wildfire.

a) Effects may be beyond regional due to climate change, other natural factors, forestry, and RFDs that occur within and beyond the RSA (i.e., the Wataynikaneyap Power Phase 2: Connecting 17 Remote First Nation Communities Project)

b) Local if no temporal overlap among activities associated with sensory disturbance; regional if temporal overlap among activities associated with sensory disturbance

ha = hectares; RSA = regional study area; RFD = reasonably foreseeable development.

7.5.2.5 Determination of Significance

The cumulative direct disturbance to moderate to high suitability whip-poor-will habitat from previous and existing disturbance, the Project, and other RFDs is predicted to be 4.7% (2,309 ha) in the RSA, relative to the Base Case. Habitat loss estimates in the RFD Case are overestimated because the limits of work was used as the Project footprint in the habitat model; the limits of work is approximately nine times larger than he anticipated Project ROW. Additionally, this species can use human linear disturbances for nesting and foraging.

Currently, sufficient numbers of individuals that are capable of reproduction are available to sustain the population and increase abundance in Canada (Environment Canada 2015b). Climate warming is predicted to result in drier forests and longer summers in northern Ontario, which could positively affect eastern whip-poor-will survival and reproduction.

The combined evidence concerning the cumulative changes in habitat availability and distribution, and survival and reproduction in the RSA from the Base Case to the RFD Case indicates that whip-poor-will populations would continue to be self-sustaining and ecologically effective. Consequently, cumulative effects on eastern whip-poor-will populations that overlap the RSA in the RFD Case are predicted to be not significant (Table 36).

7.6 Common Nighthawk

7.6.1 Assessment of Project Effects (Project Case)

7.6.1.1 Habitat Availability

The limits of work contains 2,380 ha of suitable habitat for common nighthawk, which is a measured loss of 4.7% of the RSA, relative to Base Case conditions (Table 37). This is an overestimate of habitat loss as the limits of work was used as the Project footprint; the limits of work is approximately nine times larger than the anticipated Project ROW. Additionally, the Project ROW may provide suitable foraging and nesting habitat for this species (Peck and James 1983; COSEWIC 2007a; Brigham et al. 2011). Furthermore, existing disturbances that may provide suitable habitat for common nighthawk (e.g., road ROWs) were not included as potential suitable habitat for common nighthawk in the habitat model. Also, unvegetated habitat (i.e., suitable habitat for nighthawk) will not likely need to be cleared for construction and direct habitat loss from the Project in unvegetated habitat is likely to occur only where support structures, switching stations, and connection facilities will be built in these habitats. Footprints for transmission line poles are generally small (1.5 by 1.5 m), although larger areas may be required for self-supporting steel structures. Switching stations and connection facilities have large footprints but cleared areas and flat building rooftops at these locations may provide suitable nesting habitat for common nighthawk.

Table 37: Changes to Common Nighthawk Habitat Availability in the Regional Study Area at Project Case

Habitat Suitability[a]	Base Case [ha]	Project Case [ha]	Change in Area Using the Limits of Work Footprint[a][b] [ha]	Percent Change Using the Limits of Work Footprint[b] [%]
Moderate to High	50,910	48,530	-2,380	-4.7
Nil to Low	63,309	65,690	2,380	3.8

a) Changes in habitat area result from a conversion of moderate to high suitability habitat to lower suitability habitats (i.e., nil to low).

b) The limits of work is approximately nine times larger than the anticipated Project ROW (4,355 ha for the limits of work versus 478 ha for the maximum anticipated Project ROW), but specific areas of disturbance had not been identified at the time of writing.

Note: Numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.

Note: The percent change is calculated using the total amount of moderate to high or nil to low habitat available at Base Case; percent change is not relative to the size of the study area.

ha = hectare; % = percent.

7.6.1.2 Habitat Distribution

Suitable common nighthawk habitat is predicted to be removed during site clearing for the Project throughout the limits of work (Figure 26). The loss of suitable breeding habitat in the RSA is unlikely to have a measurable effect on common nighthawk movement patterns. As breeding occurs in open areas, vegetation clearing for the Project may increase nesting habitat availability following the completion of construction activities. Nevertheless, common nighthawk have been known to show fidelity to breeding sites (Dexter 1961; Brigham et al. 2011) and clearing may affect breeding habitat distribution if individuals return to breeding grounds to find habitat removed.

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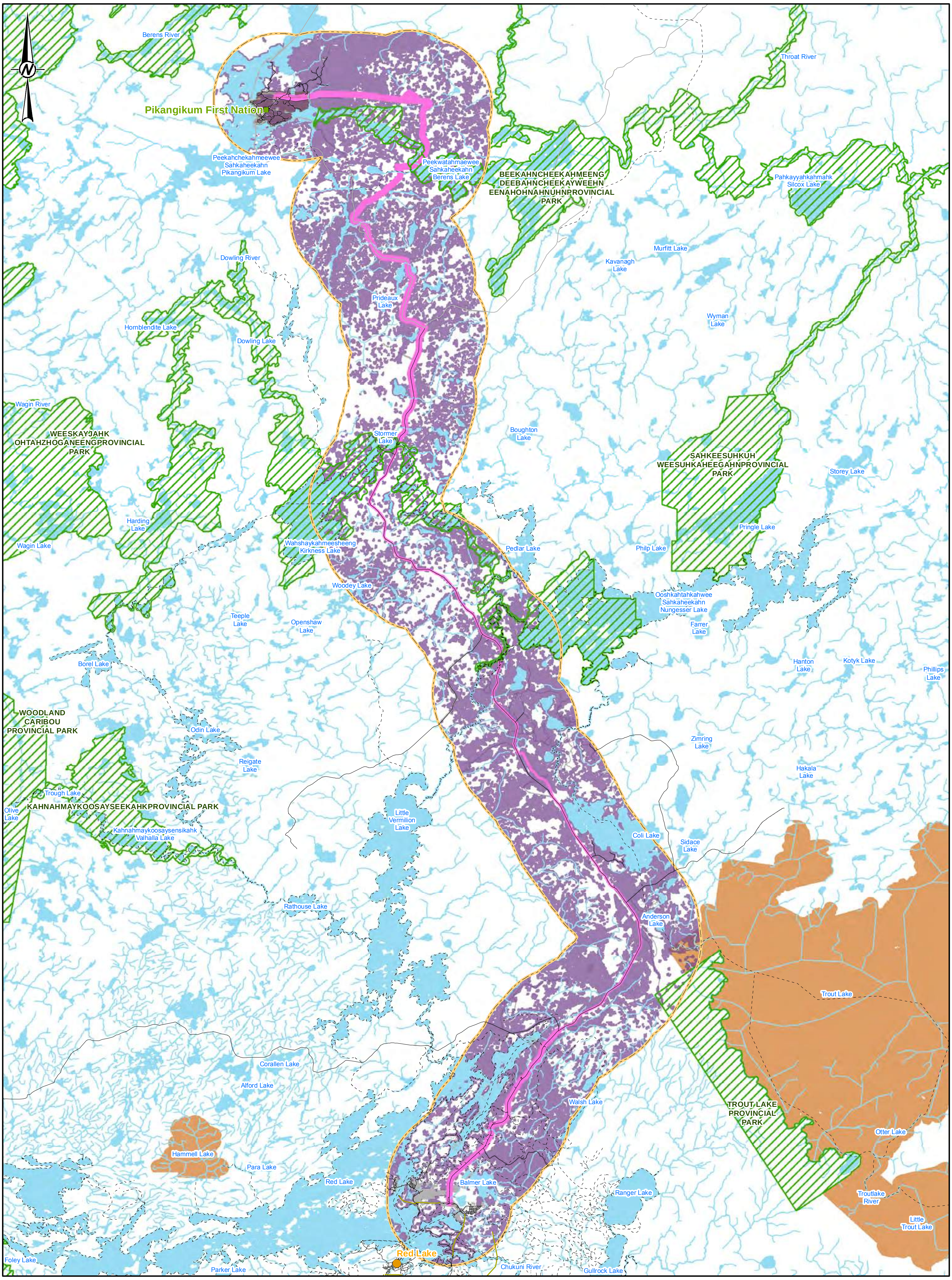

LEGEND

- City
- Town
- First Nation Community
- Wataynikaneyap Power Community
- Major Roads and Highways
- Winter Road
- Trail
- Existing Electrical Transmission Line
- Watercourse
- First Nation Reserve Land
- Waterbody
- Conservation Reserve
- Provincial Parks
- Project Limits of Work
- Regional Study Area
- Base Case Disturbance
- Common Nighthawk Habitat

REFERENCE(S)

1. BASE DATA - MNR LIO, OBTAINED 2016, NTDB
2. TRANSMISSION ROUTES - PROVIDED BY WATAYNIKANEYAP POWER L.P.
3. FIRST NATION COMMUNITIES FROM INDIGENOUS AND NORTHERN AFFAIRS CANADA (WWW.AINC-INAC.GC.CA)
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0 5 10
1:280,000 Kilometers

CLIENT
WATAYNIKANEYAP POWER L.P.

PROJECT
PIKANGIKUM DISTRIBUTION LINE PROJECT

TITLE
COMMON NIGHTHAWK HABITAT IN THE REGIONAL STUDY AREA AT PROJECT CASE

CONSULTANT

YYYY-MM-DD	2017-03-21
DESIGNED	JMC
PREPARED	JMC/PR
REVIEWED	LD
APPROVED	AE

PROJECT NO.	CONTROL	REV.	FIGURE
1657738	####	####	26

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7.6.1.3 Survival and Reproduction

The loss of breeding habitat may affect reproductive success if individuals are displaced or return to breeding grounds to find habitat removed and subsequently are unable to establish a new territory or establish a territory in lower quality habitat. In the Project Case, the carrying capacity of the RSA is predicted to be reduced by two individuals (from 36 to 34) compared to the Base Case (see Section 3.2.7.3 for estimation method). Common nighthawk habitat in the RSA appears to be abundant, but not fully occupied. As such, the loss of habitat is predicted to have no measurable effects on common nighthawk reproduction and carrying capacity at the population level.

Sensory disturbance such as noise from construction activities may affect reproductive success and survival of individuals in close proximity to construction activities by raising stress levels and interfering with communications (e.g., reducing ability to hear approaching predators or intraspecific vocalizations) (Ortega 2012).

7.6.1.4 Characterization of Net Effects

Negative effects to common nighthawk from direct changes to habitat availability and distribution are possible to certain to occur at the local scale, continuous, and permanent (due to the indefinite operation phase of the Project), although this species uses recently disturbed areas for nesting and foraging (Table 38). Effects from changes to habitat availability due to sensory disturbance are probable to occur continuously at the local scale and will be reversible within a few months after construction has ended (i.e., medium-term in duration). Inspection and maintenance of the preferred route ROW during the operation phase may also result in sensory disturbance, but such events will be infrequent, isolated, and temporary.

Effects to common nighthawk survival and reproduction from direct habitat loss and sensory disturbance are possible at the local scale (Table 38). Nighthawks were conservatively assumed to be affected by sensory disturbance from construction activities continuously for the entire construction period, even though noise effects should be isolated to portions of the limits of work due to construction being completed sequentially down the line. Construction activities will typically occur during one 12-hour shift per day (from 07:00 to 19:00); however, night-time work may be occasionally required to make up for schedule delays. Effects from sensory disturbance are anticipated to be reversed a few months after completion of construction (i.e., reversible in the medium-term). Effects on survival and reproduction from direct habitat loss are anticipated to be permanent and continuous.

Table 38: Description of Effects and Significance in the Project Case for Common Nighthawk

Indicators	Effect Pathway	Characteristic	Rating/Effect Size	Significance Determination
Habitat Availability	■ 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, corona related noise and light emissions, dust, human activity, viewscape) can change wildlife habitat availability	Direction	Negative	Not Significant
		Magnitude	■ Direct loss of 2,380 ha of suitable nesting habitat (4.7%) of RSA Base Case ■ Potential avoidance of nesting habitat in close proximity to construction activities due to sensory disturbance	
		Geographic Extent	Local	
		Duration/Reversibility	■ Permanent (direct loss) ■ Medium-term (sensory disturbance)	
		Frequency	Continuous	
		Probability of Occurrence	■ Certain (direct loss) ■ Probable (sensory disturbance)	
Habitat Distribution	■ 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, corona-related noise and light emissions, viewscape) can change wildlife habitat availability, which can lead to changes in wildlife abundance and distribution	Direction	Negative	
		Magnitude	Slight shifts in territory sizes or locations due to increased human disturbance	
		Geographic Extent	Local	
		Duration/Reversibility	Permanent	
		Frequency	Continuous	
		Probability of Occurrence	Possible	
Survival/Reproduction	■ 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, corona related noise and light emissions, dust, human activity, viewscape) can change wildlife habitat availability	Direction	Negative	
		Magnitude	■ Small reduction in productivity from habitat loss and sensory disturbance ■ Reduction in carrying capacity by 2 individuals in the RSA, from Base Case	
		Geographic Extent	Local	
		Duration/Reversibility	Permanent (direct loss) Medium-term (sensory disturbance)	
		Frequency	Continuous	
		Probability of Occurrence	Possible	

ha = hectares; RSA = regional study area.

7.6.1.5 Determination of Significance

The common nighthawk is a mobile species that will use anthropogenic features (e.g., clear-cuts, linear disturbances) for foraging and nesting habitat. These characteristics suggest resilience and adaptive capacity to changes in habitat availability and distribution. Individual common nighthawks distributed across their breeding range are capable of sustaining the population or improving its abundance provided sufficient suitable habitat is available (Environment Canada 2016b). Population estimates specific to northern Ontario are unavailable; however, the weight of evidence suggests that common nighthawk populations that overlap the RSA are self-sustaining and ecologically effective at Base Case.

For the primary pathways influencing habitat availability, habitat distribution and survival and reproduction, net effects are predicted to be negative and restricted to the Project footprint or limits of work in geographic extent. The limits of work contains 2,380 ha (4.7% of the RSA) of suitable habitat. Additional suitable habitat in close proximity to construction activities may be temporarily avoided due to sensory disturbance. The Project may result in slight shifts of territory sizes or locations at local scales. These changes are not expected to alter the spatial extent of occurrence of the population(s) that overlap with the RSA because common nighthawks are highly mobile, this species is capable of using anthropogenic disturbances for breeding, and habitat is not limiting in the RSA. Mitigation, such as spanning areas with compatible habitat (e.g., bedrock outcrops), will likely limit effects on common nighthawk from changes to habitat availability and distribution.

The incremental changes due to the Project are predicted to not adversely affect the resilience and adaptive capacity of common nighthawk populations that overlap the RSA, relative to the Base Case (i.e., populations remain self-sustaining and ecologically effective). Consequently, effects on common nighthawk from changes to habitat availability, habitat distribution, and survival and reproduction in the Project Case are predicted to be not significant (Table 38).

7.6.2 Reasonably Foreseeable Development Case (RFD Case)

7.6.2.1 Habitat Availability

For RFDs that were quantified in the RFD Case (i.e., the Project and the Wataynikaneyap Phase 2 Project), there is predicted to be a loss of approximately 2,402 ha (4.7%) of suitable habitat in the RSA, compared to the Base Case (Table 39). This is likely an overestimate common nighthawks use open areas, such as transmission line ROWs, for nesting and foraging and reasonably foreseeable human developments may provide additional habitat for this species.

Although climate change is expected to increase the frequency and intensity of wildfires, fire suppression efforts in the RSA will likely be increased proportionally. Fire suppression activities in the RSA will likely continue to decrease common nighthawk habitat availability in the RSA into the future (Environment Canada 2016b). It is expected that over the long term, outcomes of OWFMS will also change habitat availability for common nighthawk differently than what might have otherwise occurred naturally.

Table 39: Changes to Common Nighthawk Habitat Availability in the Regional Study Area at RFD Case

Habitat Suitability[(a)]	Base Case [ha]	RFD Case [ha]	Change in Area [ha][(a)]	Percent Change [%]
Moderate to High	50,910	48,508	-2,402	-4.7
Nil to Low	63,309	65,712	2,402	3.8

a) Changes in habitat area result from a conversion of moderate to high suitability habitat to lower suitability habitats (i.e., nil to low).

Note: Numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.

Note: The percent change is calculated using the total amount of moderate to high or nil to low habitat available at Base Case; percent change is not relative to the size of the study area.

ha = hectare; % = percent; RFD = reasonably foreseeable development.

7.6.2.2 Habitat Distribution

Suitable habitat for common nighthawk remains well distributed in the RSA at the RFD Case (Figures 26 and 27). Reasonably foreseeable developments such as forest harvesting, the Wataynikaneyap Phase 2 Project, and the Project are expected to increase suitable habitat for common nighthawk as this species requires open and edge habitat for nesting. The Project and other reasonably foreseeable human developments may result in a positive change in nighthawk habitat distribution, relative to the Base Case. It is assumed the RFDs will use mitigation that avoids, minimizes or offsets effects to common nighthawk habitat.

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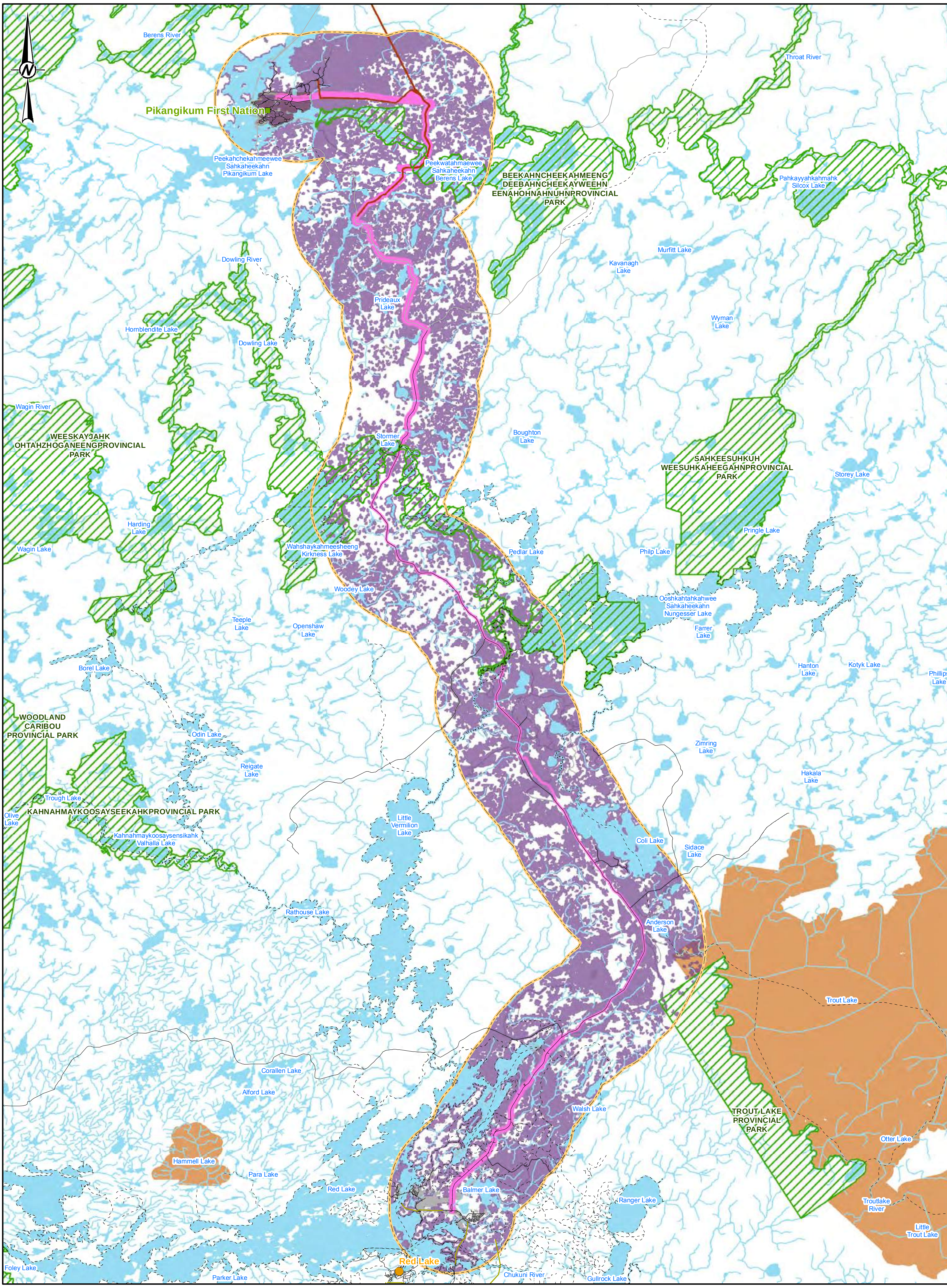

LEGEND

- City
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- Wataynikaneyap Power Community
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- Provincial Parks
- Project Limits of Work
- Regional Study Area
- Base Case Disturbance
- RFD Case Disturbance
- Common Nighthawk Habitat

REFERENCE(S)

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0 5 10
1:280,000 Kilometers

CLIENT
WATAYNIKANEYAP POWER L.P.

PROJECT
PIKANGIKUM DISTRIBUTION LINE PROJECT

TITLE
COMMON NIGHTHAWK HABITAT IN THE REGIONAL STUDY AREA AT RESONABLY FORESEEABLE DEVELOPMENT CASE

CONSULTANT
Wataynikaneyap Power
Golder Associates

YYYY-MM-DD	2017-03-21
DESIGNED	JMC
PREPARED	JMC/PR
REVIEWED	LD
APPROVED	AE

PROJECT NO.	CONTROL	REV.	FIGURE
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IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:
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7.6.2.3 Survival and Reproduction

Reasonably foreseeable developments that were quantified in the RFD Case are predicted to reduce the carrying capacity of common nighthawk habitat in the RSA from 36 individuals in the Base Case to 34 individuals in the RFD Case; no change from Project Case (see Section 3.2.7.3 for estimation method). There is no reduction in carrying capacity from Project Case to RFD Case because the Wataynikaneyap Phase 2 Project was predicted to remove 2.2 km^2 (22 ha) of suitable habitat for common nighthawk in the RFD Case. According to common nighthawk density data for OBBA Regions 39 and 44, there is approximately 1 nighthawk per 14 km^2 in the regions surrounding the RSA.

Extreme weather events (e.g., storms, periods of prolonged cold temperatures or rain) are expected to occur more frequently due to climate change. These events may negatively impact common nighthawks during migration and the breeding season as this species is an aerial insectivore that relies on warm weather for flying insects (Environment Canada 2016b). Declines in common nighthawk populations have been recorded in Massachusetts and British Columbia after inclement weather events (Firman et al. 1993; Environment Canada 2016b).

Climate change is also expected to increase the length of summers in northern Ontario. The growing season in northern Ontario is predicted to increase by 41 to 61 days (Stewart 1990). These changes are likely to have a positive effect on common nighthawk because this species is one of the last landbird species to arrive on breeding grounds (Environment Canada 2016b). A longer growing season may allow for common nighthawks to raise more than one clutch per year, which is currently not possible with the timing of this species' migration patterns (Environment Canada 2016b).

Warmer and drier conditions from climate change in Ontario may alter the timing of insect hatches (Nituch and Bowman 2013). Long distance migrants, such as common nighthawks, exhibit synchronization between breeding and peak food abundance. Earlier warming in the breeding range for the common nighthawk may create a temporal mismatch between reproduction and optimal foraging conditions for prey (Both et al. 2009; Environment Canada 2016b). There is high uncertainty about the potential effects of climate change.

7.6.2.4 Characterizaion of Cumulative Effects

Negative effects from direct habitat loss are considered certain to occur. Changes to habitat availability and distribution from transmission lines are anticipated to have permanent, continuous effects at the regional scale. Effects from changes due to forest harvesting will be continuous at the regional scale but likely reversible in the long-term (Table 40).

Sensory disturbance from construction of the Project and the Wataynikaneyap Phase 2 Project may cause common nighthawks to avoid suitable habitat at the local scale. There is currently no overlap in the construction schedule of these two projects and there is little sensory disturbance during operation of transmission lines. However, if there are delays in the construction of the Project and there is overlap with the construction of the Wataynikaneyap Phase 2 Project, effects from habitat avoidance would likely occur at the regional scale. Effects from sensory disturbance will be continuous during the construction phase and are expected to be reversed soon after construction of projects (medium-term). Effects from sensory disturbance are probable (not certain) to occur as some individuals may acclimatize to sensory disturbance (Table 40).

Effects to common nighthawk survival and reproduction from direct habitat loss are possible to occur continuously, at the regional scale, and will be permanent (e.g., transmission lines) or reversible in the long-term (e.g., forest harvesting). Changes to survival and reproduction from sensory disturbance will have continuous effects at the local to regional scale that will be reversible in the medium-term (Table 40).

Effects from changes in habitat availability and distribution due to climate change and other natural factors (e.g., declining insect populations) on common nighthawk populations are predicted to be permanent, continuous, and possible to occur at the beyond regional scale. Effects from changes to habitat availability and distribution due to natural factors such as wildfire will occur frequently over the long term at the regional to beyond regional scale (Table 40).

Table 40: Description of Effects and Significance in the RFD Case for Common Nighthawk.

Indicators	Effect Pathway	Characteristic	Rating/Effect Size	Significance Determination
Habitat Availability	■ 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, corona related noise and light emissions, dust, human activity, viewscape) can change wildlife habitat availability	Direction	Negative	Not Significant
		Magnitude	■ Suitable habitat will decrease by 2,402 ha (4.7%) in the RSA from Base Case to RFD Case ■ Magnitude depends on the influences from climate change.	
		Geographic Extent	■ Regional (direct loss)[a] ■ Local to Regional (sensory disturbance)[b]	
		Duration/Reversibility	■ Long-term to Permanent (direct loss and natural factors) ■ Medium-term (sensory disturbance)	
		Frequency	■ Continuous (sensory disturbance) ■ Frequent to Continuous (direct loss and natural factors)	
		Probability of Occurrence	■ Certain (direct loss) ■ Probable (sensory disturbance) ■ Possible (natural factors)	
Habitat Distribution	■ 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, corona-related noise and light emissions, viewscape) can change wildlife habitat availability, which can lead to changes in wildlife abundance and distribution	Direction	Negative	
		Magnitude	■ Slight shifts in territory sizes or locations due to increased human disturbance ■ Possible range expansion due to climate change	
		Geographic Extent	Regional[a]	
		Duration/Reversibility	Long-term to Permanent	
		Frequency	Frequent to Continuous	
		Probability of Occurrence	Possible	
Survival/Reproduction	■ 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, corona related noise and light emissions, dust, human activity, viewscape) can change wildlife habitat availability	Direction	Negative	
		Magnitude	■ Small reduction in productivity from habitat loss and sensory disturbance ■ Reduction in carrying capacity by 2 individuals in the RSA, from Base Case. ■ Magnitude depends on the influences from climate change	
		Geographic Extent	■ Regional (direct loss)[a] ■ Local to Regional (sensory disturbance)[b]	
		Duration/Reversibility	■ Long-term to Permanent (direct loss and natural factors) ■ Medium-term (sensory disturbance)	
		Frequency	■ Continuous (sensory disturbance) ■ Frequent to Continuous (direct loss and natural factors)	
		Probability of Occurrence	Possible	

Note: Natural factors include climate change and associated changes, inclement weather (e.g., storms), and wildfire.

a) Effects may be beyond regional due to climate change, other natural factors, forestry, and RFDs that occur within and beyond the RSA (i.e., the Wataynikaneyap Power Phase 2: Connecting 17 Remote First Nation Communities Project)

b) Local if no temporal overlap among activities associated with sensory disturbance; regional if temporal overlap among activities associated with sensory disturbance

ha = hectares; RSA = regional study area; RFD = reasonably foreseeable development

7.6.2.5 Determination of Significance

Currently, sufficient numbers of individuals that are capable of reproduction are available to sustain the common nighthawk population and increase abundance in Canada (Environment Canada 2016c). Habitat appears to be widespread but not completely occupied in the RSA at Base Case.

In the RFD Case, the cumulative direct disturbance to suitable habitat is predicted to be 4.7% (2,402 ha) in the RSA, relative to Base Case. Reasonably foreseeable developments, including the Project, the Wataynikaneyap Phase 2 Project, and forest harvesting in the Red Lake, Trout Lake, and Whitefeather forests may increase suitable habitat for common nighthawk relative to Base Case conditions by creating early successional habitats. Reasonably foreseeable developments may result in local changes to common nighthawk survival and reproduction in the RSA due to direct habitat loss and sensory disturbance; however, it is assumed that the RFDs will implement mitigations that avoid, minimize or offset these effects. An example of mitigation is clearing vegetation outside of the breeding bird season.

Climate warming is predicted to result in drier forests and longer summers in northern Ontario, which could positively affect common nighthawk survival and reproduction. Climate change will likely alter habitat availability, habitat distribution and survival and reproduction of common nighthawks in the RFD Case. However, the effects were not quantified in this assessment and there is a large amount of uncertainty regarding the potential effects of climate change because predictions are based on simulations that can be highly variable and many scenarios are possible.

Overall, the weight of evidence from the analysis of the primary pathways predicts that changes to common nighthawk habitat availability, habitat distribution, and survival and reproduction are within the resilience and adaptability limits of the species. The cumulative effects in RFD Case should not adversely influence the ability of common nighthawk populations that overlap the RSA to remain self-sustaining and ecologically effective, relative to the Base Case. Consequently, cumulative effects from the Project and other past, present and reasonably foreseeable developments on common nighthawk are predicted to be not significant (Table 40).

7.7 Olive-Sided Flycatcher

7.7.1 Assessment of Project Effects (Project Case)

7.7.1.1 Habitat Availability

The limits of work contains 444 ha of suitable habitat for olive-sided flycatcher, which is a loss of 3.4% of the suitable habitat present in the RSA at Base Case (Table 41). This is a highly conservative estimate of habitat loss as the limits of work was used as the Project footprint in the habitat model; the limits of work is 4,355 ha and the anticipated Project ROW is 478 ha. One additional disturbance area will be required for the substation. This area is anticipated to be relatively small (approximately 2 ha).

Table 41: Changes to Olive-sided Flycatcher Habitat Availability in the Regional Study Area at Project Case

Habitat Suitability	Base Case [ha]	Project Case [ha]	Change in Area Using the Limits of Work Footprint[(a)(b)] [ha]	Percent Change Using the Limits of Work Footprint[(b)] [%]
Moderate to High	13,068	12,624	-444	-3.4
Nil to Low	101,152	101,596	444	0.4

a) Changes in habitat area result from a conversion of moderate to high suitability habitat to lower suitability habitats (i.e., nil to low).

b) The limits of work is approximately nine times larger than the anticipated Project ROW (4,355 ha for the limits of work versus 478 ha for the maximum anticipated Project ROW), but specific areas of disturbance had not been identified at the time of writing.

Note: Numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.

Note: The percent change is calculated using the total amount of moderate to high or nil to low habitat available at Base Case; percent change is not relative to the size of the study area.

ha = hectare; % = percent.

7.7.1.2 Habitat Distribution

As an edge adapted species, olive-sided flycatcher is thought to benefit from habitat fragmentation; however, Haché et al. (2014) found that the density of olive-sided flycatcher was negatively affected by linear disturbances on the landscape. Haché et al (2014) also found that road side surveys overestimate olive-sided flycatcher density, which supports the association of this species with edge habitat. The effects of linear disturbance on this species may be scale and habitat dependent. Therefore, there is a high level of uncertainty associated with the direction of the response of olive-sided flycatcher abundance to habitat fragmentation in the Project Case.

Suitable olive-sided flycatcher breeding habitat remains similarly distributed in the Base Case and Project Case (Figures 10 and 28). The Project may slightly alter the sizes and locations of olive-sided flycatcher territories in close proximity to the power line ROW and other infrastructure. A study in the boreal forest of the Northwest Territories found that some passerine bird species move their territories away from human disturbance features (Machtans 2006).

This species is predicted to continue to fly directly over the Project ROW when dispersing, foraging, or searching for suitable nesting sites. Forest birds have been found to cross gaps of up to 200 m (St. Clair et al. 1998). The preferred route ROW will be an average 40 m in width, and where the alignment is adjacent to the Nungesser Road or Pikangikum All-Season Road, the effective ROW width may be up to 100 m wide. The loss of less than 4% of suitable breeding habitat in the RSA is predicted to have no ecological effect on olive-sided flycatcher territory spacing or population connectivity.

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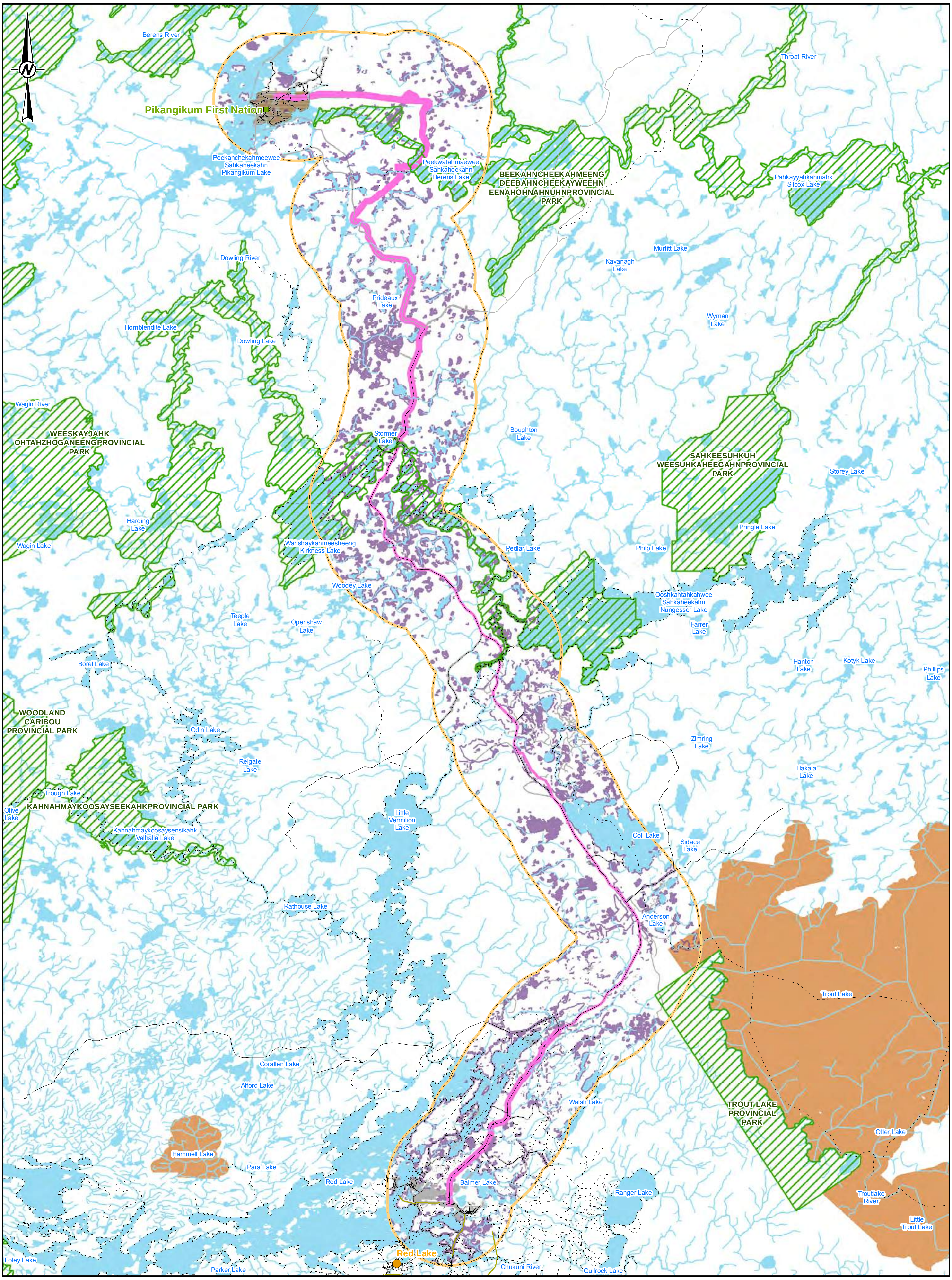

LEGEND

- City
- Town
- First Nation Community
- Wataynikaneyap Power Community
- Major Roads and Highways
- Winter Road
- Trail
- Existing Electrical Transmission Line
- Watercourse
- First Nation Reserve Land
- Waterbody
- Conservation Reserve
- Provincial Parks
- Substation Area
- Project Limits of Work
- Regional Study Area
- Base Case Disturbance
- Olive-sided Flycatcher Habitat

REFERENCE(S)
1. BASE DATA - MNR LIO, OBTAINED 2016, NTDB
2. TRANSMISSION ROUTES - PROVIDED BY WATAYNIKANEYAP POWER L.P.
3. FIRST NATION COMMUNITIES FROM INDIGENOUS AND NORTHERN AFFAIRS CANADA (WWW.AINC-INAC.GC.CA)
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5. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 15

0 5 10
1:280,000 Kilometers

CLIENT
WATAYNIKANEYAP POWER L.P.

PROJECT
PIKANGIKUM DISTRIBUTION LINE PROJECT

TITLE
OLIVE-SIDED FLYCATCHER HABITAT IN THE REGIONAL STUDY AREA AT PROJECT CASE

CONSULTANT

YYYY-MM-DD	2017-03-21
DESIGNED	JMC
PREPARED	JMC/PR
REVIEWED	LD
APPROVED	AE

PROJECT NO.	CONTROL	REV.	FIGURE
1657738	####	####	28

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7.7.1.3 Survival and Reproduction

The loss of suitable breeding habitat due to the Project is predicted to result in a small reduction in the carrying capacity of the RSA. Applying a density estimate of 1.19 individuals/km² (see Section 3.2.8.3 for estimation method) to the amount of suitable habitat remaining in the Project Case results in an abundance estimate of 150 individuals within the RSA. The carrying capacity of the RSA is reduced by six individuals at Project Case compared to the Base Case (from 156 to 150 individuals in the RSA). This small change is unlikely to have a measurable effect on olive-sided flycatcher populations that overlap with the RSA.

The effects of sensory disturbance on the abundance of olive-sided flycatchers are unknown. Noise levels above 48 dB have been shown to result in reduced abundance and pairing success for some songbird species (Bayne et al. 2008; Habib et al. 2007). Other potential effects from noise could include interference with communication (e.g., reducing ability to hear approaching predators or intraspecific vocalizations) (Ortega 2012). Sensory effects were not identified as an important factor in the federal recovery strategy for olive-sided flycatcher (Environment Canada 2016b).

7.7.1.4 Characterization of Net Effects

Effects from direct Project-related changes to habitat availability are considered certain to occur continuously at the local scale. Effects will be permanent as the Project will be operation for the foreseeable future (Table 42). Changes to habitat availability due to avoidance are probable to affect some individuals present in the limits of work (local scale); some individuals may also acclimatize to sensory disturbance. Effects would be continuous and reversible in the medium-term; likely end within a few months after completion of construction activities (Table 42).

Effects to olive-sided flycatcher from changes to habitat distribution are conservatively considered probable to occur continuously and permanently at the local scale (Table 42). Some passerine bird species shift their territory sizes or locations away from human disturbance features, including features with low sensory disturbance (e.g., seismic lines, transmission lines) (Machtans 2006).

Changes in survival and reproduction associated with alteration in habitat availability possible and would continuously occur at the local scale. Effects from sensory disturbance on survival and reproduction will likely be reversed in the medium-term, while effects from reduction in carrying capacity are predicted to be permanent (Table 42).

Table 42: Description of Effects and Significance in the Project Case for Olive-sided Flycatcher

Indicators	Effect Pathway	Characteristic	Rating/Effect Size	Significance Determination
Habitat Availability	■ Site preparation, construction and operation activities can result in the loss or alteration of vegetation and topography that may change habitat availability ■ Sensory disturbance (lights, smells, noise, corona related noise and light emissions, dust, human activity, viewscape) can change wildlife habitat availability	Direction	Negative	Not Significant
		Magnitude	■ Direct loss of 3.4% of suitable nesting habitat of RSA Base Case ■ Potential avoidance of nesting habitat in close proximity to construction activities due to sensory disturbance	
		Geographic Extent	Local	
		Duration/Reversibility	■ Permanent (direct loss) ■ Medium-term (sensory disturbance)	
		Frequency	Continuous	
		Probability of Occurrence	■ Certain (direct loss) ■ Probable (sensory disturbance)	
Habitat Distribution	■ Site preparation, construction and operation activities can result in the loss or alteration of vegetation and topography that may change wildlife habitat use and movement patterns ■ Sensory disturbance (lights, smells, noise, dust, human activity, corona-related noise and light emissions, viewscape) can change wildlife habitat availability, which can lead to changes in wildlife abundance and distribution	Direction	Negative	
		Magnitude	Slight shifts in territory sizes or locations due to increased human disturbance	
		Geographic Extent	Local	
		Duration/Reversibility	Permanent	
		Frequency	Continuous	
		Probability of Occurrence	Probable	
Survival/Reproduction	■ Site preparation, construction and operation activities can result in the loss or alteration of vegetation and topography that may change habitat availability ■ Sensory disturbance (lights, smells, noise, corona related noise and light emissions, dust, human activity, viewscape) can change wildlife habitat availability	Direction	Negative	
		Magnitude	■ Small reduction in productivity from habitat loss and sensory disturbance ■ Reduction in carrying capacity by 6 individuals in the RSA, compared to Base Case.	
		Geographic Extent	Local	
		Duration/Reversibility	■ Permanent (direct loss) ■ Medium-term (sensory disturbance)	
		Frequency	Continuous	
		Probability of Occurrence	Possible	

ha = hectares; RSA = regional study area.

7.7.1.5 Determination of Significance

Combined effects of past and present disturbance identified in the Base Case have reduced habitat availability, habitat distribution, and survival and reproduction for olive-sided flycatcher in the RSA relative to historical conditions. However, olive-sided flycatcher habitat does not appear to be limiting even though it is patchily distributed in the RSA at Base Case. Olive-sided flycatchers are well adapted to highly fragmented landscapes and some disturbances can increase habitat by providing edge habitat (McGarigal and McComb 1995). The olive-sided flycatcher is designated as Threatened in Canada (COSEWIC 2007b) and under Schedule 1 of SARA (Government of Canada 2002). The short-term population objective for olive-sided flycatcher is to halt the decline in Canada by 2025, while ensuring the population does not decrease more than 10% over this time (Environment Canada 2016b). Despite declining population trends, olive-sided flycatchers are considered common throughout the species' range and the Canadian population is estimated to be approximately 900,000 individuals (Environment Canada 2016b). Moreover, Environment Canada (2016b) states that "there are currently adequate numbers of individuals to sustain the species in Canada or increase its abundance with the implementation of proper conservation actions." As such, olive-sided flycatcher populations that overlap the RSA at Base Case are predicted to be self-sustaining and ecologically effective.

The incremental changes to habitat availability and distribution, and survival and reproduction from the Project are predicted to be within the resilience and adaptability limits of this criterion because most of its potential breeding habitat (i.e., over 96% at the RSA scale) would remain unchanged, and the reduction in carrying capacity by six individuals should have no ecological measurable effect on the population(s). Mitigation such as spanning areas of compatible vegetation and selective vegetation clearing in the Project ROW will avoid and limit effects to olive-sided flycatcher populations that overlap the RSA. The combined evidence indicates that olive-sided flycatcher populations will continue to be self-sustaining and ecologically effective in the Project Case, relative to the Base Case. Consequently, effects from the Project and previous and existing developments on olive-sided flycatcher populations that overlap the RSA are predicted to be not significant (Table 42).

7.7.2 Reasonably Foreseeable Development Case (RFD Case)

7.7.2.1 Habitat Availability

The Project and the Wataynikaneyap Phase 2 Project are predicted to remove 445 ha of potential suitable habitat, which is 3.4% of suitable habitat present in the RSA at Base Case (Table 43). This is an overestimate of habitat loss as the Project limits of work was used in the habitat model; the limits of work is anticipated to be approximately nine times larger than the anticipated Project ROW.

Forestry and fire suppression activities in the RSA will continue to have positive and negative effects on olive-sided flycatcher habitat. Selective harvesting will likely continue to create habitat that is attractive to this species; however, there has been a recent downturn in the forest sector, which has resulted in reduced harvesting and renewal levels (MNR 2012). Fire suppression will continue to limit the creation of high quality post-burn habitat favoured by olive-sided flycatcher (Environment Canada 2016b). Fire suppression has also generally resulted in older, broad-leaved-dominated forests replacing the conifer-dominated forest historically present in the RSA (Carleton 2001). Climate change may exacerbate this latter scenario because longer summers favour the persistence of broad-leaved species and limits invasion of poplar stands by conifers (Carleton 2001). Over the long term, reduced forestry activity combined with fire suppression activities and climate change could result in a shift to artificially old, broad-leaved forests (MNR 2012). The effect of this shift will not likely be favourable for olive-sided flycatcher because the species prefers open coniferous or mixed-coniferous stands (Altman and Sallabanks 2012).

Sensory disturbance from RFDs would reduce the quality of breeding habitat adjacent to developments.

Table 43: Changes to Olive-Sided Flycatcher Habitat Availability in the Regional Study Area at RFD Case

Habitat Suitability	Base Case [ha]	RFD Case [ha]	Change in Area[a] [ha]	Percent Change [%]
Moderate to High	13,068	12,622	-445	-3.4
Nil to Low	101,152	101,598	445	0.4

a) Changes in habitat area result from a conversion of moderate to high suitability habitat to lower suitability habitats (i.e., nil to low).

Note: Numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.

Note: The percent change is calculated using the total amount of moderate to high or nil to low habitat available at Base Case; percent change is not relative to the size of the study area.

ha = hectare; % = percent; RFD = reasonably foreseeable development.

7.7.2.2 Habitat Distribution

Reasonably foreseeable developments including the Project are not likely to result in a large reduction in habitat connectivity for olive-sided flycatcher in the RSA. Habitat is similarly disturbed in the RFD Case and Base Case (Figures 28 and 29). There may be slight shifts in the locations and sizes of olive-sided flycatcher territories in close proximity to the Project ROW but habitat is not limiting in the RSA and these small shifts in territory location or size are not anticipated to have measurable ecological effects at the population level. Additionally, olive-sided flycatchers are highly mobile and are therefore predicted to continue to fly directly over or around new developments while searching for suitable nesting sites. Consequently, olive-sided flycatcher habitat connectivity through the RSA should be preserved in the RFD Case and flycatcher populations that overlap with the RSA are expected to continue inter-breeding within the remaining suitable habitat in the RSA.

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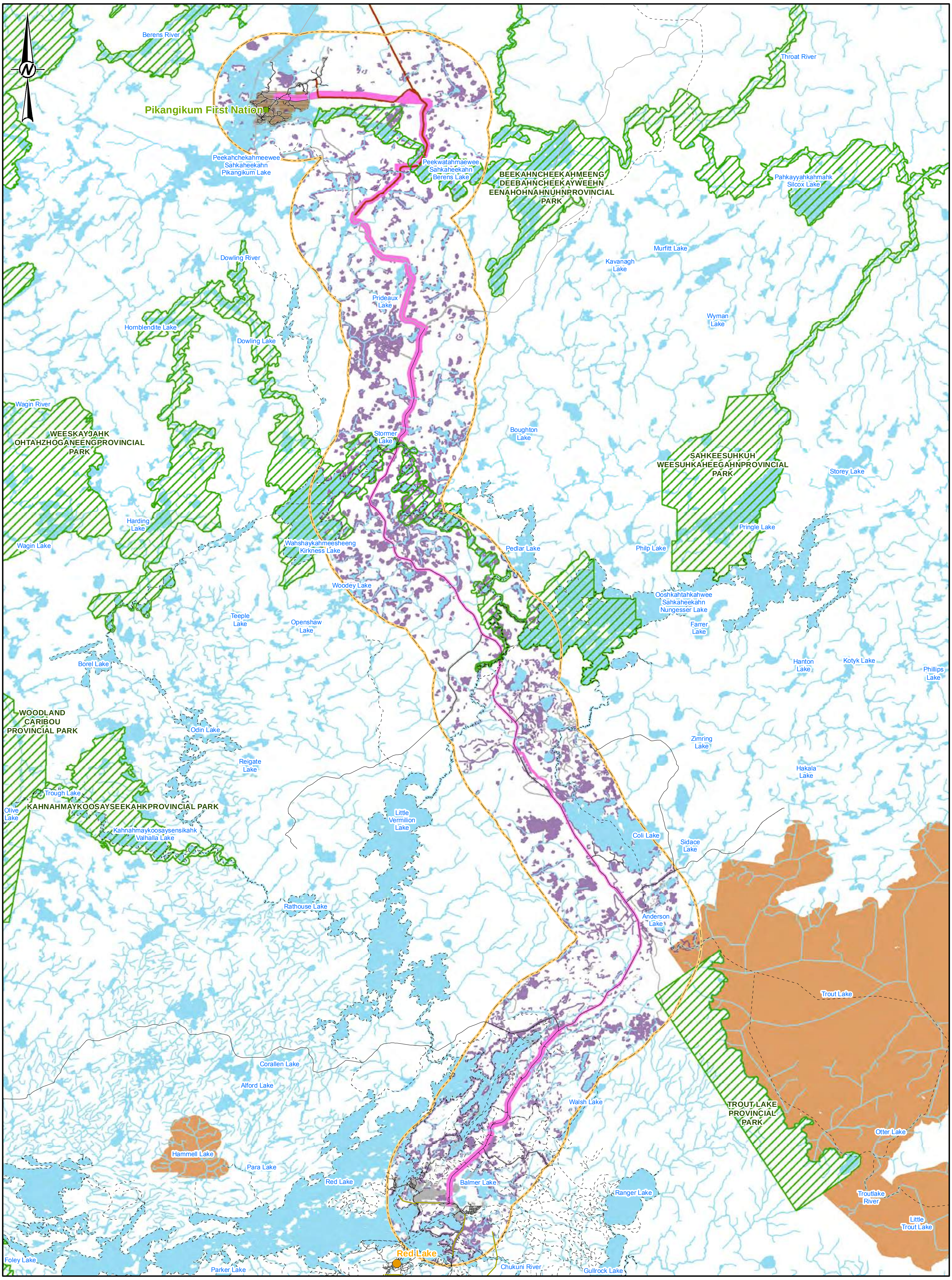

LEGEND

- City
- Town
- First Nation Community
- Wataynikaneyap Power Community
- Major Roads and Highways
- Winter Road
- Trail
- Existing Electrical Transmission Line
- Watercourse
- First Nation Reserve Land
- Waterbody
- Conservation Reserve
- Provincial Parks
- Project Limits of Work
- Regional Study Area
- Base Case Disturbance
- RFD Case Disturbance
- Olive-sided Flycatcher Habitat

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2. TRANSMISSION ROUTES - PROVIDED BY WATAYNIKANEYAP POWER L.P.
3. FIRST NATION COMMUNITIES FROM INDIGENOUS AND NORTHERN AFFAIRS CANADA (WWW.AINC-INAC.GC.CA)
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5. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 15

0 5 10
1:280,000 Kilometers

CLIENT
WATAYNIKANEYAP POWER L.P.

PROJECT
PIKANGIKUM DISTRIBUTION LINE PROJECT

TITLE
OLIVE-SIDED FLYCATCHER HABITAT IN THE REGIONAL STUDY AREA AT RESONABLY FORESEEABLE DEVELOPMENT CASE

CONSULTANT

Wataynikaneyap Power
Golder Associates

YYYY-MM-DD	2017-03-21
DESIGNED	JMC
PREPARED	JMC/PR
REVIEWED	LD
APPROVED	AE

PROJECT NO.	CONTROL	REV.	FIGURE
1657738	####	####	29

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7.7.2.3 Survival and Reproduction

Reasonably foreseeable developments including the Project may adversely affect olive-sided flycatcher survival and reproduction in the RSA by removing habitat and increasing sensory disturbance. Sensory disturbance has been shown to result in reduced abundance and pairing success for some songbird species (Bayne et al. 2008; Habib et al. 2007).

The loss of suitable breeding habitat due to RFDs is predicted to result in a small reduction in the carrying capacity of the RSA from 156 individuals at Base Case to 150 individuals in the RFD Case (see Section 3.2.8.3 for estimation methods); no change from Project Case. This small change is unlikely to have a measurable effect on olive-sided flycatcher populations that overlap with the RSA. There is no reduction in carrying capacity from Project Case to RFD Case because the Wataynikaneyap Phase 2 Project was predicted to remove 0.01 km^2 (1 ha) of suitable habitat for olive-sided flycatcher in addition to the amount of habitat present in the limits of work at Project Case. Using OBBA data for Regions 39 and 44 there is approximately 1 olive-sided flycatcher per 0.8 $km/^2$ in the regions surrounding the RSA.

In northern Ontario, climate change is expected to alter the onset of spring and summer and the timing of insect hatches (Nituch and Bowman 2013). Insectivorous long-distance migrant species such as olive-sided flycatcher often exhibit a strong synchronization between breeding and peak food abundance, and climate change may impact this timing by creating a temporal mismatch between reproduction and optimal foraging conditions for prey (Both et al. 2009; COSEWIC 2007b). Reduced availability of insect prey is identified as a major threat in the olive-sided flycatcher recovery strategy plan, but it is not clear if climate change is the leading cause of changes in prey availability (Environment Canada 2016b).

Climate change is also predicted to increase the frequency and intensity of extreme weather events, including droughts and heavy precipitation. Increases in the frequency and intensity of storms are predicted for northern Ontario (Stewart 1990). Extreme weather events during the breeding season can result in reduced fecundity and nest success, particularly for aerial insectivores. Individuals may also be susceptible to extreme weather events outside of the breeding season. The frequency and intensity of hurricanes are predicted to increase as a result of climate change, which may negatively affect individuals during fall migration and on wintering grounds.

7.7.2.4 Characterization of RFD Case Effects

Changes to habitat availability from direct loss due to RFDs that are anticipated to be in operation for perpetuity, such as the Wataynikaneyap Phase 2 Project and the Project, will have continuous, permanent effects on olive-sided flycatchers at the regional scale (Table 44). Effects from direct loss of habitat due to forestry are expected to continuous at the regional scale and reversible in the long-term.

Effects from changes to habitat availability due to avoidance from sensory disturbance are expected to be reversible in the medium-term as all RFDs will have little sensory disturbance during operations (e.g., transmission lines) or will be of short duration (e.g., forestry harvesting). Effects will be local or regional, depending on the temporal overlap of activities in the RSA (Table 44). Changes to habitat distribution are expected to affect olive-sided flycatchers permanently or over the long-term (direct loss) or over the medium-term (sensory disturbance). Effects from changes to habitat distribution are possible to occur continuously (Table 44).

Changes to survival and reproduction from direct habitat loss and sensory disturbance are possible and occur continuously. Effects to survival and reproduction from direct habitat loss will occur at the regional scale, while effects from sensory disturbance can be local or regional, depending on temporal overlap of activities from RFDs (Table 44). Direct loss of habitat from forest harvesting and forestry roads will influence survival and reproduction (i.e., reduction in carrying capacity in the RSA) and will be reversible over the long-term. Effects to survival and reproduction associated with direct loss from permanent features such as transmission lines will not be reversible. Sensory disturbance effects on olive-sided flycatcher survival and reproduction will be reversible over the medium-term as all RFDs are either of short duration (e.g., forestry harvesting) or will have little sensory disturbance during operations (e.g., transmission lines).

Effects from changes in habitat availability and distribution due to climate change and other natural factors (e.g., declining insect populations) on olive-sided populations are predicted to be permanent, continuous, and possible to occur at the beyond regional scale. Effects from changes to habitat availability and distribution due to natural factors such as wildfire and severe storms will occur frequently over the long term at the regional to beyond regional scale (Table 44).

Table 44: Description of Effects and Significance in the RFD Case for Olive-sided Flycatcher.

Indicators	Effect Pathway	Characteristic	Rating/Effect Size	Significance Determination
Habitat Availability	■ 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, corona related noise and light emissions, dust, human activity, viewscape) can change wildlife habitat availability	Direction	Negative	Not Significant
		Magnitude	■ Suitable habitat is predicted to decrease by approximately 445 ha (3.4%) in the RSA from Base Case to RFD Case. ■ Magnitude depends on the influences from climate change.	
		Geographic Extent	■ Regional (direct loss and natural factors)[(a)] ■ Local to Regional (sensory disturbance)[(b)]	
		Duration/Reversibility	■ Long-term to Permanent (direct loss and alterations natural factors) ■ Medium-term (sensory disturbance)	
		Frequency	■ Continuous (sensory disturbance) ■ Frequent to Continuous (direct loss and natural factors)	
		Probability of Occurrence	■ Certain (direct loss) ■ Probable (sensory disturbance and natural factors)	
Habitat Distribution	■ 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, corona-related noise and light emissions, viewscape) can change wildlife habitat availability, which can lead to changes in wildlife abundance and distribution	Direction	Negative	
		Magnitude	■ Slight shifts in territory sizes or locations due to increased human disturbance ■ Magnitude depends on the influences from climate change	
		Geographic Extent	Regional[(a)]	
		Duration/Reversibility	Long-term to Permanent	
		Frequency	Frequent to Continuous	
		Probability of Occurrence	Possible	
Survival/Reproduction	■ 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, corona related noise and light emissions, dust, human activity, viewscape) can change wildlife habitat availability	Direction	Negative	
		Magnitude	■ Small reduction in productivity from habitat loss and sensory disturbance ■ Reduction in carrying capacity by 6 individuals in the RSA, compared to Base Case ■ Magnitude depends on the influences from climate change	
		Geographic Extent	■ Regional (direct loss and natural factors)[(a)] ■ Local to Regional (sensory disturbance)[(b)]	
		Duration/Reversibility	■ Long-term to Permanent (direct loss and natural factors) ■ Medium-term (sensory disturbance)	
		Frequency	■ Continuous (sensory disturbance) ■ Frequent to Continuous (direct loss and natural factors)	
		Probability of Occurrence	Possible	

Note: Natural factors include climate change and associated changes, inclement weather (e.g., storms), and wildfire.

a) Effects may be beyond regional due to climate change, other natural factors, forestry, and RFDs that occur within and beyond the RSA (i.e., the Wataynikaneyap Power Phase 2: Connecting 17 Remote First Nation Communities Project)

b) Local if no temporal overlap among activities associated with sensory disturbance; regional if temporal overlap among activities associated with sensory disturbance

ha = hectares; RSA = regional study area; RFD = reasonably foreseeable development.

7.7.2.5 Determination of Significance

Reasonably foreseeable developments including the Project are predicted to reduce habitat quantity and quality for olive-sided flycatcher in the RSA. Suitable breeding habitat is predicted to be reduced by approximately 445 ha (3.4%) in the RSA in the RFD Case relative to the Base Case. Loss of breeding habitat is not identified as a high threat for this species, while loss of nonbreeding habitat is considered a more likely limiting factor (Environment Canada 2016b).

The loss of suitable breeding habitat due to RFDs is predicted to result in a small reduction (6 individuals) in the carrying capacity of the RSA compared to the Base Case. This small change is unlikely to have a measurable effect on olive-sided flycatcher populations that overlap with the RSA. Habitat loss is assumed to be permanent because the Project and the Wataynikaneyap Phase 2 Project will operate indefinitely. Selective vegetation clearing and spanning areas of compatible vegetation are expected to limit effects from changes to habitat availability and distribution.

The loss of suitable habitat in the RFD Case is expected to be within the olive-sided flycatcher’s resilience and adaptability limits because this species is adaptable to many changes in forest structure (i.e., it is not a mature or old growth forest obligate), and some types of disturbance create habitat by increasing edge. There may be slight shifts in olive-sided flycatcher territory sizes and locations to move away from areas of human disturbance (Machtans 2006). However, functional connectivity of olive-sided flycatcher populations is not anticipated to be affected by changes in habitat distribution in the RFD Case because patches of suitable habitat remain well distributed in the RSA, and olive-sided flycatchers are highly mobile and would be able to disperse to new and vacant territories.

Changes in the abundance of olive-sided flycatcher are not predicted to exceed the short-term population objective, particularly in view of the results from the Boreal Avian Monitoring Project, which found no evidence for a decline in olive-sided flycatcher density across Canada from 1997 to 2013 (Haché et al. 2014). Overall, the combined evidence on changes in habitat availability, distribution, and survival and reproduction in the RSA indicates that olive-sided flycatchers would continue to be self-sustaining and ecologically effective in the RFD Case, relative to the Base Case. Consequently, cumulative effects on olive-sided flycatcher populations that overlap the RSA are predicted to be not significant (Table 44).

7.8 Canada Warbler

7.8.1 Assessment of Project Effects (Project Case)

7.8.1.1 Habitat Availability

The limits of work contains 1,291 ha of moderate to high suitability habitat for Canada Warbler (Table 45). This is a loss of 4.4% of suitable habitat in the RSA, relative to Base Case conditions, but a conservative estimate as the limits of work used in the habitat model is approximately nine times larger than the anticipated Project ROW.

Table 45: Changes to Canada Warbler Habitat Availability in the Regional Study Area at Project Case

Habitat Suitability[(a)]	Base Case [ha]	Project Case [ha]	Change in Area Using the Limits of Work Footprint[(a)(b)] [ha]	Percent Change Using the Limits of Work Footprint[(b)] [%]
Moderate to High	29,642	28,352	-1,291	-4.4
Nil to Low	84,578	85,868	1,291	1.5

a) Changes in habitat area result from a conversion of moderate to high suitability habitat to lower suitability habitats (i.e., nil to low).

b) The limits of work is approximately nine times larger than the anticipated Project ROW (4,355 ha for the limits of work versus 478 ha for the maximum anticipated Project ROW), but specific areas of disturbance had not been identified at the time of writing.

Note: Numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.

Note: The percent change is calculated using the total amount of moderate to high or nil to low habitat available at Base Case; percent change is not relative to the size of the study area.

ha = hectare; % = percent.

7.8.1.2 Habitat Distribution

Suitable habitat for Canada warbler is similarly distributed in the RSA at Base Case and Project Case (Figures 11 and 30). Some songbird species may shift their territory locations to avoid areas of human disturbance (Machtans 2006). As such, the Project may result in a slight shift in Canada warbler territory boundaries near the Project ROW. These shifts are not anticipated to be have measurable ecological effects at the population level. Additionally, Canada warblers are highly mobile and the Project ROW is not likely to be a barrier to species movements as songbirds in the boreal forest were found to cross gaps of up to 200 m (the Project ROW will be 40 m) (St. Clair et al. 1998). Based on the above information, the Project is not anticipated to result in a measurable change to Canada warbler habitat distribution or population connectivity in the Project Case.

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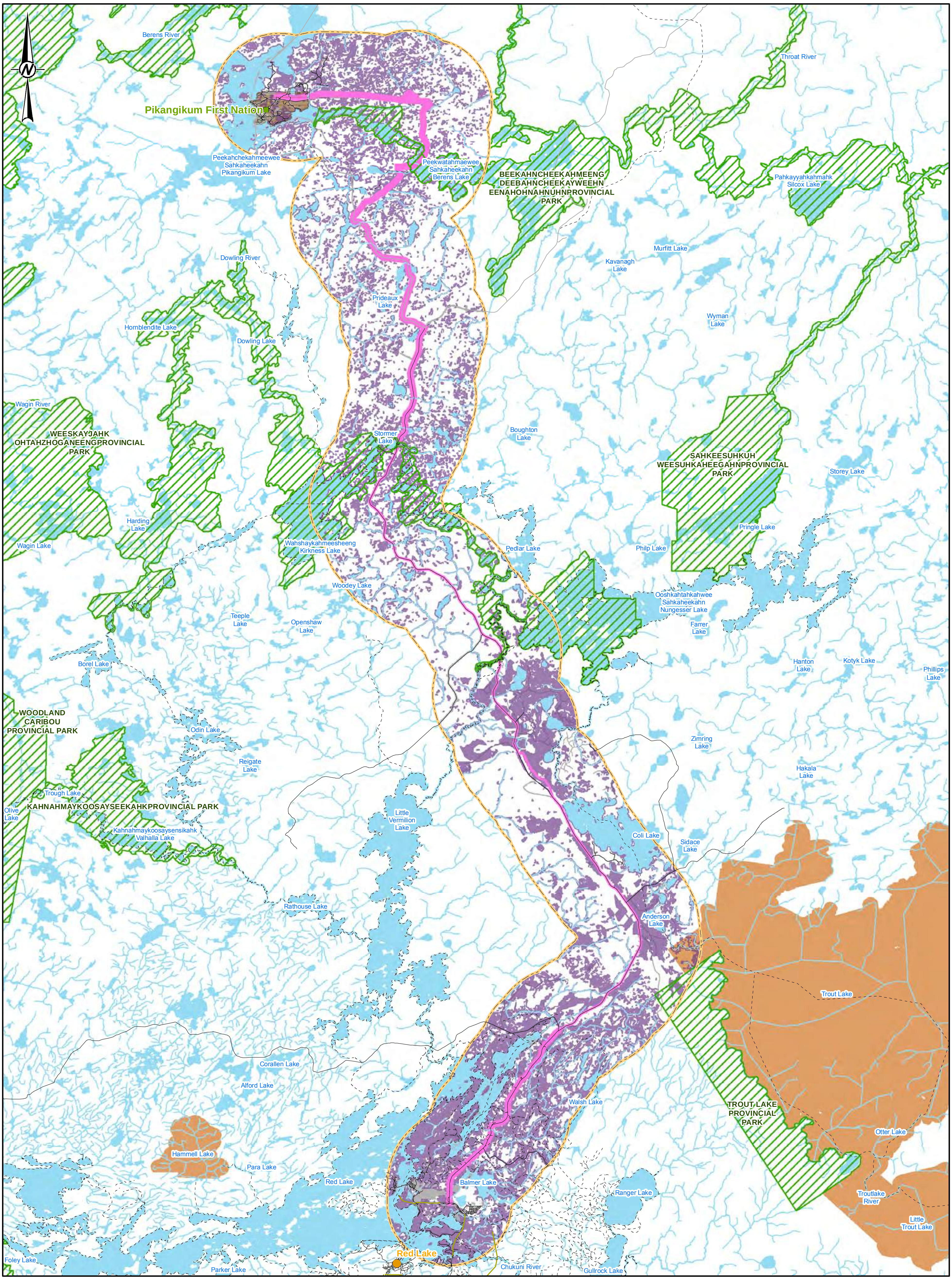

LEGEND

- City
- Town
- First Nation Community
- Wataynikaneyap Power Community
- Major Roads and Highways
- Winter Road
- Trail
- Existing Electrical Transmission Line
- Watercourse
- First Nation Reserve Land
- Waterbody
- Conservation Reserve
- Provincial Parks
- Project Limits of Work
- Regional Study Area
- Base Case Disturbance
- Canada Warbler Habitat

REFERENCE(S)

1. BASE DATA - MNR LIO, OBTAINED 2016, NTDB
2. TRANSMISSION ROUTES - PROVIDED BY WATAYNIKANEYAP POWER L.P.
3. FIRST NATION COMMUNITIES FROM INDIGENOUS AND NORTHERN AFFAIRS CANADA (WWW.AINC-INAC.GC.CA)
4. PRODUCED BY GOLDER ASSOCIATES LTD UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2016
5. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 15

0 5 10

1:280,000 Kilometers

CLIENT
WATAYNIKANEYAP POWER L.P.

PROJECT
PIKANGIKUM DISTRIBUTION LINE PROJECT

TITLE
CANADA WARBLER HABITAT IN THE REGIONAL STUDY AREA AT PROJECT CASE

CONSULTANT

Wataynikaneyap Power

Golder Associates

YYYY-MM-DD	2017-03-21
DESIGNED	JMC
PREPARED	JMC/PR
REVIEWED	LD
APPROVED	AE

PROJECT NO.	CONTROL	REV.	FIGURE
1657738	####	####	30

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25mm

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7.8.1.3 Survival and Reproduction

The loss of breeding habitat may affect reproductive success if individuals are displaced or return to breeding grounds to find habitat removed and subsequently are unable to establish a new territory or establish a territory in lower quality habitat. The loss of suitable breeding habitat due to the Project is predicted to result in a small reduction in the carrying capacity of the RSA from 148 individuals in the Base Case to 141 individuals in the Project Case (see Section 3.2.10.3 for estimation methods). This small change is unlikely to have a measurable ecological effect on Canada warbler populations that overlap with the RSA.

Sensory disturbance such as noise from construction of the Project may potentially affect reproductive success and survival in close proximity to construction activities by raising stress levels and interfering with communications (e.g., reducing ability to hear approaching predators or intraspecific vocalizations) (Ortega 2012). However, sensory disturbance will be isolated and of short duration across the limits of work due to construction being completed sequentially along the line.

The Project may also increase edge effects, such as increased nest parasitism risk. Fragmentation of forests in eastern North America has increased accessibility for brown-headed cowbirds, which prefer more open habitats (Lowther 1993). Canada warbler is considered to be particularly susceptible to parasitism by brown-headed cowbirds but little information is available (Reitsma et al. 2009). Canada warblers are susceptible to nest parasitism in areas with high cowbird densities. For example, 20% of Canada warbler nests were found to be parasitized in southern Ontario (Peck and James 1983) where cowbird densities are around 10 cowbirds per km^2 (Cadman et al. 2007). Cowbird densities in northern Ontario are low; brown-headed cowbird density in OBBA Region 39 is 0.14 individuals/km^2, and no cowbirds were recorded in OBBA Region 44 during the second Atlas survey (Cadman et al. 2007). No brown-headed cowbirds were observed during field surveys in the baseline study area. As such, nest parasitism related to the Project is unlikely to pose a measurable effect to Canada warbler reproductive success. Increases in edge habitat are anticipated to have negligible effects on Canada warblers as this species is an interior forest breeder and is not commonly found in edge habitat (Lambert and Faccio 2005).

7.8.1.4 Characterization of Net Effects

Changes to habitat availability and distribution from direct habitat loss and fragmentation are predicted to have continuous, permanent effects on Canada warbler populations that overlap the RSA (Table 46). Effects from changes to habitat availability are certain, while effects from changes to habitat distribution are probable. Effects from changes to habitat availability and distribution will occur at the local scale. Effects from changes to habitat availability due to sensory disturbance are considered to be probable to occur continuously at the local scale. Effects will be reversible in the medium-term (i.e., likely within a few months after construction is complete) (Table 46).

Changes to Canada warbler survival and reproduction from reductions in carrying capacity and sensory disturbance are anticipated to possibly affect Canada warbler populations continuously at the local scale (Table 46). Effects from direct habitat loss are not reversible (i.e., permanent) and effects from changes due to sensory disturbance will be reversible in the medium-term. Effects from changes from increased nest parasitism risk are possible to occur permanently and continuously at the local scale.

Table 46: Description of Effects and Significance in the Project Case for Canada Warbler

Indicators	Effect Pathway	Characteristic	Rating/Effect Size	Significance Determination
Habitat Availability	■ 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, corona related noise and light emissions, dust, human activity, viewscape) can change wildlife habitat availability	Direction	Negative	Not Significant
		Magnitude	■ Direct loss of approximately 1,291 ha (4.4%) of suitable nesting habitat of RSA Base Case ■ Potential avoidance of nesting habitat in close proximity to construction activities due to sensory disturbance	
		Geographic Extent	Local	
		Duration/Reversibility	■ Permanent (direct loss) ■ Medium-term (sensory disturbance)	
		Frequency	Continuous	
		Probability of Occurrence	■ Certain (direct loss) ■ Probable (sensory disturbance)	
Habitat Distribution	■ 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, corona-related noise and light emissions, viewscape) can change wildlife habitat availability, which can lead to changes in wildlife abundance and distribution	Direction	Negative	
		Magnitude	Slight shifts in territory sizes or locations due to increased human disturbance	
		Geographic Extent	Local	
		Duration/Reversibility	Permanent	
		Frequency	Continuous	
		Probability of Occurrence	Probable	
Survival/Reproduction	■ 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, corona related noise and light emissions, dust, human activity, viewscape) can change wildlife habitat availability ■ Vegetation clearing will result in an increase in edge habitat, which could increase nest parasitism risk for Canada warbler	Direction	Negative	
		Magnitude	■ Small reduction in productivity from habitat loss and sensory disturbance ■ Reduction in carrying capacity in the RSA by 6 individuals from Base Case ■ Small increase in nest parasitism risk	
		Geographic Extent	Local	
		Duration/Reversibility	Permanent (direct loss and nest parasitism risk) Medium-term (sensory disturbance)	
		Frequency	Continuous	
		Probability of Occurrence	Possible	

ha = hectares; RSA = regional study area.

7.8.1.5 Determination of Significance

Populations of Canada warblers that overlap the RSA are most sensitive to changes in habitat availability, accidental mortality, and changes in the availability of insect prey (Environment Canada 2016a). At Base Case, cumulative effects from these threats have likely adversely affected habitat availability, habitat distribution, and abundance of Canada warblers in the RSA. This species may have a low ability to adapt to changes because they produce a single-brood and arrive late on the breeding grounds and leave early. However, Canada warblers are highly mobile with the ability to produce many young, which increases resilience to changes in habitat availability and distribution. Despite ongoing declines, the number of individuals is currently considered to be adequate to sustain the species in Canada (Environment Canada 2016a). Additionally, habitat does not appear to be limiting for this species in the RSA and the use of early successional habitat may increase the resilience of Canada warblers to adapt to changes in habitat distribution, particularly from forestry activities. The weight of evidence suggests that Canada warbler populations that overlap the RSA are self-sustaining and ecologically effective at Base Case.

For the primary pathways influencing habitat availability, habitat distribution and survival and reproduction, the net effects are predicted to be negative and restricted to the Project footprint or limits of work, 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 limits of work contains 1,291 ha (4.4%) of suitable Canada warbler habitat in the RSA. This is an overestimate of habitat loss as the limits of work is larger than the anticipated Project footprint (4,355 ha for the limits of work versus 478 ha for the anticipated Project ROW). Additionally, mitigation such as selective vegetation clearing and spanning areas of compatible vegetation (e.g., open and shrubby habitats) will limit effects from the Project on Canada warbler.

The loss of habitat would be experienced continuously during construction of the Project, but some of this disturbance would be temporary and functional early successional habitat would become available in six to ten years following completion of construction. Additional suitable habitat in close proximity to construction activities may be avoided by Canada warbler due to sensory disturbance.

With effective implementation of mitigation, the incremental changes to habitat availability and distribution, and survival and reproduction due to the Project are not predicted to adversely affect the resilience and adaptive capacity of populations of Canada warbler that overlap with the RSA (i.e., they are still self-sustaining and ecologically effective relative to the Base Case). Consequently, effects on Canada warbler populations in the Project Case are predicted to be not significant (Table 46).

7.8.2 Reasonably Foreseeable Development Case (RFD Case)

7.8.2.1 Habitat Availability

The Project (limits of work) and Wataynikaneyap Phase 2 Project are predicted to result in the loss of 1,303 ha (4.4%) of suitable Canada warbler breeding habitat in the RSA (Table 47). As noted, this prediction is conservative given that the limits of work is approximately nine times larger than the anticipated Project ROW. Forestry road development, forest harvesting, and construction of future transmission lines have the potential to reduce Canada warbler habitat availability in the RSA through direct habitat loss and avoidance due to sensory disturbance.

Forestry and fire suppression activities in the RSA will continue to have positive and negative effects on Canada warbler habitat. Initially forestry activities remove suitable habitat, while areas 6 to 30 years post-harvest that contained residual live trees will provide suitable habitat (Hagan et al. 1997; Hobson and Schieck 1999;

Schieck and Hobson 2000; Lambert and Faccio 2005; Hallworth et al. 2008; Environment Canada 2016a). There has been a recent downturn in the forest sector, which has resulted in reduced harvesting and renewal levels (MNR 2012). Fire suppression results in less early successional habitat, which is an important habitat for this species in the eastern portion of its range (Ball and Bayne 2014; Environment Canada 2016a). However, mature forests (>100 years) may have a dense shrub layer (Alaback 1982; McKenzie et al. 2000), which is suitable for Canada warbler. It is expected that over the long term, reduced forestry activity combined with fire suppression activities could result in a shift to artificially old forests (MNR 2012). The effect of this shift to old forests on Canada warbler is unknown and depends on the density of the shrub layer that will exist in old forests in the RSA. The OWFMS includes managing fire to meet ecological and resource objectives (MNRF 2014f), and it is expected that over the long term, outcomes of OWFMS will change habitat availability for Canada warbler differently than what might have occurred naturally.

Table 47: Changes to Canada Warbler Habitat Availability in the Regional Study Area at RFD Case

Habitat Suitability	Base Case [ha]	RFD Case [ha]	Change in Area[(a)] [ha]	Percent Change [%]
Moderate to High	29,642	28,340	-1,303	-4.4
Nil to Low	84,578	85,880	1,303	1.5

a) Changes in habitat area result from a conversion of moderate to high suitability habitat to lower suitability habitats (i.e., nil to low).

Note: Numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.

Note: The percent change is calculated using the total amount of moderate to high or nil to low habitat available at Base Case; percent change is not relative to the size of the study area.

ha = hectare; % = percent; RFD = reasonably foreseeable development.

7.8.2.2 Habitat Distribution

Reasonably foreseeable developments including the Project are not likely to result in a large reduction in habitat connectivity for Canada warbler in the RSA. Habitat in the RSA in the RFD Case is distributed similarly to the Base Case (Figure 31). There may be slight shifts in the locations and sizes of Canada warbler territories in the close proximity to the Project ROW but habitat is not limiting in the RSA and these minor shifts in territory location or size are not anticipated to have measurable ecological effects at the population level. Additionally, Canada warblers are highly mobile and are therefore predicted to continue to fly directly over or around new developments while searching for suitable nesting sites. The Project and Wataynikaneyap Phase 2 Project will have 40 m wide ROWs and songbirds have been found to cross gaps up to 200 m wide (St. Clair et al. 1998). Consequently, habitat connectivity in the RSA should be preserved in the RFD Case and Canada warbler populations that overlap with the RSA are expected to continue inter-breeding within the remaining suitable habitat.

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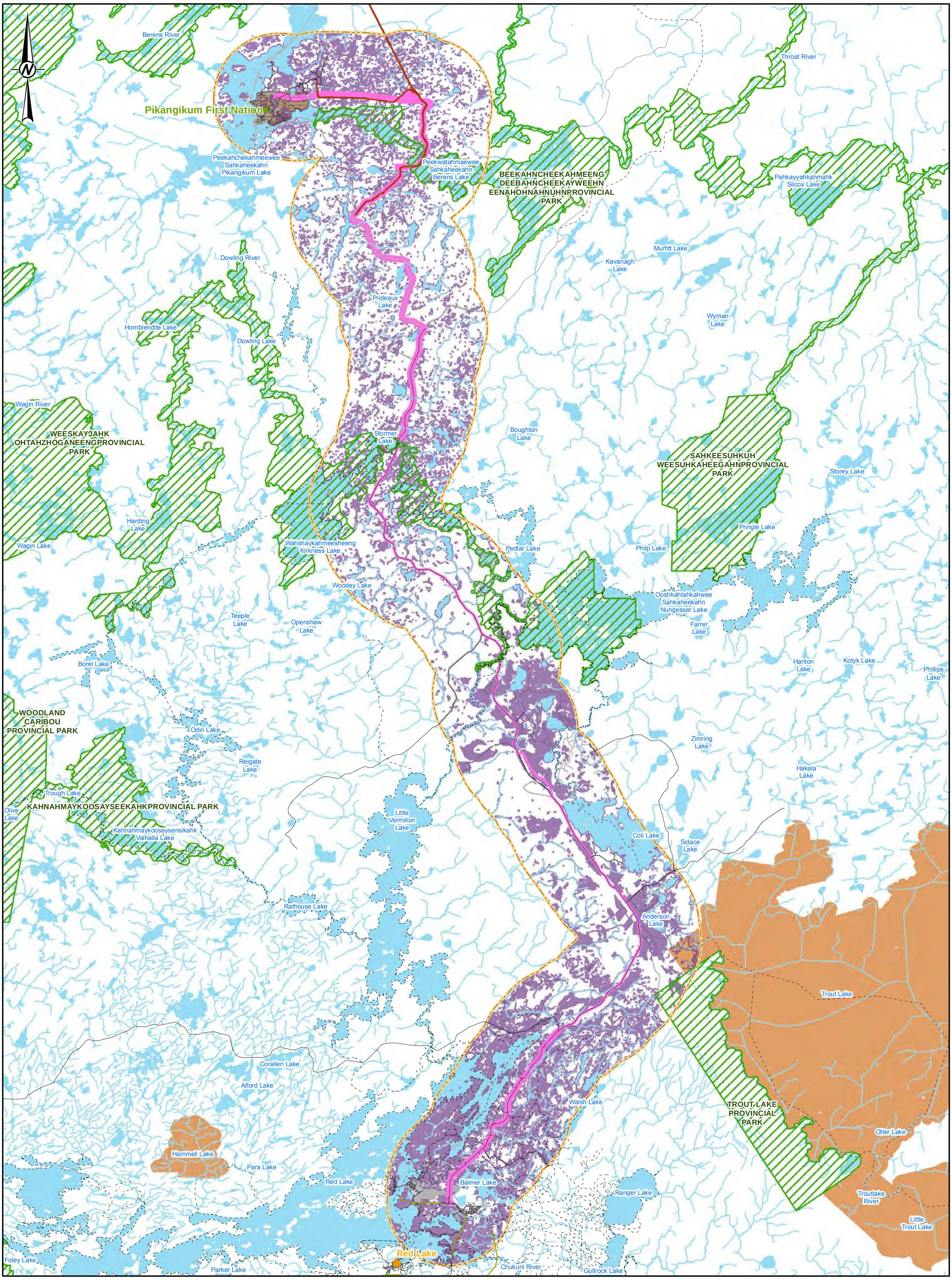

LEGEND

- City
- Town
- First Nation Community
- Wataynikaneyap Power Community
- Major Roads and Highways
- Winter Road
- Trail
- Existing Electrical Transmission Line
- Watercourse
- First Nation Reserve Land
- Waterbody
- Conservation Reserve
- Provincial Parks
- Project Limits of Work
- Regional Study Area
- Base Case Disturbance
- RFD Case Disturbance
- Canada Warbler Habitat

REFERENCE(S)

1. BASE DATA - MNR LIO, OBTAINED 2016, NTDB
2. TRANSMISSION ROUTES - PROVIDED BY WATAYNIKANEYAP POWER L.P.
3. FIRST NATION COMMUNITIES FROM INDIGENOUS AND NORTHERN AFFAIRS CANADA (WWW.AINC-INAC.GC.CA)
4. PRODUCED BY GOLDER ASSOCIATES LTD UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2016
5. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 15

0 5 10

1:280,000 Kilometers

CLIENT

WATAYNIKANEYAP POWER L.P.

PROJECT

PIKANGIKUM DISTRIBUTION LINE PROJECT

TITLE

CANADA WARBLER HABITAT IN THE REGIONAL STUDY AREA AT RESONABLY FORESEEABLE DEVELOPMENT CASE

CONSULTANT

YYYY-MM-DD	2017-03-21
DESIGNED	JMC
PREPARED	JMC/PR
REVIEWED	LD
APPROVED	AE

PROJECT NO.	CONTROL	REV.	FIGURE
1657738	####	####	31

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7.8.2.3 Survival and Reproduction

Reasonably foreseeable developments may negatively affect Canada warbler survival and reproduction in the RSA by removing habitat, increasing sensory disturbance, and increasing risk of nest parasitism from edge effects. Best management practices (e.g., vegetation clearing outside of the breeding season) are expected to limit effects to Canada warbler survival and reproduction.

Reasonably foreseeable developments that were quantified in the RFD Case are predicted to reduce the carrying capacity of Common warbler habitat in the RSA from 148 individuals in the Base Case to 141 individuals in the RFD Case; no change from Project Case (see Section 3.2.10.3 for estimation method). This small change is unlikely to have a measurable effect on Canada warbler populations as the change is expected to be distributed among the populations that overlap with the RSA. There is no reduction in carrying capacity from Project Case to RFD Case because the Wataynikaneyap Phase 2 Project is predicted to remove 1.2 km^2 (12 ha) of suitable Canada warbler nesting habitat, additional to the habitat that is present in the limits of work at Project Case. According to data in the OBBA Regions 39 and 44; there is 1 Canada warbler per 2 km^2 in the regions surrounding the RSA.

Canada warblers may be less sensitive to increased nest parasitism risk due to increased edge from RFDs because they are interior forest nesters. However, habitat availability will be decreased with increased edge and changes to habitat availability are considered the largest threat to Canada warbler populations (Environment Canada 2016a). The loss of breeding habitat may affect reproductive success if individuals are displaced or return to breeding grounds to find habitat removed and subsequently are unable to establish a new territory or establish a territory in lower quality habitat.

In northern Ontario, climate change is expected to alter the onset of spring and summer. Spring and summer are expected to begin earlier and the growing season is expected to increase by 41 to 61 days by the 2050s (Stewart 1990). These changes are likely to have a positive effect on Canada warbler because this species is one of the last warbler species to arrive on breeding grounds (COSEWIC 2008). A longer growing season may allow for Canada warblers to raise more than one clutch per year, which is currently not possible with the timing of this species' migration patterns (COSEWIC 2008). However, climate change is also predicted to increase the frequency and intensity of extreme weather events, including droughts and heavy precipitation. Extreme weather events during the breeding season can result in reduced fecundity and nest success. Individuals may also be susceptible to extreme weather events outside of the breeding season. The frequency and intensity of hurricanes are predicted to increase as a result of climate change, which may negatively affect individuals during fall migration and on wintering grounds.

Warmer and drier conditions in Ontario due to climate change may alter the onset of spring and summer and the timing of insect hatches (Nituch and Bowman 2013). Insectivorous long-distance migrant species such as Canada warblers often exhibit a strong synchronization between breeding and peak food abundance, and climate change may impact this timing by creating a temporal mismatch between reproduction and optimal foraging conditions for prey (Both et al. 2009; COSEWIC 2008). However, confidence in the potential effects of climate change is low because predictions are based on simulations that can be highly variable.

7.8.2.4 Characterization of RFD Case Effects

Changes to habitat availability from direct loss due to RFDs that are anticipated to be in operation for perpetuity, such as the Wataynikaneyap Phase 2 Project, will have continuous, permanent effects on Canada warbler populations that overlap the RSA (regional scale) (Table 48). Effects from direct loss of habitat due to forestry are expected to continuous at the regional scale and reversible in the long-term.

Effects from changes to habitat availability due to sensory disturbance are expected to be reversible in the medium-term as all RFDs will have little activity during operations (e.g., transmission lines) or will be of short duration (e.g., forestry harvesting) (Table 48). Effects will be local or regional, depending on the temporal overlap of activities in the RSA.

Changes to habitat distribution are expected to affect Canada warblers permanently (e.g., transmission lines) or over the long-term (e.g., forestry). Effects from changes to habitat distribution are possible to occur continuously (Table 48).

Changes to survival and reproduction from direct habitat loss and sensory disturbance are possible and will likely occur continuously (Table 48). Effects to survival and reproduction from direct habitat loss will occur at the regional scale, while effects from sensory disturbance can be local or regional. Direct habitat loss from forest harvesting and forestry roads will influence survival and reproduction and should be reversible over the long-term. Effects from direct habitat loss from permanent features such as transmission lines will not be reversible (i.e., permanent). Sensory disturbance effects to survival and reproduction will be reversible over the medium-term as all RFDs are either of short duration (e.g., forestry harvesting) or will have little sensory disturbance during operations (e.g., transmission lines).

Effects from changes in habitat availability and distribution due to climate change and other natural factors (e.g., declining insect populations) on Canada warbler populations are predicted to be permanent, continuous, and possible to occur at the beyond regional scale. Effects from changes to habitat availability and distribution due to natural factors such as wildfire and severe storms will occur frequently over the long term at the regional to beyond regional scale (Table 48).

Table 48: Description of Effects and Significance in the RFD Case for Canada Warbler

<table>
<tr><th>Indicators</th><th>Effect Pathway</th><th>Characteristic</th><th>Rating/Effect Size</th><th>Significance Determination</th></tr>
<tr><td rowspan="6">Habitat Availability</td><td rowspan="6">■ 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, corona related noise and light emissions, dust, human activity, viewscape) can change wildlife habitat availability</td><td>Direction</td><td>Negative</td><td rowspan="20">Not Significant</td></tr>
<tr><td>Magnitude</td><td>■ Suitable habitat will decrease by 1,303 ha (4.4%) in the RSA from Base Case to RFD Case
■ Magnitude depends on the influences from climate change</td></tr>
<tr><td>Geographic Extent</td><td>■ Regional (direct loss and natural factors)[(a)]
■ Local to Regional (sensory disturbance)[(b)]</td></tr>
<tr><td>Duration/Reversibility</td><td>■ Long-term to Permanent (direct loss and natural factors)
■ Medium-term (sensory disturbance)</td></tr>
<tr><td>Frequency</td><td>■ Continuous (sensory disturbance)
■ Frequent to Continuous (direct loss and natural factors)</td></tr>
<tr><td>Probability of Occurrence</td><td>Probable</td></tr>
<tr><td rowspan="6">Habitat Distribution</td><td rowspan="6">■ 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, corona-related noise and light emissions, viewscape) can change wildlife habitat availability, which can lead to changes in wildlife abundance and distribution</td><td>Direction</td><td>Negative</td></tr>
<tr><td>Magnitude</td><td>■ Slight shifts in territory sizes or locations due to increased human disturbance
■ Magnitude depends on the influences from climate change</td></tr>
<tr><td>Geographic Extent</td><td>Regional[(a)]</td></tr>
<tr><td>Duration/Reversibility</td><td>Long-term to Permanent</td></tr>
<tr><td>Frequency</td><td>Frequent to Continuous</td></tr>
<tr><td>Probability of Occurrence</td><td>Possible</td></tr>
<tr><td rowspan="6">Survival/Reproduction</td><td rowspan="6">■ 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, corona related noise and light emissions, dust, human activity, viewscape) can change wildlife habitat availability
■ Vegetation clearing will result in an increase in edge habitat, which could increase nest parasitism risk for Canada warbler</td><td>Direction</td><td>Negative</td></tr>
<tr><td>Magnitude</td><td>■ Small reduction in productivity from habitat loss and sensory disturbance
■ Reduction in carrying capacity by 6 individuals in the RSA, compared to Base Case
■ Small increase in nest parasitism risk
■ Magnitude depends on the influences from climate change</td></tr>
<tr><td>Geographic Extent</td><td>■ Regional (direct loss and nest parasitism risk)[(a)]
■ Local to Regional (sensory disturbance)[(b)]</td></tr>
<tr><td>Duration/Reversibility</td><td>■ Long-term to Permanent (direct loss, natural factors, and nest parasitism risk)
■ Medium-term (sensory disturbance)</td></tr>
<tr><td>Frequency</td><td>■ Continuous (sensory disturbance and nest parasitism risk)
■ Frequent to Continuous (direct loss and natural factors)</td></tr>
<tr><td>Probability of Occurrence</td><td>Possible</td></tr>
</table>

Note: Natural factors include climate change and associated changes, inclement weather (e.g., storms), and wildfire.

a) Effects may be beyond regional due to climate change, other natural factors, forestry, and RFDs that occur within and beyond the RSA (i.e., the Wataynikaneyap Power Phase 2: Connecting 17 Remote First Nation Communities Project)

b) Local if no temporal overlap among activities associated with sensory disturbance; regional if temporal overlap among activities associated with sensory disturbance

ha = hectares; RSA = regional study area; RFD = reasonably foreseeable development.

7.8.2.5 Determination of Significance

In the RFD Case, approximately 1,303 ha (4.4%) of suitable Canada warbler habitat in the RSA will be lost, relative to Base Case conditions. Forestry is predicted to further reduce habitat availability for this species until areas are at least six years post-harvest. Fire suppression activities may increase Canada warbler habitat if old forests have a dense shrub layer. The Project combined with RFDs has the potential to result in local changes in habitat connectivity, but not throughout the RSA. Reasonably foreseeable developments may also result in local changes to Canada warbler survival and reproduction in the RSA; however, it is assumed that the RFDs will implement mitigations that avoid, limit or offset effects.

Climate change will likely alter habitat availability, habitat distribution and survival and reproduction of Canada warbler in the RFD Case. However, the effects were not quantified in this assessment and there is a large amount uncertainty regarding the potential effects of climate change because predictions are based on simulations that can be highly variable and many scenarios are possible.

Overall, available evidence indicates that the cumulative effects from the Project and other past, present and reasonably foreseeable developments should not have an adverse influence on the resilience and adaptive capacity of Canada warbler populations that overlap the RSA (i.e., populations remain self-sustaining and ecologically effective, relative to the Base Case). Consequently, cumulative effects on Canada warbler in the RFD Case are predicted to be not significant (Table 48).

8.0 PREDICTION CONFIDENCE IN THE ASSESSMENT

Prediction confidence refers to the degree of certainty in the net effects predictions and associated determination of significance. The EA 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 (level of confidence in the assessment results) depends on the degree of uncertainty and how it is addressed. Primary factors affecting confidence in the predictions made in the wildlife assessment include:

- availability and accuracy of baseline data;
- accuracy of vegetation maps (Land Cover 2000 data) and wildlife habitat models;
- level of understanding of the strength of effects pathways (i.e., mechanisms) on each criterion;
- level of certainty associated with the effectiveness of proposed mitigation; and
- level of understanding of the cumulative drivers of change in measurement indicators and associated effects on assessment endpoints (e.g., climate change).

The level of certainty is considered during the effects assessment, and how uncertainty was addressed to increase the level of confidence so that net effects will not be worse than predicted, such as building conservatism into the analysis and assessment. Uncertainty in the assessment was managed by:

- conducting quality assurance and control on baseline data;
- reviewing regional information such as FMPs and caribou IRAs;
- using the limits of work (4,355 ha) as the Project footprint due to the uncertainty of the final corridor routing;
- acquiring local and regional data from provincial government departments to understand ecological relationships relevant to potential pathways, and inform the assessment;
- using the best available land cover data across the RSAs;
- using data to make inferences about ecological interactions and mechanisms of change; and
- 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 the purpose of this assessment the loss of wildlife habitat due to the Project and RFDs is assumed to be permanent and irreversible because the Project and Wataynikaneyap Phase 2 Project are expected to operate indefinitely. Although vegetation under the transmission conductors will be maintained at heights consistent with safety guidelines, residual low shrub and/or tree cover is expected to provide forage and movement paths for some wildlife species (e.g., wolverine and Canada warbler). The uncertainty in the location and timing of forest harvesting was also managed using conservative assumptions. For example, although no forest harvesting has been completed in the Whitefeather FMU, to date, it was assumed that forest harvesting will occur in this FMU in the RFD Case. Similarly, forest harvesting was assumed to overlap the criterion-specific RSAs at the RFD Case.

Therefore, the confidence in predictions concerning effects to wildlife from changes in habitat availability and distribution due to the Project is moderate to high.

There is likely low accuracy of the Land Cover 2000 data as this dataset does not represent current conditions on the landscape (e.g., Land Cover data were collected in 2000). For wildlife, the uncertainty is managed by completing the assessment using habitat models that combine ecosites into broad-scale categories of moderate to high and negligible to low habitat suitability. Therefore, predicted effects to wildlife from the incremental and cumulative changes of the Project and other developments have a moderate level of confidence.

Although climate change models predict an increase in average global temperatures in the Project Case and the RFD Case, 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). Boreal tree species (e.g., black spruce, Jack pine, white spruce, balsam fir and trembling aspen) are predicted to migrate northwards; however, because trees are long-lived species with slow migration rates some trees are likely to have decreasing adaptive capacity to unfavourable climate conditions making them susceptible to mortality (Canadian Council of Forest Ministers 2010). Changes in water levels and flows are uncertain, and may result in negative or positive effects to wildlife. 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.

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). For example, climate change is 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 (Stewart 1990). 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 fecundity and 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 criterion (i.e., adverse effect of climate change on wildlife populations in the RFD Case).

9.0 FOLLOW-UP, INSPECTION, AND MONITORING

The objectives of follow-up, inspection and monitoring programs include:

- evaluate the effectiveness of mitigation and reclamation, and modify or enhance measures as necessary through adaptive management;
- identify unanticipated potentially adverse effects, including possible accidents and malfunctions; and
- contribute to continual improvement.

Wataynikaneyap will retain an environmental monitor during clearing activities to identify incidental sensitive features (e.g., rare vegetation communities or species, bat hibernacula) that have not previously been identified within the Project footprint, if any. In the event that a sensitive feature is suspected, work will cease and the Ministry of Natural Resources and Forestry or Environment and Climate Change Canada will be contacted. Additional activities to be completed by the environmental monitor will include:

- erosion and sedimentation control measures will be monitored to avoid and minimize sediment mobilization from disturbed areas to drainages, wetlands or watercourses;
- soil piles (including topsoil) will be monitored for weeds; and
- reclamation concerns would be monitored and managed, and include soil erosion, re-vegetation and slope stability.

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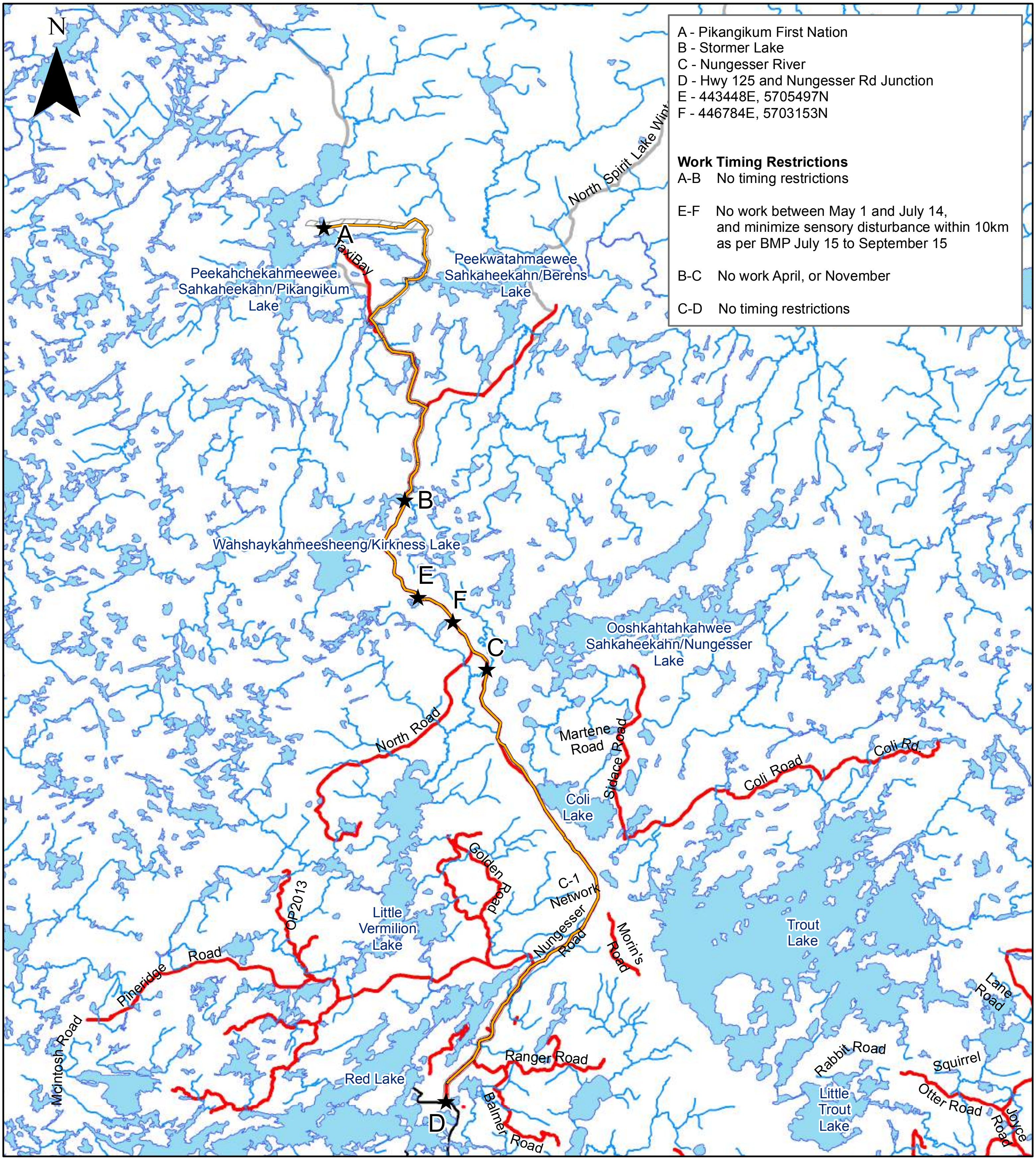
ATTACHMENT A

Woodland Caribou Timing Restrictions Map



Proposed Pik Hydroline
Caribou timing restrictions

Legend

- Proposed Hydroline
- Project Limit of Work
- Waterbody
- Watercourse
- Primary roads
- Highways
- Winter roads

0 5 10 20 Kilometers

Ontario

This map is illustrative only.
Do not rely on it being a precise indicator of features, nor as a guide to navigation

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NAD 1983 UTM Zone 15N

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