

DRAFT TECHNICAL BACKGROUNDER  
Northern Ontario Multimodal Transportation Strategy

# Winter Roads

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Prepared for the Ontario Ministry of Transportation and  
Ministry of Northern Development and Mines



Consulting Team: **IBI Group** | Hemson Consulting Ltd.  
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## IBI GROUP DRAFT TECHNICAL BACKGROUNDER: WINTER ROADS

Prepared for the Ontario Ministry of Transportation and Ministry of Northern Development and Mines

This technical backgrounder was prepared for the Ontario Ministry of Transportation and Ministry of Northern Development and Mines by the consultant team to assist the ministries in developing the Northern Ontario Multimodal Transportation Strategy. The opinions and ideas in this backgrounder are those of the authors and do not necessarily reflect the positions of the ministries or of the Government of Ontario.

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**IBI GROUP DRAFT TECHNICAL BACKGROUNDER: WINTER ROADS**

Prepared for the Ontario Ministry of Transportation and Ministry of Northern Development and Mines

# 1 Overview

Few communities in the Far North have direct all-season road or rail connections<sup>1</sup>. Year-round, these communities primarily make use of remote airports for travel between communities, for delivery of goods, and to access services in urban centres.

During deep-freeze conditions, the communities rely also on winter roads to connect them to the all-season road or rail network for the critical and more cost-effective re-supply of essential goods such as fuel, housing materials, food, potable water, and other goods. Ontario's 3,200-km winter road network consists of unpaved, un-graveled routes that are constructed annually over frozen earth, wetlands, lakes, and rivers, allowing vehicles weighing up to tens of thousands of kilograms to travel over the frozen terrain. A photograph of a Northern Ontario winter road is shown in Exhibit 1.1.

**Exhibit 1.1:** James Bay Corridor Winter Road



Photo credit: Yukari Hori

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<sup>1</sup> The only paved highway that crosses into the Far North is Highway 599, which extends from Highway 17 at Ignace northward to Pickle Lake.

North of Pickle Lake is the Northern Ontario Resources Trail (NORT) or Pickle Lake Road, which is a gravel road extending about another 200 km northward from Pickle Lake to Windigo Lake, about 40 km south of North Caribou First Nation.

Similarly, a gravel road (known as both the NORT and Nungesser Road) extends north from Red Lake about 100 km, where a 33-km winter road then connects to Pikangikum First Nation. The other all-season ground transportation infrastructure that extends to the Far North is the rail line that connects the municipality of Moosonee to Cochrane.

Ontario's winter road network in relation to the North's transportation infrastructure is shown in Exhibit 1.2. A large majority of the winter road network is in the Far North, though two winter road routes in the Near North (the term used in this document to denote areas in Northern Ontario outside the area designated under the Far North Act of Ontario) connect First Nation communities normally only accessible by boat to the highway network.

For purposes of this analysis, the Ontario road network is divided into eight corridors, as shown in Exhibit 1.3. From approximately west to east and north to south, these include the following:

- **Far North Corridors:**

- **Western:** The westernmost corridor includes a branch connecting three Treaty 5 communities and two westernmost Treaty 9 communities to Nungesser Road, which runs north from the municipality of Red Lake and Highway 105. Plans are in place to extend Nungesser Road across the Berens River to connect to Pikangikum, the nearest of the Treaty 5 communities.
- **North Caribou:** This corridor connects with Pickle Lake Road at its northern terminus, and serves five communities. A feasibility study has recently been completed toward extending Pickle Lake Road as far as the community of North Caribou Lake.
- **Kingfisher:** This corridor represents the third branch of the winter road network connecting with Pickle Lake Road, and serves six remote communities.
- **Webequie:** This corridor represents the second branch of the winter road network connecting with Pickle Lake Road, and serves four remote communities.
- **Cat Lake:** This is the southern-most of four corridors connecting to Pickle Lake Road, connecting at the southern end of Pickle Lake Road at Highway 599 and the Municipality of Pickle Lake.
- **Marten Falls:** This corridor connects to an all-season trail leading to Nakina and Highway 584.
- **Hudson Bay:** This corridor connects two communities on the Hudson Bay shore to Shamattawa and Gillam, MB. Gillam is situated on the Hudson Bay Rail Line.
- **James Bay:** This corridor connects four communities along the James Bay shore to the rail line at Moosonee, and extends as far west as the Victor Diamond Mine (De Beers) west of Attawapiskat.



- **Near North Corridors:**

- **Lake of the Woods:** This corridor connects two communities, otherwise only accessible by boat, to Kenora and Highway 11; this corridor is limited to light vehicle loads only.
- **Temagami:** The most southern winter road, this route connects to the Temagami First Nation community on Bear Island to an all-season road on the eastern shore of Lake Temagami; this corridor is limited to light vehicle loads only.

Exhibit 1.4 summarizes populations served, 2013–14 and 2014–15 operating season information, and winter road lengths for each winter road corridor. Detailed corridor maps are included as Appendix A.

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### Exhibit 1.2: Northern Ontario Multimodal Transportation Infrastructure



This map illustrates the geographical features and infrastructure of Northern Ontario, Canada. It includes a legend defining symbols for population centres, roads, railways, airports, and permafrost limits. The map shows major cities like Thunder Bay, Sault Ste. Marie, and Sudbury, along with numerous smaller communities and First Nation locations. Key geographical features include Hudson Bay, Lake Superior, and the international border with the United States. A scale bar and north arrow are provided at the bottom left.

**Legend**

- Population Centre (>5000 Pop.)
- Other Population Centre
- First Nation Community
- International Border Crossing
- Major Port
- Ontario Far North Boundary
- District Boundary
- Northern Ontario

**Roads**

- Primary Highway
- Secondary Highway
- Secondary Highway: Local
- Other All-Season Road
- Winter Road
- Major Out of Province Road

**Active Railway**

- Canadian National
- Canadian Pacific
- Huron-Central
- Ontario Northland
- Ottawa Valley
- Out of Province Rail

**Approximate Permafrost Southern Limits**

- Continuous Permafrost
- Discontinuous Permafrost

**Airports**

- Remote (MTO)
- Remote (Other)
- Municipal
- International

**Winter Road Corridors**

- Winter Road Traffic Counts



# IBI GROUP DRAFT TECHNICAL BACKGROUNDER: WINTER ROADS

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## Exhibit 1.4: Ontario Winter Road Operating Statistics, Road Lengths, and Populations Served by Corridor

Length (km)	Population (Census 2011)	Population (INAC 2016*)	Season	Construction Start Date	Road Open to Light Traffic	Date Road Open to 1/2 or 3/4 Loads	Date Road Open to Full Loads	Date of Official Closure	Operating Season (Days)
Western Corridor									
432	5,665	7,377	2013-14	Dec 9 - Jan 15	Jan 15 - 31	Jan 18 - Feb 2	Jan 31 - Feb 10	Mar 15 -31	54 - 75
			2014-15	Dec 3 - 24	Jan 2 - 26	Jan 2 - Feb 1	Jan 30 - Feb 20	Mar 15 - 24	52 - 72
North Caribou Lake Corridor									
453	2,230	2,475	2013-14	Nov 11 - Jan 24	Dec 23 - Jan 30	Dec 30 - Feb 28	Jan 12 - Feb 28	Mar 21 - Apr 15	31-110**
			2014-15	Nov 11 - Dec 13	Dec 15 - Feb 7	Jan 19 - Feb 4	Feb 11 - Mar 18	Mar 21 - Apr 7	51-110**
Kingfisher Corridor									
525	3,055	3,746	2013-14	Dec 1 - Jan 1	Jan 9 - Feb 15	Jan 25 - Feb 28	Feb 1 - Mar 1	Mar 28 - Apr 12	49-86
			2014-15	Dec 1 - Jan 3	Dec 15 - Feb 14	Dec 15 - Feb 18	Dec 15 - Feb 21	Mar 21 - Apr 7	46-118
Webequie Corridor									
474	2,325	2,184	2013-14	Nov 15-Dec 31	Dec 12- Jan 15	Jan 25 - Feb 24	Jan 20 - Feb 22	Mar 31 - Apr 20	58-129
			2014-15	Nov 10 - Dec 8	Dec 18 - Jan 20	Jan 26 - Feb 6	Jan 20 - Mar	Mar 30 - Apr	60**-104
Cat Lake Corridor									
175	490	589	2013-14	Dec 12	Jan 15	Feb 5	N/A	Apr 15	90
			2014-15	Dec 2	Feb 2	Feb 2	Mar 8	Mar 31	57
Marten Falls Corridor									
141	190	345	2013-14	Dec 31	Jan 25	Feb 6	Feb 15	Mar 28	62
			2014-15	Dec	Feb	Feb	Mar	Apr	60**
James Bay Corridor									
498	6,585	8,467	2013-14	N/A	N/A	N/A	N/A	N/A	N/A
			2014-15	Dec 1-29	Dec 9 - Jan 15	Jan 22 - Feb 1	Jan 29 - Feb 6	Mar 26 - Apr 13	70-125
Hudson Bay Corridor									
434	580	548	2013-14	N/A	N/A	N/A	N/A	N/A	N/A
			2014-15	Jan 9	Feb 5	Feb 5	Feb 10	Apr 7	61
Lake of the Woods Corridor									
84	335	388	2013-14	N/A	N/A	N/A	N/A	N/A	N/A
			2014-15	N/A	N/A	N/A	N/A	N/A	N/A
Temagami Corridor									
6	200	240	2013-14	N/A	N/A	N/A	N/A	N/A	N/A
			2014-15	Dec 10	Jan 5	N/A	Jan 19	Mar 31	85
Total									
3,222	21,655	26,189	2013-14	Nov 11 - Jan 24	Dec 12 - Feb 15	Dec 30 - Feb 28	Jan 12 - Mar 1	Mar 15 - Apr 20	31 - 129
			2014-15	Nov 10 - Jan 9	Dec 9 - Feb 14	Dec 15 - Feb 18	Dec 15 - Mar 18	Mar 15 - Apr 13	46-125

Source: Operations data summarized from MNDM reports (2015a, 2015b)

## 2 Jurisdiction, Programs and Policies

### 2.1 Programs

The Northern Ontario Winter Roads program provides approximately \$5 million in total annually to individual First Nations and companies, with each funding recipient responsible for the construction and maintenance of a segment of the province's winter road network. MNDM administers the program, with funding support from the federal department of Indigenous and Northern Affairs Canada (INAC). For the 2016–17 winter road season, MNDM is providing \$5.5 million; INAC has committed to match MNDM funding for the program, consistent with the Memorandum of Understanding (MOU) between the two ministries/departments. The program provides funding on a per-kilometre basis.

The MNDM role in winter roads does not encompass regulatory or inspection activities.

Note that among Northern Ontario First Nations, inter-community organization regarding winter roads and other issues is often on tribal council or a treaty area basis; treaty area boundaries are shown for reference in Exhibit 2.1.

### 2.2 Regulations, Safety and Enforcement

As for any public road in the Ontario, users of the Ontario winter road network are subject to the regulations Ontario Highway Traffic Act. Anyone using the winter road network must have a valid Ontario driver's licence and use a plated, insured vehicle — requirements that are not always enforced when driving within the remote communities themselves.<sup>2</sup>

Ontario Provincial Police have authority to enforce the applicable laws on the winter road network, but due to a lack of resources, patrols are infrequent. Nishnawbe Aski Police Services conduct spot checks for contraband substances at checkpoints on the network.

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<sup>2</sup> MTO provides a travelling service to remote communities so that residents can take their driver's licence examinations.

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## Exhibit 2.1: First Nations and Treaties in Ontario



## 3 Winter Road Usage

### 3.1 Vehicle Volumes

For the 2015-16 winter road operating season, MNDM installed vehicle induction counters at four Far North corridors, with locations as were shown above in Exhibit 1.3. This marked the first time that this technology was used for counts for Ontario's winter roads, and the first time that season-long counts could be obtained. The counters recorded total vehicles in both directions, not distinguishing by vehicle class (car vs. truck) or by direction (due to limitations of the technology). For these four corridors, two-way traffic over the course of the operating season totalled almost 5,500 vehicles, with 700 to 2,200 vehicles per corridor.

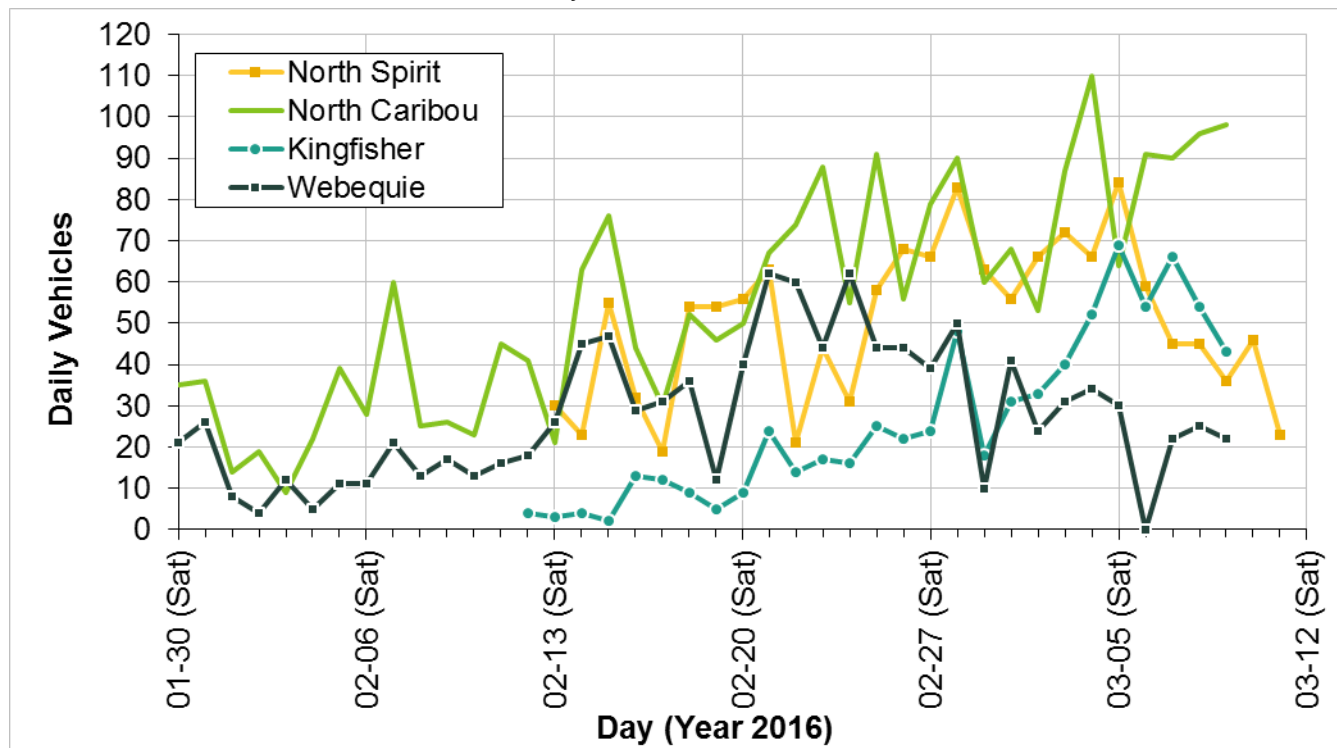
Daily and weekly traffic totals by corridor are shown in Exhibit 3.1 and Exhibit 3.2, respectively. Due to an unusually mild winter, the winter road operating season started quite late, between January 30 and February 13, 2016 depending on the corridor. The counters were removed between March 9 and 11, 2016, though the winter roads generally remained open until the end of March. Over the operating season, average daily traffic ranged from approximately 30 to 70 vehicles per corridor, with peak daily traffic as high as approximately 60 to 110 vehicles per corridor.

A ramping-up period can be seen on each of the corridors, with the highest-volume travel taking place approximately mid-February to near the end of the operating season, with approximately 300 to 500 vehicles per week per corridor during this period<sup>3</sup>.

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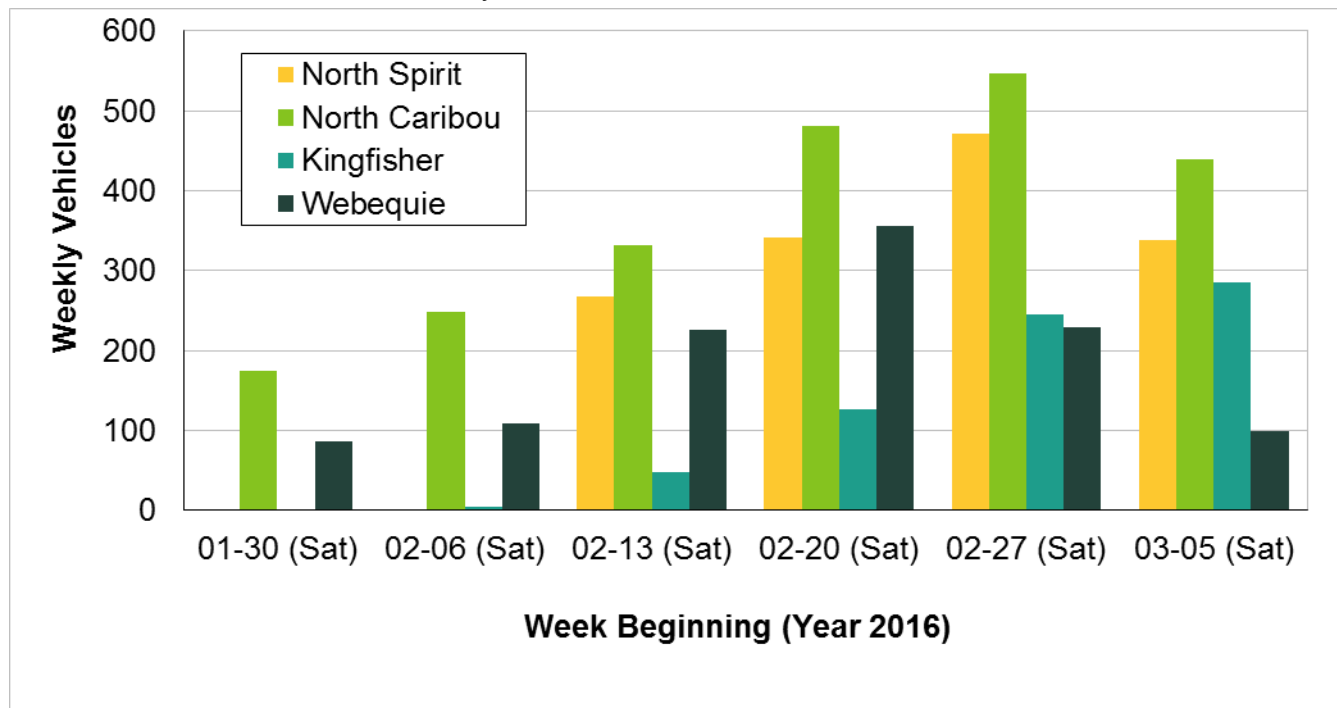
<sup>3</sup> It was noted during Strategy-related discussions with representatives from Far North communities that some of this late-season peak can be attributed to communities scheduling their shipments of goods until closer to March 31, the date that payment is received from MNDM for the winter roads, so they are in a better position to pay shippers.

**Exhibit 3.1:** Ontario Winter Roads Daily Traffic Counts — Select Corridors, 2016



Data source: IBI Group analysis of MNDM 2015-2016 count data

**Exhibit 3.2:** Winter Roads Weekly Traffic Counts — Select Corridors, 2016



Data source: IBI Group analysis of MNDM 2015-2016 count data



## 3.2 Goods Movement

A variety of goods are transported using winter roads, as summarized in Exhibit 3.3. (Note that because there are inconsistencies between individual communities as to how the data were reported, the findings should be considered to be indicative but not exact.) Diesel fuel is critical to remote communities, and is the most common commodity transported. During the 2014–15 season, over 14 million litres of diesel fuel were trucked to remote communities by winter road.<sup>4</sup> Other bulk fuels were also frequently transported. Housing material, school supplies and food were also goods commonly transported on winter roads.

**Exhibit 3.3:** Self-Reported Volumes of Goods Transported on Ontario Winter Roads, 2014–15

Commodity	Bulk Fuels	Other Commodities	
	Volume (1,000 litres)	Truck Trips	Total Weight (tonnes)
Diesel	14,290	-	-
Gasoline	5,801	-	-
Housing Fuel	761	-	-
Hydro One Fuel	1,138	-	-
Housing Material	-	143	375
Food	-	146	68
School Supplies	-	420	-
Equipment	-	12	-
Other	187	107	6
<b>Total*</b>	<b>21,416</b>	<b>828</b>	<b>449</b>

Note: Goods in the “Other” category include chemicals for water treatment/ sewage treatment, cement, and fire wood. Several communities did not report the quantity of their imports. Several communities did not report the weight of their truck loads.

\* Incomplete due to incompletely reported information across winter road corridors.

Data Source: *Ontario 2014–2015 Winter Roads Final Report*

<sup>4</sup> This dataset is based on a survey of remote communities with 27 of 30 submitting information on transported goods.

### 3.3 Inter-Community Connections

Winter roads not only allow for the hauling of heavy freight to remote communities, but also enable inter-community social travel and connect the residents to the rest of the province.

The winter road season provides opportunities for residents of remote communities to participate in larger social events. Of 28 communities receiving winter roads funding for the 2014–15 season reporting on social events, 19 hosted sporting events, 11 hosted fishing derbies, 10 hosted community festivals, 9 hosted church and cultural activities, and 12 hosted other recreational activities (MNDM 2015b).

## 4 Construction and Maintenance

### 4.1 Guidelines

An MNDM document published in 2010, *First Nations Guidelines for the Construction and Maintenance of Existing Winter Roads*, provides detailed information on how to construct, inspect, and safely operate winter roads over a variety of terrain and water conditions. The document states that it is a guideline only, as:

“It is the responsibility of each First Nation community or winter road corporation to develop their own specific document and policies related to winter road construction and maintenance” (p. iii).

The guidelines include the following performance recommendations:

- All roads (over land and water) should be constructed to support constant hauling of vehicles weighing up to 37,500 kg gross weight. Note that this is the only technical requirement included in the agreements; however, given the unpredictability of climate change, the best efforts of a community to meet this requirement may still not result in a road that can support this weight. This standard is therefore difficult to enforce.
- The suggested winter road widths are as follows:
  - Overland: 12 m
  - Over open muskeg, swamps and sloughs: 18 m
  - Over rivers, streams and smaller lakes: 30 – 60 m
  - Over large lakes: 60 m
- Roads over land should be designed to allow trucks to travel safely at an average speed of at least 35 km/h. The recommended speed limit for trucks over ice crossings is 15 km/h.

The *Guidelines* also discusses the importance of testing ice and of visual inspection of ice during construction and during the operating season, recommended ice crossing restrictions, signage recommendations, and general safety information.

## 4.2 Overview of Construction Process

Some of the tasks involved in preparing a winter road corridor for the operating season include the following, drawing in part on the MNDM *Guidelines* document:

- Clearing of the corridor:
  - Clear debris such as fallen trees and branches that may have fallen on the corridor, and also clear vegetation that may have grown onto the corridor. This is a task that can be done in the summer or fall where the route is accessible, otherwise it is done with route compaction, below.
- Compaction:
  - Construction of winter roads generally begins with the first winter snow. First, lightweight equipment such as snowmobiles is used to pack the snow and reduce its insulating effect and drive the frost into the ground, while keeping the snow's white surface to reflect sunlight and further contribute to cooling and ice formation.
  - Once the ground surface freezes and hardens sufficiently, heavier equipment (ideally first small groomers, then larger bulldozers) is used to clear away excess snow from land while ensuring that the roadway retains enough snow cover to remain reflective.
  - Ramps and snow bridges are constructed by piling snow, then flooding and leaving at least overnight before repeating until the desired shape is developed for the transition between water and land surfaces. Ice depth needs to be checked across the width of lakes and water crossings before bringing heavy equipment onto it.
- Preparing Water Crossings:
  - Water routes are plowed clear, to allow ice to form naturally.
  - For short water crossings, the ice is cleared and flooded one or more times until it reaches the required thickness.
  - For long water body crossings, markers are put in place to define the route.
- Shaping:
  - As soon as heavier equipment can be used, the road is shaped to construct a base for a level road surface. Fresh fallen snow

should be bladed and compacted. Snow banks should be pushed away from the cleared right-of-way.

- Blading and Dragging:
  - This involves using heavy equipment to blade and drag the road to drive the frost into the ground and to level the road.

Push-out areas should be provided to the same standard as the actual winter road. These should be large enough for a grader to make a safe U-turn or to park.

### **Best Practices in Winter Road Construction**

Methods that can be used to protect the integrity of winter roads to help extend the operating seasons include the following (summarized in Conference Board of Canada [2015], pp. 28–29):

- Pre-emptively removing snow to remove its insulating effect (but maintaining enough snow cover to keep its reflective properties in order to avoid sunlight absorption and heating);
- Flattening side slopes and widening road shoulders;
- Constructing and maintaining snow caches near difficult land crossings allow for the quick rebuild of overland sections;
- Spraying ice roads and bridges to thicken the ice and delay closure.
- Towards the end of the operating season, restricting hauling to the nighttime, when the ice sheet is stronger;
- Establishing or improving permanent crossings, including bridges over lakes and streams; and
- For the longer term, developing and assessing alternate routes for the road when winter road sections become too difficult to keep in reliable service.

Additional best practices identified through community engagement include the following:

- Flooding all creek crossings;
- Widening road corners to improve sightlines and increase safety; however, there can be a trade-off with ice quality, as removing shade can speed melting;
- Making snow piles near difficult land crossings to be used to help rebuild the crossing quickly if needed; and
- Installing permanent culverts in strategic locations.

## **Construction Equipment**

Most communities own their own maintenance equipment. According to a Winter Roads Report on the 2014-2015 season, the most common types of equipment are groomers, dozers, snowmobiles, pickup trucks/plows, and graders. Some communities also lease their maintenance equipment.

In selecting equipment, there is a trade-off between efficiency and risk to equipment. While the smaller equipment is less likely to fall through thinner ice, it increases the time needed to build and maintain the winter road.

## **4.3 Bridges**

The MNDM role in winter roads has not encompassed regulatory or inspection activities. However, in 2015, MNRF began a comprehensive inspection of the bridges on the winter road network to identify ones that require maintenance and/or replacement. There is currently a wide range of bridges in use along the winter road network, varying in size, materials and quality. All bridges on Crown land in the Far North under MNRF jurisdiction are considered to be MNRF assets. MNDM is working with MNRF and INAC to identify all existing bridges and establish a routine inspection and maintenance program to ensure their long-term safety.

## **4.4 Signage**

MNDM's *Guidelines* document includes recommendations for providing signage on winter roads, which is the responsibility of the communities or corporations building the winter roads. The document recommends the following types of signage:

- Signs should inform users of road openings and closures, the distance to the nearest community where fuel, accommodations and food are available, etc.
- Signs should be placed at the start of the winter road system when roads are temporarily closed.
- For safety, signs should warn users that winter survival and communication equipment are recommended. Also, for users of water body (ice) crossings, that the bearing capacity of ice depends on the quality of the ice, the presence of cracks and other properties.
- Speed limit signs should be placed at the approaches to the ice crossings.

- Signs should identify river and stream crossings and distances to the nearest communities.
- Kilometre markers should be placed every 5 km.
- Markers should identify potential hazards, such as steep hills, sharp curves, severe bumps, boulders or narrow areas.
- In practice, these signage guidelines are generally not adhered to.
- In addition, having signs in the applicable First Nation languages for the area (e.g. Cree, Oji-Cree) in addition to English can increase their effectiveness.

The *Guidelines* document does not have recommendations relating to signage design, quality, or placement.

## 5 Operations

A summary of maintenance issues reported for the 2014–15 season is shown in Exhibit 5.1. Almost all corridors reported weather-related delays and issues, while safety, road closures due to trucks getting stuck, and other issues were also noted.

**Exhibit 5.1:** Summary of 2014–15 Operational Issues by Corridor

Weather-Related Issues	Other Issues/Updates
<b>Western Corridor</b>	
<ul style="list-style-type: none"> <li>- Issues with ice cracking due to air holes and slush (truck hit cracks but did not go through)</li> <li>- Delay was caused when ice cracked due to a lot of water on the ice</li> <li>- Delays due to warm weather, snow and maintenance</li> <li>- Creek crossings have no culverts and slush builds up</li> <li>- Warm weather caused the road to melt in March, which limits road use for freight</li> </ul>	<ul style="list-style-type: none"> <li>- Issues with contraband and speeding: band constables and security services were put in place to help monitor</li> <li>- Trucks get stuck going uphill</li> <li>- Semi-trailer truck was stuck on the road, another slid off the road, both caused road closures</li> </ul>
<b>North Caribou Corridor</b>	
<ul style="list-style-type: none"> <li>- Temporary road closures due to warm weather</li> <li>- 3-day by pass due to flooded road</li> <li>- Weather delays such as drifting snow</li> </ul>	<ul style="list-style-type: none"> <li>- Issues with trucks breaking down and getting stuck at side of road</li> <li>- One groomer went through the creek ice into 4 feet of water</li> <li>- Van drove through security check gate</li> <li>- Security checks for alcohol and contraband made road safer</li> <li>- Road crew fuel shortage resulted in fuel being flown in</li> </ul>
<b>Kingfisher Corridor</b>	
<ul style="list-style-type: none"> <li>- Rain and freezing rain caused delays</li> <li>- Bridge washout caused closure at end of season</li> </ul>	<ul style="list-style-type: none"> <li>- Worker was injured while attempting to pull equipment from slush</li> <li>- Contraband was minimized by placing a checkpoint 30 km from some communities</li> </ul>

(continued on next page)



**Exhibit 5.1: Summary of 2014–15 Operational Issues by Corridor (continued)**

Weather-Related Issues		Other Issues/Updates	
Webequie Corridor			
<ul style="list-style-type: none"><li>- Summer tree debris and overhang causing more work to ready the road for use</li><li>- Warm spells caused road deterioration, 2-day road closures</li><li>- Hired labour to clear the road from tree debris caused by rain and snow</li><li>- Road closures due to high snowdrifts</li></ul>		<ul style="list-style-type: none"><li>- Equipment issues (freezing)</li><li>- Issues with unlicensed drivers, and uninsured/unplated vehicles</li><li>- Network security issues</li><li>- Uncertainty over toll fee usage</li><li>- Issues with sharp corners</li><li>- Road was temporarily closed to repair a bad spot and to strengthen a temporary bridge</li><li>- Security checkpoint set up to check for contraband</li></ul>	
Cat Lake Corridor			
<ul style="list-style-type: none"><li>- Warm weather caused road to soften (Recreation company was not able to leave the community as scheduled)</li></ul>		<ul style="list-style-type: none"><li>- Road checks caught speeders, contraband and seatbelts not being worn</li><li>- Someone got stuck in the snow 10 km down the road when checking conditions</li></ul>	
Marten Falls Corridor			
<ul style="list-style-type: none"><li>- Delays due to heavy snow accumulation</li></ul>		<ul style="list-style-type: none"><li>- Set up a checkpoint to monitor traffic, visitors and trucks</li></ul>	
James Bay Corridor			
<ul style="list-style-type: none"><li>- One-day closure due to high tide at Albany River and Attawapiskat River</li><li>- Delays due to blowing snow and high tide on Moose Factory River</li></ul>		<ul style="list-style-type: none"><li>- Issues with speeding</li><li>- Some vehicles lose control</li></ul>	
Hudson Bay Corridor			
<ul style="list-style-type: none"><li>- Severe storm closed road for 3 days</li><li>- Early thaw had one truck go off the road and was damaged</li></ul>		<ul style="list-style-type: none"><li>- Trucks delivering cement blocks damaged road by wearing chains on the tires for no reason</li></ul>	
Lake of the Woods Corridor			
<ul style="list-style-type: none"><li>- Wind, snow and slush caused delays</li></ul>		<ul style="list-style-type: none"><li>- Truck hit slush, lost control and hit pressure ridge</li><li>- Truck lost control on portage, causing 3-hour delay</li></ul>	
Temagami Corridor			
<ul style="list-style-type: none"><li>- Not reported</li></ul>		<ul style="list-style-type: none"><li>- Not reported</li></ul>	

Source: Summarized from MNDM (2015b)

## 6 Jurisdictional Comparison of Winter Road Guidelines and Road Management Approaches

Other Canadian Provinces and territories with winter roads face many of the same climate change related challenges as Ontario and many have proposed steps to address the issues.

### 6.1 Manitoba

#### **Jurisdiction and Construction Procedures**

This section summarizes the history and procedures regarding Manitoba's winter road system as described by the province's Department of Infrastructure and Technology (2016). The winter roads were originally privately built in the 1950s. The Manitoba Department of Northern Affairs took responsibility for the construction and maintenance of the province's winter road network in 1971, and upgraded the privately-built roads to a standard that would accommodate truck access. Since 1978, the Manitoba Department of Transportation has been responsible for supervision of the system. The majority of Manitoba's winter road system is funded jointly with the federal government.

Since 1999, Manitoba has made a dedicated effort to improve the winter road system by using more overland routes, improving safety, reducing construction difficulties, and addressing environmental concerns. Existing winter roads have been relocated and new roads constructed, as well as upgrading existing winter and forestry roads.

Given the safety concerns of using winter roads, the Department of Infrastructure and Transportation schedules pre-season meetings with truckers planning to use the roads.

There are several differences between Manitoba's model and Ontario's model of providing winter road infrastructure. The Province of Manitoba sets the construction standards and retains responsibility and oversight for the system, generally contracting out construction to the communities involved, thereby creating local employment opportunities. In Ontario, the Province's role is mostly administrative. In Ontario, winter roads are the responsibility of the communities who build each road segment, and each First Nation determines to what extent they conform to the Province's *Winter Road Guidelines*.

## **Manitoba Winter Road Construction Guidelines**

The *Manitoba Contractors Manual for Winter Roads* (2012) was compared to Ontario's guide. The general performance recommendations are the same in both provinces, i.e. that winter roads should support a gross vehicle weight of 37,500 kg, provided that vehicles over 7,000 kg limited their speeds to 15 km/h over water crossings. However, the Manitoba guidelines generally expand on the information provided on many topics, and include several illustrations.

Ice testing guidelines are similar between the two provinces, though they are described in more detail in the Manitoba guidelines. While both guides say that ice on water crossings should be tested every 30 m, the Manitoba guidelines state beyond 250 m from shoreline for lakes, testing can be reduced to 250-m intervals, and intervals should be reduced to 30 m again when there are changes in ice texture. Manitoba's guidelines also include a sample Contractor Ice Report form for reporting results.

Manitoba's guide provides information about ice in general, and about equipment use/safety and signage. The Manitoba document also notes environmental considerations such as abandoned vehicles and contaminants due to accidents.

Manitoba's guide provides detailed safety and accident management information. It also stipulates that a "working alone or in isolation policy" is to be developed by workers and employers in situations where employees must work or travel alone. Directions on the following aspects of winter road safety are included:

- Personal protective equipment, including using a CSA-approved harness and lifeline for working on ice;
- Safety equipment that should be carried on-board vehicles;
- Hazards that can be encountered during winter road construction and travel;
- Safe vehicle/equipment operations;
- Communications equipment and protocol;
- Risk management; and
- Incident response.

Overall, Manitoba's guidelines are very comprehensive and there is an opportunity for Ontario to utilize and build on the information available.

## 6.2 Northwest Territories

### **Jurisdiction and Construction Procedures**

The Department of Transportation (DOT) of the Government of the Northwest Territories (GNWT) has responsibility for the 1,425 km of winter roads in the territory. Winter road construction is completed through private contractors, including First Nation-owned companies.

### **Climate Change Adaption Plan Strategies for Winter Roads**

The GNWT DOT has proposed several solutions to address climate change-related impacts in its *Climate Change Adaption Plan* (GNWT, 2013).

These include the following strategies beyond what has been mentioned elsewhere in this backgrounder:

- Construction methods:
  - pre-emptive snow removal from water crossings to enhance ice formation; one contractor has successfully used floating snow removal equipment, and GNWT DOT is looking at expanding the use of this equipment;
  - exploration of new technologies for construction, such as using geotextile “blankets” to reduce heat transfer;
  - promoting ice growth through ice auger flooding techniques and through ice-spray technology;
  - building “hybrid” winter roads where shallow (1.5-m) soil embankments are built at portage sites along the winter road route.
  - establishing snow storage at troublesome land crossing locations (at sufficient distance from the road so as not to affect the freezing of soil in the vicinity of the winter road);
  - vegetation management to reduce amounts of snow cover required to establish portage sections.
  - construction of embankments or other sun-shielding structures on the south sides of winter road portages to reduce exposure to sun on the road bed.
- reducing construction time:
  - having equipment storage at different places along the route to allow simultaneous construction along multiple sections of winter

- road – i.e. not being limited to having construction proceed sequentially from the one end of the road where the only equipment is stored;
- increased human resources and equipment to allow compressed construction in the event of delayed onset of winter road construction conditions;
- installing permanent bridge structures, whose benefits include speeding up construction each winter road season;
- improved water crossings:
  - converting temporary culvert crossings to permanent culverts, including stacked culverts, where larger culverts at higher elevations remain open when lower, smaller culverts ice up;
  - increase grade level of ice crossing, which has the benefit of reducing water overflow;
  - proactive and aggressive reduction of overflow occurring on road beds through higher intensity tracking and intervention.
- advanced ice profiling equipment, i.e. ground-penetrating radar (GPR) for construction phase and monitoring;
- routing reviews:
  - where winter road sections are increasingly difficult to keep in reliable service, developing and assessing alternative routing for these roads, including both small-scale and large-scale realignments;
  - realignment of select routes onto completely land-based routes that can be upgraded to all-weather roads;
- expanded information sharing:
  - liaising with contractors to share information regularly through construction and operating phases;
  - expanded information sharing and collaboration within the Department of Transportation and between external jurisdictions.

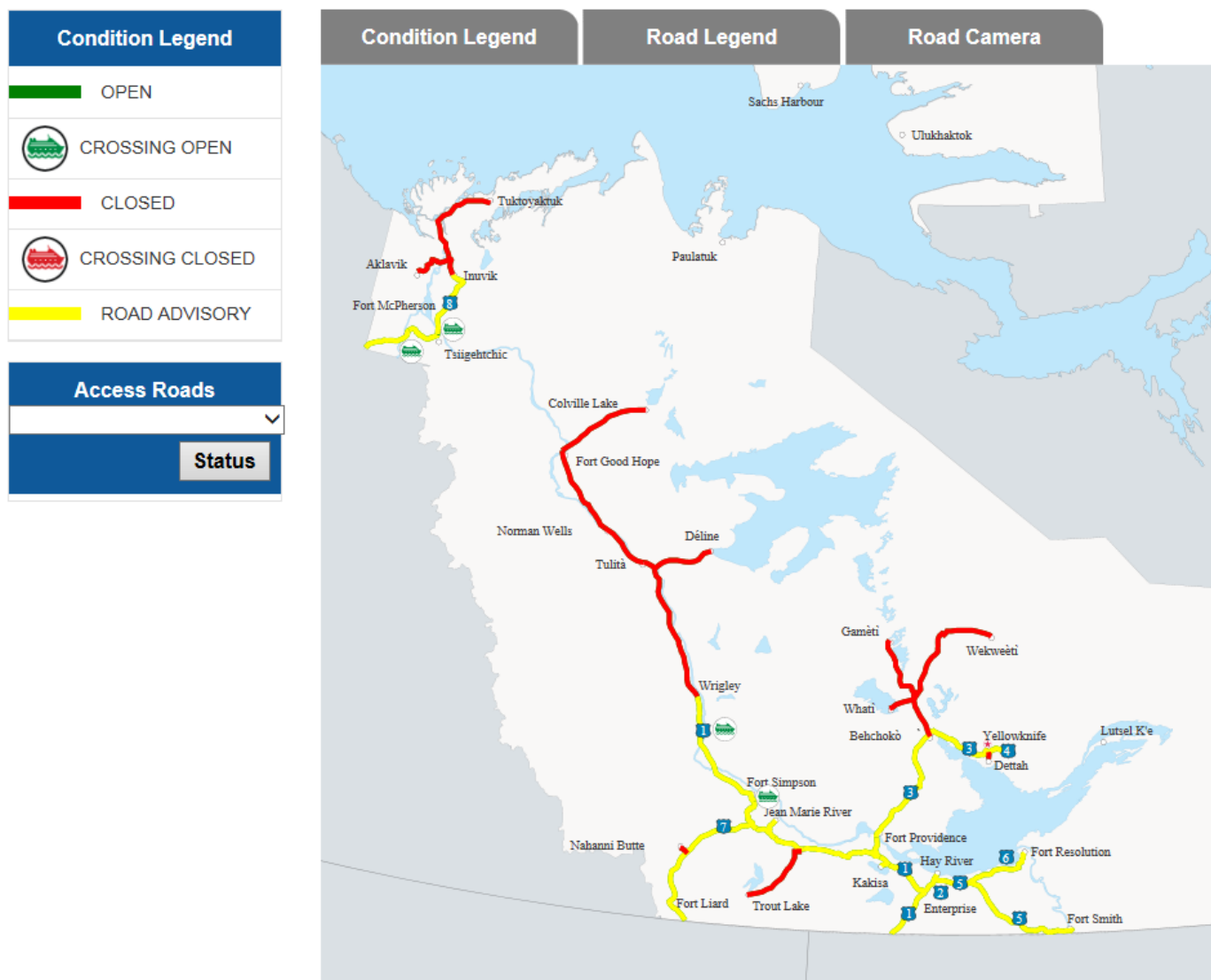
### **Real-Time Winter Road Condition Information**

The GNWT DOT displays winter road condition information integrated with other highway condition information on their website, shown in Exhibit 6.1. The exhibit shows highway and winter road conditions in summer, when the four winter road areas are shown as red links indicating that they are closed. When any highway

or winter road link is selected on the interface, additional information is shown, such as soft sections, rough sections, closed crossings, or construction.

Users are also directed to a 1-800 number or Twitter to access up-to-date information on winter road conditions.

**Exhibit 6.1:** Northwest Territories Highway Conditions Interface, Including Winter Roads Information



Source: Government of Northwest Territories, Department of Transportation (2016)

## 7 Outlooks

### 7.1 Climate Change Considerations

A changing climate has resulted in shorter travel seasons and less consistent operating conditions for winter roads, as was discussed in the Phase 1 summary report. When adverse weather conditions result in reduced truck shipments, greater use of air transport, which is significantly more expensive, is necessary (noting that other modes can also be affected by climate change through damage to infrastructure, flooding, etc.). Proactive methods to extend the life of the winter road network must be implemented, and the possible alternative of extending the all-season road network to replace portions of winter roads becomes more pressing.

A research article in *Climate and Development* (Golden et al, 2014) explores the experience of climate change in Ontario's Far North through the lens of the changing experience of "blue-ice", which is a strong, dense ice as compared to less strong white ice. Blue-ice forms when water is exposed to very cold sub-zero temperatures over a period of several weeks. Snowfall can cool the water more quickly, but once the ice starts forming, snowfall, especially slushy snow, can reduce the ice's strength and form white ice. The article notes that the experience shared by the Far North communities is that blue-ice is forming later and disappearing sooner, both by approximately two months, and that there is more slushy snow affecting blue-ice's formation. The thickness of blue-ice also is less than in the past.

Winter road construction and maintenance methods noted in Section 4.2 can help extend the operating seasons through climate challenges to a certain extent, at least in the short-term.

### 7.2 Strong Population Growth

Northern Ontario's Indigenous communities including the remote communities served by winter roads are experiencing among the strongest population growth rates in Northern Ontario. These communities are anticipated to continue to have strong growth rates through the Strategy horizon.

### 7.3 Incremental All-Season Road Expansion

Given the large cost of extending the all-season road network, all-season road expansions will likely need to be incremental. As is current practice in Ontario, any road extensions must be subject to a feasibility study in addition to band chief and band council request and approval. The locations, designs and timing of implementation of new all-season roads will require balanced consideration of the benefits of providing year-round over-land access to remote communities and resource sites relative to implementation costs and potential negative environmental and social impacts.

Under the Far North Act, 2010, most development in the Far North of Ontario, including all-weather transportation infrastructure, is prohibited from proceeding in advance of a jointly approved community based land use plan for the area, unless an order is made to except or exempt an individual project. Where a community based land use plan is in effect, development must be consistent with the direction contained in the approved plan.

A feasibility study to examine extending the all-season road to North Caribou has recently been completed and plans are continuing toward constructing this expansion.



## 8 Issues and Opportunities

### 8.1 Summary of Issues

#### **Variable Winter Road Seasons Conditions**

Winter road operating seasons are becoming increasingly variable: an exceptionally good winter road season one year can be followed by a mild winter the next, and vice versa. Construction seasons can be delayed due to late-onset of winter conditions. It can be difficult to plan and mobilize winter road construction activities around such variable weather conditions.

#### **Risk of Incomplete Community Resupply**

When the winter road operating season is compromised, or when winter road operating information is not adequately conveyed to shippers, communities risk not being able to receive the goods needed for the year by winter road, substantially increasing the costs of goods for the community, as the goods then need to be flown in at much higher cost compared to winter road.

#### **Lack of Redundancy on the Winter Road Network**

For most remote communities, there is a single winter road corridor route connecting to the all-season road network. When that route is not usable, for example, due to late construction, flooding at a water crossing, or a disabled vehicle blocking the route, no route alternatives are available. Improvements to winter road network redundancy are needed, in tandem with improvements to road resiliency, such as improved or more permanent water crossings and realignment to higher, drier ground.

#### **Funding Concerns**

##### ***Winter Road Program Funding Basis***

The Winter Roads program provides funding on a per-kilometre basis. Communities that have more difficult water crossings or other challenges along their route are compensated the same way as those with fewer challenges.

### ***Financial Challenges for Communities***

To receive funding, communities must submit budgets during the summer before the winter road operating season. Communities currently receive 75% of their allotted funding from MNDM in early in the season (late October to November) and the remaining 25% on March 31. If communities need to engage in winter road maintenance activities over the summer, such as clearing vegetation or flattening slopes, they must save funds from the previous winter to do so.

Some communities have put off shipments of goods to close to the end of the winter road operating season so that they are in a better financial position to pay shippers, but risk not receiving their shipments should the operating season be unexpectedly shortened.

### **Inadequate Training and Support for Communities**

While some community representatives and MNDM have expressed that Ontario would benefit from improved standards for winter roads (such as in Manitoba), there is not yet a consensus regarding the benefit of standards as compared to the current guidelines. Overall, increased support for training and access to better equipment would facilitate and shorten the construction phase, and result in higher-quality winter roads.

### **Inconsistent Winter Road Corridor Quality and Timing**

In Ontario, each community is responsible for constructing and maintaining its own section of the winter road network. There is no organization with a mandate for oversight and inspection, and the Ontario *Guidelines for Winter Roads* serve as recommendations only. This can be a challenge for communities further from the all-season road network on a winter road corridor, as they are dependent on communities closer to the all-season road network connection to do their part in constructing and maintaining the road network.

In NOMTS engagement activities, shippers to remote areas have noted that there is considerable inconsistency in road quality between winter road corridors in Ontario, as compared to other jurisdictions such as Manitoba. Winter road widths especially are inconsistent in Ontario. A narrower road means there is less room for vehicles in opposite directions to pass, and the road has more insulating snow at its sides, and therefore tends to thaw and soften earlier.

Resources and organization vary across communities, and can have an impact on the ability to build roads as quickly as required. If one particular community has a longer length of road but fewer resources, it can take them longer to build their sections than other communities on the corridor need, shortening the effective operating season for the larger corridor.

## **Lack of Long-Term Construction Practices**

Certain steps can be taken, to substantially improve the construction and operation of the winter road, but tend to be avoided or put off, due in part to limited resources and a focus on quickly getting the winter road operational each season:

- removing large rocks and other obstacles; this can potentially be done in the early spring as the winter road starts to thaw but heavier equipment is still usable on the winter road network;
- leveling slopes;
- improving curves and sight lines; and
- installing permanent bridges and culverts at river and stream crossings to reduce the need to build new ice bridges each year.

Some of these actions could be taken in the off-season for winter roads.

## **Inconsistent and Inadequate Winter Road Signage**

Signage on the winter road system is the responsibility of communities and companies who build each road system. Signage is often lacking or inadequate, and tends not to include Indigenous languages. Consistent wayfinding signage and distance markers would be very helpful to travellers.

## **Safety and Security Concerns for Road Users**

Safety concerns have been reported in winter road annual reports (MNDM 2015a, MNDM 2015b) and by community members in NOMTS engagement activities.

It was also noted that it is difficult to get a driver's licence in a remote community despite MTO's current efforts to make the process easier. This in part results in unlicensed drivers using the winter roads. Drivers also do not always have their vehicles insured.

General road safety is also a concern with reports of unsafe behaviour such as speeding, using winter roads before and after the official opening/closing, and a high prevalence of driver fatigue. Enforcement of the Highway Traffic Act is sporadic on winter roads.

Communities are also concerned with the smuggling of contraband by winter road. Indigenous police checkpoints for checking vehicles for contraband, set up at a distance from the community, have helped toward reducing contraband smuggling.

## **Lack of Rest Areas**

Winter road users travel long distances at low speeds in cold weather. Communities along the route can provide a place to rest along the way, though they do not tend to have designated traveller rest facilities. There are long stretches of road without communities or facilities to rest, and there can be issues of driver fatigue.

Garbage along the route is also a concern, which could be mitigated by providing garbage facilities along the route along with rest areas.

## **Shortcomings in Communications and Information-Sharing**

Communications along the winter road network are difficult and often not possible. Any road construction crew needs or road user emergencies cannot be communicated by phone; instead messages must be relayed by driving back to the community.

As shown in Exhibit 8.1, mobile phone coverage is limited to a few small areas in the Far North. Only the communities themselves have telephone service and broadband internet connections.

Shippers who use remote winter roads to transport goods to remote communities have noted that it can be difficult to get current information on any given winter road, such as whether the operating season has started or finished, or if there are incidents along the route that have resulted in temporarily closures. Information tends to be piecemeal with no centralized number to call or source of information.

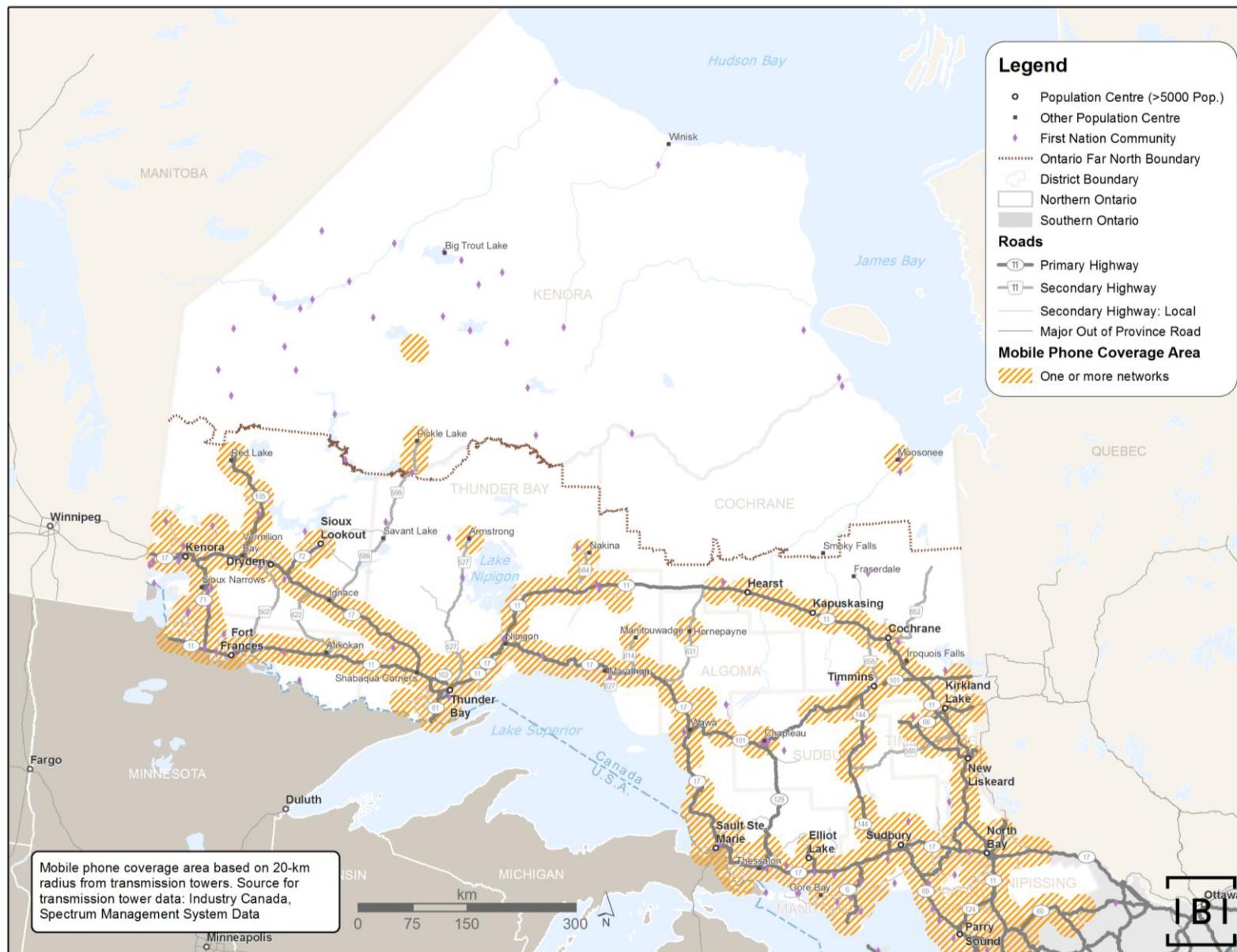
## **All-Season Road Access Considerations**

A long-term solution to the issues relating to winter roads in Northern Ontario is to upgrade at least selected sections to all-season roads.

First Nations may vary in their desire for all-season road access. As one example, Cat Lake First Nation, currently accessible by winter road from Pickle Lake, has expressed interest in having all season road access. The community supports the minimum number of routes needed for economic development while maintaining the current land use in the area (Cat Lake First Nation; Slate Falls First Nation; Ministry of Natural Resources Ontario, 2011). Other communities may wish to maintain the current level of transportation access provided by seasonal winter roads and a remote airport.

Community concerns relating to all-season roads include easier transportation of contraband substances, and that non-Indigenous individuals seeking hunting and fishing locations would have easier access to the communities' traditional lands, affecting the communities' resources.

**Exhibit 8.1: Cell Phone Coverage in Northern Ontario**



**Note:** The coverage area indicated is an estimate only, and is based on a set distance from transmission tower locations. Signal strength will vary within the coverage area, and there may be gaps or coverage not reflected in the map.

Permafrost can create a solid base for transportation infrastructure. However, a changing climate will degrade permafrost and change soil stability. Construction methods for building permanent ground-based transportation infrastructure must take into account the potential for inconsistent soils and resultant structural instability for in the summer season.

In addition, aggregate resources may be limited in some areas and may affect the ability to construct all-season roads.

### **Species-at-Risk Protection**

Several species at risk can be found within the Far North of Ontario including the Boreal population of Caribou. Species that are listed on the Species at Risk in Ontario List as threatened or endangered receive species and habitat protection under the Endangered Species Act. When determining the feasibility of locations for new winter or all season roads, consideration should be given to whether negative impacts on the species or its habitat can be avoided. If not, an authorization would be required, which may include conditions to minimize adverse effects or achieve an overall benefit for the species.

## **8.2 Opportunities**

### **All-Season Road Connections being Considered by Remote Communities**

Several remote First Nations are at various stages of considering connecting to the all-season road network, as follows:

- Plans are underway to extend Pickle Lake Road (also called the Northern Ontario Resources trail, or NORT) northerly from its current end point about 200 km northwest of Pickle Lake to North Caribou Lake First Nation, replacing a 40-km winter road. Working with INAC and MNDM, several planning and preliminary construction tasks have also been completed, including completing a feasibility study, clearing of the right-of-way, detailed design for a bridge across the “narrows”, and securing funding for the bridge, for a portion of the all-season road, and for long-term maintenance.
- INAC has also been working with Shoal Lake #40 First Nation southwest of Kenora to construct an all-season road to their community.
- A number of First Nations communities north of the Berens River are pursuing road access options across the Berens River to connect to

the all-season road network. . There have been ongoing discussions among communities and a general desire to continue moving forward in this direction. Challenges include gaining community agreement and identifying a corridor that does not impact environmentally or culturally sensitive areas. One challenge for either the winter road or the future all-season road extension is crossing Berens River, flowing westerly toward Manitoba. Currently, Pikangikum – the closest of these communities to the all-season road network – is connected to Nungesser Road by a 33-km winter road.

- Four of the five Matawa<sup>5</sup> remote communities are receiving combined support from INAC and MNDM to realign their winter roads to higher ground with a view to future all-season road development potential; these new alignments would connect to the planned Noront Ring of Fire road. The fifth Matawa member community is currently studying a separate all-season road route.
- Other activities such as bridge design studies and road routing studies are being pursued by Muskrat Dam, Kasabonika Lake, and Wunnumin Lake First Nations, all with the intent to support and/or advance eventual all-season road development.
- Mushkegowuk Tribal Council is also undertaking a Feasibility Study to construct an all-season road to connect the communities of Attawapiskat, Kashechewan, Fort Albany, Moose Factory and Moosonee to each other and to the Ontario highway network.

Note that under the *Far North Act, 2010*, most development in the Far North of Ontario is prohibited from proceeding in advance of a jointly approved community based land use plan for the area unless an order is made to except or exempt an individual project. Where a community based land use plan is in effect any development must be consistent with the direction contained in the approved plan.

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<sup>5</sup> Matawa First Nations include Eabametoong, Marten Falls, Neskutange, Nibinamik and Webequie remote First Nations, as well as Aroland, Constance Lake, Ginoogaming, and Lake #58 First Nations.

## **Connected Corridors for Route Redundancy**

A winter road link providing a connection between the north ends of the North Caribou and Kingfisher winter road corridors has been completed in recent years between Kitchenuhmaykoosib Inninuwug and Wapakeka. With improved information-sharing about current route conditions on each corridor, each corridor could better serve as a redundant route for the other corridor, in the event of winter road segment closures.

## **Enhanced Construction Practices to Reduce Winter Road Construction Time and Improve Road Quality**

The Government of the Northwest Territories has identified a number of strategies that can improve winter road construction and maintenance practices and extend the operating season of winter roads, as discussed earlier in Section 6.2. These include, for example, having construction take place at more than one location rather than proceeding from one end of the road only; generally in Northern Ontario, construction begins at the community and continues southward toward the all-season road connection.

## **Alternative Models of Winter Road Governance**

Jurisdictions such as Manitoba and the Northwest Territories have very different models of providing winter roads where the Province/Territory has a more direct role in construction as well as in setting and maintaining standards. In both jurisdictions, the Department of Transportation has a direct role in determining standards and direct responsibility for construction of the winter road system, which is done by contracting work to local First Nation-owned companies. This can put much less financial burden on the communities compared to the current model, as contractors could be paid as the work is completed. The Province could potentially better allocate resources based on the needs of particular road segments rather than on a straight per-kilometre basis.

However, some Far North communities may not welcome a more direct role by the Province, resulting in potentially less direct control by the community. A specifically made-for-Ontario solution is needed that would better ensure a higher quality of winter road for all users.



## **Advanced Technologies**

A number of technological advancements can help with many aspects of road construction from planning to construction to maintenance and information sharing. These include the following, among others:

- Ground-penetrating radar: this can greatly increase the frequency and accuracy of measuring ice thickness, with benefits for both road construction and maintenance phases, while also better preserving the integrity of the road system compared to ice boring methods.
- Online applications for information-sharing about winter road conditions, such as the one showing the condition of Northwest Territories highways and winter roads (discussed in Section 6.2), which are increasingly easy to implement.
- Alternative construction methods such as the use of geothermal blankets, which is being explored in Northwest Territories and other jurisdictions.
- Induction counters such as those installed at select corridors in the 2015–2016 season: the use of these could be expanded to provide better information about traffic levels and the needs of the winter road corridors.

## **Connection to the Power Grid**

The majority of communities connected by winter roads are not connected to Ontario's transmission system<sup>6</sup>; these communities therefore depend critically on winter road shipments of large volumes of diesel fuel for the community diesel generation facilities that provide power through community distribution systems to schools, health care clinics, band offices, homes and businesses throughout the year. Reliability of delivery of these supplies is essential to the well-being of remote communities. Supplemental shipments of diesel fuel by air (and sometimes marine) modes are also sent throughout the year, at a significantly higher cost. As the winter road operating season becomes shorter, an increasing proportion of diesel fuel is being delivered by air.

A Draft Remote Community Connection Plan prepared by the former Ontario Power Authority (now the Independent Electricity System Operator) has

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<sup>6</sup> A high-voltage transmission line built by Five Nations Energy Inc. along James Bay in 2000 – 2003 connects Attawapiskat, Kashechewan, Fort Albany and Moose Cree to Hydro One's system at Moosonee. In the Pickle Lake area, Slate Falls and Cat Falls are also currently connected to the hydro grid. The remaining remote Far North First Nations are currently not connected. Mishkeegogamang is also not connected, but has all-season paved road access and is not numbered among the remote communities for the Northern Ontario Multimodal Transportation Strategy.

identified that there is an economic case to connect up to 21 remote communities at this time. Wataynikaneyap Power, a partnership of 22 Ontario First Nations together with Fortis-RES, an electricity transmitter, is seeking to build, own and operate transmission infrastructure to connect remote First Nations in the Far North of Ontario to the grid. Alternatives to diesel generation are being explored for the remaining communities where grid connection is not economical, including Fort Severn and Weenusk on Hudson Bay.

The connection to the power grid or to using alternative power sources (e.g. wind or solar power) will help communities to focus less on shipping diesel and more on shipping other goods such as food and construction materials to help improve their quality of life.

There may also be opportunities to coordinate the construction and maintenance of the transmission lines with realignments or other improvements to the winter road corridors. A number of these communities are working with the Ministry of Natural Resources and Forestry (MNR) on the development of community based land use plans under the Far North Act, 2010. A Far North Land Use Strategy is being prepared to provide joint First Nation – Ontario planning teams with guidance to help them consider landscape-level matters, such as roads, transmission corridors, and other infrastructure, that go beyond the scope of individual plans. This would align with Growth Plan direction for synergies between different types of infrastructure.

### **Potential for Partnership with First Nation Police Services**

Most of the remote First Nations in the Far North have a local police service. Even the winter roads are public roads, enforcement of the roads by Ontario Provincial Police is very sporadic. A potential for partnership with Nishnawbe Aski Police Services (NAPS) to increase enforcement of the roads would increase safety for all winter road users.

Enforcement could also help winter road quality. For example, daytime restrictions for heavy vehicles on water crossings are in place at the end of the season when daytime temperatures are above zero, but these restrictions are currently difficult to enforce — especially in the absence of rest facilities for drivers who would need to wait several hours before crossing.

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## Alternate Text for Exhibits

### **Exhibit 1.1: James Bay Corridor Winter Road**

This photo shows tanker trucks on a wide snow covered winter road. Small trees are visible on either side of the road.

Return to **Exhibit 1.1**

### **Exhibit 1.2: Northern Ontario Multimodal Transportation Infrastructure**

This map shows the roads, railways, and airports that make up Northern Ontario's transportation system. Airports are classified as remote, municipal, or international. Roads are classified as primary, secondary, other all-season, winter, or major out of province. Active railways are distinguished by owner. Marine features are distinguished as major ports, other ports, or provincial ferries. International border crossings are also noted. The Far North boundary is shown, as are the approximate southern limits of continuous permafrost and discontinuous permafrost.

Return to **Exhibit 1.2**

### **Exhibit 1.3: Winter Road Corridors and Count Locations**

This map shows the nine winter road corridors in Northern Ontario and the location of the four vehicle counters. From approximately West to East the corridors are Lake of the Woods, Western, North Caribou, Cat Lake, Kingfisher, Webequie, Marten Falls, Hudson Bay, and James Bay. The counters from West to East are located in the corridors of North Spirit Lake, North Caribou Lake, Kingfisher, and Webequie. The map includes airports, which are classified as remote, municipal, or international. Roads are classified as primary, secondary, other all-season, winter, or major out of province. Active railways are distinguished by owner.

Return to **Exhibit 1.3**

### **Exhibit 2.1: First Nations and Treaties in Ontario**

This map displays all of the Indigenous Treaties in Ontario. The map includes treaty boundaries and dates, in addition to Indigenous settlements, First Nation Reserves, and the Provisional Algonquin Settlement Area. Highways are included distinguished as Trans-Canada or other highway.

Return to **Exhibit 2.1**

**Exhibit 3.1: Ontario Winter Roads Daily Traffic Counts — Select Corridors, 2016**

This line chart shows the number of daily vehicles that were counted by traffic counters on four winter road corridors during the 2016 winter road season. The corridors are North Spirit Lake, North Caribou Lake, Kingfisher, and Webequie.

Return to **Exhibit 3.1**

**Exhibit 3.2: Winter Roads Weekly Traffic Counts — Select Corridors, 2016**

This bar chart shows the number of weekly vehicles that were counted during the 2016 winter road season on four corridors. The corridors are North Spirit Lake, North Caribou Lake, Kingfisher, and Webequie.

Return to **Exhibit 3.2**

**Exhibit 6.1: Northwest Territories Highway Conditions Interface, Including Winter Roads Information**

This exhibit is a screenshot of the Northwest Territories Highway condition user interface. The interface displays a map of the winter road network and colour codes indicating the sections of road that are open or closed, the bridges that are open or closed, and which sections of road are under advisory. Users can also access a road camera.

Return to **Exhibit 6.1**

**Exhibit 8.1: Cell Phone Coverage in Northern Ontario**

This map shows the mobile phone coverage area. Roads are also included and are classified as primary, secondary, secondary local, or major out of province.

Return to **Exhibit 8.1**



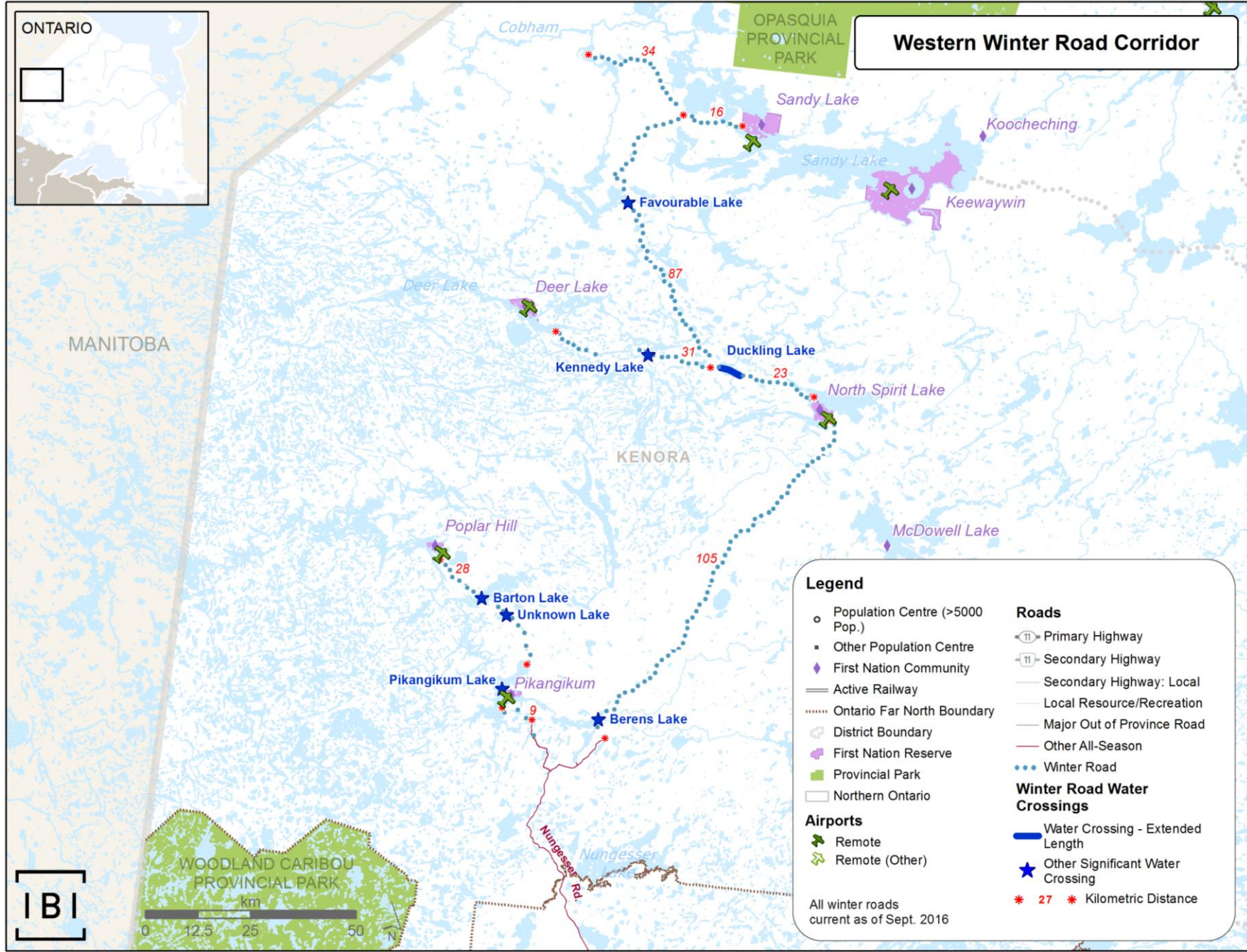
# Appendix A: Winter Road Corridor Maps

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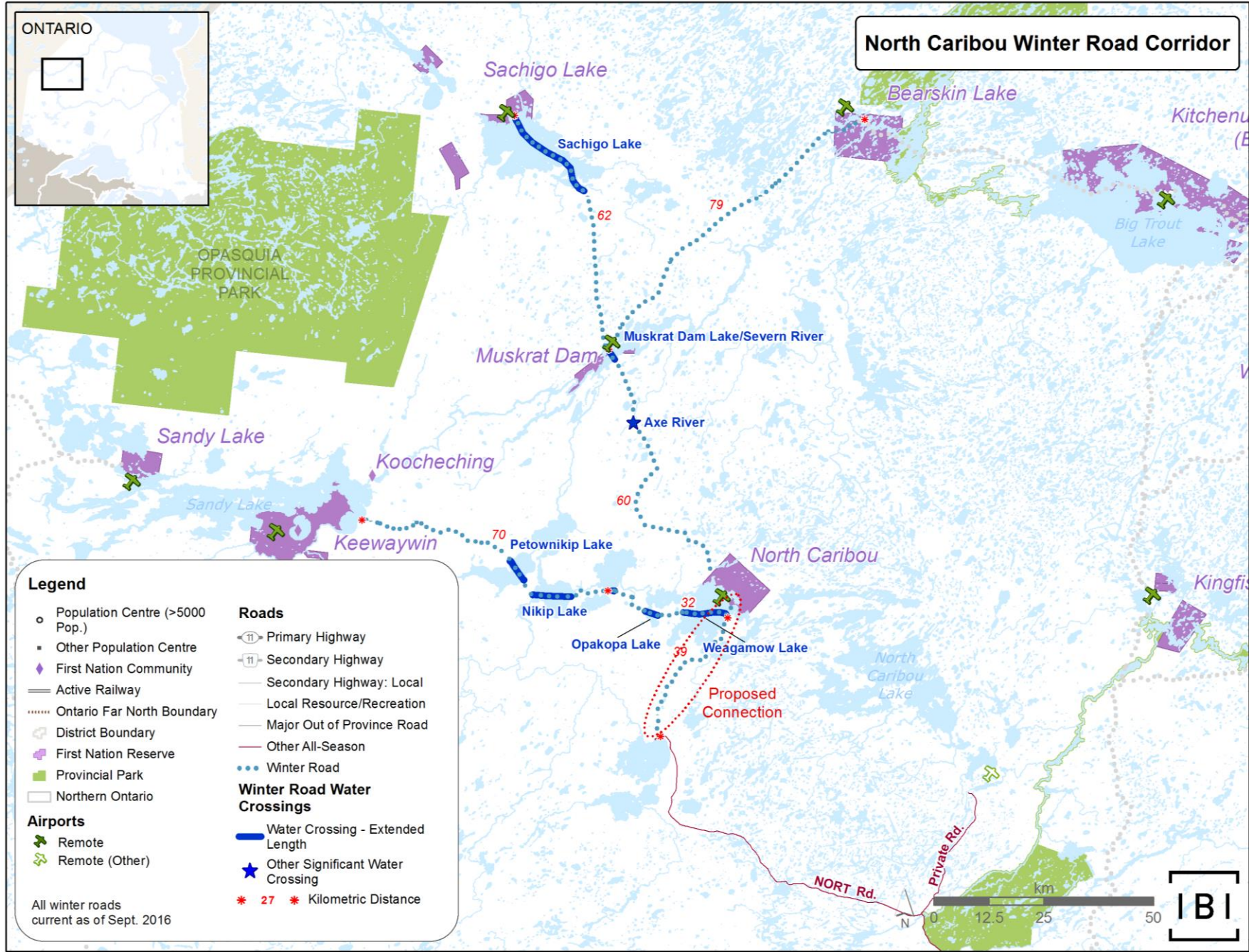




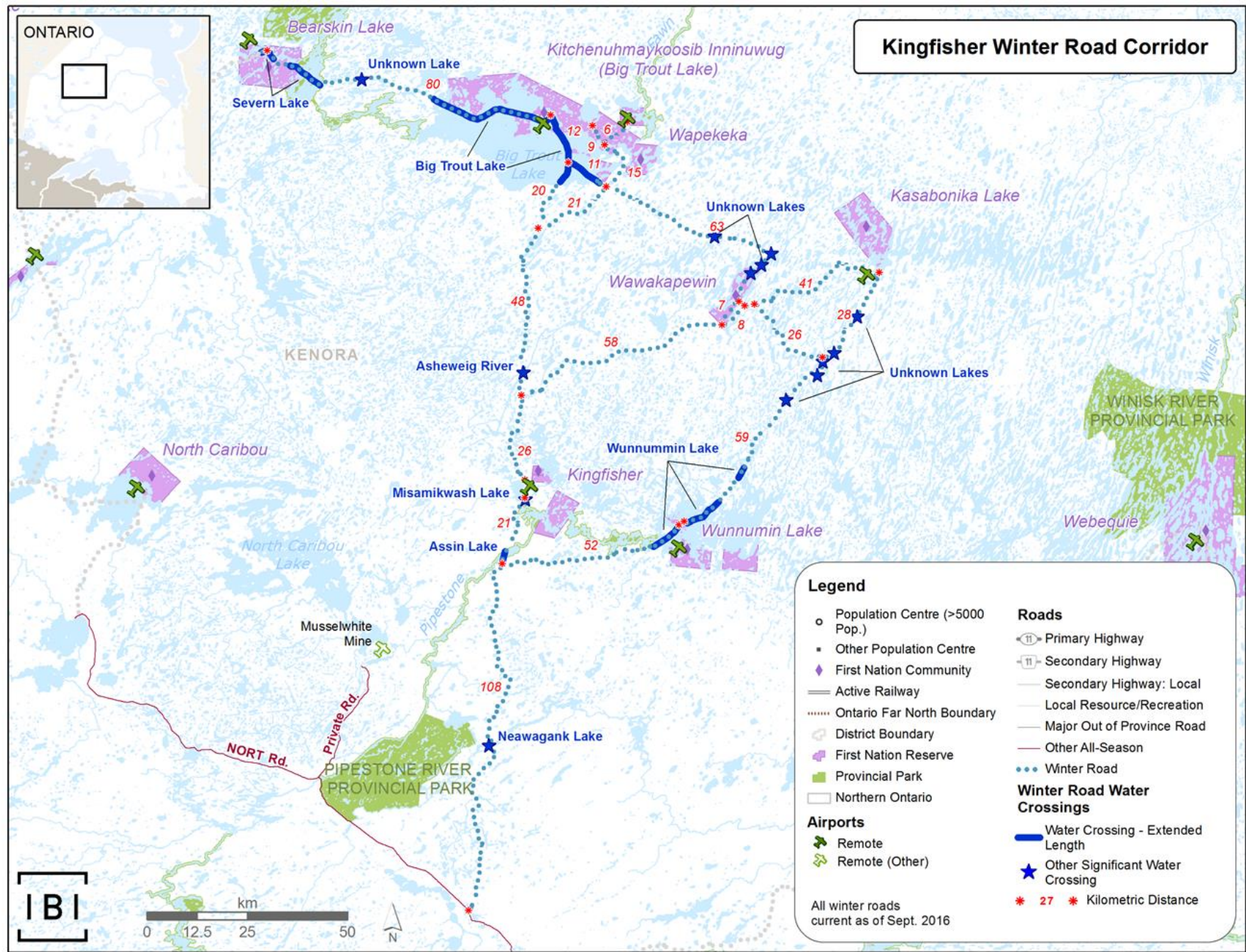
**IBI GROUP DRAFT TECHNICAL BACKGROUNDER: WINTER ROADS**  
Prepared for the Ontario Ministry of Transportation and Ministry of Northern Development and Mines



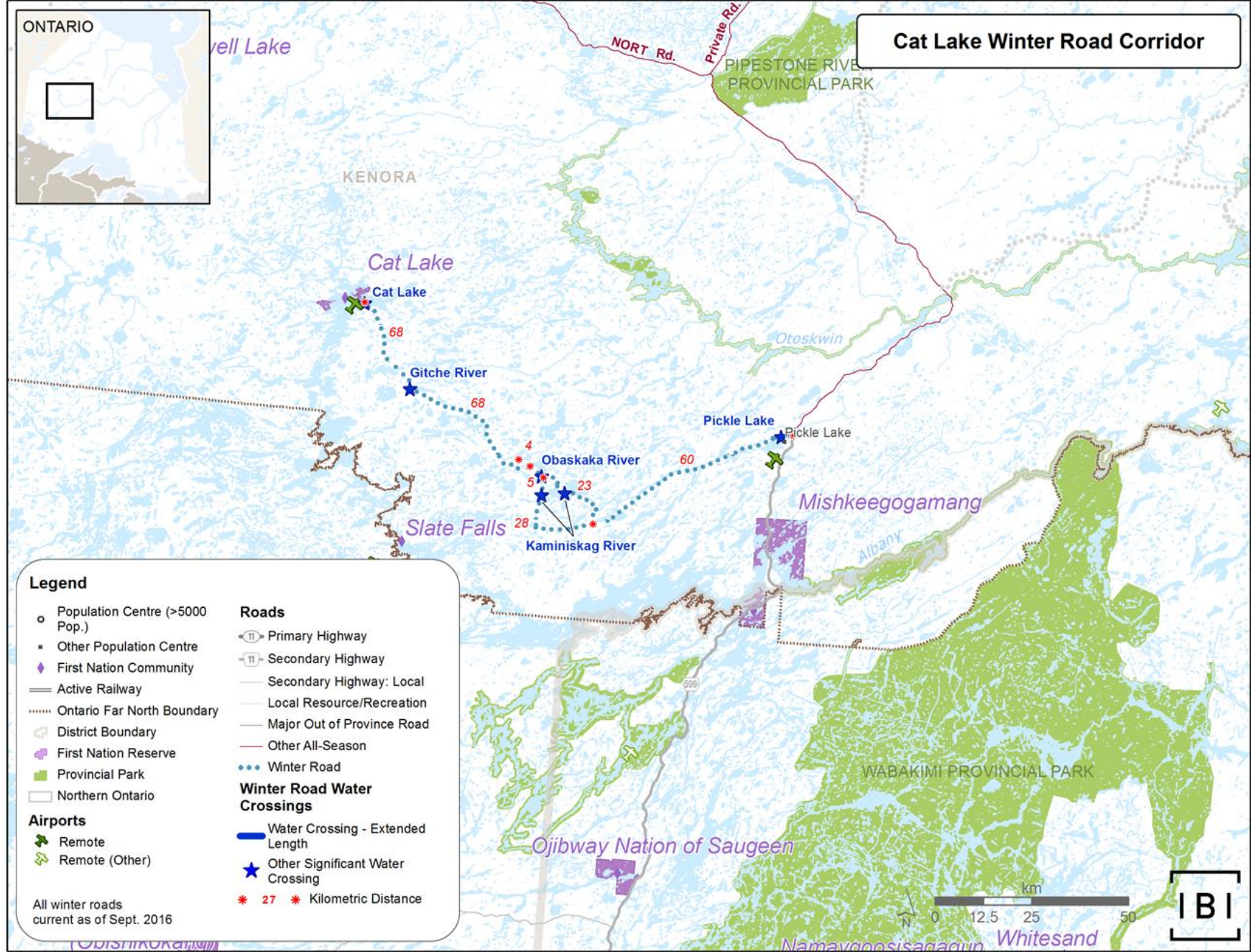




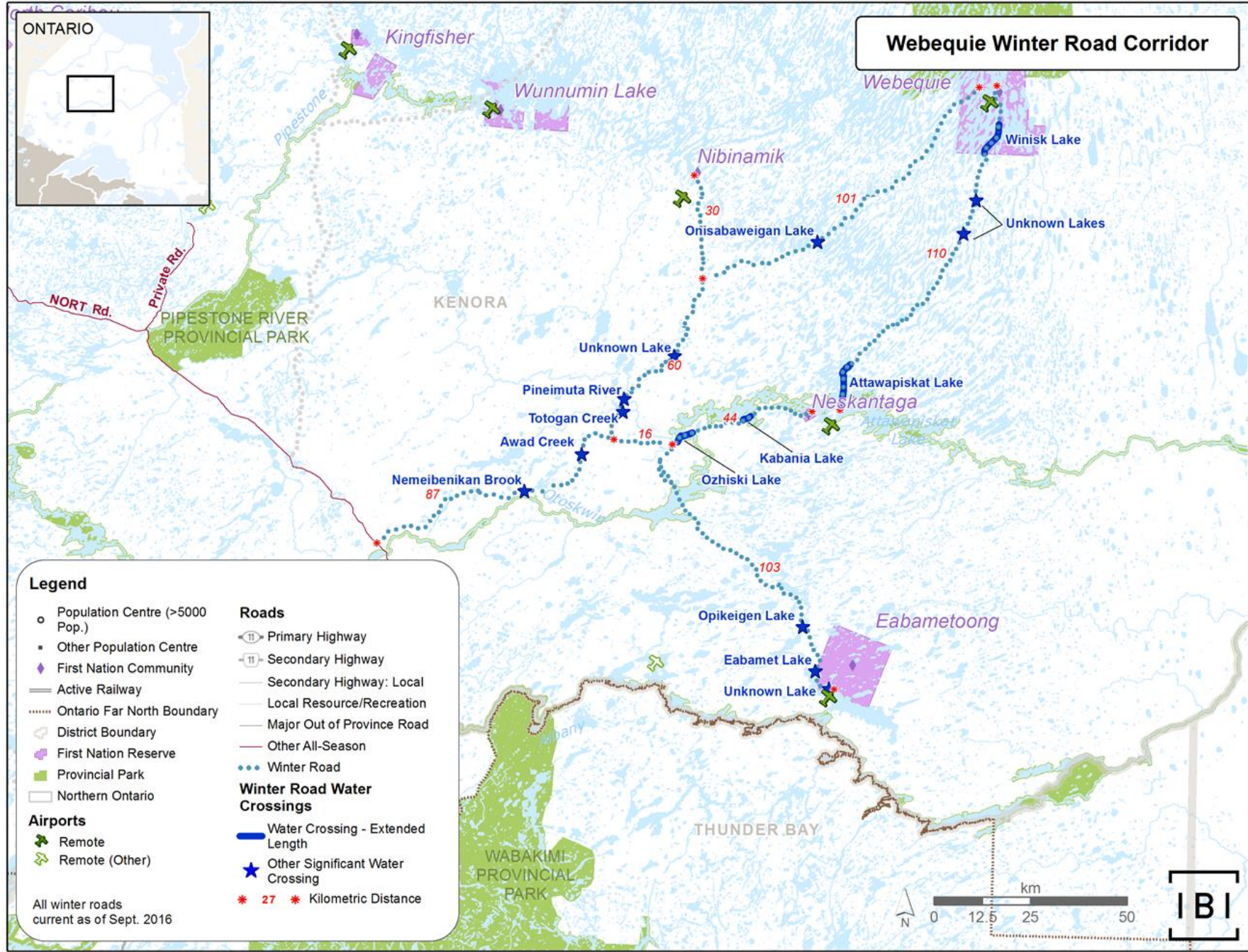








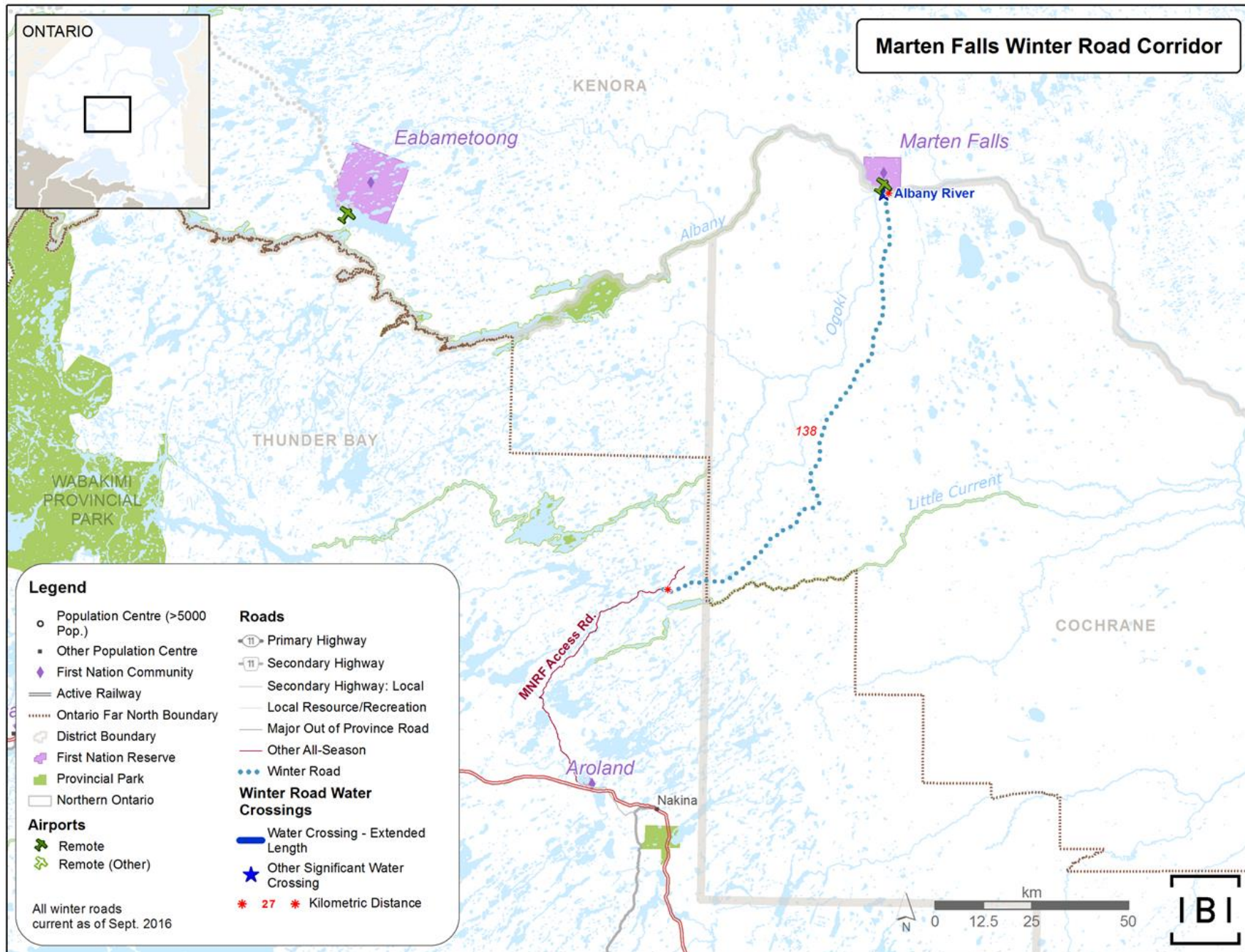




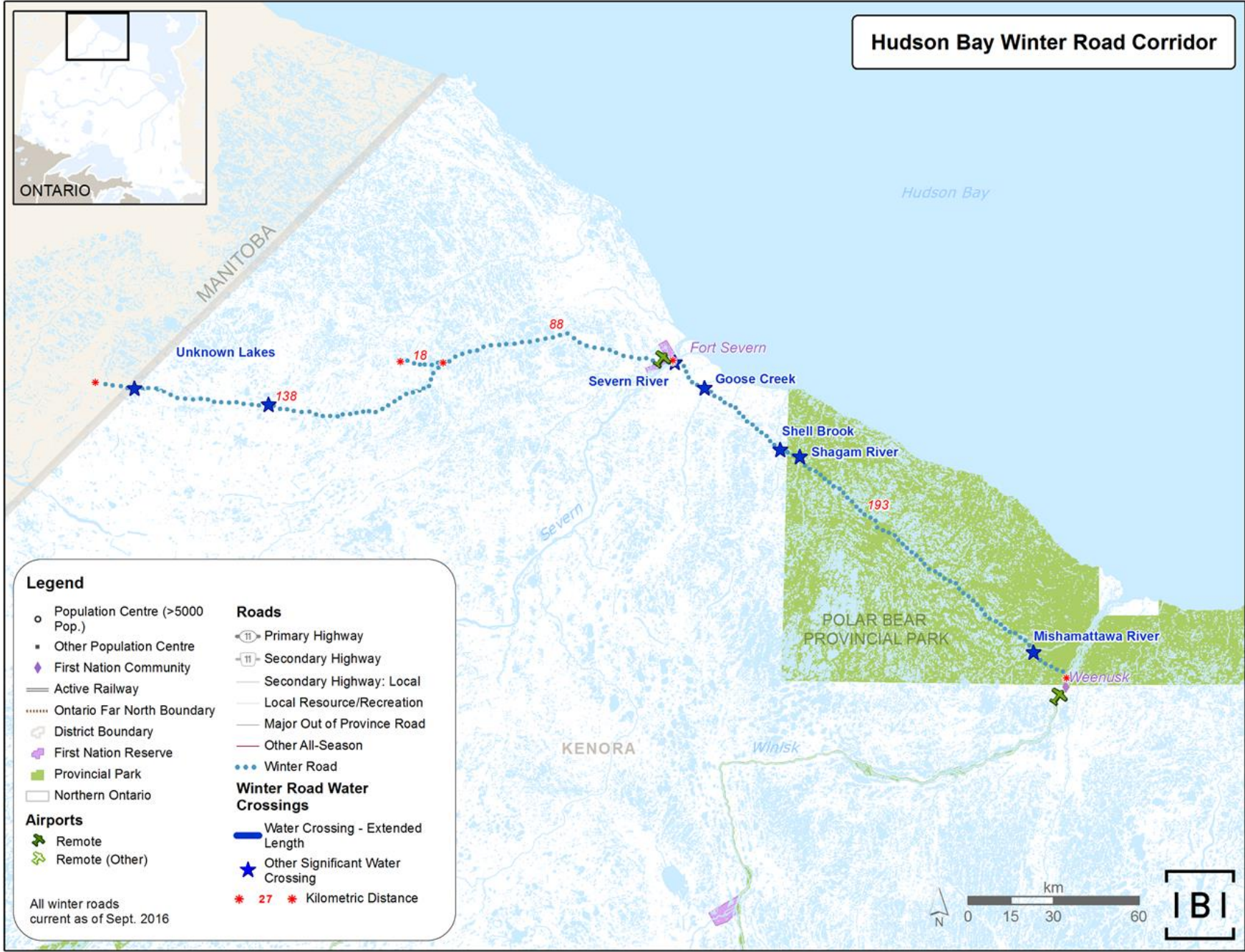


# IBI GROUP DRAFT TECHNICAL BACKGROUNDER: WINTER ROADS

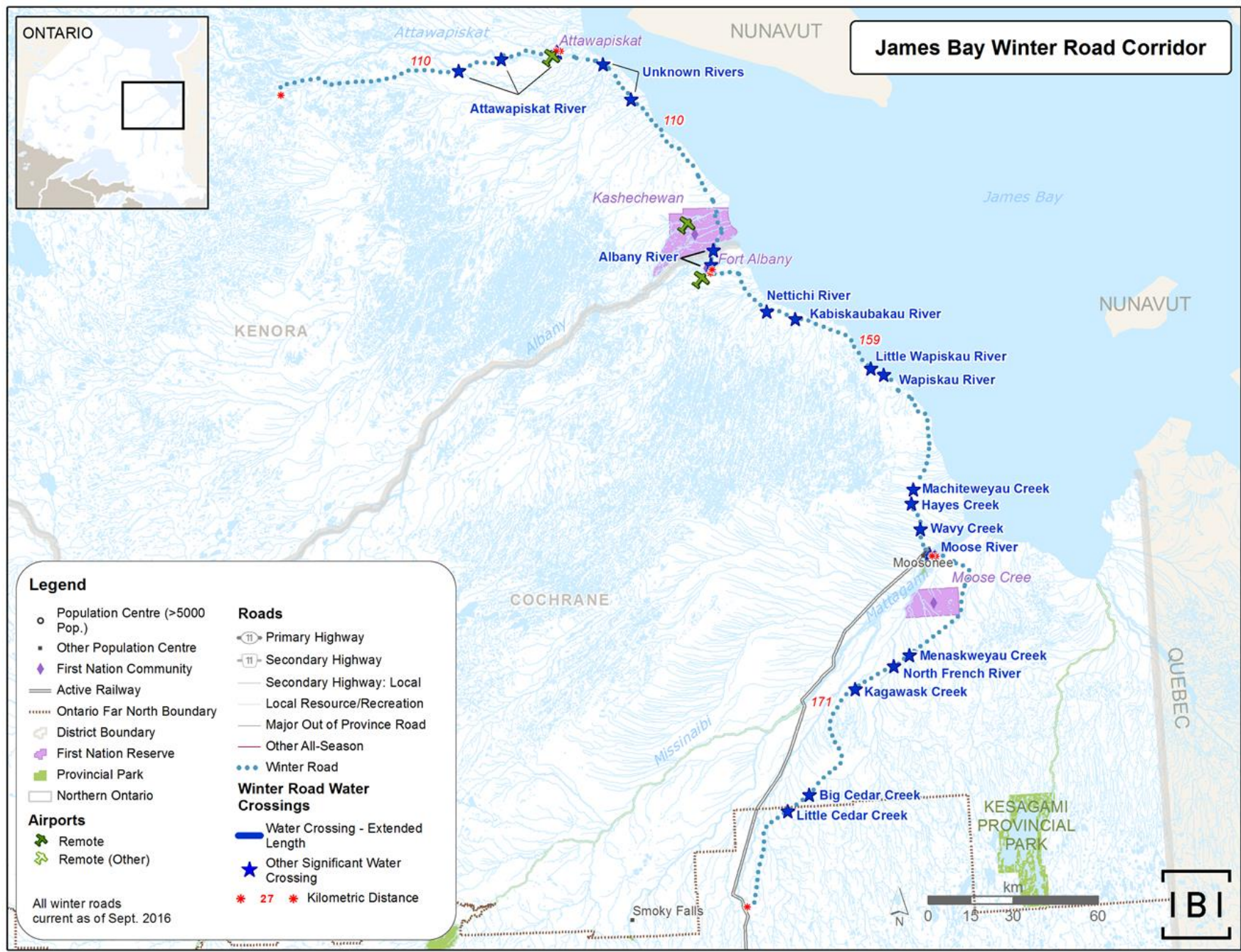
Prepared for the Ontario Ministry of Transportation and Ministry of Northern Development and Mines



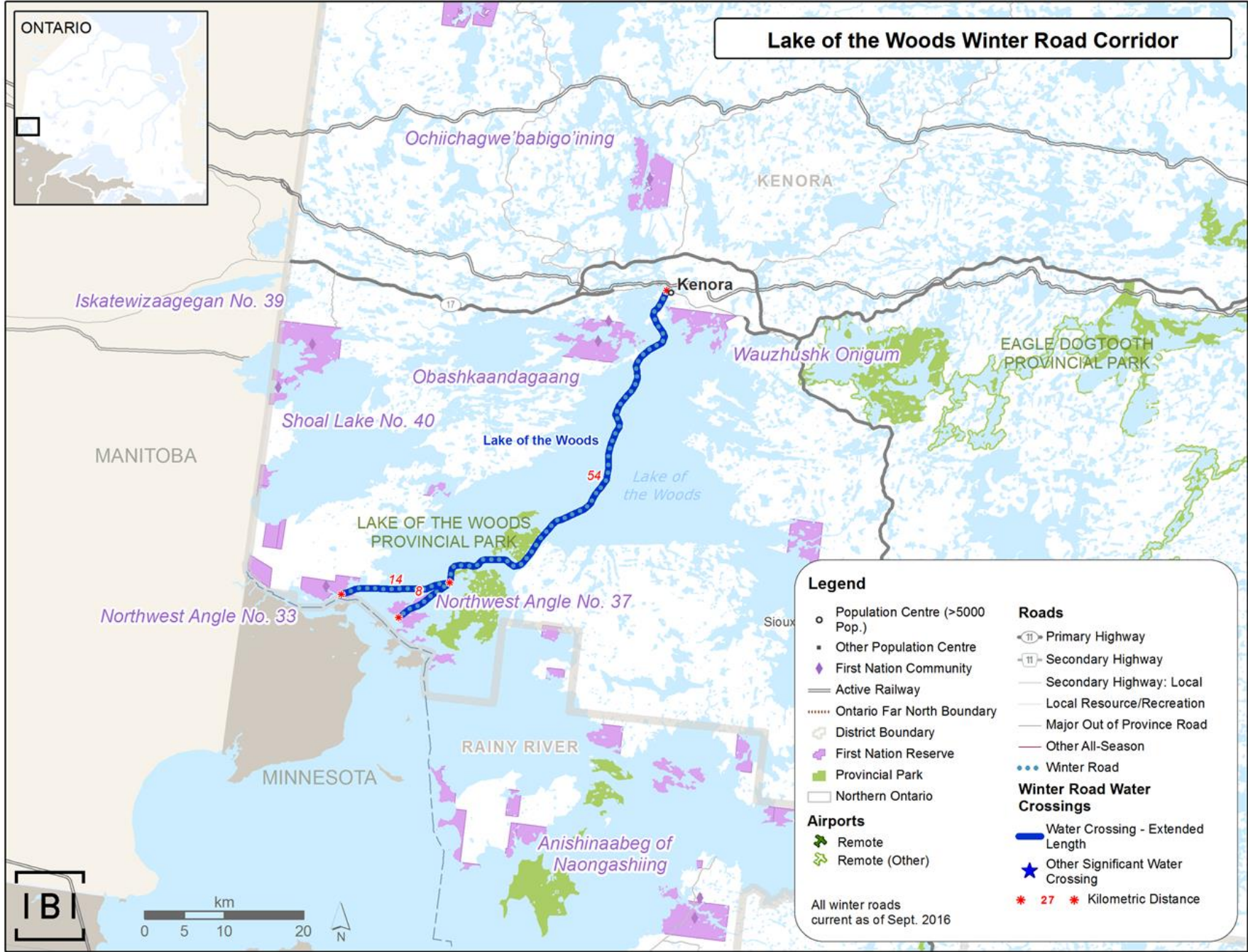




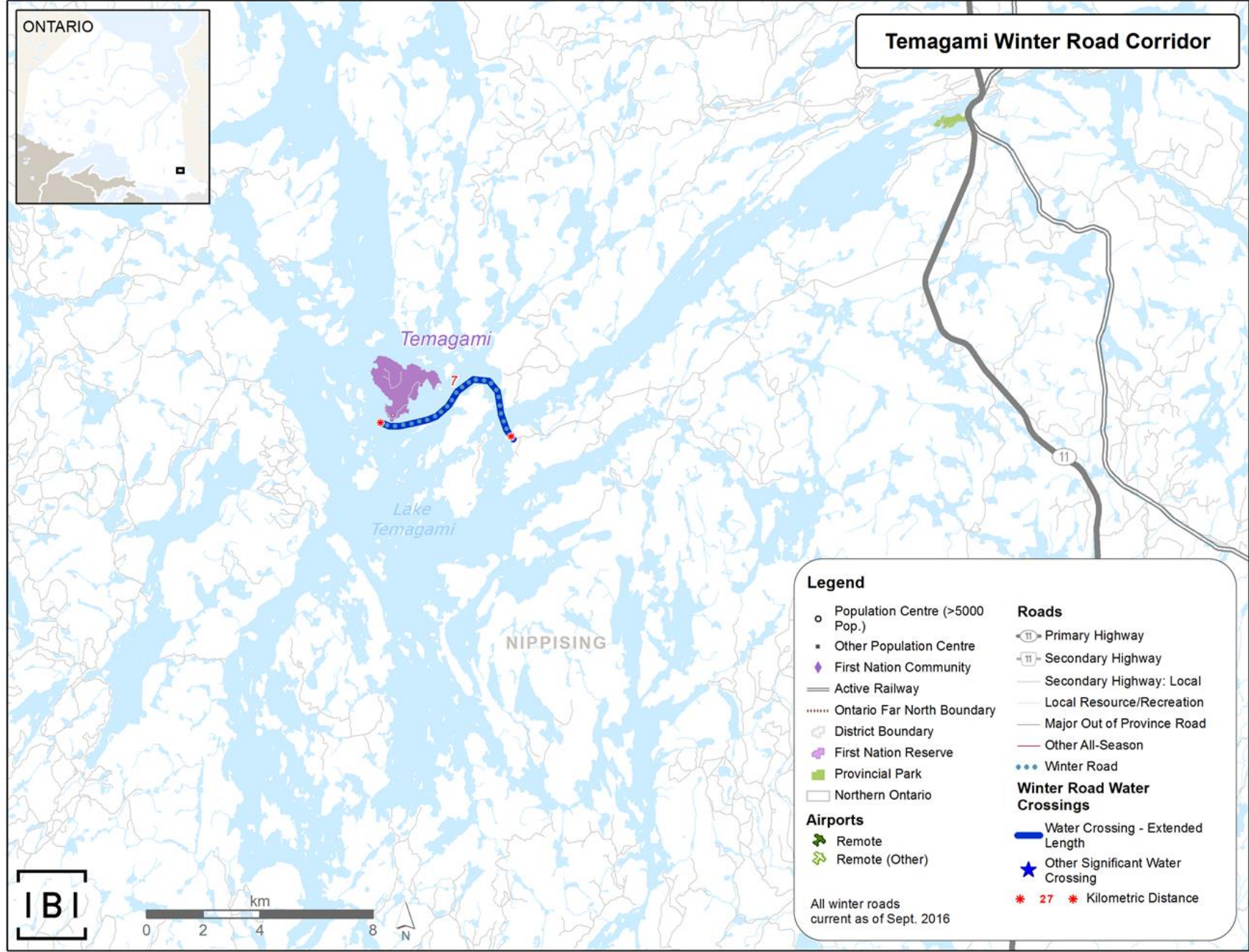












## **Alternate Text for Winter Road Corridor Maps**

### **Western Winter Road Corridor**

This map provides details of the winter roads within the Western corridor including alignment as of September 2016, water crossings, and kilometric distance between certain points. Water crossings are distinguished as extended length or other significant crossings, both of which are named for the body of water that they cross. All-season roads are classified as primary, secondary, other all-season, or major out of province. Remote airports are also included.

### **North Caribou Winter Road Corridor**

This map provides details of the winter roads within the North Caribou corridor including alignment as of September 2016, water crossings, and kilometric distance between certain points. Water crossings are distinguished as extended length or other significant crossings, both of which are named for the body of water that they cross. All-season roads are classified as primary, secondary, other all-season, or major out of province. Remote airports are also included. This map includes a proposed connection between NORT Road and the community of Weagamow Lake.

### **Kingfisher Winter Road Corridor**

This map provides details of the winter roads within the Kingfisher corridor including alignment as of September 2016, water crossings, and kilometric distance between certain points. Water crossings are distinguished as extended length or other significant crossings, both of which are named for the body of water that they cross. All-season roads are classified as primary, secondary, other all-season, or major out of province. Remote airports are also included.

### **Cat Lake Winter Road Corridor**

This map provides details of the winter roads within the Cat Lake corridor including alignment as of September 2016, water crossings, and kilometric distance between certain points. Water crossings are distinguished as extended length or other significant crossings, both of which are named for the body of water that they cross. All-season roads are classified as primary, secondary, other all-season, or major out of province. Remote airports are also included.

### **Webequie Winter Road Corridor**

This map provides details of the winter roads within the Webequie corridor including alignment as of September 2016, water crossings, and kilometric distance between certain points. Water crossings are distinguished as extended length or other significant crossings, both of which are named for the body of

water that they cross. All-season roads are classified as primary, secondary, other all-season, or major out of province. Remote airports are also included.

### **Marten Falls Winter Road Corridor**

This map provides details of the winter roads within the Marten Falls corridor including alignment as of September 2016, water crossings, and kilometric distance between certain points. Water crossings are distinguished as extended length or other significant crossings, both of which are named for the body of water that they cross. All-season roads are classified as primary, secondary, other all-season, or major out of province. Remote airports are also included.

### **Hudson Bay Winter Road Corridor**

This map provides details of the winter roads within the Hudson Bay corridor including alignment as of September 2016, water crossings, and kilometric distance between certain points. Water crossings are distinguished as extended length or other significant crossings, both of which are named for the body of water that they cross. All-season roads are classified as primary, secondary, other all-season, or major out of province. Remote airports are also included.

### **James Bay Winter Road Corridor**

This map provides details of the winter roads within the James Bay corridor including alignment as of September 2016, water crossings, and kilometric distance between certain points. Water crossings are distinguished as extended length or other significant crossings, both of which are named for the body of water that they cross. All-season roads are classified as primary, secondary, other all-season, or major out of province. Remote airports are also included.

### **Lake of the Woods Winter Road Corridor**

This map provides details of the winter roads within the Lake of the Woods corridor including alignment as of September 2016, water crossings, and kilometric distance between certain points. Water crossings are distinguished as extended length or other significant crossings, both of which are named for the body of water that they cross. All-season roads are classified as primary, secondary, other all-season, or major out of province.

### **Temagami Winter Road Corridor**

This map provides details of the winter roads within the Temagami corridor including alignment as of September 2016, water crossings, and kilometric distance between certain points. Water crossings are distinguished as extended length or other significant crossings, both of which are named for the body of water that they cross. All-season roads are classified as primary, secondary, other all-season, or major out of province.