NORTHERN ONTARIO MULTIMODAL TRANSPORTATION STRATEGY

THE NORTHERN ONTARIO CONTEXT: IMPLICATIONS AND CONSIDERATIONS FOR STRATEGY DEVELOPMENT

Ontario

Ministry of Transportation
Ministry of Northern Development and Mines

Consulting Team: IBI Group | Hemson Consulting Ltd. | Stantec

DRAFT
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Northern Ontario Multimodal Transportation Strategy

The Ministry of Transportation, Ontario (MTO) and the Ontario Ministry of Northern Development and Mines (MNDM) are developing a Northern Ontario Multimodal Transportation Strategy. The Strategy will include direction to improve the transportation system — including road, rail, air and marine transport modes, and other key aspects of transportation — through a planning horizon of 2041, in a collaborative plan that will meet a variety of transportation planning objectives. The Strategy is being developed with the input of a wide range of public and private stakeholders, First Nations, Métis, and other Northern Ontario residents. For more information, visit www.nomts.ca.

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EXHIBITS

1 INTRODUCTION

The Ministry of Transportation, Ontario (MTO) and the Ministry of Northern Development and Mines (MNDM) are developing a Northern Ontario Multimodal Transportation Strategy (NOMTS, or the Strategy). This initiative will help implement the Growth Plan for Northern Ontario, 2011 which sets out a vision and directions to support development in Northern Ontario over the next 25 years.

NOMTS will adopt an integrated multimodal approach that considers road, rail, air and marine transport modes, and other important aspects of transportation. The Strategy will result in short-, medium- and long-term improvements and directions for the transportation system in Northern Ontario, which could include transportation policy, program and investment opportunities. Building on today's Northern Ontario transportation system (see Exhibit 1.1), the Strategy will recommend improvements for the movement of people and goods with an ultimate planning horizon of 2041.

The Strategy is being developed through a three-phase process:

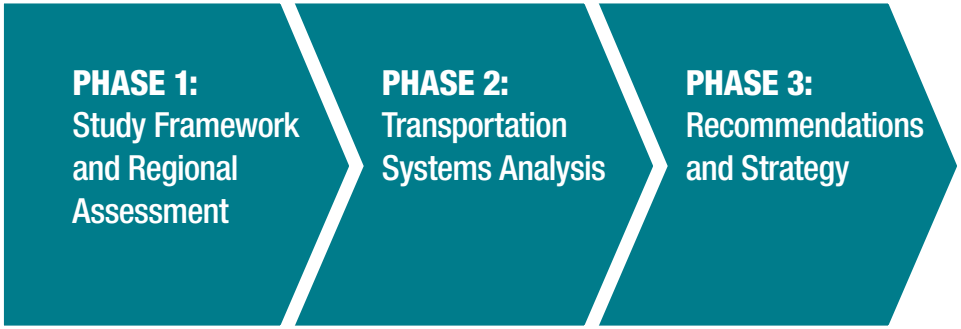
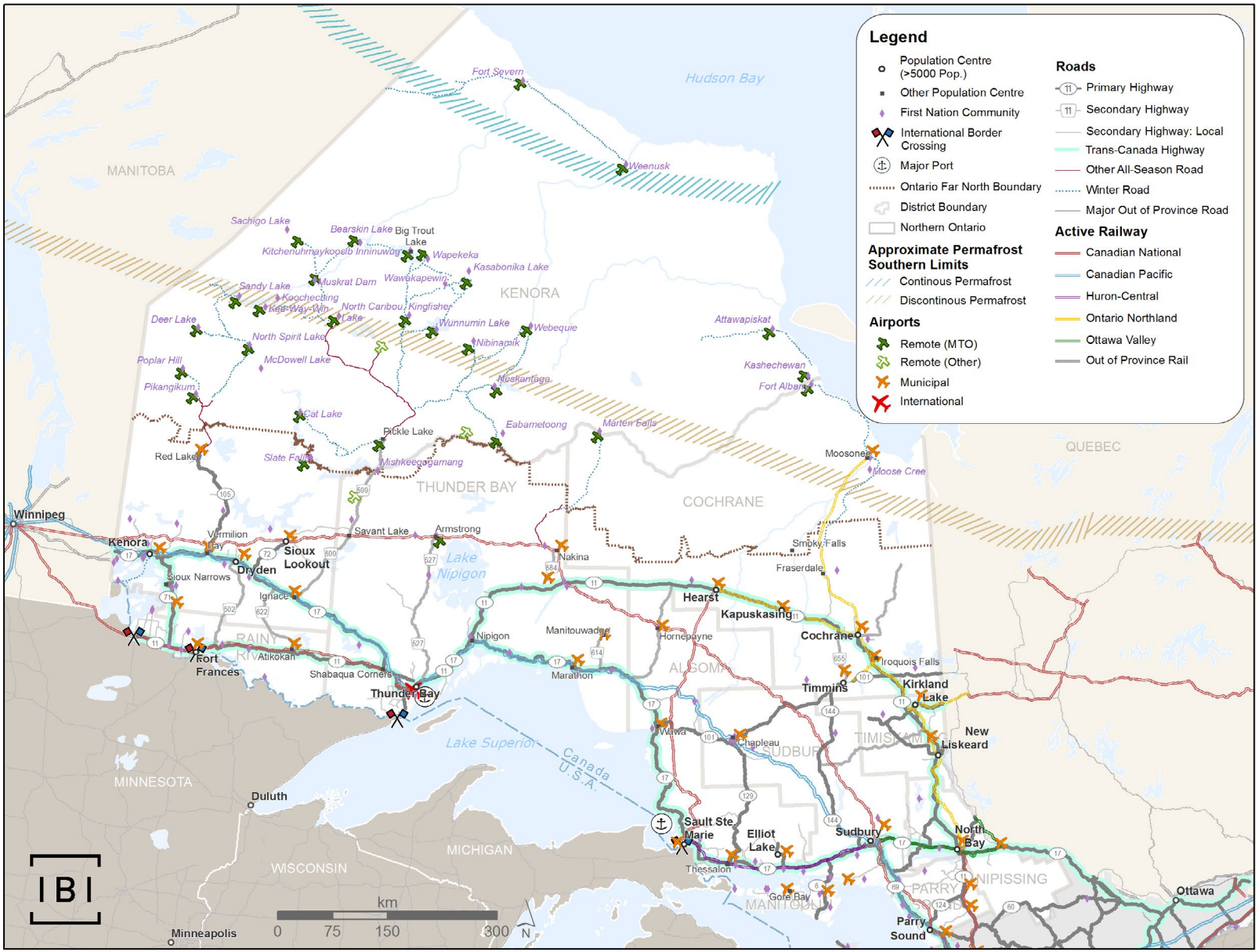


Exhibit 1.1: Map of Northern Ontario Transportation System Infrastructure



This report summarizes the findings of Phase 1 and outlines considerations and implications as they relate to the seven NOMTS planning objectives that were developed during earlier NOMTS outreach in 2011–2013.

Following this introduction, Section 2 of this report — The Northern Ontario Context – highlights the key findings of three recently completed technical background working papers:

- **Geographic and Planning Context:** This working paper describes the physical geography, climate and settlement patterns that have shaped Northern Ontario's transportation system. It also provides an overview of the region's governance systems and the planning and policy context.
- **Socio-Economic Context:** This working paper provides a demographic and economic analysis to support the identification of transportation infrastructure improvements and priorities over the next quarter-century.
- **Climate Change Context**: This working paper describes the current and anticipated impacts of climate change and extreme weather events on the transportation system in Northern Ontario, and discusses options and strategic directions to meet these challenges.

Section 3 of this report — Objectives, Challenges and Opportunities — discusses the seven planning objectives guiding the NOMTS work:

- Enhancing Mobility and Connections for Northern Communities;
- Improving Access for Remote Communities;
- More Efficiently Moving People and Goods between Northern and Southern Ontario;
- Enhancing Interprovincial Links and Border Crossings;
- Identifying and Integrating New Infrastructure to Support Major New Economic Development;
- Supporting Northern Ontario Tourism through Transportation Improvements; and
- Enhancing Connectivity and Access for Northern Industries.

These planning objectives have been identified following extensive outreach with public- and private-sector stakeholders as well as with First Nation and Métis peoples and communities. The planning objectives are being used to help organize the Strategy, to ensure that the Strategy is integrated, and to guide the Strategy development in meeting the Northern Ontario transportation needs identified to date.

Section 3 discusses key findings from the work to date in relation to the seven planning objectives guiding the NOMTS work.

Section 4 — Next Steps — summarizes how the Phase 1 work will inform the Phase 2 technical analysis and the development of the overall Strategy, and identifies sources of further information.

2 THE NORTHERN ONTARIO CONTEXT

The NOMTS aims to provide vision and direction to address the unique challenges and to realize the unique opportunities facing the Northern Ontario transportation system. To be achievable, this vision must be based on a solid understanding of the Northern Ontario context.

This section highlights findings regarding the Northern Ontario context, and describes their implications as they relate to Strategy development. These are documented more fully in the three Phase 1 working papers.

2.1 Geographic and Planning Context

Northern Ontario's geography, governance, planning and policy context have had a major influence on the formation of the region's transportation system, and will continue to shape its development. Related Phase 1 findings are summarized here, and are described more fully in the NOMTS Working Paper 1, *Geographic and Planning Context*.

The Geography of Northern Ontario

The physical geography and climate of Northern Ontario has shaped how Northern communities and economic activities have developed, and can pose significant challenges for transportation planners and providers. Exhibit 2.1 shows the major physiographic regions of Northern Ontario, which are described below.

Canadian Shield. The Canadian Shield is characterized by rugged and rocky topography, dense forest cover and many lakes and swampy areas, as shown in Exhibit 2.2. These features make construction, maintenance and operation of roads, rail lines and airports difficult and expensive, especially considering the long distances spanned.

Historically, highway and railway alignments have generally avoided the most rugged terrain of the Canadian Shield. For example, in Northeastern Ontario, Highway 17 follows a lower-elevation alignment close to the Great Lakes shoreline, and Highway 11 runs along a lower-elevation alignment on the north side of the Canadian Shield including the Clay Belt area. The region's major urban centres are located along or near these primary highway corridors. Similarly, rail lines avoid the high elevations and rugged terrain in the area northwest of Elliot Lake.

The Far North of the Canadian Shield has only two all-weather road corridors, with a combined length of a few hundred kilometres. These roads have gravel surfaces, with the exception of Highway 599 to Pickle Lake, which is paved. Highway 599 links the NORT road, located north of Pickle Lake, to the provincial highway network.

Exhibit 2.1: Physical Geography of Northern Ontario

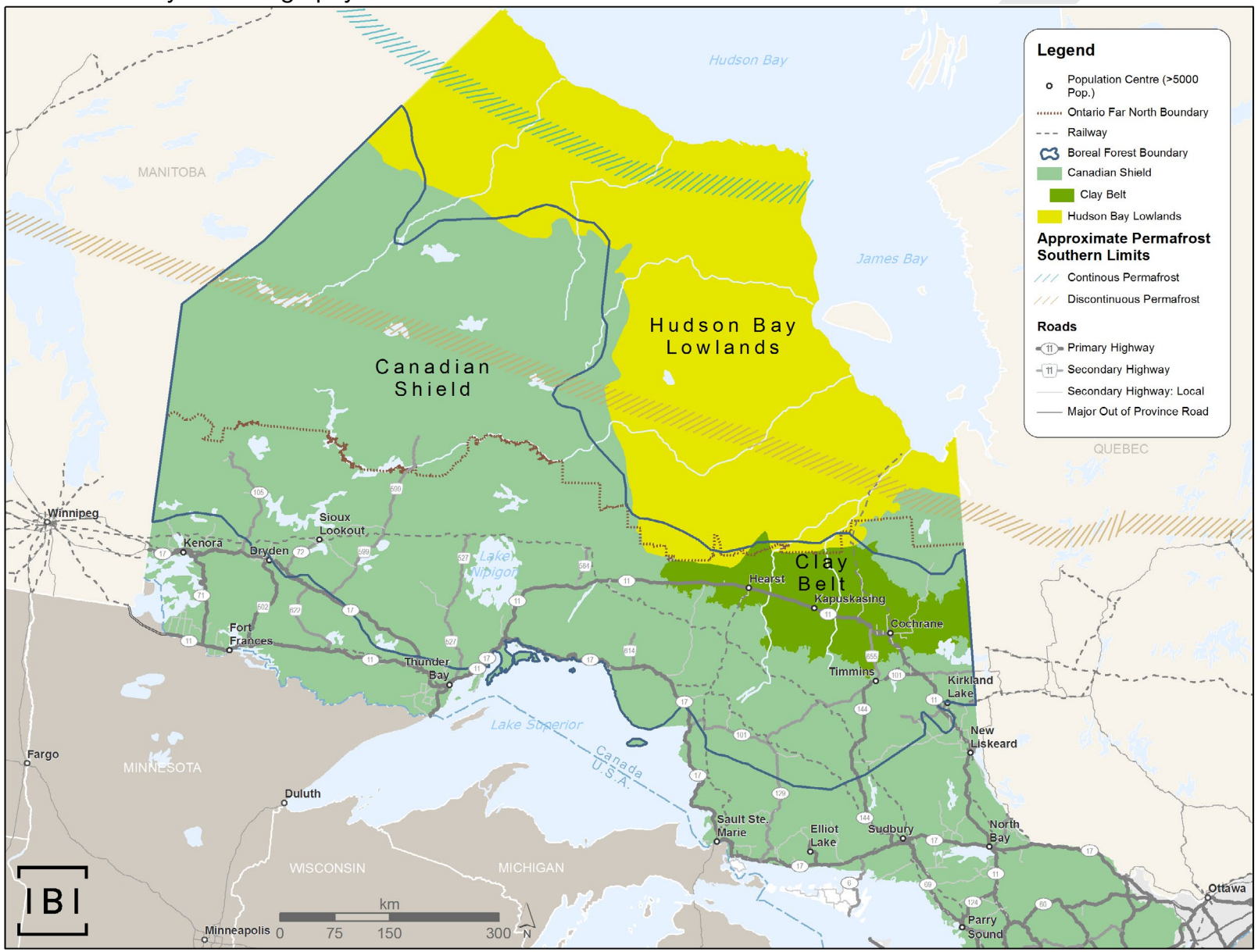


Exhibit 2.2: Typical Landscapes of the Northern Ontario Canadian Shield

Typical Rocky Outcrop

Typical Boreal Forest

Photo Credit: peupleloup

Hudson Bay Lowlands. Land elevations in the Hudson Bay Lowlands are close to the sea level of neighbouring Hudson Bay, and typical landscapes include numerous lakes, rivers and wetlands, as shown in Exhibit 2.3. The region's numerous water bodies, poorly drained wetlands, inconsistent soil structure due to patchy permafrost, and extensive tundra present engineering challenges for construction, maintenance, and operation of roads, railways and airports. Reflecting these challenges, the area is very sparsely populated compared to the rest of the province.

Rail connects Moosonee to the provincial highway network to the south, and the remaining Hudson Bay Lowlands communities are connected by winter roads operating seasonally, allowing vehicles to travel over frozen terrain and waterways, and by remote airports.

Exhibit 2.3: Typical Landscapes in Northern Ontario's Hudson Bay Lowlands

Typical Wetlands

Photo Credit: Chris Kyrzyk

Typical Tundra

Photo Credit: Ontario Biodiversity Council

Great Lakes, Hudson Bay and James Bay. The large water bodies bordering Northern Ontario affect the region's climate and weather. Proximity to Hudson Bay results in a sub-arctic climate in the more northerly parts of the region. To the south, Lake Superior's large water mass can moderate the summer and winter temperatures of nearby areas, though winter storms that move eastward across the lake can be particularly harsh as they reach its north shore.

The water bodies also provide marine transportation opportunities. Large cargo volumes from Western Canada — typically grain, coal, and fertilizer — are shipped from the Port of Thunder Bay to ports on the Great Lakes. Products from Northern Ontario — such as iron ore and steel — are shipped through the Essar Steel Algoma port at Sault Ste. Marie. Potential development of a deep water port on Ontario's northern coast is challenged by the shallow water depth and by the short ice-free season in Hudson Bay and James Bay, though climate change has the potential to increase the shipping season.

Clay Belt. The fertile soil of the Clay Belt supports agriculture to an extent, the primary limitations to agriculture being the Northern Ontario climate that offers a

shorter growing season and colder winters relative to other agricultural regions in Ontario and Canada, as well as poor drainage, which is being addressed through the installation of systematic tile drainage. There are approximately 2,800 square kilometres (700,000 acres) of farmland in Northeastern Ontario, accounting for 6% of all farmland in Ontario. The majority of farms in Northeastern Ontario are beef cattle (18%) and mixed (58%) farming operations (2011 Census). The productive capacity of farmland in Northern Ontario is rising due to a variety of factors, such as investment in the improvement of agricultural land, changing climate conditions, and new crop varieties.

Permafrost.[1] Exhibits 1.1 and 2.1 showed the southern boundary of permafrost, with discontinuous (patchy) permafrost extending to about 300 to 400 km inland from Hudson Bay. The permafrost boundary in Ontario, particularly continuous permafrost, is much further south than in other parts of Canada due to the influence of Arctic air masses. This results in greater challenges to building transportation infrastructure in the Far North than at locations at similar latitudes in other provinces.

Wildlife and Ecosystems. Northern Ontario can also be described in terms of its wildlife and ecosystems[2] — wildlife refers to a population, and ecosystems refer to the ecological system in which species exist. Northern Ontario's various water systems perform a variety of vital ecological functions. The Far North alone provides essential habitat for several species at risk. As discussed in more detail in the Ministry of Natural Resources and Forestry's (MNRF's) Draft Far North Land Use Strategy, stewardship is about conserving the unique geography and cultural landscape of the Far North, while also allowing its people to prosper through economic development. Through land use planning, Ontario and First Nations have an opportunity to advance the commitment to stewardship and provide for orderly development.

1 **Permafrost:** occurs when the ground remains at or below a temperature of 0° C for a minimum period of two years, though most permafrost has been frozen much longer. Permafrost can vary in thickness from a few decimeters to many metres. The top part of the ground that thaws each summer and refreezes each winter is called the active layer. (Natural Resources Canada, 1995)

2 **Ecosystem:** A dynamic complex of plant, animal and micro-organism communities and their physical environment functioning as an ecological unit.

The Transportation Infrastructure in Northern Ontario

Provincial Highways. There are over 11,000 km of provincial highways in Northern Ontario. Highway 11 and Highway 17 are the primary corridors, running east-west and connecting the region's population centres and industries to the rest of the province. They are largely two-lane highways, widening to four lanes near large urban centres. Major routes include the following:

- Highway 400/69 links Northern and Southern Ontario from its Northern terminus at Sudbury via Parry Sound.
- Highway 11 also serves to link Northern and Southern Ontario but via Barrie and Huntsville; Highway 11 intersects with Highway 17 at North Bay and continues north and west, intersecting (merging) with Highway 17 between Nipigon and Thunder Bay before terminating at Rainy River and the Ontario-Minnesota border.
- Highway 17 links Northern Ontario with Ottawa, Eastern Ontario and Quebec to the east; Highway 17 also serves as a major east-west corridor through the North and as the road gateway to Western Canada.

In the 2015/2016 fiscal year, MNDM budgeted $560 million for capital construction and maintenance of this vast network.

In 2011, an average of 54,000 truck trips were made weekly using the Northern Ontario provincial highway system (IBI Group, 2013a). About 48%, or 26,000, of these truck trips were internal to Northern Ontario while 7,500 trips were through traffic, such as trucks moving on Highway 17 between Quebec and major American trading points via Sault Ste. Marie.

Some 2,000 to 3,000 more trucks weekly travel westbound each week through Northern Ontario than travel eastbound (IBI Group, 2013a). This imbalance reflects a triangular trade pattern in which trucks carry goods from the Greater Toronto Area to Western Canada, then travel through the American Midwest collecting goods bound for Southern Ontario.

A typical fall weekday sees about 16,000 cars as well as intercity buses cross the north-south Ontario gateways of Highways 400/69, 11 and 17 (IBI Group, 2013b). This inter-regional passenger traffic, combined with truck traffic and local traffic in urban communities, can cause congestion and delay on key north-south highways, especially at peak recreational times.

Intercity Bus. Services connect several communities in the North, and link Northern Ontario to cities in Southern Ontario, as well as to Manitoba and Quebec. Bus fares are generally lower than air fares, making the bus an important mode for intercity travel. However, the rising costs of operating transportation services between communities are becoming more challenging for service providers to meet through revenues in the face of declining populations and travel demand levels. Intercity bus service providers, including Greyhound and Ontario Northland, have reduced service in Northern Ontario in recent years, and in some cases, intercity bus service no longer exists due to service discontinuances between certain Northern communities (e.g. between Geraldton/Longlac and Hearst, and between Fort Frances and Kenora).

International Bridges. There are four road-based international border crossings in Northern Ontario: Rainy River, Fort Frances, Pigeon River and Sault Ste. Marie. Taken together, the four crossings serve about $3.7 billion in trade annually. The International Bridge at Sault Ste. Marie is the most heavily used, handling about 54% of the 75,000 vehicles that crossed the four bridges every week in 2011, and representing $2.2 billion in trade annually (IBI Group, 2013a). The Sault Ste. Marie Bridge served nearly 100,000 trucks and 1.9 million passenger vehicles in 2012. Ownership of the four international bridges also varies from private sector to public sector to joint state-province ownership models.

Local Roads. Local roads within municipal boundaries are built and maintained by municipal governments with assistance from the Province. In unincorporated areas, a total of 191 Local Roads Boards (LRBs) are responsible for 4,300 km of local roads (MNDM, 2011). Movement of heavy equipment by mining and forestry companies along local roads can drive up road maintenance costs, but Local Roads Boards cannot levy charges on companies that are not based in their jurisdictions.

Same-Day Return Travel

Respondents to the Province's recent Environmental Bill of Rights (EBR) posting on Ontario's intercity bus transit noted that service frequency cuts have made it impossible to complete same-day trips to urban centres from many communities in Northern Ontario. Travellers must now stay overnight at their destination before returning home, which significantly increases the cost of the trip. Meanwhile intercity bus service discontinuances mean that some intercommunity trips are no longer possible at all by public transit.

Forest Access Roads. There are over 29,000 km of primary roads and over 17,000 km of branch roads identified in Northern Ontario as Forest Access Roads (MNRF, 2015). MNRF's administration of the Provincial Forest Access Roads Funding Program supports the construction and maintenance of primary and branch roads to forests on crown land. This program provides reimbursement for 100 % of the primary road construction and maintenance costs and 50% of the branch road construction and maintenance costs. In addition to the forest industry, these roads are also utilized by the mining industry, the tourism industry, anglers, hunters, First Nations, utilities, railways and for emergency management.

In addition, Forest Access Roads are often used instead of the highway system by the general public to reduce travel times and distances between communities. For example, using Forest Access Roads to travel from Geraldton/Longlac to Terrace Bay can save drivers between one and four hours of travel time, and can reduce travel time from Fort Frances/Atikokan to Ignace, Dryden or Kenora by two to six hours.

Rail. Taken together, there are well over 8,000 km of rail lines in Northern Ontario. Rail traffic in Northern Ontario is dominated by freight. Canadian National (CN) and Canadian Pacific (CP) operate the two trans-continental freight rail lines; CN operates an additional line between Winnipeg and the Port of Thunder Bay. Northeastern Ontario is also served by several short lines: the Huron Central Railway between Greater Sudbury and Sault Ste. Marie; a CN Rail line between Sault Ste. Marie and Hearst (used by Algoma Central Railway); and the Ottawa Valley Railway between Sudbury and Timiskaming (Quebec) via Mattawa. The Ontario Northland Transportation Commission also operates rail freight between North Bay and Hearst, and rail freight and passenger services from Cochrane to Moosonee. The Class 1 railways in Northern Ontario serve large volumes of grain, fuel and fertilizer from Western Canada, as well as mining and forestry products from Northern Ontario; these flow southward for eventual marine shipments from Thunder Bay for export via the Great Lakes and St. Lawrence Seaway system.

Roads Connecting First Nation Communities

The roads linking First Nation reserves to the provincial highway network have been found to be inconsistently owned, operated and maintained across the region. A range of players are involved in the operation of these roads, from First Nation communities, to various governments, to Local Roads Boards. This adds a layer of complexity to transportation planning.

A significant change to the railway network of Northwestern Ontario is the abandonment of the CN Longlac to Thunder Bay line in recent years. This means that a connection to and from the east to Thunder Bay is now only possible via the CP line, reducing options and competitive choices for shippers.

In terms of passenger service, there are few rail options in the North. VIA Rail's Toronto-Vancouver train makes several stops in Northern Ontario during night-time hours 2 to 3 times per week. Ontario Northland's Polar Bear Express line offers the only passenger rail service into the Far North, connecting Cochrane to Moosonee. In addition, the Agawa Canyon tour train runs return from Sault Ste. Marie to the Agawa Canyon; however, it does not serve passengers other than tourists bound for the one-day Canyon experience.

Winter Roads. Few communities in the Far North have any all-season road connections. Most remote communities rely on the 3,100 km of winter roads usable only during deep-freeze conditions that allow vehicles to travel over frozen earth, wetlands, lakes and rivers. From about mid-January to March-April winter roads provide ground transportation links to remote northern communities, enabling heavy equipment and supplies to be moved into remote communities.

Winter roads are vital to the economic and social well-being of remote communities. They provide employment for First Nation residents who build and maintain the roads, and enable the movement of heavy equipment to remote mining camps.

Marine. To the south, the Great Lakes St. Lawrence Seaway System carries large volumes of freight, mainly bulk commodities from Western Canada. Thunder Bay and Sault Ste. Marie are the region's main ports and their shipping season can range from a couple of months to upwards of nine months per year. Marine activity in the Far North is limited to summer resupply barges operating from Churchill, Manitoba and from Moosonee to communities such as Fort Albany, Attawapiskat, Kashechewan and Fort Severn.

All-Year Ground Access to the Far North

The only paved highway that crosses into the Far North is Highway 599, which links Savant Lake to Pickle Lake. North of Pickle Lake is the Northern Ontario Resources Trail (NORT), which is a gravel road extending another 200 km northward to Windigo Lake. Another NORT gravel road extends north from Red Lake about 100 km where a 33 km winter road then connects to Pikangikum First Nation.

In terms of passenger transportation, the Owen Sound Transportation Company operates the MS Chi-Cheemaun from Tobermory to Manitoulin Island, and the Niska 1 ferry between Moosonee and Moose Factory. Although small, there is also a ferry that crosses the Abitibi River near Cochrane (Gardiner Ferry) and operates while the river is not frozen. Some cruise operators also offer itineraries that connect ports in the Great Lakes; this is a small sector with likely potential for growth.

Air. There are 67 public airports in Northern Ontario (1 international, 37 municipal and 29 remote). Thunder Bay is the only international airport in the region, and is the fourth-busiest airport in Ontario. It handled 1,500 tons of cargo and 740,000 passengers in 2014.

The 37 municipal airports connect northern municipalities to larger urban centres, and some also act as regional hubs. Twelve municipal airports have regularly-scheduled passenger flights. Many municipal airports report challenges with maintaining financial viability amidst serving an important role in delivering vital government services.

Lastly, the Province owns and operates the 29 remote airports that offer the only year-round connection to Far North communities. They are mostly located on reserve land and typically have gravel runways, though some can accommodate large aircraft.

2015 NOMTS Municipal Airports Survey

A survey of northern municipal airports in 2015 confirmed that municipal airports are critical to delivering emergency and medical services, resource management, aerial policing and to the movement of goods and people. It also found that most airports had insufficient revenues to fully cover operating and capital costs, and financial viability is linked to the ability to support scheduled service.

Governance, Policy and Funding

The key responsibilities of agencies involved in the governance of Northern Ontario with respect to transportation are described below.

Provincial government. The Province has significant responsibility for matters relating to transportation and land use planning through a number of ministries. MTO has responsibility for primary highways, as well as for secondary highways in non-incorporated areas beyond the jurisdiction of municipalities and Local Roads Boards. MTO also owns and funds 29 remote airports in the Far North, and licenses short-line railways.

The Ministry of Municipal Affairs and Housing (MMAH) has land use planning and regulation responsibilities in Northern Ontario. These include issuing policy governing land use planning, approving municipal official plans, and working with the Ministry of Northern Development and Mines to develop overarching plans such as The Growth Plan for Northern Ontario, to which all municipal plans must conform.[3]

MNDM's responsibility for Northern roads includes the following:

- identifying priorities for, and funding expansion and rehabilitation of provincial highways through the Northern Highways Program;
- funding of unincorporated roads including Local Roads Boards; and
- administering the Winter Roads Program with funding support from the federal department of Indigenous and Northern Affairs Canada (INAC).

The Ontario Northland Transportation Commission (ONTC) provides bus and rail services within Northeastern Ontario as well as intraprovincial linkages. The Owen Sound Transportation Company provides ferry services between Tobermory and South Baymouth, and between Moosonee and Moose Factory. Both of these organizations are agencies of the provincial government. The ONTC is a provincial agency overseen by MNDM, and is governed by the ONTC Act. The Province, through MNDM, provides operating and capital support for the ONTC's services.

The Ministry of Natural Resources and Forestry (MNRF) is responsible for land use planning on, and management of Crown lands under the Public Lands Act as well as the Provincial Parks and Conservation Reserves Act, and works jointly with First Nations to prepare land use plans for the Far North on Ontario under the Far North Act, 2010. Land use plans developed under the Far North Act, 2010 take precedence over other growth plans that may conflict, including the province's Growth Plan for Northern Ontario.

The provincial and federal governments provide funding and technical assistance for transportation improvements under a variety of programs. See Sections 5.3 and 5.6 of the Geography and Political Context Working Paper for details.

3 There are varying degrees to which municipalities in the North have been delegated planning approvals for developments. For example, MMAH approves consents and subdivisions in Hornepayne. There are also areas outside of municipal boundaries that are covered by Planning Boards that have varying levels of planning approvals as well.

Indigenous communities and organizations. Indigenous communities and organizations have a central role in planning in Ontario. Over two thirds of Ontario's Indigenous communities are located in Northern Ontario. For the purposes of NOMTS and undertaking a consistent population-based analysis for this Strategy, IBI Group and Hemson Consulting used Statistics Canada's definition of the term "on reserve" to organize First Nation population data. This definition includes six types of census subdivisions (CSDs) that are legally affiliated with First Nations or Indian Bands. This exercise resulted in a list of 118 First Nation reserves[4] in Northern Ontario.

The Province's need to build and maintain collaborative relationships with its Indigenous peoples and communities is important. Considerations include furthering reconciliation between Indigenous peoples and Ontario; providing opportunities for Aboriginal communities to fully participate in and benefit from infrastructure development; and ensuring that communities are meaningfully consulted on proposed initiatives that could potentially affect their Aboriginal and treaty rights. These are all considerations in seeking to develop a collaborative relationship. An understanding of Aboriginal and treaty rights is critical to development in the North.

Under the *Far North Act, 2010*, the MNRF works with First Nations who indicate an interest in initiating planning, to prepare and jointly approve community based land use plans (CBLUPs) that clarify where development can occur and where land is dedicated to protection. The Far North boundary was shown in Exhibit 1.1.

There are several different forums and organizations that represent the rights and interests of Indigenous peoples in Ontario. Typically they engage in collective decision-making and political advocacy. Organizations include: the Chiefs of Ontario, Nishnawbe Aski Nation (NAN), Grand Council Treaty #3 (GCT3), Union of Ontario Indians (UOI) also referred to as Anishinabek Nation, Association of Iroquois and Allied Indians (AIAI), and the Independent First Nations Alliance (IFNA).

The Métis Nation of Ontario (MNO) represents the collective aspirations, rights and interests of the Métis Nation throughout Ontario; Red Sky Métis Independent Nation is a non-MNO Métis community in Northern Ontario.

Additionally, the Ontario Federation of Indigenous Friendship Centres (OFIFC) supports and advocates on behalf of member Friendship Centres across Ontario, which are not-for-profit corporations that serve Indigenous peoples in urban communities.

4 Note: some First Nation communities have multiple CSDs forming part of the same community.

Municipalities. There are 144 municipalities in Northern Ontario. The region's districts and municipalities are shown in Exhibit 2.4. Territory outside these municipalities — a majority of the land in Northern Ontario — is unincorporated.

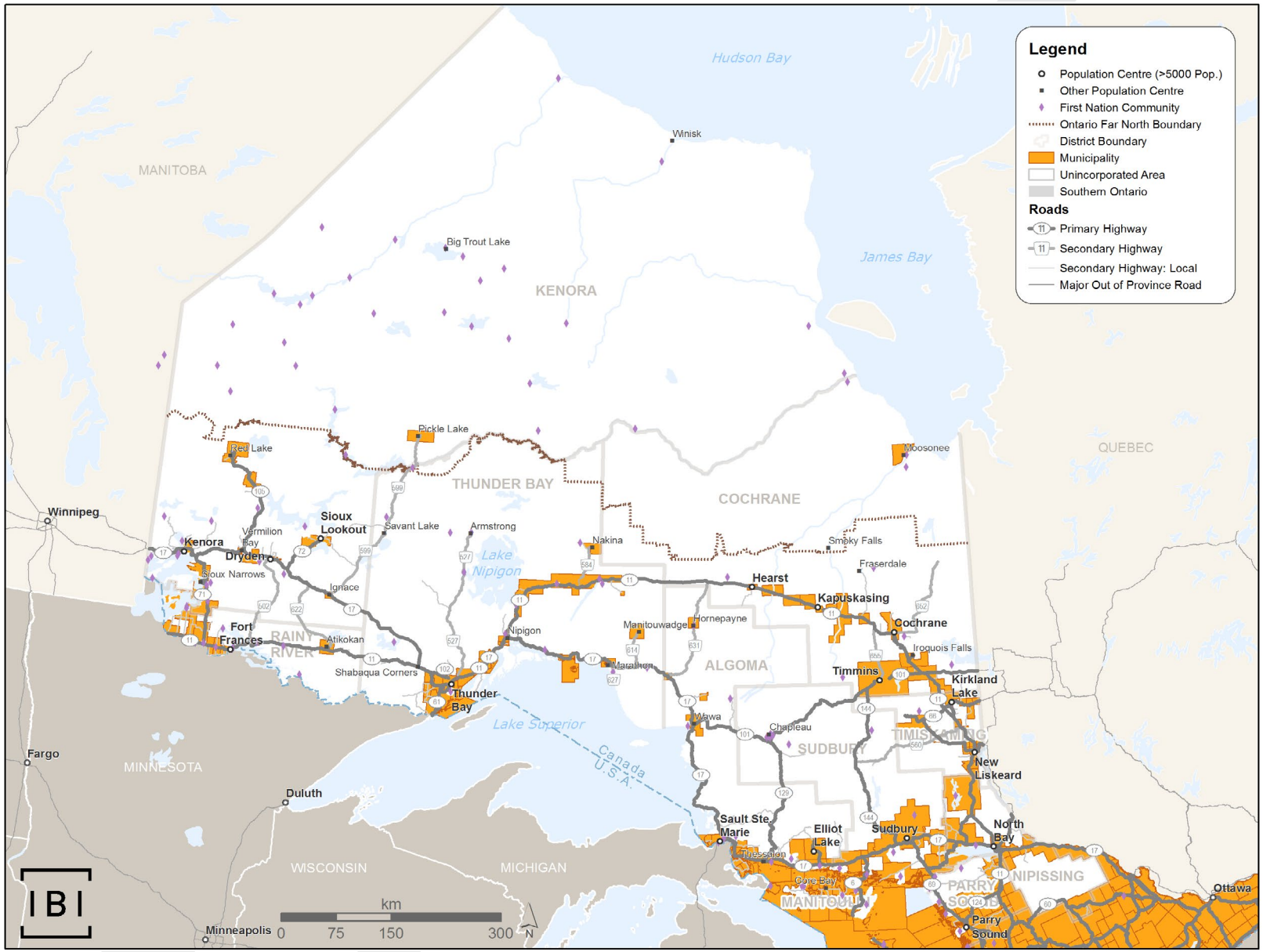
Municipalities in Ontario are directly responsible for the land use, infrastructure and municipal services within their boundaries, including transportation. They plan, deliver and regulate municipal roads and municipal transit systems. Municipalities create Official Plans, by-laws, and approve new developments.

Federal government. The federal government's primary transportation role is regulation. It does not have direct control over land use planning other than for federal lands. Federal regulations include statutes relating to air transportation, railway safety, marine port regulations, the transportation of dangerous goods, and border crossing facilities.

The introduction of the First Nations Land Management Acts allows First Nation communities to apply to opt out of the land related sections of the Indian Act and assume jurisdiction over their respective reserve lands and resources under their own land code. Successful applicants to join the First Nations Land Management regime assume the administration of all land related issues, including the authority to enact land-related laws and manage the environment and resources. First Nations with direct control over their reserve lands and resources under this framework have reported increased opportunity for investment and economic development (KPMG, 2014). At least five Northern Ontario First Nations are currently administering their own land codes under this framework[5], with additional communities in the process of developing their own codes.

5 These are Nipissing, Whitefish Lake (Atikameksheng Anishnawbek), Anishinaabeg of Naongashiing (Big Island), Henvey Inlet and Mississauga #8.

Exhibit 2.4: Map of Northern Ontario: Far North Boundary, Statistics Canada Census Districts and Municipalities



Transportation Strategy Development Implications

Long travel distances, varied topography, sparse population and Northern weather/climate realities are challenging for transportation planning and operations. These physical features also influence settlement patterns and human activities that generate transportation demand.

In the Strategy development, it will be important to recognize and take into account the existing ecozones[6] and ecoregions[7], watersheds[8], caribou migration ranges, and species at risk that have specific habitat requirements, among a number of other key wildlife and ecosystem factors.

In this context, the basic ongoing function of operating and maintaining safe, reliable transportation, particularly by road, is an expensive undertaking. This places a premium on spending the budget available for expansion prudently, and based on careful planning, serving the most pressing needs while ensuring that the quality of existing transportation is maintained and improved.

It is also clear that the transportation planning and policy context in Northern Ontario is complex, given the many government and community organizations involved. Engaging meaningfully with all involved is vital to effective transportation planning.

As outlined more fully in the first working paper, a transportation strategy must consider a variety of geographic, governance, legal and policy conditions, as well as a range of interests, from those of First Nation and Métis peoples and communities to municipal needs to private sector interests. Coupled with this is the need to foster, maintain and enable future enhancements to economic development in Northern Ontario. This includes the sustainable development of natural resource industries in a manner that balances the rights and interests of all the residents of the region.

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6 Ecozone: A very large area of land and water characterized by a distinctive bedrock domain that differs in origin and chemistry from the bedrock domain immediately adjacent to it.

7 Ecoregion: A unique area of land and water nested within an ecozone that is defined by a characteristic range and pattern in climatic variables, including temperature, precipitation, and humidity. The climate within an ecoregion has a profound influence on the vegetation types, substrate formation, and other ecosystem processes, and associated biota that live there.

8 Watershed: The area of land that drains into a river, lake or other water body.

2.2 Socio-Economic Considerations

Existing and future settlement patterns, including growth or decline in population and employment levels, are primary drivers of transportation demand. Phase 1 socio-economic findings are highlighted in this section, and described more fully in the NOMTS Working Paper, *Socio-Economic Context*.

Demographics and the Economy

Demographics

Northern Ontario had just over 807,700 residents in 2011 according to Statistics Canada figures (including undercount), with about 97,000 residents (12%) identifying as Aboriginal.

The ten largest municipalities in Northern Ontario have 2011 Census populations ranging from approximately 8,000 to as many as 160,000; all of these are in the Near North:

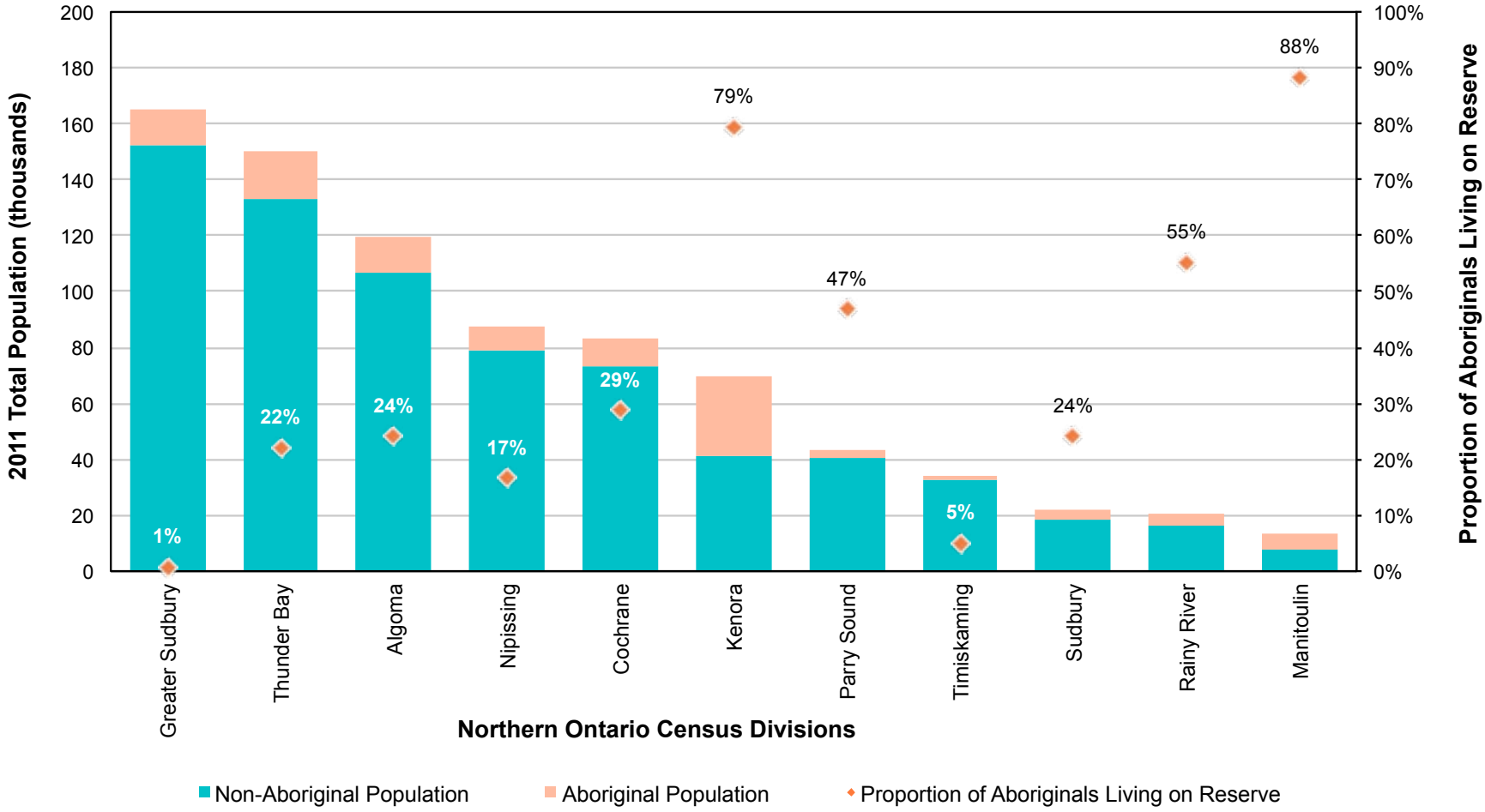
- Greater Sudbury – 160,400 residents
- Thunder Bay – 111,100 residents
- Sault Ste. Marie – 75,100 residents
- North Bay – 53,700 residents
- Timmins – 43,200 residents
- Kenora – 15,400 residents
- Elliot Lake – 11,300 residents
- Temiskaming Shores – 10,400 residents
- Fort Frances – 8,000 residents
- Dryden – 7,600 residents.

These communities are home to more than 60% of Northern Ontario's residents. The remaining 298,300 people live in the region's other 134 municipalities (two of which are in the Far North — Pickle Lake and Moosonee), as well as First Nation communities, other settlements and unincorporated areas.

Exhibit 2.5 shows the distribution of Northern Ontario's population across the region's Census Divisions, and notes the proportion of population who identified as "Aboriginal"[9] as part of the 2011 the National Household Survey (NHS). It also shows the proportion of Indigenous population living on reserves. As in the rest of Ontario, most Indigenous peoples in the North do not live on reserve year round. However, the proportion of Indigenous peoples living on reserve in the North (41%) is more than twice the provincial average (16%).

9 For the 2011 National Household Survey, collected by Statistics Canada, the term Aboriginal was used to assist individuals self-identify as Indigenous when completing the survey. Since this time, Indigenous has become preferred terminology; as such it is used in this report where applicable.

Exhibit 2.5: Population by Northern Ontario Census Division, Including Proportion Identifying as Aboriginals (2011 National Household Survey)



Data Source: Statistics Canada, 2011 National Household Survey

While Ontario's total population grew by more than 12% over the decade ending in 2011, Northern Ontario was among the regions that saw declines: from 2001 to 2011, the population of Northern Ontario dropped by 0.4%, and from 1996 to 2011, the net decrease was 5.2%.

At the same time, the number of households in Northern Ontario has been increasing in contrast with the declining population. Northern Ontario's housing supply has seen an overall increase of 19% since 1986, with almost 52,000 households added to the region between 1986 and 2011.

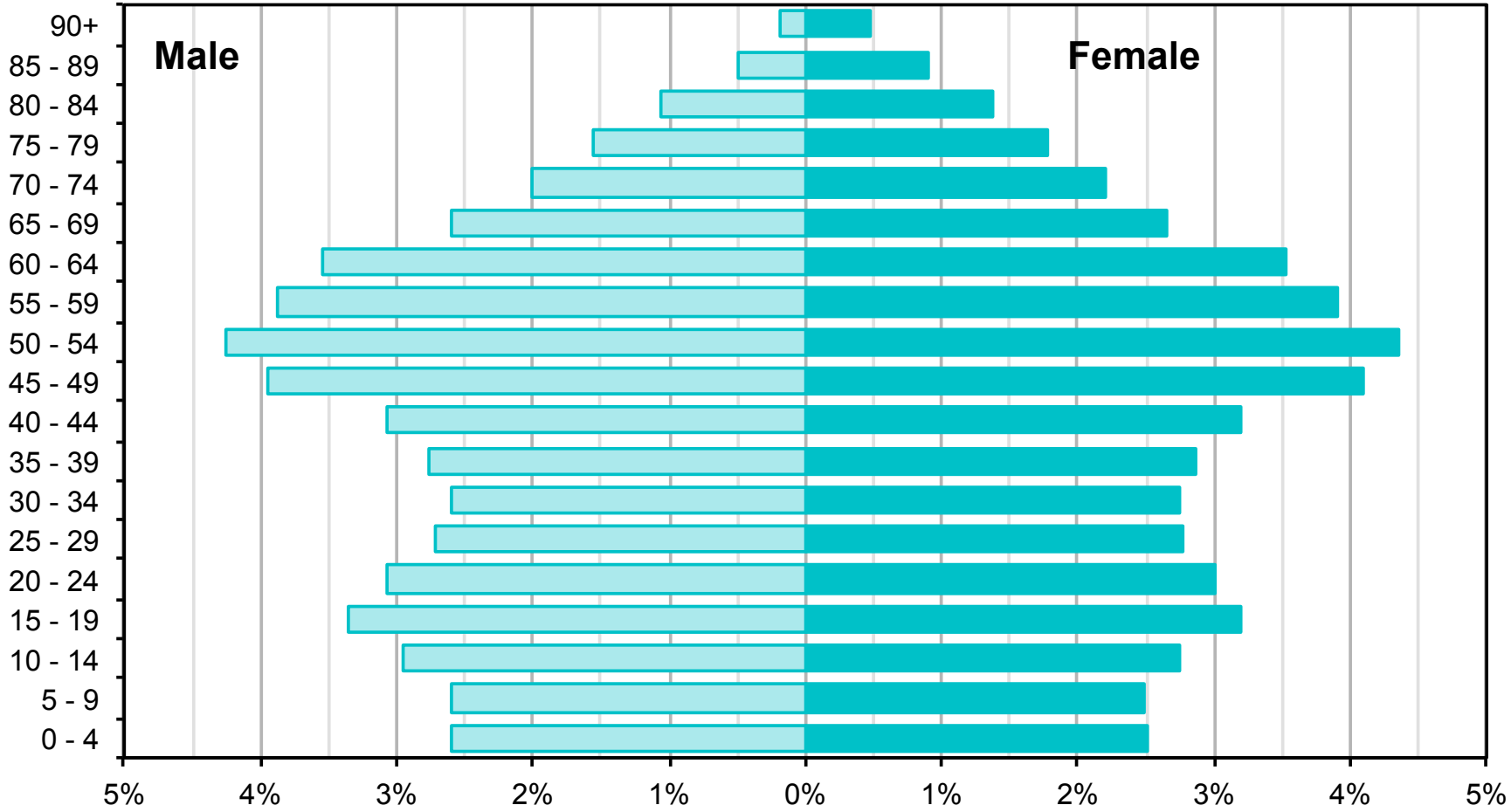
Consistent with demographic trends throughout the province, the population in Northern Ontario is aging. The average age of Northern Ontario residents (43.9 years in 2011) is higher than for the province as a whole (40.0 years in 2011), and is increasing more quickly. This trend is linked to the region's shrinking labour force, a phenomenon that has led to labour shortages reported by the mining and forestry industries.

In the longer-term, Northern Ontario's age structure is the most important factor influencing demographic growth and change. The unusual pattern in the age "pyramid" is the result of out-migration of young adults, primarily to Southern Ontario. The longer-term effect of a large out-migration in the 1980s and 1990s was apparent by 2011 and can be seen in the age structure plot shown in Exhibit 2.6: that the pronounced absence of young adults in the early 2000s has meant fewer children in the next generation (at the base of the pyramid).

First Nation Treaties

Treaties formalize the relationship between the Crown and First Nations based on principles of trust and mutual respect. They are the legally binding agreements that set out the rights, responsibilities and relationships of First Nations and the federal and provincial governments. Each treaty is unique, representing an agreement between First Nations and the Crown and may include elements such as the protection of hunting, fishing and harvesting rights, payment of annuities and the creation of reserves. There are a number of treaties in Northern Ontario signed between 1850 and 1930. Recognition of Treaty rights is an important part of land use planning processes in Northern Ontario.

Exhibit 2.6: Northern Ontario Age Structure, 2011



Source: Hemson Consulting Ltd. Based on Statistics Canada Data

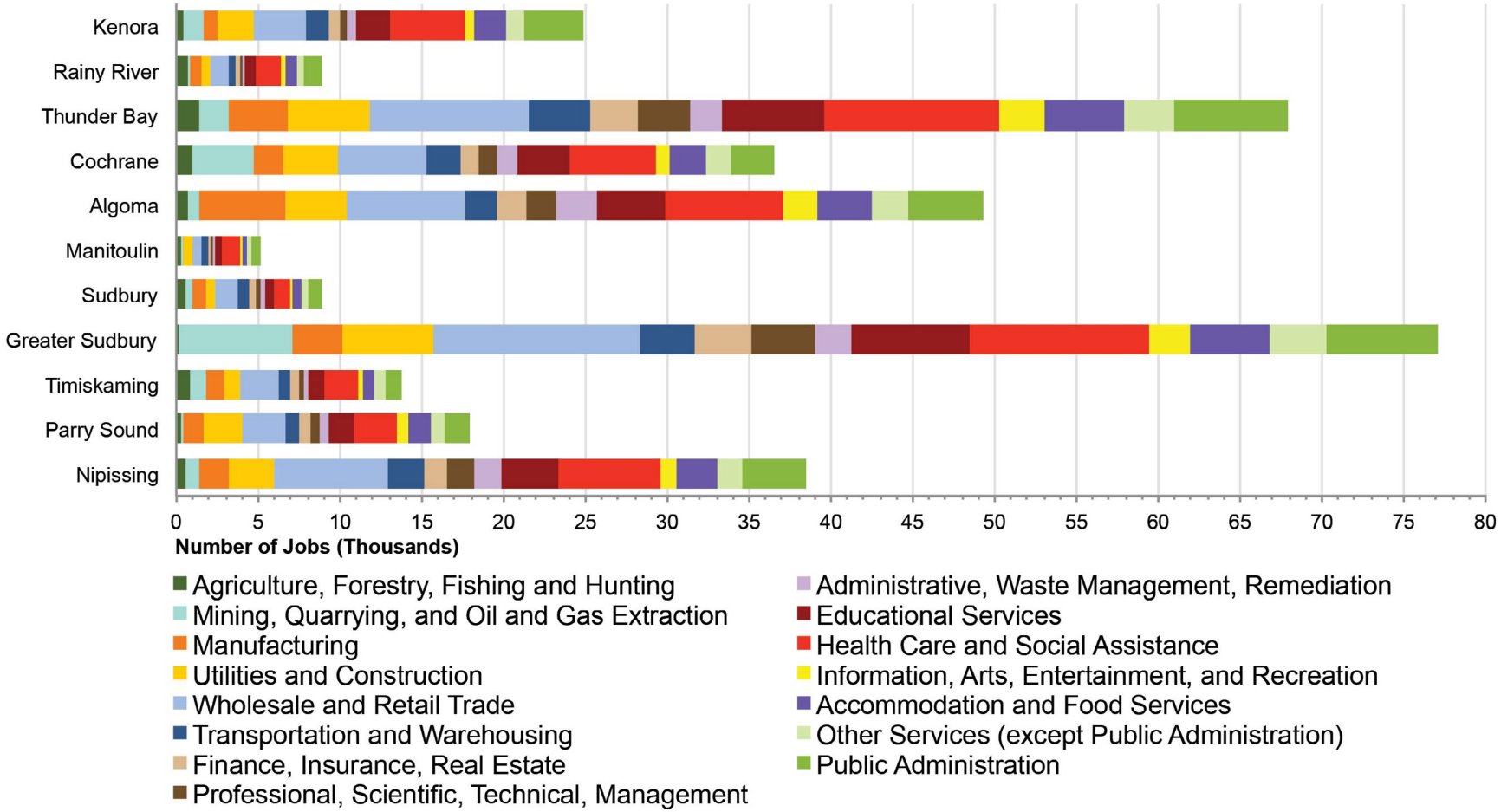
While the population of Northern Ontario has seen a net decline, its First Nation population living on reserve has demonstrated considerable growth over the last 25 years. This cohort of the population comprises of a demographic that is younger than the region's general population and workforce. Using comparative community-level data available for both 2006 and 2011, the Socio-Economic Assessment indicates a growth rate of 6.2% for Northern Ontario's First Nation communities living on reserve. Furthermore, over two-fifths (40.6%) of Northern Ontario's First Nation peoples were under the age of twenty at the time of the 2011 National Household Survey, which is almost double the share of the region as a whole (22%).

From a socio-economic perspective, one of the greatest challenges faced by First Nation communities, particularly those in the Far North, is reliable transportation access. Almost a quarter of the region's First Nation reserves are only accessible by air or seasonal winter roads. For those communities with all-year ground transportation, access can be hampered by the closure of a single entry/exit point.

The Economy

Economic sectors in Northern Ontario can be categorized into two general types: natural resource-based industries and population-based industries. The resource-based industries are mining, forestry, agriculture, and manufacturing. The population-based industries include retail, institutional (i.e., education, health sector, and public administration), arts and culture, and work-at-home. Tourism can be considered to be either a resource-based or a population-based industry. Exhibit 2.7 summarizes the number of workers by industry in each Northern Ontario District, and a summary of the main industry types is provided below.

Exhibit 2.7: Place-of-Work by Industry and Census Division, 2011



Source: IBI Analysis of 2011 National Household Survey: Data tables, industry groupings based on North American Industry Classification System (NAICS) 2007 (102)

Data: downloaded from <www12.statcan.gc.ca>/

Mining. Mining is an important part of the Northern Ontario economy. Approximately 64% of all provincial mining employment is located within the region, with notable concentrations in Greater Sudbury, North Bay, Timmins and Thunder Bay. According to the Ontario Mining Association, the region's mining sector production was valued at $11 billion in 2014. There are 32 metallic mineral mines, including 16 gold mines, 14 base metal mines, 1 iron mine and 1 platinum group metals mine.

The mining sector uses all components of the transportation network in Northern Ontario. Base metal mines are mainly served by road and rail, while precious mineral mines can be served by road where available, or by air and/or seasonal winter roads. About 90% of local aggregate movements are carried by truck, but ships are important for moving aggregates to and from Northern Ontario.

Forestry. In 2009, Ontario's forestry sector was valued at $12 billion, with 75% of activity located in the North. Though the sector has seen a decline in demand due to factors such as the 2008 recession and decline of the newspaper industry, forestry remains an important component of the regional economy.

All harvested wood fibre is transported via the vast forest road infrastructure by trucks, either directly to a processing facility (including sawmills and pulp mills), or to a rail-siding for rail shipment to the processing facility. Both truck and rail transport finished wood products to national and international customers due to the availability of rail access at many processing facilities.

Agriculture. The Northern Ontario farming industry is diverse, with over 30 different types of farms, the most common types being dairy farming, livestock and cattle farming, field crops (including hay and canola), and aquaculture. The agri-food industry was identified as a top economic driver in the Growth Plan for Northern Ontario and has seen growth in recent years. The food and beverage processing sector in Northern Ontario is providing over 1,000 jobs in more than 100 facilities in the bakery, beverage and meat sub-sectors.

Some farming inputs arrive by rail at regional hubs, where they are then transferred to trucks for distribution. Given their perishable nature, agricultural products are carried mostly by truck on primary highways wherever possible.

Manufacturing. Manufacturing in Northern Ontario is a diverse industry with many sub-sectors. The majority of manufacturing activity is characterized as "resource-based manufacturing," which is both directly and indirectly linked to the mining and forestry sectors. This includes the manufacturing of forest products, primary metal products and mining equipment.

The region is also home to some non-resource-based manufacturing as well as advanced manufacturing, which is the highly technical, advanced production of items such as aerospace technology, computing equipment and robotics. The majority of non-resource based manufacturing is associated with major operations, such as Bombardier Transportation in Thunder Bay.

Virtually all manufacturers rely on trucking. Smaller companies often use less-than-truckload (LTL) shipping and for-hire trucking to move consolidated smaller shipments. Some larger companies use rail; however, this is not common, as it is not economical for most companies. Marine is used by some manufacturers, largely by the steel manufacturers in Sault Ste. Marie.

Tourism. Tourism in Northern Ontario is an important part of the regional economy. Niche markets continue to attract tourists, including hunting, fishing, camping, cycling, and motorcycle cruising. In 2012, 9.5 million visitors to Northern Ontario spent approximately $1.7 billion. The majority of visitors come from other parts of Ontario (81%), with the remainder from the U.S. (11%), other parts of Canada (7%) and international travellers (1%) (MTCS).

The majority of tourists travel in Northern Ontario by personal vehicle. Tourists also make use of regional airlines, charter flights, intercity buses, some marine options and certain passenger rail services. Non-local visitors can also fly into the region via regional hubs such as Sudbury and Thunder Bay.

Retail. Retail development generally follows population trends. In 2011, employment in the retail, wholesale trade and accommodation and food services categories amounted to approximately 23% of all employment in Northern Ontario. The primary service areas are the Cities of Greater Sudbury, North Bay, Sault Ste. Marie, Thunder Bay and Timmins.

Institutional. Institutional employment includes education, healthcare, social assistance and public administration. Based on the 2011 NHS, institutional represents approximately 34% of all Northern Ontario employment. The key driver of institutional employment is population.

Arts and Culture. The arts, culture and creative industries are the most established of the North's emerging sectors, with just over 6,000 jobs listed in the 2011 National Household Survey.

Work at Home. Work at home employment, as a share of total population, is anticipated to follow general population trends.

Population and Employment Forecasts, and Industrial Outlook

Low, medium and high population and employment forecast scenarios were presented in the Socio-Economic Context working paper. These were prepared based on varying assumptions about future economic and social conditions and their effects on growth and demographics. Outlooks for economic growth are based on major shifts in the primary employment markets, commodities in particular, as well as on demographic shifts, such as the long-term effects of the aging of the existing population base and out-migration of young people.

The industrial outlooks presented in the Socio-Economic Context report are as follows:

- **Low:** Under this scenario, resource-based industries perform at lower than historically average growth rates in terms of value and production. For most industries, this is the continuation of the current situation. This results in higher levels of out-migration to other parts of Ontario and Canada. The Ring of Fire is not assumed to see development in this scenario

  This scenario produces population results similar to forecasts prepared by the Ontario Ministry of Finance. In this scenario, the population of Northern Ontario would decline by 40,200 people between 2011 and 2041.
- **Medium (Reference):** Under this scenario, the Growth Plan for Northern Ontario is largely achieved and resource-based industry activity returns to the historically average growth rates and price profiles of the last 20 to 30 years. The exceptions may be continued decline in pulp and paper, and, in the other direction, gold, where mine re-openings in the past decade will likely keep production higher than historic averages. The Ring of Fire is assumed to see development, but relatively slowly toward 2041. Migration patterns would continue at (moderated) historic levels.

  In this scenario, the population decline in Northern Ontario would be limited to 13,300 people between 2011 and 2041. Almost half of this decline, a drop of about 5,500 people, is thought to have occurred already and may be confirmed by the 2016 Census.
- **High:** This scenario is based on full and successful achievement of the Growth Plan's economic objectives. Resource- based industries perform at higher price and production than the medium scenario, with some exceptions. The Ring of Fire is assumed to see development more quickly in this scenario. Migration patterns are more positive; consistent with the economic outlook.

  In this scenario, the population of Northern Ontario would grow by 7,700 people between 2011 and 2041.

The high and low scenarios are not intended to represent extreme cases, but variations on historical patterns of growth.

Northern Ontario population and employment forecasts are summarized by district for the reference scenario in Exhibit 2.8. While the population in a majority of districts is expected to decline, some districts (e.g. Greater Sudbury and the districts of Nipissing, Kenora, Manitoulin and Parry Sound) are expected to experience modest growth. Three of those areas (Kenora, Greater Sudbury and Manitoulin) are also expected to see employment growth, which could affect future transportation demand.

Exhibit 2.8: Northern Ontario Population and Employment Forecast by District (Reference Scenario)

District	POPULATION				EMPLOYMENT			
	2011	2016	2041	2011-41 Growth	2011	2016	2041	2011-41 Growth
Algoma District	119,400	116,400	108,300	(11,100)	49,000	49,000	41,100	(7,900)
Cochrane District	83,300	82,500	74,400	(8,900)	37,100	36,100	29,000	(8,100)
City of Greater Sudbury	164,900	165,400	172,300	7,400	77,800	79,200	78,400	600
Kenora District	69,600	70,700	73,000	3,400	25,400	29,000	28,200	2,800
Manitoulin District	13,300	13,300	14,600	1,300	5,100	5,400	5,700	600
Nipissing District	87,600	87,500	91,500	3,900	40,600	40,400	40,200	(400)
Parry Sound District	43,200	43,000	43,700	500	14,900	15,100	14,400	(500)
Rainy River District	20,900	20,200	17,500	(3,400)	9,300	8,700	6,900	(2,400)
Sudbury District	21,600	20,800	18,500	(3,100)	7,600	7,200	5,000	(2,600)
Thunder Bay District	150,000	148,800	147,400	(2,600)	68,100	67,800	60,600	(7,500)
Timiskaming District	33,900	33,600	33,200	(700)	14,100	13,700	12,200	(1,900)
Total	**807,700**	**802,200**	**794,400**	**(13,300)**	**349,000**	**351,600**	**321,700**	**(27,300)**

Source: Hemson Consulting Ltd. based on Statistics Canada data.
Note: Figures above have been rounded.

Transportation Strategy Development Implications

Growth in Northern Ontario's population, employment and transportation demand will be closely tied to the region's economic outlook. Resource-based industries remain the core of the Northern Ontario economy and drivers of its transportation demand. The development of mineral reserves in the Ring of Fire could play a major role in Northern Ontario's future economy.

The four largest population and employment districts in Northern Ontario — Greater Sudbury, Thunder Bay, Algoma and Nipissing — are located in the Near North. There are significant demands for transportation within and between these districts, particularly by road.

The fifth- and sixth-largest population and employment districts — Cochrane and Kenora — both straddle the boundary between the Near North and Far North. Their current transportation needs relate primarily to road travel in the southern parts of the districts, rail transportation in the District of Cochrane, and air transportation over the entire Far North.

While tied to commodity cycles, feasibility and timing of development is also tied to factors such as investments in transportation infrastructure and land-use negotiations with First Nation communities in the area. In turn, transportation infrastructure improvements to support mineral development would provide potential new opportunities, such as enhancing connections to remote communities.

Future population and employment growth rates in Northern Ontario are also highly influenced by the current demographic structure. The region's population has an increasingly higher average age than the overall provincial population, and may result in a greater focus on mobility challenges in transportation planning. At the same time, the region's First Nation population has a younger population profile and stronger population growth, resulting in a growth in travel demand in certain Northern Ontario areas.

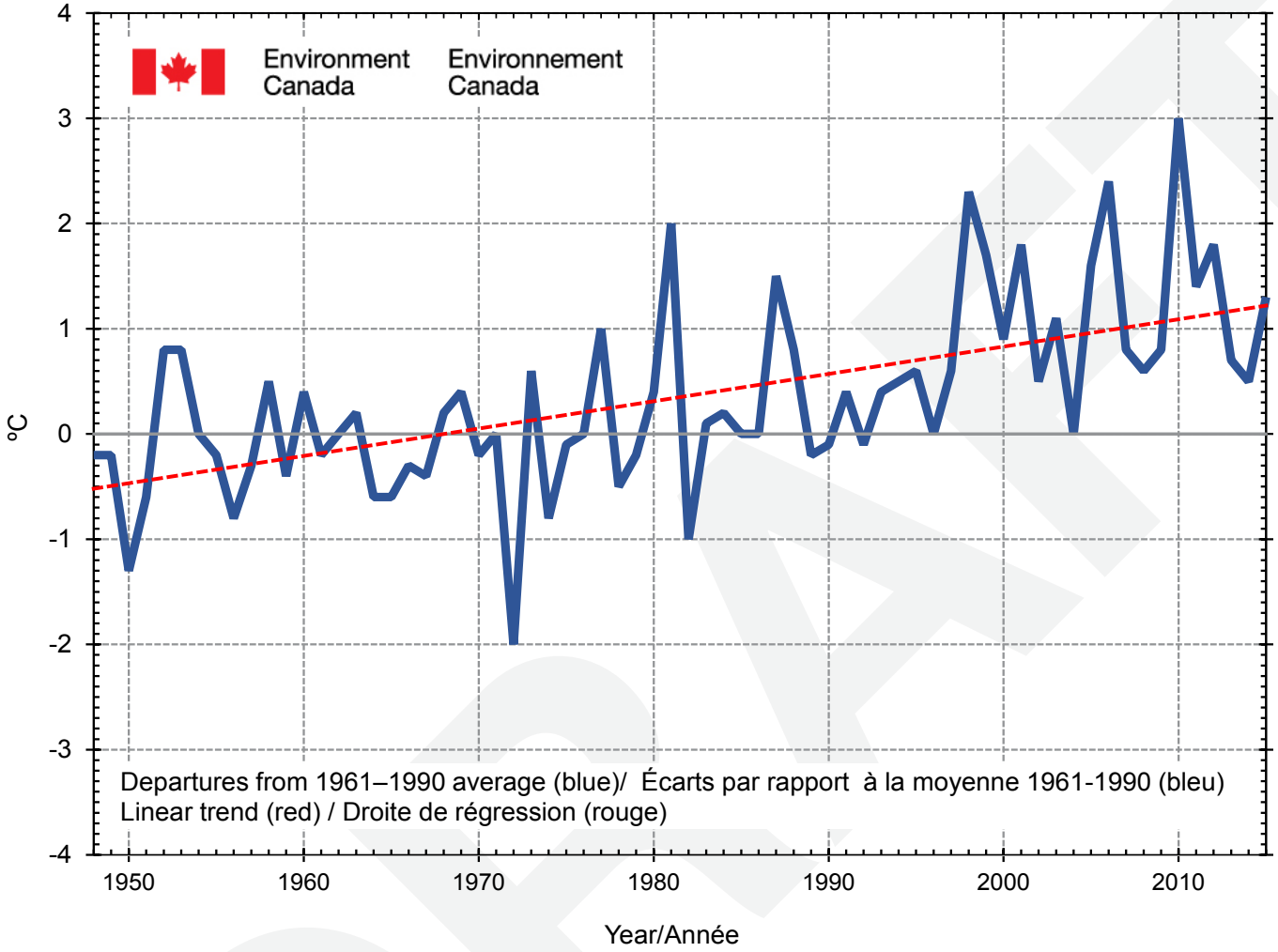
2.3 Climate Change Considerations

Climate change is already affecting transportation in Northern Ontario. Significant future impacts are expected, and strategies are being developed and applied to both mitigate and adapt to these effects. Phase 1 findings regarding climate change considerations are summarized here, and described more fully in NOMTS Working Paper 2, *Climate Change Context*.

Climate Change Trends and Effects

Across Canada and in Northern Ontario, global climate change trends have become steadily more evident since the 1950s, chiefly in terms of ongoing warming trends, increased precipitation and related increases in severe weather events. Between 1948 and 2014, Canada's average annual temperature rose by about 1.7°C (see Exhibit 2.9) and average annual precipitation rose by about 17% (see Exhibit 2.10). Similar trends have occurred in Northern Ontario.

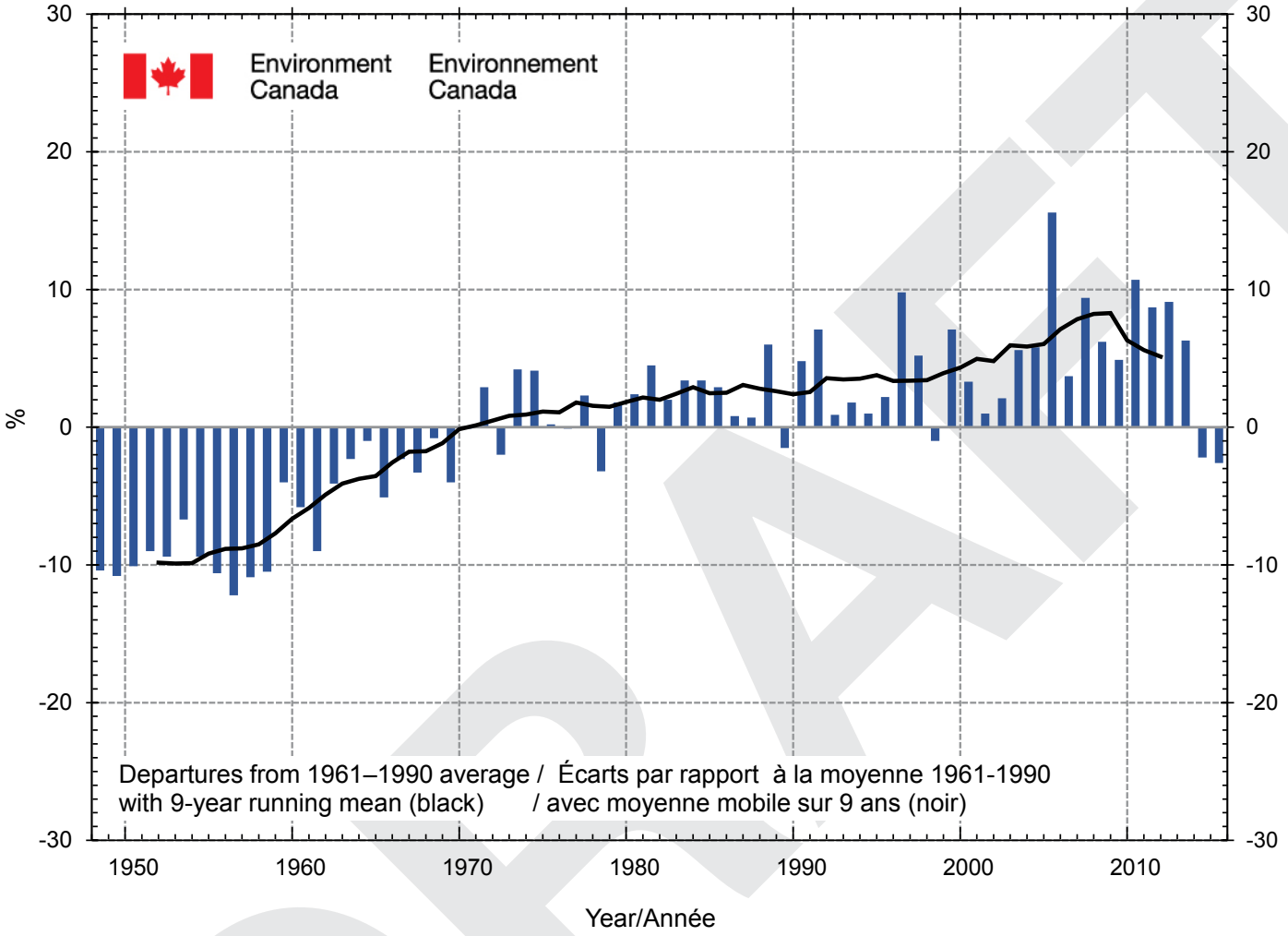
Exhibit 2.9: Temperature Trends, Canada, 1948-2014



Note: The red line is a linear trend line fitted statistically to the blue curve, which shows the year-to-year fluctuations of average annual temperatures. The trend line smooths the fluctuations to show the average rate of temperature increase.

Source: Environment Canada, 2016 (image adapted for increased resolution)

Exhibit 2.10: Precipitation Trends, Canada, 1948-2014



Note: The black line is a running mean showing the 9-year average for each year: this is the average of values for the current year, the previous four years and the following four years. This trend line smooths the fluctuations to show the trends in precipitation more clearly.
Source: Environment Canada, 2016 (image adapted for increased resolution)

To provide a more regional understanding of climate change trends, precipitation and related weather records at twelve Environment Canada weather stations in Northern Ontario (eight in the Near North and four in the Far North) were analyzed (see Exhibit 2.11). Based on straight-line trends of historic weather data[10], and averaged over the twelve locations, from the mid-1950s to mid-2050s the following changes in the occurrence of various weather events are projected:

- average daily temperature below 0°C: **decrease** of about 20 days/year;
- temperature above 25°C: an **increase** of about 10 days per year;
- temperature below -25°C: a **decrease** of about 9 days per year;
- rainfall more than 25 mm: no clear trend;
- snowfall more than 10 cm: no clear trend; and
- winter rainfall of more than 0 mm during the five coldest months: an **increase** of approximately 7 days per year (this is a proxy for freezing rain and ice storm events, which often occur at the beginning or end of rainfall events during the winter months).

10 These trend lines were based on the period of available weather data, typically 1955 to 2005. Straight-line trends were used, as other types of trend lines did not show a better fit to observed data than the straight-line trends over the period of available data.

Significant climate change-related effects on Northern Ontario's transportation system are anticipated. In some cases, the effects are already being observed. Effects on transportation infrastructure include the following:

- pavement softening or rutting from higher summer temperatures;
- pavement cracking from freeze-thaw cycles;
- subsidence and embankment failure of roads, rail lines and airport runways in the Far North due to melting permafrost; and
- reduced capacity and increased costs for marine shipping on the Great Lakes, owing to lower water levels and reduced drafts.

Additionally, the effects of climate change on the winter road network will likely require adaptation strategies. The effects include the following:

- shorter seasons of freezing conditions;
- thinner ice on northern watercourses;
- decreased capacity loads;
- increased costs to maintain operating conditions;
- more varied weather events that affect operations; and
- more freeze-thaw cycles during the winter season leading to operational problems, service interruptions, reduced safety and increased costs.

Exhibit 2.11: Historic and Projected Changes in Local Weather Event Frequencies

Location in Northern Ontario	Number of Days/Year when Weather Event Occurs (trend-line)											
	Daily Average Temp. below 0°C		Maximum Daily Temp. above 25°C		Minimum Daily Temp. below -25°C		Rainfall above 25 mm		Snowfall above 10 cm		Winter Rainfall above 0 mm	
	1950s	2050s	1950s	2050s	1950s	2050s	1950s	2050s	1950s	2050s	1950s	2050s
Near North												
Gore Bay	164	149	0	0	12	18	3	2	4	9	9	32
North Bay	142	121	23	37	13	8	5	6	5	7	12	20
Sudbury	144	121	30	54	14	7	4	6	5	7	9	19
Sault Ste Marie	132	102	29	38	10	3	3	6	6	9	10	20
Thunder Bay	143	125	29	38	26	14	4	0	6	0	6	3
Timmins	158	142	33	39	37	30	3	1	9	3	5	13
Kenora	156	129	32	39	34	11	2	8	3	0	3	7
Sioux Lookout	158	142	30	42	47	18	2	8	4	4	2	10
Average	150	129	26	36	24	14	3	5	5	5	7	16
Far North												
Moosonee	171	161	20	10	52	48	2	2	4	1	4	3
Big Trout Lake	190	168	10	22	79	44	2	3	2	7	1	4
Smoky Falls	166	148	30	41	46	51	3	3	7	5	2	8
Pickle Lake	175	145	21	49	54	42	2	2	4	7	0	8
Average	175	155	20	31	58	46	2	2	4	5	2	6
Northern Ontario												
Average	158	138	24	34	35	24	3	4	5	5	5	12

Notes: Mid-1950s and mid-2010s values are based on trend-line backcast/forecast value in 1955 and 2015, with trend line based on available data for the years, typically approximately 1955 to 2005. Trend-line numbers of days shown in the exhibit are rounded to the nearest day.

Source: IBI Group analysis of Environment Canada data (Environment Canada, http://climate.weather.gc.ca).

Already the operating season length and reliability of these roads is reduced, resulting in higher costs to move heavy equipment, fuel, food and other supplies (Pendakur et al, 2015; Prowse et al, 2009). The relative costs to move goods by different transportation modes and by distance shipped are shown in Exhibit 2.12. The chart indicates that the cost per unit of cargo weight to move freight by highway truck or winter road truck remains relatively low regardless of travel distance compared to moving freight by cargo airplane, cargo airships are a potential intermediate-cost alternative to road modes or planes for long-distance shipments.

A total of 31[11] remote First Nation communities are served by the winter road network in Ontario. Since the majority of these communities are not on the power grid[12], large volumes of diesel fuel are supplied over the winter roads (and supplemented by air and marine shipments) to fuel the community diesel stations that power community facilities, schools, health care clinics, band offices, homes and businesses. Reliability of delivery of these supplies is essential to the well-being of remote communities.

An additional effect of climate change is variable precipitation trends. These trends have been less pronounced to date in Northern Ontario compared to the rest of the province, although there have been significant recent flooding events — for example, in Wawa (October 27, 2012), Kashechewan (May 5, 2013) and Rainy River/ Fort Frances (June 15, 2015) — and road closures in Northeastern Ontario (January 30, 2013) due to severe blowing snow and freezing rain.

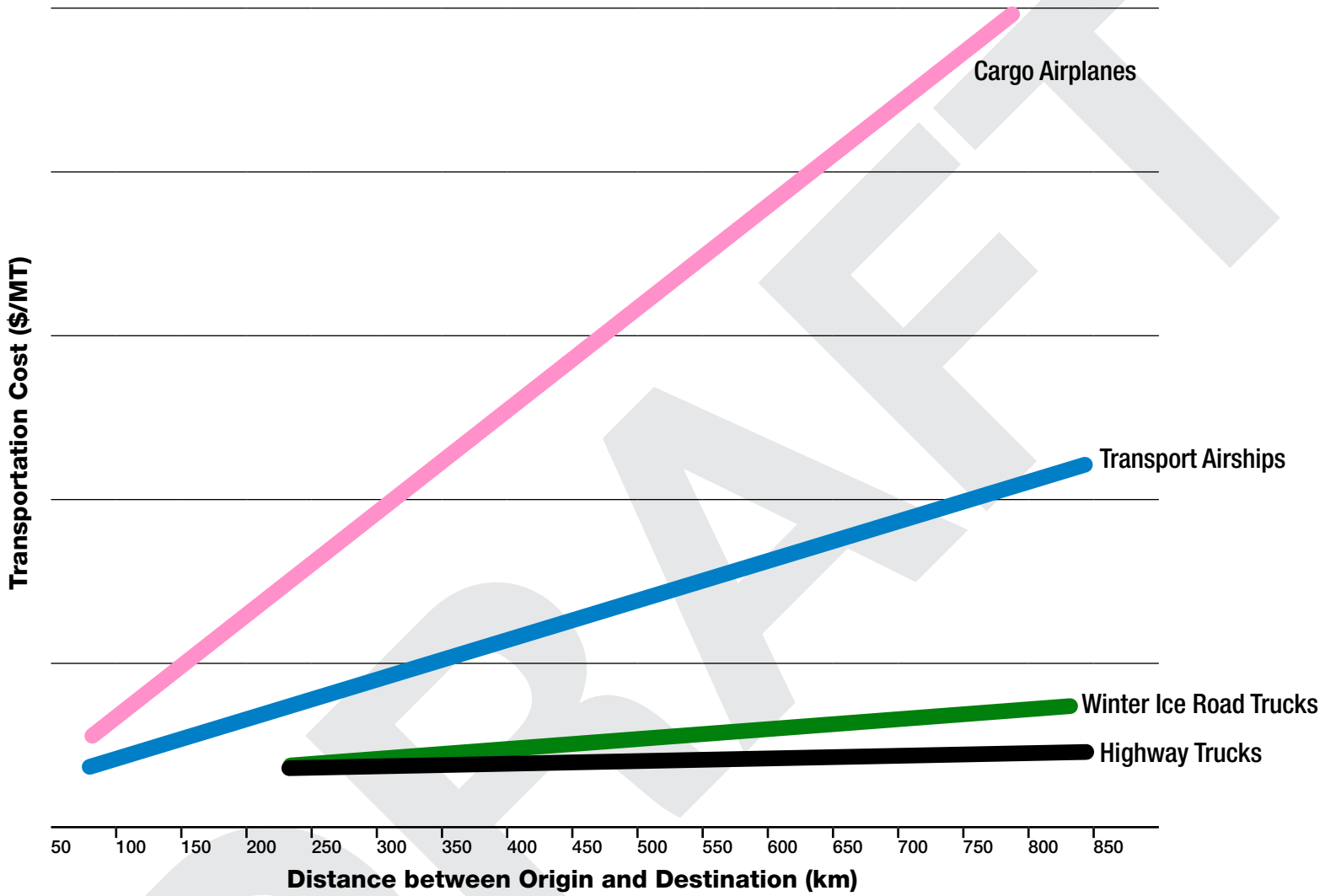
Increases in the intensity, duration and frequency of extreme weather events are expected to impact the transportation system, such as through the following:

- more flooding and the resulting road or rail washout events;
- more freezing rain events with heavy ice build-up and subsequent blockages from fallen trees and power lines; and
- bridge problems from thermal expansion or cycling, and scouring (erosion) of soil around foundations caused by severe flooding events.

11 This includes 29 communities in the Far North. In the Near North, North West Angle #37 and North West Angle #33 First Nations are connected by winter road to Kenora for a total of 31 communities being served by winter roads.

12 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 Ontario's power facilities 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 remote communities.

Exhibit 2.12: Broad Modal Cost Comparisons for Regular Food Delivery to Remote Communities



Note: The Y-axis had been removed from the original chart for confidentiality purposes. The cost for transport airships is a projected cost, not based on commercial airship operations.
Source: Prentice and Adaman, 2015 (image adapted)

In the Near North, anticipated reductions of water levels in the Great Lakes owing to increased evaporation rates caused by warming temperatures are expected to result in increasing marine shipping costs as vessels would be forced to carry less cargo because of reduced drafts (Warren and Lemmen, 2014). This could be partially offset by increasing shipping season lengths, but the overall impact on shipping costs is expected to be negative.

As outlined in the next section, governments and transportation infrastructure owners, operators and planners have responded with policies aimed at mitigating climate change trends and, where possible, adaptation strategies that would create more resilient transportation systems able to function effectively in the face of climate change.

Current Mitigation and Adaptation Strategies

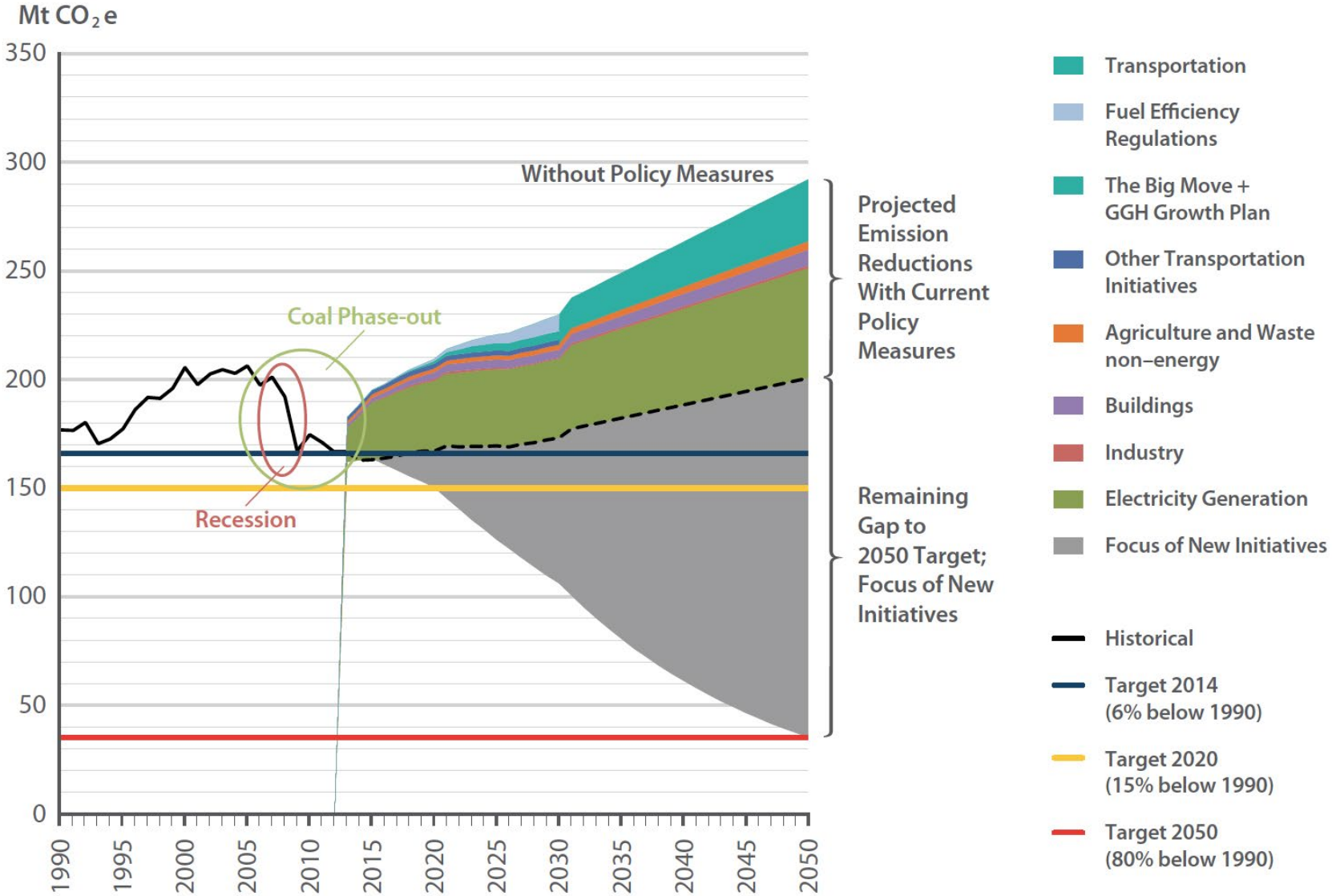
Mitigation. In November 2015, the Province of Ontario released its Climate Change Strategy for reducing greenhouse gas (GHG) emissions. The strategy sets out Ontario's vision for combatting climate change and achieving greenhouse gas reduction targets.

As illustrated in Exhibit 2.13, the province will address greenhouse gas emissions through policies and programs aimed at all sectors, including transportation and public transit, buildings, industry, electricity, and agriculture and waste.

Provincial policy measures and recent economic trends have resulted in approximately a 6% reduction in Ontario's GHG emissions compared to 1990 levels. These have been primarily due to the phase-out of coal-fired electricity generation stations, the introduction of improved energy efficiency measures, and changes in the composition of Ontario's industrial base.

Despite these province-wide results, Ontario's transportation emissions have continued to increase. Achieving reduced GHG emissions from transportation in Northern Ontario will be a significant challenge, since fossil fuels remain the main energy source for transporting goods to Northern Ontario's dispersed populations.

Exhibit 2.13: Ontario's GHG Emissions Trajectory



Source: Ministry of Environment and Climate Change, 2015

Adaptation. The NOMTS will help to identify planning processes and strategies to help create more resilient transportation facilities and services. This recognizes that, with the concentration of GHGs already in the atmosphere, a global temperature increase of at least 2°C by the end of the century is likely. Temperature and precipitation trends at least as high as those outlined in the previous subsection are all but inevitable in the absence of effective international actions to reduce GHG emissions.

The international climate change agreement negotiated in Paris in December 2015 has the long-term goal of keeping the increase in global average temperature to less than 2°C above pre-industrial levels. However, the comprehensive national climate action plans submitted by the 195 countries involved in the negotiations are not yet enough to keep global warming below 2°C. The agreement points the way to achieving this target, however, through meetings every five years to set and work towards more ambitious targets, by reporting to each other on their actions to reduce GHG emissions, and by committing the substantial resources necessary to achieve these objectives.

Short- and long-term adaptation measures are both necessary and achievable. The MTO has been taking action to address climate change challenges in terms of both short-term effects (e.g. road flooding and washouts from increasing frequency and intensity of severe weather events) and longer-term effects from ongoing warming trends (e.g. infrastructure subsidence from permafrost melting, pavement damage from heat and freeze-thaw cycles, shorter operating seasons for winter roads).

Current and planned MTO climate change adaptation initiatives include enhanced maintenance practices, reviewing and improving drainage systems and infrastructure, reviewing new pavement design approaches and materials to prevent degradation of road surfaces, and using new Intelligent Transportation Systems (ITS) such as wireless traffic counters that can be deployed in all weather conditions.

Planning for the Future

Climate change is affecting transportation in Northern Ontario, and trends of warming temperatures and more variable weather are projected to continue at possibly increasing rates. Transportation system planners and operators will have to adapt to these trends and help mitigate the effects through lower carbon practices, while continuing to provide safe, reliable and efficient transportation. Important considerations will include the need to assess the risks of events and their consequences, and to set priorities for cost-effective adaptation measures.

Risk assessment. There is uncertainty associated with several factors affecting decisions about how best to adapt Northern Ontario's transportation system to deal with climate change. The most significant uncertainties are the rate at which climate change will occur, the frequency and severity of extreme and variable weather events, the risk of transportation system disruptions as a result of such events, and the extent to which steps can and should be taken to reduce vulnerability and exposure.

Engineers Canada, in association with various public and private sector organizations and with financial support from Natural Resources Canada, has developed a protocol to address the challenges presented by risk assessment and priority planning related to climate change, through the efforts of its Public Infrastructure Engineering Vulnerability Committee (PIEVC). Transportation planners, owners and operators are applying this protocol to help develop cost-effective adaptation strategies for specific transportation systems and system elements.

Setting adaptation priorities. The process of setting priorities involves judging the exposure of transportation facilities and services to the effects of climate change, assessing the risk of major future problems and costs if various adaptation measures are taken, and deciding on a "least cost" or "minimum regret" course of action. The latter is based on comparing higher present costs for adaptation to the possibility of major damage, injuries and costs in the future if little or no adaptation is undertaken.

To help Ontario practitioners develop quantitative estimates of severe rainstorms and flooding events, the MTO has developed a web-based tool for providing rainfall intensity, duration and frequency (IDF) curves based on past data. The tool provides IDF curves electronically for any location in the province based on a one-kilometre grid. It helps to ensure that future highway drainage infrastructure designs reflect climate change trends and are based on more precise representation of recent weather patterns. The curves are updated periodically when new rainfall data becomes available from Environment Canada.

Other risk assessment and priority-setting initiatives that have been and could be undertaken include the following:

- municipal vulnerability workshops to develop more resilient roads and associated transportation infrastructure, as demonstrated by a Sudbury pilot study in 2008 that applied the PIEVC protocol;
- establishing strategies to address reduced operating seasons of winter roads in the Far North, including ice-thickening measures, partial relocation, alternative technology vehicles and selective replacement with all-season roads; and
- deciding how best to address subsidence of roads and airfield runways built on discontinuous permafrost, including engineering analyses of alternatives ranging from adding more gravel as required to reconstruction and/or relocation.

These and related initiatives will be required to continue providing safe, reliable and efficient transportation in Northern Ontario in the face of climate change.

Transportation Strategy Development Implications

Understanding the effects of climate change and its related variable weather events will require ongoing study. It will also require transportation mitigation and adaptation responses in order to deliver safe, reliable and efficient transportation in Northern Ontario. While the focus in Strategy development is on adaptation to climate change, solutions will also support and contribute to mitigation. A climate change adaptation lens should be inherent in all transportation options/projects going forward. Adaptation measures are already being considered and implemented where appropriate to improve the resiliency of the transportation system. Understanding the requirements and costs of adapting the transportation system to reduce its vulnerability to climate change and severe weather events will be an essential element of ongoing transportation planning in Northern Ontario.

The Strategy development builds on transportation outlooks based on current and past trends, and based on an informed understanding of future outlooks. Climate change could affect future activities, industries and travel demand in ways that may not be entirely predictable, but a focus on planning adaptability and resiliency into the Northern Ontario transportation system will serve the region well in any event.

Some studies indicate that the effects of climate change may be accelerating; the analysis of more recent Northern Ontario weather data than were available for analysis to date may confirm this. The Strategy will need to consider how we can better plan for and build infrastructure that is adaptive to changes in climate, and how future investments in Northern Ontario infrastructure will support communities and industry in light of climate change impacts.

3 OBJECTIVES, CHALLENGES AND OPPORTUNITIES

This section discusses the seven planning objectives that have been identified following extensive outreach since 2011 with public- and private-sector stakeholders as well as with First Nations and Métis peoples and communities, and represent the most important themes for transportation for the region.

The seven planning objectives will help guide, develop and organize the Strategy, and include the following:

- Enhancing Mobility and Connections for Northern Communities;
- Improving Access for Remote Communities;
- More Efficiently Moving People and Goods between Northern and Southern Ontario;
- Enhancing Interprovincial Links and Border Crossings;
- Identifying and Integrating New Infrastructure to Support Major New Economic Development;
- Supporting Northern Ontario Tourism through Transportation Improvements; and
- Enhancing Connectivity and Access for Northern Industries.

It is important to note that safety and sustainability are overarching objectives for MTO and MNDM in long-term transportation planning. Though they are not stated as separate planning objectives, they are inherent in MTO's transportation planning.

The purpose of this section is to synthesize and relate Phase 1 work to the planning objectives. Notable findings from both the Phase 1 working papers and technical analysis, as well as feedback and input to date from stakeholders, First Nations and Métis peoples, are summarized and related to the planning objectives, in order to identify additional implications and considerations for Strategy development.

This section is not meant to be comprehensive in identifying all possible implications and considerations, but is meant to be a sampling of the types of thematic considerations emerging to date.

Among the planning objectives are overlapping needs and issues. Understanding these overlaps can help to identify future potential action options that address the needs of multiple users.

3.1 Enhancing Mobility and Connections for Northern Communities

A Northern Ontario transportation system that provides residents and visitors an effective means of travelling between larger centres, and provides connections to these centres from smaller communities.

A practical means of travel between communities is essential to ensuring that Northerners can access the services, facilities and activities located in Northern Ontario's larger centres. These services include health care, financial services, education, shopping, entertainment, and others.

This objective addresses passenger travel between communities in the Near North, where options include road, rail, air and marine modes. (Travel to remote communities in the Far North is addressed in Section 3.2, and freight movement is addressed in several locations including Section 3.7.)

Transportation Implications and Considerations

The implications and considerations for Strategy development under this objective identified to date are summarized below.

Mobility between, through and around Northern communities

- The Province has implemented a variety of transportation infrastructure improvements in Northern Ontario in recent years, including constructing additional passing lanes, four-laning in higher-capacity areas, and certain airport infrastructure improvements to enhance mobility for the movement of goods and people. The Strategy development process involves taking stock of current and future operational characteristics of Northern Ontario's transportation system. Continued identification of priority areas for infrastructure and operational improvements will be an important component of enhancing mobility throughout the region.
- Transportation planning could further seek to serve both the local transportation and safety needs of municipalities with the mobility needs of long-distance or inter-regional movements of people and goods looking to move across the region quickly and efficiently; for example, through strategic by-passes of urban centres.
- Many Northern Ontario settlements have developed along the northern highway corridors. Over the years, heavy commercial traffic has become increasingly incompatible with urban streets and intersections in some of these settlements. Highway bypasses to divert heavy truck traffic around urban centres are being explored by a number of Northern Ontario municipalities,

including Thunder Bay, Timmins and Cochrane as part of their official plans. These can draw on examples of successful bypasses in Northern Ontario, such as in Kenora and Sudbury.

Other operational considerations for enhancing mobility

- Background climate change research has outlined various adaptation strategies and operational improvements that could maintain or enhance mobility as the effects of climate change materialize and affect transportation infrastructure. This could include consideration of infrastructure improvements to reduce road closures and service interruptions due to more-frequent extreme weather events, and of enhanced system resiliency and driver information systems to better respond to road closures when they do occur.
- Wildlife collisions on Northern Ontario highways are far more frequent than for the province as a whole, especially at dusk and at night. Ways of reducing these types of collisions could be explored and included in the Strategy.
- Improvements or increased consistency of highway signage could enhance way-finding in the movement of people and goods.

Mobility considerations relating to the physical and natural environment

- As the Strategy seeks to enhance mobility and connections, understanding the physical features of Northern Ontario's geography will continue to be a foundational part of the transportation planning process. Considerations include the following:
  - numerous rock outcrops that are part of the Canadian Shield; these must be blasted and maintained for highway construction and operations;
  - caribou migration patterns that must be considered in the development of new infrastructure; and
  - the Clay Belt's unique potential for agricultural development, supported by the region's transportation system.

Local responses to passenger transportation service reductions and discontinuances

- Certain passenger transportation modes have seen service reductions and discontinuances in Northern Ontario, including intercity bus service provided by Greyhound, ONTC, and others, as well as passenger rail service provided by VIA, Algoma Central Rail, and ONTC.
- The Strategy could identify locations with no ground-based, inter-city/inter-regional mobility options other than personal vehicle.

- In recent years a number of place-based, community-driven inter-regional bus services have arisen in an effort to help meet the mobility needs of Northern communities. There is now a range of governance, administrative, operational and service delivery scenarios in the inter-regional bus transportation system. Two examples of local and community responses to service discontinuances are the following:
  - A.J. Bus Lines, contracted by the municipality of Elliot Lake, provides daily service between Elliot Lake and the closest Greyhound stop on Highway 17; and
  - Porky's Shuttle Service, which provides scheduled van services between Thunder Bay and Longlac.
- A consideration for the Strategy development is how the place-based and grass-roots transportation services interplay with traditional intercity bus service.

Connection gaps between passenger services

- Connections between passenger service modes are typically not direct or seamless. For example, transferring from municipal airports to other connecting transportation modes such as bus or rail may require a significant taxi ride in some Northern Ontario urban centres.
- A consideration for Strategy development is determining where potential improvements in connections between modes in Northern Ontario could better serve passenger travel needs. (Connections between freight transport modes are a consideration under Section 3.7.)

Mobility and connection needs of First Nations peoples and communities

- Road connections between Northern Ontario's First Nations reserves and the provincial highways network vary greatly from road to road in terms of surface treatment, maintenance, and road owner. While some reserves in the Near North are well served from a transportation perspective (i.e., multiple entry/exit points, well-maintained roads connecting to the provincial highway network), the transportation options for others are less optimal.
- The maintenance of road connections for First Nation communities living on-reserve to the provincial highway network at times involves considerable complexity. For instance, in some cases the roads belong to the local municipality, whereas in other cases the roads are a shared responsibility across various partners (i.e., the First Nation, the federal government, a Local Roads Board, the provincial government).
- The Strategy development process involves developing a better understanding of the highway connectivity needs relating to all First Nation communities living on-reserve in Northern Ontario in order to advise on potential action options.

Planning for future potential mobility and network capacity needs

- The Phase 1 socio-economic analysis identified future potential areas of population and employment growth. Among the findings was the trend that populations in a number of First Nation communities are growing faster than other populations in Northern Ontario.
- Currently, the average age of Northern Ontario residents (43.9 years in 2011) is higher than for the province as a whole (40.0 years in 2011), and increasing more quickly. The travel needs and patterns of older population cohorts will be a consideration in future strategic transportation planning.
- Travel needs change with the changing nature of households. At current rates, Northern Ontario may see declining household sizes but with continued growth in the number of households, increasing the demand for housing. As the number of households increases, the demand for additional roads or other transportation services may increase as well.

3.2 Improving Access for Remote Communities

A Northern Ontario transportation system that provides more reliable and affordable connections between remote communities and the all-season transportation network.

This objective addresses both passenger travel and goods movement for the remote communities located in the Far North of Ontario.

The Province's Growth Plan for Northern Ontario defines remote communities as those that cannot be reached by all-season roads. There are 31 such communities in the Far North[13]. They are currently connected to the province's transportation system by remote airports owned and operated by MTO, as well as by seasonal winter roads. Residents of these communities are dependent on the remote airports and the seasonal winter roads in order to access services such as health care and education in larger urban areas, and to transport essential supplies to their communities.

Transportation Implications and Considerations

The implications and considerations identified thus far to help inform this objective are summarized below.

Climate change impacts on ground transportation

- It is much more cost-effective to move goods and equipment by winter road than by air. As winter road usage is challenged by the warmer temperatures and more-frequent extreme weather events of climate change, the costs to transport supplies would increase significantly should air transportation become more heavily relied upon rather than winter road. With this reality, options such as winter road realignments to higher ground or to more effective routes with less water crossings, the construction of permanent crossings (e.g. bridges) at key locations, as well as consideration of future new all-weather road construction, are being discussed by communities and governments alike.
- Some communities in Northeastern Ontario are connected directly or indirectly by rail. The ONTC Polar Bear Express runs as far north as Moosonee,

13 The following were included in the total of 31 Far North First Nation communities; other sources may have different totals depending on whether these are included:

- McDowell Lake is a small community with a band government, but without reserve land, and residents tend to have permanent homes off-site;
- Koocheching has a band government; current population data are not available; and
- Slate Falls is near the Far North boundary.

Note that Mishkeegogamang is in the Far North, but has all-season road access and is therefore not numbered among remote communities.

and then winter roads connect some remote communities to this rail connection. As permafrost degradation occurs due to a warming climate, consideration should be given to rail infrastructure maintenance and adaptation to be more resilient to climate change impacts.

Community implications of changes in access

- Extending all-season roads or rail to remote communities has the potential to bring significant benefits to community members. All-season transportation may make the provision of health care, education, and other services within the community more feasible, rather than requiring community members to access these services off-site. If services are still not feasible within the community, the costs of travel by rail or road to access services outside of the community are typically lower than the costs of flying.
- The movement of contraband substances into remote First Nation communities, such as drugs or alcohol, is a significant security concern tied to access for a number of communities. Increasing access by way of potential all-season roads or rail would require collaborative planning alongside communities to balance and/or mitigate potentially negative implications such as increased access to contraband substances with the benefits of enhanced access for the communities.
- Other considerations regarding new or revised ground access include any potential implications for traditional lands and practices, including associated risks of forest fires, habitat loss, and impacts on ecosystems. The potential for new corridors through remote areas to have unintended effects on land uses such as remote outpost camps that may be operated by First Nations is an important consideration.

Getting on the Grid: Remote Communities

Twenty-five remote First Nation communities in Ontario's Far North are currently not connected to Ontario's power grid. They rely on local diesel generating stations to provide electricity, with diesel fuel brought to their community by air, water or winter road. 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 identified that there is an economic case to connect up to 21 remote communities at this time. Wataynikaneyap Power, a partnership of 20 Ontario First Nation communities together with Fortis-RES, an electricity transmitter, is seeking to build, own and operate transmission infrastructure to connect remote First Nation communities 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.

Ground access considerations

- Potential new ground transportation infrastructure in support of Ring of Fire or other mineral development in the Far North (see Section 3.5) would also provide year-round access to the province's highway network for remote communities in the vicinity.
- It should be explored whether any existing Forest Access Roads or NORT roads (see box on page 13) could serve a dual purpose, or be re-purposed, to improve access for remote communities in the Far North, and to enhance connections to communities in the Near North.

Air access considerations

- Although many remote airstrips can accommodate larger aircraft, such as the Hercules C-130, the movement of very large equipment is still generally restricted to winter ice roads.
- Selective upgrades of remote airports used to transport certain vital supplies (e.g. construction supplies and equipment) and support industrial activities, such as remote mineral extraction, could be a Strategy consideration to enhance access for remote communities.
- First Nation communities have also expressed the need for updated navigation landing systems at their airports to assist in poor weather conditions.

Policies and funding affecting access for remote communities

- Both the provincial and federal governments are involved in the policy and funding landscape that affects and shapes transportation connections to remote communities. For example, MNDM jointly funds the Winter Roads Program with Indigenous and Northern Affairs Canada (INAC).
- First Nation communities have noted that complexity can sometimes exist for communities in identifying and addressing issues. Given both the provincial and federal governments' work with communities on the winter roads program, it is not always clear whom communities should be communicating and meeting with on various winter roads issues. A consideration during Strategy development is whether opportunities could be explored to streamline some of the complexities in the policy and funding processes.
- Additionally, though many remote airports are located on reserve lands, it can still be challenging for people to move between their home and the airport. Local on-reserve roads vary in terms of surface treatment, and there may be limited personal vehicle options or constraints on use of local government vehicles. In some cases, multiple orders of government are involved in this area, including the local Band Council, INAC, and MTO, as well as the private sector.

- Winter road operations as well as policies and funding supporting winter roads could be enhanced through more consistent data measurement and collection. Opportunities exist to explore new traffic counting technology and data collection related to winter roads.
- Plans for electrical power transmission connections to remote communities should be considered in transportation planning, as well as any linkages to telecommunications enhancements in the Far North.

Adaptability to technological advancements

- In the long term, new or advanced transportation technologies could be used to move heavy loads across vast distances to remote locations, such as air ships or hovercraft. These future technologies could have the potential to be more cost-effective than current transportation practices.
- The NOMTS is a 25-year strategy; therefore, consideration should be given to being adaptable to future technological advancements that could change the transportation landscape.

3.3 More Efficiently Moving People and Goods between Northern and Southern Ontario

A Northern Ontario transportation system that improves mobility of people and goods between Northern and Southern Ontario.

This objective strives to improve the movement of goods and people between Northern and Southern Ontario using linkages that are important to both regions and represent a variety of transportation modes.

In terms of goods movement, road, rail, air and marine modes enable commodities from Western Canada and Northern Ontario to flow east and south, and for goods and services from the south and east to flow north, west, and beyond. At the same time, personal automobile, intercity bus, rail and air modes provide Northern Ontario residents with reliable access to centres and services in the south, and allow Southern Ontario residents and tourists to travel northward for recreation and other purposes.

Note that transportation within Northern Ontario is addressed by the planning objectives of “enhancing mobility and connections for Northern communities” (Section 3.1) and “enhancing connectivity and access for Northern industries” (Section 3.7).

Transportation Implications and Considerations

Strategic implications and considerations informing this objective are summarized below.

Economic implications related to efficient north-south links

- Implications related to highways include the economic costs of travel delays. On a typical weekday about 10,000 trucks travel between Northern and Southern Ontario by highway. These trucks may experience delays due to summer recreational traffic, poor driving conditions in winter, and traffic incidents that limit or halt highway operations.
- Air connections are also used for certain freight movement to/from Southern Ontario, and implications related to municipal airports in the Near North could impact the efficient movement of goods and people between Northern and Southern Ontario. The 2015 Northern Ontario Municipal Airports Survey confirmed that most mid- to small-size municipal airports require significant infrastructure upgrades but struggle to dedicate enough funding to capital investments due to their tenuous financial situation and a challenging funding environment. Some airports lack appropriate cargo-handling facilities to support goods movement.
- The effects of climate change, such as more frequent extreme weather events and severe storms, may impact the efficient north-south movement of goods and people. Given the volume of commercial traffic and commodity value using the north-south links, a consideration for Strategy development is how best to integrate climate change mitigation and adaptation practices in transportation planning, particularly for highways.
- The Strategy development process will look at system enhancements that could potentially increase the economic efficiency of travel on north-south links. For instance, consideration could be given to whether specific capacity improvements in high-traffic locations or areas of concern would be cost-effective.

Societal implications of efficient north-south connections

- In addition to the economic need for north-south links to operate efficiently, there is a strong societal need for the same. A variety of travel modes are used for passenger travel to and from Southern Ontario, from air, to road, to passenger train, to marine by way of the MS Chi-Cheemaun Ferry that runs between Tobermory and Manitoulin Island.

- The Socio-Economic Context working paper noted that Northern Ontario's net population decline over the last 25 years is due in part to out-migration of working-age people to larger urban centres in Southern Ontario, as well as to certain neighbouring jurisdictions. Residential migration within Ontario will continue to take place over the next 25 years and beyond.
- When people relocate, family and community ties often remain. Reliable north-south transportation links remain important aspects of social and familial well-being. A NOMTS technical background report found that the main trip purposes for travelling on Northern Ontario highways included visiting friends and family, both within the region and interregionally (IBI Group, 2013b).

3.4 Enhancing Interprovincial Links and Border Crossings

A Northern Ontario transportation system that provides efficient connections to adjacent provinces and to the United States.

Northern Ontario's central location in Canada and its largely resource-based economy mean that efficient transportation connections with neighbouring jurisdictions are critical for the health of the regional, provincial and national economies. This objective centres on Northern Ontario's interprovincial and international links, particularly for freight. These links include the highway system, transcontinental railways, and shipping on the Great Lakes and St Lawrence Seaway.

These links support Canada's resource- and export-based economies by enabling the efficient movement of Northern Ontario products to market. At the same time, interprovincial and international passenger travel via road, rail and air is also essential to the region's social and economic well-being.

Transportation Implications and Considerations

The economic role of international bridges

- A background report informing NOMTS summarizing Northern Ontario commercial vehicle results (IBI Group, 2013a) reported that over 4,000 trucks per week cross international borders to and from Ontario, carrying about $42 million weekly in Ontario-bound goods, and $30 million weekly in U.S.-bound goods.
- Phase 1 work has also begun to describe the various governance structures presently in place for Northern Ontario international bridges. Currently, the oversight of border crossings in Northern Ontario is not consistent with other international crossings in Ontario, where border authorities generally have a more established role. It is unclear at this point how variances affect transportation operations in Northern Ontario. The Strategy development could determine the potential implications of having differing governance structures and whether there is justification to either maintain or change these structures.
- In some areas, direct high-quality road connections are lacking to reach border crossing points. Commercial truck movements may be hindered by connecting routes that are not suitable for heavy trucks, and international tourists and visitors could also face travel inefficiencies on these routes.

Interjurisdictional air connections

- Some industries also move freight by air to and from Northern Ontario locations from outside Ontario. An opportunity exists for the Strategy to assess the existing cargo handling facilities at Northern airports to inform how to plan for more efficient interjurisdictional commodity flows.

Considerations for connections to Western Canada

- Interprovincial and international road connections are important for transporting industrial inputs and outputs for Northern Ontario's industrial sectors such as forestry, mining, manufacturing and agriculture.
- Northern Ontario's interprovincial road connections are also economically significant to areas outside of the region. For example, a significant proportion of trucks travelling through Northern Ontario bring goods from Southern Ontario or Eastern Canada to transportation warehousing centres in Winnipeg for broader distribution.
- The Ontario-Manitoba transportation links move goods from Western Canada through Northern Ontario to market. For example, agricultural commodities such as grain and canola move by rail and truck from the Prairies through Ontario to intermodal facilities at the Port of Thunder Bay.

- Cross-jurisdictional links between Ontario and Manitoba are important for passenger travel as well, in terms of accessing services as well as recreation. A Fall 2011 survey found that nearly 25% of Ontario – Manitoba weekday trips were to access medical services (e.g. in Winnipeg, the closest regional centre), with an average trip length of over 200 km (IBI Group, 2013b).
- Recent reductions in bus and rail service frequencies make travel between Northwestern Ontario and Winnipeg more costly, as a return trip can no longer be made the same day.

Interjurisdictional marine implications

- Potential interjurisdictional and economic development opportunities exist related to a cruise ship industry for the Great Lakes, though there are a range of associated challenges, limitations, and potential. For example, given current cabotage[14] laws, non-Canadian operators cannot bring passengers or goods between two Canadian ports, so Great Lakes cruises would need to alternate between Canadian and American ports.
- Non-road, cross-border transportation between Northern Ontario and the U.S. is served by rail and air primarily, with some marine usage by certain industries. Relative to other regions in the country, the volume of goods generated in Northern Ontario has historically been insufficient to make truck/rail intermodal facilities for containerized traffic commercially viable; however, an opportunity exists during Strategy development to assess and confirm whether this remains the case.

3.5 Identifying and Integrating New Infrastructure to Support Major New Economic Development

A Northern Ontario transportation system that supports economic development of new resource sites.

Future and continued economic development in Northern Ontario will require new transportation infrastructure to support economic activity, particularly to connect new major resource sites in the Far North to highway and/or rail networks in the Near North.

This objective reflects the need to guide transportation planning that supports development of such infrastructure in a manner that is economically viable, environmentally sustainable, and that supports the socio-economic well-being of nearby communities.

14 Cabotage is the restriction of the operation of transportation services within a particular country to that country's own transportation services, and applies to marine, rail, air and road modes.

Planning for transportation access to new resource extraction sites — often located in remote areas of the Far North — is the focus of this objective. The most significant new resource extraction site the Province is looking to develop is the Ring of Fire. Due to its estimated economic importance, and the advancing work undertaken to date by the Province alongside local First Nation communities, it is used as the main example for this planning objective.

The infrastructure required to support mineral development will vary over the life of a project. During early-stage development of a remote mine, companies rely on air access and in some cases winter roads. Later during the resource extraction stage, new high-capacity ground-based transportation connections are required. This section addresses both stages of infrastructure development.

Transportation Implications and Considerations

Considerations relating to physical geography and the environment

- Any ground transportation route to the Ring of Fire would need to be designed for the realities of the local physical geography. The Ring of Fire is located in the transition area between the Canadian Shield and the Hudson Bay Lowlands, and is an area characterized by many lakes, rivers and swampy areas and at times rugged and rocky topography. These features make the construction, maintenance and operation of roads, rail lines and airports difficult and expensive.
- Implications of new transportation infrastructure related to the physical environment also include a potential increased risk of forest fires and ecosystem disruptions when road and rail access are expanded in sensitive wilderness areas, as well as implications related to wildlife migratory routes.
- The effects of climate change, namely the degradation of permafrost in the Far North, will be an ongoing concern for the integrity of transportation

Ontario's Commitment to Ring of Fire

Since 2014, Ontario has committed to provide up to $1 billion toward the development of strategic transportation infrastructure for the Ring of Fire.

The Ring of Fire, located 540 kilometres northeast of Thunder Bay, is one of the most significant mineral regions in the province. It has economic potential of $60 billion and includes North America's largest deposit of chromite, a key ingredient of stainless steel.

infrastructure supporting the Ring of Fire development. The Strategy development will give consideration to best practices in climate change adaptation strategies.

- Marine transportation of resources from the Ring of Fire via James Bay would be challenged by the shallow depths of James Bay. Should a deep-water port be constructed, which would be technically and financially challenging, significant dredging as well as icebreaker use during the spring and fall months would be required to keep this route open for enough of the year to be economically viable.

Need for aggregates

- New or improved road or rail transportation infrastructure supporting the Ring of Fire and spanning long Northern Ontario distances will require vast quantities of aggregates (e.g., sand, gravel, and crushed stone). Though aggregates are a low-cost commodity per tonne, they are heavy and can be expensive to transport. Trucking costs for aggregate are high, so aggregate extraction close to construction sites is ideal.

Multimodal system considerations

- The 2015 Northern Ontario Municipal Airports Survey found that many of Ontario's northern municipal airports are not able to operate on a cost recovery basis and require infrastructure enhancements. Given that air transportation is often used in early-stage development of new mines, the Strategy has the opportunity to include strategic municipal airport improvements to support Ring of Fire development.
- Mined products from the Ring of Fire would need to be moved to mineral processing facilities, which could be located in the Near North. A consideration for the Strategy is supporting the transportation options needed to adequately serve both the Ring of Fire and related processing facilities.

Needs, role and input of remote First Nation communities

- First Nation communities in the Far North are working with the Ministry of Natural Resources and Forestry to jointly develop Community-Based Land Use Plans (CBLUPs) under the Far North Act, 2010, which clarify where development can occur and where land is dedicated to protection[15]. The Act states that where there is a CBLUP in effect, all decisions regarding the allocation, disposition or use of public land and natural resources shall be consistent with that CBLUP. Under the Far North Act, 2010, most development is prohibited from proceeding before a CBLUP is in effect, unless an exception or exemption applies. The CBLUPs in the Ring of Fire area are still being developed, and will have implications for potential resource extraction locations and transportation infrastructure construction.

15 CBLUPs do not apply to First Nation Reserves themselves or to municipal lands in the Far North of Ontario, but to the traditional lands outside of the reserves.

- In addition, the Strategy will need to consider how to balance cross-cutting objectives met by potential new transportation infrastructure with local community needs. Specifically, new transportation infrastructure to support the Ring of Fire could also serve to increase reliable access to some northern First Nation communities, which is another NOMTS objective. The NOMTS work to date has included information-sharing meetings with First Nation and Métis peoples and communities in which an interest has been expressed in exploring potential training, employment and/or procurement processes that could more meaningfully involve Indigenous peoples in future industrial and transportation system activities.

3.6 Supporting Northern Ontario Tourism through Transportation Improvements

A Northern Ontario transportation system that enables and enhances the tourism experience.

This objective addresses strategic transportation planning from the perspective of supporting and enhancing Northern Ontario tourism.

Tourism is economically important to Northern Ontario, as the industry employs approximately 15,000 people. In 2010, there were 4.9 million visitors to Northern Ontario who spent approximately $1.4 billion (CPCS, 2013). The region offers a unique experience for tourists due to its topography, many lakes and rivers that offer outdoor adventure activities, and other social and culture experiences. Provincial and national parks are among the major draws for tourists to the region, in addition to tourism offerings such as remote lodges and outpost camps, museums and art galleries, and scenic trails/routes.

Transportation itself can be an attraction, including the Polar Bear Express rail line from Cochrane to Moosonee, the Agawa Canyon Tour Train offering day trips between Sault Ste. Marie and Agawa Canyon Park, and the MS Chi-Cheemaun ferry service connecting Tobermory to Manitoulin Island.

Transportation Implications and Considerations

Where Northern Ontario visitors travel from and why they travel

- The majority of visitors to Northern Ontario come from within the province, accounting for 77% of tourists in 2011. The remainder derived from the U.S. (14%), other parts of Canada (7%), and international travellers (1%) (CPCS, 2013).

In 2012, the most common reason for Ontario residents to visit Northern Ontario was to visit friends and family (about 44% of Ontario-based visitors, or 2.8 million people). The next most-common reason was pleasure trips, including hunting, fishing and other activities (36%) (CPCS, 2013).

Multimodal transportation demand

- Though most tourism travel in Northern Ontario is conducted by passenger vehicle, other modes are also used, including commercial and charter flights, intercity bus, passenger rail and certain marine options

  However, as also noted in Section 3.1, multimodal connections between transportation modes are not always straightforward. When arriving to the region by rail or air, many tourists first arrive in the region's urban centres. Connections to subsequent travel modes are often not direct. A consideration for the Strategy development is how to enhance the tourism travel-connection experience.

- Without the ability to access federal subsidies (which are tied to scheduled service), smaller municipal airports do not offer passenger service due to the high cost. Scheduled passenger service is inconsistently available, which increases the need to drive to destinations. For example, in the Near North, a large area north of Sault Ste. Marie, west of Timmins south of Nakina and east of Thunder Bay has no airports with scheduled passenger flights.
- Tourism activities in Northern Ontario, such as fishing, boating, cycling, hiking and camping, can be widely distributed and are often distant from urban centres. Certain tourist attractions located outside of Northern Ontario cities typically require a personal vehicle to visit and are not easily accessible to all potential visitors.
- Certain travel options, such as ride-sharing, may be both more cost-effective and convenient for tourists than the use of rental or personal vehicles.
- Northern Ontario tourist activities also include modes of transportation such as snowmobiling, use of all-terrain vehicles (ATVing), and cycling. A consideration for NOMTS is how these modes interact and align with other provincial strategies, policies and planning initiatives related to these tourist activities.

Highway-specific considerations for supporting tourism

- Tourists may not be aware of the challenges associated with driving across the region that are more typically understood by Northerners, such as the following:
  - long distances between gas stations and rest stops;
  - increased risk of wildlife collisions;
  - lack of cell-phone connectivity in certain areas;
  - wayfinding and signage that are not always consistent across the region; and
  - locations and spacing of passing lanes.

An opportunity exists for the Strategy to include strategic operational improvements to enhance travel safety, consistency and reliability for tourists and visitors.

Implications of emerging tourism opportunities

- A cruise ship industry on the Great Lakes is a potential tourism offering. However, given the short operating season for Great Lakes cruises and other challenges, it can be difficult for a Canadian-owned cruise operations to be financially viable. Federal cabotage regulations preclude non-Canadian operators from carrying passengers between two Canadian ports. American or other international cruise operators are limited to routes that alternate between American and Canadian ports. Currently Canadian charter yacht operations exist, but there are no Canadian cruise ships operating in the North. There is one American operator in the Great Lakes; the operator stays only in US waters because of regulations.
- Growing tourism opportunities centred on Indigenous cultural experiences are also emerging, such as nature-based Indigenous tours, traditional ceremonies celebrating Indigenous culture, food and history, and canoe trips that retrace ancient routes, though it is recognized that interest in providing this type of tourist experience varies greatly by community.

3.7 Connectivity and Access for Northern Industries

A Northern Ontario transportation system that enables the movement of inputs to industry and of products to market.

This objective highlights the need for transportation infrastructure to serve Northern Ontario's industries, from the movement of important industry inputs like equipment, supplies and labour, to the movement of products to market.

Mining, forestry, agriculture and manufacturing are the main sources of the employment that is fundamental to the region's prosperity, together with tourism (Section 3.6). Mining and forestry in particular bring the largest share of wealth to the region. Agriculture and manufacturing have smaller but significant roles, and provide important inputs to the mining and forestry industries. Approximately 80% of Northern Ontario's manufacturing activity is directly related to the mining and forestry industries.

In addition to mineral development, the productive capacity of agricultural land in Northern Ontario is increasing due to investment in tile drainage and other land improvements, new crop varieties, the use of innovative technologies, and changing climate conditions. This contributes to opportunities for considerable expansion of Northern agricultural production, which also has implications for the transportation system.

Transportation Implications and Considerations

Transportation planning to support economic development, recognizing the cyclical nature of resource-based sectors

- Growth in certain economic sectors, primarily resource-based sectors like mining and forestry, is at least partially dependent on investments and improvements to the transportation network. Each of the industry profiles in the Phase 1 Socio-Economic Context Working Paper indicates some level of dependence on an efficient and reliable regional transportation system to move goods and people.
- Long-term commodity price trends are important for informing long-term transportation planning. The nature of transportation planning exercises like NOMTS is to look beyond just short-term needs, and apply a long-range view to planning. The price histories of gold, copper and nickel shown in the Socio-Economic Context Working Paper indicate the price cycles over the past 20 to 25 years have generally seen a rising trend despite cyclical variations. Mining commodities have also seen greater price growth than forestry or agriculture, two other sectors of importance to Northern Ontario.
- For the mining sector, continuing growth of existing mine sites, combined with anticipated future development of new mines, mean that the mining industry will continue to rely on Northern Ontario's existing transportation network and new links as appropriate to ensure the movement of goods and labour.
- The mining supply and services industry will grow in tandem with direct mining activity in the North, with its own transportation requirements.
- Forestry is also historically a cyclical industry. Over the last ten years, the forestry sector in Ontario has experienced a general decline due to lower demand for lumber and manufactured wood products. However, alternative forestry products such as biomass for energy production, chemicals and materials represent future opportunities in Northern Ontario. From a long-term economic development perspective, a consideration for Strategy development is whether and how transportation system access affects or influences the alternative forestry products sub-sector.

Efficient movement of industry inputs and of goods to market

- Commercial truckers sometimes face substantial delays travelling on Northern Ontario routes due to temporary road or bridge closures, particularly where a feasible detour route is not available. A consideration for Strategy development is whether enhanced network resiliency is required to better support the economic efficiency of Northern Ontario industries. In addition, the Strategy could be an opportunity for MTO and other road system operators to accelerate initiatives for reporting highway conditions and using

intelligent transportation systems (ITS) so that all road users have timely information of potential issues with the route ahead.

- The NOMTS process has included developing an in-depth understanding of highway routes used by goods moved to, from, within and through Northern Ontario by all industry sectors. This insight can be applied in prioritizing transportation system improvements to improve connectivity and access for Northern industries as part of the Strategy.
- The Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) is working with partner ministries on a strategy for the Agriculture, Aquaculture and Food Processing sector under the Growth Plan for Northern Ontario, 2011. This strategy development process will identify opportunities for growth in Northern Ontario and will consider factors such as transportation implications. The ability to accommodate potential increased movements of agricultural equipment and goods is a consideration for Northern Ontario's transportation system.
- Given their perishable nature, agricultural products are carried mostly by truck on primary highways throughout the region. Some farming inputs arrive by rail at regional hubs, where they are transferred to trucks for distribution by farm supply companies. A lack of local processing facilities and long distances to markets contribute to high transportation costs for farmers in the area, in addition to the generally rising cost of agricultural inputs like fuels and fertilizer.

Regulatory implications for goods movement

- Most industries rely on trucking to some degree to move their inputs and products. Commercial truck drivers must follow hours-of-service regulations, and find that for certain long-haul routes in Northern Ontario, the locations and spacing of rest facilities that are suitable for trucks do not coincide well with their allowable work hours. As a result drivers may be fatigued as they drive too long in search of a suitable rest area, attempt to rest at undesignated areas, or stop before maximizing their work day, resulting in shorter days and lost productivity. Transportation planning to support Northern Ontario's future economic development will therefore need to consider how the location and offerings of rest areas align with regulatory requirements for hours of service.

- Additionally, vehicle weights and dimensions are regulated by the Province for safety reasons, and due to the rapid road deterioration that results from heavy truck loads. The movement of some products would be more efficient by more heavily loading vehicles, which would require oversize/overweight permits or revised vehicle weights and dimensions standards. Vehicle weight regulations to support industrial activity must be considered against transportation planning needs. Examples include the need to maintain quality road infrastructure for all road users; and the need to factor in the effects of climate change, such as potential increased pavement softening or rutting from higher temperatures
- Depending on the type of road surface, the spring thaw period may necessitate having reduced load limits on roadways, which reduces the efficiency of moving goods during that period. Spring load limits can be increased if the road structure is upgraded.

Funding and policy landscape for Northern industry

- Northern Ontario communities and industries receive support through a variety of government funding programs and policy directives. One example of Ontario's response to transportation needs is the Forest Access Roads program (administered by MNRF). Industry stakeholders generally report the program provides benefits to the forest industry, the mining and exploration industry, the tourism industry, anglers, hunters, First Nations, utilities, railways and emergency management.
- The Strategy development could include the review and/or consideration of government funding programs and related policies to support the transportation needs of forestry and other industries in Northern Ontario.

4 NEXT STEPS

Phase 1 of the NOMTS is nearly complete. Refinement and finalization of this phase and of this report will occur once public input and feedback have been received and incorporated.

- ✓ As a reminder, please share any feedback or new information for topics contained within this report with the NOMTS team by July 15, 2016.
- ✓ Comments can be submitted through the Environmental Bill of Rights (EBR) posting for this study or shared through the project website: http://nomts.ca/contact-us/.

Phase 2 is now underway and involves detailed information-gathering activities and multi-modal transportation system analysis. This phase will identify the transportation challenges and opportunities in Northern Ontario, now and in the future.

- ✓ Stay tuned on the project website (www.nomts.ca) for details on locations and dates for fall 2016 public information sessions planned to be held across Northern Ontario as part of Phase 2.

Phase 3 will refine multimodal transportation strategy options and prioritize them in relation to their contribution to achieving cross-cutting objectives.

- ✓ The strategy recommendations will be confirmed and refined based on an interactive process with a variety of stakeholders and further public consultation.

The final Strategy is anticipated to be completed in 2017.

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6 ALTERNATE TEXT FOR EXHIBITS

Exhibit 1.1: Map of Northern Ontario Transportation System Elements

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. Major ports and 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 1.1

Exhibit 2.1: Physical Geography of Northern Ontario

This map shows the Hudson Bay Lowlands, Canadian Shield, and Clay Belt, with the boreal forest boundary and the permafrost southern limit. Other labelled features include: select population centres, primary and secondary highways, local secondary highways, major out of province roads, and railways.

Return to Exhibit 2.1

Exhibit 2.2: Typical Landscapes of the Northern Ontario Canadian Shield

These two photos show typical landscapes of the Canadian Shield in Northern Ontario. There is a typical rocky outcrop and a typical boreal forest landscape.

Return to Exhibit 2.2

Exhibit 2.3: Typical Landscapes in the Hudson Bay Lowlands

Typical landscapes in the Hudson Bay lowlands include wetlands and tundra. The wetlands are photographed from above, displaying their vast expanse.

Return to Exhibit 2.3

Exhibit 2.4: Map of Northern Ontario: Far North Boundary, Statistics Canada Census Districts and Municipalities

This map depicts Northern Ontario administrative divisions, including municipal boundaries, Statistics Canada census districts, and the Far North boundary. The map includes select population centres, other population centres, and highways – primary, secondary, and local – in addition to out of province roads.

Return to Exhibit 2.4

Exhibit 2.5: Population by Northern Ontario Census Division, Including Proportion Identifying as Aboriginal

This bar graph shows the population by Northern Ontario census divisions with the proportion of the population in each division identifying as Aboriginal. In order from the highest population to the lowest population the census divisions are Greater Sudbury, Thunder Bay, Algoma, Nipissing, Cochrane, Kenora, Parry Sound, Timiskaming, Sudbury, Rainy River, and Manitoulin. 41% of Aboriginal people in the North live on reserve compared to 16% across Ontario. Data drawn from the 2011 National Household Survey.

Return to Exhibit 2.5

Exhibit 2.6: Historical Age Structure in Northern Ontario, 2011

This graph demonstrates the distribution of the population among Northern Ontario's population for the year 2011. Population shares are shown based on 5-year cohort groupings for both men and women, each represented as a percentage of Northern Ontario's total population. The peak age cohort is ages 50-54. All data are from Statistics Canada.

Return to Exhibit 2.6

Exhibit 2.7: Place-of-Work by Industry and Census Division, 2011

This bar chart demonstrates the diversity of place of work by industry and census division for 2011. Census Divisions include Greater Sudbury, Thunder Bay, Algoma, Nipissing, Cochrane, Kenora, Parry Sound, Timiskaming, Sudbury, Rainy River, and Manitoulin. The industry categories are Agriculture, Forestry Fishing, and Hunting; Mining, Quarrying, and Oil and Gas Extraction; Manufacturing; Utilities and Construction; Wholesale and Retail Trade; Transportation and Warehousing; Finance, Insurance, Real Estate; Professional, Scientific, Technical, Management; Administrative, Waste Management, Remediation; Educational Services; Health Care and Social Assistance; Information, Arts, Entertainment, and Recreation; Accommodation and Food Services; Other Services

(except Public Administration); and Public Administration. Data are from the 2011 National Household Survey and industry groupings are based on North American Industry Classification System (NAICS) 2007.

Return to Exhibit 2.7

Exhibit 2.9: Temperature Trends, Canada, 1948-2014

This line chart presents average annual temperatures from 1948 to 2014 in Canada as the departure from the 1961 to 1990 average in degrees Celsius. The yearly data show temperature fluctuations from year to year. A linear trend line is fitted to the data, showing an increase from approximately 0.5 degrees Celsius below the 1961 to 1990 average in 1950, to approximately 1.2 degrees above the 1961 to 1991 average in 2014.

Return to Exhibit 2.9

Exhibit 2.10: Precipitation Trends, Canada: 1948-2014

This bar chart shows average yearly precipitation from 1948 to 2014 in Canada as the departure from the 1961 to 1990 average precipitation levels. A 9-year running mean is shown as a line across the chart as well, indicating overall increases in precipitation levels from approximately 10 percent below 1961 to 1990 levels in 1950 to approximately 7 percent above 1961 to 1990 levels in 2010.

Return to Exhibit 2.10

Exhibit 2.12: Broad Modal Cost Comparisons for Regular Food Delivery to Remote Communities

This line graph compares the approximate costs per tonne of delivering food to remote communities via cargo airplanes, transport airships, ice road trucks, and highway trucks. Transportation Costs are shown as dollars per megatonne on the vertical y-axis, and distance between origin and destination on the horizontal x-axis. The transport modes in order of cost from highest to lowest are cargo planes, airships, ice road trucks, and highway trucks. The increase in transportation costs by distance is highest for cargo airplanes, second for airships, and lowest for winter road truck and for highway truck.

Return to Exhibit 2.12

Exhibit 2.13: Ontario's GHG Emissions Trajectory

This graph shows Ontario's greenhouse gas emissions trajectory with a line depicting historical GHG emissions in megatonnes CO2 emissions from 1990 to 2012. From 2012 to 2050 a wide band of projected emissions is shown. The highest increase in emissions is shown as "Without Policy Measures". The contribution of a number of policy measures to reducing the projected GHG emissions is shown. These policies include Transportation, Fuel Efficiency Regulations, The Big Move plus Greater Golden Horseshoe (GGH) Growth Plan, Other Transportation Initiatives, Agriculture and Waste Non-Energy, Buildings, Industry, Electricity Generation, and New Initiatives. There are three lines on the graph depicting three different GHG emissions target levels, each with a further reduction from 1990 greenhouse gas emission levels: 2014 with a 6 percent reduction, 2020 with a 15 percent reduction, and 2050 with an 80 percent reduction.

Return to Exhibit 2.13