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URGENT

BUILDING CLIMATE RESILIENCE ACROSS CANADA'S CRITICAL TRANSPORTATION INFRASTRUCTURE

Report of the Standing Senate Committee on Transport and Communications

The Honourable Leo Housakos, Chair
The Honourable Julie Miville-Dechêne, Deputy Chair

For more information please contact us:
by email: TRCM@sen.parl.gc.ca
by mail: The Standing Senate on Transport and Communications
Senate, Ottawa, Ontario, Canada, K1A 0A4
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The Committee Membership

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Chair

The Honourable Julie Miville-Dechêne
Deputy Chair

The Honourable Senators

Andrew Cardozo

Bernadette Clement

Rodger Cuzner

Donna Dasko

Clément Gignac

Fabian Manning

Jim Quinn

Paula Simons

Ex-officio members of the committee:

The Honourable Senator Gold, P.C. and/or the Honourable Senator LaBoucane-Benson
The Honourable Senator Plett and/or the Honourable Senator Martin
The Honourable Senator Saint-Germain and/or the Honourable Senator Clement
The Honourable Senator Tannas and/or the Honourable Senator Patterson
The Honourable Senator Dalphond and/or the Honourable Senator White

Other Senators who have participated in the study:

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The Honourable Senator Bev Busson
The Honourable Senator René Cormier
The Honourable Senator Pierre J. Dalphond
The Honourable Senator Dennis Dawson (retired)
The Honourable Senator Percy Downe
The Honourable Senator Éric Forest
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Khamla Heminthavong, Analyst

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Natassia Ephrem, Administrative Assistant

Senate Communications, Broadcasting and Publications Directorate:

Sabryna Lemieux, Communications Officer
Ben Silverman, Communications Officer

Order of Reference

Extract from the *Journals of the Senate* of Thursday, February 10, 2022:

With leave of the Senate,

The Honourable Senator Housakos moved, seconded by the Honourable Senator Wells:

That the Standing Senate Committee on Transport and Communications be authorized to examine and report on the impacts of climate change on critical infrastructure in the transportation and communications sectors and the consequential impacts on their interdependencies, and measures needed to increase resiliency to those impacts;

That the committee also examine the impacts of critical infrastructure in the transportation and communications sectors on climate change, and measures to reduce those impacts; and

That the committee submit its final report no later than November 30, 2023, and that the committee retain all powers necessary to publicize its findings for 180 days after the tabling of the final report.

The question being put on the motion, it was adopted.

Interim Clerk of the Senate

Gérald Lafrenière

Extract from the *Journals of the Senate* of Thursday, November 30, 2023:

The Honourable Senator Miville-Dechêne moved, for the Honourable Senator Housakos, seconded by the Honourable Senator Boehm:

That, notwithstanding the order of the Senate adopted on Thursday, February 10, 2022, the date for the final report of the Standing Senate Committee on Transport and Communications in relation to its study on the impacts of climate change on critical infrastructure in the transportation and communications sectors and the consequential impacts on their interdependencies be extended from November 30, 2023, to November 30, 2024.

The question being put on the motion, it was adopted.

Interim Clerk of the Senate

Gérald Lafrenière

Introduction

Like many countries around the world, Canada is feeling the impacts of climate change, which are becoming increasingly destructive. Climate change related events, including major storms, floods, droughts and forest fires, are becoming increasingly intense and frequent. These climate hazards pose a significant risk to the health and well-being of communities, the natural environment and the nation's economy.[1]

The impacts of climate change are many and varied in Canada, ranging from the degradation of permafrost[2] and ice coverage, which can be detrimental to infrastructure in the North, to sea-level rise and erosion[3] along Canada's three coast lines, which can jeopardize transportation infrastructure and related services.[4]

Given the urgent need to respond to the potentially devastating effects of climate change on the supply chain infrastructure used to move goods and people to, from and within Canada, the Standing Senate Committee on Transport and Communications (the committee) decided to conduct a study on the impacts of climate change on critical transportation infrastructure and on the measures that can be taken to reduce those impacts.

Over the course of 29 meetings and two site visits, the committee met with all three levels of government, Indigenous peoples, and stakeholders from the transport, construction, engineering, business and academic sectors. Following the recommendation of the Honourable Senator Colin Deacon, the committee structured its work into four case studies: (1) the Chignecto Isthmus; (2) Canada's North; (3) Vancouver airport and marine port; and (4) the Great Lakes St. Lawrence Seaway.

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[1] Council of Canadian Academies, The Expert Panel on Climate Change Risks and Adaptation Potential, *Canada's Top Climate Change Risks*, 2019.

[2] According to the Canadian Permafrost Association, "Permafrost is ground (soil or rock) that remains at a temperature of 0°C or lower for at least two consecutive years. Most permafrost in Canada also contains water in the form of ice".

[3] According to CLIMAtlantic, "Coastal erosion is a natural process that consists of the breakdown of rock and sediments at the shoreline, both above and below the water surface. In Atlantic Canada, coastal erosion happens due to the action of waves, and to a lesser extent tidal action, wind, storm surge, ice, rain, and surface runoff." CLIMAtlantic, *Erosion (Coastal)*.

[4] Darren Swanson et al., *Advancing the Climate Resilience of Canadian Infrastructure: A review of literature to inform the way forward*, International Institute for Sustainable Development, July 2021.

The structure of the report reflects this focus; the first section offers background information on climate change and its impacts on transportation infrastructure. The following sections provide information on each of the four case studies, in the order outlined above. This report then identifies key overarching themes and recommendations from these case studies, before reaching its concluding section.

Background

Definition of Critical Infrastructure

Infrastructure systems play a vital role in the development of any community. Public Safety Canada defines critical infrastructure (CI) as:

> *the processes, systems, facilities, technologies, networks, assets and services that are essential to the health, safety, security or economic well-being of Canadians and the effective functioning of government. CI can be stand-alone or interconnected and interdependent with other sectors, provinces, territories and national borders, namely the United States in our case. Disruptions of CI could result in catastrophic loss of life, adverse economic effects and significant harm to public confidence.*[5]

Economic Importance of the Transportation System

A transportation infrastructure system plays a crucial role in securing the supply chain and providing essential services to communities. Representatives from Transport Canada stated that "a transportation system that is safe, secure and reliable forms the backbone of a thriving economy."[6] In order to ensure Canada's long-term economic prosperity, many witnesses stressed the importance of having efficient, well-maintained infrastructure.

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[5] Standing Senate Committee on Transport and Communications (TRCM), 1st Session, 44th Parliament, *Evidence*, 2 March 2022 (Ryan Schwartz, Acting Director General, Critical Infrastructure Directorate, National and Cyber Security Branch, Public Safety Canada). Unless otherwise specified, any mention of "TRCM, *Evidence*," comes from the 1st Session of the 44th Parliament.

[6] TRCM, *Evidence*, 16 April 2024 (Paula Vieira, Director General, Environmental Policy, Transport Canada).

However, aging infrastructure cannot operate efficiently. On several occasions, various witnesses referred to the aging state of the infrastructure, which makes it increasingly vulnerable to climate disruptions. Most roads and bridges were built over 50 years ago, and some infrastructure dates to the 1920s.[7] The Canadian infrastructure report card shows that nearly 40% of these assets are in either fair or poor condition, and the cost of rehabilitation is around $90 billion.[8]

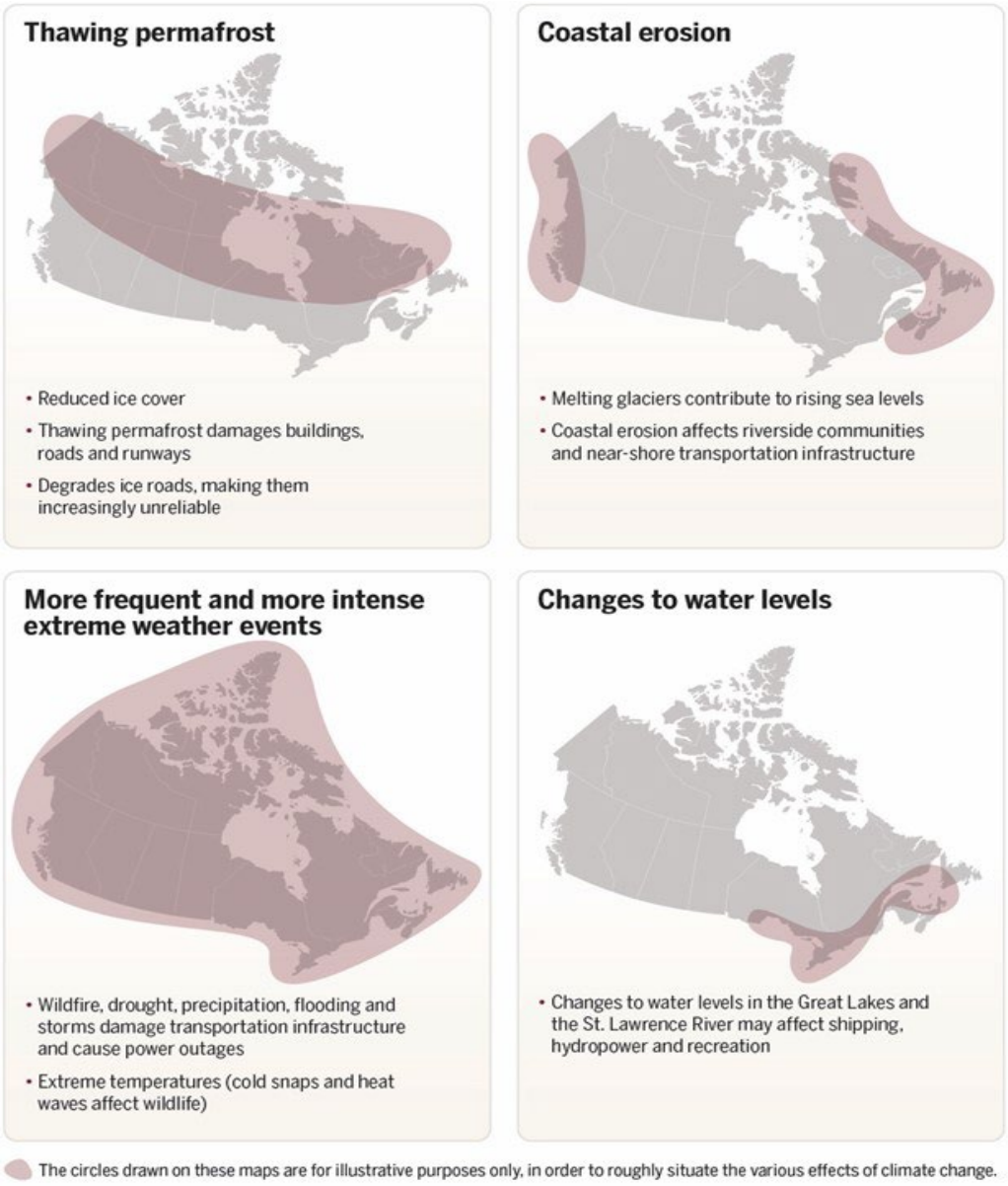
Matt Gemmel, Director of Policy and Research at the Federation of Canadian Municipalities, said that municipalities own nearly 60% of public infrastructure and are responsible for the maintenance and renewal of this infrastructure.[9] The exorbitant repair and maintenance costs are of great concern to a number of mayors. Andrea Horwath, Mayor of the City of Hamilton, expressed deep concern and stated the following: "Most cities … are in the same situation as our infrastructure ages out, and we don't have municipal capacity to deal with any of our infrastructure."[10]

Effects of Climate Change on the Supply Chain Infrastructure

As mentioned earlier, Canada is already feeling the effects of climate change disruptions. A 2019 report by the Council of Canadian Academies, *Canada's Top Climate Change Risks*, provides examples of the negative effects of climate change across Canada (see Figure 1). For instance, permafrost degradation and reduced ice cover affect northern infrastructure and Indigenous ways of life such as hunting, fishing and foraging; melting glaciers contribute to rising sea levels; and changes to water levels in the Great Lakes St. Lawrence Seaway affect shipping. Climate change threatens ecosystems and biodiversity, as well as agricultural and forestry activities. Witnesses confirmed the devastating impacts of climate change described above. The railway industry added that extreme temperatures are contributing to the buckling of railway lines, causing rails to expand due to the heat and shrink because of severe winters.[11]

[7] TRCM, *Evidence*, 28 February 2024 (Jim Athanasiou, Vice-President, Engineering and Technology, St. Lawrence Seaway Management Corporation).
[8] TRCM, *Evidence*, 27 April 2022 (Mary Van Buren, President, Canadian Construction Association).
[9] TRCM, *Evidence*, 27 April 2022 (Matt Gemmel, Director, Policy and Research, Federation of Canadian Municipalities).
[10] TRCM, *Evidence*, 20 March 2024 (Andrea Horwath, Mayor, City of Hamilton).
[11] TRCM, *Evidence*, 18 May 2022 (Rahim Karmali, Chief Engineer, Supply Chain and Technology, Canadian National).

Figure 1 – Impacts of Climate Change



Source: Figure prepared by the Library of Parliament based on the report by the Council of Canadian Academies, *Canada's Top Climate Change Risks*, 2019.

Over the course of its study, the committee heard numerous witnesses describe the transportation network as a highly complex and interconnected system that involves a wide range of stakeholders. An airport site includes, among other things, "the airport authority, private actors, government agencies, airlines and

subcontractors."[12] At port sites, roads and railways serve the terminals. All these networks are interdependent and interconnected. As a result, damage caused to one type of infrastructure can have a ripple effect on other parts of the supply chain.

Climate disasters can therefore have a devastating impact on the entire economy, both regionally and nationally, as well as on the health and safety of Canadians. This is why witnesses unanimously agreed on the absolute urgency of being prepared and having a coordinated plan to protect Canadians and the integrity of Canada's transportation system, while building its resilience to climate change.

Government Initiatives

In 2022, the transport sector was the second-largest source of greenhouse gas (GHG) emissions, accounting for 22% of total national emissions — the equivalent of 156 megatonnes of carbon dioxide.[13]

The federal government has developed measures to adapt to the impacts of climate change, including Canada's National Adaptation Strategy and programs such as the National Trade Corridors Fund, as well as the creation of the Canada Water Agency in June 2023. The Canada Water Agency's primary mandate is to improve freshwater management and restoration, primarily in the Great Lakes and the St. Lawrence River.[14]

In June 2023, the federal government launched Canada's first National Adaptation Strategy, which was developed together with the provinces, territories, Indigenous groups and various stakeholders.[15] Among other things, this strategy aims to build and maintain resilient infrastructure.

To reduce the vulnerability of Canadians to challenges such as climate change, the Government of Canada is developing a National Strategy for Critical Infrastructure (the Strategy). The goal of this strategy is to "build a safer, more secure and more resilient Canada" given current and emerging hazards.[16] The Strategy sets the

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[12] TRCM, *Evidence*, 10 April 2024 (Martin Massé, Vice-President, Public Affairs and Vice-President, Sustainability, Aéroports de Montréal).
[13] Environment and Climate Change Canada, Greenhouse Gas Emissions: Canadian Environmental Sustainability Indicators, 2024.
[14] TRCM, *Evidence*, 27 February 2024 (Eamonn Horan-Lunney, Senior Director Policy, Canada, Great Lakes and St. Lawrence Cities Initiative).
[15] Environment and Climate Change Canada, *How we got here: The evolution of the National Adaptation Strategy*.
[16] Public Safety Canada, *National Strategy for Critical Infrastructure*, 2009, p. 2.

direction in 10 critical infrastructure sectors, including transportation, and information and communication technology.[17] The objectives of the Strategy are to:

- build partnerships;
- implement an all-hazards risk management approach; and
- advance the timely sharing and protection of information among partners.[18]

Since publishing the Strategy in 2010, the federal government has released several action plans that outline concrete steps toward advancing the Strategy's objectives.

The *National Cross Sector Forum 2021–2023 Action Plan for Critical Infrastructure* lists the federal departments and agencies that are involved in the implementation of the *National Strategy for Critical Infrastructure*. It does not include the other partners involved in the Strategy, such as municipalities and the private sector. Yet, in addition to being the first affected by disasters, municipalities are also majority owners of infrastructure. Federal government representatives acknowledged that there were gaps in terms of engagement with municipalities for the development of this Strategy.[19]

The federal government provided $27.2 million in Budget 2023 for the creation of the National Supply Chain Office. In collaboration with the industry, Indigenous groups and other levels of government, the Office will develop and implement a "National Supply Chain Strategy."[20] At the time of writing this report, this strategy has not yet been published. Witnesses, especially those from the industry, welcomed the creation of the National Supply Chain Office because they believed the organization is in the best position to coordinate and plan the activities of the different parts of the supply chain.

[17] Ibid.
[18] Ibid., p. 3.
[19] TRCM, *Evidence*, March 2, 2022 (Ryan Schwartz, Acting Director General, Critical Infrastructure Directorate, National and Cyber Security Branch, Public Safety Canada).
[20] Transport Canada, "Minister of Transport announces launch of the National Supply Chain Office to strengthen Canada's supply chains and increase the economy's competitiveness," News release, December 1, 2023.

Case Study 1: Chignecto Isthmus[21]

Background

Located along the interprovincial border, the Chignecto Isthmus is the land that connects the provinces of New Brunswick and Nova Scotia and it is the only road and rail connection between the two provinces. This land bridge separates the Bay of Fundy from the Northumberland Strait (see Figure 2).

Figure 2 – Chignecto Isthmus

Sources: Map prepared by the Library of Parliament, 2024, using data obtained from Natural Resources Canada (NRCan), *Administrative Boundaries in Canada – CanVec Series – Administrative Features*, 1:250K, 1 March 2019;

[21] In addition to witness testimony, this section uses information from: New Brunswick Transportation and Infrastructure, *Investing in New Brunswick's Future: Rising Sea Levels are Threatening the Chignecto Isthmus*; and Wood Environment & Infrastructure Solutions, *Chignecto Isthmus Climate Change Adaptation Comprehensive Engineering and Feasibility Study – Final Report*, 16 March 2022.

NRCan, *Transport Networks in Canada – CanVec Series – Transport Features*, 1:250K, 1 March 2019; NRCan, *Lakes, Rivers and Glaciers in Canada – CanVec Series – Hydrographic Features*, 1:250K, 1 March 2019; NRCan, *National Railway Network – NRWN – GeoBase Series*, 1 October 2016; "Figure 1.2 Study Infrastructure Components" [MAP], in Wood Environment & Infrastructure Solutions, *Chignecto Isthmus Climate Change Adaptation Comprehensive Engineering and Feasibility Study – Final Report*, Report prepared for the New Brunswick Department of Transportation and Infrastructure, 16 March 2022; and Statistics Canada, *2021 Census – Boundary files*. The following software was used: Esri, ArcGIS Pro, version 3.2.2. Contains information licensed under *Open Government Licence – Canada* and *Statistics Canada Open Licence*.

The Chignecto Isthmus is slightly above sea level, and therefore threatened by flooding due to rising sea levels and more frequent severe weather events. Currently, dykes originally installed in the 1600s protect communities, infrastructure, private lands and natural resources from rising sea levels. The Trans-Canada Highway and a Canadian National (CN) rail line pass through the isthmus. An official from the Government of New Brunswick told the committee that "Atlantic Canada is expecting a one-metre increase in sea level by 2100, and two metres or more by 2150.[22]"

Impacts of Climate Change

With the increasing frequency and intensity of storms, combined with rising sea levels, witnesses suggested that there is an increased likelihood of flooding in the isthmus, particularly if storms come at high tide, underscoring the urgent need for action. Storms that used to occur once in a hundred years are becoming more frequent, with several such storms having occurred over the last 10 years.[23]

Witnesses described the devastating impacts that such a flood in the area would have on the supply chain and the communities in the region. The Trans-Canada Highway and CN rail line that pass through the isthmus carry about $35 billion per year in goods and services through the region. For example, most of the propane used in New Brunswick and Nova Scotia for home heating travels along the stretch of Trans-Canada Highway that passes through the isthmus, as it travels via truck from Ontario.[24]

Witnesses also noted that the Trans-Canada highway and CN rail line that pass through the isthmus are crucial to getting goods and raw materials to and from the

[22] TRCM, *Evidence*, 25 October 2023 (Rob Taylor, Deputy Minister, Department of Transportation and Infrastructure, Government of New Brunswick).
[23] TRCM, *Evidence*, 25 October 2023 (Peter Hackett, Deputy Minister, Department of Public Works, Government of Nova Scotia).
[24] TRCM, *Evidence*, 18 October 2023 (Shannon Watt, President and CEO, Canadian Propane Association).

Port of Halifax. Any disruption in the isthmus would have cascading impacts on the other Atlantic provinces, not to mention the rest of Canada.[25]

In addition to the supply chain impacts, witnesses also discussed the impact that a major flood would have on the people that live near the isthmus. David Kogon, Mayor of the town of Amherst, Nova Scotia, told the committee that 25% to 33% of his town would be flooded if the dykes around the isthmus failed.[26] Andrew Black, Mayor of the municipality of Tantramar, New Brunswick, also explained that many people travel between his town and Amherst, Nova Scotia for work and leisure.[27]

Noting that many of the areas of land protected by the dykes are below sea level, Mayor Kogon explained that "If this area were to flood, the water would not recede; it would be permanent, with major consequences.[28]"

Witnesses from Mi'gmawe'l Tplu'taqnn Incorporated, which represents the nine Mi'gmaq First Nations in New Brunswick, explained to the committee that the Chignecto Isthmus is a significant cultural area for their people. Climate change, including sea level rise, have impacted these First Nations through the loss of both land and artifacts. These witnesses also highlighted the importance of deep and meaningful consultation of Indigenous communities by federal and provincial governments when undertaking work in the region.[29]

The Société de l'Acadie du Nouveau-Brunswick (SANB), in a May 2024 brief to the committee, also explained the cultural significance of the region to the Acadian people. It was home to the Acadian colony of Beaubassin and a theatre for the war between France and Great Britain, as well as the Acadian Expulsion.[30]

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[25] TRCM, *Evidence*, 18 October 2023 (Matthew Hynes, Executive Vice President, Oceanex Incorporated); and TRCM, *Evidence*, 24 October 2023 (Ernie Hudson, Minister of Transportation and Infrastructure, Government of Prince Edward Island; and Allan Gray, President and Chief Executive Officer, Halifax Port Authority); TRCM, *Evidence*, 25 October 2023 (Chris McKee, Executive Director, Atlantic Provinces Trucking Association).
[26] TRCM, *Evidence*, 18 October 2023 (David Kogon, Mayor, Town of Amherst, Nova Scotia).
[27] TRCM, *Evidence*, 18 October 2023 (Andrew Black, Mayor, Town of Tantramar, New Brunswick).
[28] TRCM, *Evidence*, 18 October 2023 (David Kogon).
[29] TRCM, *Evidence*, 25 October 2023 (Tracy Cloud, Director of Trilateral Negotiations, Mi'gmawe'l Tplu'taqnn Incorporated; and Charles Labillois-Bjorndal, Director of Indigenous Knowledge, Mi'gmawe'l Tplu'taqnn Incorporated).
[30] Société de l'Acadie du Nouveau-Brunswick (SANB, in partnership with the Fédération acadienne de Nouvelle-Écosse and the Société nationale de l'Acadie), *Chignecto National Park*, May 2024.

A train crosses the almost-flooded railroad atop a dyke north of Aulac, New Brunswick on October 29, 2015. A storm surge coupled with a high tide threatened to overtop the dyke and railbed.
Photo: Mike Johnson, Cumberland County.

Moving Forward

Working with Transport Canada, the provincial governments commissioned a climate change adaptation engineering and feasibility study (published in 2022) to examine options for the protection of the Chignecto Isthmus. Media reports suggest that the entire cost of the project could be $650 million to $700 million.[31]

Nova Scotia and New Brunswick have applied for federal funding through the Disaster Mitigation and Adaptation Fund.[32] However, the Council of Atlantic Premiers has called on the federal government to fully fund the project.[33] The Government of Nova Scotia — with the federal, New Brunswick and Prince Edward Island governments as intervenors — has asked the Nova Scotia Court of Appeal to rule on whether or not the federal government has exclusive responsibility to maintain the infrastructure that protects the isthmus.[34]

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[31]"N.B. and N.S. premiers to apply for federal funding to protect crucial isthmus," *CTV News Atlantic*, 18 July 2023; and Shane Magee, "Senate bill would make feds responsible for Chignecto Isthmus work," *CBC News*, 19 September 2023.
[32]Ibid.
[33]Council of Atlantic Premiers, *Atlantic Premiers Work Together to Improve Health Care and Strengthen the Atlantic Economy*, News release, 12 June 2023.
[34]Jean Laroche, "N.S. government asking Court of Appeal to rule on Chignecto Isthmus," *CBC News*, 20 July 2023; and Taryn Grant, "N.B., P.E.I., Ottawa join N.S. court case on Chignecto Isthmus costs – but local MLA left out," *CBC News*, 21 September 2023.

Professor Ronald Rudin from Concordia University suggested that there is historical precedent for federal intervention in the area, with the federal government having created the Maritime Marshland Rehabilitation Administration (MMRA) in 1948 to handle deteriorating dykes in the region, some of which had already failed and flooded the region earlier in the 1940s. The MMRA operated until 1970, when it handed responsibility for the dykes back to the provincial governments.[35]

There are a variety of natural and engineered options to consider when making sure that the dykes protecting the isthmus are resilient to climate change. In addition to building stronger and taller dykes, witnesses pointed to the possibility of building new dykes further inland, so that wetlands in front of those dykes could be restored to provide a buffer, absorbing some of the initial shock of higher and stronger tides. As explained by Danika van Proosdij, Director, TransCoastal Adaptations Centre for Nature-Based Solutions at Saint Mary's University:

> In some areas, we will absolutely need to raise and reinforce existing protection infrastructure or construct new defences using new engineering standards that have been demonstrated in other parts of the world. We will need to realign dike infrastructure and restore tidal wetlands that can provide a suite of ecosystem services, including coastal protection and carbon sequestration, and can be resilient to sea level rise.[36]

Nova Scotia government officials assured the committee that all options are still on the table.[37] The SANB also noted the option of creating a national park in the area.[38]

Case Study 2: Canada's North

Background

The committee is thankful for the contributions of the Honourable Senator Dennis Glen Patterson, who recommended this case study and suggested witnesses. In this

[35] TRCM, *Evidence*, 17 October 2023 (Ronald Rudin, Distinguished Professor Emeritus, Department of History, Concordia University, as an individual).
[36] TRCM, *Evidence*, 24 October 2023 (Danika van Proosdij, Director, TransCoastal Adaptations Centre for Nature-Based Solutions, Saint Mary's University, as an individual).
[37] TRCM, *Evidence*, 25 October 2023 (Kevin Bekkers, Director, Resource Sustainability, Department of Agriculture, Government of Nova Scotia).
[38] SANB (2024).

document, "Canada's North" refers to its three territories: the Yukon, the Northwest Territories and Nunavut. These territories cover approximately 40%[39] of the total area of Canada, but account for less than 1%[40] of the Canadian population, with a higher proportion of Indigenous people than in the rest of Canada[41] (see Table 1). The majority of this northern area is on permafrost, a frozen layer of soil that supports most northern infrastructure (see Figure 3).

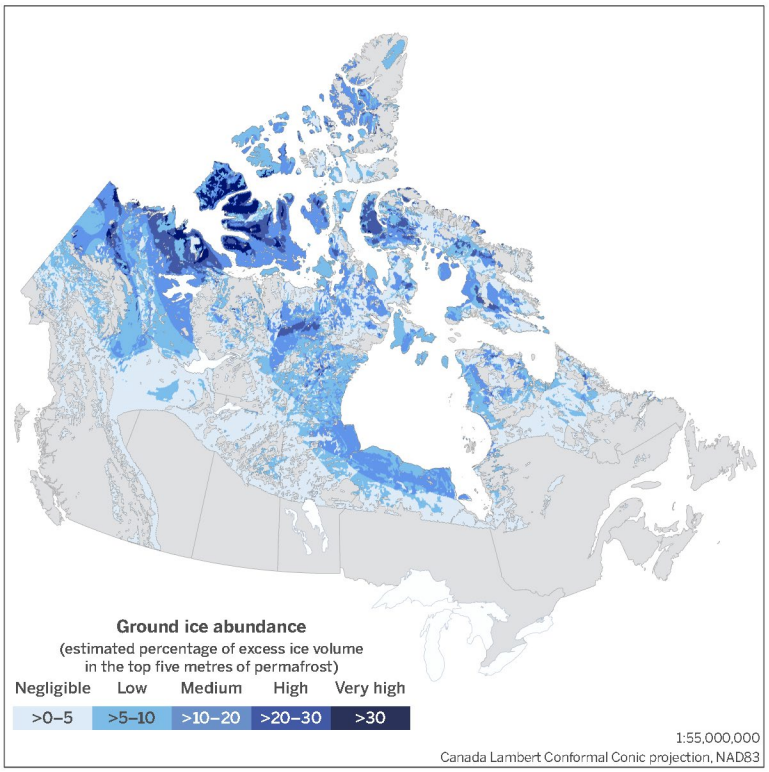
Table 1 – Population of Northern Canadian Communities

Region/Territory	Proportion of Population Self-Identifying as Indigenous (%)	Urban Centre	Percentage of Population within the Urban Centre	Total Population of the Region/Territory (number of people)
Yukon Territory	20	Whitehorse	70	39,590
Northwest Territories	51	Yellowknife	49.5	40,380
Nunavut	85	Iqaluit	20	36,605

Sources: Government of Canada, "Chapter 6," *Canada in a Changing Climate: Regional Perspectives Report, Northern Canada*, 2022 and Yukon Bureau of Statistics, Indigenous peoples – Census 2021.

[39] Natural Resources Canada, The North.
[40] Statistics Canada, Census of Population, 2021.
[41] Government of Canada, "Chapter 6," *Canada in a Changing Climate: Regional Perspectives Report, Northern Canada*, 2022.

Figure 3 – Ground Ice Abundance in Canada



Sources: Map prepared by the Library of Parliament, 2024, using data obtained from Natural Resources Canada (NRCan), *Ground ice map of Canada*, 28 August 2020; NRCan, *Administrative Boundaries in Canada – CanVec Series – Administrative Features*, 1:5M, 1 March 2019; and NRCan, *Lakes, Rivers and Glaciers in Canada – CanVec Series – Hydrographic Features*, 1:5M, 1 March 2019. The following software was used: Esri, ArcGIS Pro, version 3.2.2. Contains information licensed under *Open Government Licence – Canada*.

The transportation system in the North plays a vital role in the socio-economic development of the region's communities. The transportation system strengthens ties between various communities and facilitates the movement of goods and people. However, Northern Canada is at a disadvantage compared to southern Canada in terms of infrastructure.

Northern Canada is characterized by a substantial infrastructure deficit that is detrimental to the well-being and economic development of the region's communities. In some regions, residents have few alternative transportation routes and only one or two ways in and out to get supplies and travel. It becomes problematic when these routes are interrupted and people do not have access to the same level of services as other Canadians, including access to health care, food, etc.[42]

[42] TRCM, *Evidence*, November 1, 2023 (Alison Perrin, Senior Research Professional, Northern Adaptation and Resilience, Yukon University, as an individual).

Many witnesses expressed deep concern regarding the magnitude of climate change in Northern Canada. Indeed, climate change in Northern Canada is happening faster than anywhere else in the country and is having a greater impact.[43]

Effects of Climate Change and the Unique Needs of Canada's North

The permafrost that supports ecosystems, buildings and transportation networks in the North is degrading more rapidly and threatening the stability of these transportation corridors. Transportation infrastructure in the North includes not only road networks, airports and shipping routes, but also ice roads, trails, rivers and lakes, since it is common to travel by snowmobile and ATV.[44]

A number of witnesses noted that the ice road seasons have become significantly shorter in recent decades due to global warming. In the Northwest Territories, ice roads represent 35% of the highway system.[45] These ice roads are vital to many remote communities and mining companies that depend on winter transportation links to deliver various commodities, fuel and construction supplies at reasonable costs.

Witnesses from northern regions and researchers noted that climate change is threatening the stability and safety of winter routes that are becoming increasingly unreliable and dangerous to use. Moreover, outside of the short winter route season, goods are transported by air or by a tug-and-barge system on the Mackenzie River.[46] For example, Frank Pope, Mayor of the Town of Norman Wells in the Sahtu Region, urged the government to build an all-season road about 330 kilometres from Wrigley to Normal Wells, because otherwise the communities would be accessible only by air. Due to the thinning ice that could compromise travel safety, as well as the cost of maintaining ice roads, many witnesses believe that the northern adaptation strategy should focus on building all-season roads.

Air transportation is the only option for moving people and goods in some remote communities, even though it is costly and GHG-intensive. Most northern airports have gravel runways that were built on permafrost during the Cold War and have received few upgrades since then. The thawing permafrost destabilizes runways,

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[43] TRCM, *Evidence*, October 31, 2023 (Ryan Ness, Director, Adaptation, Canadian Climate Institute).
[44] TRCM, *Evidence*, November 1, 2023 (Alison Perrin).
[45] TRCM, *Evidence*, November 29, 2023 (Gary Brennan, Assistant Deputy Minister, Regional Operations, Department of Infrastructure, Government of the Northwest Territories).
[46] TRCM, *Evidence*, November 21, 2023 (Frank Pope, Mayor, Town of Norman Wells).

which compromises the safety of northern aviation. Captain Aaron Speer, the Vice-President of Flight Operations for Canadian North, stated that they are averaging 175 weather-related flight cancellations each month.[47] For example, increasingly frequent extreme weather events such as strong, violent winds affect small aircraft operations that serve communities like Grise Fiord and Kimmirut in Nunavut. These communities often do not have access to essential goods in a continual, sustainable way.[48] Witnesses agreed that more investment is needed in northern airport infrastructure.

Researchers have observed reductions in sea ice across the Arctic region. Jackie Dawson, a professor at the University of Ottawa, noted that it "has led to a 75% increase in shipping activity in recent years and an over 200% increase in kilometres travelled by those ships."[49] Although global warming has created opportunities for shipping activity, it has also generated problems for communities and mine sites served by the Mackenzie River. Hot and dry conditions in the summer of 2023 caused low water levels that made the river unnavigable. The Northwest Territories Marine Transportation Services had to ship goods by truck, making a 4,000-km detour instead of barging cargo down the Mackenzie River.[50]

Paul Irngaut, Vice-President of Nunavut Tunngavik Incorporated, said that the marine operations of the Arctic's Inuit communities consist of "undersized public breakwater piers, which are only accessible at high tide, with no infrastructure for sealift operations or for protecting vessels or the community."[51] However, the changes to conditions in the Arctic Ocean and melting sea ice create new demands on harbour infrastructure.[52]

Forest fires have also had a major impact on transportation in the North. The CN rail line that extends to Hay River was damaged by fire. Hay River is a central hub for the transfer of goods to the North, either by barge along the Mackenzie River, or by air

[47] TRCM, *Evidence*, 22 November 2023 (Aaron Speer, Vice-President, Flight Operations, Canadian North).
[48] TRCM, *Evidence*, 22 November 2023 (Paul Irngaut, Vice-President, Nunavut Tunngavik Incorporated).
[49] TRCM, *Evidence*, 28 November 2023 (Jackie Dawson, Canada Research Chair in the Human and Policy Dimensions of Climate Change, Full Professor, University of Ottawa, and Scientific Director, ArcticNet, as an individual).
[50] TRCM, *Evidence*, 1 November 2023 (Tristan Pearce, Associate Professor, Geography and Canada Research Chair in Cumulative Impacts of Environmental Change, University of Northern British Columbia, as an individual).
[51] TRCM, *Evidence*, 22 November 2023 (Paul Irngaut, Vice-President, Nunavut Tunngavik Incorporated).
[52] TRCM, *Evidence*, 22 November 2023 (Paul Irngaut).

or road.[53] Wildfires also complicated the evacuation of several remote communities, especially those that have access to only one transportation route.[54]

Many witnesses deplored the serious lack of northern infrastructure and the limited funds allocated to it, but many also believed that it would be difficult and costly to address the infrastructure deficit.

As part of the adaptation measures in place, northern communities are currently monitoring local conditions and ice conditions, and they are installing weather forecast stations.[55] Another measure involves the Northern Transportation Adaptation Initiative, which is being led collaboratively by practitioners, engineers and scientists to strengthen the resilience of the northern transportation network, while giving various groups the opportunity for knowledge exchange.[56] Researchers also mentioned that the scientific documentation lacked observations and knowledge provided by Indigenous peoples, yet Indigenous people are the first to notice and feel the effects of climate change.

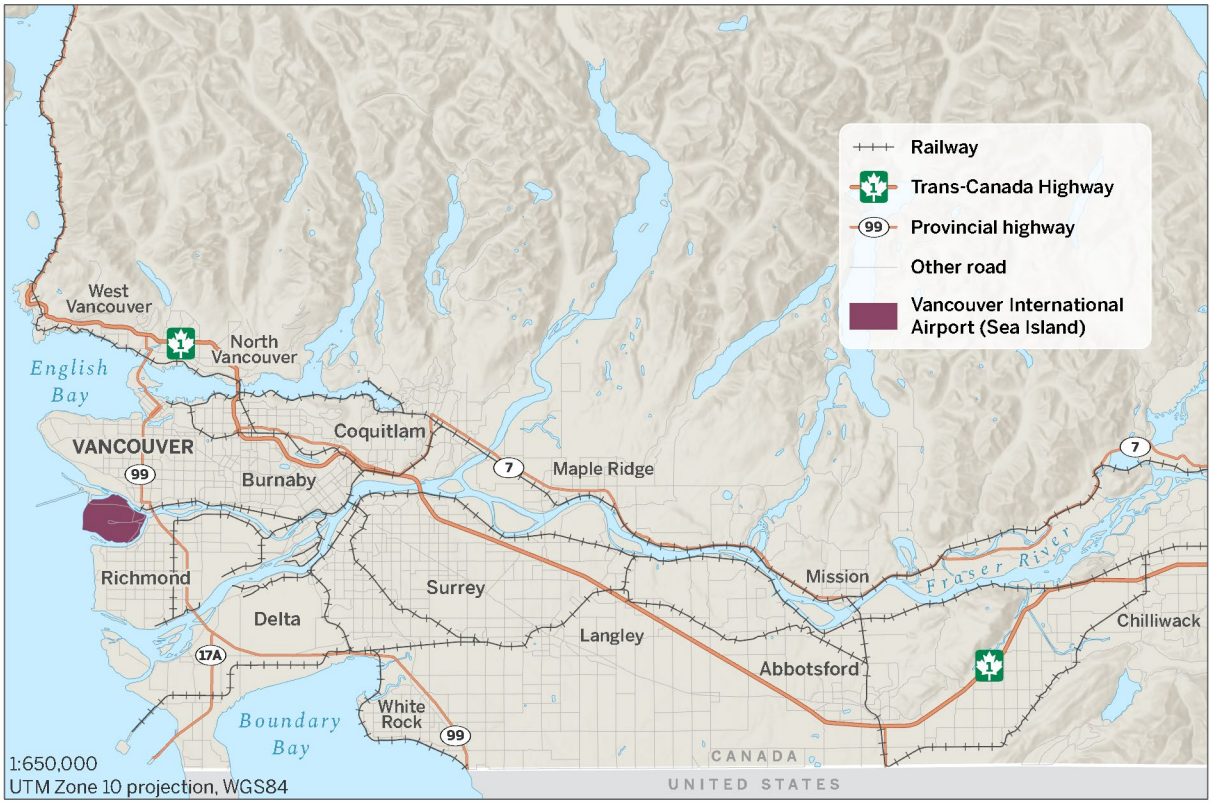
Case Study 3: Vancouver Airport and Marine Port

Background

The Port of Vancouver and Vancouver International Airport (YVR) are key supply chain nodes not only for the regional economy, but also for the national economy and for Indigenous communities. Witnesses explained that these two entities are part of a complex interconnected infrastructure system (see Figure 4). Thousands of people and tons of merchandise come through Vancouver's airport and port every day.

[53] TRCM, *Evidence*, 1 November 2023 (Tristan Pearce).
[54] TRCM, *Evidence*, 21 November 2023 (Frank Pope).
[55] TRCM, *Evidence*, 31 October 2023 (Natalie Carter, Community Engagement Lead, StraightUpNorth, McMaster University, as an individual).
[56] TRCM, *Evidence*, 28 November 2023 (Steve Kokelj, Senior Permafrost Scientist, NWT Geological Survey, Department of Industry, Tourism and Investment, Government of the Northwest Territories).

Figure 4 – Transport Infrastructure in the British Columbia Region

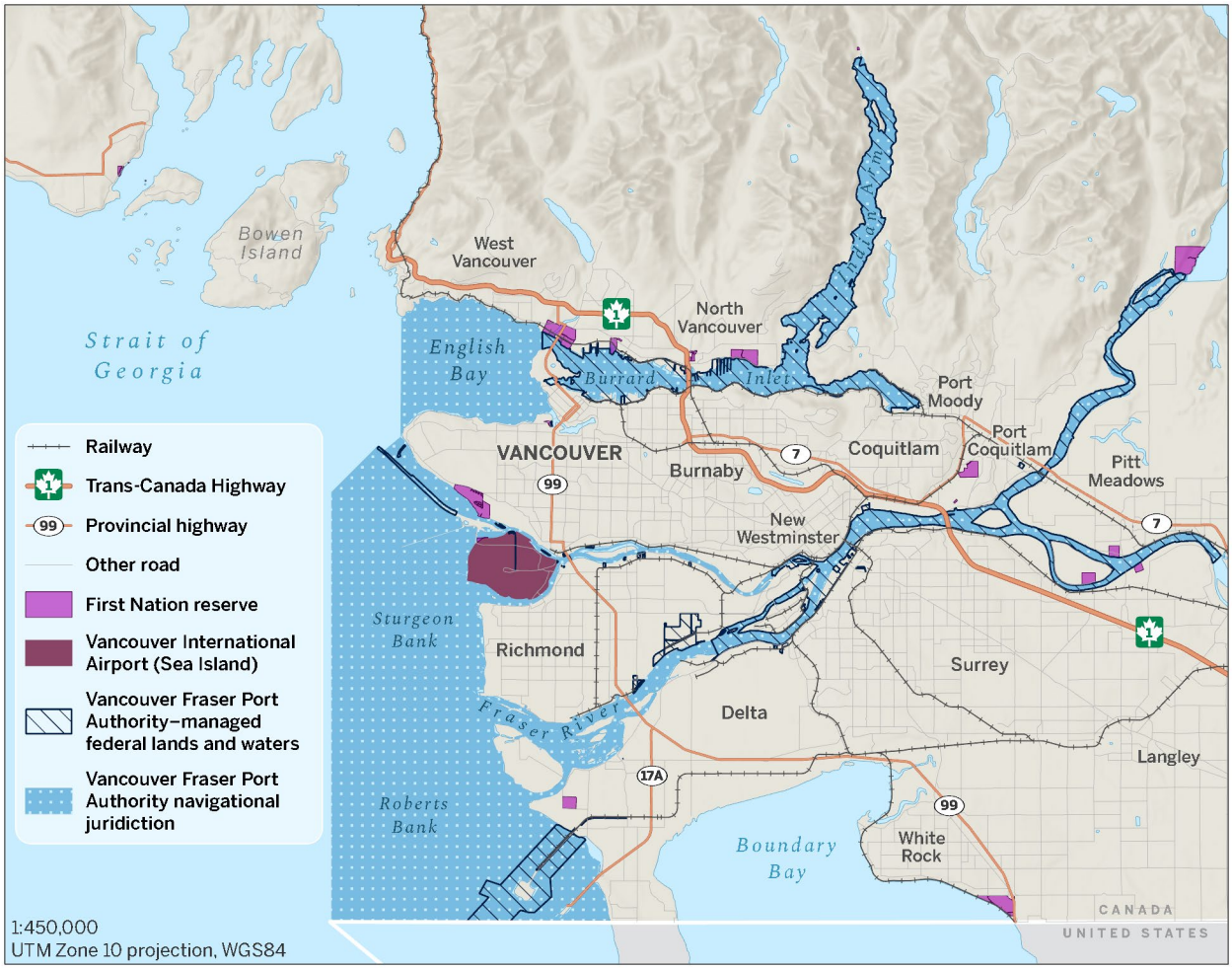


Sources: Map prepared by the Library of Parliament, 2024, using data obtained from Natural Resources Canada (NRCan), *Administrative Boundaries in Canada – CanVec Series – Administrative Features*, 1:250K, 1 March 2019; NRCan, *Transport Networks in Canada – CanVec Series – Transport Features*, 1:250K, 1 March 2019; NRCan, *Lakes, Rivers and Glaciers in Canada – CanVec Series – Hydrographic Features*, 1:250K, 1 March 2019; and NRCan, *National Railway Network – NRWN – GeoBase Series*, 1 October 2016. The Elevation/World Hillshade layer is the intellectual property of Esri and is used under licence; © 2024 Esri and its licensors. The following software was used: Esri, ArcGIS Pro, version 3.2.2. Contains information licensed under *Open Government Licence – Canada*.

Vancouver Airport

Situated less than 15 kilometres south of downtown Vancouver (see Figure 5), the Vancouver International Airport (YVR) was built on an island in the Fraser River, Sea Island, in the municipality of Richmond, British Columbia.

Figure 5 – Transport Infrastructure in the Greater Vancouver



Sources: Map prepared by the Library of Parliament, 2024, using data obtained from Natural Resources Canada (NRCan), *Administrative Boundaries in Canada – CanVec Series – Administrative Features*, 1:250K, 1 March 2019; NRCan, *Transport Networks in Canada – CanVec Series – Transport Features*, 1:250K, 1 March 2019; NRCan, *Lakes, Rivers and Glaciers in Canada – CanVec Series – Hydrographic Features*, 1:250K, 1 March 2019; NRCan, *National Railway Network – NRWN – GeoBase Series*, 1 October 2016; and NRCan, *Aboriginal Lands of Canada Legislative Boundaries*, 28 July 2017. Geospatial data on the Port of Vancouver jurisdiction provided by the Vancouver Fraser Port Authority. The Elevation/World Hillshade layer is the intellectual property of Esri and is used under licence; © 2024 Esri and its licensors. The following software was used: Esri, ArcGIS Pro, version 3.2.2. Contains information licensed under *Open Government Licence – Canada*.

A system of dykes four to eight metres wide extends approximately 22 kilometres, surrounds the island where YVR airport is located in order to protect the airport infrastructure from flooding, erosion and potential seismic events.[57]

[57] TRCM, *Evidence*, 12 December 2023 (Christoph Rufenacht, Vice President, Airport Development and Asset Optimization, Vancouver Airport Authority).

YVR airport is the second busiest airport in Canada, after Toronto Pearson Airport.[58] As a central link between Asia and the Americas, YVR airport plays a key role for passengers as well as the supply chain.

The Vancouver airport also has two programs that help fund its adaptation measures, including projects to raise dykes and improve its drainage and pumping system.[59] In addition, Indigenous peoples have an agreement with both the Vancouver Port Authority and the Vancouver Fraser Port Authority regarding measures to address climate change.[60]

The Vancouver airport is working toward net zero: it is participating in an international carbon management accreditation program called the Airport Carbon Accreditation program, and it is ranked at one of the highest levels.[61]

Port of Vancouver

As one of Western Canada's main points of entry for international trade — the other being the Port of Prince Rupert — the Port of Vancouver is "[l]ocated on the southwest coast of British Columbia [and] extends from Roberts Bank and the Fraser River up to and including Burrard Inlet"[62] (see Figure 5). It is Canada's largest port and the third largest in North America. The Port of Vancouver borders 16 municipalities and several traditional territories of Indigenous peoples.[63]

The Port of Vancouver includes 29 terminals, and its activities enable the trade of more than $300 billion in goods annually and sustain over 115,000 jobs. Vancouver's port facilities connect to road and railway networks, including the Canadian National (CN) Railway, the Canadian Pacific Kansas City (CPKC) Railway and the Burlington Northern Santa Fe (BNSF) Railway.

Unlike the Vancouver airport, which is more vulnerable to climate change, marine terminals are highly resistant to weather events. However, the roads and railways serving the port are more vulnerable to extreme weather events. The Vancouver Fraser Port Authority noted the importance of collaboration with the province, the

[58] Vancouver International Airport, Past and Future.
[59] TRCM, *Evidence*, 12 December 2023, (Christoph Rufenacht).
[60] TRCM, *Evidence*, 7 February 2024 (Wade Grant, Intergovernmental Affairs Officer, Musqueam Indian Band).
[61] TRCM, *Evidence*, 12 December 2023 (Wendy Avis, Director, Climate and Environment, Vancouver Airport Authority).
[62] Port of Vancouver, About us.
[63] Port of Vancouver, About us.

federal government and other stakeholders that are involved in maintaining roads and rail areas to improve resilience.[64]

The Port of Vancouver has also adopted technologies and practices to phase out port emissions. For instance, the port proceeded with the testing and adoption of low-carbon fuels, including the use of biodiesel in commercial vessels and the introduction of shore power facilities.[65]

Impacts of Climate Change

YVR airport and the Port of Vancouver are important hubs for the shipment of goods. Derek Ray, Principal Geomorphologist at Northwest Hydraulic Consultants, noted that, "[l]ocated along the Lower Fraser River at the Strait of Georgia, both of these entities are vulnerable to climate-change-induced flood hazards."[66] Their locations make them susceptible to sea-level rise, storm surges and earthquakes that may significantly impact their operating capacity.[67]

It is also projected that the sea level will rise more than one metre by the end of the century in the Vancouver area. This sea-level rise, combined with an increase in extreme precipitation, will likely cause more severe flooding.[68]

An official at the Government of British Columbia's Ministry of Transportation and Infrastructure added that the impacts of climate change in British Columbia are "increasingly damaging and costly for our communities, provincial infrastructure and the national and international supply chains."[69]

Climate change specifically impacts Indigenous peoples in the region. Michael Bonshor, Managing Director of First Nations Business Development Association, stated that climate change affects the livelihood of Indigenous peoples, as well as their health, economic standing and food security, including aquatic resources, such

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[64] TRCM, *Evidence*, 12 December 2023 (Ronan Chester, Director, Climate Action and Sustainability Leadership, Vancouver Fraser Port Authority).
[65] Ibid.
[66] TRCM, *Evidence*, 6 February 2024 (Derek Ray, Principal Geomorphologist, Northwest Hydraulic Consultants).
[67] TRCM, *Evidence*, 1 November 2023 (Kees Lokman, Associate Professor and Chair, Landscape Architecture, University of British Columbia, as an individual).
[68] TRCM, *Evidence*, 6 February 2024 (Xuebin Zhang, Director, Pacific Climate Impacts Consortium).
[69] TRCM, *Evidence*, 12 December 2023 (Kaye Krishna, Deputy Minister, Ministry of Transportation and Infrastructure, Government of British Columbia).

as salmon, which is a traditional food source for many Indigenous peoples.[70] Allyson Fraser, Councillor of the Musqueam Indian Band, explained that warming affects salmon spawning, putting the survival of the fish at risk.[71]

Recent extreme weather events

Many witnesses reminded the committee of the atmospheric river event in November 2021 that led to intense rainfall resulting in flooding and landslides. It completely paralyzed British Columbia's supply chain for over a week, cutting off access to the Port of Vancouver and flooding a number of major roads, including a part of Highway 1, the major east-west corridor through the Fraser Valley. The disruption of port operations represented $840 million in cargo affected per day.[72] This atmospheric event also damaged bridges and rail lines. The aviation sector was the only mode of transportation that remained fully operational.

Kees Lokman, Associate Professor and Chair of Landscape Architecture at the University of British Columbia, painted an alarming picture of the risks posed by extreme weather events and rising water levels to the Vancouver International Airport, which is located in an area known for flooding.[73] In December 2022, a snow storm battered the region and paralyzed air traffic for several days.[74] Several witnesses mentioned that these disruptions have consequential effects on the whole supply chain.

These recent meteorological events, whether they be forest fires, major snowstorms or flooding, have underscored the vulnerability of the transportation sector in the Greater Vancouver area, which includes 21 municipalities and traditional Indigenous territories. These events have also highlighted the importance of collaboration with respect to climate change adaptation. Stephanie Chang, a professor at the University of British Columbia, noted that "the problem of potential transportation disruption in

[70] TRCM, *Evidence*, 7 February 2024 (Michael Bonshor, Managing Director, First Nations Business Development Association).
[71] TRCM, *Evidence*, 7 February 2024 (Allyson Fraser, Councillor, Musqueam Indian Band).
[72] TRCM, *Evidence*, 12 December 2023 (Ronan Chester).
[73] TRCM, *Evidence*, 1 November 2023 (Kees Lokman).
[74] CBC News, WestJet suspends all flights to and from Vancouver Airport as winter storm bears down on B.C.'s South Coast, 22 December 2022.

a disaster is something that exceeds the jurisdiction of any one municipality. It affects many at the same time."[75]

Although the 21 municipalities have different management approaches, witnesses acknowledged that in times of crisis, the unprecedented collaboration between various stakeholders, including various supply chain actors and multiple levels of government, resulted in the quick resumption of activities.[76] According to Bridgitte Anderson, the President and Chief Executive Officer of the Greater Vancouver Board of Trade, the response to the events of November 2021 happened very quickly because of this willingness to work together.[77]

However, some witnesses criticized the red tape that hinders their activities. For instance, vessels have to share their clearance data with 10 different departments because of privacy laws that limit information sharing. To minimize disruptions in the event of extreme weather events, witnesses urged the government to put in place international data sharing centres. Sharing information is key to enabling regional and national collaboration across borders in the event of a catastrophe.[78]

Case Study 4: Great Lakes St. Lawrence Seaway

Background

The St. Lawrence River is a major seaway that flows out of the Great Lakes — specifically, out of Lake Ontario. From its headwaters to the gulf, the St. Lawrence River is nearly 1,200 km long.[79] The full length of the seaway system stretches 3,700 km, extending from the Great Lakes to the Atlantic Ocean (see Figure 6).[80]

> [Its] 15 locks (13 Canadian and 2 American) allow ships to transit between Montreal and Lake Erie, a difference in elevation of 168 metres. The "Soo" [Sault Ste. Marie] Locks, managed by the

[75] TRCM, *Evidence*, 13 February 2024 (Stephanie Chang, Professor, School of Community and Regional Planning and Institute for Resources, Environment, and Sustainability, University of British Columbia, as an individual).
[76] TRCM, *Evidence*, 13 February 2024 (Bonnie Gee, President, Chamber of Shipping).
[77] TRCM, *Evidence*, 7 February 2024 (Bridgitte Anderson, President and Chief Executive Officer, Greater Vancouver Board of Trade).
[78] TRCM, *Evidence*, 13 February 2024 (Bonnie Gee).
[79] Clear Seas, *Navigating the St. Lawrence: Challenging Waters, Rich History and Bright Future*.
[80] St. Lawrence Seaway Management Corporation, *The St. Lawrence Seaway: A Vital Waterway*.

U.S. Army Corps of Engineers, enable ships to reach Lake Superior, which is 183 metres above sea level.[81]

The St. Lawrence poses multiple challenges to navigation and logistics, such as shallows, fogs, the presence of ice in winter, strong tides, multi-directional currents, locks, etc.[82] Under Canada's *Pilotage Act*, commercial vessels using the Seaway are assigned to trained pilots with knowledge of the physical attributes of Canadian waterways to lead the vessels to port (see Figure 7).

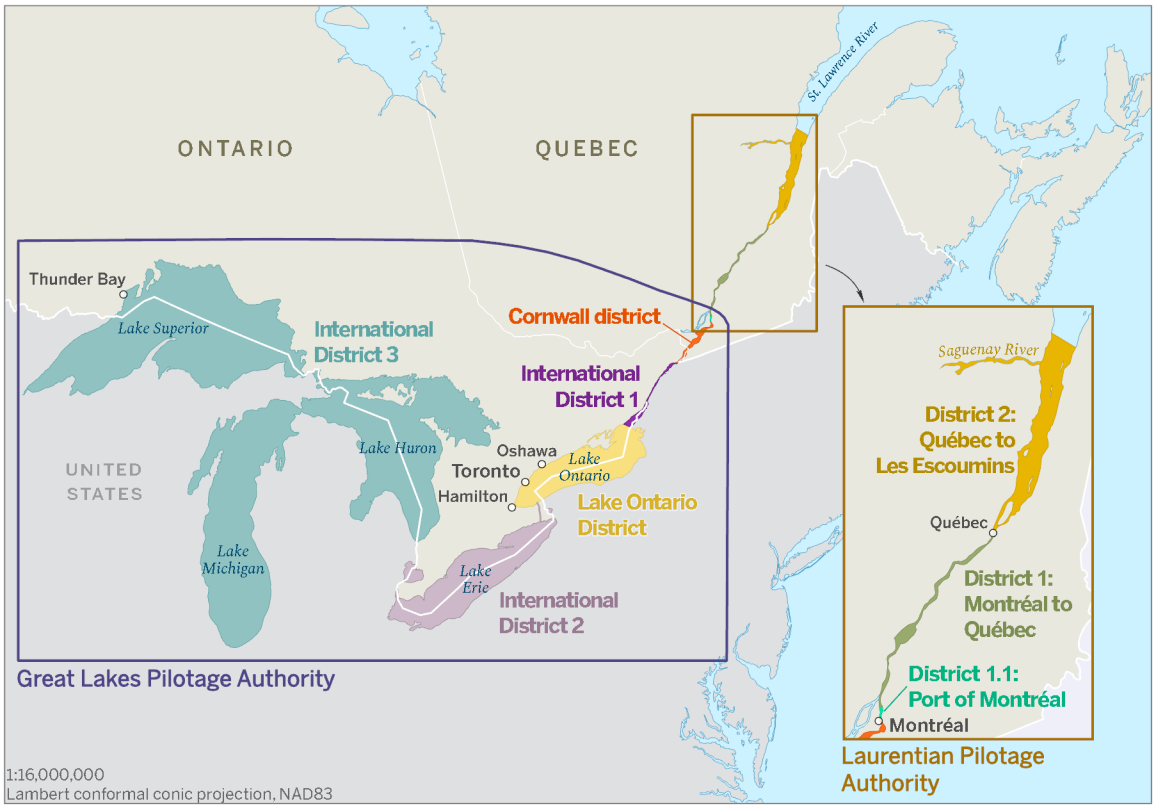
Figure 6 – Transport Infrastructure of the Great Lakes-St. Lawrence Seaway

Sources: Map prepared by the Library of Parliament, 2024, using data obtained from Natural Resources Canada (NRCan), *Administrative Boundaries in Canada – CanVec Series – Administrative Features*, 1:1M, 1 March 2019; NRCan, *Transport Networks in Canada – CanVec Series – Transport Features*, 1:5M, 1 March 2019; Natural Earth, *1:10m Cultural Vectors* and *1:10m Physical Vectors*, version 5.1.1; and United States Homeland Security, Homeland Infrastructure Foundation-Level Data, *Border Crossings in Canada*, Esri feature layer. The following software was used: Esri, ArcGIS Pro, version 3.2.2. Contains information licensed under *Open Government Licence – Canada*.

[81] Ibid.

[82] Clear Seas, *Navigating the St. Lawrence: Challenging Waters, Rich History and Bright Future*, 18 January 2024.

Figure 7 – Compulsory Pilotage Areas in the Great Lakes-St. Lawrence Seaway



Sources: Map prepared by the Library of Parliament, 2024, using data obtained from Natural Resources Canada (NRCan), *Administrative Boundaries in Canada – CanVec Series – Administrative Features*, 1:1M, 1 March 2019; NRCan, *Lakes, Rivers and Glaciers in Canada – CanVec Series – Hydrographic Features*, 1:5M, 1 March 2019; Natural Earth, *1:10m Cultural Vectors*, version 4.1.0; Great Lakes Pilotage Authority, *Great Lakes Pilotage Region Districts Map*; and Laurentian Pilotage Authority, *Geographical Limits of Activities*. The following software was used: Esri, ArcGIS Pro, version 3.2.2. Contains information licensed under *Open Government Licence – Canada*.

The seaway is a key economic driver in the region. Gino Moretti, Mayor of Saint-Anicet, Quebec and Chair of the Great Lakes and St. Lawrence Cities Initiative, noted that the seaway has been "the foundation of regional economic prosperity since before colonization.[83]" The Port of Montreal, the largest container port in Eastern Canada, supports over 600,000 jobs and accounts for 10% of Quebec's GDP (and 3.5% of Canada's).[84] Ken Boshcoff, Mayor of the City of Thunder Bay, highlighted that the Port of Thunder Bay, the western Canadian terminus of the seaway, plays a strategic role providing access to European markets for Western Canadian grain.[85]

[83] TRCM, *Evidence*, 27 February 2024 (Gino Moretti, Chair and Mayor, Municipality of Saint-Anicet, Great Lakes and St. Lawrence Cities Initiative).
[84] TRCM, *Evidence*, 20 March 2024 (Sylvain Ouellet); and TRCM, *Evidence*, 1st Session, 44th Parliament, 9 April 2024 (Julien Baudry, Director, Public Affairs, Montreal Port Authority).
[85] TRCM, *Evidence*, 20 March 2024 (Ken Boshcoff, Mayor, City of Thunder Bay).

Impacts of Climate Change

Rising temperatures due to climate change are expected to make the seaway's shipping season longer, with the season extending into the first week of January 2024 this year. In addition to the economic benefits of a longer shipping season, there are environmental benefits of using marine shipping (which is less carbon intensive) instead of trucking for a longer part of the year.[86] As was explained during the committee's visit to the Port of Montreal, moving cargo from large vessels onto smaller ones — rather than onto trucks — reduces both emissions and traffic congestion. Officials from the Ontario Trucking Association noted that warmer weather also reduces the amount of snow and ice on the road, thus improving road conditions for the trucking industry.[87]

Noting that the seaway is currently operating at 50% capacity, some witnesses noted that a modal shift from trucking to short sea shipping on the seaway can be used in efforts to reduce greenhouse gas emissions.[88] Andrea Horwath, Mayor of the City of Hamilton, told the committee that:

> A single marine vessel can accommodate cargo equivalent to 963 transport trucks while emitting significantly lower carbon emissions. This presents a strong case for modal alternatives, especially considering the over 12,000 truck trips per week between southern Ontario and U.S. Great Lakes ports, all carrying non-perishable commodities that are ideal candidates for marine service to transport.[89]

A brief from Professor Brian Slack at Concordia University suggests that warmer temperatures and low water levels are expected to pose a challenge around the Port of Montreal. However, Professor Slack's brief also notes that these water levels have long been cyclical in nature.[90] Sylvain Ouellet, a City Councillor in Montreal, explained to the committee that although there have always been variations in water levels, those variations have become more intense and unpredictable.[91]

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[86] TRCM, *Evidence*, 27 February 2024 (Gino Moretti, Chair and Mayor, Municipality of Saint-Anicet, Great Lakes and St. Lawrence Cities Initiative).
[87] TRCM, *Evidence*, 10 April 2024 (Geoffrey Wood, Senior Vice-President, Policy, Ontario Trucking Association).
[88] TRCM, *Evidence*, 20 March 2024 (Sylvain Ouellet, City Councillor, City of Montreal; and Bill Steele, Mayor, City of Port Colborne).
[89] TRCM, *Evidence*, 20 March 2024 (Andrea Horwath).
[90] Brian Slack, *Brief presented by Brian Slack to the Standing Senate Committee on Transport and Communications*, 26 February 2024.
[91] TRCM, *Evidence*, 20 March 2024 (Sylvain Ouellet, City Councillor, City of Montreal).

Unlike the St. Lawrence part of the seaway, Professor Robin Davidson-Arnott, from the University of Guelph, suggested that scientists believe that water levels in the Great Lakes will stay the same or increase slightly.[92]

The International Joint Commission (IJC), established in 1909 by Canada and the United States, is responsible for managing water levels in the seaway. However, as explained by Maguessa Morel-Laforce, Senior Director at the Chamber of Marine Commerce, there are practical limits to what the IJC can do to manage water levels, because overcorrecting in one part of the seaway may lead to flooding in another part.[93]

For both the Great Lakes and St. Lawrence parts of the seaway, the reduction in ice cover is contributing to erosion of the shorelines. Professor Jacob Stolle, from the Institut national de la recherche scientifique, explained that ice connected to the shoreline would normally dissipate the waves' energy before they hit the shore; less ice cover means that there is more impact from waves on the shoreline.[94]

This increased erosion can pose a threat to any infrastructure located close to the shore, such as Route 132 and Route 138, which pass beside the St. Lawrence across most of Quebec and are at a greater flood risk because of the shoreline erosion.[95] The increase in wave impact may also increase the cost of maintaining port infrastructure.

The increasing frequency and intensity of extreme weather events can damage and reduce the lifespan of infrastructure, and the seaway has been no stranger to such events. Professor Bolisetti from the University of Windsor explained that what used to be 100-year rainfall events are now becoming 25-year rainfall events.[96]

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[92] TRCM, *Evidence*, 27 February 2024 (Robin Davidson-Arnott, Professor Emeritus, Department of Geography, Environment and Geomatics, University of Guelph, as an individual).
[93] TRCM, *Evidence*, 9 April 2024 (Maguessa Morel-Laforce, Senior Director, Government and Stakeholder Relations, Chamber of Marine Commerce).
[94] TRCM, *Evidence*, 27 February 2024 (Jacob Stolle, Professor and Scientific Head, Environmental Hydraulics Laboratory, Institut national de la recherche scientifique).
[95] According to Professor Stolle, provincial authorities require an analysis of whether or not it makes sense to reroute flood-prone highways instead of putting in new infrastructure. While it is currently more expensive to move the highway, Professor Stolle suggested that situation may change soon. TRCM, *Evidence*, 27 February 2024 (Jacob Stolle).
[96] TRCM, *Evidence*, 9 April 2024 (Tirupati Bolisetti, Professor, Faculty of Engineering, University of Windsor, as an individual).

Reg Niganobe, Grand Council Chief of the Anishinabek Nation, discussed the particular challenges faced by the 39 First Nations[97] that his organization represents. Chief Niganobe explained that some of those First Nations are accessible either only by ferry or by a single rural road. Climate change and extreme weather events have the potential to be disastrous for these communities, if their only means of transporting people and goods is cut off.[98]

Two of those First Nations, Georgina Island First Nation and Beausoleil First Nation, used to have ice roads in and out of their communities, but warming temperatures have meant that they have not been able to use those winter roads for the last four years due to climate change.[99]

Similar to other Indigenous leaders who testified as part of the study, Chief Niganobe stressed the importance of consulting Indigenous communities in discussions about transportation infrastructure.[100]

Site Visits

On May 31, 2024, the committee conducted a site visit to the Port of Hamilton, which is managed by the Hamilton Oshawa Port Authority (HOPA). Reiterating testimony from Andrea Horwath, Mayor of the City of Hamilton, HOPA officials discussed the need for Canada Border Services Agency (CBSA) customs clearance support for the recently built intermodal[101] rail facilities. According to HOPA officials, they have been waiting two years for CBSA's decision. Once these facilities open, trucks can be taken off the road and their cargo can be moved via marine and rail transport, which have a lower carbon footprint.

On October 4, 2024, the committee conducted a site visit to the Port of Montreal. Port officials highlighted the importance of collaborating with other port authorities, while also noting the legal and contractual barriers preventing them from doing so. They also suggested that Canada has a network of ports that are not allowed to function as a network. Officials explained that, while ports can and sometimes do

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[97] These 39 First Nations are spread across Ontario, as far south as Sarnia and as far north as Thunder Bay. TRCM, *Evidence*, 20 March 2024 (Reg Niganobe, Grand Council Chief, Anishinabek Nation).
[98] TRCM, *Evidence*, 20 March 2024 (Reg Niganobe, Grand Council Chief, Anishinabek Nation).
[99] Ibid.
[100] Ibid.
[101] The word "intermodal" is used to describe facilities where cargo can be moved between two or more modes of transport, in this case rail and marine transport.

collaborate at the planning stage of projects, they are unable to work together on the financing and procuring needed to implement those projects. This situation can affect a variety of projects, including those related to dredging, green shipping corridors, and shore power facilities.[102]

Port officials explained that proposed government legislation[103] would address some of the barriers, but further changes would be needed to the *Competition Act* and to the letters patent[104] of each port authority.

Members of the Senate Standing Committee on Transport and Communications and representatives of the Montreal Port Authority. From left to right, front row: Senators Cuzner, Dasko, Clement, and Housakos; Julie Gascon, President and Chief Executive Officer; Senators Miville-Dechêne and Cardozo.

[102] For example, port officials noted that their $10 million investment in shore power has reduced the idling of cruise ships, allowing 20% of them to turn off their engines while at the dock, but collaboration on procurement with ports in Trois-Rivières and Quebec City would improve efficiency and expand the use of shore power on the St. Lawrence River.
[103] Bill C-33, An Act to amend the Customs Act, the Railway Safety Act, the Transportation of Dangerous Goods Act, 1992, the Marine Transportation Security Act, the Canada Transportation Act and the Canada Marine Act and to make a consequential amendment to another Act (short title: Strengthening the Port System and Railway Safety in Canada Act), 1st Session, 44th Parliament.
[104] Letters Patent are the document that incorporate the port authority under the *Canada Marine Act*, which govern the activities and powers of the port authority.

Key Themes and Recommendations

The committee's study shows how climate change, including the increasing incidence of extreme weather events, is already posing a threat not only to the movement of people and goods, but also to public health and safety, national security, and Canada's future long-term economic prosperity. The committee believes that there is an urgent need for a federal government response.

Over the course of the four case studies, the importance of collaboration emerged as a key theme. Of course, the division of power in the Canadian Constitution means that all three levels of government need to be at the table for discussions around the resiliency of critical transportation infrastructure. In particular, some of the municipal and Indigenous leaders that appeared before the committee expressed concern that they are not always consulted.[105]

Witnesses also highlighted the importance of private sector partners, who own and manage key supply chain infrastructure, as well as Indigenous communities, whose traditional knowledge can contribute to the management of such infrastructure. Researchers from academia also provided invaluable input to the committee's study.

The committee believes that the situation regarding the Chignecto Isthmus stood out as a particular example where the federal government could play a leadership role.

Another key theme in witness testimony — particularly from municipal governments, who highlighted the need for stable, predictable funding in light of their limited taxation powers — was the key role of federal and provincial programs in paying for infrastructure upgrades and repairs.[106] This tension between levels of government about who should pay for new or upgraded critical infrastructure was most explicit in the Chignecto Isthmus case study, but the issue was also raised by municipal officials who the committee heard from in other case studies. Mayor Boshcoff from Thunder Bay recommended expanding existing infrastructure programs — such as the Disaster Mitigation and Adaptation Fund, the National Disaster Mitigation Program and the Green Municipal Fund — and increasing the range of eligible projects.[107]

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[105] For example, see: TRCM, *Evidence*, 18 October 2023 (David Kogon; and Andrew Black); and TRCM, *Evidence*, 20 March 2024 (Andrea Horwath, Sylvain Ouellet and Reg Niganobe); and TRCM, *Evidence*, 9 April 2024 (Catherine Vallières-Roland, Deputy Mayor, Quebec City).
[106] TRCM, *Evidence*, 27 February 2024 (Gino Moretti); and TRCM, *Evidence*, 9 April 2024 (Catherine Vallières-Roland).
[107] TRCM, *Evidence*, 20 March 2024 (Ken Boshcoff).

For private infrastructure, such as the rail lines discussed in the Chignecto Isthmus and Vancouver case studies, there was also some discussion of the private sector's role in funding this infrastructure. At Canada's largest airports, the federal government owns the land, but leases it to not-for-profit airport authorities, who are responsible for operating the airports. In the committee's view, setting clear expectations about who pays for what is a critical component of any effort to move forward on this urgent policy file.

An additional recurring theme was the need to build more resiliency into the supply chain, to adapt to expected changes in the climate. As explained by Matthew Hynes, Executive Vice President of Oceanex Incorporated, cost is one of the reasons why there is not a lot of resiliency built into the system:

> In the past, we have generally found that the transportation system is very tight. The capacity is very well matched to the demand. People tend not to pay a premium to have all these alternate solutions waiting, ready, on standby. […] For all these things, if you want a warehouse and to build inventory, that comes at a cost. At the end of the day, the consumers want costs as low as possible. Major retailers are tending to that desire, in one way at least, by cutting out any fat in their systems. That means, on a good day, it runs very well, very lean, but on a rainy day, such as we're discussing here, the system is much more susceptible to the risk of a shortage.[108]

Some witnesses from the transport sector suggested that they have started analyzing anticipated climate change impacts and integrating those lessons into their operations and long-term planning.[109]

Another step towards building more resiliency is to identify the most vulnerable supply chain infrastructure assets. Officials from Transport Canada told the committee that they are working with other governments, including the United States, on an updated list of the most economically and environmentally vulnerable assets in Canada's supply chain. Noting that this work is still ongoing, they declined

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[108] TRCM, *Evidence*, 18 October 2023 (Matthew Hynes).

[109] TRCM, *Evidence*, 25 October 2023 (Martin Guimond, Vice-President, Transportation, Eastern Region, CN); TRCM, *Evidence*, 12 December 2023 (Christoph Rufenacht and Ronan Chester); and TRCM, *Evidence*, 10 April 2024 (Martin Massé, Vice-President, Public Affairs and Vice-President, Sustainability, Aéroports de Montréal; Todd Ernst, Director, Energy and Environment, Greater Toronto Airports Authority; and Hugues Paris, Vice-President, Sustainability, Quebec Port Authority). See also: Calgary Airport Authority, *Submission to the Senate of Canada Standing Committee on Transport and Communications*, 12 March 2024.

to provide the committee with examples of the top two or three vulnerable supply chain infrastructure assets.[110]

The importance of local level climate change data also emerged as a key theme in witness testimony. Professor Stolle explained to the committee that there is often a lack of data regarding the local impacts of climate change on critical transportation infrastructure. The centralized sharing of that data — currently, that data is often dispersed rather than being available in one place — was also highlighted as an issue related to local level climate data used for decision making.[111]

The committee notes that the Canadian Centre for Climate Services has a mandate to, among other things, provide access to climate information, offer training, and build local capacity through its five regional hubs (Pacific Climate Impacts Consortium, ClimateWest, Ontario Resource Centre for Climate Adaptation, Ouranos and CLIMAtlantic.)

In addition to climate adaptation, witnesses from the transport sector discussed efforts to mitigate climate change (i.e., reduce emissions) in their industry. These efforts include Hamilton Airport's work towards net-zero emissions, modal shift on the Great Lakes St. Lawrence Seaway, efforts to make flights more fuel efficient, the use of alternative fuels in the rail and marine sectors and the Vancouver-Fraser Port Authority's efforts to phase out all port-related emissions by 2050.[112] In contrast, witnesses from the trucking sector noted the impossibility of meeting federal emissions reduction targets.[113]

In particular, trucking is a major component of moving cargo in North America and is notably significant along the Great Lakes St. Lawrence Seaway system. Heavy traffic congestion on adjacent highways is a reality throughout this system, contributing to overall traffic congestion and significant carbon emissions, which in turn contribute

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[110] TRCM, *Evidence*, 16 April 2024 (Christian Dea, Director General, Transportation and Economic Analysis and Chief Economist, Transport Canada).
[111] TRCM, *Evidence*, 27 February 2024 (Jacob Stolle).
[112] TRCM, *Evidence*, 29 November 2023 (Joseph Sparling, Director, Northern Air Transport Association and President, Chief Executive Officer, Air North, Northern Air Transport Association); TRCM, *Evidence*, 12 December 2023 (Ronan Chester, Director, Climate Action and Sustainability Leadership, Vancouver Fraser Port Authority); TRCM, *Evidence*, (Marc Brazeau, President and Chief Executive Officer, Railway Association of Canada), 13 February 2024; TRCM, *Evidence*, 9 April 2024 (Maguessa Morel-Laforce); and John C. Munro Hamilton International Airport, *Written Submission to the Senate Committee of Canada Standing Committee on Transportation and Communications*, 13 May 2024.
[113] TRCM, *Evidence*, 13 February 2024 (Dave Earle, President and Chief Executive Officer, British Columbia Trucking Association).

to the effects of climate change. During the committee's visits to ports in Hamilton and Montreal, officials discussed efforts to replace trucking with short sea shipping, which would result in reducing truck traffic and associated emissions while also increasing the efficiency of moving cargo.

The case study on Canada's North highlighted the particular needs of this region. Witnesses identified a need for more all-season roads, the need for further investment in northern airports, a lack of port infrastructure and the need for further data on permafrost and other aspects of northern climate conditions.

In light of its study, the committee concludes that Canada is not ready to confront and overcome the effects of climate change on its means of transportation, and therefore on its supply chain. Current efforts are scattered; there is no national coordination, no concrete plan and no predictable funding, and yet there is an urgent need to take action. The committee therefore recommends:

- **That the Government of Canada prepare a list of the country's most critical transportation infrastructure to increase its resilience and maintain our supply chains in case of extreme weather events.**

- **That the Government of Canada develop a concrete action plan to protect the country's most critical transportation infrastructure in partnership with the provinces, territories, municipalities, Indigenous communities (First Nations, Inuit and Métis) and the private sector.**

- **That stable, long-term funding be available (from governments and the private sector) for climate change adaptation and mitigation efforts for transportation infrastructure.**

- **That the Government of Canada work with municipalities and Indigenous communities to determine the path forward in protecting the Chignecto Isthmus from the increasing likelihood of flooding.**

- **That the Government of Canada, in consultation with northern communities, develop a detailed plan to meet the specific needs of Northern Canada, including the construction of all-weather roads, port facilities and resilient airport runways.**

- **Recognizing the essential nature and the long-term vulnerability of the Vancouver International Airport, that the Government of Canada immediately begin consultations on protecting the Sea Island location against storm surges and rising water levels.**

- **Recognizing that marine transportation is currently the least polluting mode of transportation, that the Government of Canada relax regulations so that the ports of the Great Lakes and the St. Lawrence can work together to improve their capacity and resilience.**

- **That the Government of Canada investigate the advantages of short sea shipping to increase cargo movement by marine modes of transportation, which would reduce carbon emissions by reducing the volume of cargo moved by trucks.**

- **That the Government of Canada work with the provinces, territories, municipalities and Indigenous communities to ensure that emergency plans and supplies are in place in the event of extreme weather events.**

- **That the Government of Canada develop a detailed plan for responding to the particular needs of Northern Canada, including:**

    - **A major investment in building all-season roads that link remote communities without a road network in order to support the affordable movement of goods and people;**

    - **Further investment in northern airport infrastructure in an effort to modernize it and supply goods to remote communities in an ongoing and sustainable manner;**

    - **An investment in port construction that is resilient to the effects of climate change to address the critical lack of port infrastructure in Canada's Arctic; and**

    - **Further investment in research to increase knowledge of permafrost and conditions in northern environments in collaboration with**

Indigenous communities, with a view to providing adequate support to northern communities.

Conclusion

In undertaking its study about the climate resiliency of transportation infrastructure, the Standing Senate Committee on Transport and Communications sought to understand how Canada's supply chain is adapting its infrastructure to a changing climate.

The division of powers amongst different levels of government, combined with the mix of publicly and privately owned infrastructure in the transport sector, means that addressing this challenge will involve bringing together governments with Indigenous peoples, the private sector, academia and civil society.

Given the urgent nature of this issue, the committee has recommended, among other things, that the federal government create a list of the most important transportation infrastructure, as well as a concrete plan to protect it, while highlighting the need for stable long-term funding from governments and the private sector.

The committee believes that its recommendations will help Canada build more resilient supply chain infrastructure, while mitigating the risk of climate change impacts on this pillar of the Canadian economy.

Appendix A – Witnesses

Wednesday, March 2, 2022

Public Safety Canada:
- Ryan Schwartz, Acting Director General, Critical Infrastructure Directorate, National and Cyber Security Branch

Transport Canada:
- Megan Nichols, Acting Associate Assistant Deputy Minister, Policy
- Kim Benjamin, Director General, Intermodal Surface, Security and Emergency Preparedness
- Paul Sandhar-Cruz, Director General, Strategic Policy
- Christian Dea, Director General, Transportation and Economic Analysis, and Chief Economist
- Maxime Bilodeau, Director, Environmental Policy Framework and Integration

Wednesday, March 23, 2022

Environment and Climate Change Canada:
- Douglas Nevison, Assistant Deputy Minister, Climate Change Branch
- John Moffet, Assistant Deputy Minister, Environmental Protection Branch

Innovation, Science and Economic Development Canada:
- Susan Hart, Director General, Spectrum Management Operations Branch
- Marc-André Rochon, Senior Director, Spectrum Management Operations Branch
- Wen Kwan, Senior Director, Information and Communications Technology Resilience
- Martin Proulx, Director General, Spectrum and Telecommunications Sector
- Andre Arbour, Director General, Telecommunications and Internet Policy Branch

Wednesday, March 30, 2022

Council of Canadian Academies:
Jérôme Marty, Project Director

Canada West Foundation:
John Law, Senior Fellow

Wednesday, April 6, 2022

Railway Association of Canada:
Caroline Healey, Executive Vice-President and General Counsel
Gregory Kolz, Director, Government Relations

New Brunswick Southern Railway:
Ian Simpson, General Manager

Arctic Gateway Group:
Sheldon Affleck, President and Chief Executive Officer

As individuals:
Michael Hendry, Director, Canadian Rail Research Laboratory, University of Alberta
Paul Miller, Railroader in Residence, Canadian Rail Research Laboratory, University of Alberta

Wednesday, April 27, 2022

Federation of Canadian Municipalities:
Matt Gemmel, Director, Policy and Research

Canadian Construction Association:
Mary Van Buren, President

Engineers Canada:
Gerard McDonald, Chief Executive Officer

Wednesday, May 18, 2022

Canadian National Railway:
Chantale Després, Assistant Vice-President, Sustainability
Rahim Karmali, Chief Engineer, Supply Chain and Technology

Canadian Pacific Railway:
Glen Wilson, Managing Director, Environmental Risk

Wednesday, February 15, 2023

Transport Canada:
The Honourable Omar Alghabra, Minister of Transport
Craig Hutton, Associate Assistant Deputy Minister, Policy
Nicholas Robinson, Associate Assistant Deputy Minister, Safety and Security

WestJet:
Andrew Gibbons, Vice-President, External Affairs

Air Canada:
David Rheault, Vice-President, Government and Community Relations
Kevin O'Connor, Vice-President, System Operations Control

Tuesday, October 17, 2023

As an individual:
Ronald Rudin, Distinguished Professor Emeritus, Department of History, Concordia University

Wednesday, October 18, 2023

Canadian Propane Association:
Shannon Watt, President and Chief Executive Officer
Royden Boudreau, Chair, Atlantic Canada Committee

Oceanex Incorporated:
Matthew Hynes, Executive Vice-President

Town of Amherst:
David Kogon, Mayor

Municipality of Tantramar:
Andrew Black, Mayor

Tuesday, October 24, 2023

Government of Prince Edward Island:
The Honourable Ernie Hudson, Minister of Transportation and Infrastructure
Paul Godfrey, Director of Infrastructure, Policy and Planning, Department of Transportation and Infrastructure

Halifax Port Authority:
Allan Gray, President and Chief Executive Officer

As individuals:
Danika van Proosdij, Director, TransCoastal Adaptations Centre for Nature-Based Solutions, Saint Mary's University
Tim Webster, Research Scientist, Applied Geomatics Research Group, Nova Scotia Community College

Wednesday, October 25, 2023

Government of New Brunswick:
Rob Taylor, Deputy Minister, Department of Transportation and Infrastructure
Jim Doyle, Director, Strategic Partnership and Trade Corridors, Department of Transportation and Infrastructure
Melissa Cummings, Director, Environmental Services, Department of Transportation and Infrastructure
Michael Pauley, Project Manager

Government of Nova Scotia:
Peter Hackett, Deputy Minister, Department of Public Works

Bonnie Miles-Dunn, Director, Federal Infrastructure Programs and Stakeholder Engagements, Department of Public Works
Kevin Bekkers, Director, Resource Sustainability, Department of Agriculture

Canadian National Railway:
Martin Guimond, Vice-President, Eastern Region

Atlantic Provinces Trucking Association:
Chris McKee, Executive Director

Mi'gmawe'l Tplu'taqnn Incorporated:
Tracy Cloud, Director of Trilateral Negotiations
Charles Labillois-Bjorndal, Director of Indigenous Knowledge

Tuesday, October 31, 2023

Canadian Climate Institute:
Ryan Ness, Director, Adaptation

As individuals:
Natalie Carter, Community Engagement Lead, StraightUpNorth, McMaster University
John Gradek, Faculty Lecturer, School of Continuing Studies, McGill University
Barry Prentice, Director, University of Manitoba Transport Institute and Professor, Supply Chain Management Department, University of Manitoba
David Sauchyn, Professor, Director, Prairie Adaptation Research Collaborative, University of Regina
Sebastian Weissenberger, Professor, Environmental Sciences, TÉLUQ University

Wednesday, November 1, 2023

As individuals:

Jeff Birchall, Associate Professor, Department of Earth and Atmospheric Sciences, University of Alberta

Kees Lokman, Associate Professor and Chair, Landscape Architecture, University of British Columbia

Tristan Pearce, Associate Professor of Geography and Canada Research Chair in Cumulative Impacts of Environmental Change, University of Northern British Columbia

Alison Perrin, Senior Research Professional, Northern Adaptation and Resilience, Yukon University

Eric Rapaport, Associate Professor, School of Planning, Dalhousie University

Clarence Woudsma, Associate Professor, School of Planning, University of Waterloo

Tuesday, November 21, 2023

Town of Norman Wells:

Frank Pope, Mayor

Government of the Northwest Territories:

Tracy St. Denis, Assistant Deputy Minister, Programs and Services, Department of Infrastructure

HRN Contracting Limited:

David Hodgson, President

Boiler Controls and Installations Limited:

Jason Balaski, President

Wednesday, November 22, 2023

Nunavut Tunngavik Incorporated:

Paul Irngaut, Vice-President

Taqialuk Peter, Executive Assistant to the Vice-President

The Firelight Group:
Rachel Olson, President and Director

Canadian North:
Shelly De Caria, Interim President and Chief Executive Officer
Aaron Speer, Vice-President, Flight Operations

West Kitikmeot Gold:
Brendan Bell, Chief Executive Officer

Tuesday, November 28, 2023

Government of the Northwest Territories:
Steve Kokelj, Senior Permafrost Scientist, NWT Geological Survey, Department of Industry, Tourism and Investment

As individuals:
Alex de Barros, Professor, Department of Civil Engineering, University of Calgary
Jackie Dawson, Canada Research Chair (tier 1) in Human and Policy Dimensions of Climate Change, Full Professor at the University of Ottawa and Scientific Director of the ArcticNet Network of Centres of Excellence
Eva Stephani, Permafrost Research Geographer, Alaska Science Centre, US Geological Survey

Wednesday, November 29, 2023

Government of the Northwest Territories:
Gary Brennan, Assistant Deputy Minister, Regional Operations, Department of Infrastructure
Julian Kanigan, Assistant Deputy Minister, Environmental Management, Monitoring and Climate Change, Department of Environment and Climate Change
Ziaur Rahman, Manager, Surface Design and Construction, Department of Infrastructure

Chamber of Marine Commerce:
Paul Topping, Director, Regulatory and Environmental Affairs
Maguessa Morel-Laforce, Director, Government and Stakeholder Relations

Northern Air Transport Association:
Joseph Sparling, Director, Northern Air Transport Association and President and Chief Executive Officer, Air North

Ontario Trucking Association:
Stephen Laskowski, President and Chief Executive Officer

Tuesday, December 12, 2023

Government of British Columbia:
Kaye Krishna, Deputy Minister, Ministry of Transportation and Infrastructure
Kevin Richter, Associate Deputy Minister, Highway and Regional Services Division, Ministry of Transportation and Infrastructure
Kevin Volk, Assistant Deputy Minister, Integrated Transportation and Infrastructure Services Division, Ministry of Transportation and Infrastructure

Vancouver Airport Authority:
Christoph Rufenacht, Vice-President, Airport Development and Asset Optimization
Wendy Avis, Director, Climate and Environment
Trevor Boudreau, Director, Government Relations

Vancouver Fraser Port Authority:
Ronan Chester, Director, Climate Action and Sustainability Leadership

Tuesday, February 6, 2024

Northwest Hydraulic Consultants:
Dale Muir, Principal Hydrotechnical Engineer

Derek Ray, Principal Geomorphologist

Pacific Climate Impacts Consortium:
Xuebin Zhang, Director

Clear Seas:
Paul Blomerus, Executive Director

As an individual:
Amy Kim, Associate Professor, Civil Engineering, University of British Columbia

Wednesday, February 7, 2024

Musqueam Indian Band:
Allyson Fraser, Councillor
Wade Grant, Intergovernmental Affairs Officer

Greater Vancouver Board of Trade:
Bridgitte Anderson, President and Chief Executive Officer

First Nations Business Development Association:
Michael Bonshor, Managing Director

Abbotsford Chamber of Commerce:
Alex Mitchell, Chief Executive Officer

Tuesday, February 13, 2024

Ocean Networks Canada:
Kate Moran, President and Chief Executive Officer

Railway Association of Canada:
Marc Brazeau, President and Chief Executive Officer

British Columbia Trucking Association:
David Earle, President and Chief Executive Officer

Chamber of Shipping:
Bonnie Gee, President

As individuals:
Stephanie Chang, Professor, School of Community and Regional Planning, Institute for Resources, Environment, and Sustainability, University of British Columbia
Vanessa Lueck, Researcher-in-Residence, Living with Water project, Pacific Institute for Climate Solutions, University of Victoria

Tuesday, February 27, 2024

Great Lakes St. Lawrence Cities Initiative:
Gino Moretti, Chair and Mayor, Municipality of Saint-Anicet
Eamonn Horan-Lunney, Senior Director Policy, Canada

As individuals:
Robin Davidson-Arnott, Professor Emeritus, Department of Geography, Environment and Geomatics, University of Guelph
Jacob Stolle, Professor and Scientific Head, Environmental Hydraulics Laboratory, Institut national de la recherche scientifique

Wednesday, February 28, 2024

St. Lawrence Seaway Management Corporation:
Jim Athanasiou, Vice-President, Engineering and Technology

Hamilton-Oshawa Port Authority:
Ian Hamilton, President and Chief Executive Officer

PortsToronto:
Roelof-Jan Steenstra, President and Chief Executive Officer

Laurentian Pilotage Authority:
Marc-Yves Bertin, Chief Executive Officer

Great Lakes Pilotage Authority:
Jason Rimmer, Chief Executive Officer

Wednesday, March 20, 2024

City of Hamilton:
Andrea Horwath, Mayor

City of Montreal:
Sylvain Ouellet, City Councillor

City of Port Colborne:
Bill Steele, Mayor

City of Thunder Bay:
Ken Boshcoff, Mayor

Anishinabek Nation:
Reg Niganobe, Grand Council Chief

Tuesday, April 9, 2024

Montreal Port Authority:
Julien Baudry, Director, Public Affairs
Claude Deschambault, Director, Environment

Chamber of Marine Commerce:
Paul Topping, Director, Regulatory and Environmental Affairs
Maguessa Morel-Laforce, Director, Government and Stakeholder Relations

Quebec City:
Catherine Vallières-Roland, Deputy Mayor
Charles-Éric Bernier, Environment Director, Communauté métropolitaine de Québec

As an individual:
Tirupati Bolisetti, Faculty of Engineering, University of Windsor

Wednesday, April 10, 2024

Aéroports de Montréal:
Martin Massé, Vice-President, Public Affairs and Vice-President, Sustainability

Greater Toronto Airports Authority:
Todd Ernst, Director, Energy and Environment

Quebec Port Authority:
Hugues Paris, Vice-President, Sustainability

Ontario Trucking Association:
Stephen Laskowski, President and Chief Executive Officer
James Steed, Chair
Geoffrey Wood, Senior Vice-President, Policy

Tuesday, April 16, 2024

Transport Canada:
Paula Vieira, Director General, Environmental Policy
Paul Sandhar-Cruz, Director General, Strategic Policy
Christian Dea, Director General, Transportation and Economic Analysis, and Chief Economist
Charles Haines, Executive Director, Decarbonization of Air, Rail and Marine Transport

Appendix B – Fact-Finding Missions

May 30 to May 31, 2024 | Hamilton, Ontario

Hamilton-Oshawa Port Authority (HOPA Ports)

Ian Hamilton, President and Chief Executive Officer
Larissa Fenn, Vice-President, Corporate Affairs
Peter Hammerl, Director, Information Technology
Gina DelleRose-Ash, Supply Chain and Strategic Innovation Lead

Stakeholders

Tyler Carlson, Director, Operations, Richardson International
Sean Goff, Director, Rail Development, Hamilton Container Terminal
Frank Montecalvo, Vice-President, Operations, Logistec

October 4, 2024 | Montreal, Quebec

Montreal Port Authority (Port of Montreal)

Julie Gascon, President and Chief Executive Officer
David D'Amboise, Chief Operations Officer
Jean-François Belzile, Harbour Master and Director, Marine Operations
Julien Baudry, Director, Public Affairs
Claude Deschambault, Director, Environment
Florent Perrin, Energy Transition Manager
Geneviève Dionne, Manager, Relations with First Nations
Claude Comtois, Professor of Geography and Marine Transportation, University of Montreal

Appendix C – List of Briefs

A complete list of the briefs and follow-up information received during the study can be found at: https://sencanada.ca/en/committees/TRCM/briefs/44-1.

- Letter from the Honourable John G. Abbott, Minister of Transportation and Infrastructure, Government of Newfoundland and Labrador
- Follow-up information from Jim Athanasiou, Vice-President, Engineering Technology, St. Lawrence Seaway Management Corporation
- Brief from the Calgary Airport Authority
- Brief and follow-up information from Robin Davidson-Arnott, Professor Emeritus, Department of Geography, Environment and Geomatics, University of Guelph, as an individual
- Follow-up information from David Earle, President and Chief Executive Officer, BC Trucking Association
- Follow-up information from Martin Guimond, Vice-President, Eastern Region, Canadian National Railway
- Brief from the John C. Munro Hamilton International Airport
- Follow-up information from Jérôme Marty, Project Director, Council of Canadian Academies
- Brief from Kate Moran, President and Chief Executive Officer, Ocean Networks Canada
- Brief from NAV Canada
- Brief from Brian Slack, Distinguished Professor Emeritus, Department of Geography, Planning and Environment, Concordia University
- Brief from the Société de l'Acadie du Nouveau-Brunswick, in partnership with the Fédération acadienne de Nouvelle-Écosse and the Société nationale de l'Acadie
- Follow-up information from Transport Canada
- Brief and follow-up information from Sebastian Weissenberger, Professor, Environmental Sciences, TÉLUQ University, as an individual

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