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## Nunavut's Infrastructure Gap Report: Insights into Critical Infrastructure in Canada's Arctic

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In October 2020, Nunavut Tunngavik released [Nunavut's Infrastructure Gap Report](#). The product is a synthesised reflection of several reports, including Canada's 2019 [Arctic and Northern Policy Framework \(ANPF\)](#). Specifically, the ANPF acknowledges significant infrastructure deficits and defines [Goal #2](#) as "Strengthened infrastructure that closes gaps with other regions of Canada" with eight stated objectives.

This quick impact brief explores the findings from the report associated with Public Safety Canada's [definition of Critical Infrastructure \(CI\)](#). Many of the infrastructure gaps identified in the report fit within the [framework of Canada's CI sectors](#), which have been developed predominantly according to circumstances and needs in Canada's southern provinces. However, the report's analysis further finds that defining CI in the Arctic requires a situational awareness of community-level infrastructure operations. This Quick Impact seeks to promote awareness and offer an interpretation of Canadian Arctic CI challenges, with a focus and emphasis on Nunavut-related circumstances. Following a summary of Canada's CI sectors and report measures, I raise three main points related to: northern remoteness, compounding CI deficits, and implementation challenges.

### Background

Canada's ten CI Sectors and Lead Federal Agencies are summarized in Exhibit 1. These CI sectors embody "processes, systems, facilities, technologies, networks, assets, and services essential to the health, safety, security or economic well-being of Canadians and the effective functioning of government."<sup>1</sup> The designation of infrastructure assets as CI within these categories is reflective of their essential nature. Their functionality is understood to be necessary and if an asset were to go offline, even temporarily, significant social, health and safety impacts may result.

### Exhibit 1-Canada's Critical Infrastructure Sectors

CI Sector	Sector-specific federal department/agency
Energy and utilities	Natural Resources Canada
Information and communication technology	Innovation, Science and Economic Development Canada
Finance	Finance Canada
Health	Public Health Agency of Canada
Food	Agriculture and Agri-Food Canada
Water	Environment and Climate Change Canada
Transportation	Transport Canada
Safety	Public Safety Canada
Government	Public Safety Canada
Manufacturing	Innovation, Science and Economic Development Canada; Department of National Defence

Source: Public Safety Canada National Cross Sector Forum 2018-2020 Action Plan for CI

It is worth highlighting the operational qualities inherent to the CI sector framework. It is assumed that the failure of a power plant or highway may be acute in nature, with disruptions and impacts felt immediately when they go offline. In contrast, the housing sector is not included. Issues related to housing can lead to a lower standard of living and even life-threatening harm, however, such “crises” tend to be slower moving. Similarly, failures in the education sector may not be felt for a generation.

[Nunavut’s Infrastructure Gap Report](#) applies a regional approach to analyzing infrastructure in the territory. The Territory of Nunavut has 25 distinct communities, examined within the report. To quantify the infrastructure gap between Nunavut and other regions, the report applies 55 measures to 18 infrastructure areas. The report includes baseline metrics for the presence of infrastructure, the operational performance of existing assets and related impact indicators. Measures applicable to CI sectors are summarized in Exhibit 2.

### Exhibit 2 - CI Sectors Discussed Within Nunavut Infrastructure Gap Report Measures

CI Sectors	Measures used by Nunavut Infrastructure Gap Report
Energy and Utilities	<ul style="list-style-type: none"> <li>• Total annual power generation</li> <li>• Maximum generating capacity</li> <li>• Annual electricity consumption per capita</li> <li>• Share of electricity produced by renewables</li> <li>• Kilometres of publicly owned sewer pipes &lt;450mm</li> <li>• Sewer pipes, sewage lagoons state of repair</li> </ul>
Information and Communication Technologies	<ul style="list-style-type: none"> <li>• Availability of fibre optic technology</li> <li>• Internet speed and capacity</li> <li>• LTE availability</li> </ul>

Finance	<ul style="list-style-type: none"> <li>• Bank branches per capita</li> <li>• Bank-owned ATMs per capita</li> </ul>	<ul style="list-style-type: none"> <li>• Average household spending on financial services</li> </ul>	<ul style="list-style-type: none"> <li>• Take-up rate for tax-advantaged savings accounts: (RESPs RRSPs)</li> </ul>
Health	<ul style="list-style-type: none"> <li>• Number of hospital beds staffed and in operation</li> <li>• Mental health care and addictions infrastructure</li> </ul>	<ul style="list-style-type: none"> <li>• Government spending on out-of-jurisdiction health care</li> </ul>	<ul style="list-style-type: none"> <li>• Percentage of residents with a regular health care provider</li> </ul>
Food	<ul style="list-style-type: none"> <li>• Stages of food travel and transfer</li> </ul>	<ul style="list-style-type: none"> <li>• Price differences on commercial food items</li> </ul>	<ul style="list-style-type: none"> <li>• Number of Canadian Food Inspection Agency (CFIA) licensed establishments</li> </ul>
Water	<ul style="list-style-type: none"> <li>• Length of drinking water pipes per capita</li> <li>• Share of population served by drinking water systems</li> </ul>	<ul style="list-style-type: none"> <li>• Physical condition of drinking water infrastructure</li> </ul>	<ul style="list-style-type: none"> <li>• Investment in drinking water infrastructure per capita</li> </ul>
Transportation	<ul style="list-style-type: none"> <li>• Number of ports</li> <li>• Number of harbours</li> <li>• Length of roadway and sidewalks (per 100,000 km<sup>2</sup>)</li> </ul>	<ul style="list-style-type: none"> <li>• Physical condition of roadway</li> <li>• Number of paved runways</li> </ul>	<ul style="list-style-type: none"> <li>• Average runway length</li> <li>• Kilometres of track per 100,000 km<sup>2</sup></li> </ul>
Safety	<ul style="list-style-type: none"> <li>• Coast guard search and rescue stations</li> <li>• Firefighting infrastructure</li> <li>• Fire damage</li> </ul>	<ul style="list-style-type: none"> <li>• Customs and border service locations</li> <li>• Capacity/state of repair for correctional institutions</li> </ul>	<ul style="list-style-type: none"> <li>• Policing infrastructure</li> <li>• Courts and sentencing rates</li> </ul>

Sources: Public Safety Canada and Nunavut Infrastructure Gap Report

## Canada’s Northern Critical Infrastructure: Location and Circumstances

Conditions in Nunavut communities are dissimilar from conditions in Canada’s southern provinces in several ways. First, the remoteness of communities means that communities face greater pressures to be self-sufficient in times of crisis. “Because of the great distances between communities and the lack of transportation links,” the report notes, “it is generally impractical for Nunavut communities to share infrastructure assets or resources. Therefore, unlike other parts of Canada each community must have its own local infrastructure: for example, a power plant, a drinking water plant, bank branch — or go without.”<sup>2</sup> These observations are even more significant from an asset planning standpoint because of the small populations of people living in Nunavut’s communities, as well as their isolated locations, which present challenges related to the operational planning of expensive assets such as hospitals.

The regional (as opposed to sectoral) analysis offered in the Nunavut report finds that infrastructure gaps across multiple sectors may compound each other. For example, fighting a 2015 fire at Pangnirtung’s power plant was made more difficult by a lack of water - community water pumps did not have backup generation separate from the burning power plant.<sup>3</sup> Although the fire was extinguished, 1,500 residents faced a month-

long state of emergency, subsisting in freezing conditions without heat, electricity, internet, or running water. The local gravel runway was too short for the delivery of replacement generators by a cargo plane. In order to transport essential supplies, the Government of Nunavut was obliged to charter an Antonov An-124 (one of the world’s largest cargo planes) to deliver a special Skycrane helicopter to Iqaluit. <sup>4</sup> The helicopter was manually reassembled at the Iqaluit airport before proceeding to make multiple trips, delivering replacement parts to Pangnirtung’s diesel power generation station.<sup>5</sup>

Such accounts uncover compounding effects when multiple CI assets are mutually dependent to function. The report draws attention to ways in which circumstances specific to Nunavut may necessitate an understanding of CI functionality that is different from in Canada’s southern provinces. The report applies six “cross cutting factors” which impact all infrastructure types summarized in Exhibit 3. A key strength of [Nunavut’s Infrastructure Gap Report](#) is its success in highlighting the interconnectedness of infrastructure issues experienced by individual communities.

**Exhibit 3 - Points for Systemic Regional Analysis**

Regional points of Analysis Used by Nunavut Infrastructure Gap Report		
• State of repair	• Climate change adaptation	• Skills and Human Capacity
• Governance and Ownership	• Energy Efficiency and Environmental Sensitivity	• Accessibility

Source: Nunavut Infrastructure Gap Report

Applying these points of analysis helps to reframe some of the assumptions inherent to Canada’s CI sectors, including how acute-operational needs of Critical Infrastructure (CI) rely upon the presence of other “taken-for-granted” systems, such as a functioning private housing market. In Nunavut, the private housing market is weak, with 75 percent of renter households living in public housing.<sup>6</sup>

The Nunavut labour market is similarly affected by characteristics of the region. Small populations living in remote and isolated communities may lack the education, skills, and human capacity needed to maintain CI assets, or execute upon emergency plans. A reliance on expertise outside individual communities reflects a skills and human capacity gap, exacerbated by limitations upon the capacity for communities to host non-residents due to housing supply pressures and limited hotel accommodations for travellers.<sup>7</sup>

## Infrastructure Implementation Challenges

The remote geography of Nunavut and the compounding effect of multiple infrastructure gaps reinforces a need for a cross-disciplinary, community-focussed approach to CI planning in remote communities. Where there is a heavy reliance on fly-in labour, housing shortages present a major barrier both to hiring construction workers and expanding services through instruction, to build skills-based education and training.

From an implementation standpoint, Canada’s CI infrastructure design, operation, and maintenance closely involves the private market and associated professional organizations. As the Nunavut report notes,

communities in that territory represent a tiny share of the overall Canadian market. Private firms who generate designs or invest in expertise suitable for the unique circumstances in the Arctic may not find their investments to be transferrable to southern clients. Indeed, as the report notes, “the private sector, which plays a significant role in infrastructure development in southern Canada, is most evident by its absence” in Nunavut.<sup>8</sup> The principle of market competition may fail to produce suitable candidates or pricing may be less competitive than in other parts of the country owing to this smaller private sector presence.

Private sector actors may abstain from pursuing infrastructure projects in remote communities if they are seen to be high cost and high risk. From a profitability standpoint, improving existing infrastructure becomes more difficult where multiple infrastructure gaps make projects logistically challenging – for example high travel costs, delays in accessing materials by sealift, multiple air-cargo transfer points and similar bottlenecks. Climate change is a liability for market actors – engineering challenges and significant uncertainty add costs and risks to infrastructure construction and maintenance – and the Arctic is experiencing climate change at a rate three times the global average.<sup>9</sup>

Recent COVID-19 isolation measures combined with the short construction season may further compound the infrastructure gap. The Government of Nunavut has funded additional costs to quarantine Southern workers for two weeks before entering the territory, and the effects have slowed the \$600 million in capital projects scheduled for summer 2020, including a 34-percent reduction in the number of public housing units to be built in Iqaluit this year.<sup>10</sup>

## Closing Remarks

The Government of Canada’s [Arctic and Northern Policy Framework](#) makes a commitment to “strengthened infrastructure that closes gaps with other regions of Canada.” [Nunavut’s Infrastructure Gap Report](#) (2020) provides measures to help quantify what this commitment means for implementation in Nunavut’s twenty-five communities. While undertaking this comparative exercise, it is important to recognize how the needs of Nunavut’s communities are distinct from other parts of the country. The physical realities facing these communities requires an approach to designating CI that is decentralized, emphasizing community self-sufficiency.

The physical geography, labour availability and existing infrastructure assets in the North must be considered both for the type of investments which are made and how they are administered. Project scoping developed predominantly according to circumstances and needs in Canada’s southern provinces may be unsuitable for a northern context. Project tendering and administrative practices predicated upon private market contractors may require adjustment, to account for the size and robustness of private markets operating in northern communities. Where infrastructure projects are less profitable, the private sector will be less present.

Investments in Critical Infrastructure supporting northern populations are an expression of Canada’s Arctic sovereignty and also contribute to enhanced security and safety in the region. Canadian administrators responsible for implementing CI assets should recognize the importance of investments in adjacent sectors



which support CI construction and maintenance. The situational-awareness considerations discussed in this report invite opportunities for further studies of the Yukon and Northwest Territories, where infrastructure networks and supporting markets are more developed than in Nunavut but less developed than provinces in southern Canada.

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<sup>1</sup> Public Safety Canada (2020) 'Canada's Critical Infrastructure' <https://www.publicsafety.gc.ca/cnt/ntnl-scrct/crtcl-nfrstrctr/cci-iec-en.aspx>

<sup>2</sup> Nunavut Tunngavik (2020) Nunavut Infrastructure Gap Report p.14

<sup>3</sup> CBC News, "Teamwork helps Pangnirtung residents pull through power outage," 2015, <https://www.cbc.ca/news/canada/north/teamwork-helps-pangnirtung-residents-pull-through-power-outage-1.3029395>

<sup>4</sup> Nunatsiaq News, "Permanent power solution for Pangnirtung on its way: Nunavut Government," April 2015, [https://nunatsiaq.com/stories/article/65674permanent\\_power\\_solution\\_for\\_pangnirtung\\_on\\_its\\_way\\_nunavut\\_government/](https://nunatsiaq.com/stories/article/65674permanent_power_solution_for_pangnirtung_on_its_way_nunavut_government/)

<sup>5</sup> APTN News, "Big Plane – Small City, Help Is on the Way to Pangnirtung," 2015

<sup>6</sup> Statistics Canada, "The Daily — First Results from the Canadian Housing Survey, 2018," accessed June 3, 2020, <https://www150.statcan.gc.ca/n1/daily-quotidien/191122/dq191122c-eng.htm>

<sup>7</sup> Nunavut Tunngavik (2020) Nunavut Infrastructure Gap Report p.166

<sup>8</sup> Nunavut Tunngavik (2020) Nunavut Infrastructure Gap Report p.28

<sup>9</sup> Government of Canada, "Canada's Arctic and Northern Policy Framework.

<sup>10</sup> Beth Brown, "Nunavut extends public health emergency until June 11," CBC News, 2020, <https://www.cbc.ca/news/canada/north/nunavut-update-covid-19-may-28-1.5588095>; Rajnesh Sharma, "Construction of Public Housing Units Reduced by 24 amid Covid-19 - Nunavut News," Nunavut News, July 23, 2020, <https://nunavutnews.com/nunavut-news/construction-of-public-housing-units-reduced-by-24-amid-covid-19/>.