

INTRODUCTION BOOKLET:

TECHNICAL GUIDE FOR NORTHERN HOUSING



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Cover Image (top): Pangniqtuuq, Nunavut. Located on Baffin Island, Pangnirtung is an Inuit hamlet. The artistic community is well known for their woven tapestries and lithographic prints, and is situated along a fiord, in scenic mountainous terrain.

T. (n.d.). Pangnirtung. Retrieved March 26, 2021, from <https://travelnunavut.ca/regions-of-nunavut/communities/pangnirtung/>

Cover Image (bottom): Old Crow, Yukon. On the Porcupine River in the Yukon Basin, this southwards region is known as Gwitch'in, and is where the Teechik (Old Crow) community is located. This is the only community in the Yukon that is not accessible by road.

Gonçalves, M. (2017). Old Crow, an Arctic native village in northern Yukon, Canada. Retrieved March 26, 2021, from <http://ultima0thule.blogspot.com/2017/05/old-crow-arctic-native-village-in.html>

1. INTRODUCTION

The development of the *Technical Guide for Northern Housing* (TGNH) was led by the First Nations National Building Officers Association (FNNBOA). FNNBOA members play a role in serving Indigenous communities with inspection and construction of safe, healthy, and energy-efficient houses for the north. In the past few years, regional technical construction documents have been produced in various forms and complexity. This guide differs from those regional documents and is unique in the following three ways:

- This TGNH provides user-friendly illustrated booklets that outline “best practices” for building solutions in house construction. The guide seeks to cover all northern and remote regions, including the arctic and subarctic First Nations and Inuit Nunangat regions. To cover this vast area, 14 overview booklets of the subregions have been developed to show the distinct challenges within each subregion. Eleven technical booklets cover the house design and construction process.
- The TGNH Appendix also presents “community-based” house designs developed from consulting and engaging with Indigenous communities. A team of Indigenous architects completed the consultations and produced house designs in 2020 that capture the direct housing needs of the First Nations community. The Inuit house designs presented are as-built designs developed over the years with ongoing consultations with the architectural team.
- This TGNH provides information on the governance and challenges of construction in the north. It should be used by anyone working in the construction industry or providing construction supplies to the north.

1.1 Objectives

From the onset, the objectives of this technical guide have been as follows:

- Develop a series of booklets that provide technical and engineering information on the construction of new houses.
- Improve northern housing by addressing its broader context, which includes cultural and administrative government factors.
- Identify “best practices” in the building of new houses in the north that meet the provisions in the *National Building Code of Canada*, energy codes and other related housing standards.
- Contribute to current housing construction practices that are unique to communities within the arctic and subarctic First Nations and Inuit Nunangat Regions.
- Provide easy-to-understand booklets on technical information that is generally more challenging for the construction of new houses in the north. This includes aspects that always require the input of a professional engineer for specific site conditions.
- Educate individuals with no northern experience on the challenges of building residential houses in the north when compared to the south.
- Help build a common understanding among building officers, Chief and Council, designers, and contractors on the specific challenges of new-home construction in their community.

1.2 Overview Booklets

There are 14 overview booklets. This is the first, and helps to introduce the context in which housing in northern Canada occurs. The two main regions presented below, relative to the boreal forest treeline, are specified, as well as an approximate number of inhabitants. The remaining 13 overview booklets cover each subregion, providing information on natural and climatic conditions, Indigenous peoples, transportation networks and corridors, service centres and climate-change impacts.

1.3 The Intended Audience

Both northerners and people from outside northern communities are the intended users of this introduction booklet, the overview booklets, and technical booklets that make up the overall guide. The purpose is to give those not familiar with construction in the north a better understanding of what needs to be considered to successfully deliver new housing.

1.4 Guiding Principles

For the development of this guide, a set of guiding principles was used to address the objectives stated above. Building materials and construction methods that typically originate in the south were assessed for their effectiveness in northern communities and the logistical challenges they pose. These guiding principles are expanded in a separate booklet following this one. Below are four fundamentals:

- Climate zones covered: Zone 7B (subarctic), and Zone 8 (arctic)
- Remote and difficult access
- Primarily Indigenous Communities (First Nations, Métis, and Inuit)
- Most communities rely on diesel and heating oil to be shipped to their location to generate electricity and heating, at extremely high costs

1.5 Important Factors

This technical guide covers a large area of different geographies, seasonal weather patterns, numerous cultures, and communities. A technical construction approach that works in one remote northern area may not work in another remote northern area. There is no one-size-fits-all approach for all regions. To successfully manage the challenges, those involved with home construction must have an intimate understanding of the specific community they are working with, and the challenges unique to that community and location.

This guide speaks to technical and logistical challenges common across northern communities in the arctic and subarctic regions. The example house designs, enclosed within the Appendix to this guide, demonstrate how these principles can be integrated to establish a suitable house design for a specific community.

Governance, administration and the decision-making process for the construction of new houses varies among northern communities. Visitors must take the time to learn how this process works for a specific community before getting involved in decisions that affect that community.

1.6 Design as the First Step

A generalized definition for a “design” is a plan for construction that usually has to satisfy certain goals and constraints, and should take into account aesthetic, functional, economic, or social considerations, and is expected to interact with a certain environment.

To successfully design and construct of a new house in the north, especially in a remote community, three main factors need to be met. First there is a need to establish a suitable and robust “technical” design suited for a specific community. Second, and probably the greater challenge, is the delivery of the project starting with construction planning, through on-site construction to completion of the project. Third, the design of new houses should respect the needs and demands of the community. This guide addresses mostly the first and third factor for a successful house design, and outlines the challenges to be considered in the second factor of the actual construction process in a specific remote community.

1.7 Many Norths

Canada has many norths, especially when it comes to the construction of new homes. Often, construction guidelines for building new homes are very generalized, and do not address the unique character of a particular northern region, including its climate, soil conditions, or varying building practices. Many guides fail to understand the true “northern-ness” of what is required, or the demands placed on communities to build new homes. These overview and technical booklets were designed to specifically take into account “northern-ness,” including the diversity of communities across the landscape of northern Canada.

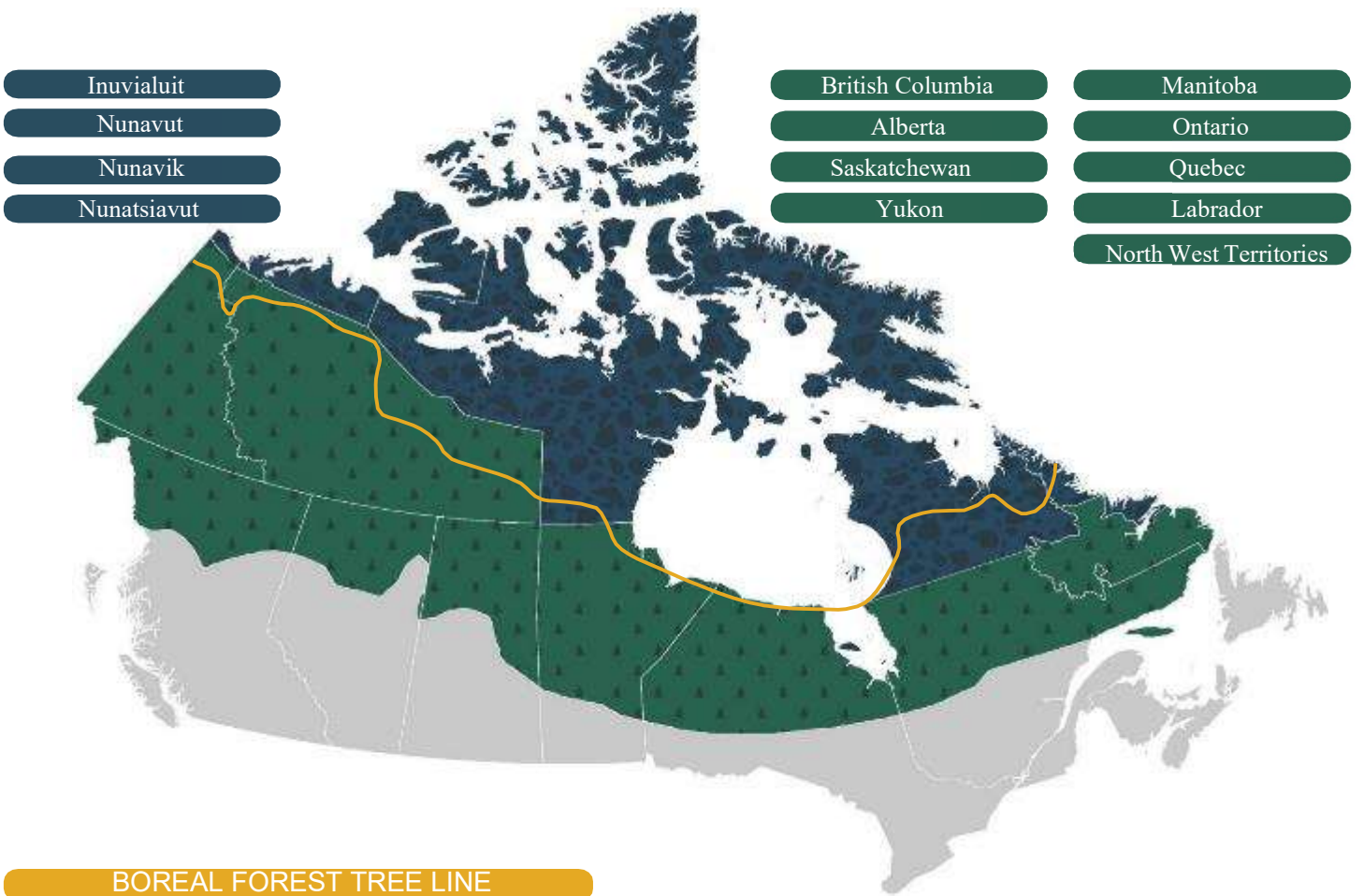
Below is a map that outlines the many norths in Canada, broken down into two main regions: (i) the sub-arctic region below the boreal forest treeline and (ii) the arctic region north of the treeline. The subarctic region is further broken down into nine subregions of First Nations communities shown within the provincial and territorial borders. The arctic region is further broken down into four subregions of the Inuit-Nunangat Nation, known as: Nunavut, Nunavik, Inuvialuit, and Nunatsiavut. More detailed information on these 13 subregions are covered in the overview booklets following this introduction booklet.

INUIT NUNANGAT

There are approximately 60,000 Inuit people in Canada. In the north, there are 45,000 Inuit in the blue area in the map below. Their communities are generally located in the arctic north of the treeline and coastal areas, and many depend on sealift shipping of materials and other essential goods.

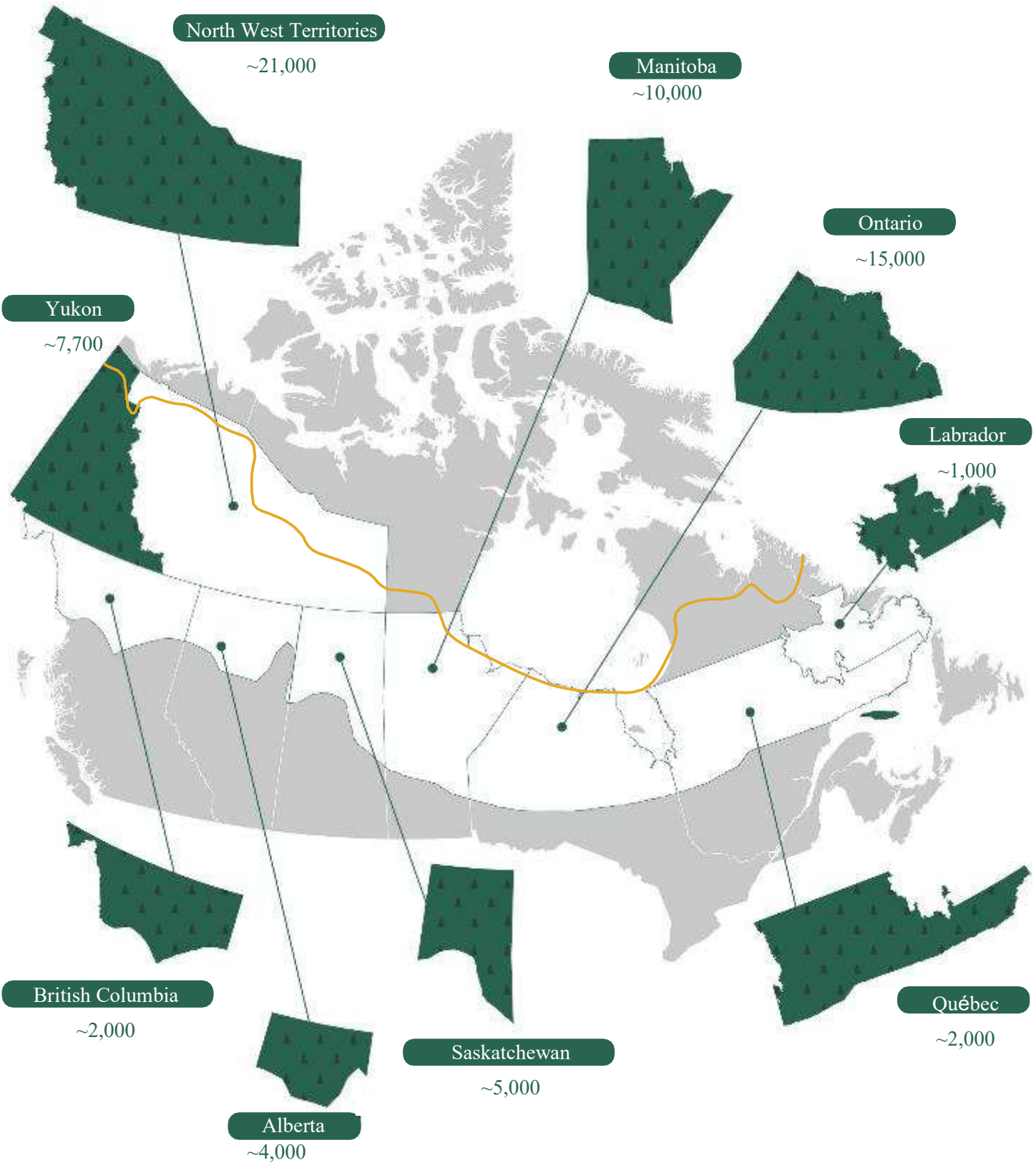
FIRST NATIONS COMMUNITIES

There are approximately 1.35 million First Nation Peoples in Canada. In the north, there are 75,000 in the green area in map below. Their communities are generally located inland on rivers and lakes and many rely on ice road shipping of materials and other essential goods.



BOREAL FOREST TREE LINE

1.8 Subarctic First Nations Communities, Regions



Approximate First Nations populations for each region.¹

1. The statistics are interpolated, as the statistic regions differ from the northern regions defined in this technical guide. The basis of the information can be found at <https://www.sac-isc.gc.ca/eng/1602010609492/1602010631711>.

1.9 Inuit Nunangat Regions

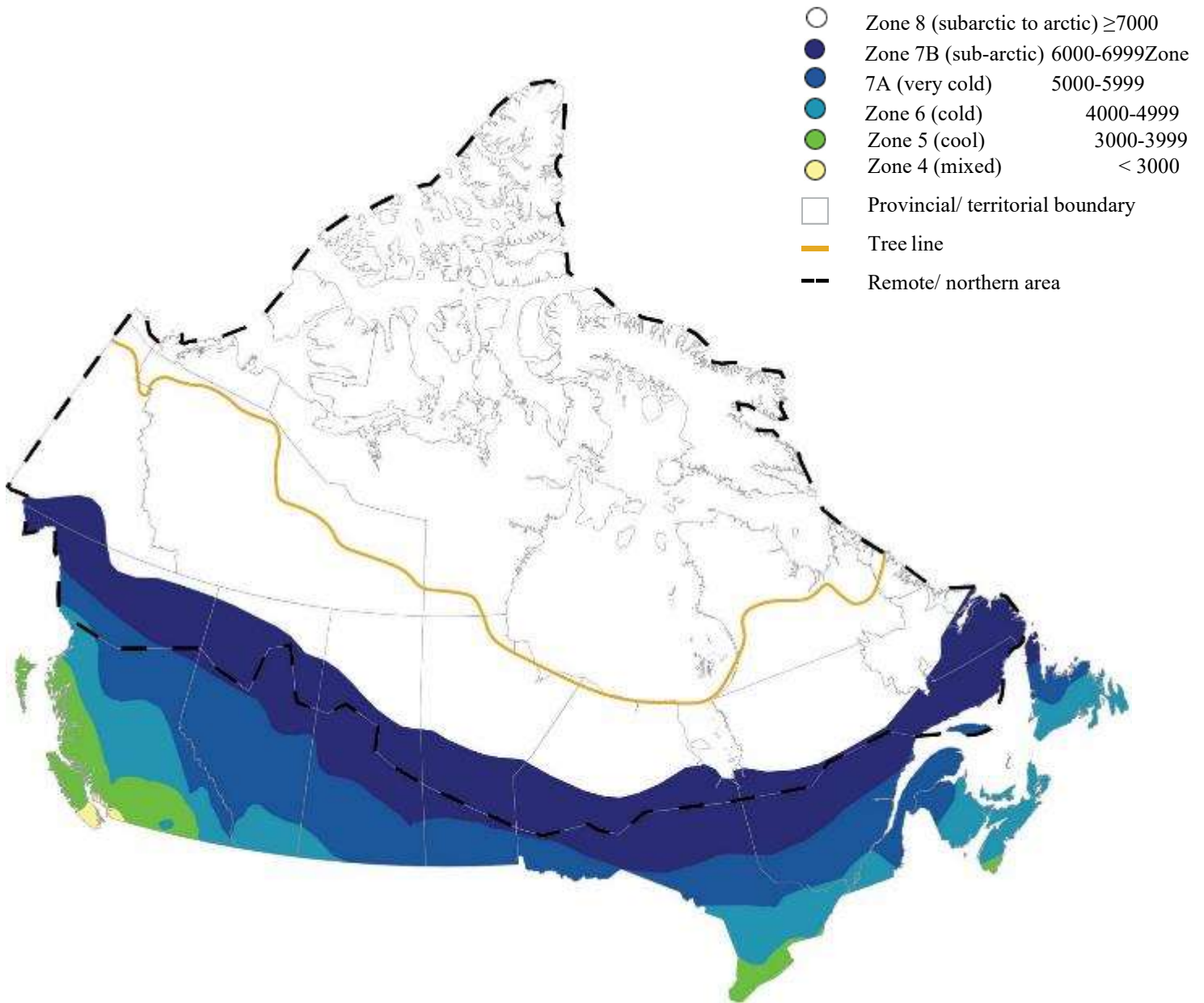


Approximate Inuit populations for each region.²

2. The statistics are referenced from *Wikipedia*, https://en.wikipedia.org/wiki/Inuit_Nunangat, recorded by Statistics Canada in a 2016 Census.

1.10 Climate Zones of the Remote and Northern Regions

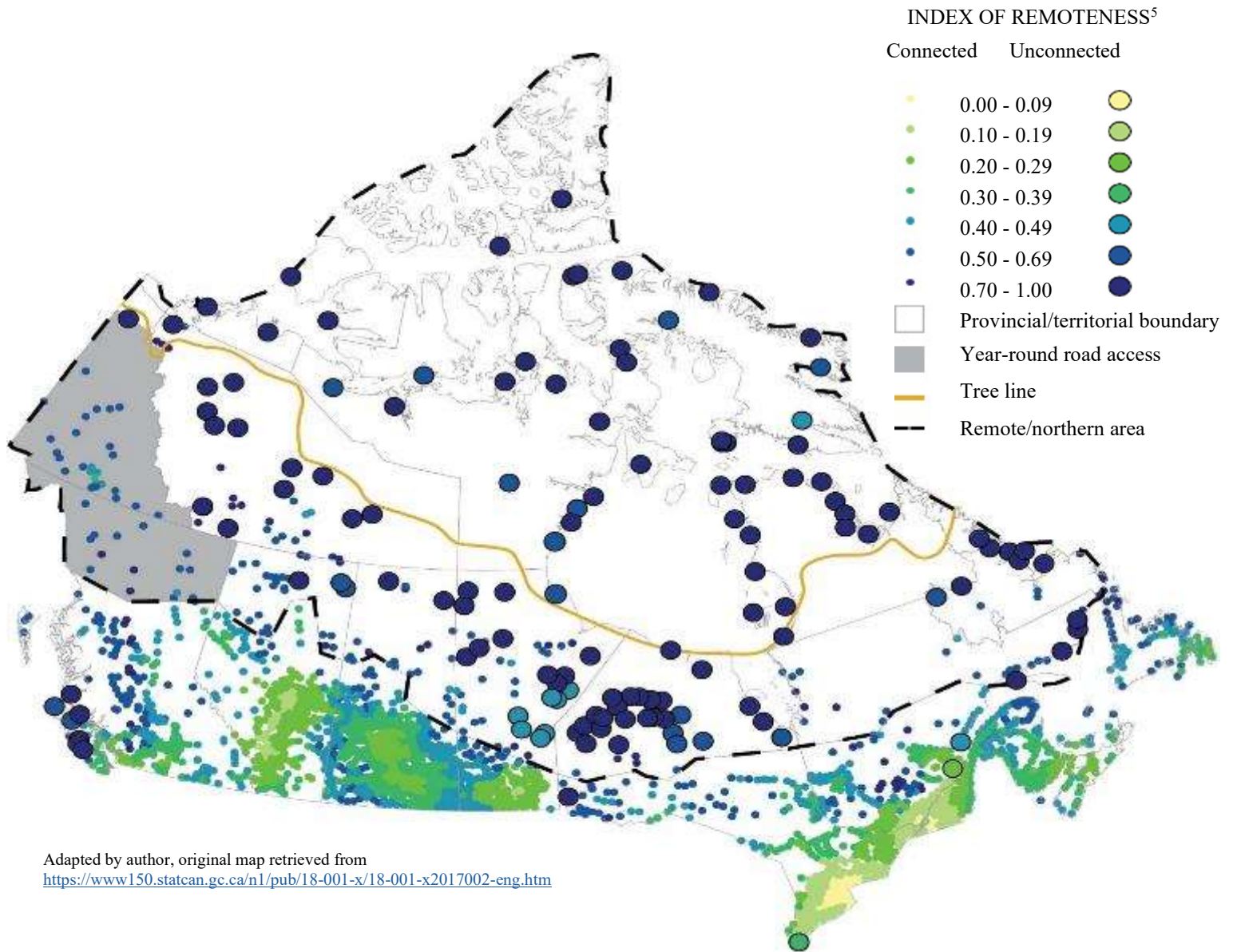
NECB³ 2011 CLIMATE ZONES (HDD)⁴



3. *National Energy Code of Canada for Buildings* (NECB).

4. The remote and northern area that will be the focus of these booklets corresponds with the subarctic and arctic climate zones, with at least 6,000 “heating-degree days” (HDD), a measure of when heating is required above an outdoor temperature of 18°C. HDD are used for establishing required building insulation, as per the *National Building Code* (NBC).

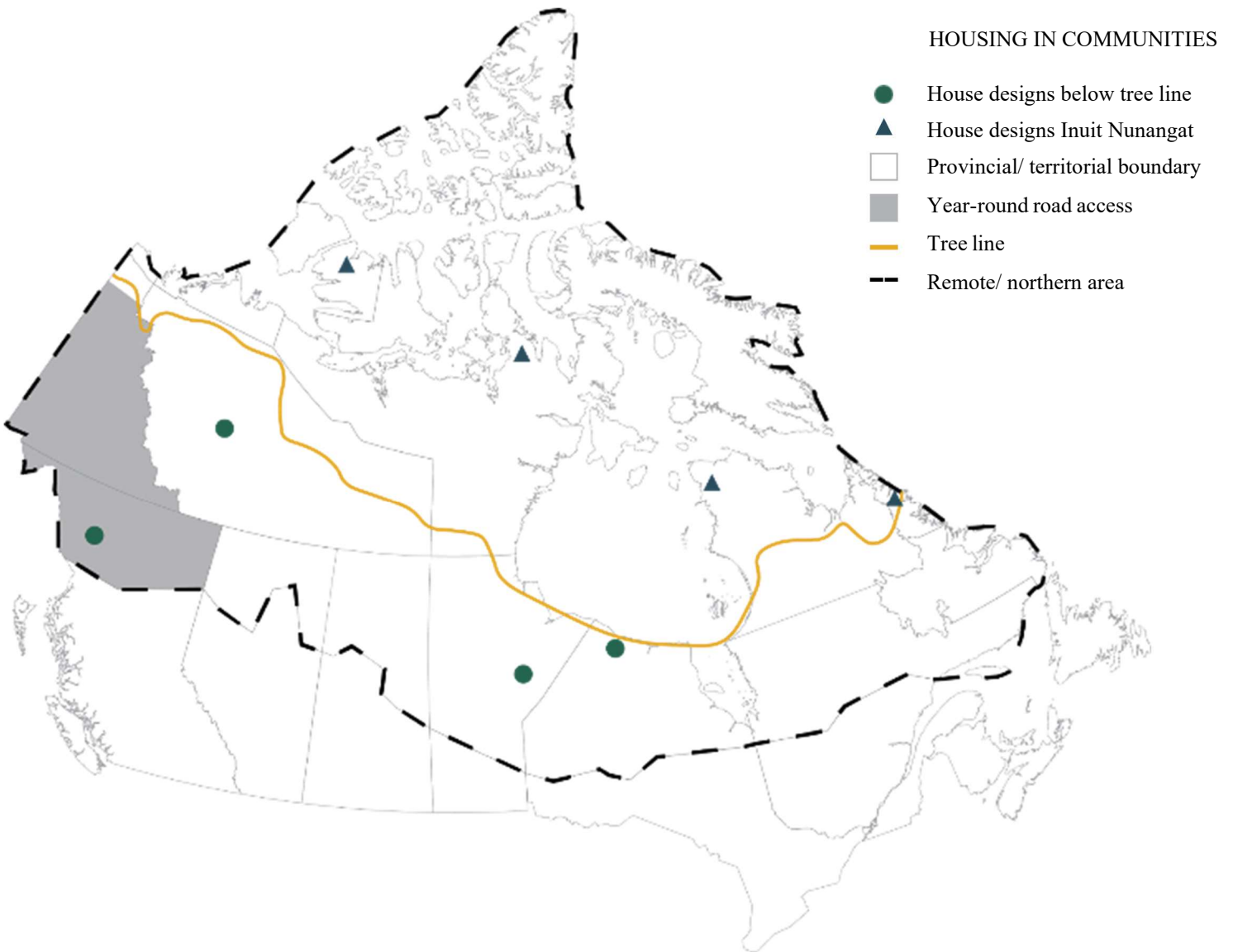
1.11 Northern Communities - Remoteness



- The area within the black-dashed line is generally considered the remote and northern region. This region includes areas above and below the treeline, represented by the yellow line. Many communities in this region have no year-round road access. These communities are shown with the larger-sized dots.
- The smaller dots represent communities with connected year-round road access (e.g. northern B.C. and Yukon).
- Communities on the coast of B.C. have been excluded from the scope of this technical guide, since they are not considered northern from a climate perspective (the climate is significantly warmer and wetter).
- This guide is primarily focused on communities without year-round road access (fly-in, ice road, barge). However, communities more than 350 kilometres by road from a service centre are still considered remote and fall within the scope of this guide.

5. Statistics Canada developed an Index of Remoteness of communities. For each populated community (census subdivision), the index is determined by its distance to all the population centres defined by Statistics Canada in a given travel radius, as well as their population size. The higher number represents an increase in remoteness.

1.12 Housing Design



Four example house designs are provided for the region below the treeline. The corresponding communities for each of the house designs are indicated with the green circles:

- Tahltan First Nation – B.C.
- Deline First Nation – N.W.T.
- Bunibonibee First Nation – MB
- Fort Severn First Nation – ON

Four examples of house designs are provided for the region above the treeline within Inuit Nunangat. The corresponding communities in Inuit Nunangat are represented by blue triangles:

- Nunavut
- Nunavik
- Nunatsiavut
- Inuvialuit

The noted house designs will be further explained in the Appendix booklet.

2. GOVERNING STRUCTURES

There are 675 distinct First Nations communities across Canada that speak 70 languages, with various dialects. There are 53 Inuit communities that speak Inuktitut with varying dialects. The people in each community have their own connections to the land, represented through their own unique art, ceremonies, languages, protocols, and spirituality. It is important to recognize the differences in social, cultural, and governance structures between First Nations and Inuit Nunangat. In First Nations communities, the chiefs and band councils are responsible for the construction of houses and community planning, while in Inuit Nunangat the local municipal council carries this responsibility.

2.1 Authority Having Jurisdiction (AHJ)

The Authority Having Jurisdiction (AHJ) is the common terminology for the person, or persons, with the authority and responsibility for the construction of buildings in a community, as well as the enforcement of the building code and standards. In First Nations communities, the local chief and council are the AHJ with respect to building houses in their communities. Higher governments grant the authority to a local community. Off reserve, provincial and territorial governments empower local cities and towns as the AHJ. On reserve, it is the federal government that empowers the chiefs and band councils as the AHJ with the authority to pass laws and regulations within their community.

In the Northwest Territories (N.W.T.), for example, the Office of the Fire Marshal (OFM) is the AHJ, as fire protection is first in terms of legislation. Persons who build within or outside an established municipality boundary are required to advise the OFM of their project.⁶ The Northwest Territories, Nunavut and Yukon have adopted the *National Building Code* and the *National Fire Code* with some modifications and additions.

First Nations administered under the Indian Act have the power under Section 81 to make bylaws for the following activities:

- Zoning—Section 81(g) the dividing of the reserve or a portion thereof into zones, and the prohibition of the construction or maintenance of any class of buildings, or the carrying on of any class of business, trade, or calling in any zone.
- Buildings—Section 81(h) the regulation of the construction, repair, and use of buildings, whether owned by the band or by individual members of the band.
- Land Survey—Section 81(i) the survey and allotment of reserve lands among the members of the band and the establishment of a register of Certificates of Possession and Certificates of Occupation relating to allotments and the setting apart of reserve lands for common use, if authority therefore has been granted under section 60 of the Indian Act.

These bylaws and regulations are passed by a chief and council to help control certain activities within the community, including implementation of building-permit processes, complete with the authority to apply and enforce building codes, standards, and construction practices.

First Nations administered by modern treaties are also designated the AHJ with authority to establish their own land use bylaws and building regulations. Some First Nations operating under a modern treaty have used their power to enact “municipal-type” zoning and land use bylaws for their communities.

Inuit-Nunangat

The Inuit are self-governing, each Inuit subregion has its own representative organization, and they are connected to each other by unifying organizations for the whole region. As a result, the delivery of housing for the multiple communities is commonly administered through centralized regional organizations and the municipal council, which is the AHJ for the Inuit community.

6. The exception is Yellowknife, which is the AHJ that reviews all plans and conducts inspections.

2.2 Importance of Bylaws

While band councils can pass rules and regulations (we'll call them band bylaws for short), to ensure that houses are built in accordance with the *National Building Code* and standards, few band councils actively exercise their role as the AHJ. Unfortunately, some band council bylaws remain unpassed, and some that have been passed are out of date. This results in houses not being built correctly, in accordance with the building code and standards. This may lead to unsafe conditions. Without band bylaws, the following can occur:

1. No process is in place to approve the location where the house is permitted to be built, nor a process for the approval of house plans.
2. Homes may not be inspected to ensure they are constructed or renovated according to building and fire code requirements.
3. Inspections may not be based on code compliance, but rather on a housing policy or a progress payment for work not done correctly.
4. Inspectors may be qualified but may not have the authority to stop construction if the home is not being built to code, or to force the contractor to fix building defects.
5. Homes may be unsafely occupied without a final inspection for the issuance of an occupancy permit or letter to state it is safe to move in.
6. Council may ultimately be responsible to pay for repairs to homes and may be legally responsible to fix private homes that are not built in accordance with their band bylaws.
7. Council may be held accountable in the event of injury or loss of life in homes not built to building and fire code standards.

While communities are encouraged to implement a building-permit system, it is important that councils exercise their role as the AHJ through Sections 81 of the Indian Act.

2.3 Approval of Building Designs and Inspections

The construction of homes in the north requires additional care to ensure homes are meeting the building code and community building and planning standards. It is important to have sufficient control over development and inspections, as well as the capacity to train the residential construction industry.

Off reserve, many municipalities, towns, and villages have a building-permit system with sets of laws and procedures to regulate the building of homes and commercial structures. The building-permit system helps to bring awareness of the importance of ensuring homes are built with approved drawings and specifications through a series of inspections. When a building-permit system is available, strict enforcement through design and inspection would promote monitoring during the construction process.

Site plans and drawings should be reviewed and stamped by a registered professional engineer or architect. Drawings are reviewed by a qualified/certified individual to verify compliance with health and life-safety provisions of the applicable building codes and other referenced standards. Typically, these include:

1. Site plans, sometimes called lot-grade drawings, where sanitary sewerage systems are in place
2. Architectural and structural plans
3. Heating, ventilating, air-conditioning, and plumbing-system plans
4. Shop drawings and material specifications

2.4 Building Inspections

The following is a list of inspections required for a typical residential unit. It is important to point out that several items may be inspected during one inspection visit/stage. The number of inspections for the stages of construction can vary:

1. Prior to backfill of storm and sanitary sewers or water service
2. Prior to pouring concrete for footings (forms in place)
3. Foundation inspection prior to backfill of foundations or next stage of construction
4. Following completion of structural framing
5. Prior to covering plumbing rough-in (including water systems)
6. Prior to covering ductwork for heating, ventilation, air conditioning, and air-contaminant removal systems (HVAC)
7. Prior to covering insulation and air/vapour barriers for all exterior walls and ceilings
8. Following completion of interior finishes, HVAC equipment installation and all fire-protection systems
9. After all plumbing fixtures are in place (final air test)
10. Final inspection—completion of project

However, construction in the far north has its limitations, including access to building inspectors. While 10 inspection points would be best, a minimum of three are recommended:

1. Pre-backfill inspection (foundation stage)
2. Pre-drywall inspection (framing, HVAC/plumbing/electrical rough-in, insulation/vapour barrier stage)
3. Final inspection

2.5 Teleinspections for Indigenous Communities

Conducting thorough inspections for new homes in many First Nations is not always possible. When this happens, homes are not considered constructed to *National Building Code* requirements, and may need major repairs prematurely in a few years. This is especially a problem in remote First Nations communities. The First Nations National Building Officers Association (FNNBOA) have developed teleinspections that use electronic information and telecommunication technologies to support building-code compliance. For teleinspections, builders are to provide photographs and other information electronically (i.e. live video) for review by a certified First Nations Building Officer in another part of Canada. These images are reviewed to ensure that the stage of construction meets building-code requirements.

2.6 Cost of Projects and Lifecycle

The goal of these booklets is twofold, one being to assist Indigenous leaders as the decision makers on construction of houses in their northern communities. Second is to assist FNNBOA members conduct construction inspections to verify conformance to the community's procurement specifications, and that the house construction conforms to codes and standards.

Housing Decision Makers—First Nations Communities

Decision-making on the number and types of housing in First Nations communities is set by the chief and council as leaders of the community. To assist in the selection of construction materials for houses and procurement of materials, the leaders should consider the principles of “lifecycle costing” to evaluate the best value per dollar spent for their construction project in their respective northern community. Houses should be designed for their community's northern climate, specific physical parameters of the site, cost of labour and shipping specific to their location, and

also take into account the cost of building operations and maintenance over the expected “service life” of a building.

The service life of a wood-frame structure in a house is considered to be a minimum of 50 years, since it is protected from the weather. However, other elements or components of a house that protect the interior of the house from the weather, and protect the wood frame, degrade faster and have service lives that could be 10, 25, 30, or 40 years. Lifecycle costing considers the service life and associated costs of different material options and future maintenance or replacement costs of each option. The future replacement cost and labour costs are estimated following realistic cost projections, and are then brought to current dollars for a comparison of material selections.

For example, community leaders may be considering specifying and procuring metal roofing instead of asphalt shingles. A certain metal roof system may have a service life of 50 years, while asphalt shingles may be 30 or 35 years. However, if the installed cost of the metal roofing is three to five times the installed cost of the shingles, which is the best choice? Proper lifecycle costing takes into account all aspects of the initial cost of a more expensive metal roof, and compares it to the initial and future cost of reroofing with asphalt shingles. Another form of lifecycle costing is also used in determining the amount of insulation to specify for walls, roofs, and floors of houses. The more you insulate, the more energy costs are reduced, but there is a point when more insulation costs do not save an equivalent amount in energy savings. Deciding on what amount of insulation is best value relates to energy savings and comfort of occupants. For roofing, siding material, or windows, budget planning is all about degradation—the projected service life of the material, future costs of replacement, and how far in the future replacement is likely.

There are many publications on lifecycle costing and estimation techniques. However, many of these are overly complex for application in a First Nations community. A lifecycle consultant can easily develop a simplified approach that could be used by the leaders of the community to help with decision making and subsequent procurement. The simplified calculations would take into account shipping costs specific to the community location and/or remoteness, as well as whether local labour or labour external to the community is used.

Procurement

Once the decision makers have studied the different construction options and used a lifecycle costing approach, it is important that the specifications and procurement reflect the exact quality and materials used in the lifecycle costing analysis. The subsequent tendering bids will then be based on the lowest bid for the same material and labour, to provide what the decision makers intended. It must be what is specified, and not replaced with something cheaper and lower quality, as the chief and council’s future projections on replacement/repair costs will be adversely impacted with premature material failures.

FNNBOA has identified a procurement process to be used to hire contractors or suppliers. This involves a professionally written tender with detailed technical drawings and specifications, prequalifying contractors, and assessing tenders using mandatory evaluation criteria. For more information, please go to www.fnnboa.ca. To ensure you are getting best value for your project, the council should consider more than one contractor to build the house. It is far better to select a contractor based on their qualifications.



FNNBOA - Inspections

Once the procurement documents are issued, bids obtained, and a construction-material supplier selected, the next steps involve confirming that the materials delivered meet the specifications, and then ensuring their proper installation. The latter is where the FNNBOA member comes in to verify the material and ensure that the installation complies with the manufacturer’s instructions and applicable codes and standards. For lifecycle projections to work, materials must be installed properly. This includes:

- The material must be as specified in the procurement documents. For instance, with metal roofing, specifications include the grade of steel, thickness, and protective coating. If the metal is thinner than it should be, and has a lower-grade coating, the metal could be exposed and rust sooner than expected.
- If a metal roof with an expected service life of 50 years is not installed properly, it may survive only 30 years or less, and the decision makers probably made no allowance for this early a roof replacement in the original planning and budgeting. It is these unexpected costs that add to budget shortfalls, roof structure damage, and possibly other internal-related damage, if not repaired as soon as possible. With lifecycle costing, there must be a coordinated effort among decision makers on material selection, procurement, and bids, then material confirmation and proper installation to ensure the proper long-term performance set by the chief and council for the future of housing in the community.

3. THE CHALLENGES

The following factors set housing in the north apart from the south, adding many obstacles to constructing adequate and healthy houses.

Challenges	Explanation	Illustration
A. Restricted and Expensive Access	Fly-in-only communities with seasonally restricted ice roads or barge access for most locations in the subarctic region.	
B. Diesel Dependency	Diesel dependency for power generation and heating buildings is a major financial expense, an energy security concern, and an environmental (storage and spill) concern for most communities. Energy is 10 times more expensive than in urban centres. Unfortunately, many communities solely rely on this energy source for everyday living.	

<p>C. High Cost for Shipping</p>	<p>Shipping costs are by weight for heavy items and by volume for bulky items. Limited flight networks limit where materials come from and the travel path for materials, workers, and specialists for fly-in communities. Shipping related costs make up about half the budget of building a new house in remote regions.</p>	
<p>D. Short Shipping Season</p>	<p>The shipping season for materials and equipment in the far north must be planned up to a year in advance for materials. Ice road access is limited to a few months at most and is typically scheduled to occur one time in the season.</p>	
<p>E. Warmer Winters</p>	<p>As the climate changes drastically, issues will arise that include shortened ice road access if the ice is not thick enough with increased risk of falling through the ice.</p>	
<p>F. Short Construction Season</p>	<p>Short construction season consisting of only the summer months for most types of construction in many communities. In the case where construction is attempted in freezing conditions many problems arise from tools breaking, to excavation issues as the ground is frozen solid.</p>	

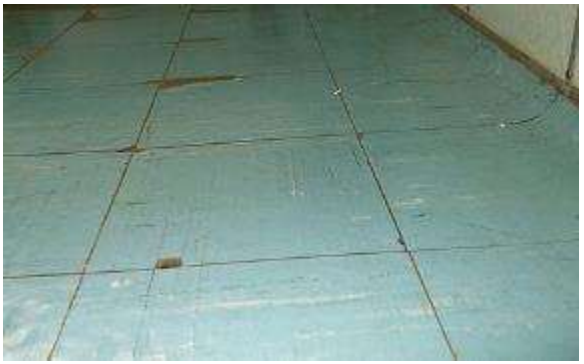
G. Long Delays

Materials' availability and labour affect timely repairs. Common problems include leaks, punctured envelopes, or mechanical failures. In many instances, if a roof starts to leak, it could take a year or more for materials to arrive, or they arrive damaged and need to be reordered before a permanent fix or roof replacement can be performed. Interim protection of the roof is needed to ensure the condition does not worsen.



H. High Occupancy/Heavy Use

Overcrowded homes often face accelerated wear and tear, leading to quicker deterioration of houses. This example shows chipped flooring, as heavy furniture, playing children, and constant people traffic results in more damage. Additionally, heating systems often operate year-round, compared to southern homes, require more maintenance, and have a shorter service life.



I. Limited Resources

Machinery, equipment, and materials are typically very limited, simply not available, or could be broken down and awaiting repairs.







J. Absence of Skilled Trades

Lack of skilled trades and specialists results in a wide range of building elements commonly being installed by the local workforce with basic knowledge. Small populations are not able to have specialized workers, unlike highly populated regions.



<p>K. Limited Local Labour</p>	<p>Construction labour is often imported from the south, since many communities do not have the capacity to create local labour. Hiring of outside contractors is expensive, can affect scheduling, and accommodating them can be problematic in some remote communities.</p>	
<p>L. Extreme Cold</p>	<p>Extremely cold conditions increase the consequences of leaks and failures, and cause certain materials, such as vinyl siding to crack, HRVs to ice up, and ice wedges to form in walls due to air leakage.</p>	
<p>M. Windblown Snow</p>	<p>Often, significant snowdrifts are created around homes by strong blowing winds. Dry, windblown snow also tends to accumulate in voids, such as vented attic spaces, a design feature in the south where blowing snow is not a common occurrence.</p>	
<p>N. Permafrost</p>	<p>Naturally occurring conditions such as permafrost impose significant constraints on foundation and building construction. This is compounded by melting permafrost, ground slumping and shoreline erosion due to climate change. This can mean more expensive foundations (e.g. adjustable space frames), more maintenance and having to move or demolish homes.</p>	

<p>O. Firefighting Ability</p>	<p>The ability to fight fires is typically very minimal or does not exist in remote communities.</p>	
<p>P. Climate Predictions</p>	<p>Predictions are for a warmer future, resulting in more humid environments, flooding issues, iceroad access, potential severe storms and rain, and melting permafrost. Climate change will impact regions differently. This topic will be explored in each subregion booklet.</p>	 <p>Temperature Change (°C) (Relative to 1976-2005)</p> <ul style="list-style-type: none"> ≤ 0 0.1 - 1 1.1 - 2 2.1 - 3 3.1 - 4 4.1 - 5 5.1 - 6 6.1 - 7 7.1 - 8 8.1 - 9 9.1 - 10 10.1 - 11 11.1 - 12 13 & above not included
<p>Q. Waste Management</p>	<p>Materials and equipment shipped to remote and northern communities generally stay there, and cause environmental problems, as most communities lack the infrastructure to process or recycle waste materials (e.g. car batteries, 45-gallon drums.). This example is the open landfill in Tuktoyaktuk.</p>	
<p>R. Limited Water and Wastewater Infrastructure</p>	<p>Typically, access to water and wastewater infrastructure is minimal or limited. Many communities require that houses have water and wastewater holding tanks, serviced by water-delivery and septic-vacuum trucks. Water quality is often an issue in remote and northern homes, and boil-water advisories are not uncommon.</p>	

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Hunter
Bohdana Chiupka-Innes

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Additional Feedback

If there is any missing or misrepresentative information please feel free to provide comments. We would greatly appreciate input in creating a complete guide that will help to advance housing in the north, and assist contractors as well as any field related to housing within a northern context. Feel free to share the document with anyone who has knowledge of building processes, or related to housing, and would be interested in providing feedback.

Comments can be emailed to info@fnnboa.ca.



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