REINTERPRETING THE IGLU | ᐃᒡᓗ

TOWARDS AN ARCHITECTURE OF INUIT DWELLING IN THE 21ST CENTURY

Michael Rosada

2015

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by

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B. Arch. Sci., Ryerson University, 2011

A design Thesis | Project,
presented to Ryerson University

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requirements for the degree of
Master of Architecture
in the Program of
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Abstract

The Canadian North has gained significant interest as of late due to expansive availability of natural resources, and the opening up of commercial shipping routes, resulting in economic and development potential. There is thus a demand to develop and build, but this has often occurred with little vision while the extreme conditions of this region make viable inhabitation a challenge.

Presently, the Inuit who have maintained a sustainable way of life in the Canadian North have seen their lifestyle and culture erode due to rapid modernization, resulting in numerous challenges and no resolutions. One such challenge is the absence of affordable, adequate, and culturally appropriate housing, complicated by a housing shortage and a growing population. In order to ensure successful inhabitation in this region, a reinterpretation of the contemporary Inuit home is required. The following thesis | project explores how the adoption of a regionally responsive architecture responds not only to economic and environmental conditions, but reinforces the unique cultural identity of the Inuit.

Acknowledgements

The following thesis project would have not been possible without the support and inspiration of countless individuals who left their mark on this work in varying degrees.

First and foremost, I would like to thank my thesis supervisor, Edward Wójs, for his guidance, support and encouragement throughout this project. I thank my second reader, Dr. Russell Richman, whose engineering background allowed him to offer unique insight and to question and challenge everything, which helped me solidify my ideas. I would also like to thank the Department of Architectural Science at Ryerson University, for the support afforded to me on my visit to Nunavut, which proved to be integral to the success of this thesis. And to the rest of the faculty and staff at the department, who have helped shaped me for the seven years I've spent in architecture school.

To all the people of Cambridge Bay, whose hospitality, kindness and willingness to help me in any way they could not only made it an unforgettable experience, but also significantly helped shape and improve this thesis. And to everyone else with an interest in the North, which helped influence and inspire me, and offered me support to significantly expand my knowledge of various fields that impact design in this context.

I would not have been able to achieve this thesis without the support of my colleagues and friends. To my St. Mike's friends, who offered a break and change of scenery, and to my undergrad friends, some of which are working in the field, some who have already completed their M.Arch, and to the others that have ventured to new territories to pursue their education, I am forever indebted. From architectural discourse, moral support, social outings, to their assistance, helped shape me and my ideas, while ensuring my sanity.

Lastly, thank you to the people closest to me: Caileah, for your love and support in both good and bad times, to my Nonno and Nonna, who have always believed in me and supported me, and to my parents, Claudio and Rosemary, who have done everything in their power to help me achieve all I have to this day.

Dedication

To my parents, Claudio and Rosemary, for their love, endless support, and encouragement.

In memory of my cousin Paul. Your influence lives with me everyday.

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Preface

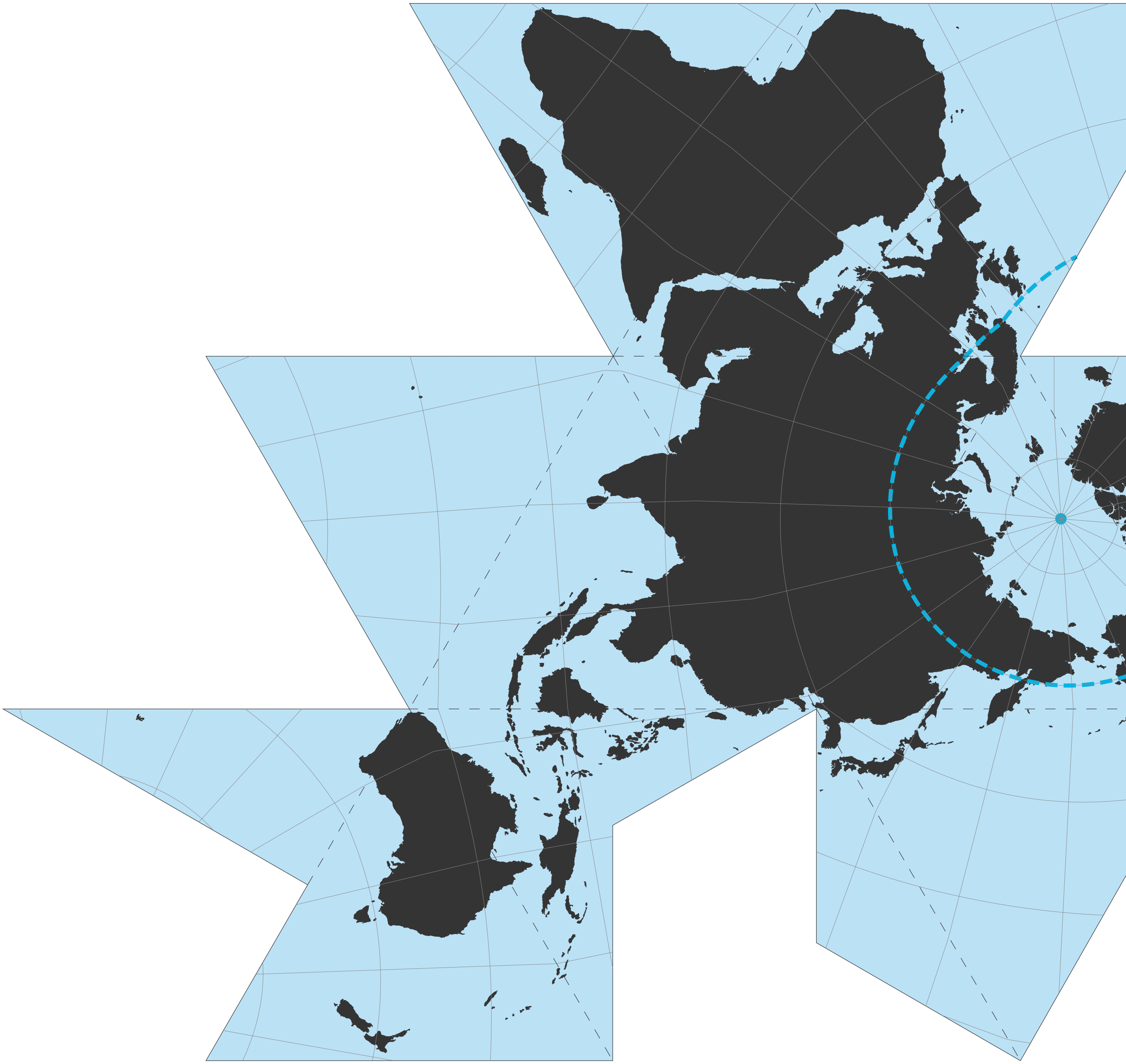
Born and raised in Toronto, I grew up enjoying a stereotypical Canadian life, embracing winter, the outdoors, and playing hockey as much as possible. Having had the opportunity to travel across Canada, and to visit many cities around the world, I have developed a deep appreciation for my country. Thus, when tasked with selecting a topic for my Master of Architecture thesis | project, it seemed only natural that the problem I would attempt to address should be Canadian specific. As a student of architecture for six years prior to my thesis | project (five academic, one work), I have become interested in the social agenda of architecture; essentially how architecture can go beyond improving the built environment to also improve the quality of life of its users. My interests have also expanded into regionalism in architecture, including the impact that landscape can have on architecture, and how architecture acts as a representation of cultural identity. With my newfound perspectives in mind, I began my search for a thesis | project topic. I flirted with the idea of a Newfoundland based project, which is familiar to me as it is my family's hometown, and I had participated in the Culture of Outports project in Brigus in 2012. I also considered a thesis | project that would respond to the challenges of the many First Nations, as I have always been inspired by their contemporary art, and I have developed a keen interest in their history around the Great Lakes.

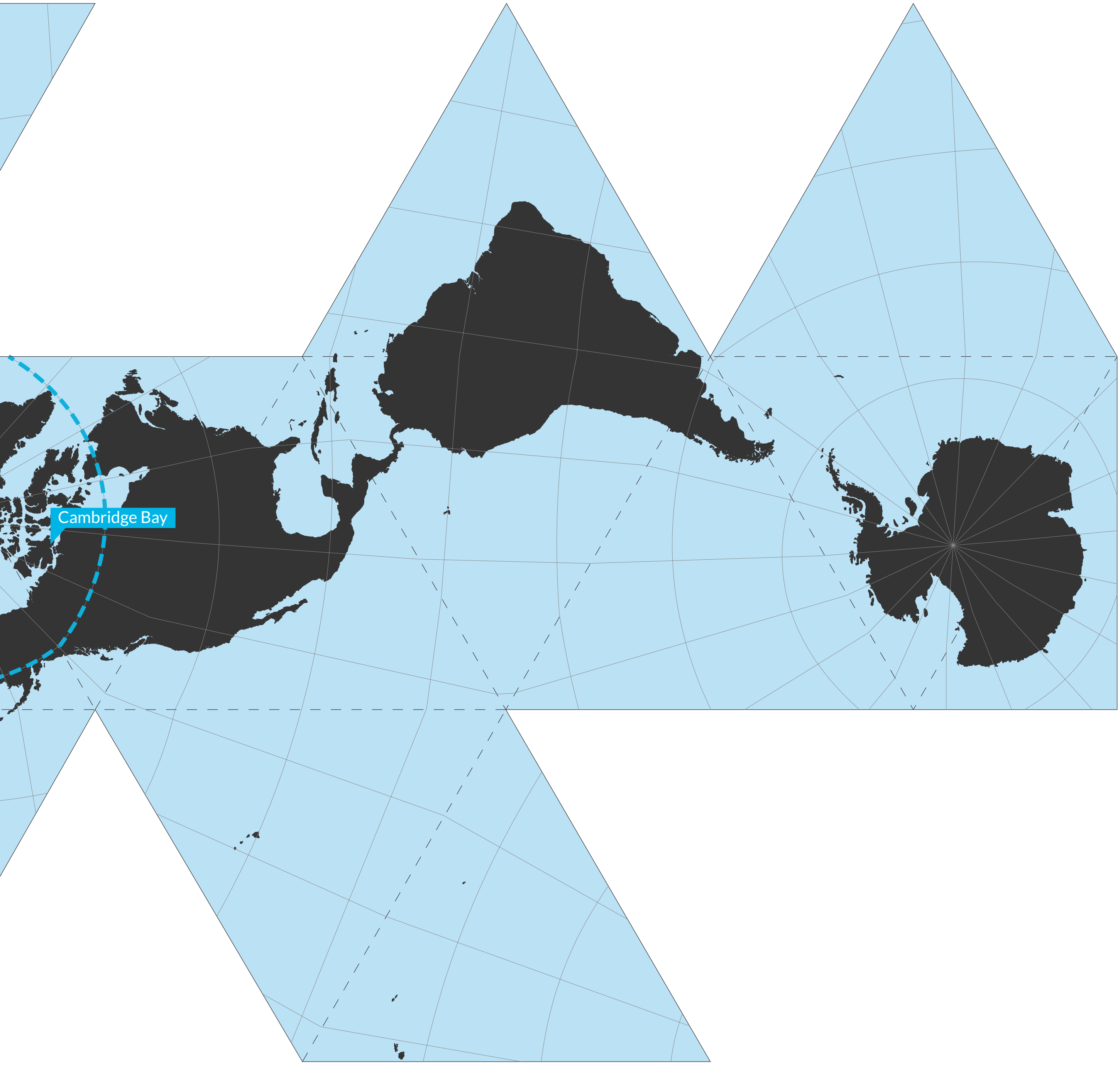
I opted, in the end, to confront the Inuit housing crisis, a topic choice that often continues to perplex people, as they either assume I was born, or at least lived in the Canadian North, or else had an Inuit ethnic background. The fact is, prior to this thesis | project, I had never visited the Canadian North nor do I have an Inuk as an extended relative. I have always been fascinated with the Canadian Arctic, and possess a growing desire to learn more about a part of Canada that I was unfamiliar with. This personal interest is complimented by the growing national and global attention being given to this region, and subsequent architectural interest, culminating in the *Arctic Adaptations* exhibit by Lateral Office in the Canadian Pavilion for the 2014 Venice Biennale. The emerging interest in this region, combined with my personal and architectural interests have made the challenges of contemporary Inuit housing an ideal thesis | project topic.

The following thesis | project has been no different from any other project I have undertaken, with the abundance of pre-design work, in adherence to my methodological approach to design, and in its representation of my views on architecture. As such, due to my unfamiliarity with the context of this thesis | project, my research into the Inuit culture and the challenges of construction and design led me far beyond the realm of architecture. The following document is a synthesis of my research, which includes not only work by architects and other building professionals, but also works by archeologists, historians, anthropologists, cultural geographers, as well as my own experiences from visiting Cambridge Bay in Nunavut. Becoming familiar with this context has been a rather exhaustive undertaking, leading me on numerous tangents, the most significant of which was attempting to understand what exactly the contemporary Inuit culture is. Well beyond my expertise as an architecture student, such a task resulted in my desire to learn as much as possible, resulting in a thesis | project which is significant in length.

In this thesis | project, I discuss anything that has impacted my understanding and decision-making, and I respond to the many questions that have been raised throughout my research. For me, this process was a necessary part of the investigation in which every piece of knowledge gained impacted my design process, and in leaving no stone unturned I was able to make the soundest decisions.

In approaching architecture and my design process, my belief is that there are a significant number of forces, which are accounted for in the design of a building, and these vary for different contexts and typologies. Since it is impossible to respond to each of these forces in an ideal manner, the ingenuity in design comes from their negotiation, aided by attributing a hierarchy based on the needs and specificities of the particular context and typology. Thus, in similar fashion to Foreign Office Architects (FOA) established by Alejandro Zaera-Polo and Farshid Moussavi, I believe in breeding a project from these forces, or "ingredients" as used by Zaera Polo, to create new and surprising forms in which the result is not driven by aesthetic composition, as beauty and ugly are relative terms (Fairs, 2003). With this understanding, Zaera-Polo states that the forms produced can be considered to be ugly by many, but in so doing, they create a reaction and a capacity to move people, which is the primary goal of aesthetics (Fairs, 2003). In the works of FOA, the project starts with a diagram, as opposed to a sketch, as sketching relies on preconceptions, or visual memories, whereas diagrams ensure that all the ingredients of a project are accounted for, whether the end result is ugly or beautiful. In so doing, the building is ensured to neither underperform, nor be fantastical. Further, the result is a straightforward and systematic approach to architecture, one that not only functions properly, but also emphasizes the building's readability, and acts as a representation of the forces acting upon it. Expectantly, this helps to rationalize some of the decisions that have been made, decisions that will become more apparent as the design unfolds throughout the following document.




Cambridge Bay

01

INTRODUCTION

The Canadian North is a region of many extremes, and is viewed by many as a remote, barren, and sparsely populated region of inconsequential importance. However, in recent years the region is gaining significant interest due to the availability of natural resources, the growing adventure tourism industry, and the opening up of commercial shipping routes. Therefore, this frontier is an area with significant economic and developmental potential. Sovereignty issues have thus arisen creating a demand to settle, develop, and build within the region, but this has often occurred with insufficient planning and little vision. While there is substantial pressure to develop the Canadian North, sustainable inhabitation in this extreme environment remains a significant challenge.

Concurrently, the Inuit who inhabit a vast expanse of the Canadian North and have maintained a viable way of life in this region for centuries through a subsistence hunting culture are confronted with the disappearance of their cultural identity due to a period of rapid modernization. As the reliance on new technology and acceptance of foreign ways of life has increased, the significance of living in harmony with nature has waned. While this acceptance is not necessarily damaging, the subsequent diminishing of their cultural identity is. As a people "caught between two worlds", they are searching to grasp what the contemporary Canadian Inuit identity really is in order to understand their place in society, to develop a sense of pride in their uniqueness, and thus achieve their full personal potential. The disappearance of the Inuit cultural identity has resulted in an ineffective response to the challenges they face today and in the future. Consequently, in order for sustainable inhabitation of the Canadian North to be achieved, the Inuit must be encouraged to address these challenges. The Inuit of tomorrow must establish a connection with their heritage and cultural identity, while still evolving to adapt to modern influences. Exploring a manner in which this can be achieved will be one objective of this thesis | project.

Specifically, one challenge the Inuit are encountering is an absence of acceptable housing; housing that is affordable, adequate, and appropriate. The present housing stock has more often than not been designed according to economically effective practices, as well as according to *Qablunaat* (Inuktitut term for non-Inuit) standards. Complicating matters are the many design and construction challenges stemming from the unique Inuit culture, economics, and environment of the region. The lack of acceptable housing for the Inuit population is magnified by the overall shortage of housing and the rise in natural population growth. The result is that the same, culturally unsuitable and ineffective houses are being constructed in vast numbers across the Canadian North to meet housing stock shortages and increasing demand from regional population growth.

Though some advancements have been made overtime in regards to housing designs in the Canadian North, these have been directed toward the economical and environmental conditions of design, falling more so into the realms of engineering and building science rather than architecture. In order to address the Inuit's loss of their cultural identity and heritage, new houses must represent the unique culture of the Inuit, which is an architectural concern. Further, as opposed to the mere design of houses, the architectural concept of the home must be explored in order to achieve a culturally appropriate dwelling. Thus, the primary objective of the following thesis | project will be to investigate how architecture can strengthen the twenty-first century Inuit identity through their dwelling designs, while still responding to the technical and logistical challenges of building in this particular context.

While there are many examples in which architecture responds to evolving cultures in the modern world, as found in the projects of the Critical Regionalists, the work pertaining to the Canadian Inuit is sparse. Presently, there are a handful of projects that attempt to address Inuit culture in architecture, including the Piqqusilirivvik Inuit Cultural Learning Facility by Stantec Architects completed in 2012, the Canadian High Arctic Research Station by FGMDA Architects to be completed in 2017, and the many theoretical projects and the *Arctic Adaptations* exhibit for the Canadian pavilion at the 2014 Venice Biennale of Architecture by Lateral Office. While successful to varying degrees, these projects do little to address the challenges of the residential type. One of the primary texts regarding design in the Canadian North that does address aspects of Inuit culture is Harold Strub's *Bare Poles* completed in 1996, which only discusses general approaches and has become outdated due to the many changes occurring within the context. Thus, this thesis | project is one of the

Figure 1: Piqqusilirivvik Inuit Cultural Learning Facility

Figure 2: Canadian High Arctic Research Station

Figure 3: Housing Project at the Arctic Adaptations Exhibit

few architectural explorations into the idea of the contemporary Inuit home.

A new approach to housing for the Canadian North is necessary in order to reinforce the cultural identity of the Inuit and to appropriately suit the projected ideal state in which the Inuit will prosperously and sustainably inhabit the region. Further, the approach should respond to the existing and future housing shortfall, and rectify the design deficiencies of the current housing stock to help ensure the successful development and inhabitation of the Canadian North in the years to come. Going forward, dwellings designed for the Inuit must address and embrace the unique living conditions in the Canadian North, and be designed beyond economic and efficient practices. To achieve these ambitions this thesis | project argues that the adoption of a regionally responsive architecture is necessary, where at the forefront of the design process is the response to the cultural conditions of the Inuit population, and that its economic and environmental conditions are addressed in their own right, through an understanding of their cultural implications. To execute the implementation of a regionally responsive architecture that will respond to the cultural needs of the Inuit and other conditions of the context, the following ideas will be explored: the manner in which Inuit identity can be represented in the dwelling, the ways in which the dwelling can accommodate the unique hybrid lifestyle and values of the Inuit, the methods in which dwellings can engage with environmental forces, how local resources can be utilized and the creation of a variable and dynamic housing system.

In order to further contribute to the discourse of architecture for the contemporary Inuit, this thesis | project will act as a guide to designing homes in the Canadian North, equivalent to a one stop shop for design, compiling information pertaining to the history of the Inuit, the architectural history of the region, the evolution of the contemporary Inuit culture, the peculiar environmental context, the economic conditions that have developed, the unique demographics, and projections into what the future may hold. In doing so, what is an unfamiliar context to most might be better understood, which will help in understanding of the architectural ideas explored, while to those interested in the subject, it offers a good introduction for further exploration, offering potential insight into opportunities not discussed in this thesis | project and allowing others to challenge and take further the ideas that have been explored.

Accordingly, Part 2 of this document will discuss the context of the Canadian North, with Chapter 2.1 focused on defining the region, Chapter 2.2 concerned with highlighting the historical evolution of the Inuit ending with the problems that they face today, Chapter 2.3 analyzing the evolution of architecture in this region, Chapter 2.4 highlighting the present housing concerns, and Chapter 2.5 speculating on the future of this region, and the ideal conditions in which Inuit homes should be designed to. Part 3 of this document will introduce the town of Cambridge Bay, Nunavut in order to give the project a particular context, and to help better illustrate some of the conditions and challenges found in Nunavut. Part 4 will describe the conditions found in the North, with Chapter 4.1 discussing the unique Inuit culture, and how this should be accounted for in design. Chapter 4.2 will discuss the environmental conditions found in the region, which impact both the daily lives of the Inuit, and the design of their dwellings. Chapter 4.3 will discuss the economic conditions that must be accounted for in design from both a technical and lifestyle perspective. Chapter 4.4 will analyze the demographic shifts occurring in the region in order to help determine the housing need, the ideal family sizes and types that need to be accounted for in design, and other factors that may impact design decisions. In developing an understanding of these conditions, the design decisions made will be justified, while other opportunities might become present as well. Part 5 will reiterate the position taken in order to introduce the proposed design project that has been developed in and explore the ideas and objectives that have been informed by the research. With the proposed design project now in mind, Part 6 seeks to analyze a wide body of influential projects and theories in order to help develop the hypothesized ideas about what the contemporary Inuit home should be. Chapter 6.1 analyzes the quintessential text of Critical Regionalism in order to determine how to design for a culture undergoing the process of modernization through a hybridization of modern and traditional practices. Chapter 6.2 examines the vernacular architecture of the Inuit to understand the methods and principles behind these structures in order to utilize this same logic in the design of their contemporary dwellings. Chapter 6.3 discusses the contemporary architecture found in Nordic countries, as it exemplifies an architecture that responds to a Northern climate and culture, resulting in a unique identity. Chapter 6.4 focuses on the contemporary architecture found in Greenland, as it is a predominantly Inuit culture, with a more mature architecture, thus offering many ideas that can be borrowed. Chapter 6.5 gives an overview of contemporary Inuit art, as this sheds light on the contemporary Inuit identity, and the aesthetic sensibilities of the Inuit. Chapter 6.6 discusses some examples of contemporary architecture, which either responds in innovative ways to the culture of the Inuit and/or to the environmental and economic conditions found in the North. Part 7 is an amalgamation and synthesis of all the ideas that have been researched and discussed, and sees their further exploration. Chapter 7.1 is the development of a set of principles, strategies and tactics, which are to govern the design of the contemporary Inuit dwelling. Chapter 7.2 sees the exploration of these ideas in the design of a home delivery system of the Inuit. Chapter 7.3 depicts the system being applied to a particular site in Cambridge Bay. Lastly, Part 8 will conclude the document with a critique of the proposed design, discussing its achievements and shortcomings, highlighting areas in need of development, and proposing ideas that might be further explored.

The Question of Not Being an Inuk

Often, throughout the progression of this thesis | project, I have been questioned on my ability to design an appropriate home for contemporary Inuit as I was born, raised, and trained in Toronto. To add some substance to my rebuttal I will borrow from the arguments of Northern Canadian architect Harold Strub, Inuit anthropologist Lisa Stevenson, and the now defunct Foreign Office Architects (FOA). Strub correctly highlights in *Bare Poles* the fact that there is no homegrown design and construction industry for the Inuit, and in regions with sparse populations this industry can take generations to mature (Strub, 1996, p. x). Even nearly 20 years after this publication there have not been any Inuit trained as architects, who have begun to address this problem. As such, as outside trained architects our designs can form "a rickety bridge across the cultural divide", which is a necessary step in the development of a homegrown architecture (Strub, 1996, p. 73). However, it is my view that outside trained architects, in learning as much about an unfamiliar context and culture, can do more than just the rickety bridge, and can actually contribute in a positive manner. This view is shared by Stevenson, who believes that otherness can be a useful tool in understanding a certain culture because insiders can take for granted and miss what is considered obvious and trivial to them (Stern & Stevenson, 2006, p. 3). Cultural difference can thus lead to certain types of knowledge and insights, which in turn can result in unexpected and exciting solutions. This line of thinking coincides with the design philosophy of FOA, who celebrate the creative capacity of foreignness in which the architect is somewhat naïve, but free from preconceptions and can utilize all the ingredients of a project to generate something unique and fresh, that someone closely connected with a culture would never consider (Fairs, 2003). Thus, despite not being an Inuk, I have become aware of many of the conditions in the Canadian North in part due to my foreignness, and I can use this knowledge to help in my design proposal, setting me apart from the many designers who simply transplant southern homes for the Inuit, and the others that fail to account for the contemporary Inuit culture in their designs.

Disclaimer

In order to emphasize the cultural uniqueness of the Inuit, I have chosen to utilize *Inuktitut* (the term for all dialects of the Canadian Inuit Languages) terms where applicable. Since this project is situated in Cambridge Bay, I opted to use the local dialect, *Inuinnaqtun* for these words as opposed to the more commonly used Eastern Inuktitut dialect. I have attempted to use the correct terms and dialect, but in the probable occasion where I have made an error, I apologize.

A Note on the Title

In titling this thesis | project *Reinterpreting the Iglu*, it expresses the intention to use a regional responsive architecture to explore the design of the Inuit home of the 21st century. It needs to be noted that the term *Iglu* or *Igloo* is often misunderstood to mean the Inuit snowhouse. It is in fact the Inuktitut term for home or house, encompassing all dwellings the Inuit inhabited during the different seasons of the year.

02

THE NORTHERN CONTEXT

It is a place of incredible beauty and many superlatives – the tallest mountain, the longest river, the longest summer days and longest winter nights, a land of extreme cold and one of the most sparsely populated areas of the world.

CMHC, 2008

In order to effectively understand the opportunities and challenges present in the Canadian North, and to identify the regional conditions that will affect architecture and the impacts that architecture can have on the region, it is important to understand its context, which will be the focus of Part 2. In order to accomplish this understanding, Chapter 2.1 will define the characteristics and subsequent boundaries that make up the Canadian North in the context of the paper. The history of settlement in the Inuit homeland will also be analyzed in Chapter 2.2, in order to understand what attracted populations to inhabit this region, and how their lives have been shaped by various influences, especially over the last 50 years, when the Inuit have experienced rapid modernization. In order to propose an effective strategy for the regionally responsive architecture in the region, an outline and critique of the different architectural responses used throughout the region since the mid twentieth century is also needed and will be discussed in Chapter 2.3. The result of this architectural evolution is the current state of housing in the region, which will be depicted in Chapter 2.4. To compliment the understanding of what has happened historically, Chapter 2.5 will speculate the future opportunities and challenges of this rapidly changing region, and will backcast a desirable future state, in which the new architecture should respond to.

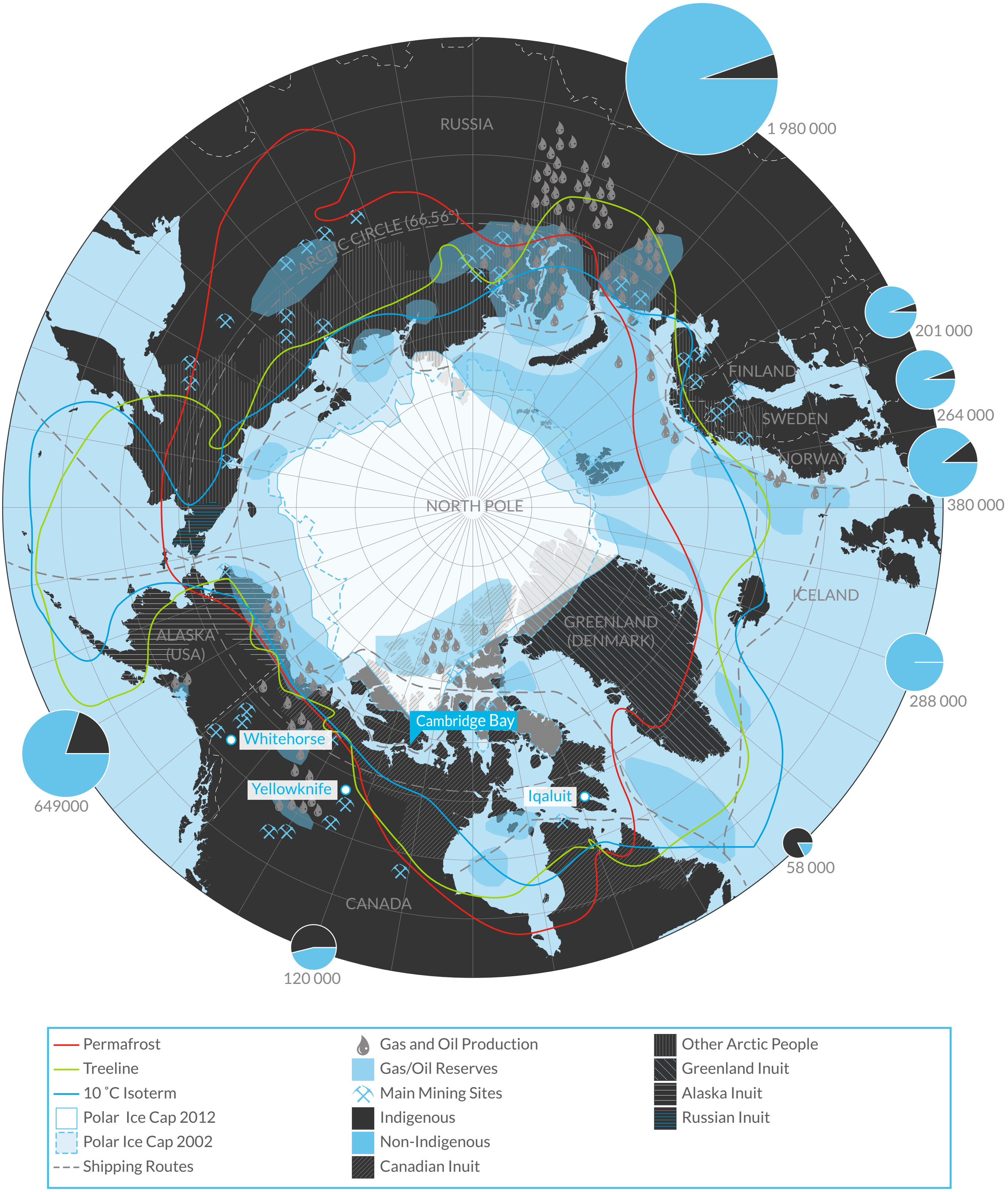
Figure 4: Cambridge Bay Dew Line Station

2.1 Situating The North

What is often considered the Canadian North covers over 40% of the landmass of the country (Canadian Mortgage and Housing Corporation, 2008, p. 63), and is an extremely vast and diverse area. The question of how to accurately define this region is thus raised, especially in terms of the characteristics that will derive an architectural response for the future of housing in the Canadian North. Firstly, to help define the Canadian North, it must be noted that a region is defined by its distinct physical features, demographics, cultural characteristics, economic activities, political identity and sense of place (Bone, 2011, p. 8). Thus, one of the first distinctions to discuss is the use of the term *North*, as opposed to the *Arctic*. More often that than not, the Arctic is considered to be the area north of the Arctic Circle, which is located at 66.56° latitude. The reason for this definition is that it is the southern most latitude where the sun remains above the horizon continuously for 24 hours during the summer solstice, and below the horizon continuously for 24 hours during the winter solstice. While this is one important characteristic to consider when developing an architectural response for the region, it is also very limiting, as many similar conditions do appear south of this border and many communities south of the Arctic Circle share other similar characteristics with communities located in the Arctic. Hence, the term *North* is used to consider the region defined by common characteristics.

However, before defining the Canadian North, common characteristics of the northern countries and territories will be briefly discussed. The purpose of this is to expand the scope of precedents to be studied, as there has been little work of significant importance undertaken in the Canadian North, and important parallels can be drawn with the many projects undertaken and the distinctive styles that have emerged in these other parts of the world. Further, it broadens the sphere of influence for some of the ideas to be discussed in this thesis | project. Thus, initially for argument sake the definition of North will be simplified to the area north of 60° latitude, which includes Iceland, Greenland, the Faroe Islands, Svalbard, northern Russia, and most of northern Canada, Alaska, Norway, Finland, and Sweden. Some unique characteristics of this region include the colder average temperatures, the lengthy presence of snow, continuous periods of darkness and sunlight, the presence of permafrost, the location above the tree line, the limited biophysical diversity, the landscape dominated by polar desert, tundra, and tundra-forest, the rising annual average temperature, the importance of wildlife, the remote location, the melting polar ice cap, a high indigenous population, a young and growing population, the sparseness of the population, the high cost of living, the predominance of the resource economy, a reliance on imported food, financial dependency, the increasing availability of natural resources and the importance of tourism (Bone, 2008, p. 9). Further, the North has one of the most dramatically changing climates on the planet, contains many undiscovered energy resources, has significant economic and development potential, is host to developing questions of sovereignty, and is seeing an urgency to expand,

Figure 5: Map of the Circumpolar North
(Opposite) Depicting the different environmental characteristics, demographics, and developments that are found in the circumpolar countries


RUSSIA
1 980 000
ARCTIC CIRCLE (66.56°)
FINLAND
201 000
264 000
SWEDEN
NORWAY
380 000
NORTH POLE
ICELAND
GREENLAND
(DENMARK)
288 000
ALASKA
(USA)
Cambridge Bay
Whitehorse
Yellowknife
Iqaluit
649000
58 000
CANADA
120 000
Permafrost
Treeline
10 °C Isoterm
Polar Ice Cap 2012
Polar Ice Cap 2002
Shipping Routes
Gas and Oil Production
Gas/Oil Reserves
Main Mining Sites
Indigenous
Non-Indigenous
Canadian Inuit
Other Arctic People
Greenland Inuit
Alaska Inuit
Russian Inuit

but with little planning (Lateral Office, 2011, p. 48). While most of these characteristics are not present concurrently in all areas of the North, most of these are present in one part of the Canadian North or another, meaning the lessons learned and the architectural response developed for this region can be applicable in many other places throughout the North.

However, for the purpose of this project, the Canadian North cannot simply be defined as the area north of the 60th parallel, as one of the main focuses of this project is to define a cultural responsive architecture for the Inuit population, which include a significant portion who reside below this imaginary border. The Inuit Homeland, often viewed as a barren polar desert, is a place, which contains a specific political, ethical and spiritual nature, and is found in parts of Canada, Alaska, and Greenland.

Figure 6: Map of the Canadian North
Depiction of the different settlements, environmental conditions and logistic networks

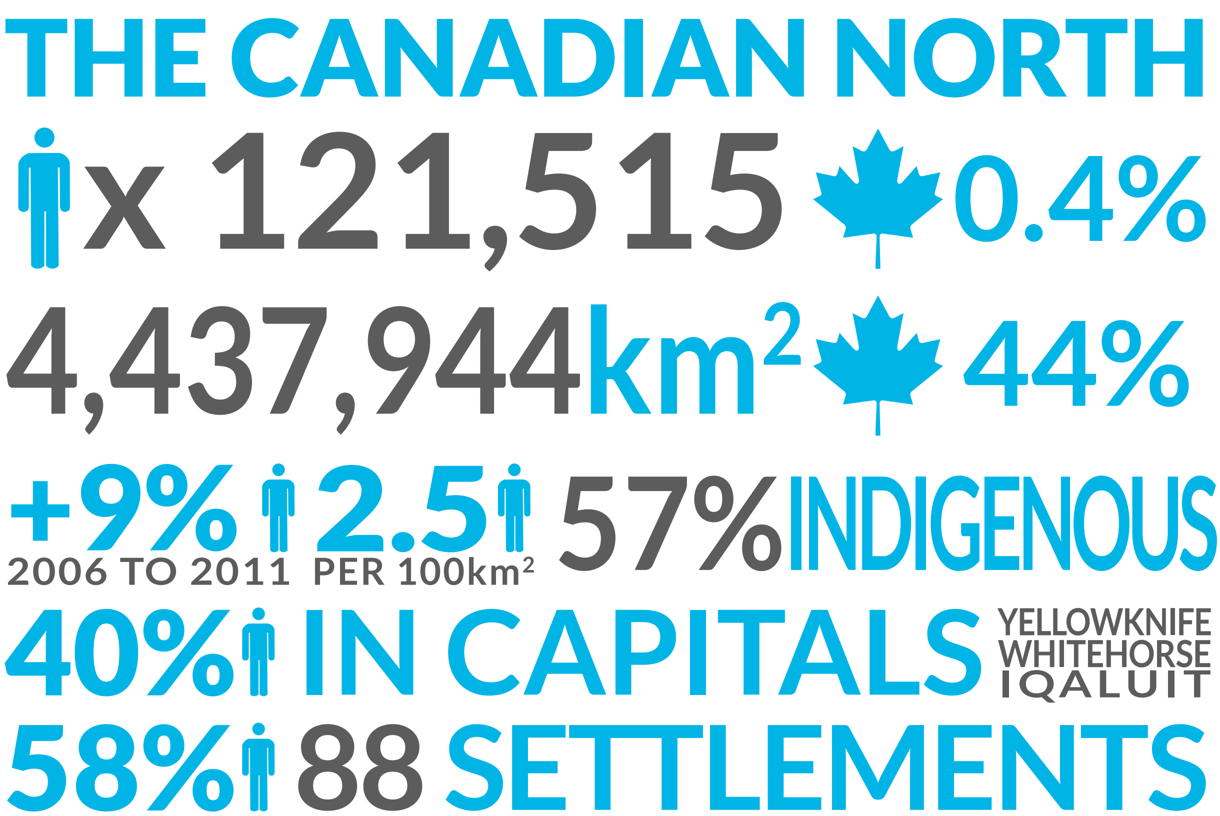


Figure 7: Canadian North Statistics

Thus, the Canadian North will be defined as the three territories, Nunavut, Yukon, and the Northwest Territories, all located north of 60, and the Inuit regions of Nunavik in Quebec, and Nunatsiavut in Newfoundland and Labrador. However, this is quite a vast and diverse landmass, and while certain strategies derived in this thesis | project are transferrable throughout, it will focus specifically on the areas populated by the Inuit, which share the characteristics of being a sparesly populated and remote region, which have different forms of self-government, have recently undergone a process of modernization, and are located in zones of continuous permafrost, above the tree line, and in the tundra landscape. Further, because the Inuit Homeland also includes Greenland and parts of Alaska, parallels of the architecture occurring in these areas can be drawn. Lastly, in order to develop an understanding of the opportunities and challenges that the Inuit population is confronted with, the territory of Nunavut will be studied. The reason for this is that 85% of the territory's population is Inuit (Canadian Mortgage and Housing Corporation, 2008, p. 66), thus many of the trends occurring across this territory are present in the rest of the Inuit Homeland. Therefore, while the thesis | project will focus on Nunavut, the issues at hand are visible throughout all the Inuit inhabited regions in Canada, and the lessons learned here can be transferred through the rest of the Canadian North, other Inuit regions, and the North in general.

Figure 8: Map of Nunavut
Depiction of the different settlements and regions

2.2 A History of the Inuit Homeland

The history of the Inuit Homeland, which includes a large portion of the Canadian North, can be divided in many different ways based on the evolution of different cultural groups who have inhabited this land. For the purposes of the thesis | project, I will divide the history into three sections which revolve around the cultural changes that took place due to relationships with the *Qablunaat*. The first is the Pre-Contact Period, before the *Qablunaat* had a significant impact on the region; the second is the Contact Period, when the Inuit experienced a period of transitions and modernization; the third is the Current Period, which began when the Inuit started to take back control of their own destiny through land claim agreements and self-governance.

Pre-Contact Period

The first population to inhabit the Canadian North were the Belkachi, who moved north to Siberia 7000 years ago when the retreat of the glaciers enabled this region to be colonized by plants, animals and people. From there they crossed the Bering Strait into Alaska, and dispersed throughout the Canadian North in 2500 B.C.E. to become what is now referred to as the Independence Culture, a Pre-Dorset group. As the people in this region began to develop their own technology, including the burning of sea mammal oil for heating, they evolved into other Pre-Dorset cultural traditions. Around 1000 B.C.E. the northern population had evolved into the Dorset culture, which shared many similarities with the historic modern Inuit, such as the construction of snow houses, seal hunting, and the decoration of utilitarian objects. However, with the arrival of the Norse and Thule in 1200 C.E., the Dorset population became extinct by 1500 C.E. The Thule were decedents of the Norton culture, who inhabited western Alaska, and had significant connections with Siberia. While not entirely confirmed, it is speculated that groups of the Thule, a nomadic culture, started moving eastward in 1000 C.E. to follow the migration of the bowhead whales, during a period when the climate was much warmer than it is today. The Thule, who the are ancestors of the Modern Inuit, developed many technologies for surviving in the Arctic, including the use of semi-subterranean winter house, as well as some technologies that modern Inuit became renowned for, including dog-sleds. Further, the Thule had direct interactions with both the Norse and the Dorset, whereby they traded walrus ivory to the Norse for smelted iron, and learned the location of soapstone and meteoric iron from the Dorset. With the Little Ice Age from 1350 C.E. to 1850 C.E., the cold temperature prevented the bowhead whales migration from the Alaskan coast to the eastern Arctic. As a response, the Thule moved south and focused their subsistence hunting on smaller marine mammals species such as seals. The change in hunting patterns also explains the transition from coastal semi-subterranean houses to the use of the Dorset snow house with soapstone oil lamps located on the sea ice, to be closer to seal breathing holes. Fur-

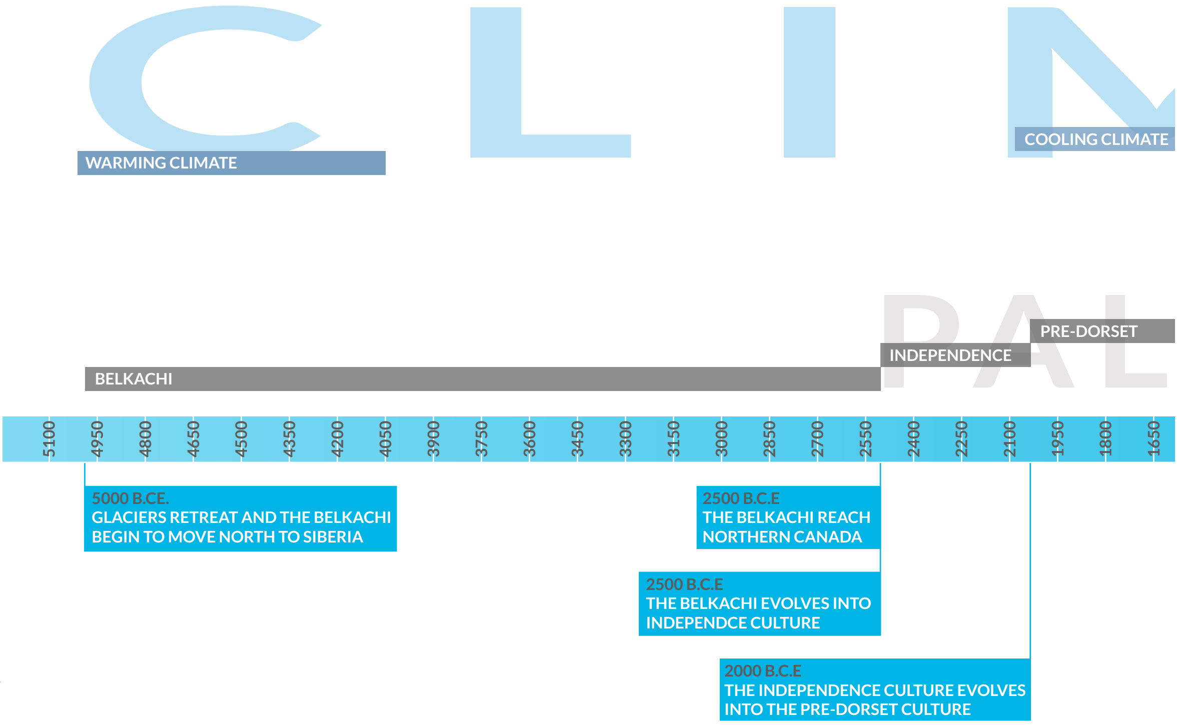


Figure 9: Chronology of Inhabitation of the Canadian North

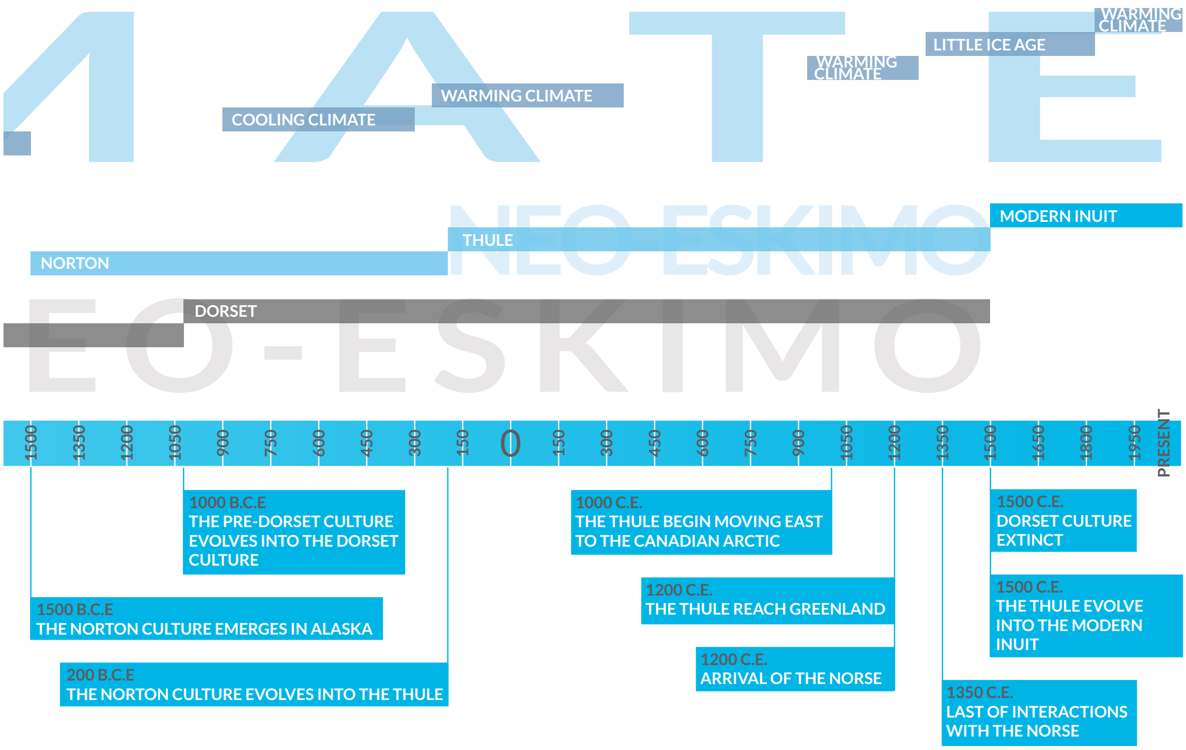
ther, it was during the beginning of the Little Ice Age when the Norse colonies ended and the Dorset population disappeared, making the Thule the only inhabitants in the North American Arctic. With the previously mentioned lifestyle changes came the transition from the Thule culture to the Inuit culture.

The Inuit cultural period can essentially be divided into two periods: the Traditional and the Modern (post 1950s). It is important to understand that traditional Inuit culture was in fact not in a static state in the past, but a period of change in which a “dynamic set of values, knowledge, and customs” existed (Collignon, 2006, p. 19).

The traditional Inuit culture was similar to their ancestors who lived as hunter-gatherers, in which their entire livelihood was dependent on the resources from *Nuna,* the land. Thus, despite the minor distinctions between different groups and the changes, which occurred overtime, one constant was that traditionally the Inuit practiced a lifestyle of subsistence harvesting.

Contact Period

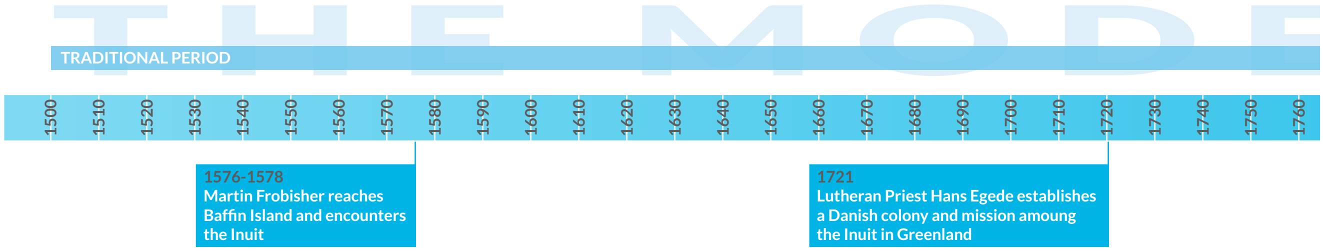
The Modern Inuit have experienced numerous periods of change mostly due to external influences. The first recorded interactions between the Europeans and the Inuit occurred between 1576 and 1578 with Martin Frobisher and the Inuit on Baffin Island. However, the first instances of significant impact occurred on Greenland in 1721, when the Lutheran Priest, Hans Egede, from Norway began to convert the Inuit. Also, the Inuit in Alaska, while they might not have had direct contact



with Russians prior to 1820, through their indigenous trade networks they were able to utilize Russian manufactured goods. Interactions between Inuit and European explorers became frequent in the Canadian Arctic post 1847, when nearly 40 expeditions were launched to search for Sir John Franklin and his crew who became stranded in the sea ice in 1845 while searching for the Northwest Passage.

In the nineteenth century, whalers began to frequent the Labrador Coast and the Eastern Arctic, significantly broadening relations between the Inuit and the *Qablunaat*. Further in 1848, American whalers began whaling north of the Bering Strait into the Beaufort Sea and moved eastward from there, where in 1889 they began wintering near the mouth of the Mackenzie River in the Northwest Territories, creating the first sustained contacts with the Inuit. These contacts with whalers resulted in the Inuit settling around these whaling stations for the trading, social, and economic benefits they presented. The whalers offered the Inuit European goods such as rifles and tobacco; new social experiences such as sports, dance and concerts; and new concepts of time, work, and conduct (Stern, 2010, p. xviii). On the other hand, there were some negative consequences including the depletion of game animals, the exposure to diseases and the introduction of alcohol (Bonesteel, 2008, pp. 2-3).

The incorporation of the Inuit lands into the three countries of Canada, Denmark (Greenland), and the United States (Alaska) also resulted in a variety of significant and distinct changes to the Inuit groups depending on each countries' involvement in their affairs. In Canada, the Inuit lands were transferred from Great Britain between



1870 and 1880. Until the mid 1940s, there was little interest from the Canadian Government with regards to the Canadian North and the Inuit residents, thus they encouraged a policy of decentralization and self-sufficiency. In part this was due to the government's confusion and indecisiveness over whether the Inuit were Canadian citizens, and the responsibility of the territorial and provincial governments, or if they were covered under the *Indian Act of 1876,* and under the jurisdiction of the federal government (Bonesteel, 2008, p. 6). Thus, the promotion of self-sufficiency meant neither body had to accept accountability.

Further changes to the Inuit way of life in the Canadian North occurred during the end of the nineteenth century when the whaling industry began to disappear and with the arrival of the Christian missionaries and the Northwest Mounted Police. They assumed an administrative role, building hospitals, churches and schools in an attempt to achieve assimilation of the Inuit culture. Also of importance is that after the collapse of the whaling industry, these bodies were the remaining links to *Qablunaat* goods such as rifles, flour, cloth and metal knives (Bonesteel, 2008, p. 3). During this period, while the Inuit adopted certain *Qablunaat* technologies, and many converted to Christianity, they still maintained their traditional, semi-nomadic lifestyle that consisted of subsistence hunting cycles, seasonal movement based on available animal and mineral resources and a community structured around small kin groups.

Significant change to the Inuit lifestyle occurred with their introduction to the fur trade. When the whaling industry collapsed, the fur traders moved north and encouraged the Inuit to trap foxes in exchange for the consumer goods that the whalers used to offer them. However, trapping foxes proved to be a time consuming endeavour, resulting in a shift from subsistence hunting towards commercial hunting, in which they became reliant on trade to supplement their diets. Thus, Inuit subsistence became significantly tied to "European economic forces and foreign consumer goods" (Bonesteel, 2008, p. v). The changes to their economic and survival practices resulted in the transition to living in shanty style villages near places such as trading posts and missions for long periods of the year. Thus, while the government promoted self-sufficiency, and the Inuit still lived a semi-nomadic lifestyle, they were deeply entrenched in a system that relied on *Qablunaat* goods and services.

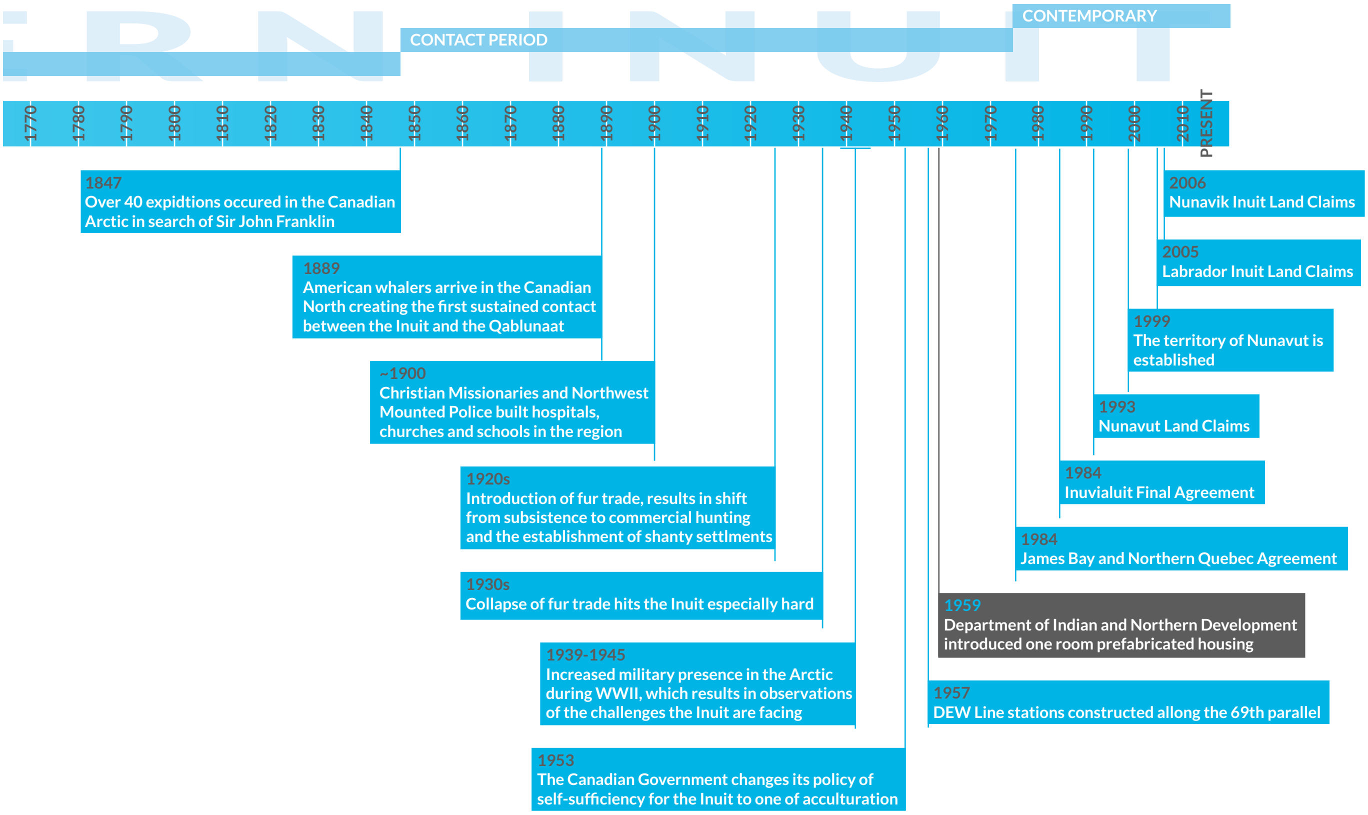


Figure 10: Chronology of the Modern Inuit

Meanwhile, during the period of Inuit fur trading, the federal government began a political process to determine what level of government was responsible for the Inuit. The eventual result of the lengthy political debate was that legally, the Canadian Government was responsible for the Inuit, as they were considered a part of the *Indian Act*. However, the policy of self-sufficiency remained unchanged, and the government provided no new services to the Inuit, as the government became preoccupied with World War Two (Bonesteel, 2008, p. 7). The only concern the government exhibited toward the Canadian North during this period was as a strategic location for air bases, and as an area where Canadian sovereignty might be at stake.

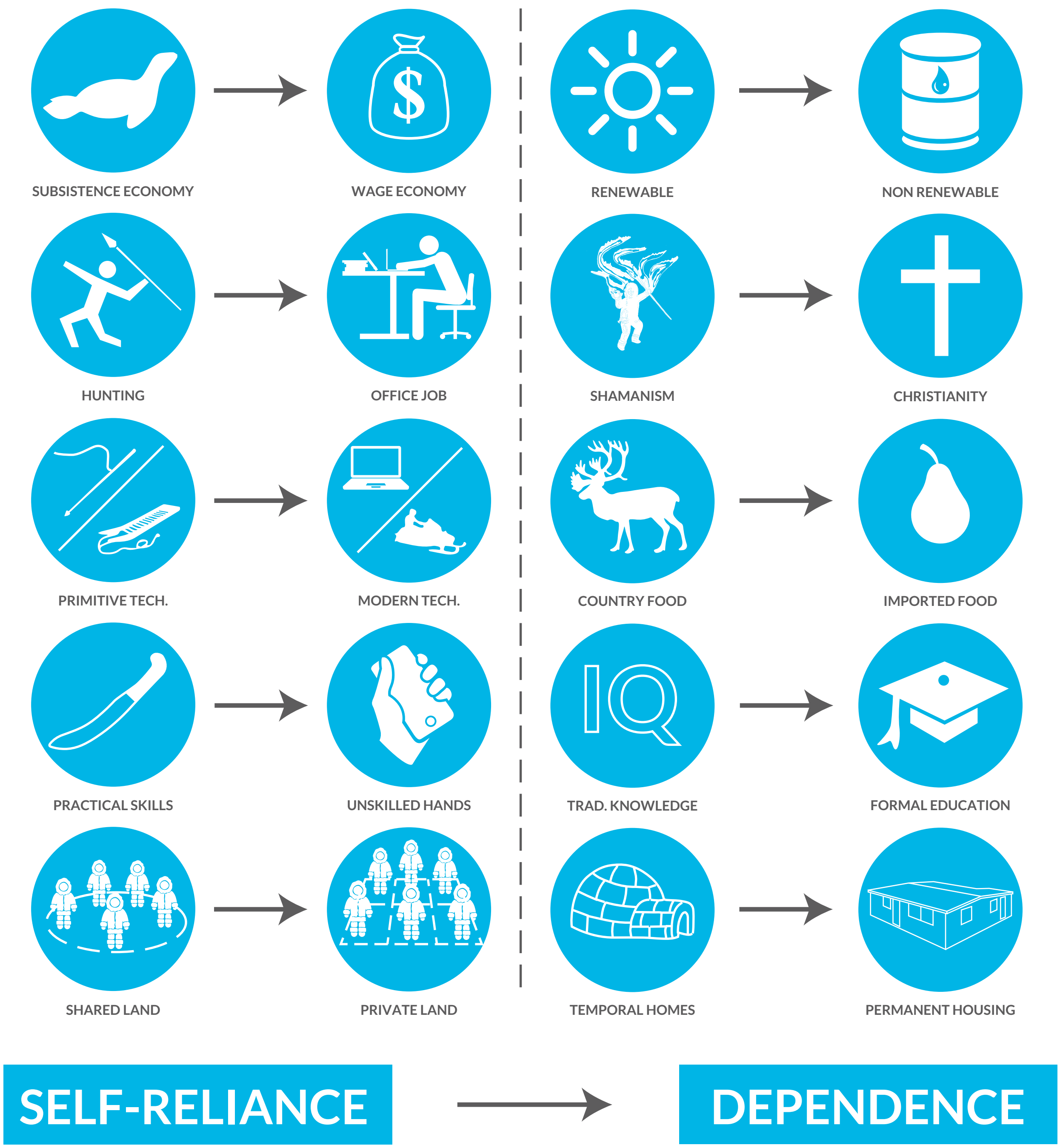
However, with the collapse of fur prices in the 1930s, the Inuit were hit especially hard. The drop in value of the furs, combined with the overhunting of caribou, resulted in widespread starvation, and subsequent relief programs introduced by the Canadian Government. Despite the minor intervention, "the official government policy advocated a traditional, self-sufficient way of life for Inuit, insofar as that was possible" until 1953 (Bonesteel, 2008, p. 4).

As mentioned earlier, the Canadian Government along with the American military did establish a military presence in the Canadian North during World War II, and it was during this period when many of the challenges the Inuit were facing began to be recognized. The Inuit in the shanty style villages built around the fur trading posts and missions were observed to suffer from respiratory diseases, high infant mortality, "inadequate education and healthcare; the collapse of the fur trade in the 1930s and consequent lack of employment for Inuit; the low numbers of available caribou, and difficulties experienced in obtaining sufficient food and winter clothing" (Bonesteel, 2008, p. 10). An initial attempt at a long-term solution by the government was to relocate Inuit to areas with an abundance of resources. However, these efforts would prove to be unsuccessful, as many of the challenges were still present and many of the Inuit became disillusioned (Bonesteel, 2008, p. 10). Thus, in 1953, the government changed its Inuit policy to one of acculturation and assimilation to *Qablunaat* culture. It entailed the introduction of a wage labour economy with consistent employment, reliable food sources, access to healthcare, education, and the establishment of permanent settlements. Not only was this implemented to solve the issues that the Inuit population faced, but permanent Inuit inhabitation also ensured Canadian sovereignty in the North, and allowed for the exploitation of minerals (Bonesteel, 2008, p. 10). Further, the development of permanent housing provided by the government was meant to improve sanitary conditions and thus prevent diseases, ensure school attendance, and allow for easier administration (Bonesteel, 2008, p. 11). Thus, the healthcare, education, and housing programs initiated for the Inuit after World War II were meant to not only improve their living standards, but to minimize the financial burden placed on the Canadian Government.

Another contributor to the permanent settlement of the Inuit in the Canadian North was the construction of 42 Distant Early Warning (DEW) Line radar stations along the 69^{th} parallel in 1957. These sites enticed the Inuit to develop communities around them as they offered opportunities for employment and access to medical services. While the technology became obsolete very early on, many sites were upgraded, or used as training facilities, some of which are still in operation today as part of the North Warning System. The eventual result was that the communities located around the DEW Line benefited from the "development of housing, transport, communications, infrastructure, education and healthcare" (Bonesteel, 2008, p. 15). Thus, the DEW Line sites initiated the establishment of many of the northern communities we see today.

In the 50 years since 1960, the approximate time of the establishment of permanent settlements administered by the Canadian Government, the Inuit have experienced rapid change and modernization in all aspects of their lives. Initially, this period of transition saw them change from a subsistence economy to a monetary economy, and thus restricted hunting activities, as they could no longer follow their prey, and had to take up wage labour to maintain a steady income. Further, they transitioned from the temporal vernacular homes to permanent housing, which was designed according the Qablunaat lifestyle and standards. This shift also brought about the foreign concept of private land, as before land was shared and you were free to change locations on any occasion. Newer and more advanced technologies such as snowmobiles, rifles, and computers were introduced, supplanting many primitive technologies like the *aalliak* (dog sled), qajaq (kayak) and *kapuut* (harpoons). This in turn has created a generation of unskilled hands, as opposed to the traditional Inuit who had an abundance of practical skills. Other imports from the Qablunaat include the overreliance on non-renewable resources, and a shift from country food to imported food from the south. Other lifestyle changes included the shift from a shamanistic animism to Christianity, and from Inuit Quajimajatuqangit (IQ), also

Figure 11: Transitions Experienced by the Inuit



known as Inuit traditional knowledge, to a formal education system. These transitions have lead to the increased adoption of Qablunaat technologies and lifestyle, and the subsequent loss of culture. However, many Inuit have been able to retain their unique identity and culture through the preservation of their traditional languages, the incorporation of traditional skills and IQ, in their everyday lives, including education, government and business. Thus, the Inuit today, are seen as a people "caught between two worlds" (Collignon, 2006, p. 1), living between their traditions and modernization.

Current Period

One manner in which the Inuit have been able to maintain their cultural identity is through their fight for land-claim agreements, co-management of natural resources and self-government that reflects their cultural values and norms of behaviour (Stern, 2010, p. 90). However, as of yet, no Inuit group has complete autonomy as they are all governed to some degree by a foreign state. The land-claims in Canada were a series of agreements that developed in response to the government and private corporations who began encroaching on land the Inuit considered theirs. Prior to these agreements, Inuit held what is called aboriginal title on these lands, which is essentially the right to occupy, but not ownership. The land claim agreements provided the Inuit with a fee simple title on a portion of these lands, financial compensation for the ceded lands and the right to participate in the management of natural resources on these lands. Further, they established Inuit native corporations, whereby the Inuit invested cash from the agreements into, which were meant to create a profit, pay dividends to members, employ Inuit, and create economic development in Inuit communities. The four Inuit groups participated in five agreements: the James Bay and Northern Quebec Agreement of 1975 and the Nunavik Inuit Land Claims Agreement of 2006 with the Inuit of northern Quebec, Inuvialuit Final Agreement of 1984 with the Inuit in the western Arctic, the Nunavut Land Claims Agreement of 1993 with the Inuit in the eastern Arctic, and the Labrador Inuit Land Claims Agreement of 2005 with the Inuit in Labrador. In some instances, these agreements resulted in the formation of self-governance. In one typical example, the Inuit of Nunavik formed a legislative body, which could make laws pertaining to language and culture, and shared powers with the province regarding education, healthcare, the environment, and natural resources. Another instance, which took the idea of self-government further is that of the Inuit in the eastern Arctic, who were able to create the territory Nunavut from the Northwest Territories in 1999. It has a public government, but one that is a consensus government as opposed to party driven, and that is informed by IQ in departmental policies, while also decentralizing many of their services to better reflect the needs of each Inuit group. Thus, through the ability to take control of their own land and affairs through these agreements, corporations and governments, the Inuit can ensure the preservation of their way of life and cultural identity, while accepting, and implementing the changes that are necessary to survive in the modern world.

While the move to self-determinism is admirable and ripe with potential for a successful future for the Inuit, since its formation, Nunavut has been plagued with many problems. The formation of Nunavut failed to solve many of the economic and social challenges that the Inuit faced beforehand. Some of these include the loss of culture, an identity crisis for the younger generations, poor access to healthcare, high dropout rate in school, high unemployment, and an unacceptable housing stock (the subject of this thesis | project), and the consequent problems that arise such as economic disparity, lack of respect for elders, overreliance on government, depression, domestic violence, gambling, youth suicide, and substance abuse (Stern, 2010, p. 99). Further, within the government itself, the low percentage of Inuit working in high

Figure 12: Challenges of the Contemporary Inuit

levels of bureaucracy has been an obstruction to the attainment of polices that truly reflect Inuit norms and values. Despite all these challenges, the North remains the Homeland of the Inuit, as it has been for centuries, and is thus not interchangeable with any other place, which is why it is imperative that the Inuit continue to respond to these challenges in order to return to a sustainable way of life in the Canadian North. The thesis | project will thus look into one of the challenges that falls directly in the realm of architecture; housing, as well as one of the challenges which architecture can positively impact; the preservation of cultural identity.

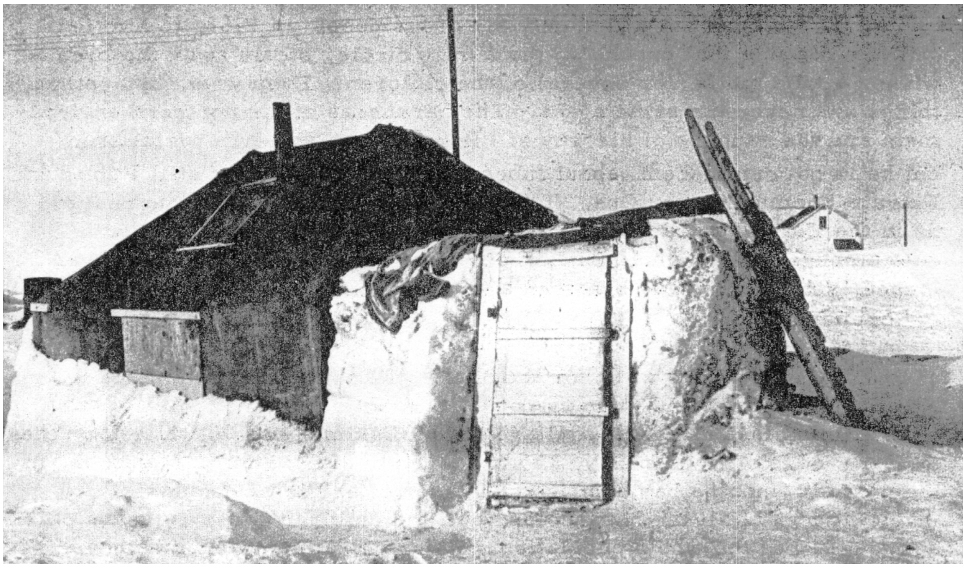
2.3 A Not-So-Brief Overview of Architecture in the Canadian North

In order to comprehend the present issues with both architecture and housing in the Inuit territories of the Canadian North, it is important to study the history of permanent structures in this region. The unique cultural, environmental and economic conditions found here have made it particularly difficult to achieve an architecture that is both economically and technically proficient, let alone an architecture that is culturally appropriate and represents the unique northern way of life. The analysis of past approaches and the evolution of architecture in this region will allow for an understanding of the conditions that have affected design, the shortcomings and failures of architecture, and the subsequent strategies that have been employed in response to these conditions. The first section of this analysis will study the evolution of housing design and the standards and prototypes developed to guide these designs. The second section will cover the architecture of efficiency that has been employed in the other building typologies found in the region. The third section will highlight both the built and unbuilt works of the 1950s and 1960s, which represented the space-age attitudes that developed during the Cold War. With a known cultural deficiency in the design of buildings used by the Inuit, the fourth section will look into the so-called culturally appropriate responses utilized. The fifth section will highlight some of the recent projects that have been completed, which have attempted to respond to all the conditions in varying degrees, but have failed to produce an architecture that is both inspiring and representative of the uniqueness of the Canadian North and its users.

The Evolution of Northern Housing Since 1950

Prior to the Canadian Government's administration of housing to the Inuit population in the Canadian North, many Inuit began building and living in shanty style communities located around trading posts and missionaries in order to take advantage of the technologies, resources and economic benefits they offered (Dawson, 2006, p. 119). However, these small, insulated quarters created very unsanitary environments, resulting in many health issues. To reduce these health risks, as well as other challenges the Inuit faced, the Department of Indian and Northern Development introduced one room prefabricated housing in 1959. These houses were known as the Rigid Frame Prefabricated Houses, and consisted of one 4.90m by 4.90m insulated room. In 1960, they also introduced an improved design called The Illukallak, which is often referred to as matchbox houses. These were larger than the Rigid Frame and consisted of a bathroom and covered porch in addition to the main living area. However, these units were too small for the typical Inuit family, were technically insufficient, and many of the Inuit could not afford the relatively cheap subsidized costs of these units because they relied solely on subsistence hunting economy. As observed by cultural anthropologist Peter Collings (2005), the houses were

Figure 13: Inuit Shanty Housing from Arviat Nunavut, 1963



"poorly designed for the Arctic environment, and the residents typically fell behind on their payments or ceased using them altogether because of the high costs of heating and maintaining the house during the long winter" (p. 53).

As a result of the failed housing units of 1959, the government introduced a social housing program along with larger and improved buildings. The first of these new designs introduced between 1961 and 1962 was the Tisi, which was the first design to include a separate bedroom, and slightly larger than the previous designs. In 1963, a luxury version of the Tisi was introduced, which was much larger and contained three bedrooms. As an understanding of how to build in the North evolved, a new design called The Angirraq was introduced, which was more technically advanced, cheaper to build, and was reminiscent of *Iglu* in that it consisted of one large sleeping room and had a two stage entry (Department of Public Works N.W.T., 1978, p. 17). The next evolution of housing design saw the introduction of the two-bedroom Qarmaq, with both a pitched roof and split pitched roof option. Two new three-bedroom plans that included a separate cold porch for food storage were also introduced between 1966 and 1971, which were called the Urquaq and Ukuvik. While these new houses did make improvements, they still "fell short in addressing issues specific to northern environment and lifestyles" (Canadian Mortgage and Housing Corporation, 2008, p. 75). Furthermore, because these houses were based on *Qablunaat* designs and technology, they were "not designed for a hunting culture, for skinning animals at home, or for the traditional large gatherings to eat country food" while many also "developed structural deficiencies" (Canadian Mortgage and Housing Corporation, 2008, p. 78). Historian Robert Robson (1995) said the following in regards to the particular housing delivered in 1969:

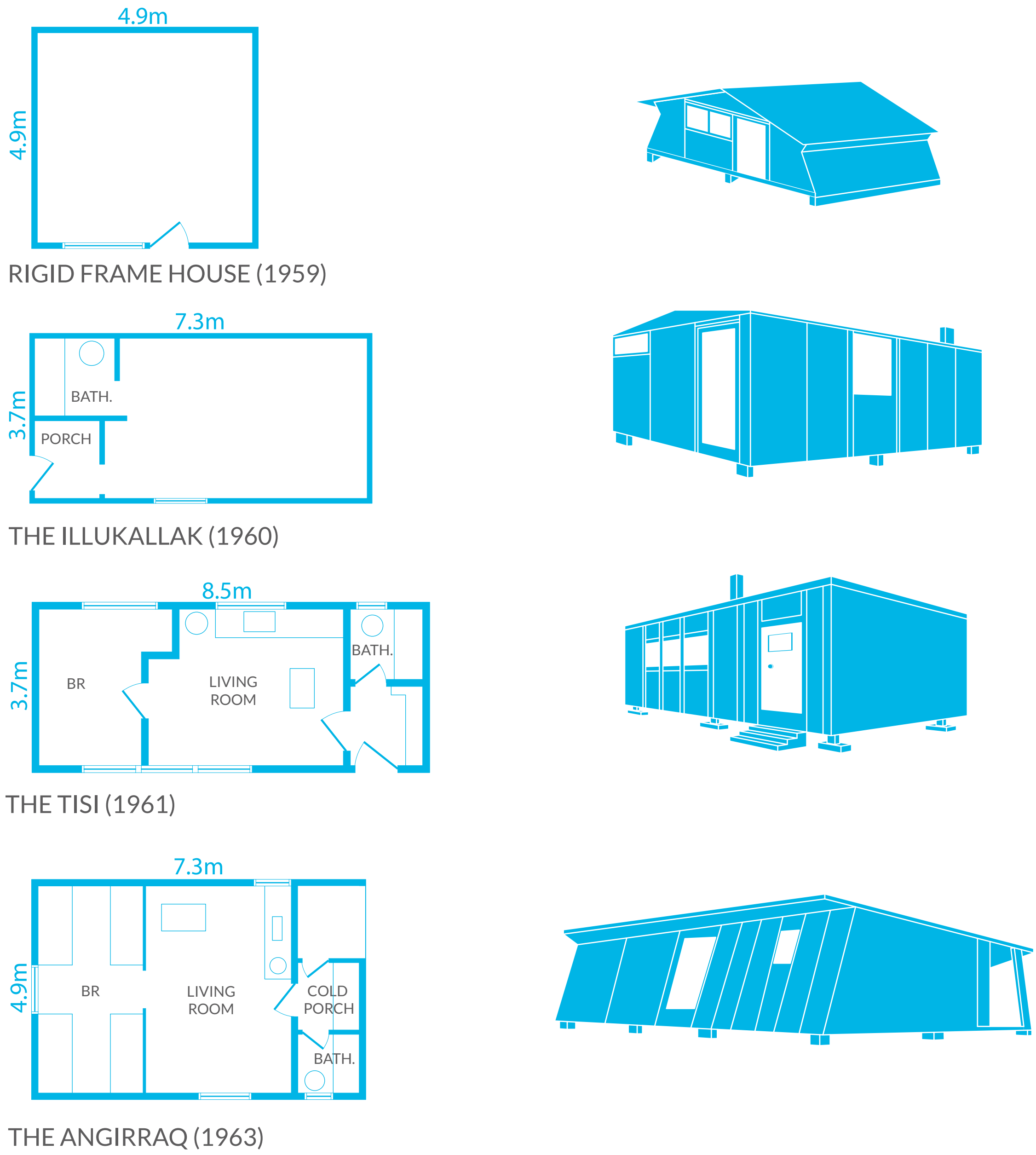
The houses were inferior, expensive, small, often not provided with services and … the living space was compartmentalized, there was no workspace within the unit to *clean or prepare meat or fix snow machines, [and] little thought was given to storage areas*. (p. 17)

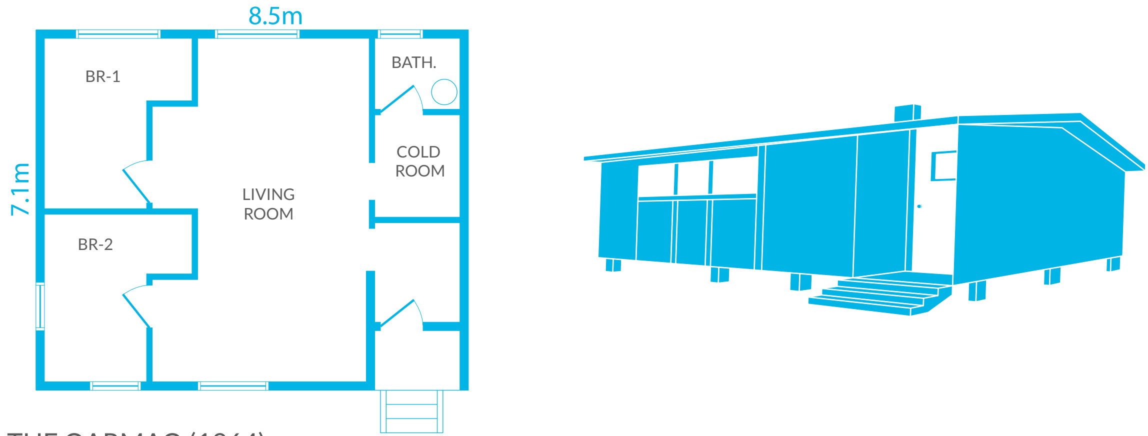
Despite the improvements that were made during this period, the housing provided still did not consider the end users, and further suffered from a lack of understanding of the overall context by the designers.

The ongoing issues of housing in the Canadian North resulted in the conference *Building in Northern Communities* held in Inuvik in the Northwest Territories in 1974 and organized by the Arctic Institute of North America. The conference identified three problems of the current housing situation in the region, which were the poor construction of buildings, designs based on *Qablunaat* traditions, and overcrowding. Consequently three questions were posed: "what are the faults of the present designs?"; "how should the design be changed?"; and "what is a reasonable level of comfort which Northerners have a right to expect?" (Glover, 1974, p. 59). The most significant result of this conference was the formation of the Northwest Territory Housing Corporation, which transferred the housing delivery program from the federal to territorial level, meaning they would have a better understanding of the housing issues in the region. The conference also called for an increase in minimal technical standards, which despite the good intentions of these standards, the insulation levels would actually be less than the minimal standards found in southern Ontario today. The utilization of as much local labour as possible, as well as incorporating the end users in the design process was also proposed. However, in so far as the end users were concerned, it was not really about what they wanted, but a means for the acculturation and modernization of their culture. Thus, while strides in the right direction were made because of the *Building in Northern Communities* conference, the resulting houses to be produced were still far from satisfactory.

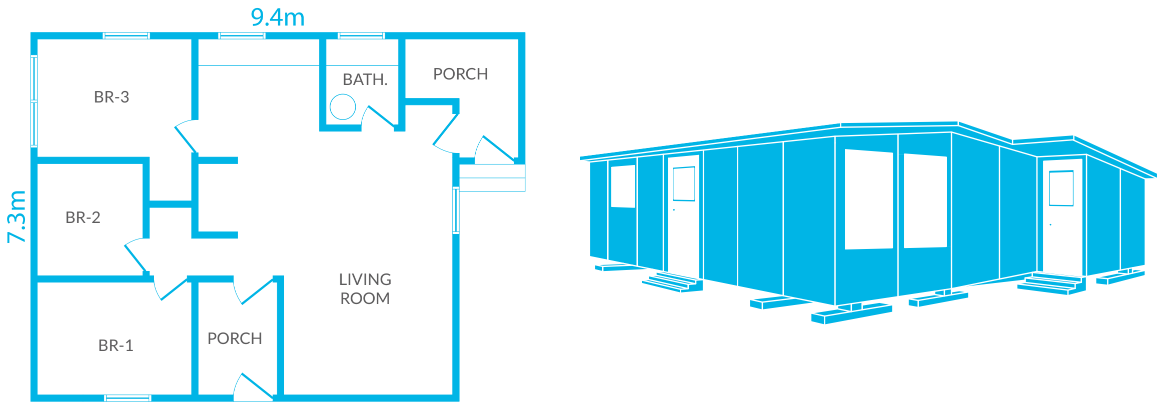
During the same period as the *Building in Northern Communities* conference, the architects, Van Ginkel Associates, produced the *Building in the North: Responding to the Environment* report in 1976. One of the most valuable aspects of this document is that it takes the time to describe many of the unique conditions impacting design and construction in the North. While slightly out-dated today, this paper still forms an excellent starting point for design, and this is why it will be used to help understand some of the unique conditions in the Canadian North later in this document. Some of the conditions described include permafrost, cold temperatures, daylight, wind, snow, snowdrifts, humidity, remoteness, and resource availability. The report then documents how these conditions impact the sitting, form, layout, materiality, structure, and energy use and production of building designs. The guideline is able to separate itself from others of the time because it does not discuss minimal technical requirements, but is concerned with a performance based architecture that responds to its environment, creating the potential for more unique and innovative designs. Unfortunately, this approach is lacking the presence of a culturally responsive archi-

Figure 14: Early Housing Evolution

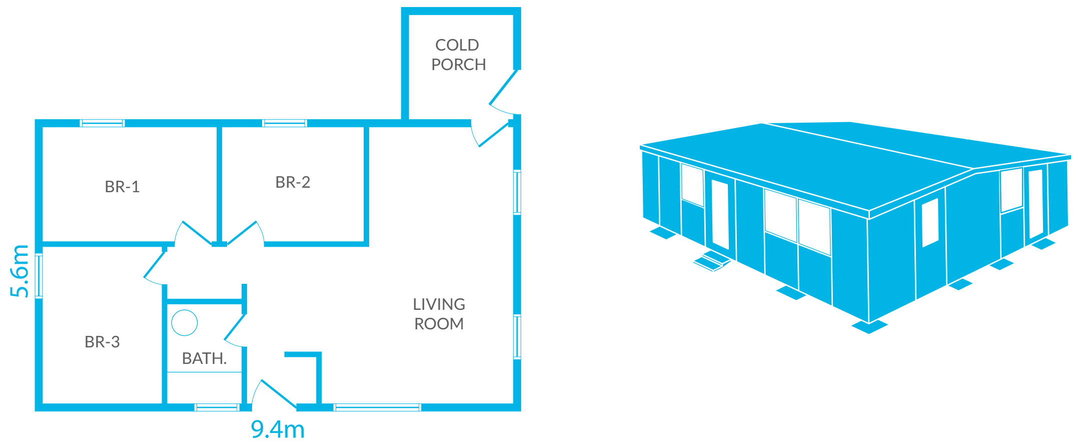




THE QARMAQ (1964)



THE URQUAQ (1966)



THE UKUVIK(1971)

tecture, and has resulted in projects like Ralph Erskine's proposal for housing for Resolute Bay, Nunavut, which seem very alien to their users and surroundings.

Housing design in the Canadian North was further influenced by the document *Design Guidelines and Technology for Northern Housing Construction* produced by the Department of Indian and Northern Affairs in 1982. The document was produced in part due to the rising energy costs, as well as observations that the houses built in the first two decades of permanent settlement, which were based on southern designs and standards, are unsuitable for the conditions found here. The goal was to increase the knowledge of building in this unique context for builders, designers, and anyone else related to the development of homes in the Canadian North. While brief and not nearly exhaustive enough, one of the first parts discusses the different programmatic needs for a home suited to the northern lifestyle, which is one of the first significant attempts to consider the end users in the design process. Further, this guide goes into great detail highlighting construction details and technical requirements for houses in this region. Unfortunately, due to its overreliance on technology and its very prescriptive nature, as opposed to a document that is performative in nature, it curbs creativity, innovation and any uniqueness from the design. Regardless, today it can be used as a basis for the technical understanding of a buildings design in the region, while at the time it led to better performing buildings, and a more knowledgeable building industry, which was a necessary step in the right direction.

Nearly five years later in 1987, the University of Winnipeg arranged another conference called *Northern Housing: Perspectives on Design and Construction*. The state of housing at the time of this conference was that the majority had developed distinct characteristics based on the "peculiar economic and logistic factors of the north" (Robson, 1987, p. 1). It was also noted that cultural responses had started to impact the design of housing through "the design of all-purpose sleeping areas, smaller sleeping quarters and additional storage space" (Robson, 1987, p. 2). The conference also reiterated a reoccurring problem, which is that often the Inuit had been left out of the design process. Also stated is that because there are so many issues to account for in the design of northern housing, the eventual design is just about overcoming these obstacles and not about enhancing the built environment. The five papers included in this publication are by Nils Larsson, Richard Bushell, Glen Wither, David McCann, and Richard Roberts, and offer up potential solutions to these issues. Despite the range of topics covered, the common characteristic between all the papers is their emphasis on the needs of the inhabitants (Robson, 1987, p. 4). In relation to housing design, the papers call for a variety of design considerations including the long-term effects that design has at the socio-economic level, the inclusion of spaces that respond to the unique culture, design based on a response to the environment, and the implementation of new technical knowledge and technologies. Unfortunately, while houses became more successful in function, they still neglected to address the uniqueness of the Inuit identity, and failed at the creation of homes for the Inuit. Also, some of the technical improvements suggested reflect southern standards and would be insufficient by today's standards, such as wall assemblies with an RSI value of 4.6. Further, some of the new building techniques proposed, such as the use of timber and steel piles, have become problematic today due to issues of frost heaving caused by the warming climate. Thus, while advancements had been made, the influence of Inuit culture on the design did not go far enough and the overreliance on new and improved building methods and technical standards was not only limiting, but also problematic.

While each of the previous documents help contribute to the development of housing in the North, they were ultimately ineffective in producing innovative and holistic housing designs. The overreliance of technology expressed in these documents were not only limiting, but at times counterintuitive due to overly complex technologies that could fail and breakdown, and to technological solutions that were simply wrong. Further, by just focusing on technology, inspiration from vernacular architecture and passive design strategies can be overlooked. The prescriptive nature of some of these documents also inhibited the evolution of housing design in this region. By simply following these standards, designs became one dimensional, monotonous, uninspiring and lacked innovation. Hence, they were unsuccessful in producing a truly regionally responsive architecture, which would not only respond to the challenges of living and building in the north, but also failed to take advantage of the opportunities. Lastly, these documents did not emphasize the significance of responding to the unique Inuit culture, which further resulted in the inadequacy of housing designs. While they called for house designs to respond the needs of the end users, these needs were often assumed to be the desire to modernize and assimilate to *Qablunaat* culture, as opposed to responding to their own culture. Thus, houses had to not only respond to the functional requirements of the Inuit lifestyle, but also had to evoke the Inuit identity in their design.

Due to the shortcomings of these previous publications, Harold Strub, an architect working in the Canadian North at the time, sought to fill this gap with his own design handbook titled *Bare Poles* published in 1996. In this book, Strub gives a comprehensive and insightful overview of building in high latitudes, covering the many options available, and discussing which have been successful and which have fallen short. The book provides a non-technical summary of the people, climate, and terrain found in the North, and then continues to discuss how these variables impact a building's programming, shape, orientation, location, construction methods, and materiality. Through this method, he successfully ties together the economic, climatic, social, and cultural conditions that affect architecture in the North, giving a performative analysis, as opposed to a purely technical or an excessively prescriptive document. Since its publication, this has been one of the primary handbooks for design in the North, however, nearly 20 years have passed, and the context has significantly changed due to a warming environment, a rapidly growing population, and just an overall improvement in the knowledge pool for building design and construction. Furthermore, the success of the documents content did not necessarily translate into its adoption, which is why many problems still persist in the Canadian North, and a truly regional responsive architecture of the North has not yet been developed. Regardless, this is still a valuable resource for anyone looking to design for an Inuit population, which is why it will be utilized in later parts of this thesis | project.

During the 20 years since the publication of *Bare Poles*, significant improvements were made to housing design in the Canadian North. However, the emphasis on design in this region was still based on how to overcome obstacles, as opposed to contributing positively to the built environment and working with the conditions to take advantage of unique opportunities. Further, the issue of sustainability in the built environment began to emerge as an important one, which had previously not been considered to a significant degree for housing design in the North. One response to this was the report *Healthy Housing in the North: Towards a Northern Healthy House* produced for the Canadian Mortgage and Housing Corporation (CMHC) in 2002. The report had a clear objective, which was to form strategies for the realization of sustainable and healthy homes in the region, which would "[address] and [enhance] the ecological sustainability, social appropriateness, and total (real) economic aspects of northern housing" (Bromley, Fancott, Frandrick, & Pin, 2002, p. iv). To achieve this goal, five healthy house principles were proposed and developed: occupant health, energy efficiency, resource efficiency, environment responsibility, and affordability. In order to implement these principles, the report calls for an integrated approach in which "the building orientation, form, envelope, systems, materials, and contents interact together" and results in a building "that will perform as a resource-efficient and cost-efficient dwelling, and that will enhance the occupants productivity and well-being" (Bromley, Fancott, Frandrick, & Pin, 2002, p. 49). Thus, much can be learned regarding building in the North from this report, which is why it will be used during the design stage of this thesis | project. While improvements were in fact made to the built environment due to emerging issues, it failed to produce a regionally responsive architecture for the North. Houses were now more technically sound, had better living conditions, were more affordable, and thus overall were more sustainable, but they still fell short on a cultural level, and continued to produce variations of the southern cookie cutter designs.

Despite all the progress made due to the previous documents, in 2005, the Government of Nunavut produced the *Good Building Practices Guideline* as a supplement to the *National Building Code,* which did little to contribute positively to the built environment. The guide is simply a technical reference handbook, which "contains performance guidelines, preferred materials or methods, and logistical considerations for the design and construction of northern facilities" (Community and Gov-

Figure 15: Housing Examples from Cambridge Bay (Opposite)








ernment Services Nunavut, 2005, p. 6). Unfortunately, this is not a binding code such as the *Ontario Building Code*, thus it acts as a set of standards to aim for, which may not always be achieved. The significant problem with this guideline is that the minimums it presents are actually far below what they should be, especially because it would be safe to assume most buildings will fall just below these standards due to cost cutting strategies. One such example is how it calls for an exterior wall insulation value of RSI 4.9, when an ideal building in the North should have an RSI value of 7.0 to 10.0 (Arctic Energy Alliance, 2012, p. 7). Hence, while only addressing the technical requirements of building in the North, the standards of this 'good' building practices guideline should at least reflect the reality of building an environmentally sustainable building in this region in order to be effective.

Some Recent Approaches to Housing

With an understanding of the shortcomings of the latest guidelines for building in the North, the CMHC and the Cold Climate Housing Research Centre (CCHRC) have taken a more active approach in order to improve the housing situation in the North. To accomplish this, they have not only released numerous documents online, which include technical standards, case studies, and research projects, but have also undertaken the design and construction of prototype houses. In doing so, they go above and beyond guidelines by showing what can be done beyond the norm, setting an example for other houses to be built in the future.

The Northern Sustainable House, designed by the CMHC in 2006 was the product of charrettes that occurred with the Inuit of Arviat, Nunavut in 2005. The objective of this design was to respond to the local culture better, while also improving energy consumptions to 50% of the Model National Energy Code for Housing (MNECH) (Canadian Mortgage and Housing Corporation, 2007, p. 10). Thus, through the charrettes, four areas of improvement were identified: to minimize building and operating costs, to respond to the unique lifestyle of the contemporary Inuit, to accommodate the needs of all members in a family, and to improve interior comfort. The design was successful in that it included many spaces, responding to the needs of their traditional culture and activities. The technical improvements made in the design, such as the increased insulation values and efficient appliances also resulted in energy saving costs of nearly $8000 per year over the typical house design (Semple, 2010). Despite these significant improvements, the design fails to address the uniqueness of the Inuit identity, and does not respond to the environment in any significant manner. While improving many of the spaces and accounting for different cultural activities to take place the design is still lacking, as none of the spaces are identifiable as uniquely Inuit, and they do not necessarily encourage Inuit activities to take place. Further, by just being a single detached dwelling, it fails to address issues of community design, and doesn't allow for any variability to occur. Thus, this design is only just a starting point and much more work has to be done.

The Quinhagak Prototype home was completed in 2010 by the CCHRC in the Yup'ik village of Quinhagak, Alaska. The design was also influence by charrettes with the local population, who identified the major housing challenges to be material shipping costs, moisture migration, the effects of wind and operating costs. The form was inspired from the vernacular *igluit* (snow house), whose circular shape and low profile reduced impacts from the wind, reduced heat lose due to its decreased surface-to-volume ratio, and prevented snow drifting against the building. The design also utilized an arctic entry, which is a two stage entry, preventing heat loss and the penetration of moist air. The design also takes advantage of spray foam insulation

Figure 16: Render of the Northern Sustainable House

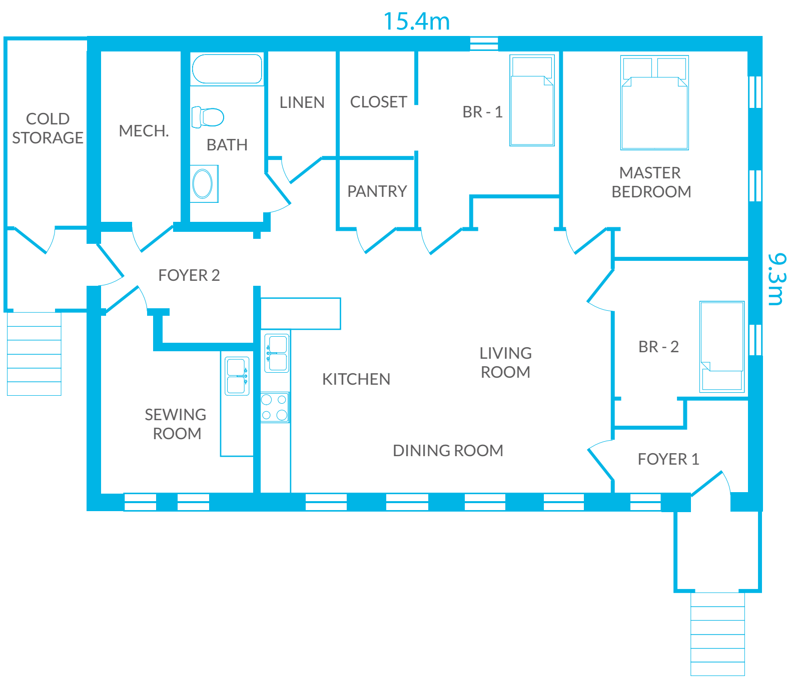
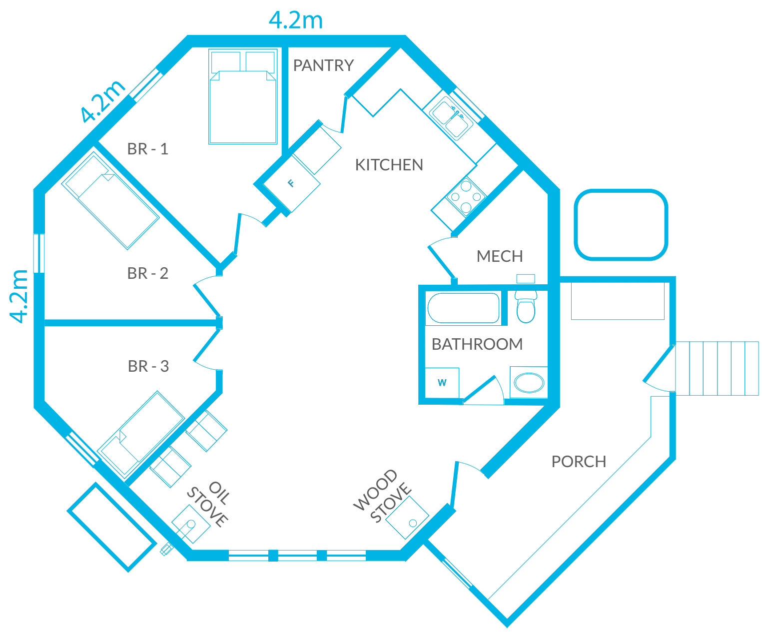


Figure 17: The Northern Sustainable House Floor Plan

due to its high thermal resistance and minimal shipping bulk, while it also ensures a continuous envelope and prevents thermal bridging. Further, materials were chosen for their ease of shipping and constructability, allowing the building to be completed in a six week period by a local construction crew. However, despite the high insulation value of the floor, the fact that it rests on the ground can be problematic for areas where frost heaving may occur. The use of a octagonal plan in combination with a primarily *Qablunaat* program has created very awkward interior spaces. The closed ended nature of the octagonal plan is also very limiting in that it offers no possibility for any variations, meaning that this design will be repeated over and over again, creating a monotonous built environment. The interior spaces also fail to do enough to address the uniqueness of the Yup'ik culture, while aside from being an octagon in plan, it still looks very much like an imported design.

Figure 18: The Quinhagak Prototype Home

Figure 19: The Quinhagak Prototype Home Floor Plan



The Buckland Prototype home, which was designed in 2011 by the CCHRC and located in the Inupiat village of Buckland, Alaska, also utilized the charrette process to influence the design. Two of the primary contributing factors to the design were the concern for solar orientation and the effects of the prevailing winds. Hence, the buildings form is a direct response to the environmental conditions, in which the roof edge runs diagonally, so the smaller walls face the wind, and the larger south facing wall has more glazing. The building also utilizes a prefabricated integrated truss system for the floor, walls, and roof, which allows for quick construction, a heavily insulated envelope, with minimal thermal bridges. While the construction technique is fairly innovative, and the form is moving in the right direction for a regionally responsive architecture that can be identified as just that, the program falls short of responding to the culture of the Inupiat, as it is a typical *Qablunaat* plan.

Thus, while some of these documents and prototypes have contributed positively to the knowledge base of housing design and construction in the Canadian North,

Figure 20: The Buckland Prototype House

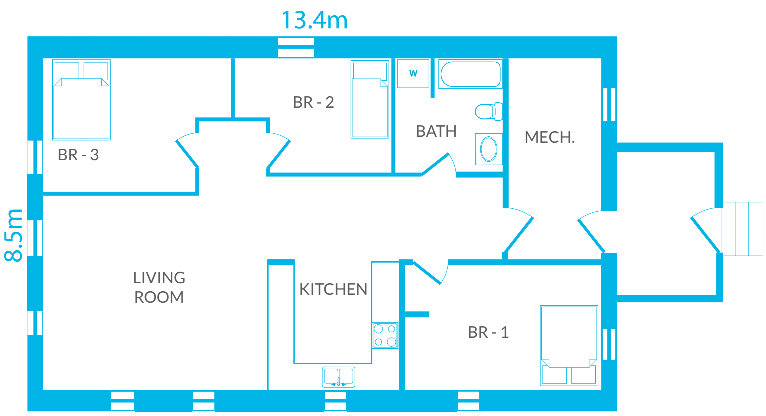


Figure 21: The Buckland Prototype House Floor Plan

there has been a failure to establish a regional architecture that is both culturally appropriate and economically feasible. Most of the structures built are still designed based on cost effectiveness and climatic conditions. They are often just adaptations of *Qablunaat* housing, and are neither aesthetically pleasing nor culturally appropriate. Until a regional responsive architecture, which responds to the economic, environmental and cultural conditions in a meaningful way is established, the shortcomings of housing design will continue to be repeated, creating a significantly worse situation as time goes on.

A Utilitarian Architecture

Many of the shortcomings of housing architecture found in the Canadian North can also be found in the other building types found in this region. The lack of local materials, the remote location, the harsh climate and the absence of an advanced construction industry have created an architecture of efficiency, or more accurately stated, the lack thereof architecture. The result is that buildings are designed around transportation logistics and the economics of construction. Consequently most buildings are pre-fabricated structures or temporary structure converted to permanent use. Further, most buildings are just boxes, with minimal windows, and clad in a typical metal or vinyl panel. While these building are quickly constructed and cost

Figure 22: Cambridge Bay Recreation Centre
An example of the overtly utilitarian buildings constructed throughout Nunavut

effective, they fail to respond in a meaningful way to the unique conditions of the region, primarily the Inuit culture, and the extreme environment.

Futurism in The Arctic

Despite the lack of a regional responsive architecture in the Arctic, during the 1950s, 1960s and 1970s there were a few proposals that attempted to address the conditions in this region in unique ways. These projects were inspired by the neo-futurist movement occurring at the time, with many of the projects focusing on mastery over the environment, as opposed to integration with the environment. The result was a space age like aesthetic reflective of modern life, incorporating new materials and technologies.

The first three projects discussed are proposed master plans for Frobisher Bay, Nunavut (now Iqaluit). The first proposal from 1958, titled Frobisher Bay New Town I was developed in response to increased growth of the town. The proposal called for a central communal dome containing public programs, which was to be surrounded and protected from what was viewed as an inhospitable environment by clusters of high-rise towers that housed 1000 residents. The towers were connected to each other and to the central dome through a covered circulation route, further isolating the built world from the natural environment. Two years later in 1960, the proposal was adjusted to make it more economical and was titled Frobisher Bay New Town II. The new proposal consisted of a central raised plaza, which contained the public and commercial programs below, which was then surrounded by three 6 to 8 storey towers, which were to house the 1000 residents. These residential buildings also contained commercial and public programs at grade, and they created a barrier to protect the centre from environmental forces. Both of these proposals, due to their introverted and closed ended nature, represent an autonomous approach to the environmental and cultural context of the region. However, the project never came to fruition as a result of the changing political attitudes toward arctic development, only to have interest peak again in the mid 1970s.

In 1974, Moshe Safdie was commissioned to design a 10 year plan for the growth of the settlement at Frobisher Bay. The Safdie proposal consisted of large public and commercial buildings placed at the top of a hill, while the detached residential units were placed to the south and on the downward slope of the hill, which as opposed to previous schemes, was open ended to allow for future growth. Further, as opposed to the autonomous whole created by the enclosing perimeter buildings of the previous

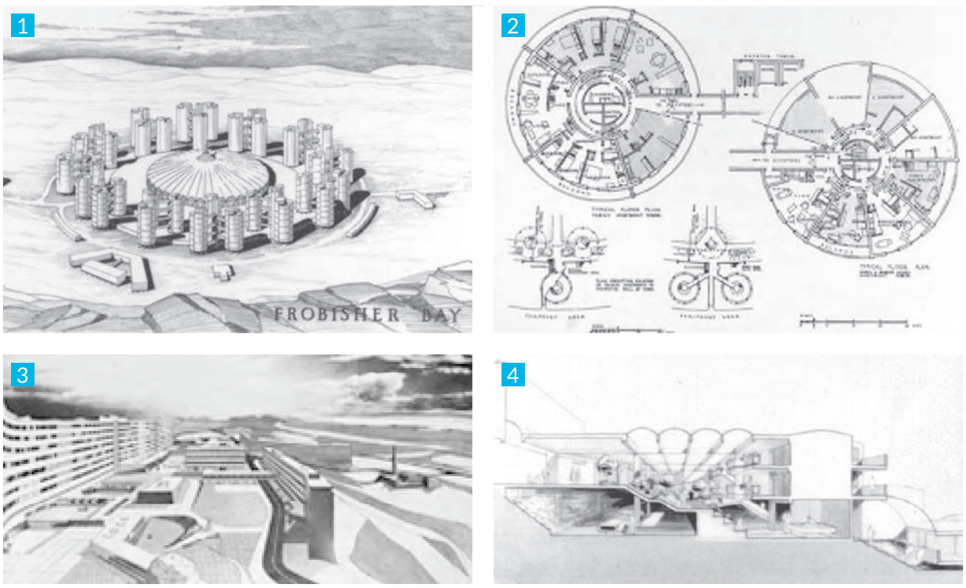


Figure 23: Frobisher Bay Proposals
1. Frobisher Bay New Town I Perspective
2. Frobisher Bay New Town I Plan
3. Frobisher Bay New Town II
4. Frobisher Bay Safdie Proposal:

proposals, autonomy was created at the individual scale of the residential buildings. The residential buildings were hermitically sealed, two storey octagonal structures that were designed to deflect the wind while preventing snowdrifts from occurring. Thus, this project does not propose a complete separation from nature as the previous proposals, but it represents an inappropriate *Qablunaat* interpretation of the region by viewing the environment as inhospitable, as displayed by the large scale, self-contained public buildings and the residences, which do not attempt to connect with the surrounding landscape.

In 1971, Ralph Erskine was commissioned to adapt his theoretical Arctic Town Plan into a master plan for Resolute, Nunavut, which was to relocate the distinct Inuit and *Qablunaat* communities that had formed around the airport to a new town that contained housing, public spaces, and commercial spaces. While the proposal still represented the megastructures of the Frobisher Bay proposals, which housed multiple programs, creating a complete separation from the environment, Erskine's proposal displays a thoughtful attempt to engage with the local Inuit population and the environmental conditions. To accomplish this, much like the Frobisher Bay New Town proposals, a perimeter wall multi-functional building was proposed to sur-

Figure 24: Ralph Erskine's Proposed Community for Resolute, NU

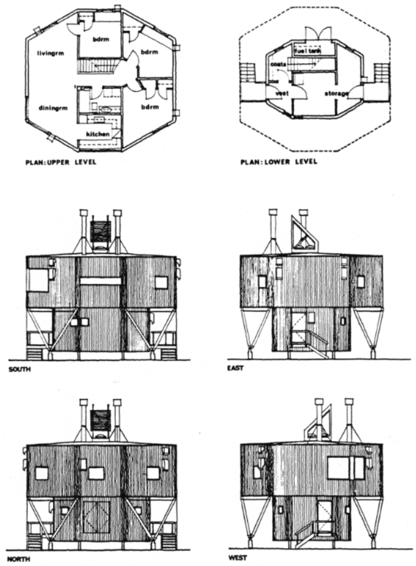


Figure 25: Erskine's Proposed Residential Units for Resolute, NU
(Left)

Figure 26: Built Portion of Erskine's Proposal for Resolute, NU
(Right)

round the town in a horseshoe shape, in order to protect the interior from the harsh winds and snowdrifts. Contained within the protected space would be spaces for communal interaction, and the individual housing units, which were compact, efficient forms, which maximized daylight and reduced snowdrifts. The aesthetics and form of the project were driven by an engagement and response to the environment, which is one of the first northern projects to do this in a meaningful way. However, his preference to devote budget to form, while using cost effective materials, is counterintuitive to the Inuit's appreciation of materiality. Also, while the Inuit were engaged in the design process, the response was to improve their living conditions, but the buildings still lacked a cultural relevance. Only a portion of the perimeter building was ever completed, but the advancements made toward designing in the North by Ralph Erskine are still very important, which is why his theories will be discussed later.

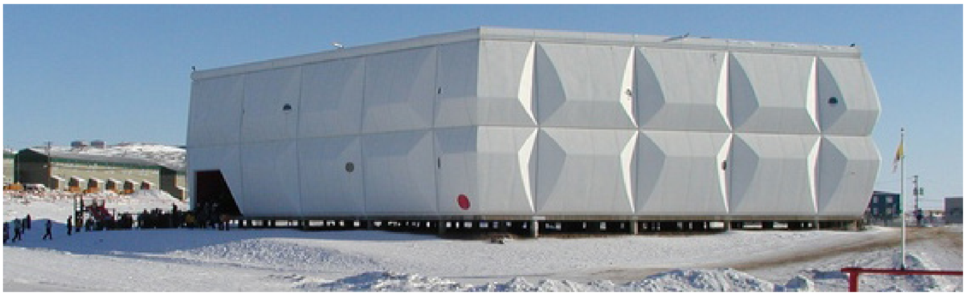
There are three significant built projects that represent this neo-futurist approach to architecture, which were designed as individual structures and not as part of a larger master plan. The first is the mushroom shaped Igloolik Research Centre, built in 1975. The form of this building is a direct response to the environmental conditions in which the aerodynamic minimizes air turbulence, and reduces the snowdrifts around the building. Despite the effectiveness of this form, it is not very a very practical form for most building functions, while it further does not address the Inuit culture.

The Inuksuk High School, completed in 1970, and the Nakasuk Elementary School, completed in 1973, were designed by Quebec architects Papineau Gerin-Lajoie LeBlanc Architects. These structures are dominated by the repetitive use of fiberglass panels, which were designed for prefabrication and nested packaging in response to the high cost of shipping. The use of panels also allowed for rapid installation, while

Figure 27: Igloolik Research Centre

Figure 28: Inuksuk High School, Iqaluit, NU

Figure 29: Nakasuk Elementary School, Iqaluit, NU



also shutting out the harsh climate. Further, the masses were elevated to prevent permafrost melting, and the forms deflected wind and snow. However, to block out the exterior environment, fenestration was minimal, with only small porthole windows, creating an interior environment with poor daylight and ventilation. The large massing and alien aesthetic resulted in a building that has failed to integrate into the environment, and has no cultural relevance to the Inuit users.

The neo-futurist projects presented in this section depict examples of a search for a more appropriate architecture in the North. The projects have gone to far greater lengths to create a better living environment for the users than the housing designs provided for them during this period. They have all displayed a unique and different way of responding to the environmental and economic conditions affecting architecture in the North, and the lessons learned here can be utilized today. However, all these projects have failed in one way or another in responding to the Inuit culture in a meaningful way.

A Culturally Appropriate Response?

The need for a cultural relevant, contemporary architecture for the Inuit who now resided in permanent settlements became more evident as the buildings provided for them resulted in many challenges. One such attempt to provide a culturally meaningful architecture were the prototype houses built by the Canadian Government in Cape Dorset, Nunavut between 1956 and 1959. As described by Arctic anthropologist Peter C. Dawson (1997), these dwellings mimicked the form of the Inuit *igluit*, but utilized translucent foam blocks and an adhesive sealant, as opposed to the snow blocks found in the vernacular structure (pp. 223-224). The design allowed for a low construction cost, a simple construction method, a high insulation value and an abundance of natural daylight, but overtime the Styrofoam blocks broke down due to exposure to the harsh winds and ultra violet light (Dawson, 1997, p. 224).

Another attempt to respond to Inuit culture in housing were the double-walled canvas tents, which were meant to resemble the *tupiq*, the traditional skin tent used for summer and spring dwelling. Dawson (1997) depicts this structure as having a layer of canvas, a wood frame filled with fiberglass insulation, and then another layer of canvas. The design proved to be more costly to build than estimated, and they also broke down from the constant exposure to ultra violet light (pp. 226-228).

Some of the most recent attempts to represent Inuit culture in their architecture include St. Jude's Cathedral in Iqaluit, Nunavut, which was completed in 2012, and Our Lady of Victory Parish in Inuvik, Northwest Territories, which was completed in 1960. These structures attempt to address Inuit culture by mimicking the form of the *igluit*. However, this is just a merely symbolic gesture as the form of the *igluit* is derived from a response to the harsh environmental forces acting on home, and the material properties of snow. Thus, the churches represent neither a culturally relevant or environmental responsive architecture, but a mere caricature of the *igluit*.

The many attempts to derive a culturally appropriate architecture for the Inuit have thus resulted in a disneyfication of their traditional forms. As opposed to analyzing the Inuit vernacular on a superficial level, an analysis of the logic behind these structures will reveal strategies that can be applied to the design of a contemporary Inuit home that will be culturally appropriate in both its identity and function.

Figure 30: The Disneyfication Process
Creating a caricature out of a historical building style

Figure 31: Our Lady of Victory Parish, Inuvik, NT

Figure 32: St. Jude's Cathedral, Iqaluit, NU

2.4 The Current State of House

In order to highlight the housing situation, which many of the Inuit in the Canadian North are facing, statistics and examples from Nunavut will be used, while keeping in mind the fact that similar challenges are occurring in the Northwest Territories, Nunavik, and Nunatsiavut.

Affordability

The unique environmental and economic conditions of Nunavut have made it so construction, maintenance, and operation costs for a typical house are much greater than anywhere else in Canada. As defined by CMHC, affordable housing is that in which less than 30% of a household's income is spent on shelter (Statistics Canada, 2010, p. 10). Hence, despite the slightly higher average incomes in Nunavut, it is not proportionally higher to the cost of living, and there is still a large unemployed population, thus a majority of the population can neither afford to own or build their own house nor can they afford the yearly maintenance and operating fees. The costs associated with construction, maintenance, and operations will further be broken down in Chapter 4.3.

Ownership

Home ownership in Nunavut is over three times less than the national average, while those that do own homes pay around $1141.00 per month, which is 31% more than in the rest of Canada (Nunatsiaq News, 2013). The high cost to purchase a home, the restrictions placed on obtaining a mortgage or construction loan, misunderstandings about the credit system, and the high unemployment rate have made the possibility of home ownership unachievable for most *Nunavummuit*. Further, there is practically no private rental housing available, the majority of rental housing in Nunavut is social housing and the balance is government staff housing (Canadian Mortgage and Housing Corporation, 2008, p. 68)

Hidden Homelessness

Nearly 4% of Nunavut's population do not have a place to call their own home, living in another person's dwelling for a part of the year (Nunavut Bureau of Statistics, 2011, p. 4). Nearly a third of the houses in Nunavut have taken in a temporary resident for a part of the year (Nunavut Bureau of Statistics, 2011, p. 4), which essential *hides* the homeless population, and thus masks the severity of the issue.

Housing Shortage

The high cost of construction, in combination with the natural birth rate, and the influx of *Qablunaat* workers has resulted in a housing shortage in Nunavut. As of 2011, they are short over 3,500 houses (Nunavut Housing Corporation, 2012, p.

9400

8550 OCCUPIED
4230 < STANDARD
2930 CROWDED
3580 SHORTAGE

57.5%
SUBSIDIZED HOUSING

OPERATING COST
+$25,750
PER YEAR

CROWDED MEDIAN 6
UNCROWDED MEDIAN 3

51%
$510,000
UNIT

26%
$400,000
UNIT

1 IN 5
WAITING LIST

CROWDED
1810
NEED 1 BEDROOM
50%
IN LIVING ROOM

4%
HIDDEN HOMELESS
1200
1/3
HOUSE HOMELESS

150-200

DEMAND PER YEAR

85.0%
60.0%

	Nunavut	
OWNERSHIP	21.0%	69.0%
HOUSEHOLD SIZE	3.84	2.50
AFFORDABLE	6.3%	24.7%
CROWDED	30.5%	6.0%
INADEQUATE	27.6%	7.4%
MULTI-FAMILY	10.6%	2.0%

34), but this figure does not account for population growth, which means this number will increase annually. Unfortunately, due to the high cost of construction, the Nunavut Housing Corporation cannot keep up with the demand.

Household Size

The average household size in Nunavut is 3.84, which is much larger than the national average of 2.50 (Statistics Canada, 2011). The high number is aided by the fact that a significant number of the houses in Nunavut are multi-family households, while there is small number of single person households in comparison with the national average (Canadian Mortgage and Housing Corporation, 2008, p. 67). Traditionally, the Inuit lived in multi-family households, as they value familial relationships and the sharing of resources between an extended family. Another significant contribution to this large household size is the high cost of operating and maintaining a house, so people often live together to share costs. Further, there is already a housing shortage in Nunavut, so the Nunavummuit often have no choice but to share a residence.

Crowding

The large household size, in combination with the high cost of housing, has meant large families are forced to live in houses that are too small for them. Thus one third of the houses in Nunavut are considered overcrowded, while the Canadian average of overcrowded houses is only 6% (Statistics Canada, 2010, p. 8). While the median household size for uncrowded houses is three, the median household size for crowded households is six (Statistics Canada, 2010, p. 8). It should also be noted that the majority of these are considered crowded because they fall short by one bedroom (Nunavut Bureau of Statistics, 2011, p. 2). Thus, the typical size of the home in Nunavut needs to be larger to accommodate the larger Inuit family size in order to prevent a crowded condition.

Adequacy

Housing adequacy is defined as those homes, which are not in need of any major repair, thus their basic services are at least able to function. Nearly a quarter of the houses in Nunavut are defined as inadequate, which is nearly four times the Canadian average (Nunavut Bureau of Statistics, 2011, p. 7). Not only do these houses no longer function properly, their poor condition has also resulted in health risks due to poor thermal comfort and air quality. The minimal funding for repairs, the lack of local skilled trades, lack of local construction and repair resources, and the continuous delivery of inappropriately designed houses ensure that this trend will continue for the near future.

Improper housing design for the extreme climate found in this region has contributed

Figure 33: Nunavut Housing Statistics (Opposite)

to the degradation of the buildings physical condition. Materials have weathered overtime, envelope systems have failed, foundations have shifted, and new technologies have broken down without resources available to fix them. Further, the overcrowding of dwellings has resulted in its overuse, resulting in a faster deterioration of its physical condition. The introduction of housing designed for the *Qablunaat* lifestyle to the Inuit has also resulted in their deteriorating condition because of improper use, and the lack of knowledge on how to repair and maintain the building.

Lifestyle Suitability

The housing designed for the *Qablunaat* lifestyle has had some significant consequences on the Inuit inhabitants. It has forced them to alter their lifestyles around this foreign building, which has increased the rate of acculturation, eroding the Inuit's traditional knowledge and lifestyle, and thus their unique identity. Attempts to retain certain aspects of their traditional lifestyle have resulted in improvisations to the intended functions of the houses. Dawson noted to observing families "butchering seals in living rooms, storing the meat in bathtubs, and repairing mechanized hunting equipment in living rooms, bedrooms, and kitchens" (Dawson, 2006, p. 114). The compartmentalized nature of these houses, especially of the living areas such as the kitchen, eating area, and living room, has isolated people from one another, as opposed to encouraging socializing and interaction, which is a significant part of the Inuit lifestyle. As seen in the open nature of traditional Inuit dwellings, different activities take place in one large highly integrated space, but the *Qablunaat* design makes it so these activities are scattered across the house (Dawson, 2006, p. 130). As found in the traditional dwellings, there are no large integrated spaces to allow for large family meals, the butchering of animals, for small drum dances and musical gatherings to occur, for children to play, for skins to be stored and stretched, for sewing and for crafts to be made. Due to the crowded nature of the home, and the need to use bedrooms for other activities that weren't accounted for in the design, living rooms would often double as bedrooms, further impeding the activities that could occur in this space. The *Qablunaat* kitchen is not meant for the preparation or consumption of country foods, so the preparation of such food often occurs outside, and is then consumed communally, usually on the floor of the kitchen with all the furniture removed in order to accommodate a large group (Dawson, 2006, p. 127). Thus, the spaces of a home need to be reimagined in order to allow for traditional food to be prepared and consumed in larger groups in a sheltered open area. In instances when traditional food is prepared inside, it usually involves a lot of boiling, which results in high condensation levels and the formation of ice on windows and the warping of floors and walls (Dawson, 2003, p. 12). However, when store bought food was consumed as opposed to traditional food, families would eat at the kitchen table as opposed to the floor, which indicates that both types of meals need to be accounted for in design. Both secluded and open areas also need to be accounted for to suit the different needs of the young and old generations, allowing for both times of individual privacy and socializing (Canadian Mortgage and Housing Corporation, 2007, p. 17).

Also, as observed by Dawson (2003, 2006), storage spaces are a challenge, as they is not accounted for in the *Qablunaat* designed house. Many items such as skins, meat, and hide clothing need to be stored in cold spaces, which are absent or small in size in the design of their houses. There are also many household items such as sewing equipment, large cooking pots, hunting equipment, and toys that need to stored in warm spaces, which are not accounted for in design. The inadequate storage has resulted in every available surface containing shelving to store these items, which were often in highly used spaces, impeding the functionality of the house and giving the home a cluttered appearance.

The sewing of skins and hides which is an important task performed by women in Inuit culture is also not accounted for in design. Sewing needs to occur in larger workspaces that are colder than normal to prevent the skins from cracking, but no such space occurs in the *Qablunaat* design, so either the interior temperature of the house was reduced, or sewing occurred in cold porches or in larger crawl spaces (Dawson, 2003, p. 27). Carving, which has become an indispensable part of the Inuit economy, has also not been considered in the design of houses. In the cold weather, carvers are forced to work inside, which creates a significant mess and noise, and also releases airborne dust particles into the houses ventilation system, causing it to malfunction, resulting in poor interior air quality (Dawson, 2006, pp. 127-130). While many activities such as the repairing of equipment and hunting preparation should take place outside of the house, there are no provisions taken to allow these to occur in the cold temperatures or severe weather systems, which results in these functions sometimes occurring in spaces that are meant for bedrooms (Dawson, 2003, p. 33). Aside from the lack of sheltered workspaces that are not accounted for in the site design, outdoor storage of vehicles, equipment and animal parts is also not considered. The result is the cluttered appearance of yards, which are covered with snowmobile parts, sleds, fuel containers, frozen animal parts, skins, drying racks, skin stretchers, and hunting traps (Strub, 1996, p. 37). Site access has also not been considered, which results in many pedestrian, ATV and snowmobile shortcuts occurring through these sites, which disrupt activities that should occur in these spaces. Thus, sites need to be better designed to account for the activities, which are intended to occur outside of the main dwelling.

Windows are also a concern, as they are small in size minimizing the amount of daylight that enters the house, while also not encouraging views to the outside. Further, views and orientation are rarely considered in the placement of windows, so their effects are further minimized. Residents also thought that the current houses were insufficient in the number of bathrooms, shelving and light switches they had, and that improvements needed to be made to kitchen counters, sinks, door knobs,

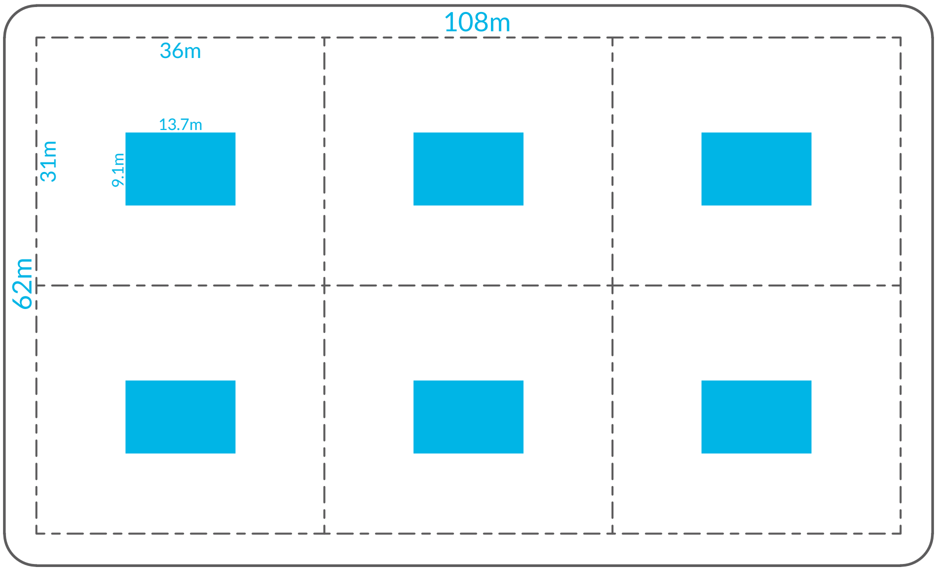


Figure 34: Typical Proposed Block Plan
The typical division of property found in new developments in Nunavut, which mimics the *Qablunaat* site planning practices

cabinets, steel doors and ventilation (Canadian Mortgage and Housing Corporation, 2007, p. 15).

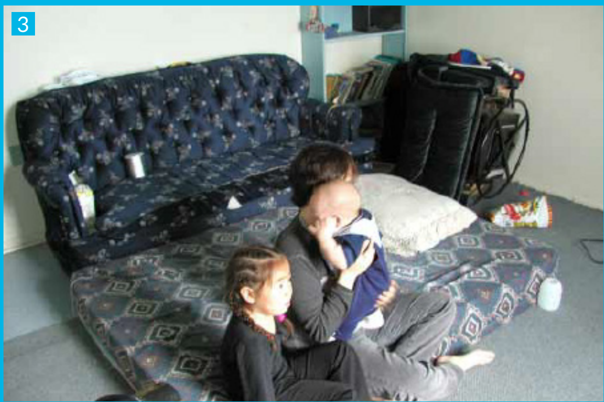
Other challenges have been created through the manner in which services are delivered to each house. The method of delivering utilities through utilidors, while reliable, break up the landscape, creating access issues, and are visual eyesores which take away from the beauty of the landscape, which is so important to well being of the Inuit. On the other hand, the manner in providing some utilities (water, sewage and oil) on an individual basis through trucks is problematic, as it can be unreliable with the weather found in Nunavut, resulting in houses being without water or heat for several days. Thus, the approach to delivery utilities in Nunavut needs to better reflect the needs of the Inuit, and the environmental realities of living in the North.

The size, type and planning of housing is also not reflective of the Inuit culture. As mentioned earlier, housing units are often too small to suit the larger nature of the Inuit family. The relationships between the dwellings also do not reflect the importance of establishing a relationship with the land, and the significance of communal and familial relationships. Houses are treated as isolated entities, which shut out the environment, while in multiplexes, opportunities for communal interactions are overlooked, and a relationship with the land is even further diminished. There is also a preference to build multiplexes and larger multi-unit housing projects, which is counter intuitive to the Inuit preference for detached houses (Canadian Mortgage and Housing Corporation, 2007, p. 12). Inuit homes need to be more intimate in scale, allowing for both visual and physical access to the land, which is made impossible by large multi storey apartment buildings. While the units themselves need to be larger to accommodate a larger extended family, some opportunities for relationships between households can be taken advantage of through proximity and access, as well as the sharing of spaces between dwellings. Further, the division of property

Figure 35: Houses in Use
1. Crowded storage area
2. Family eating on kitchen floor
3. Bed in living room
4. Bed in living room
5. Preparing traditional food
6. Butchering meat outside of house
7. Carving on front steps of house
8. Socializing

1

2



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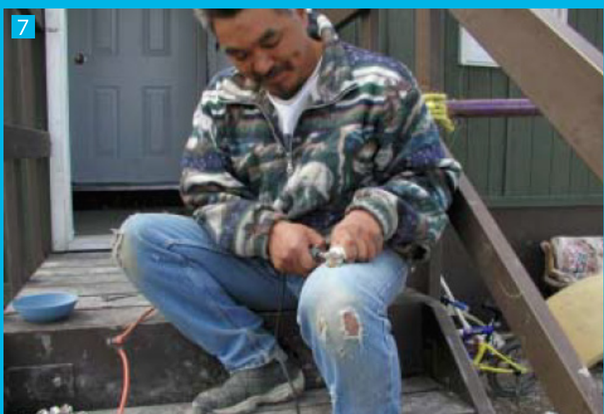

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is also a foreign concept, so the current practice of delineating boundaries between structures should be abandoned so that homes in close proximity to each other can form clusters that share the land for community uses and other ancillary structures.

Thus, these houses and sites are inadequately designed to suit the needs of the Inuit resulting in the loss of their practices and identity, as well as no sense of pride or ownership in their home. Further, when these spaces have been adapted to meet their needs it has resulted in the poor physical condition of the structures, as well as increased health risks for the inhabitants.

Acceptable Housing Stock

Acceptable housing refers to housing that is adequate, suitable and affordable. As stated earlier, adequate houses are those that do not require any major repair. Suitable houses are those that are appropriate in size for their household number. Another indicator of suitability can be said to be its appropriateness for the households lifestyle, but this is hard to quantify, and it can be assumed that the majority of houses do not meet this standard. Affordable houses are those that cost less than 30% of before tax household incomes, which can include rent, utilities, maintenance, and other associated costs. Due to the highly subsidized nature of housing in Nunavut, it can be assumed that most households do not meet this criterion, despite technically being affordable for its inhabitants. Consequently, affordability will not be included in determining the unacceptable housing stock. In looking at suitability and adequacy together, it is determine that 49% of the housing stock in Nunavut is unacceptable (Statistics Canada, 2010, p. 10). Thus, considering the previous assumptions, the housing situation is even worse than the 49% figure of unacceptable houses, highlighting the extent and urgency of the situation.

Identity

While the functional design of a house can either impede or encourage the preservation of traditional Inuit practices, and thus their unique contemporary culture, the identity of the building can also help reinforce the Inuit culture. As a representation of their unique identity, the dwelling reinforces their distinctiveness as a people, and can instill a sense of pride in their home and themselves. The result is significant contribution to the process of self-actualization, which leads to the participation in more traditional practices, and thus happier inhabitants, who are able to deal with challenges they are facing. Further, this pride in their home can contribute positively to its physical condition, as a sense of ownership is established. However, presently the existing housing stock is not representative of the unique Inuit identity, but is a mere repetition of *Qablunaat* houses, which furthers the process of acculturation. These houses have a rather boring, utilitarian and even depressing aesthetic, which does nothing to promote a sense of pride in one's home, nor the notion of Inuit uniqueness. Thus, Inuit homes going forward must consist of an architectural language that is not only different from that of *Qablunaat* houses, but is representative of the facets of the Inuit identity.

A Note of Sustainability

Despite detesting the term *sustainability* for the extensive green washing that has occurred in response to fear mongering and the development of irrational "solutions", it non-the-less represents an intention to do good that has resulted in numerous improvements to the built environment. In looking at ecological sustainability, it has become our ethical mandate to design buildings that will help maintain the integrity of the natural environment. Thus, any new built project, no matter what the context, should strive to achieve this goal. However, most of the projects that have been built, and continue to be built in the Canadian North have been anything but sustainable, especially on the ecological level. Most designs have little regard for local materials, solar orientation, wind direction and annual climatic variations, which were all accounted for in the vernacular dwellings of the Inuit. The majority of dwellings have been designed from the view that fossil fuels are cheap and bountiful, failing to account for the damage they do to the environment, and the long-term rise in price. A significant amount of heating from oil furnaces is required as most houses are under insulated, and a diesel-burning generator provides the only source of electricity, resulting in a largely unsustainable form of development. The irony is that a significant Inuit belief is the need to live in harmony with the natural environment, and that in attempting to modernize the Inuit their reality has moved away from this belief, until recently when the *Qablunaat* have realized its merit.

Lessons Learned

The present housing situation in Nunavut has highlighted the need to involve the Inuit in the design, planning, construction, operation and maintenance of their housing. In doing so, the future homes will be appropriate for the size of the Inuit family, while also respond to their unique lifestyle. Further, interior comfort in design is a significant issue that has to be addressed, in order to respond to the cultural activities that will occur within, and the environmental forces acting on the building. The achievement of interior comfort should also consider operation costs, as utility bills are significantly expensive, which is why passive strategies should be considered. Cost and time of construction should be reduced, without compromising the durability of the building, which has become an issue with the existing housing stock.

2.5 Future of the North

While there remain to be many challenges that need to be overcome in the Canadian North, the future of this region is one of significant potential for advancement and change. The global conditions that have arisen in the past few decades have created significant potential for resources extraction in this region. If capitalized, the result will be significant development and an influx of people and capital. However, at the other end of the spectrum, there is potential for environmental degradation, sovereignty issues, and a further loss of the Inuit culture. The significant threat here is that the short term gains for the Inuit may come at the "expense of more traditional activities which characterize [their] mixed subsistence based economy that are so vital for the long term economic and social health of their communities" (Inuit Tapiriit Kanatami, 2004, p. 14). The loss of their traditional way of life has resulted in the adoption of a lifestyle that does not result in sustainable inhabitation of the region and an inability to confront the many challenges which the Inuit population face today. The question of the viability of successful long-term inhabitation in this region is then raised. In order to achieve successful inhabitation here, it is important to prevent the disappearance of their way of life and cultural identity, allowing for an organic evolution. To achieve this, the changes that are predicted to occur in this region must be understood in order to properly respond to them.

One of the first areas to consider in terms of the future conditions of the Canadian North are the changing environmental conditions. The most significant change that is occurring is that as a result of global climate change, the temperatures in the past few decades in this region have increased at twice the rate as anywhere in the world (Hassol, 2004, p. 9). The reason for this is because the areas in high latitudes have experienced the initial effects of climate change, resulting in reduced snow and ice cover, which in turn has allowed solar energy to heat the ground and water more effectively, as opposed to reflecting back into the atmosphere (Bone, 2011, p. 66). The trend of a warming climate is likely to continue during the next century, resulting in many changes to the physical landscape, natural systems, and socio-economic characteristics.

The temperature rise in the Canadian North will continue to result in the melting of glaciers and sea ice (Emmerson, 2010, p. 128). Consequently, the river flows will increase, along with the sea level. Further changes to transpire are a shorter period of river and lake ice, declining snow cover, thawing of the permafrost, and an increase in precipitation (Hassol, 2004, pp. 12-13). The result of these changes to the physical landscape of this region will be a change in the make up of the biodiversity, the creation of economic and development opportunities, disturbances to existing settlements, and adjustments in the way of life of the Inuit.

A further result of the warming will be a transformation to the biodiversity of the region. With the warming temperature, the tree line, and vegetation zones will shift further north, but soil quality might still prevent this from happening in specific areas (Hassol, 2004, p. 14). The melting of the permafrost will also cause a shift in wetland locations, with some draining, and thus forming in other areas (Hassol, 2004, p. 14). With these changes, some species will also move north, which will increase the biodiversity of the region, but will also cause disruption to the existing ecological cycles (Hassol, 2004, p. 14). The existing population of marine mammals and birds will become at risk as their territory is reduced due to the melting of the sea ice (Hassol, 2004, p. 14). Land animals such as caribou and the arctic fox will also be at risk due to deviations to their food sources, migration routes, and breeding grounds (Hassol, 2004, p. 14). Lastly, more insects will be found in the north, which aside from being a nuisance to both animals and humans will also spread diseases (Hassol, 2004, p. 14). The potential adjustments to biodiversity will thus create new opportunities, while also challenging the existing way of life of those who presently inhabit the region.

With the changes to the natural environment, the socio-economic conditions in the Canadian North will be both positively and negatively impacted. Due to the potential of changing animal living patterns, and population decline, the Inuit who hunt them and depend on them for food will be forced to alter their lifestyle (Hassol, 2004, p. 16; Coates, Lackenbauer, Morrison, & Poelzer, 2008, p. 143). They may be forced to travel farther, and thus for longer periods of time to hunt, animal routes may become unfamiliar, conditions can be more dangerous and unpredictable, they might become more reliant on a *Qablunaat* diet, and the worst-case scenario is that they might endure the outright loss of their hunting, which is an important part of their mixed economy, and the basis for their social and cultural identity. The melting permafrost also means that existing buildings, pipelines, roads and other infrastructure systems might be destabilized, resulting in a significant need for repair and disrupted transportation networks (Bone, 2008, p. 40). The shrinking ice road season is also contributing to disrupted transportation networks, which results in delays for supplies being transported to communities and industrial operations (Coates, Lackenbauer, Morrison, & Poelzer, 2008, p. 142). The possible rise of the sea level due to the melting glaciers has the potential to cause further damage to communities, especially since 25 of the 26 communities in Nunavut are coastal, and it may even result in the loss of entire communities (Emmerson, 2010, p. 149; Van Loon, 2009, p. 530). However, the diminishing presence of sea ice throughout the entire year has created economic opportunities through an extended coastal shipping season, permitting ocean shipping through the Northwest Passage, and increasing marine access to resources (Hassol, 2004, pp. 16-17). The better ocean conditions will also allow for the increase in productivity for arctic marine fisheries (Hassol, 2004, p. 17). The warming climate and changing biodiversity will also push agriculture opportunities farther north, which will have positive ramifications on the region's economy (Van

Loon, 2009, p. 530). Further, these changing conditions have made it an attractive area for scientific research, which can contribute significantly to the local economy, while the presence of *Qablunaat* researchers will result in further influences on the Inuit lifestyle (Bravo, 2009, pp. 143-145). The adapting environment has thus created the potential for numerous socio-economic transformations to occur in the Canadian North.

The North can be viewed as a resource hinterland, and thus is governed by global demand for resources and the current economic situations. Presently, there is a significant demand for both renewable and non-renewable resources, which in combination with the changing environmental conditions are becoming more feasible to develop in the Canadian North. Mining is one industry in the Canadian North, which has not reached its full potential, yet is still the largest private sector employer in the region (Bone, 2008, p. 149). As the industry grows, it has significant potential to alter the economical conditions of the Canadian North. Gold and diamond reserves are found in this region, and because of their high value, their extraction has been a feasible endeavour (Bone, 2008, p. 137). However, many other mineral deposits, such as nickel and copper have yet to be extracted because their location would make their transportation too difficult (Bone, 2008, p. 133). There is also great potential for hydrocarbon extraction in the region. Many hydrocarbon reserves are found in both the land and sea, with estimates indicating that 20% of the world's reserves are found in the Arctic (Coates, Lackenbauer, Morrison, & Poelzer, 2008, p. 152). Previously, due to their isolated and difficult to reach location, the lower price of oil, and the technology of the time, these reserves were too expensive to exploit (Bone, 2008, p. 137). However, with the opening up of ice-free shipping routes through this region, the extraction of new resources is becoming a more viable endeavour, especially as demand grows and prices increase, resulting in numerous economic gains for the region (Coates, Lackenbauer, Morrison, & Poelzer, 2008, p. 152). Also, the land claims agreements have given the Inuit corporations more control over what is to happen in their land, ensuring that the profits gained are reinvested into their communities, while also ensuring the training and employment of the local population (Stern, 2010, pp. 94-95). Further, these endeavours are often damaging to the environment, and environmental sensitive methods are more costly, but the Inuit corporations can now make certain that companies partaking in resource extraction on their lands are utilizing environmentally sustainable processes and employing remediation technologies throughout the extraction period. Another step that also needs to be taken is the preservation of as much land as possible; otherwise too many natural systems will be disrupted, causing significant damages to the environment. However, due to the finite nature of non-renewable resources, and the shift occurring to reduce our consumption of hydrocarbon resources because of the pollution they produce, the long-term economic impact that these resources can have on the region is limited (Bone, 2008, pp. 126-127).

Renewable resources on the other hand, if managed properly, can result in a sustainable industry in the Canadian North (Bone, 2008, p. 143). Wildlife is both a commercial and subsistence resource; however, the trapping industry has often over consumed wildlife, resulting in a depleted population (Bone, 2008, pp. 143-144). The act of subsistence hunting though, remains an important part of the Inuit life in which they supply their families with meat, fish, and other useful by-products. Arctic fisheries are a barely tapped resource, which if moderate effectively can result in a stable economic activity (Coates, Lackenbauer, Morrison, & Poelzer, 2008, p. 155). Another renewable resource available in this region is fresh water, most often found in glaciers and frozen in the ground. Regardless, the access to fresh water is significantly important to habitation anywhere on the planet, and the Canadian North is very fortunate to have a considerable supply. Also, as there is shift towards sustainable energy production, there is substantial potential in this region to utilize both wind and solar energy. While solar is essentially effective only half of the year, during the summer there is an abundance of solar exposure making it a viable endeavour, albeit one that cannot be the sole means of energy production (Van Ginkel Associates, 1976, p. 110). Wind energy captured through wind turbines on the other hand, proves to carry the most potential. Not only does the Canadian North produce some of the highest wind speeds in North America, but most communities rely solely on expensive fossil fuel generators for their electricity, creating many advantages for the adoption of wind power, and the creation of long-term benefits (Bone, 2008, pp. 284-285). While non-renewable resources can supply significant capital for a short term into many northern communities, the renewable resources that exist can ensure sustainable inhabitation in this region.

The natural characteristics of the Canadian North, which inspired the Inuit to settle here and call it their homeland, have begun to be noticed by the *Qablunaat*, resulting in an young, but stable tourism industry that has significant potential. Sport tourism has become a popular industry as people from all over the world come to the Canadian North to participate in the unique hunting, fishing and boating opportunities. Eco-tourism and ethnographic tourism have also developed, as people want the chance to experience the unique culture and to see the sublime undisturbed natural landscape found in the national parks (Notzke, 2003, p. 281; Stanley & Perron, 2003, p. 276). With the more navigable waters due to the decreasing sea ice, cruise ships have been making there way to the Arctic further contributing to the growing tourism economy. Lastly, the extremes of the landscape and natural beauty have also created an adventure tourism industry, where people come to experience an adventure on one of the most inhospitable environments on the planet. Thus, the tourism industry is becoming an important part of the Canadian North's economy, as it is not as prone to boom and bust cycles like the resource industry (Stanley & Perron, 2003, pp. 278-279). However, as the industry grows, a better understanding of how it can be integrated into the evolving lifestyle of the local Inuit needs to be better defined

(Notzke, 2003, pp. 281-282).

The economic potential resulting from the demand for the resources found in the Canadian North, as well as the inevitable opening up of the Northwest Passage as a commercial trade corridor has made sovereignty an ongoing issue (Canadian Arctic Resource Comittee, 2003, p. 425). There is a continuing debate between the circumpolar countries as to which territories and ocean extents fall under their respective national, or international jurisdictions. The opening up of the Northwest Passage would significantly reduce shipping time from Japan and East Asia to eastern North America and Western Europe. However, Canada believes these waters are internal, and subject to their control, while others see it as an international strait (Canadian Arctic Resource Comittee, 2003, p. 425). Until a few years ago, this matter was of only theoretical concern as the possibility of commercial shipping routes through the Northwest Passage seemed years away, yet as the sea ice is less present year after year, Canada has no choice but to enforce its sovereign claim to these waters (Coates, Lackenbauer, Morrison, & Poelzer, 2008, p. 146). Even though some agreements have been made on paper, occupation and surveillance is needed to enforce Canadian governance of Arctic waters. If traffic were to increase through this strait without Canadian consent, and Canada failed to act, then the claim that these are internal waters would be void. It is thus crucial that Canada establish an active military presence in these waters, in order to detect and monitor all surface and subsurface transit through the Northwest Passage, to maintain their claim to sovereignty (Coates, Lackenbauer, Morrison, & Poelzer, 2008, p. 118). Canada's claim to sovereignty over this corridor is crucial, because consent would be needed to cross these waters, subjecting them to Canadian regulations and laws, preserving the environment and people located adjacent to these waters, and preventing any disasters that might do irreparable damage to Canada territory (Coates, Lackenbauer, Morrison, & Poelzer, 2008, pp. 146-148). It is further important to maintain jurisdiction over these waters as many of them are covered by sea ice for significant periods of time and act as extension of the land for the Inuit (Bone, 2008, p. 278). Other sections of the Arctic waters remain contested because of the natural resources located within them. One such example is an area of 21,436 km^2 in the Beaufort Sea, claimed by both the United States and Canada, which has yet to be resolved (Emmerson, 2010, p. 95). In order for Canada to ensure that the potential of the Canadian North is capitalized on in the future, it is not only crucial that they maintain their presence in this region, but that they ensure prosperous inhabitation for the people that call this region home.

The future of the Canadian North is thus one of significant change. With the demand to develop its resource reserves, while establishing a greater presence to validate Canada's sovereignty claim, there will be a large influx of people and capital. Both the positive and negative changes that are anticipated will forever change the conditions of this region. The evolving natural environment, and the increased presence of the *Qablunaat* and their way of life will exert further pressure on the Inuit to abandon the remnants of their way of life and identity, creating new challenges as well. If the Inuit can find ways to maintain their cultural identity in this changing region, they will be able to tackle their issues and find new ways to live in harmony with the land they call home. It is the hope that by reinforcing the Inuit cultural identity, predicting and preparing for new challenges, and capturing the potential present in this region, that successful and sustainable inhabitation of the region by both the Inuit and *Qablunaat* will be possible. The thesis | project will thus explore the idea that architecture is one of the mediums through which the notion of the modern Inuit identity can adapt, and a sustainable way of life in the Canadian North can once again be achieved.

Backcasting

Since the situation of the Canadian North, and the Inuit found within it will be going through tremendous changes over the next few decades due to present challenges the Inuit find themselves facing, and the changing environmental and economic landscape, it is necessary to hypothesize what this prospective condition might look like. However, as opposed to forecasting based on the present situation, backcasting will be employed to illustrate what a utopic Inuit society in the Canadian North should look like. In doing so this will enable the development of an architectural solution that will help attain these goals and fit within this future context, as opposed to merely responding to the present conditions. Without getting to in depth in worrying about the details and concerns with policy, economical barriers, the willingness of government and industry, and other possible barriers, the following will highlight some key aspects about this utopic Inuit vision. Obviously, in reality these conditions cannot not be ignored, however it is necessary to think big in the hopes that even half of the vision is achieved, otherwise there is no goal to work toward, which would minimize the desire to make significant changes to the status quo.

The world in which the contemporary Inuit will thrive in, is one which is a hybrid of both traditional and modern practices. Traditional values such as the maintaining communal relationships, the establishment of sharing networks and maintaining a spiritual and physical relationship with the environment will be emphasized at every facet of society. The Inuit will be able to participate in many traditional activities, which in part will be facilitated by the architecture of their homes. They will be encouraged to participate in the hunt as both a subsistence and culture preserving practice. Provisions will be made for drum dancing, throat singing, festivals, feasts and other social events to occur. The sewing of traditional winter garments will also be encouraged, as it utilizes the animals from the hunt, they are still the most effective insulators in the cold temperature, it preserves a traditional practice, they can be traded for other goods and offsets the monetary cost of clothes from the south. The crafting of other objects from animal parts, drift wood, and stone, including toys,

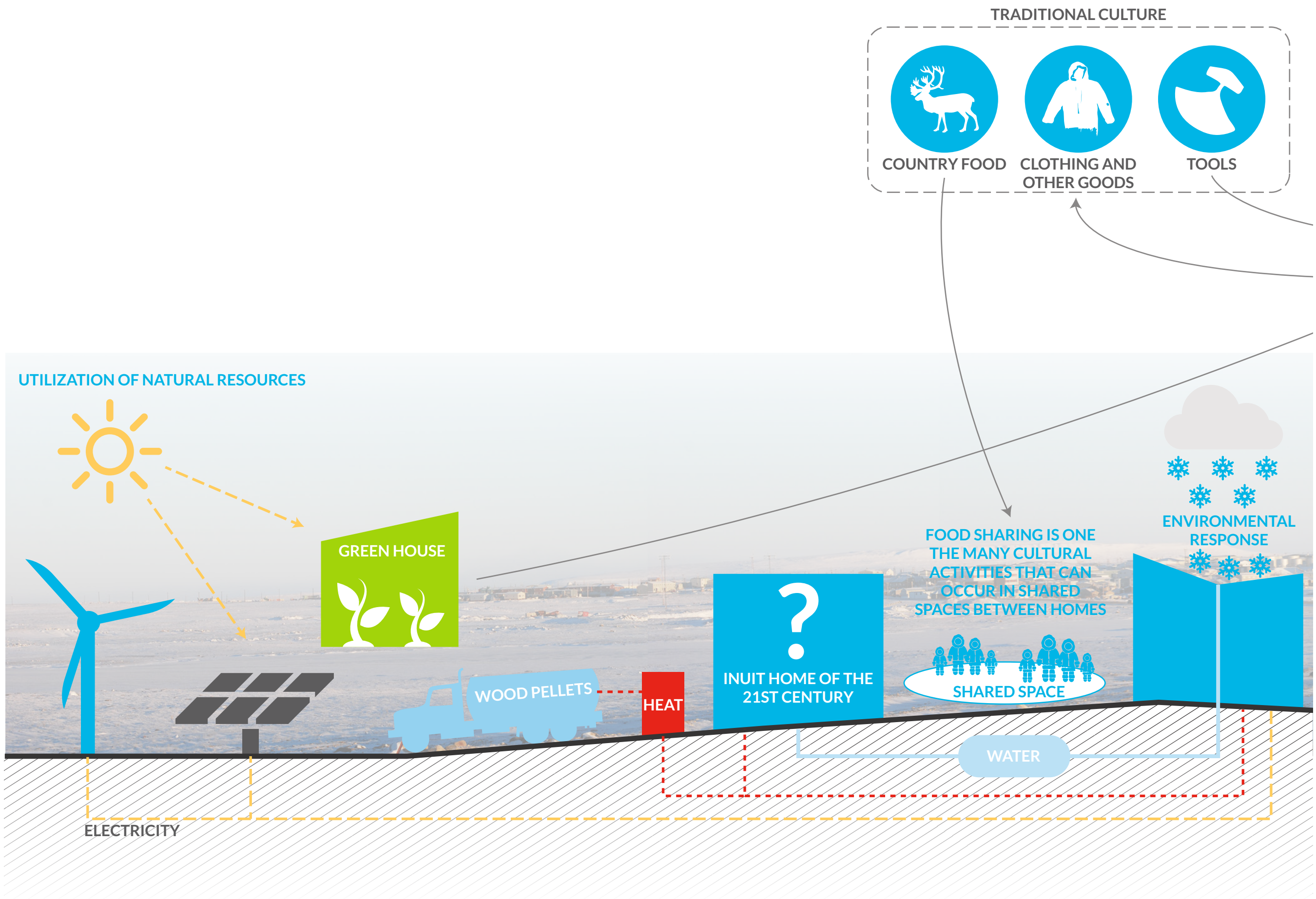
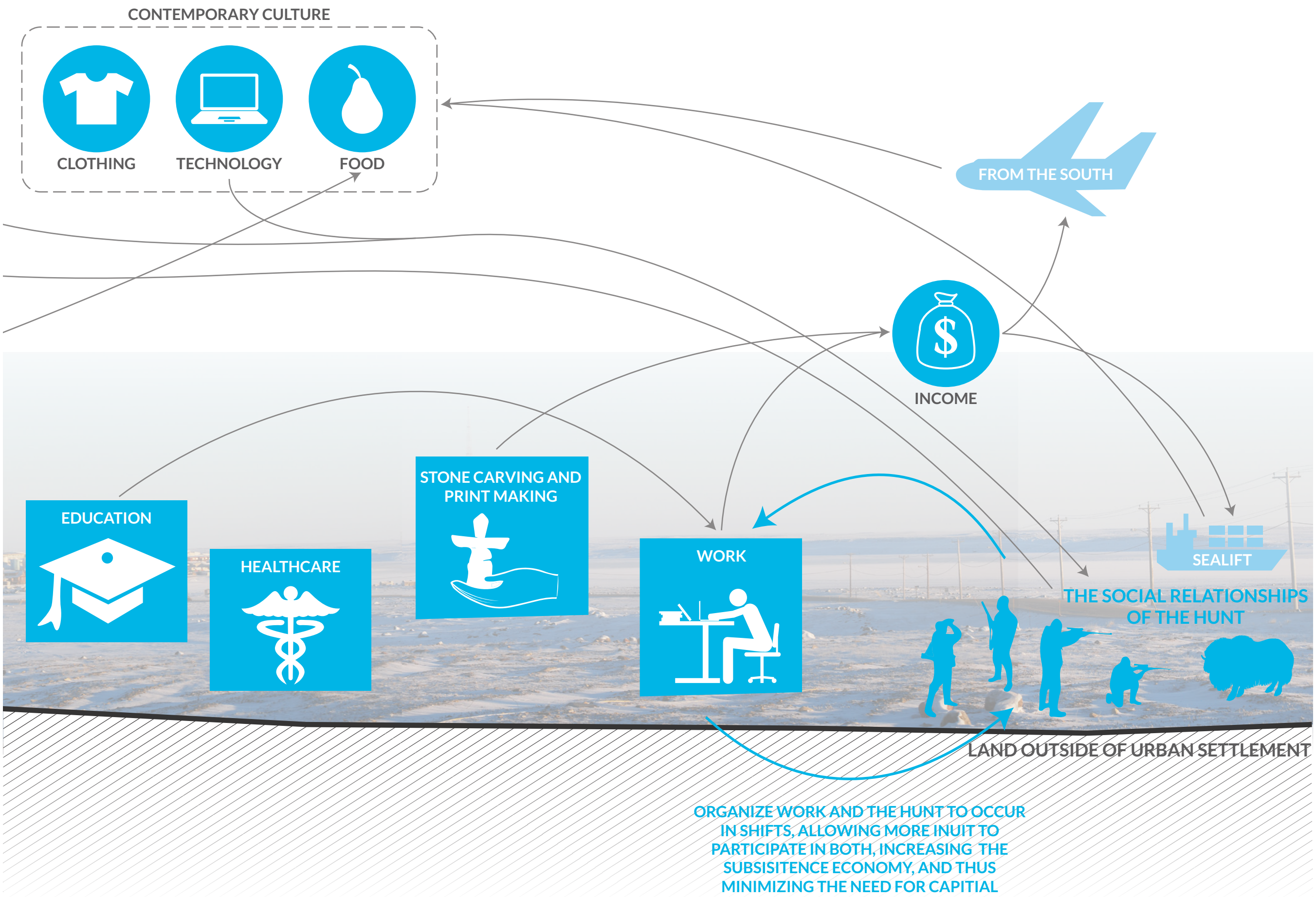


Figure 36: What the Future Inuit Situation May Look Like

tools will also be encouraged to promote traditional practices, to offset the purchase of southern goods and to be traded and sold.

On the other hand modern technologies such as trucks, snowmobiles, ATVs, computers, televisions, mobile phones, construction materials, tools, and energy producing equipment, will be utilized in areas where they can make traditional practices easier and in other facets of life in which they have become commonplace, such as watching television and playing on the computer. However, these technologies can also be used to promote traditional values such as the strengthening of communal relationships in the act of gathering to watch a hockey game. Also, other *Qablunaat* goods such as food and clothing have become accepted as a part of everyday life to varying degrees. However in instances where the reliance and acceptance of these items can be minimized, it should be taken advantage of, such as the use of traditional winter *atigi* (parka) to wear on the hunt, the traditional *amauti* (woman's parka to carry children), having more traditional meals, or preparing hunted food in a *Qablunaat* manner. The formal education system of the *Qablunaat* will also remain intact, however, it will teach not only the typical subjects, but will also teach practical and traditional skills in order to promote the uniqueness of the Inuit identity, giving the students the knowledge and tools to face their future challenges. Further,



more higher education institutions must be established in the region, as many Inuit lack the skills need to perform many of the jobs required to run the community as they are reluctant to leave their home for a foreign place for a lengthy period of time. Healthcare will also remain, but hopefully a more effective manner in its delivery will be devised. Other public services provided by the government will also remain, as long as they do not impede in the maintenance of traditional practices.

A variation of the mixed economy that presently exists will appear in a more formalized and accepted part of the society. Subsistence practices such as hunting, fishing and gathering will provide families with as many resources as possible, as found in the traditional Inuit society. Sharing networks will also be established, in part due to the strengthening of communal relationships through the participation in traditional activities. Within these sharing networks, any surplus food, hides, and other objects and be shared and traded between families. Other expensive items and spaces, which are infrequently, yet still required, can be shared between these families, offsetting a significant economic burden. Members of these groups should strive to attain as many skills as possible in order to live as self-sufficiently as possible. In instances where one is lacking a certain skill, the sharing network will allow him to exchange services and goods to accomplish what needs to be done. The result of these subsistence and sharing practices will be that economic burden of the family unit will be far less then it presently is.

However, with the acceptance of certain *Qablunaat* practices and technologies, a subsistence economy is not enough to provide a family with their needs. Thus participation in the wage economy in some form is necessary. There are some activities that the Inuit can participate in for monetary gain which utilize traditional Inuit skills. They can produce items for resale such as stone, bone and ivory sculptures, which has become one of the biggest industries in Nunavut. They can also sell traditional garments and objects to other people in town, to tourists or ship them to other parts of Canada. Commercial hunting can also be practiced, though this must be limited to ensure animal populations do not get depleted. They can also cater towards tourists, utilizing their knowledge of the land to act as guides for sport and adventure tourists, while also providing opportunities for those interested in experiencing a different culture.

Moreover, because they do require some modern services, people are needed to perform these jobs, so it is necessary that some Inuit enter the workforce, whether it be in administrative positions, labourers, nurses, teachers and any other necessary occupation. However, unlike the typical 9:00AM to 5:00PM, five days a week job found in the south, these occupations need to be structured in a way to allow the Inuit to partake in traditional practices. Whether self employed or employed by a larger business, they need to maintain some degree of personal freedom, as individual autonomy is a valued characteristic, and is required if they are to maintain their unique identity. Having as many tasks as possible performed in the dark winter months, and giving more time off in the summer might be one method to achieve this. Working in daily shifts might be another possibility, in which less hours in a day are worked, but more days over the span of the year are spent on the job, or one might alternate days between working and time off. It might also be that they work for longer periods of time, such as two weeks, and then have two weeks off in order to give one more continuous time at one task. However, these are only some possible ideas, but the main argument is that some provisions must be made to allow the Inuit to participate in the hunt, otherwise their culture will continue to disappear, or they will have little desire to obtain a long-term stable job.

In order to strive towards a self-sufficient society, and to live in harmony with the environment, renewable resources should be taken advantage of. Wind and solar energy can be utilized to produce electricity for the community. The buildings in the community can also be passively designed, which would limit the amount of energy and resources they required to operate. On site water retention should be practiced as well in order to limit the amount of water delivered by the municipality. If greenhouses are utilized, some agriculture opportunities exist, which would further limit the food, which had to be flown in. Where local renewable resources are not an option, efficient and renewable resources from afar can be shipped in such as the use of wood pellets for heating.

Thus, the design contemporary Inuit home should respond to the fundamental characteristics of this ideal state, which consist of both contemporary and traditional practices and values. The homes must not only be designed for, but must encourage the participation in traditional activities. They must also avoid romanticizing the Inuit way of life by accommodating all the contemporary practices that have become accepted parts of their daily lives. The homes need to be as self-sufficient as possible, while also promoting its user to adopt self-sufficient practices.

03

AN INTRO TO CAMBRIDGE BAY

The municipality of Cambridge Bay, Nunavut, situated on Victoria Island, just north of mainland Canada, has been selected as the trial site for this thesis | project. While the design strategies and the consequent building system discussed in this thesis | project are meant to be transferable throughout the Inuit territories, especially the communities within Nunavut, one site has been selected to show how the design can be applied in a specific context.

Since many Inuit settlements in the Canadian North have been developed around the DEW Line stations located between the 68th and 70th parallel, one of these sites was the logical choice, as many of the climatic conditions found in one site would be similar in the other communities. Further, with a population of around 1,600, the municipality is similar in size to many of the towns in Nunavut, with many others not far behind. Thus, in many ways Cambridge Bay represents the stereotypical Nunavut town.

Cambridge Bay also holds a seat of significance, as it is located adjacent to the Northwest Passage, which is due to gain magnitude as an international shipping corridor in the near future, making the site of critical importance. The town is also a hub for commercial fisheries, research expeditions and passenger vessels, making it an economically important centre. The multi-million dollar Canadian High Arctic Research Station is about to be built in the community, which will further its significance. The municipality is the seat of the *Kitikmeot* region, which is one of the three

Figure 37: Landscape View of Cambridge Bay

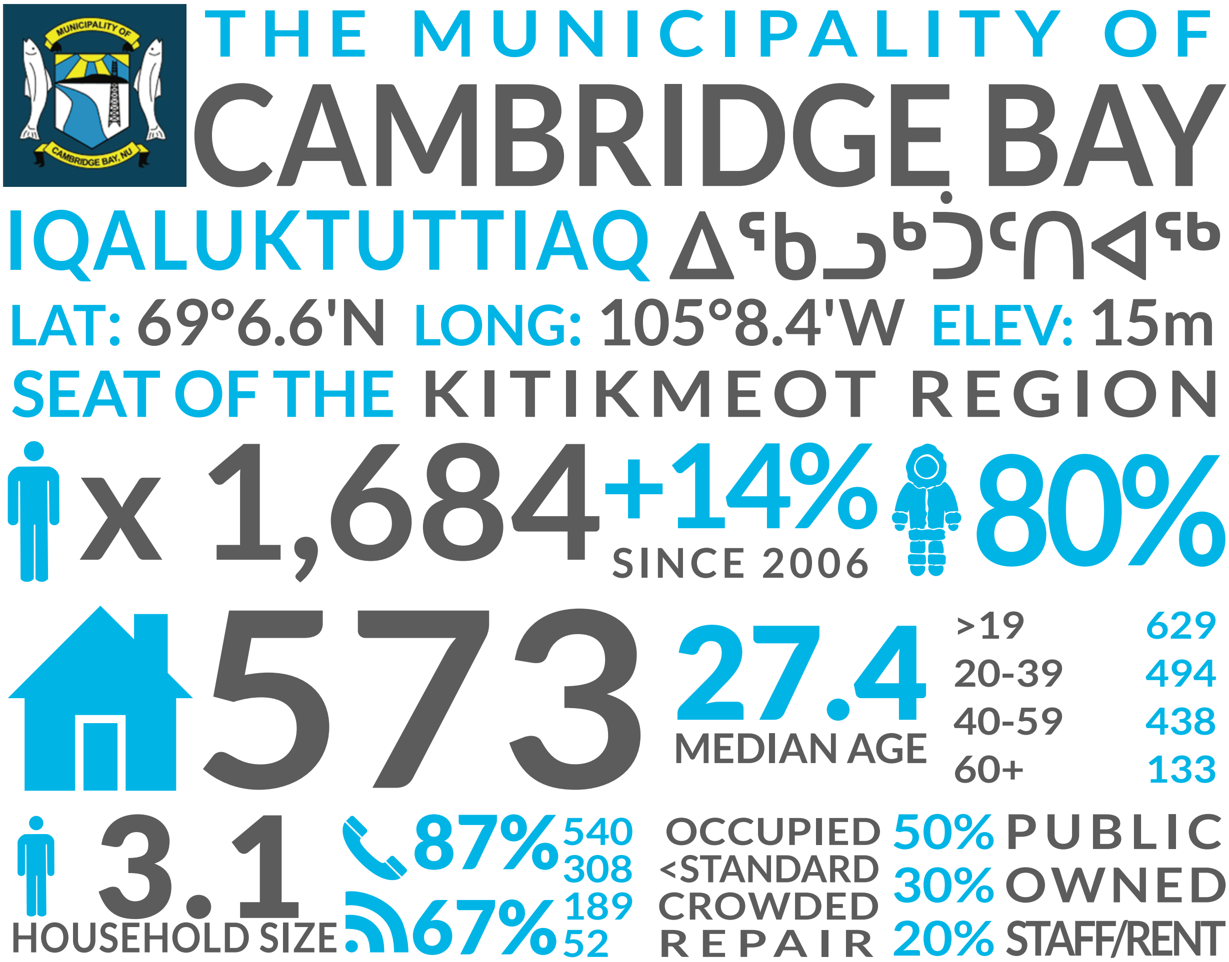


Figure 38: Cambridge Bay Statistics and Facts

regions of Nunavut, so it is a major administrative centre. The area surrounding the town is a site of traditional importance to the Inuit, who have fished and hunted there for nearly 500 years. Consequently, the area is an important archaeology site. Thus, the municipality has an interesting combination of historical, traditional and economic importance.

The growing significance of Cambridge Bay means that its already sizable population, relative to other Nunavut communities that is, will nearly double by 2026 if the high projections are achieved. A substantial portion of the new population will be the *Qablunaat*, which will exert further pressure on the Inuit to assimilate. Therefore, the potential found in Cambridge Bay, and the consequence this can have on the local Inuit culture have created a situation where the reinforcement of the Inuit cultural identity and lifestyle is needed more than ever.

Figure 39: Loran Tower (Opposite) Until its demolition in 2014, the Loran Tower was the most prominent landmark in Cambridge Bay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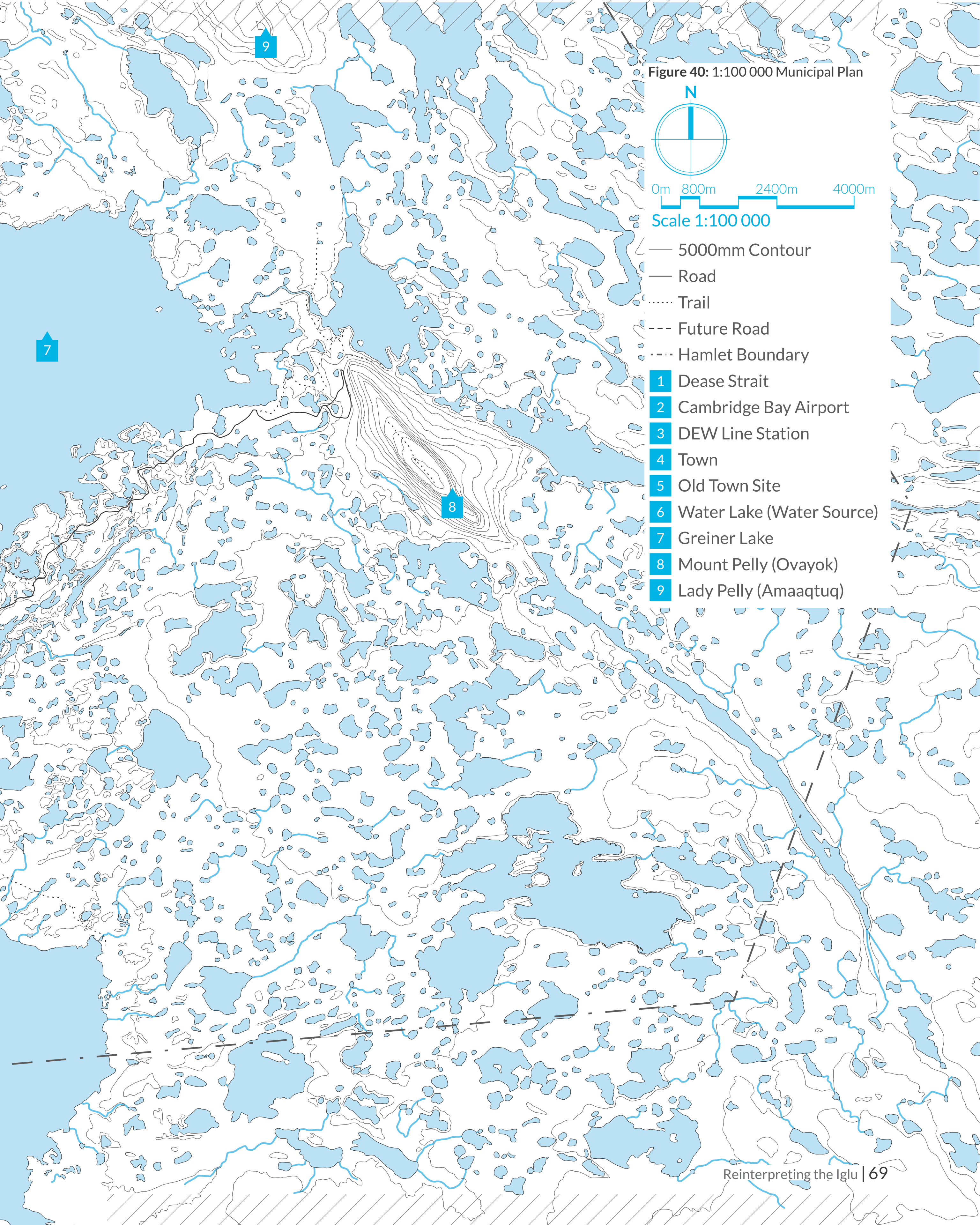
Figure 40: 1:100 000 Municipal Plan
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2 Cambridge Bay Airport
3 DEW Line Station
4 Town
5 Old Town Site
6 Water Lake (Water Source)
7 Greiner Lake
8 Mount Pelly (Ovayok)
9 Lady Pelly (Amaaqtuq)
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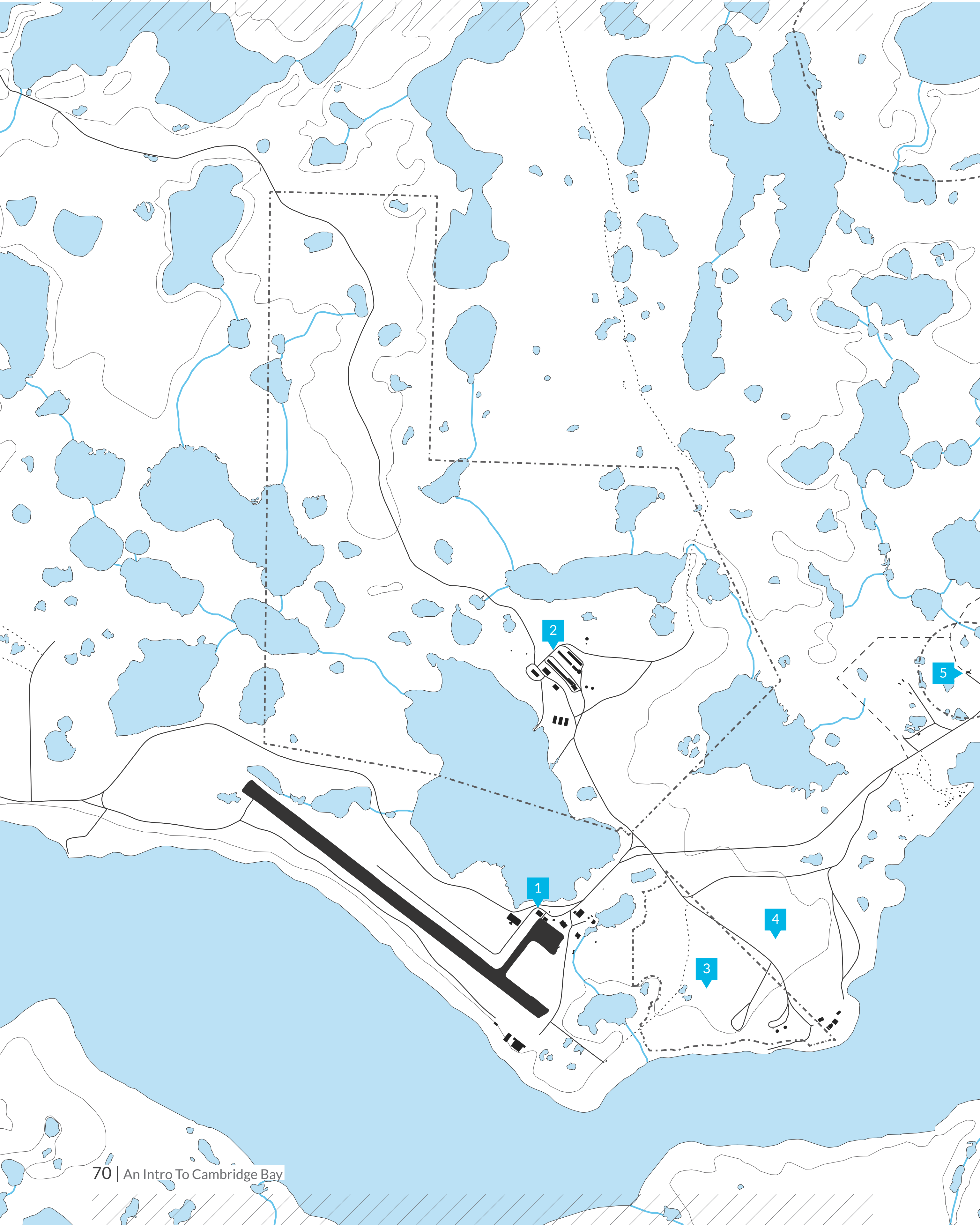
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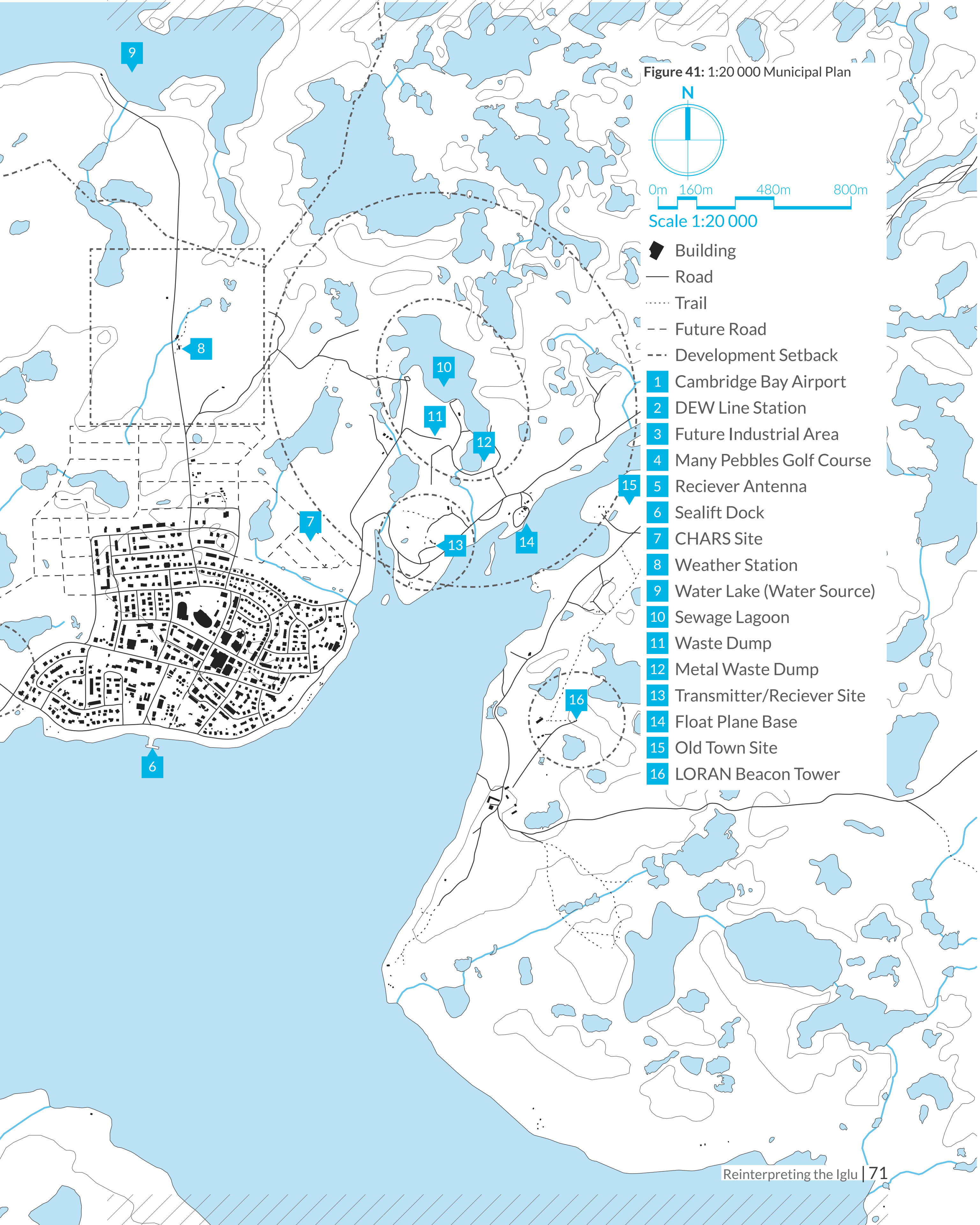

Figure 41: 1:20 000 Municipal Plan

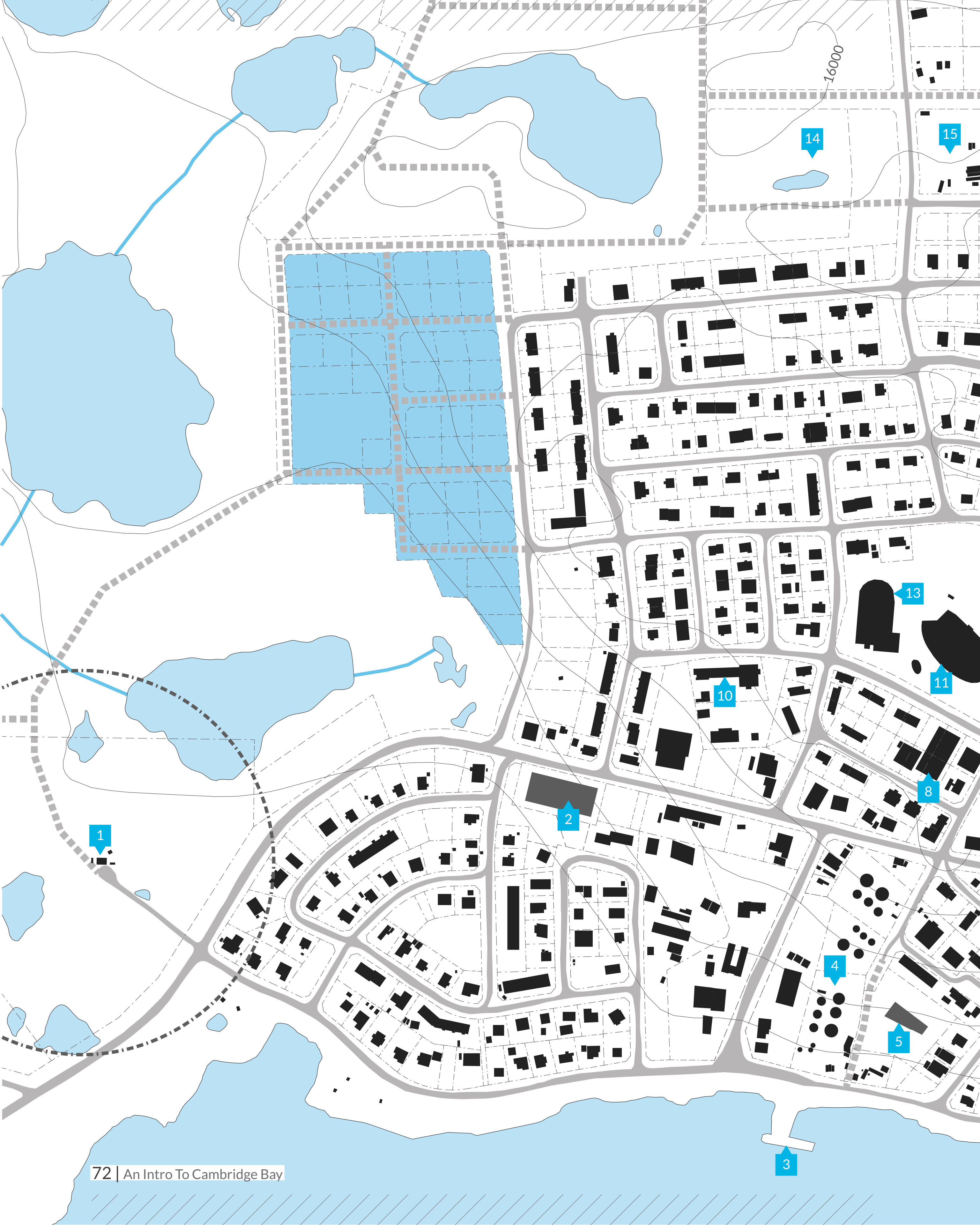
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Figure 42: 1:5 000 Town Plan

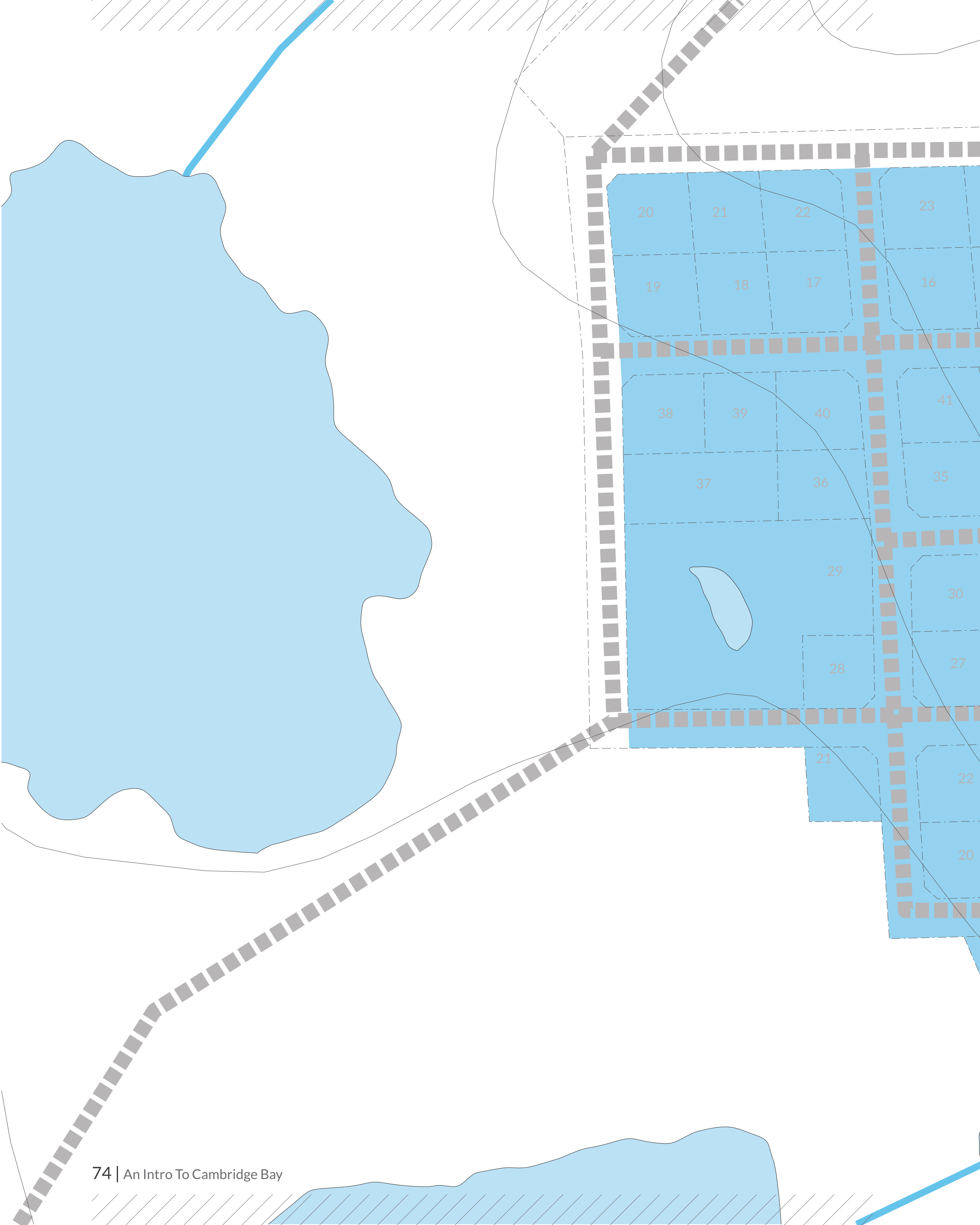
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Figure 43: 1:2 000 Neighbourhood Plan

3.1 Identifying the Culture of Cambridge Bay

Traditional settlement in the Cambridge Bay area occurred at *Iqaluktuuq*, northwest of the present community. This site was located on a short river, which contained a considerable amount of arctic char, hence the name Iqaluktuuq, which translates into 'a place of many fish'. The area also formed a natural funnel for caribou, making it a valuable hunting site. Due to the hunting and fishing of this area, a local group of Inuit formed, who became known as *Iqaluktuurmuit*. The Iqaluktuurmuit are a community within the regional group of Inuit called *Inuinnait*, often referred to as Copper Inuit because of their extensive use of native copper found in the region.

The Inuinnait in the Canadian Central Arctic speak the Inuinnaqtun dialect of Inuktitut. The primary differences between the Inuinnait and other Inuit groups are rooted in their local geographic knowledge (Collignon, 2006, p. 20). The result was the evolution of their own dialect, and their own intimate knowledge of the natural landscape, which was passed down through oral tradition. Further, the differences in biodiversity from each region also impacted the hunting patterns and available resources. Traditionally, due to the large area inhabited by the Inuit, these regional differences were strong because their interactions with others from outside their territory were minimal at best. However, with modernization came both the erosion of the Inuit culture, as well as improved communications between the different regional groups of the Inuit. The result is that the scale of Inuit identity has been extended, in part due to their consciousness of other regional groups, and also due to the need to collectively reinforce the common ideas and practices that make up the pan-Inuit culture in the response to globalization (Collignon, 2006, p. 20; Stevenson & Stern, 2006, p. 15). Presently, while regional differences exist to some degree, the Inuit of Cambridge Bay now identify themselves as part of the Kitikmeot administrative region, and even more so as a part of the Canadian Inuit culture. Thus, the design of a culturally appropriate home in Cambridge Bay has relevance in the rest of Nunavut, while a century ago this would have not been the case.

Figure 44: View En Route to Cambridge Bay
(Opposite)

3.2 Photographing Cambridge Bay

While the Internet is an extraordinary tool, and images of Cambridge Bay can now be found on Google Street View, it was non-the-less crucial for me to visit the municipality of Cambridge Bay to experience the extreme conditions first hand. The rest of the chapter will be a photographic journal of my one-week experience in Cambridge Bay, in November 2013.

Figure 45: First Air ATR 72 Combi Aircraft
The plane I took from Yellowknife to Cambridge Bay. Interesting experience, half the plane is cargo, and landing on a gravel runway in a large plane is a unique experience.

Figure 46: Buffalo Airways C-46
Airline made popular in TV series Ice Pilots NWT.

Figure 47: Cambridge Bay Dew Line Site

Figure 48: Arctic Island Lodge
My home for the week.

Figure 49: Omingmak St. Cambridge Bay
The RBC, Arctic Co-op, both schools, offices and recreation centre can be found on this street.

Figure 50: Recreation Centre and Hamlet Office

Figure 51: Kiilinik High School 1

By Pin/Taylor Architects, this building represents an environmentally responsive architecture, and seeks to find beauty in a utilitarian approach to design.

Figure 52: Kiilinik High School 2

Figure 53: Kiilinik High School 3

Figure 54: Tank Farm
Where a year supply of oil for the entire community is stored.

Figure 55: Water Supply Truck

Figure 56: View Toward the Bay

Figure 57: Townhouses 1

Figure 58: Typical House 1

Figure 59: Typical House 2
Note the cluttered yard, storage underneath, oil tank, and lack of glazing

Figure 60: Typical House 3
Note the caribou antler ornamentation. Clearly a sign that a proud hunter lives here.

Figure 61: Occupied House in Poor Condition

Figure 62: Typical Semi-Detached House 1

Figure 63: Waterfront and Main Dock
Underutilized land, which is primarily used for storage.

Figure 64: Waterfront 1

Figure 65: Waterfront 2

Figure 66: Unoccupied House
While a housing shortage exists, there are many dwellings that are unoccupied because they have fallen into disrepair

Figure 67: Original Hudson's Bay Trading Post

Figure 68: Anglican Church

Figure 69: Construction Equipment at the Edge of Town

Figure 70: Steel Piles for the future Arctic College Building
The piles need to be set in place a year before the rest of construction can occur to ensure they are stable

Figure 71: Mount Pelly in Ovayok Territorial Park

Figure 72: Shipping Containers
Because the sealift comes once a year, shipping containers dot the landscape of Cambridge Bay

Figure 73: Outpost Camp Across the Bay

Figure 74: Shipping Crate
Do not freeze? If -40°C isn't freezing I don't know what is.

Figure 75: Recent Housing Development by the Nunavut Housing Corporation 1
While not very interesting, these houses utilize a SIP panel constriction method resulting in an easier assembly and an efficient envelope.

Figure 76: Recent Housing Development by the Nunavut Housing Corporation 2
Note the lack of consideration for site design

Figure 77: Townhouses 2

Figure 78: Townhouses 3

Figure 79: Typical Residential Street 1

Figure 80: Typical Residential Street 2
My new puppy friend who kept me company for a little while. It seemed that every other house had a dog outside, some leashed, and some unleashed.

Figure 81: Townhouses 4

Figure 82: Typical House 4

Figure 83: Front Yard
Note the dog house, the old snowmobile, the animal parts, and all the stored items scattered around the yard.

Figure 84: Typical House 5

Figure 85: Playground

Figure 86: Atypical House
The house of a proud hunter for sure.

Figure 87: Typical House 6

Figure 88: Typical Semi-Detached House 2

Figure 89: Typical Semi-Detached House 3

Figure 90: Typical House 7

Figure 91: Typical House 8

Figure 92: Typical House 9

Figure 93: Government of Nunavut Office

Figure 95: Kitikmeot Inuit Association Building

Figure 94: Health Centre

Figure 96: Receiver Antenna

Figure 98: Road to the Airport and DEW Line Site

Figure 97: Canadian North 737 Aircraft

04

CONDITIONS OF THE NORTH

The unique context of the Canadian North means that the adoption of a regionally responsive architecture in this region has to respond to a unique set of conditions, which will create a built environment unlike any other. The following part of the thesis | project will discuss these unique conditions found in the Canadian North that will impact the architecture of this region. The conditions to be discussed are the unique culture of the contemporary Inuit, the environmental features, the economic constraints, and the changing demographics. Through gaining an understanding of these conditions, unique opportunities will emerge, areas of exploration will be determined and ultimately, appropriate design decisions can be achieved.

Figure 99: Cambridge Bay Landscape

4.1 Culture

Through the exploration of contemporary Inuit culture, an architectural response that represents the Inuit identity and one that suits their lifestyle can be achieved. The myth isthat culture is an object and as such, is static, timeless, and pristine. Instead, culture must be viewed as a practice, one that is constantly evolving from a shared memory, and influenced by contemporary conditions (Stevenson & Stern, 2006, p. 12). In order to design for the unique culture of the contemporary Inuit, an understanding of these conditions is therefore required and must be developed through a study of the Inuit cultural heritage and the state to which it has evolved to in the present day. While regional variations have existed, the acceptance of global Inuit identity has emerged amongst the modern Inuit. Due to a fear of extinction, of the inability to survive as a race, which came about with the critical event of their modernization, the sharing in a collective cultural memory has allowed them to successfully take on the challenges they are facing today (Stevenson & Stern, 2006, pp. 168-176). The first section of this chapter will discuss the important ideas and practices that make up the Inuit cultural heritage. The second section of this chapter will discuss the notion of the contemporary Inuit, and how it is a hybrid between traditional and modern practices and ideas.

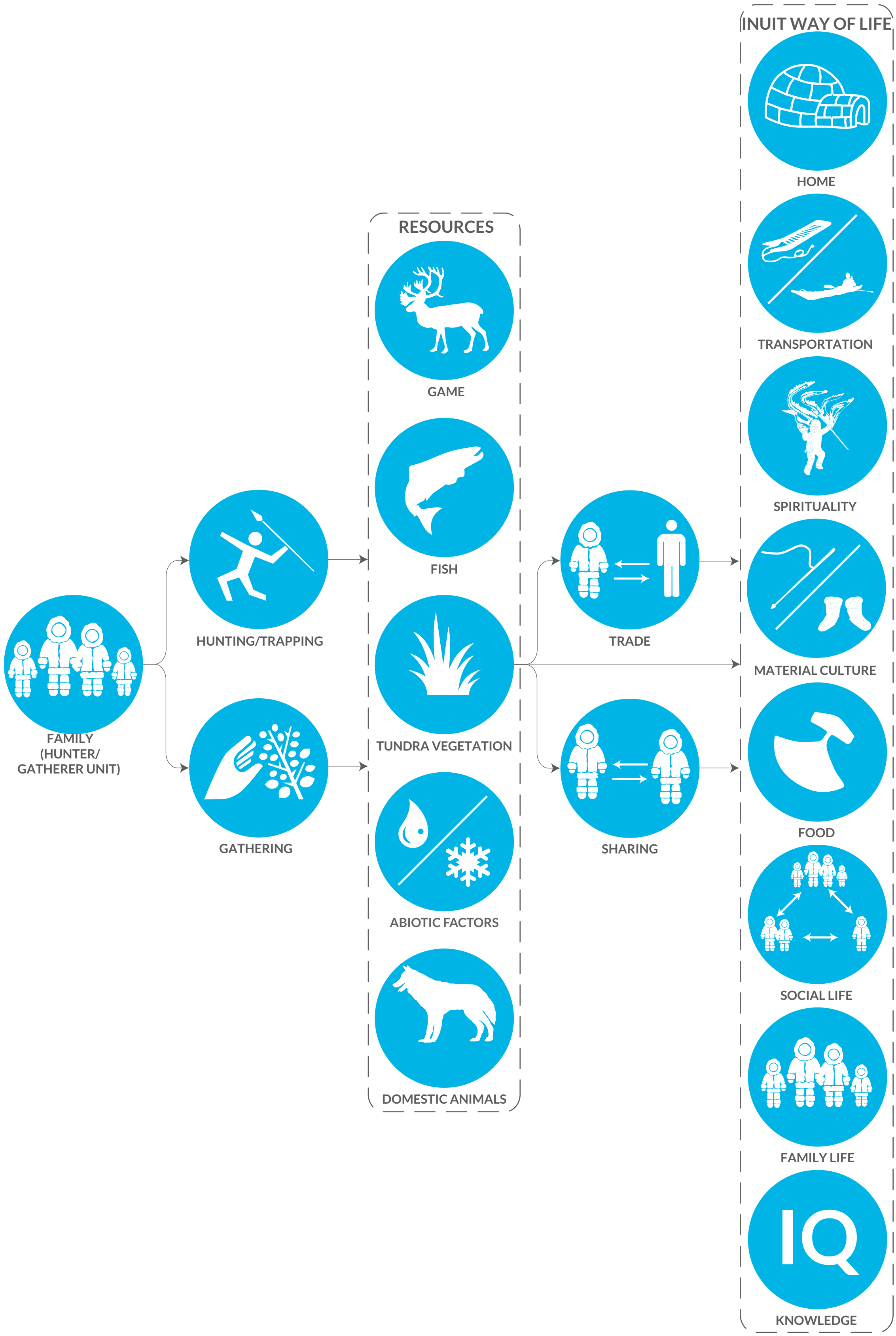
Cultural Heritage

The livelihood, and the very lives, of hunter-gatherers depend on the availability of resources in their territory... They do not change the land, they adapt themselves to it - to the way the animals and plants are distributed across it.

Collignon, 2003

The Inuit are an indigenous people who share a common ancestry, language, culture, homeland, and values. Despite the traditional regional differences, there are many commonalties based on a collective cultural, which form the Inuit identity, including unique ideas and practices that make up their shared cultural heritage. The Inuit homeland offers a bounty of resources, however, it remains an expansive and harsh environment, and as such, human survival has had the most significant impression on their cultural evolution. In order to survive on the land, a semi-nomadic hunter-gatherer lifestyle developed, similar to other hunter-gatherer societies, whereby the Inuit lifestyle revolved around a culture of subsistence harvesting. As stated by French geographer Beatrice Collignon (2006), "hunting was not only the main source of food and clothing, nor merely an activity; it was an entire way of life" (p. 26). Through hunting and gathering activities, the Inuit family unit was able to obtain multiple types of resources from *nuna* including different types of game animals, fish, the minimal tundra vegetation that did grow, abiotic elements such as snow and water, and domesticated animals. The utilization of these resources and the obtaining of scarce and supplementary resources through interfamily sharing, trade

Figure 100: Subsistence Harvesting Culture (Opposite)


INUIT WAY OF LIFE
RESOURCES
FAMILY
(HUNTER/
GATHERER UNIT)
HUNTING/TRAPPING
GATHERING
GAME
FISH
TUNDRA VEGETATION
ABIOTIC FACTORS
DOMESTIC ANIMALS
TRADE
SHARING
HOME
TRANSPORTATION
SPIRITUALITY
MATERIAL CULTURE
FOOD
SOCIAL LIFE
FAMILY LIFE
IQ
KNOWLEDGE

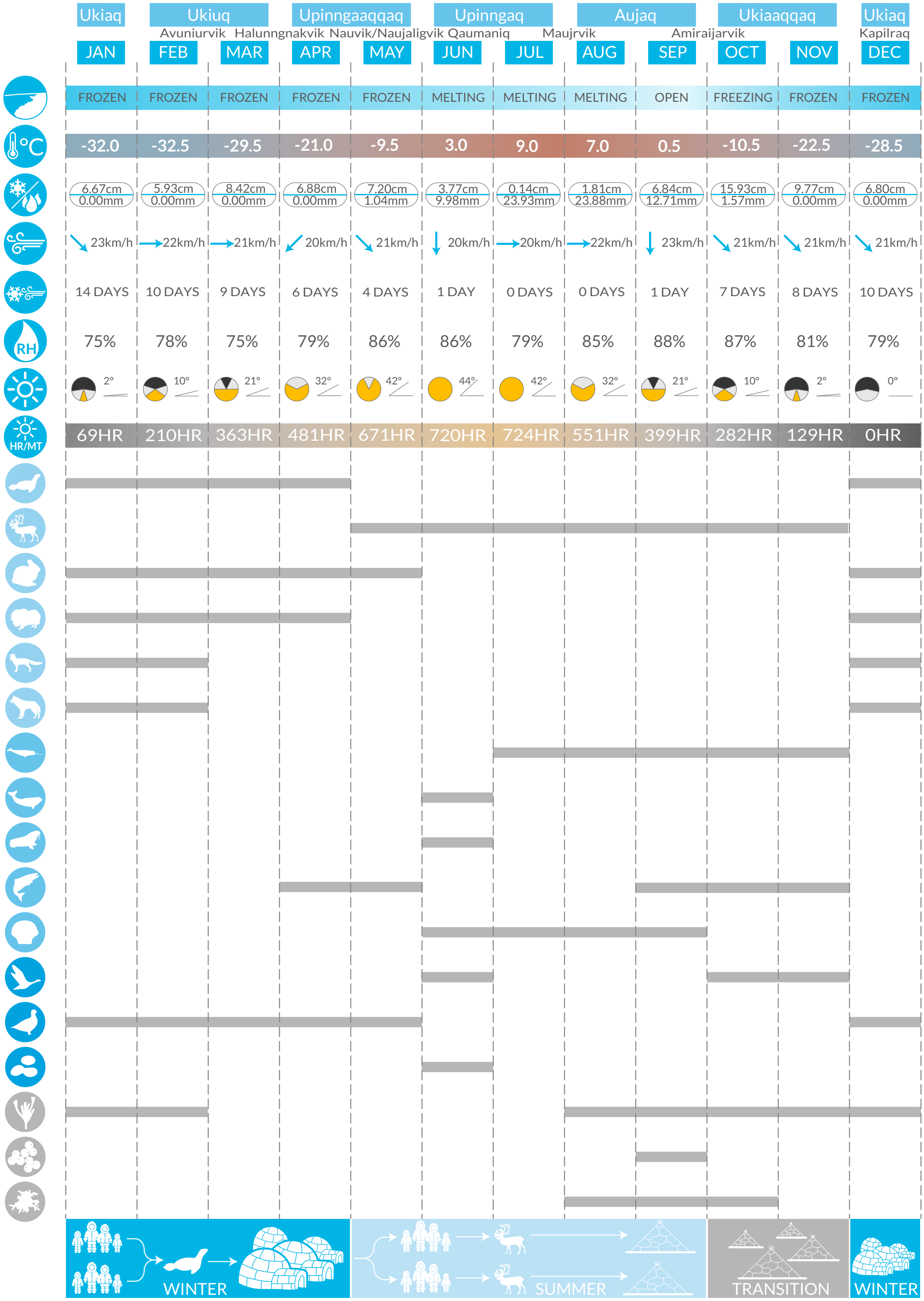
with other Inuit groups and eventually the *Qablunaat,* results in the traditional Inuit lifestyle. The facets of this way of life include their vernacular architecture, modes of transportation, food and food preparation, social life, their religion: shamanistic animism spirituality, family life, material culture and traditional knowledge, referred to as Inuit *Qaujimajatuqangit* (IQ).

Due to the engrained connection between the *nuna* and the *Inuit* (which means people of the land), knowing when and where to collect these resources was the foundation of IQ. IQ revolved around understanding the life cycles and rhythms of the Arctic animals, following seasonal indications, and being proficient at mobility in order to make critical decisions towards survival. Furthermore, this knowledge, as well as the familiar routes and sites that were passed down from previous generations, helped determine the territory a particular Inuit group resided in. However, because of the unpredictability of weather patterns and animal locations these sites were never set in stone, so being able to understand and adapt to these conditions was an important part of their livelihood.

The Inuit year is divided into six seasons, which aids in the understanding of the environment. The seasons fall according to light and temperature variables that created seasonal rhythms of the land, animals and people, which signalled when they were to move and dictated differences in their seasonal lifestyle. The seasons are as follows: *Ukiaaqqaq* (the nearly young winter), *Ukiaq* (the young winter), *Ukiuq* (winter), *Upinngaq* (the young spring), *Upinngaaqqaq* (the not so young spring), *Aujaq* (summer). In the different regions of the Canadian North, these seasons bring about different changes, resulting in the further break down of the seasons according to local characteristics, such as the season of berries. Despite the differences between regional Inuit groups, the constant, as stated by Collignon (2006), was that seasonal changes brought about a pattern of alternating land use and lifestyle between the different ecosystems of *nuna* and *hiku*, the ice (p. 33).

Nuna would often be associated with summer, when the Inuit winter camp would break up and disperse across the landscape in search of caribou. This was the time of the individual, when family units would live on their own in *tupiqs*. They would move along familiar routes to follow the caribou migration, only to turn back in the middle of summer to take the same route back, collecting the supplies they left along the way. Without the luxury of snow during this period, travel became more difficult, so food and supplies were stored in stone caches, which were pre-existing on these familiar routes. However, in certain instances, travel across open bodies of water became possible with the qajaq, which helped extend the scale of the daily hunting region. Summer was the time of the hunt for caribou and other Arctic mammals, as well as fishing, and these became their primary diet source during this season. It was also a period when the women could gather whatever resources they could from the landscape, and also begin to prepare for the long winter. On the other hand, hiku

Figure 101: Seasonal Variations
(Opposite)


Ukiaq Ukiuq Upinngaaqqaq Upinngaq Aujaq Ukiaaqqaq Ukiaq
Avuniurvik Halunngnakvik Nauvik/Naujaligvik Qaumaniq Maujrvik Amiraijarvik Kapilraq
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
FROZEN FROZEN FROZEN FROZEN FROZEN MELTING MELTING MELTING OPEN FREEZING FROZEN FROZEN
°C
-32.0 -32.5 -29.5 -21.0 -9.5 3.0 9.0 7.0 0.5 -10.5 -22.5 -28.5
6.67cm 0.00mm
5.93cm 0.00mm
8.42cm 0.00mm
6.88cm 0.00mm
7.20cm 1.04mm
3.77cm 9.98mm
0.14cm 23.93mm
1.81cm 23.88mm
6.84cm 12.71mm
15.93cm 1.57mm
9.77cm 0.00mm
6.80cm 0.00mm
23km/h 22km/h 21km/h 20km/h 21km/h 20km/h 20km/h 22km/h 23km/h 21km/h 21km/h 21km/h
14 DAYS 10 DAYS 9 DAYS 6 DAYS 4 DAYS 1 DAY 0 DAYS 0 DAYS 1 DAY 7 DAYS 8 DAYS 10 DAYS
RH
75% 78% 75% 79% 86% 86% 79% 85% 88% 87% 81% 79%
2° 10° 21° 32° 42° 44° 42° 32° 21° 10° 2° 0°
HR/MT
69HR 210HR 363HR 481HR 671HR 720HR 724HR 551HR 399HR 282HR 129HR 0HR
WINTER
SUMMER
TRANSITION
WINTER

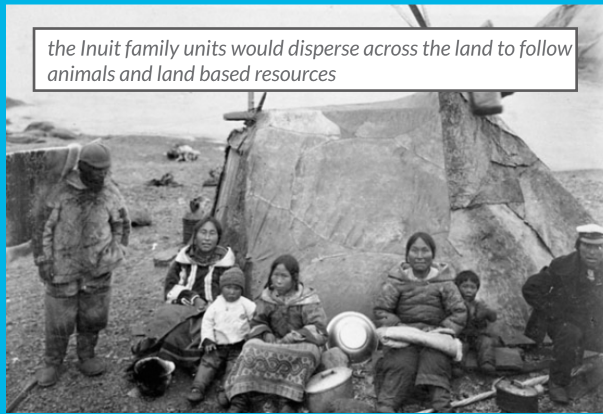
was associated with wintertime, when the Inuit would return to the ice and form camps for the season to effectively hunt seals. This was the time of the community, when family units would come together to live in *igluit* villages, share resources and socialize. In order to effectively hunt seals on the ice, a large group of hunters was needed to watch over the many breathing holes, which explains part of the reason why winter was the time of the community. In the winter, the use of the dog sled made transportation easier, consequently enlarging the scale of the daily hunting range. The diet during this season consisted primarily of seal meat, supplemented by other marine mammals such as polar bears, and muskox, and when the ice began to break up some fishing occurred. Before the sea froze and families could gather on the ice, they gathered on the coast where women made clothes for the winter, while men hunted occasionally, and spent time playing games, singing, and dancing. Seasonal variations therefore, not only impacted the Inuit land use pattern, but also guided their entire way of life (including their social life), affected their community organization, and created a healthy balance between the time of the community and the time of the individual (Collignon, 2006, p. 37).

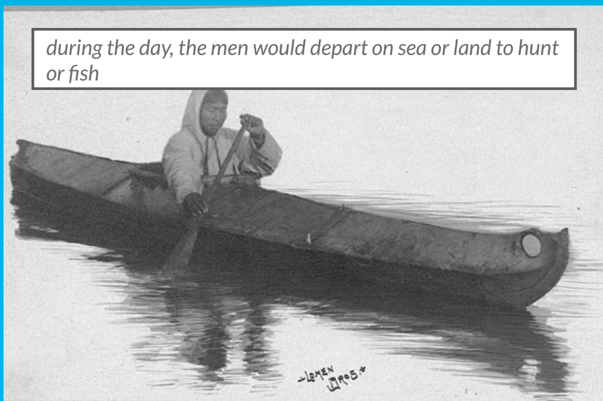
The seasonal rhythm of the Inuit therefore resulted in a regional scale of movement, while the hunt resulted in a daily, local scale of movement. The outcome was that the characteristics of mobility and flexibility significantly impacted the Inuit life-style. The readiness to move and the need to cover a large territory was necessary for a successful hunt, thus the Inuit had only essential, lightweight, and manageable equipment. The most important technology was their knowledge of how to survive on the land efficiently, which had developed over centuries. Thus, the Inuit used an *aalliak* to move cargo across the land efficiently, they built shelters from *nuna*, ate as much of the kill at the site to lessen the transport load, and stored food, equipment and clothing in stone caches to be retrieved at a later date when needed. The light-weight nature of their material culture meant that their lifestyle had minimal impact on the land, further emphasizing their harmonious relationship with the natural environment.

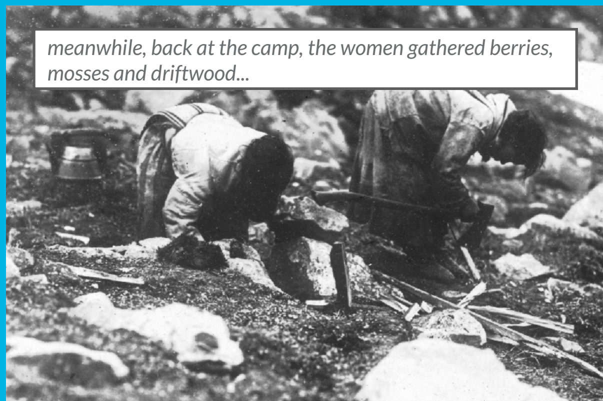
The basic unit of social organization for the Inuit was the nuclear family, which consisted of parents, unmarried children and widowed grandparents. The family unit acted as an independent unit, where men, women and children all had different duties, and in working together, formed an efficient hunting unit (Collignon, 2006, p. 34). Because each family had to take care of their own needs to survive independ-ently, no family specialized in one skill, creating a non-hierarchal society (Collignon, 2006, p. 29). Men were responsible for hunting, which provided food and hides while the women were responsible for preparing food, sewing skins and sharing resources, all of which made the hunt possible. Children were always under adult or elder supervision, and because of this proximity, they learned different gender based tasks necessary for survival through observing and learning at their own pace.

Figure 102: Day in the Life of the Traditional Inuit
(Opposite)

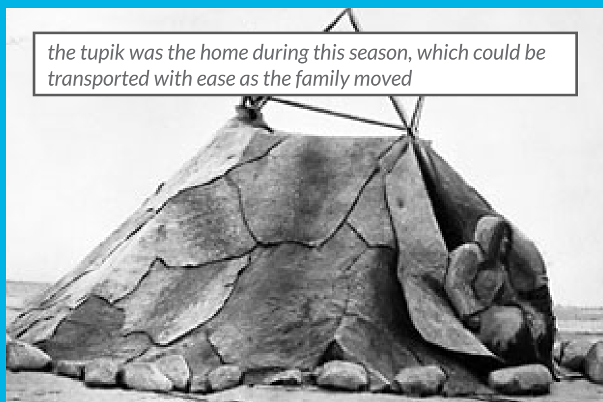

in the summer on the Arctic tundra where the caribou graze...


the Inuit family units would disperse across the land to follow animals and land based resources


during the day, the men would depart on sea or land to hunt or fish


meanwhile, back at the camp, the women gathered berries, mosses and driftwood...


while the young children play and tend to the pups


the tupik was the home during this season, which could be transported with ease as the family moved


in the winter on the ice floes where the seals come up for air and rest...


the Inuit family units would congregate in igluit villages to socialize and effectively hunt seals

Return of the Sun Celebration

During the time when taboos were strictly adhered to (prior to conversion to Christianity), the first day that the Sun came out was marked by the belief that the whole community must start a new life, so the children of the camp would go to each household to blow out the flames of the qulliq. After the lamps had been extinguished the old wicks were removed and a new wick set in place and then the lamp would be relit. In order to begin life anew, the children of the camp including myself, would run to each of the dwellings hoping that we would be the first to blow out the lamps before the others did. So this was how the first day of the Sun was observed.

When he reached the age of six, the boy would be given a toy bow to play with. He was also allowed to help his father as he worked, his father carefully explaining all there was to be done. One day, perhaps his father was building an iglu, the boy would be invited to help…

Martha Angugatiaq, 1985 (Bennett & Rowley, 2004)

In the summer these units would function independently from other units, but come winter, they would group together to form camps with other family units, forming dwellings with extended family members.

Inuit communities were composed of families, who lived in a specific region, and were often part of an extended family joined by marriage. The relationship to the landscape is evident here, as they refer to their community based on a local environmental feature (Collignon, 2006, p. 43). These communities were dynamic, as they lived in temporal structures, with no formal leadership, and could join another community if they pleased, but because they were often based on familial ties, this rarely occured. When each family came together at the beginning of winter, the communities ranged in size from 20 people to over 100. In the community, sharing was a hallmark of their social relationship, with everyone working together for survival.

The reason our ancestors tried to kill a lot of caribou is because they didn't think only of themselves. They also thought about people somewhere else who might be hungry, so they caught more than they needed in order to help others.

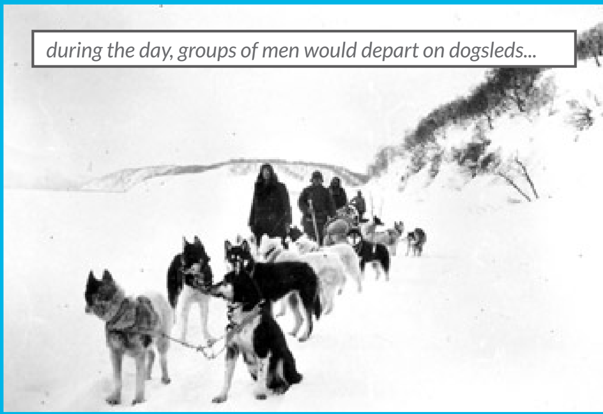
George Tataniq (Bennett & Rowley, 2004)

Though hunting did take place when the sunlight made it possible, during the polar night the only thing that was left to do was socialize. Hence, this was a time when many feasts and ritual celebrations occurred, song and drum dances where shared, and the oral history was passed on.

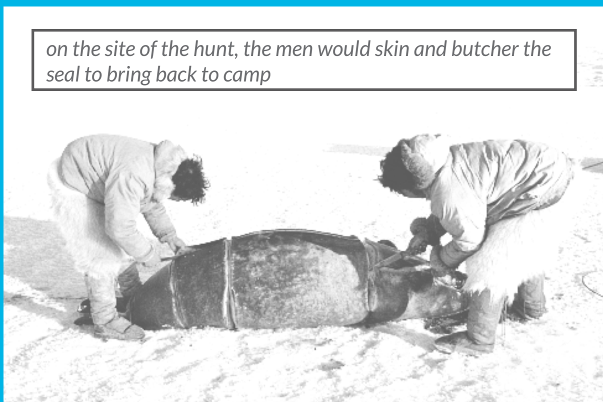
The Inuit pihiit [songs] tell of having learned the best way to do things, perhaps about the best way to catch animals. They record stories that can be told forever before a voice is forgotten.

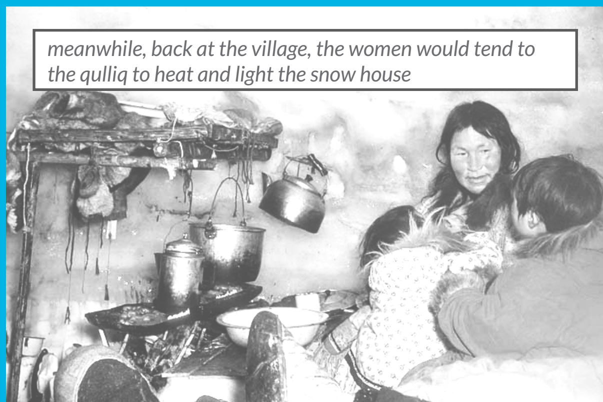
Donald Suluk, 1987 (Bennett & Rowley, 2004)

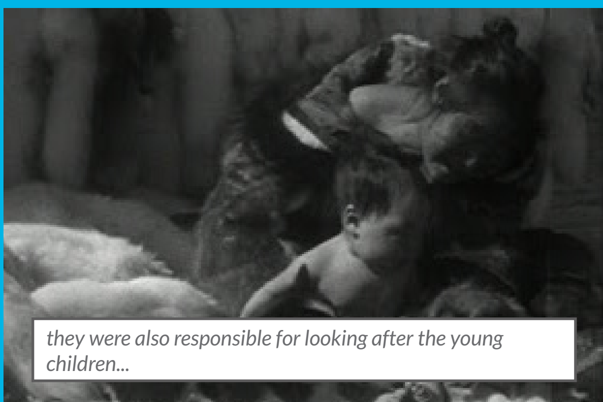
Figure 103: Day in the Life of the Traditional Inuit
(Opposite)


during the day, groups of men would depart on dogsleds...


in order to hunt seals to share with their families and community.


on the site of the hunt, the men would skin and butcher the seal to bring back to camp


meanwhile, back at the village, the women would tend to the qulliq to heat and light the snow house


they were also responsible for looking after the young children...


and the sewing of garments from skins and firs


the men then returned from the successful hunt...

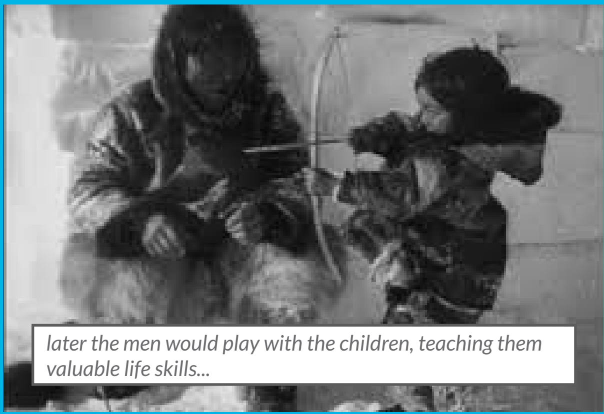

and the families gathered in the snow house to share the food and socialize

Furthermore, during this time, once it became light again, families visited and traded with neighbouring camps, and held large festivals to celebrate new relationships. During the summer, individual life on the land was just as important as the social interactions that transpired during the winter. It was this balance based on seasonal conditions that was the organizing principle of their social structure (Collignon, 2006, p. 37).

Another aspect of the Inuit culture derived from their relationship with the land was their spiritual life, which was a form of shamanistic animism. Inuit spirituality is rooted in the need to maintain appropriate relationships between people and animals. Traditionally, the Inuit viewed the natural world as a place where multiple *tuurngait* (spirits) lived. These *tuurngait* had an active role in this world, and the Inuit interacted with them through *angakkuit (shamans)*. *Angakkuit* were either male or female, and one of their primary tasks was to communicate with the *tuurngait,* sometimes in the form of a soul flight, in order to ask them to intercede in earthly matters. Another task was to heal, which involved getting the ill to admit to violating one of the taboos. The taboos dictated proper behaviour, some being logical, while others were absurd, such as sewing at the wrong time of year. Furthermore, because of the presence of *tuurngait* throughout the world, activities such as hunting had a spiritual significance and had rituals to accompany them. Thus, spirituality played a very important role in the way the Inuit viewed the world, and impacted their day-to-day activities.

Inuit oral tradition was also a significant part of their cultural heritage which profoundly impacted their belief system and way of life. The importance of oral tradition is highlighted by the commonality of the stories over a large geographic range (Collignon, 2006, p. 78). Inuit oral tradition often consists of tales, creation myths, and heroic sagas, and can be classified according to three different scales: global, regional, and local. The global scale, or more appropriately the Inuit-wide scale narratives that are known to all Inuit, are the heart of the culture and traditional knowledge. These narratives apply to all fields of knowledge and act as a framework for their spirituality, particularly within magical and animistic thought (Collignon, 2006, p. 83). There are three types of stories found at the global scale: The first being cosmogonies, which explain how the universe and its elements were created further establishing their basic world-view (see tale about creation of *Hiqiniq*, and *Tatqiq*); the second is origin myths about humankind and life; and the third are tales about bringing order to the world. At the regional scale, tales explained how specific land features were created (see tale about the three hills of Cambridge Bay), as well as the history of the people who inhabited the region and offered advice for living on the land. The oral tradition at the local scale was composed of stories shared between families and hunt camps, which mentioned incidents that happened in familiar places, to familiar people, usually emphasizing some aspect of the land. These anecdotal stories often gave practical advice about the land, but also gave the land

Figure 104: Day in the Life of the Traditional Inuit
(Opposite)

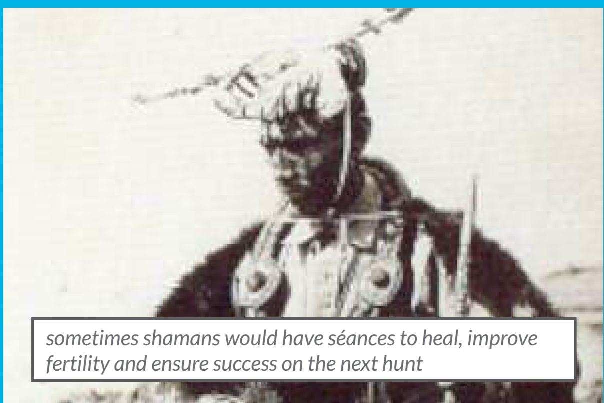


later the men would play with the children, teaching them valuable life skills...

while other men maintained their tools and carved ivory toys

in the evening families of the village would gather in the qaggiq...

for drum dancing, singing and story telling



sometimes shamans would have séances to heal, improve fertility and ensure success on the next hunt

on special days, like when the sun came up in late winter, the community would have a festival with feasts and games

eventually the family would retreat to the snow house and prepare for rest

Global Scale: The Creation of the Sun and Moon

The Sun goddess Hiqiniq and her brother, the Moon god Tatqiq, lived together and used to play games. But once adults, things changed. One night, while they were playing in the dark (as they used to do when they were children), Tatqiq raped his sister. During the fight, a seal-oil lamp overturned, soiling Hiqiniq 's hands with black grease. When Hiqiniq tried in vain to push Tatqiq away, she blackened his face with her dirty and greasy hands.

She ran as far as she could into the sky, where she became the Sun. Tatqiq, showing no remorse for his crime, continued to chase his sister in the sky where he became the Moon. This eternal race makes the Sun alternate with the Moon in the sky. But occasionally, the Moon god reaches the Sun goddess and rapes her again, causing a solar eclipse.

Tatqiq concentrates on his sister so much that he often forgets to eat. So as the days go by, he gets thinner. Once a month, the Moon disappears for three days, so the Moon god can eat. He always returns to chase his sister again. This is how the Inuit people explained the phases of the Moon.

Regional Scale: The Creation of Ovayok, Inuuhuktuq, and Amatok (Three Hills of Cambridge Bay)

Long ago, there were three giants, Ovayok, Inuuhuktuq, and Amatok. They came from the sea to the north of Victoria Island (Gelinik), where they had been eating seals, walrus, and whales. Travelling overland, they could not find food, because they were not used to eating small animals like caribou and muskox, and died. The woman, Amatok, collapsed and died first, and then the boy, Inuuhuktuq, then the man, Ovayok. Their bodies turned into mountains, which remain there today.

an emotional and historical depth. These oral traditions reinforce the relationship between the Inuit and the land, and are thus a significant part of the Inuit culture and identity.

One of the last aspects of the Inuit cultural heritage to discuss is their expressive culture, found in their folk art. Inuit fine art is a construct of their relationship with the *Qablunaat*. Traditionally there was no separation between aesthetics and utilitarian objects (Stern, 2010, p. 143), therefore Inuit visual expression was initially seen in their weapons, tools, games, masks, religious items, charms, clothing, and toy models. These were often made of scavenged or hunted materials such as bone, ivory, or stone, and were very primitive and crude in nature. The subject matter of these pieces portrayed traditional values and lifestyles, often consisting of animals, or hunting and camping scenes. Eventually as contact with the *Qablunaat* became more frequent, these items became valuable trade commodities. This was the beginning of the transitional period of Inuit art, when the Inuit began catering to the desires of *Qablunaat*, who valued realism, particularly art expressing Inuit life and technology (Hessel, 2002, p. 21). Despite being practical in nature, the traditional Inuit folk art represents their aesthetic sensibilities, and their thematic motifs highlight the importance of their traditional subsistence lifestyle.

The Inuit subsistence hunting culture is governed by the relationship between the Inuit and the natural environment. Everything about their culture and lifestyle, in one way or another, stems from their physical and spiritual connection with the land.

This association is highlighted by the fact that traditionally the Inuit defined themselves by a local landscape feature and today, they identify themselves as a people of the land. Furthermore, it is important to understand the distinction between space and place, as spaces are interchangeable, but places are meaningful spaces that are derived from the spiritual nature of its history and memories (Stevenson & Stern, 2006, p. 17). Inuit identity is intrinsically intertwined with the land that they inhabit, it is not merely a space where they live, but has a special meaning to the people, and is "the place of their identity" (Collignon, 2006, pp. 42-43). The relationship to the landscape should thus be strengthened, in opposition to modernization and globalization, which creates a separation from the land and a dependency on the *Qablunaat*.

From our ancestors we were always told to respect the land,... try not to pollute or anything like that, because if you do that the land will give you abundant wildlife. What you do to the land, the land will do to you.

Mariano Aupilaarjuk (Bennett & Rowley, 2004)

Inuit identity must be maintained through the understanding and conservation of the unique qualities beyond ethnicity that make them a people. The use of Inuit *Qaujimajatuqangit* must be maintained through practice; oral traditions must be preserved; dialects of Inuktitut must be spoken; living in harmony with the natural environment must be encouraged; the importance of hunting must be upheld; strong community ties must be maintained; seasonal variations must be emphasized; all of which will help preserve the Inuit identity and way of life.

Inuit of the 21st Century

We are an adaptable people. There is no doubt about that. We've had to be. That's how we have always traveled season to season looking in pursuit of animals. We've weathered this storm of modernization fairly well - going from dog teams to snowmobiles, and flying jumbo jets and going from iglu huts to permanent homes, and of course, going from our environment - which is our supermarket - to now having supermarket-like stores in communities - all within a few decades.

This has not been without consequences. But through it all, we have always had our land. Our very predictable environment and climate and the wisdom of our hunters and our elders that they have gained through the millennia - and that always helped us to adapt to the situation. Because the hunting culture is not well understood - it is not only about the killing of animals, or the pursuit of animals. In fact, the real process of the hunt is extremely powerful. Eating and hunting personifies what it means for us to be Inuit. These skills and traditions are passed down generation to generation.

Sheila Watt-Cloutier, 2008

The attempt to modernize the Inuit has resulted in the wide spread acceptance of *Qablunaat* technologies and practices that were not necessarily appropriate for the cultural and environmental conditions found in this region, which does not result in the increase in quality of life as initially intended. The primary result is a culture of dependence and loss of their traditional practices and culture, leaving the Inuit unable to overcome many of the challenges they face, which threatens their very survival. It is vital that the Inuit maintain their unique identity, allowing them to adapt modern technologies and practices to suit their needs and lifestyle to ensure their prosperity in the North once again.

In order to maintain Inuit distinctiveness and ensure northern priorities are accounted for, the Inuit have attempted to regain control of their own affairs through initiatives like the creation of Nunavut. However, even though this is a step in the right direction, a return to that way life is no longer feasible, and the impacts of the *Qablunaat* are here to stay. This results in a people that are "caught between two worlds" where they are no longer traditionally Inuit like their parents, yet they will not be able to compete in a *Qablunaat* world (Searles, 2010, p. 163). Stuck in this ambiguous state, defining societal goals and seeking a future vision for the Inuit has become challenging, as the question of what constitutes the Inuit identity has been extensively debated.

In contemporary discourse regarding Inuit identity, the idea of authenticity has become a significant point of discussion. Frequently, authenticity for any indigenous people is related to a traditional way of life. As such, it is to no surprise that the relationship to the land is seen as being an essential part of the Inuit culture, and their survival as a distinct people (Searles, 2010, p. 153). However, more often than not this has reduced the question of Inuit identity to the land versus town, and Inuit versus *Qablunaat* dichotomy. Thus, an Inuk who speaks Inuktitut, hunts, and lives on the land, is seen as being more authentic than an Inuk who speaks English, uses modern technology and lives in a town, working at a desk from 9:00AM to 5:00PM.

However, this method of identification has proven to be especially problematic, creating more barriers than benefits to their survival. The idea that towns are antithetical to the Inuit identity and culture is a rather antiquated view. It is based on the premise that towns are a result of the modernization process which was "beyond the control and against the will of Inuit themselves", and that the social structure of towns caused segregation and subordination, resulting in the Inuit to be "socially stigmatized and politically marginalized" (Searles, 2010, p. 158). But this view relates to a time before the 1970s, before the Inuit began to take control of the decisions being made in regards to their lands and way of life, as depicted through the creation of Nunavut. The reality is that the majority of the Inuit have voluntarily moved to towns, and they now have an opportunity to work with the *Qablunaat* to create "a new society and political culture" (Searles, 2010, p. 159), but a mere rejection

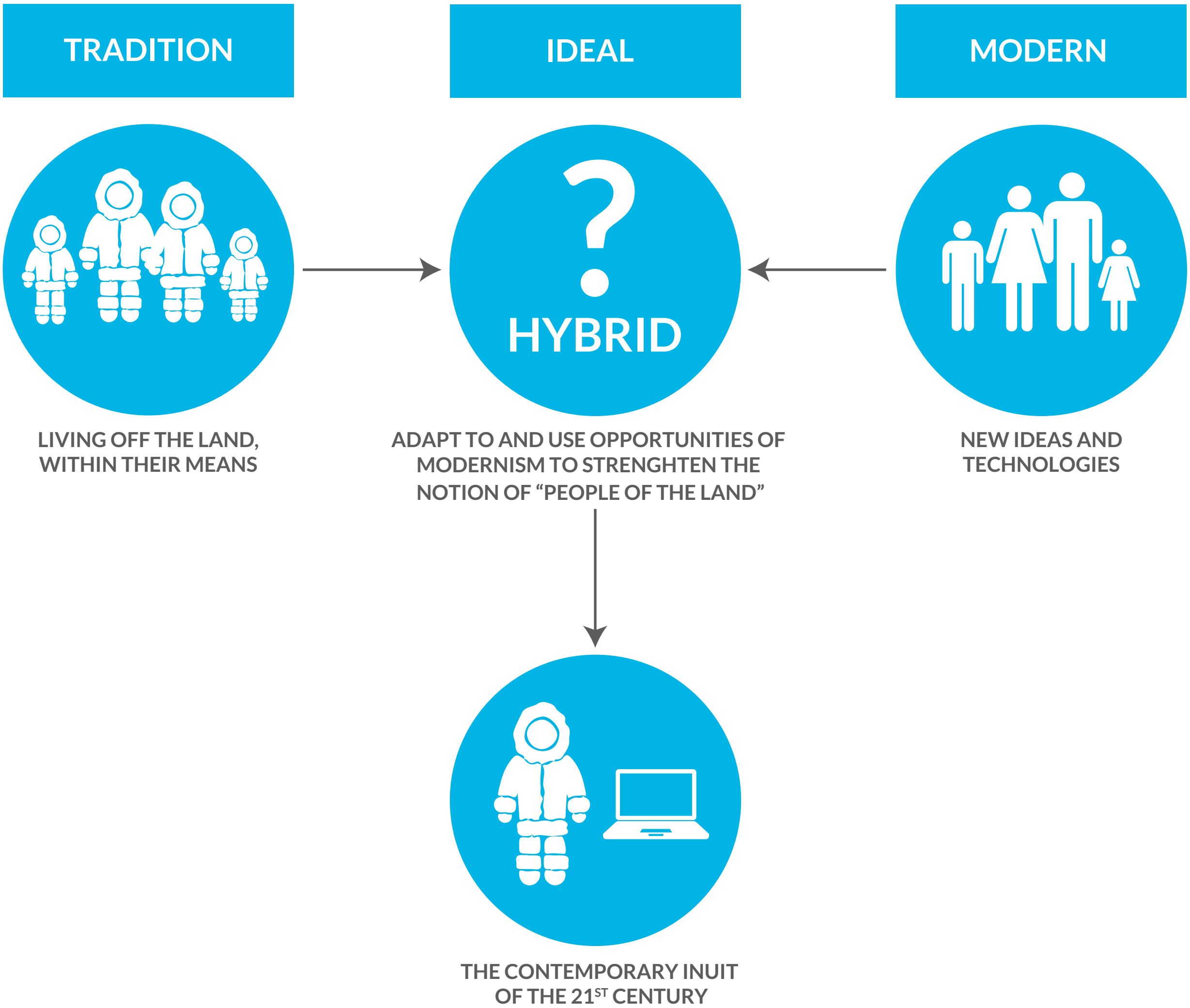


Figure 105: The Contemporary Inuit Identity

of living in a town is only hindering this process. The dismissal of living in towns is also related to the belief that towns are breeding grounds for immorality because they fail to cultivate skills that are essential to living on the land, which, in turn, reinforces values of personal virtue and collective vitality, and thus creates a moral person. Conversely, this view negates the many benefits and opportunities that living in a town provide, while also failing to recognize that it is still possible, though in a limited manner, for the Inuit to practice many of the traditions, such as hunting, which strengthen their relationship to the land. Despite the many challenges that have resulted from a transition to urban life, the idea of Inuit authenticity is not as clear-cut that if you live in a town, you are no longer an Inuit. On the other end of the spectrum, Inuit authenticity has often been linked to the outpost camps, which have developed over time as a means to maintaining the Inuit culture and way of life. The camps are located at varying distances outside of the towns, and are either permanent or seasonal residences where Inuit can hunt, live off the land and escape the *Qablunaat* way of life. However, as many have argued, their 'authentic' label

Figure 106: Family of Eight by Tim Pitsiulak, 2008
This piece captures the embracement of modern technology by the Inuit

begins to erode due to the use of many modern technologies such as snowmobiles, oil stoves, and rifles, in combination with the fact that these communities still depend on government subsidies for their survival, and are thus not self-sufficient entities. Equating Inuit authenticity with living a traditional life is no longer a relevant argument as more and more Inuit move to towns and utilize modern technologies.

The discourse has begun to change from that of an argument for a return to the past and a renunciation of new technologies to one of embracing the positive changes that have occurred, and determine how to adapt *Qablunaat* practices and technologies to strengthen their relationship to the land, allowing them to survive in their homeland as a distinct people. The questions of what constitutes the contemporary Inuit identity are thus no longer about how traditional or new a practice is, but what is the most appropriate practice. Essentially does the practice advance the Inuit interpretations of appropriate relationships among people and between people and animals? Consequently, the contemporary Inuit identity has evolved into a hybrid culture between traditional and *Qablunaat* cultures, integrating the best of both worlds. The idea of an urban Inuit identity has begun to be accepted, and with this acceptance, the built environment, which the Inuit inhabit, can finally be designed to suit their needs.

The hybrid culture is routed in shared cultural memory of the Inuit, which is strengthened through the preservation of Inuktitut, their oral traditions, and history. In doing so, their unique identity will be articulated, resulting in the "positive affirmation of Inuit culture" (Searles, 2010, p. 152). Emphasized in this cultural memory is the importance of living in harmony with the natural environment, the significance of sharing networks and the communal relationships, the activities that foster these sharing networks, the impact of seasonal variations on their way of life and identity, and the importance of knowledge though practice. The practice of traditional activities is an essential facet of the Inuit cultural memory, as it allows for the development of *isuma* (reason), teaches practical skills, maintains ties to the land, and creates moral persons, which could not be attained by reading books, or merely being taught. Thus, the importance of hunting must be maintained and advanced, as it was a critical part of the Inuit identity, way of life, and survival in the past. It is not only of symbolic importance, in which it reinforces the notion of living in harmony with the land, but has significant potential to contribute to the mixed economy, which offsets the need for many imported goods, becoming a deciding factor for their survival in their homeland once again. The importance of communal sharing can also not be understated as the networks and bonds developed from these practices form an essential part of the economic and social life, by providing a means of acquiring labour, equipment and food (Dawson, 2003, p. 26). Another predominant facet of this hybrid culture is the mixed economy, which sees the combination of both a wage and subsistence economy. The result is a mix of country and imported food; locally made material goods and modern technologies like snowmobiles and the internet; and traditional subsistence practices, *Qablunaat* occupations and unique entrepreneurial opportunities. Political, legal, healthcare, and educational institutions found in the *Qablunaat* world have also been accepted by the Canadian Inuit. These institutions offer many benefits to the Inuit, and in combination with ideas that are derived from traditional Inuit knowledge, help contribute to their survival in their homeland (Stern, 2010). Additionally, without negatively impacting the Inuit spiritual relationship with the land, the introduction of Christianity has resulted in the disappearance of shamanism, which has only improved their way of life. The shamans, which the Christian missionaries fought so hard to denounce, often abused their powers, and enforced ridiculous and harmful taboos, which still cause anxiety for the elders that grew up with them (Stern, 2010, p. 110). Thus, the hybrid culture of the contemporary includes positive aspects of both traditional culture and the *Qablunaat* world, while also establishing distinctly Inuit ways of adapting to the contemporary world, positively contributing to their survival in their homeland.

Due to the hybrid nature of their contemporary culture, the idea of Inuit authenticity should, thus, stem from qualities of distinctiveness and originality that are entrenched in their cultural memory (Stevenson & Stern, 2006, p. 12; Searles, 2010, p. 153). The institutionalization of the concept of Inuit *Qaujimajatuqangit* in their decision making process has shown these qualities, especially when applied to *Qablunaat* institutions, as depicted by the decisions made by the government of Nunavut. In this context, the concept refers to the "values, world-view, language, social organization, knowledge, life skills, perceptions and expectations" that are derived from traditional Inuit culture, and can be applied to modern ideas and practices, to reimagine the Inuit way of life in the twenty-first century (Searles, 2010, p. 159). Some of the key values, which are facets of the Inuit identity, include self-sufficiency, individual autonomy, cooperation, sharing, leadership, innovation and patience (Pauktuutit Inuit Women of Canada, 2006). It is the embracement of these values which result in the creation of capable and resilient minds, which are able to make decisions in a uniquely Inuit way. Furthermore, as discussed earlier in this chapter, the transition to an understanding that Inuit identity is derived from originality and uniqueness has also resulted in the emergence of a global Inuit identity, as opposed to emphasizing the regional differences of the traditional Inuit identity. The Inuit identity is thus placed on a shared ethos, applicable across all regions, providing a distinctly Inuit way of modernization and confronting the unique challenges they are faced with.

The hybrid culture, while in its infancy, and still in need of significant development, has still seen some successful examples of this cross cultural integration. One such example is the wellness and recovery on-the-land programs run by the government of Nunavut, which are used for spiritual retreats, substance abuse rehabilitation, criminal reform, and child education. These land-based activities teach the participants how to survive in the wilderness, creating awareness of their obligations for others and the environment, allowing them to develop into moral and intelligent persons. Another example of this hybrid culture is the Inuit art industry, which is one of the primary economic sources in Nunavut. The industry is comprised of sculpting, printmaking, and textiles, and was initiated by *Qablunaat* forces and is produced for a *Qablunaat* market. It did not evolve organically from traditional Inuit culture, but was pursued as a necessity to make a living, and to continue to survive in their homeland (Hessel, 2002, pp. 188-189). However, despite this foreign origin, Inuit art has become a vehicle for the preservation of their history by depicting traditional Inuit culture, as there was no written history, and therefore has strengthened their shared cultural memory, and the distinctness of the Inuit identity. There are many proposals, which show the potential opportunities for this hybrid culture. In particular are the Next North projects for the Canadian North by Toronto's Lateral Office, which address the challenges created by the culture, geography and climate of the region. These projects attempt to uncover overlooked and dormant opportunities from the cross over and integration of the themes of settlements, culture, transport, monitoring, ecologies, and resources. One example is the Arctic Food Network, which proposes a regional network of hunting and fishing camps along snowmobile trails that connect the communities of Baffin Island. The project embraces the mixed economy of the Inuit, creating an infrastructure that embraces the hunting culture of the Inuit, helps to recover traditions, enhances the production and exchange of local food, and creates a small-scale economy. Another example is the Caribou Pivot Stations, which seeks to help the threatened caribou populations due to the changing environment by capitalizing on the *Qablunaat* investments directed toward research stations in the Arctic. Located along caribou migration routes, this new research station typology forms a microclimate, enhancing the caribou's food supply. In doing so, the practice of subsistence hunting by the Inuit can be sustained.

These examples show how the Inuit have adapted to pressures exerted upon them from modernization, showing the resilience of the people, and the ability to utilize opportunities afforded to them in a distinctly Inuit way. As such, the contemporary Inuit identity is rooted in their hybrid culture, shared cultural memory, and a distinctly Inuit way of doing things, which all contribute to their overall survival as a distinct people in their homeland.

Lessons Learned

Since the contemporary Inuit identity and culture is in fact compatible with life in an urban setting, how might a regional architecture facilitate the urban Inuit identity? The reinterpretation of the *iglu* must then acknowledge the unique hybrid lifestyle, which the Inuit now practice, and the architectural language must be representative of the unique Inuit identity. The dwelling must then accommodate for the different activities associated with hunting and food preparation. The dwelling and community must also make provisions for activities such as family gatherings, food sharing, song and dance, story telling, craft making, sculpting, and sewing. The architecture must aid in creation of sharing networks as well encourage communal activities and development. Formally, the building should react to the environmental conditions, representing the importance of self-sufficiency and living in harmony with the land. A connection to the land should be established through views, accessibility, and materiality. The seasonality of the Inuit way of life should be reflected in their dwellings through the manner in which they function and adapt with the seasons, and through a changing aesthetic. In utilizing these strategies, the Inuit home will not only support their hybrid lifestyle, but will reaffirm their distinctiveness as a people.

4.2 Environment

In order to discuss the general environmental conditions that will affect architecture in the Canadian North, the following chapter will be divided into three sections. The first section will discuss the general terrain conditions found in this region, the second will discuss the climatic conditions, and the third will specifically highlight the particular conditions found in Cambridge Bay, Nunavut.

Terrain of The Canadian North

Topography

A physiographic region is a large continuous expanse of the earth that has similar soil conditions, land relief or topography, which has been shaped by the same geomorphic processes and share a geological structure and history. The Canadian North is composed of parts of four regions. The Canadian Shield occurs in the south eastern portion of the region and was formed of Precambrian rock 2.5 billion years ago, containing many mineral deposits such as copper, diamonds, gold, nickel, iron and uranium. The Cordillera, found in the most western portion, consists of mountains of sedimentary rock formed in the Cenozoic era 65 million years ago, further shaped by glaciers. The Interior Plains in the mid western part is made of layers of sedimentary rock deposits formed at the end of the Precambrian era 500 million years ago, which contains many hydrocarbon deposits. The Arctic Lands in the central area of the region, consist of sedimentary rock formed during the Paleozoic era 500 million years ago, which covers the majority of the territory and nearly 40% of Canada's land surface alone. In particular, the Arctic lands are composed of the Innuitian Mountains and the Arctic Coastal Plains, enveloping a terrain of rolling hills, coastal plains, plateaus and mountains. Further land relief features found in this territory are patterned ground, pingos, and a thermokarst topography formed by the melting permafrost and presence of ground ice. As most settlements are found on the coastal plains, the predominate topography upon which buildings will have to be designed for are rock covered, gently sloping land and rolling hills.

Ground Cover

The soil found in the Canadian North is classified as crysolic, which is soil affected by frost action. Consequently, the ground is not a good growing medium and is covered by resilient vegetation, which offers no agricultural opportunities. The ground is mostly barren rock, shattered bedrock and sterile gravel composed of igneous, metamorphic and sedimentary rock. It should also be noted that this ground is covered in snow for a lengthy period, which significantly alters the conditions, which need to be addressed in design. Thus, landscaping options are limited in terms of what can grow here, but there is potential for an innovative and interesting use of landscaping elements to form and delineate site features.

Permafrost

One of the defining characteristics of the ground in the Canadian North is the presence of permafrost, which is permanently frozen ground, where the temperature stays below 0°C, for at least 2 years. In order for this to occur, the average annual air temperature must also remain below freezing. Except for a thin surface layer called the active layer, which thaws each summer, the ground remains frozen year round and reaches up to a depth of 1000m. There are two zones of permafrost: the continuous permafrost zone and the discontinuous permafrost zone. The continuous zone occurs beyond the tree line where permafrost can reach depths of 1000m, and is defined as an area where 80% of the ground is permanently frozen, which happens when the average air temperature is -15°C. The discontinuous zone is located below the tree line, commonly referred to as the subarctic region where the permafrost never reaches a depth of more than 3m, and is defined as an area where 30 to 80% of the ground is permanently frozen, which ensues when the average air temperature is between -15 and -5°C.

The active layer can vary in depths of up to 1m, depending on soil type and exposure to sun, wind and water. Since permafrost is impervious to water, a permafrost table is formed which traps water within the active layer. The freeze-thaw cycle that results within the active layer, in combination with the presence of water, creates a changing volume that turns this into a very unstable ground condition, which can wreak havoc on foundation systems which are bonded to the ground (Strub, 1996, p. 114). Furthermore, site drainage must also be considered, as the greater the water volume, the more significant the effects will be (Strub, 1996, pp. 117-118).

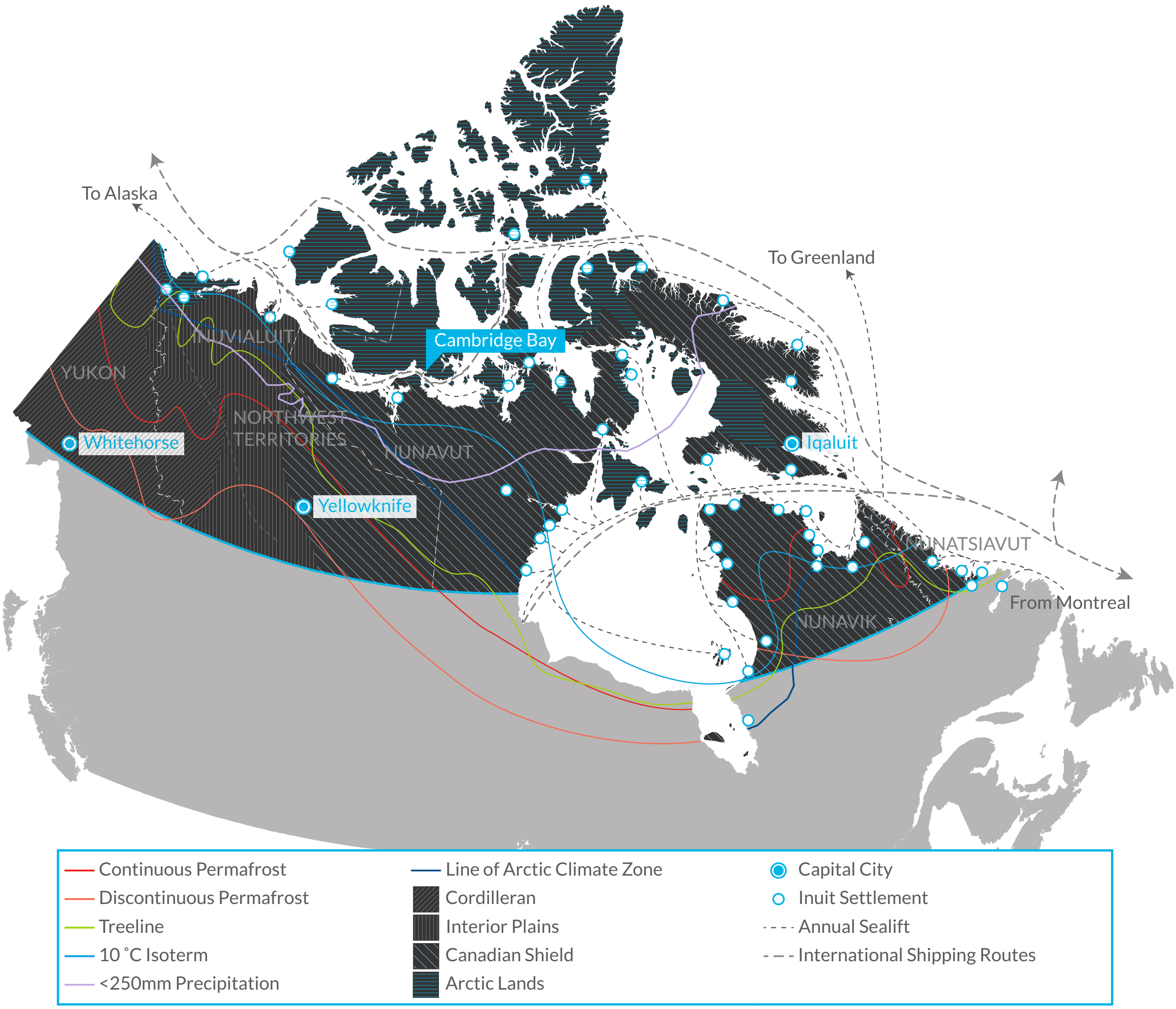
The permafrost layer is also very sensitive to warming temperatures, which creates an unstable settlement. As is, the vegetation as well as the snow cover creates an insulating layer which helps maintain the temperature, but any disturbance to this layer can have a significant impact on the permafrost. The overall rising of the temperature occurring in the Canadian North will also affect the stability of the permafrost. Lastly, heat loss from man-made structures resting on the ground can expedite the process of melting the permafrost causing future unsettling (Crittenden, 2010, p. 22).

Thus, while permafrost itself offers a very stable foundation, buildings within this region should be designed based on the assumption of destabilized ground conditions due to rising temperatures. Everything possible should be done to minimize the disruption of the ground, and a thermal separation should be created between the building and the ground to prevent heat loss directly into the ground (Van Ginkel Associates, 1976, p. 81; Crittenden, 2010, p. 22). Further, services such as water and sewage need to be delivered by trucks or in above ground insulated utilitdors, as in ground systems will either destabilize the permafrost, and are more susceptible to changing ground conditions (Strub, 1996, p. 150; Crittenden, 2010, p. 23).

Water

The most significant presence of water in the Arctic Archipelago is the Arctic Ocean, which offers no potable water, but allows for coastal shipping to most communities. It also offers hunting, fishing and transportation opportunities for the Inuit. Thus, the construction process, particularly material delivery and scheduling, become integral to the building design, while understanding the Inuit relationship to the ocean will also impact design. The warming of the earth significantly impacts the Arctic Ocean as ocean levels could rise, threatening some coastal communities, and the opening up of the Arctic Ocean for longer periods of time could increase the coastal shipping season (Hassol, 2004, pp. 16-17).

Figure 107: The Canadian North Environmental Conditions



Fresh water can be found in the many lakes and rivers which dot the region, but potable water is still scarce due to the low annual precipitation, and the fact that most water is found in solid form due to the cold average annual temperature (Van Ginkel Associates, 1976, p. 116). Thus, any form of water retention from snow or rain and water use efficiency should be factored into building design in the Canadian North. Furthermore, there are no significant opportunities for hydroelectric power generation, which makes the delivery of clean energy a challenge.

Ice

The presence of ice is abundant in the Canadian North, and is a condition that must be addressed. Over 5% of Canada's landmass is covered in glaciers, which prevent any form of life from inhabiting this area for an extended period of time (Strub, 1996, pp. 23-24). However, they are a significant source of the world's fresh water, which is a resource that can be tapped into. When parts of the glacier crumble, icebergs are formed which are also a source of fresh water, but can create seafaring transportation difficulties (Strub, 1996, p. 24).

Within the ocean there are two types of ice: slow and fast. Slow ice is slow moving permanent ice that is translucent in colour, and comes in the form of ice packs, ice floes and ice fields. Fast ice is seasonal ice that is transparent and forms at the coast to extend the shoreline. However, in some places polynyas form which are areas where ocean ice does not form. Also, both slow and fast ice are affected by winds and currents, which can shift the ice within a matter of hours, creating very unpredictable conditions. The freeze-thaw cycle created by the ice along the shore, results in the break up of rocks and an unstable shoreline, which should be avoided as sites for development (Strub, 1996, p. 25). However, although the presence of ocean ice creates many shipping obstacles, it also extends one's range on foot, allowing for new hunting territories.

Flora

Within the Canadian North, two prominent natural vegetation zones exist: the *tundra* and the *taiga*. The division between these two zones is the imaginary tree line, which is more of a wide transition zone where tundra vegetation runs into the taiga, where the dwarf spruce and pines peak through the moss covered ground, and constantly change as the average annual air temperature rises.

The *taiga*, or boreal forest, is located south of the tree line within an area of discontinuous permafrost. Due to the permafrost, long winters and needle cover, a thin active layer of acidic and nutrient poor soil is created, which can support only the most resilient species. However, the higher amount of precipitation allows for more vegetation growth. Also, the growing season starts a month later than it does in lower latitudes, and the longer summer days increase the intensity of the growing season. Consequently, conifers such as black spruce, pine, larch, and fir dominate the landscape, while lichens, moss, evergreen shrubs and berry producing shrubs make up the undergrowth. In areas of poor drainage, peat bogs form which are even less suitable for many plant and tree species.

Covering most of the Canadian North and located north of the tree line, within the continuous permafrost zone is the *tundra*. Within this vegetation zone significant constraints to growth exist. There is minimal annual precipitation, a poor distribution of the scarce water due to snowdrifts and the imperviousness of the permafrost table. Also constraining growth is the permafrost table, which prevents root penetration; the cold active layer, which prevents water absorption by the roots; and the instability of soil in the active layer. The low winter temperature and wind may kill plants; the soil is nutrient poor and acidic, due to the cold temperature that prevents plant and animal decay; there is a short growing season; and long shadows cast prevent plants from getting enough sunlight. Thus, the vegetation cover is sparse, and the number of species is restricted, which means the possible relationships are limited, resulting in an unstable simple ecosystem where balance is fragile because a drop in one species directly affects the other. Also, due to the harsh conditions, certain microhabitats can significantly improve the growth of vegetation. Found along dry beach ridges are crustose lichens, saxifrage, and arctic poppies, while on the backside of ridges artic willow, grasses, heathers, and mats of lichen and moss are found. In wet lowlands sedges, herbs and mosses grow. These microhabitats become particularly visible in fall when the leaves turn creating patches of red, orange, rust and burgundy, which delineate the boundaries. Because of harsh conditions, including the 50°C temperature variation, plants have to be adaptable to enable their survival. Thus, most plants hug the ground, forming a canopy with their leaves and stems to protect them from the wind and to absorb sunlight, creating a warmer temperature below the canopy. Some plants grow hair to insulate, some have frost resistant structures, others are shaped to concentrate light and follow the path of the sun, and many are more abundant around perennial snowdrifts in order to take advantage of the melt water.

The tundra is of significant importance for human survival as it feeds the caribou and birds, nurtures insects which feed fish and birds, provides a breeding ground for waterfowl and lemmings, all of which are a source of food for humans (Strub, 1996, p. 35). It also provides plants for medicinal use, Vitamin C in berries and saxifrage flowers, and provides lichen and dwarf willow for camp fires (Strub, 1996, p. 35). Thus, anything built here must respect the fragile environment, maintaining all vegetation where possible, while creating conditions where vegetation growth can prosper. Furthermore, buildings must attempt to connect to the landscape, as an understanding of the tundra's importance to people must be maintained and signified.

Fauna

As previously stated, the fragile tundra environment is host to a small selection but relatively large population of fauna. The primary land based mammals found here are caribou, arctic foxes, ermines, lemmings, wolves, bison, moose, hare, polar bear, muskox, martens, muskrats, and wolverines. The marine mammals found in this region are beluga whales, narwhals, bowheads, walruses, and seals. There are a significant number of bird species in this region, the most prominent being snow geese, Canada geese, brant geese, white fronted geese, pintails, common and king eiders, old squaws, scoter ducks, ravens, owls, gulls, gyrfalcon, gray jays, mergansers, loons, grouse, ptarmigan, murres, and dovekies. There are also a large number of fresh and salt water fish species found in the region which include arctic char, whitefish, lake trout, northern pike, inconnu, walleye, grayling, salmon, capelin, Atlantic cod, Greenland halibut, herring, turbot and suckers. Also found in the waters are select species of shellfish and crustacean. Lastly, there are about 1000 species of insects found in this region, including 50 species of moths, 20 species of butterflies, while the most populous in numbers are mosquitos, black flies, midges, bees and wasps.

Understanding the fauna found in the region is of particular value when designing for the Inuit because traditionally their way of life revolved around hunting and relating to the animals, in so much as the animals were not viewed as being wild, but as being a part of the same world as the Inuit (Strub, 1996, p. 37). The recent adoption of many southern practices has done exstensive damage to wildlife populations, and this process must be reversed. Thus, any form of development must ensure that many animal habitats are left intact and undisturbed. It is also important that buildings be designed to prevent animals from doing considerable damage to them, preventing them from nesting anywhere adjacent to the building, keeping them away for security reasons, and to protect people from the nuisances created by black flies and mosquitos.

Northern Lights

An interesting phenomenon that occurs in the Canadian North is the Aurora Borealis, which is Latin for northern dawn. This is a band of light forming an oval over the geomagnetic North Pole, produced by solar wind where energy is released creating a light only visible on the dark side of the earth. The different particles produce several colours, with atomic oxygen producing green and red, while molecular nitrogen produces purple. Views towards this unique and spectacular sight, especially during the long dark winters, should be incorporated into the building's design.

Climate

The following section will discuss climatic conditions found in the Canadian North. It should be noted that while the conditions discussed are general throughout, the higher the latitude the harsher the conditions as higher latitudes receive less solar energy.

Seasons

The earth is a spherical object that rotates on 23.5° angle, which means the sunlight's angle of incidence changes throughout the year, resulting in varying intensities of solar radiation, creating seasonal variations. Unlike many locations to the south, which experience four distinct seasons, the Canadian North can be said to experience two distinct seasons: summer and winter. As such, there is a contrasting relationship between the two seasons which dominate the year, while the transition seasons are nearly non-existent. The prominence of the two seasons is proven in the dichotomous way of life of the Inuit who have inhabited this region for centuries (Collignon, 2006, p. 33). However, it should be noted that the Inuit break their seasons up into six or more, due to minor variations, local characteristics and animal movements. The winters can be seen as a time when darkness prevails for most of the season, bodies of water freeze over, it is very windy, it is brutally cold and snow dominates the landscape. The summers can be seen as a time when sunlight prevails for most of the season, bodies of water open up, wind still blows, but is not as brutal, the temperature is cool, but above freezing, and vegetation and barren rock dominate the landscape. These two distinctive seasons need to be addressed in the design of dwellings to ensure that they function properly in the two differing states, and that their aesthetics are representative of these differences.

Sunlight/Darkness

Since the sunlight's angle of incidence changes depending on the time of year and location, the intensity of sunlight experienced by that particular location varies throughout the year. As such, in most locations seasonal variations are created where the sun's angle of incidence is at its lowest and sunlight is at its longest during summer, and in winter, darkness prevails. The Arctic Circle, found at latitude 66.56° North, is the location where winter nights last 24 hours on the winter solstice (December 22) and summer days last for 24 hours during the summer solstice (June 22), while at the North Pole a winter night and summer day lasts nearly 6 months. Any latitude located between these two locations experiences a winter night and summer day that last between 24 hours and 6 months. Also noteworthy is that due to the angle of the earth's rotation during the summer, sunlight comes in from almost all directions of the horizon. This results in vastly different conditions throughout the year, creating the polarity of night and day, winter and summer, cold and warm.

Solar altitude at its peak in the Canadian North is significantly low, and becomes lower during the winter, and is even lower the further north the location. The solar altitude at noon can range between the angles of 0 to 50° depending on the latitude and time of year. Consequently this means that vertical surfaces experience more sunlight, and objects in the landscape cast long shadows (Strub, 1996, p. 42). Further, sunlight is most intense at altitudes above 25°, as the sunlight has further to

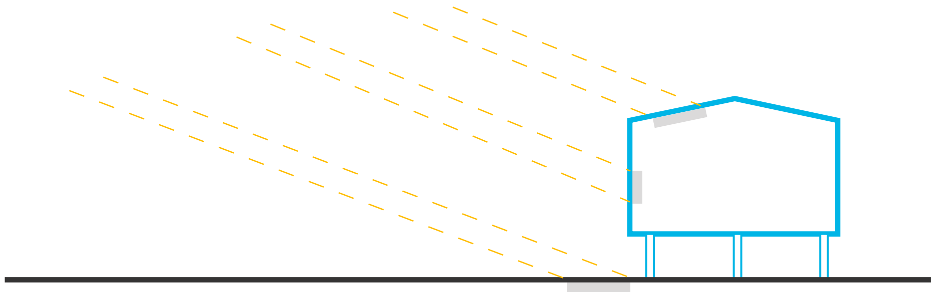


Figure 108: Sunlight Concentration

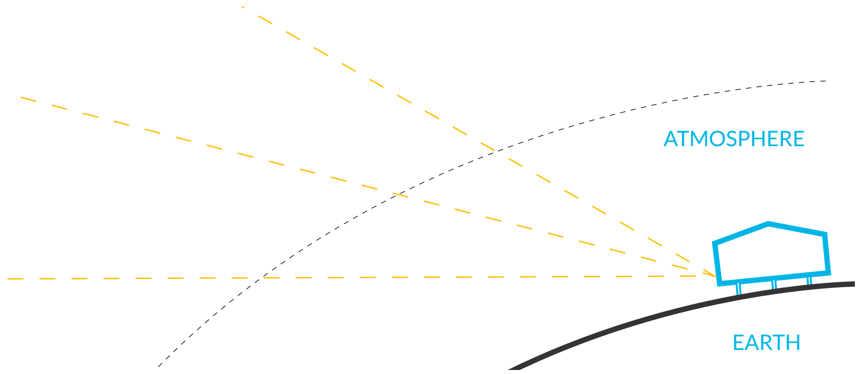


Figure 109: Sunlight Strength
Low angle sunlight travels a longer distance through the energy absorbing atmosphere

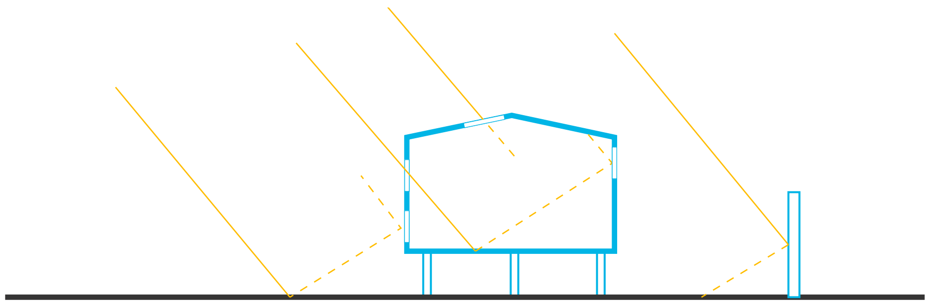
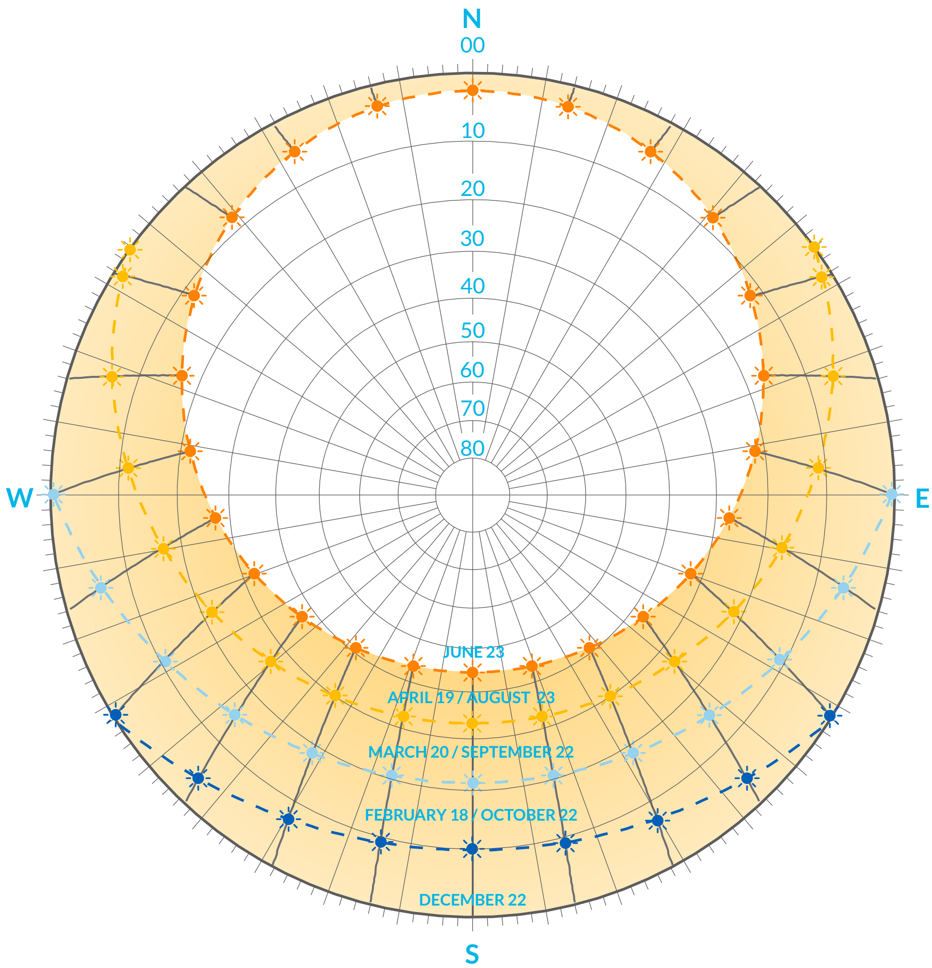


Figure 110: Sunlight Effects on the Built Environment

travel the lower the altitude.

Another aspect to note in terms of sunlight is that sometimes the sun appears to be above the horizon even if it is not, due to stable air masses found at high latitudes, which allow for air stratification and the subsequent refracting of light, which distorts images, making the sun appear above the horizon (Strub, 1996, p. 30). Sunlight is also affected by the presence of clouds, fog, and blowing snow, resulting in only 40% of the potential sunlight in an area being received (Strub, 1996, p. 44). The difference between potential sunlight and actual sunlight received is more drastic in the summer as more clouds and fog form due to the open water. Moreover, sunlight becomes more intense during the late winter because it bounces off the snow, but in winter there is minimal sun, and in summer there is no snow for the sunlight to reflect off of.

Figure 111: Sun Path at 69° North



In the Canadian North, sunlight is something that needs to be considered early in the design of buildings, as it is already scarce. Buildings can no longer be divorced from the landscape as they have been in the past; spaces that ignore sunlight or are covered in long shadows are undesirable and neglected. As previously stated, because of the low solar altitude, vertical surfaces are more effective at capturing the sunlight, allowing sunlight to penetrate deep within buildings. The low altitude also means the shadows cast from buildings will be significant, which needs to be accounted for in site planning through the providing adequate spaces between buildings and locating taller buildings to the north (Crittenden, 2010, p. 20). Worth noting is that the sun can reach the building from most sides depending on the time of day, and because of this, while vertical surfaces will take their turn being exposed to the sun, horizontal surfaces will experience constant solar exposure, just to a lesser intensity (Strub, 1996, pp. 55-56).

The various sunlight conditions during the different seasons must also be considered in design. Since summer sunlight is constant, and late winter sunlight is amplified due to the reflection off of snow, the sunlight can cause glare and significantly heat up the interior spaces, so great care must be taken in controlling sunlight in both sleeping and family spaces during these periods. Thus, mobile shading systems such as shutters must be considered in the design of dwellings. In the winter, sunlight needs to be maximized and must penetrate spaces as much as possible in order to positively impact the psychological well being of its inhabitants (Crittenden, 2010, p. 19). Artificial lighting is required for much of the season, resulting in higher electrical fees, and heat loss needs to be prevented even more during the darkness. In terms of building layout, sunlight should be captured and focused in the main living spaces, while kept out of sleeping areas due to the lengthy periods of sunlight in the summer. Solar orientation needs to be considered, so that the long axis faces the equator, allowing the building to absorb more heat (Strub, 1996, p. 94). Also, sunlight can be captured and focused to create areas of thermal comfort, stored by thermally massive materials, and used to produce energy. However, sunlight can also heat up the ground and destabilize the permafrost, and the durability of exterior building materials can be impacted from intense exposure to sunlight as it will experience a temperature variation of nearly 100°C (Strub, 1996, p. 41). Lastly, the extended periods of darkness in the winter limit the construction season.

Temperature

As mentioned before, since the earth is a spherical object the angle of incoming sunlight becomes lower at higher latitudes, the light has to travel farther reducing its intensity, resulting in a lower average annual temperature the further north you go. Because the earth rotates on a 23.5° angle, the intensity of sunlight varies throughout the year which results in significantly colder winters. Since snow and ice cover the ground for much of the year, the ground is unable to absorb heat and cannot release it into the atmosphere, therefore making conditions even colder. The moderating effects of large bodies of water also impact the temperature in this region. The air masses off of the Pacific Ocean, a large warm body of water, result in the western arctic being warmer than it is to the east. Hudson's Bay, located in the south central part of the Canadian North, is a large body of cold water, which pushes colder temperatures further south in the areas surrounding it. Also, the further inland a location is from large bodies of water, the moderating effect of water has a lesser impact on the temperature. As such, while many places do in fact get as cold as the Canadian North, nowhere else endures these temperatures for a long duration. Generally, in the Canadian North, during the winter months, the average daily temperature ranges from -35 to -20°C and during the summer months, despite the frequent solar exposure, the mean daily temperature ranges from 5 to 15°C. Since most days in the Canadian North are considered degree days, days where the air temperature is under 18°C, it is almost always heating season (Strub, 1996, p. 47). Also, air temperature lags behind solar radiation due to the ocean's moderating effect and an air buffer in the atmosphere, so the coldest and hottest periods occur one month after the winter and summer solstice respectively. The mean temperature of water and soil lag even further behind the air temperature, in so much as they reach their coldest and warmest temperatures nearly 2 months after the solstices. Soil temperature is often warmer than the air during winter months, while it is colder than the air during summer, which helps maintain a stable permafrost table.

Thermal comfort becomes really important in the Canadian North because unlike animals, which have adapted to the extremely cold conditions, humans are very inefficient when it comes to retaining heat. Humans are not very well insulated and rely on layers of clothing to keep them warm. Heat is lost through convection, conduction, radiation, evaporation from skin, and in water vapour exhaled through the lungs. Uncontrolled human heat loss can be significantly damaging as it can lead to hypothermia and frostbite, however on the short term, the body can deal with a temporary drop of 3°C. Nonetheless, creating a comfortable environment for human inhabitation becomes a significant priority in building design. Thus, the volume enclosed within a building should be minimized to reduce a dwelling's heating loads, while other strategies to reduce heating load should be explored. Alternate methods to effectively and economically heat interior spaces need to be utilized, such as radiant heating, and utilizing solar gain.

As described by Harold Strub (1996) in *Bare Poles*, cold temperatures have four significant effects on building design. The first is heat loss, where the greater the difference between the interior and exterior temperatures, the greater the rate of heat loss. Another prominent factor contributing to heat loss is duration, which is significant in the Canadian North, making this an even more important factor to consider in design. The result for the majority of the buildings in the North is that they are often under insulated and have high heating costs. The second noteworthy factor to consider in design is the phase changes of water within the wall assembly. In this context, water vapour quickly changes to water and then to ice, which speeds up deterioration by rotting wood when it is warm enough, reducing insulation values, and destroying roofing membranes through contraction and expansion. The third factor is the freeze-thaw cycles experienced by exposed surfaces. With the presence of water this becomes a significant weathering agent as materials exposed to sun might stay above freezing during the day and then drop below freezing at night, making this process frequent. Further, this can also cause moving components to freeze shut, limiting the buildings functionality. The fourth is the dimensional change of exposed materials due to the cold temperature. When materials are exposed to cold temperatures, contraction occurs, resulting in cracking, while other times when the materials heats up, buckling may occur. Thus, homes in this climate need to be well insulated, have strategically placed windows, have minimal thermal bridges, and be hermitically sealed. The form should have a low surface-to-volume ratio in order to retain heat, as the greater the surface area the more heat is lost (Strub, 1996, p. 100). Openings can be protected with the use of insulated shutter systems and an Arctic entry system, a vestibule which creates a cold trap. Materials selected for construction must maintain their integrity with such large temperature swings, and not become brittle in severely cold temperatures.

However, one positive aspect regarding the low mean air temperature is that it slows down the deterioration of materials. For example, wood rot that occurs at temperatures below 5°C is negligible (Strub, 1996, p. 46). Another aspect to consider in design is the creation of microclimates, using the built environment to providing shelter from the wind, and using the sun to heat the air, and to heat surfaces, which can be amplified by utilizing reflective materials on vertical surfaces in order to create an area of thermal comfort (Strub, 1996, p. 95). Cold temperatures also affect the construction process, as it limits the time in which exterior work can occur, and temporary interior heating systems have to be set up to allow work to continue during the winter.

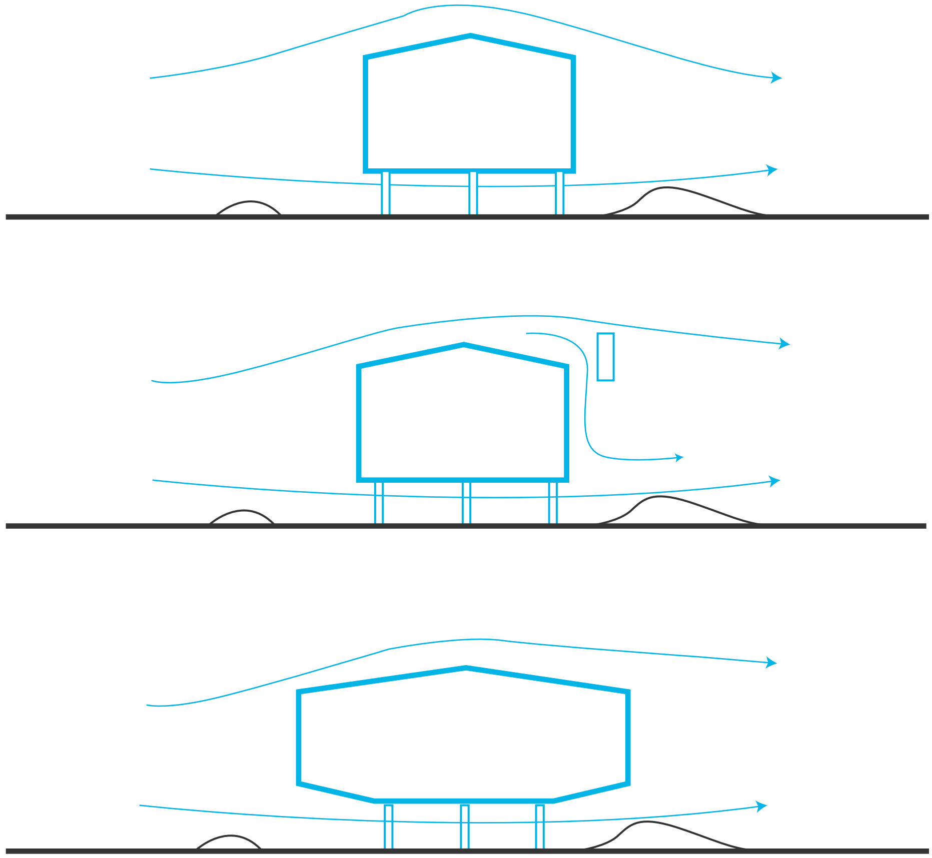
Wind

Wind is created when air passes from a zone of high atmospheric pressure to a zone of low atmospheric pressure. In the Canadian North winds are either the westerly winds caused by global air circulation or originate from the cold arctic air mass. Thus, the prevailing winds come primarily from the north, ranging from northwest to northeast throughout the year. A characteristic of wind is that it flows regularly until it encounters an obstacle on the earth's surface, when it becomes turbulent, as the wind needs to speed up temporarily in order to maintain a constant air volume at both ends of the obstacle. A zone of high pressure is created upwind against the obstacle, and a zone of low pressure is created at the downwind side of the obstacle. Due to the minimal obstructions in the tundra landscape, wind has a frictionless path, resulting in a high average wind speed that hardly varies throughout the year, and is an almost constant presence. Consequently, calmness is a pleasant surprise in the winter. The open snow covered tundra is a huge source of snow and ice particles, which can be picked up by wind with a speed as little as 10km/h. It thus erodes snow in certain areas, carries the snow in the airstream, creates blinding conditions, and creates snowdrifts in other areas when the air stream runs into obstacles and turbulence occurs.

Humans are adversely affected by wind chill because the human body loses more heat with more fresh air adjacent to them, which means the higher the wind speed, the more fresh air is pushed by a person resulting in significant heat loss. Human flesh has no tolerance for freezing and must therefore be sheltered from wind as much as possible. Thus, the need for enclosure and sheltered outdoor spaces are necessary in this environment.

Since wind is particularly strong and frequent in the north, it acts upon a building almost continuously, which is why it must be considered in design. Strub (1996) describes the following effects of wind on the built environment. In general the lateral force of the wind presses the windward face of a building inward, while the

Figure 112: Building Response to Wind and Snowdrifts



leeward face is sucked outward. Because the wind comes from the north, it has the greatest impact on north facing elevations, resulting in more heat loss, more snow build up, and more weathering. One of the primary impacts of wind on a building is its ability to steal heat and moisture, impacting its overall thermal comfort and resulting in the need to heat buildings more. The less aerodynamic a building is, the more heat is lost, so this needs to be considered in design. The air pressure created by the wind forces the air barrier to balloon inward at the upwind wall, and to balloon outward at the leeward wall, which creates moisture problems and increases heat loss. The wind can deteriorate the seals on windows and doors, it can blow components and parts off of buildings, it can lift roofs that have protruding eaves, it can peel back materials if it catches a leading edge, and if strong enough it can shift the building's structure. Furthermore, wind, along with the dust, ice crystals, rain, and snow that it may contain, results in the weathering of materials, such as changes in colour and texture, and may alter the chemical make up affecting its durability. In the summer, the dust from the gravel roads is blown against buildings by the wind, clogging screens, reducing window transparency, and entering buildings through open doors and windows. The constant presence of wind can also reduce productivity on the construction site.

A hermetically sealed and well-insulated building can help reduce many of the heat loss problems that result from wind. The area and height of the north-facing windward wall of buildings should be minimized in order to reduce heat loss and snowdrifts (Crittenden, 2010, p. 21). The windward elevation should also consist of a low roof profile to create a more streamlined form (Strub, 1996, p. 96). Durable exterior materials must be utilized to negate the deteriorating effects of the wind. Building structures must consider the strong lateral loads of the wind as well. Further, to prevent damage, large roof overhangs and other protruding elements must be avoided, especially on windward sides.

The combination of wind and snow also causes many problems for building design. Fine snow can be blown into vents and other openings, creating moisture problems within the building (Strub, 1996, p. 48). Aside from creating a tightly sealed building envelop, baffles can be used to prevent snow from entering exhausts and air intakes (Crittenden, 2010, p. 23). Another development is the Arctic Hot Roof, which has no ventilated attic space and is similar to a cathedral ceiling (Strub, 1996, p. 138). The wind can blow snow against buildings, blocking access, leading to fire safety, injury and accessibility issues (Strub, 1996, p. 49). Snowdrifts also change the nature of the building's aesthetics and proportions. Also to consider is that larger snowdrifts are created at the windward edge of a community. Having a regular street grid also means the wind will be funnelled, and creating massive snowdrifts on roads. Lastly, when snowdrifts melt in spring, muddy areas create a need for sufficient drainage. Snowdrifts can in part be prevented by raising the building, leaving an unobstructed space below, and by further shaping the building so that the wind is accelerated below, which will thus carry the snow away (Strub, 1996, p. 96).

There are also some positives created by the presence of wind. It can be an effective source of power generation, as you can almost guarantee that it will always be producing energy. Wind can also be used to clear snowdrifts, especially in front of entrances. In the summer wind can be used to cool and vent buildings, and is effective in keeping bugs away.

Precipitation

Technically the Canadian North is a polar desert, in that it receives less than 250mm of precipitation per year. Cold air has little vapour carrying capacity, which is why a region with a low mean annual air temperature has little precipitation. Also, because most of the bodies of water are frozen for a greater part of the year, this impedes evaporation significantly, meaning precipitation peaks in the summer and early winter. Distance from oceans and large bodies of water also impact precipitation amounts, but since most communities are found adjacent to water, higher amounts of precipitation can be assumed. Despite the minimal annual precipitation, when rain does occur, it can be very intense, so this intensity needs to be accounted for in site drainage and how the dwelling sheds water. Also, half the precipitation that falls in the region falls as snow, as opposed to mid latitudes where one fifth falls as snow. Thus, despite the low annual precipitation levels, it still gets equal to, if not more snow than many other locations in Canada. Most of the snow occurs in early winter, before the open water freezes, and the snow is more abundant in many areas due to snowdrifts.

Because of the extended cold period and the abundance of snow, a monotonous white landscape remains for much of the year. As the wind blows, it picks up snow from the large upwind supply or blows the snow during snowstorms, filling in the uneven landscape, creating two drastically different landscapes in summer and winter. A feeling of solitude, silence and remoteness is thus created for much of the year, which can have negative psychological impacts, begging the built environment to provide some means of difference (Crittenden, 2010, p. 21). The blowing snow also creates whiteout conditions, making visibility an issue at times. The layer of snow insulates the ground and sea ice, resulting in the ground and water being much warmer than the air temperature. The snow also reflects the sunlight when present, allowing more light to enter interior spaces and for more solar gain to occur.

The precipitation found in the Canadian North affects building design in many ways. The driving of rain and snow due to high wind speeds weathers vertical surfaces and can enter vents and building cavities causing moisture issues (Strub, 1996, pp. 48-49). Further, the snow often enters the house where it melts, creating maintenance issues. Because of the intensity of rain at times, and melting of snow, in particular in areas of snowdrifts, site and building drainage must be considered (Strub, 1996, p. 49). One thing to note, is that snow drifts blocks gutters, and melt water refreezes within gutters and downpipes, so gutters are rendered useless in this region (Strub, 1996, p. 139). The snow cover disrupts paths as well, making accessibility an issue, which is further complicated by massive snowdrifts (Strub, 1996, p. 49). However, this disruption can be minimized if buildings are oriented to take advantage of the wind to clear these snow drifts, and by lifting buildings so that drifting does not occur against them. Snow also increases the loads acting upon a roof's structure and is also unevenly distributed with more snow built up on the leeward side of the roof (Strub, 1996, p. 95).

On the other hand, precipitation can offer some opportunities in design. Melting snow and rainwater can be harvested, which is significant in this region as fresh water is scarce, and delivery is expensive. Freshly fallen snow that is filled with air can also act as an insulator, so when it gathers on roofs, it can help retain heat (Crittenden, 2010, p. 20). Lastly, because snow is such a significant characteristic of the northern way of life, utilizing its aesthetic qualities in design can help in the creation of a regionally responsive dwelling.

Humidity

Another aspect of thermal comfort is humidity, which is often misunderstood as it has many different variables and is thus not considered in design. Most humans are aware of how humidity affects them on a day-to-day basis, but are often confused with what it actually is and think it cannot be controlled. A small component of air is water vapour, which is an invisible tasteless gas measured as a ratio of water vapour mass to air mass without water vapour and is referred to as moisture content. However, the moisture content of air differs as the temperature changes, so a ratio of the actual moisture content in the air to the moisture content of the same parcel of air saturated at the same temperature, is used to determine humidity. This is referred to as relative humidity and is expressed as a percentage. In air with constant moisture content, relative humidity decreases when the air temperature rises, and increases when the air temperature drops. Thus relative humidity is the measure used to determine human comfort as well as humidity's impact on building materials both dimensionally and visually. Relative humidity can range from 0 to 100%, with the maximum being the saturation point for that particular temperature and air pressure. Also, the saturation point of warm air contains much more water vapour than the saturation of cold air.

In the Canadian North, water vapour in the air comes from the evaporation, sublimation, and transpiration of water, snow and ice. During the summer and early fall, a higher relative humidity of around 80% is created due to the evaporation of water when there is no ice. As a consequence of this, more fog is found during this period. During the winter, when the air temperature is cold, the relative humidity is around 75% due to sublimation, but the moisture content is still low. When humans are close to this cold relatively humid air, their bodies convert it into warm dry air, which then sucks the moisture out of the skin (Strub, 1996, p. 57).

Similarly, when this air is brought into a building and heated up, the moisture content remains the same, but its ability to hold moisture is greater, which is why the relative humidity becomes significantly low, and thus the dry air is forced to absorb as much moisture from its surroundings (Strub, 1996, p. 54).

Interior air with low relative humidity is harmful for both humans and the building. In humans it causes dry skin, dry irritated eyes, inflamed noses, chapped lips, cracked skin, dry throats, split fingernails and respiratory illness (Strub, 1996, p. 53). Within a building it can remove the moisture out of materials, causing them to shrink and crack, while also creating static electricity (Strub, 1996, p. 57). Thus it is not enough to just heat the air, but moisture needs to be added to the air to prevent these issues.

In buildings that have conditioned interior spaces, further problems are created due to moisture. Water vapour tends to move from zones with high moisture content to zones with low moisture content, so in the case of buildings with warm interior and

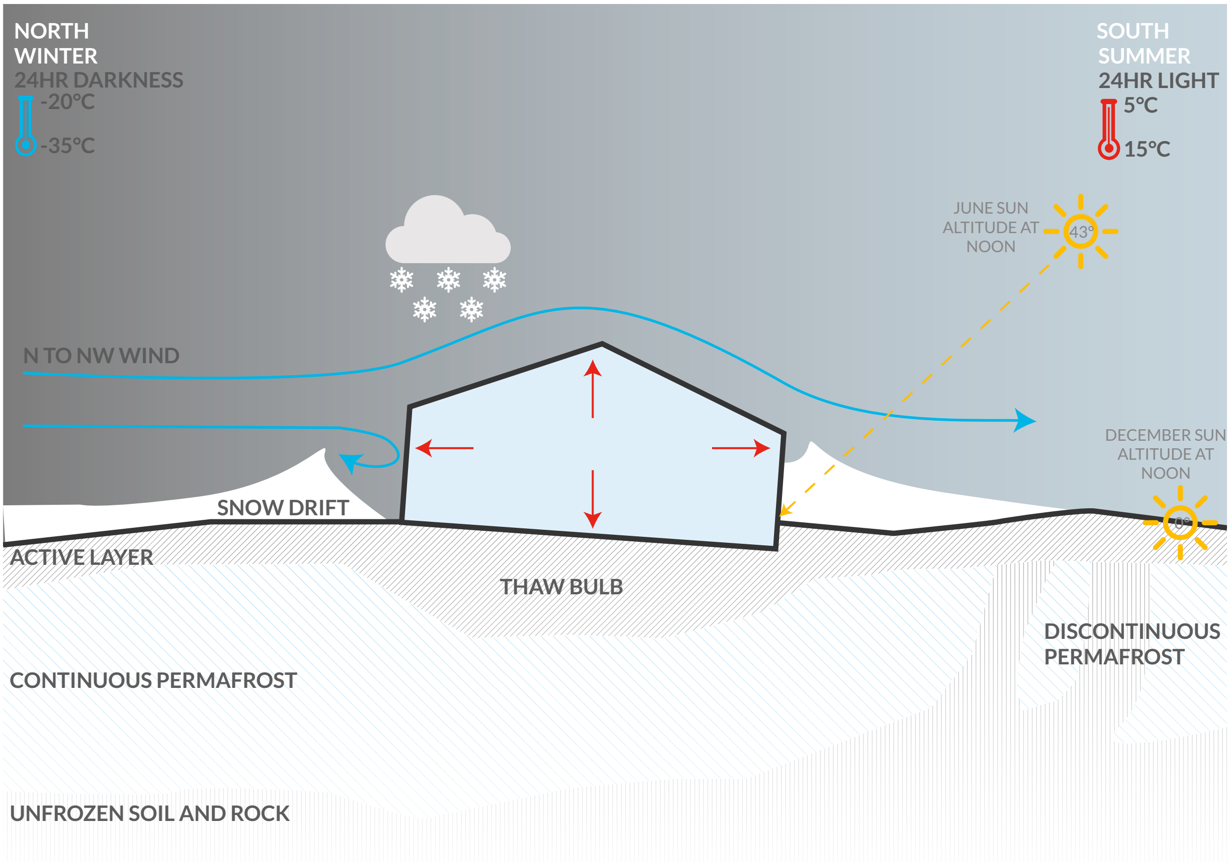


Figure 113: Environment Impacts on House

cold outside air, the water vapour will diffuse outward of a building. One problem with this is that once the warm air hits a cold surface, it will become saturated and produce condensation, which will occur within a wall assembly if is there is no vapour barrier (Strub, 1996, p. 57). Also, wind pressure, stack effect and mechanical ventilation will move the air, including water vapour from the building to zones of low pressure. Due to the greater moisture content of this interior air, more water vapour leaves the building than what enters it through air infiltration, creating the need to add moisture to interior air. Since water vapour has a high heat storage capacity, when it leaves buildings through air leaks and diffusion, a significant amount of heat is also lost, increasing the heating demand and cost. Thus, having a hermetically sealed building is crucial in this environment.

At the other end of the spectrum, too much water vapour can also lead to issues. Sources of water vapour within a building can be produced from human lungs, perspiration, laundry, cooking, and bathing. The excess water vapour can result in ice jams in doorways, the soaking of interior spaces, metal corrosion, rotting wood, water damage, staining and mould (Strub, 1996, p. 53). As mentioned before, water vapour can form inside a wall cavity when the warm air comes into contact with a cold surface, which can lead to mould, soaked insulation, and wood rot. Too high a relative humidity also affects humans by creating brittle skin, and results in many lung ailments (Strub, 1996, p. 53). Homes must have exhaust systems in place to ensure excess relative humidity can escape.

Cambridge Bay

Cambridge Bay can be seen as the prototypical community from the Canadian North, in that the environmental conditions experienced here roughly represent an average of what all the other settlements experience. Since it is located at latitude 69.12°, it is at a similar latitude to many other towns, it is far enough above the Arctic Circle, and it is situated almost in the middle of the most northerly and southerly communities. The following chart highlights the environmental characteristics found in Cambridge Bay to help establish design parameters.

Figure 114: Cambridge Bay Environmental Conditions

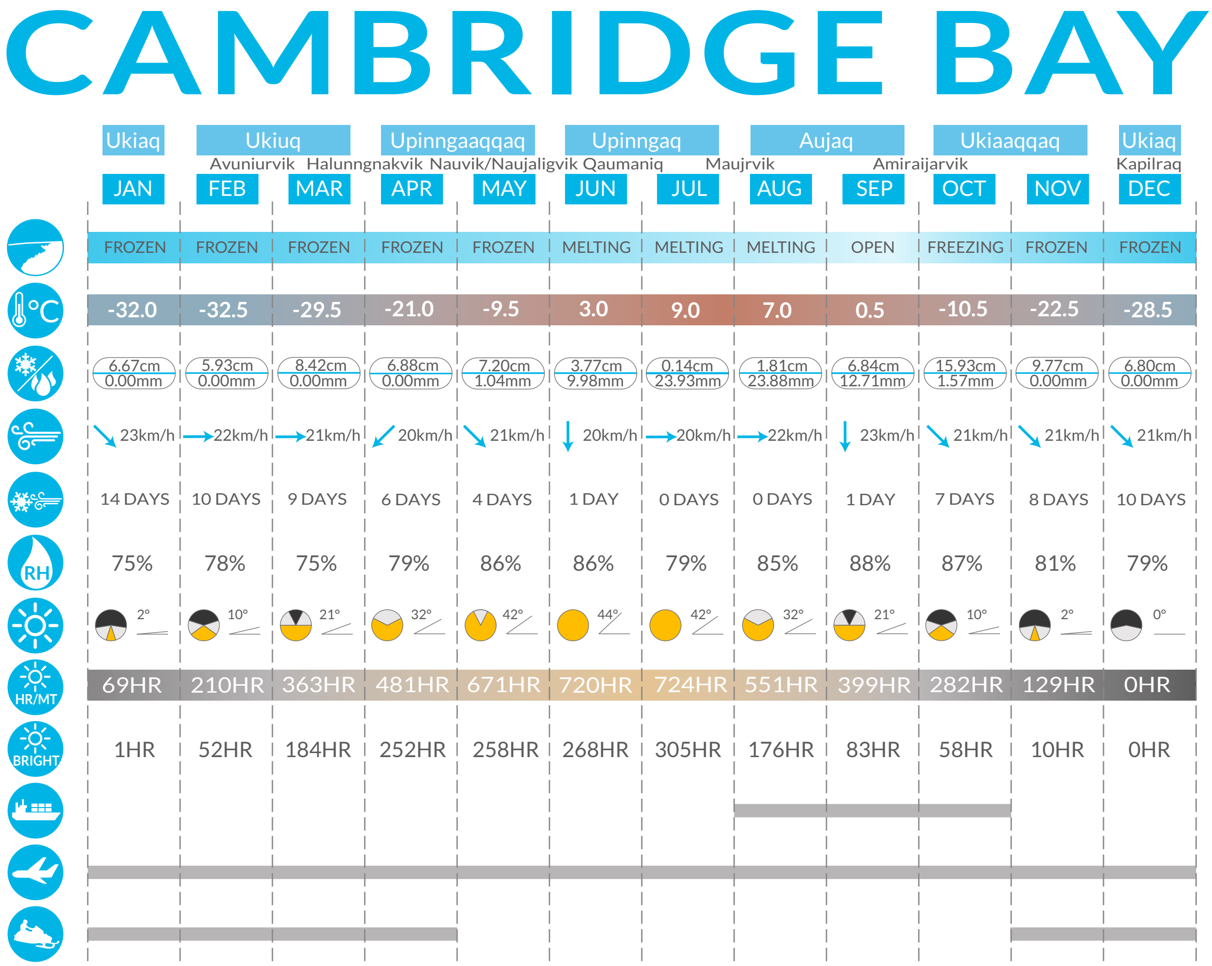
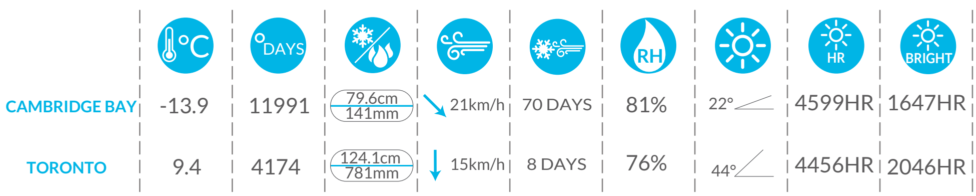


Figure 115: Cambridge Bay Environment Vs. Toronto Environment



4.3 Economic

The following chapter will address the economic factors that have an impact on the way dwellings and other buildings are designed in the Canadian North.

Region

The Canadian North has transitioned from the subsistence economy of the Inuit to a mixed economy consisting of a mix of commercial and subsistence occupations and practices. Most of the Inuit population partake in the wage economy to some degree, with many people adopting trades which they can acquire locally, giving them assorted skills and a degree of autonomy and flexibility, allowing them to switch jobs as the economy changes (Indian and Northern Affairs Canada, 1991, p. 3.5). A large portion of the Inuit population also prefers seasonal, shift or part-time employment, which allows them to participate in traditional practices. By partaking in the wage economy, the Inuit are able to afford the modern hunting technologies, which they have adopted, and it replaces the lost income from the declining commercial hunting industry. Furthermore, in cases when employment is scarce, traditional hunting and sharing practices helps support families, allowing them to be self-sufficient (Indian and Northern Affairs Canada, 1991, p. 3.5). It is very important that the architecture of this region take into account the traditional hunting lifestyle in order to encourage and sustain this mixed economy.

As a hinterland, the economy in the Canadian North is largely dependent on primary economic activities derived from the development of its natural resources. Consequently, this is a very fragile economic environment as it is subject to boom-and-bust cycles that can result in many business closures and out migration. However, this region is seen as Canada's last major resource frontier, and holds significant potential, which only grows with the rising temperatures and technological advancements. As seen in 2011, the growth rate of Nunavut's GDP was 7.7%, in comparison to the national average of 2%, highlighting the growing economy (Nunavut Housing Corporation, 2012, p. 12). The result is that many resource towns are being developed in remote locations across the region. While these projects will bring financial wealth and new jobs, they do not necessarily bring long-term economic success as many projects have a limited lifespan; thus a sequence of many successful projects is needed for sustained growth. Despite this potential, in its present state, the economy is primarily comprised of tertiary activities where municipal and territorial governments supply the vast majority of employment. The territorial government of Nunavut operates on a decentralized model, creating sustained employment in many different communities. Today, 13% of the economy is derived from the primary sector, 85% from the tertiary sector, and the remaining 2% from the secondary sector (Bone, 2011, p. 18). However, more and more of the economy will come from the primary sector in the future as the region's natural resources are developed. With this growing economy, new developments must be forward thinking and respond to local needs, as opposed to replicating the status quo in order to ensure a self-sufficient future.

Family

As stated in the previous section, most families in Nunavut practice a mixed economy. The average income in Nunavut for in 2011 was $43,305, while the Canadian average was $40,650 (Nunavut Bureau of Statistics, 2011, p. 4). Despite this average, the median income is $25,662 (Nunavut Bureau of Statistics, 2011, p. 4), which is significantly lower than the average income, meaning that a large portion of the population does not earn anywhere close to the average income. The situation is further complicated by the fact that "essential goods and services cost two to three times more than in southern Canada, and household operating costs can be five to ten times more expensive" (Nunavut Housing Corporation, 2012, p. 28). There is also a high dependency ratio of 82.1 compared to the Canadian ratio of 59.2 (Nunavut Housing Corporation, 2012, p. 28). This means that those who earn income support more people in their household than that of the rest of Canada, resulting in low-income families and creating an overreliance on government support to live their day-to-day lives. Nearly one half of the population, totalling over 15,000 people received income support payments, which is a staggering number (Nunavut Housing Corporation, 2012, p. 28). Furthermore, 57.5% of the population is housed in public housing, with many paying little or no rent, causing a huge burden on the government (Nunavut Housing Corporation, 2012, p. 24). There is also a disincentive to work, as rents are tied to income, contributing further to poverty (Nunavut Housing Corporation, 2012, p. 24). Many of the houses are also extremely expensive, especially considering the quality of housing you actually recieve, and they often sell for less than their construction costs. Also, as there is no land ownership in Nunavut, reflecting traditional Inuit values, the land is leased crown land, which makes obtaining a mortgage more difficult. Thus, for most families, even those with decent incomes, public housing remains the only option. Many families also have no savings, and have poor financial literacy, contributing to economic hardships (Nunavut Housing Corporation, 2012, p. 28). These challenges prevent the move towards a self-sufficient future for the Inuit in Nunavut. While many of these challenges can be addressed through a systematic change in how the government deals with poverty and subsidies, architecture can have an impact as well. Since the majority of housing is public housing, an economically feasible, flexible and systematic approach to housing delivery should be adopted, as opposed to the mere replication of the same building. In utilizing a set of standard components that can be assembled in different ways, an economy of scale is created without significant repetition. Homes can further be designed to encourage both subsistence and wage economy activities.

Local Resources

The variety of readily available resources in the Canadian North is limited. Even the hydrocarbon resources and minerals available are shipped south to be processed and refined and shipped back for use, effectively negating many of the positives of having locally available resources. There is also no local agriculture, so a substantial amount of food has to be flown in at a cost. With no potential for hydro electricity, communities must receive their electricity through oil burning community generators. Local building materials are scarce, and most materials arrive by barge or airplane, increasing the cost of construction significantly and having a negative impact on the environment.

Despite the lack of readily available local resources, there are still a few that can be taken advantage of, and can result in greater economic and environmental sustainability. The Inuit who practice a subsistence hunting culture do a good job of making the most of what little is locally available, therefore investigating what they used can be of particular use. They would utilize every part of the animal they caught for food, clothing, building material, tools, and fuel, all of which can still be applicable today. For example both seal blubber and moss can be used as fuel for the *qulliq*, the traditional soap stone lamp, which can be employed as an additional heating source today.

Some other advantages of locally found resources include the use of the abundant rocks in building construction. In particular, serpentine and steatite, both used in carving, can be utilized for aesthetic qualities in building design. Natural vegetation can also be applied to the design of a building to provide insulation, and help it fit into the surrounding context. Another opportunity could be to take advantage of the abundance of sunlight in the summer along with a greenhouse to produce a local source of vegetables for part of the year. Sunlight can also be employed to produce electricity through photovoltaic cells, for solar heat gain within buildings, and for solar thermal heating. Snow accumulation in the winter can also be taken advantage of to increase the insulation value of the building envelope. Local fresh water is already used to supply the houses with fresh potable water, but water from rain and the snowmelt can also be retained. The abundance of wind can also be taken advantage of to naturally ventilate in the summer, while it can also produce electricity throughout the entire year.

Services and Maintenance

The cost of operating and maintaining a building is significantly steep in the Canadian North. Power generation is particularly costly due to the isolation of each community, as each community needs to have its own source of power generation. In Nunavut, each community is supplied with electricity through a diesel generator that is fuelled once a year by the sealift. This is an environmentally damaging and costly form of electricity production due to the expensive infrastructure that has to be built, the shipping costs, and the increasing price of oil in past years. The average power rates in Nunavut are around $700 per 1000kWh, while the peak rate in Toronto is $117 per 1000kWh, which on average works out to an annual cost of $4,400 per household (Nunavut Housing Corporation, 2012, pp. 24-29). Heating buildings is very costly in this region, as they need to be heated for a better part of the year. The primary means to heat buildings is through oil furnaces, which are fuelled by delivery trucks, and is a very unsustainable source of heat. The current annual cost for heating per household is around $3,300 (Nunavut Housing Corporation, 2012, p. 24), which will only increase as the price of oil rises in the long term. Water and sewage removal is also a significant expense, as in 22 of Nunavut's 25 communities it is trucked to and from houses at an annual cost of around $6,800 per household (Nunavut Housing Corporation, 2012, p. 24). The other three communities in Nunavut are serviced by utilidors, which are expensive to build and maintain, and break up the landscape. Lastly, garbage pickup in Nunavut does not differ much from the rest of Canada, and comes at an annual cost of $600 per (Nunavut Housing Corporation, 2012, p. 24).

Home maintenance costs are very high in Nunavut. Capital maintenance, which are larger repairs that occur over the lifespan of the building, such as roof and window replacements, totals to an annual cost of $2,580 per household (Nunavut Housing Corporation, 2012, p. 24). Also, due to the harsh climate and the unsuitability of houses towards the Inuit lifestyle, the houses tend to deteriorate rapidly. As a result, many repairs have to be made throughout the year, at an average annual cost of $5,100 per household (Nunavut Housing Corporation, 2012, p. 24). As most of these houses are public housing, it is not the inhabitants, but the local housing organization's responsibility to pay for these repairs. Hence, there is an added cost to operating and maintaining a house throughout the year, an administrative cost, which works out to $2,650 per household (Nunavut Housing Corporation, 2012, p. 24).

Between maintenance, building service and administrative fees, the annual operating cost of running a single house is $25,760, which is a significant cost for the majority of families in Nunavut (Nunavut Housing Corporation, 2012, p. 24). Consequently, the government heavily subsidizes most of these expenses, further inhibiting a move towards a self-sufficient future. Thus going forward, new homes must be designed to reduce their operating costs, even if a higher construction cost is incurred, which is only a short-term expense. New homes must be energy efficient, incorporating passive strategies and taking advantage of the renewable resources available. Despite the current drop in oil prices, fuel alternatives should also be explored, as the cost will rise in the long term. The means of delivering services should also be re-examined, as there may be potential for shared infrastructure between houses, as opposed to delivery on an individual basis. Mechanical systems should be as simple as possible as such a small population base results in fewer specialists that would be familiar with a variety of systems (Crittenden, 2010, p. 23). Homes should also be designed to reduce the overall maintenance by responding to the day-to-day lives of the Inuit, instilling a sense of ownership, using durable materials, and designing for easy maintenance and replacement.

Logistics

Due to the small and sparse population, no significant manufacturing activities occur in the Canadian North, therefore the majority of the goods have to be transported from the south. The small size, as well as the isolated and disconnected nature of most of the communities has created many logistical challenges. While some communities in the region are connected by roads to each other and to the rest of Canada, in Nunavut, none of the communities are accessible to each other or to the rest of Canada through a road network. However, in winter, one ice road connects a few mines in Nunavut to the Canadian road network, while some mines are connected to communities as well through ice roads. Due to the poor road network, other means of transportation are used to deliver goods to Nunavut.

Since all the communities are adjacent to water, the annual sealift is one means, operating during September and October, after the ice has broken up and before it freezes again. The barges depart from two locations, Hay River, Northwest Territories, and Montreal, Quebec, and can also retrieve goods at Churchill, Manitoba. One of the disadvantages of the sealift is that effective planning is required because if something is missed, it will be a year wait for the next opportunity (Crittenden, 2010, p. 24). Furthermore, there is a greater risk of goods getting damaged, delays due to weather and significant emissions being produced (Crittenden, 2010, p. 24; Strub, 1996, p. 77). Also, if shipping containers are used, additional costs have to be considered, such as fees associated with the additional weight and volume, a packing fee, and fees to ship these containers back for re-use. This results in the increase in cost of receiving goods through the sealift.

Another more readily available option for the transportation of goods is through airplanes. Most communities have an airport, serviced by at least one commercial airline, which also acts as a cargo plane. There are also other charter airlines and air couriers available. While goods can be received through air transport relatively quickly (perishables are delivered by plane for this reason), and much more frequently, there is a size limit. More emissions are burned this way, there is a significant chance for delay, and it is much more expensive than the sealift, resulting in more expensive goods. Therefore, the sealift should be taken advantage of whenever possible.

In winter, when travel is necessary between communities, snowmobiles along with sleds are used to transport people and goods. However, this can be a very lengthy and dangerous endeavour. The risk of damage is even greater with this costly and inefficient means of transportation.

Due to these logistical challenges, smart planning of construction projects is crucial. In home designs, materials and components should fit within the required dimensions for transportation, while taking up as little volume and be as lightweight as possible (Strub, 1996, p. 76). Durable materials that are not prone to damage are also preferred, as the time in transit can result in damage, and the time to get replacements would be significant. There is also potential for a regional construction network to be developed, utilizing a standardized and flexible systematic approach to housing. In doing so, various components can be assembled in different communities and shipped to each other, which will become possible as the ocean becomes free of ice for a greater portion of the year.

Construction

The construction costs are exceptionally high in the Canadian North, especially in Nunavut where the cost of construction per $1m^2$ is three times what it is in southern Canada (Canadian Mortgage and Housing Corporation, 2008, p. 72). One reason for this is the lack of locally available materials, resulting in high transportation costs (Crittenden, 2010, p. 24). Since materials arrive at the same time, some might be stored on the site up to a year. Transportation and on site storage of materials increase their chances of being damaged, adding to their cost. Furthermore, to build a typical house in accordance with the *National Building Code*, many different skills are required. As there has been a lack of local training, resulting in a highly unskilled local labour force, crews have to be flown in from across the country to work on construction projects, which significantly increases budgets (Crittenden, 2010, p. 23). The weather conditions are also very harsh at times, reducing productivity by 33 to 50% in the winter months, adding time to the construction schedule (Crittenden, 2010, p. 24). Equipment used in these harsh conditions is also more susceptible to malfunctions, and due to the remote location replacement parts and repair personnel are not readily available (Crittenden, 2010, p. 24). Also, the high cost of heavy equipment, if required, must also be taken into account, as it is shipped from community to community, further complicating the construction process and increasing costs (Strub, 1996, p. 79). Because of the extreme cold and darkness in the winter, temporary lighting and heating systems also have to be installed, lengthening the construction process and increasing the budget.

In response to the construction issues experienced in the Canadian North, which drive up the construction budget, changes to building design and construction need to be implemented. If any local materials can be utilized, they should be, in order to offset some of the transportation costs. In order to reduce the number of labourers flown in for construction projects, construction systems should be selected and adapted to ensure simplicity and ease of assembly, which will ensure that the local workforce can master the necessary skills. The use of a standardized system across the territory can help in reducing construction budgets, as more people will be familiar with the skills needed for construction. Reducing on-site construction times is also a way to reduce costs, which can be achieved by using systems that are easier to assemble, and through the use of prefabricated components built off-site (Crittenden, 2010, p. 25). If a regional construction network is established, one that utilizes a standardized systematic approach to home delivery, prefabricated standard components can be assembled within the territory. This will reduce shipping costs, create an economy of scale, build a local skilled workface, reduce onsite construction time, and allow for easier assembly on site.

4.4 Demographics

In order to help further comprehend the conditions in Nunavut, which are to be designed for, a demographic study will be undertaken to understand the peculiarities of the territory.

In 2011, the total population of Nunavut was 31,906 (Statistics Canada, 2011), and Inuit made up 85% of this population (Canadian Mortgage and Housing Corporation, 2008, p. 66). Thus, any proposed home should be designed with the Inuit culture in mind. Furthermore, 66.5% of the population speaks a dialect of Inuktitut (Statistics Canada, 2011), which is an important part of the Inuit identity, and great care must be taken to ensure its survival. This preservation can be achieved in design, through the encouragement of traditional practices, especially the passing down of oral tradition.

The total population also represents an increase of 8.3% since the last census in 2006, which is a significant increase in comparison to the rest of Canada, which grew by 5.9% (Statistics Canada, 2011). The primary reason for the population increase is due to the fertility rate of the territory, which is 3.2 births per female of child bearing age (Nunavut Housing Corporation, 2012, p. 31). On average this works out to 24.1 births per 1000 people, which is twice the national average rate (Canadian Mortgage and Housing Corporation, 2008, p. 66). Of the 20-year generation cohorts in the territory, the largest cohort are those that fall 19 years old and under and second largest is the 20 to 39 year old cohort (Nunavut Housing Corporation, 2012, p. 31), which means the median age in the territory is 24.7, while in Canada it is 39.9 (Statistics Canada, 2011). If fertility rates are to remain the same, with all evidence suggesting this trend, then once the large youth population is old enough to bear children, they will produce an even larger youth generation. Although the net migration in the past has not resulted in population growth, as economic growth increases, and more job and training opportunities are found within the territory, this trend should shift, as less Nunavummuit will leave and others will move in as the economy grows. Even if the annual population growth levels off at 1%, Nunavut will see a projected population of 43,000 in 2037 (Nunavut Housing Corporation, 2012, p. 33). In order to keep up with this growth, it is expected that 3,836 more units will need to be built by 2037, which works out to 142 units per year (Nunavut Housing Corporation, 2012, p. 34).

As stated earlie,r the current household size in Nunavut is 3.84 people per household, which is significantly more than the national average of 2.50, especially considering many houses are not designed to hold as many people as they do. One reason for the overcrowded conditions in many houses is the lack of availability. There is also a 4% hidden homeless population who have no permanent address, but live temporarily in different households throughout the year (Nunavut Bureau of Statis-

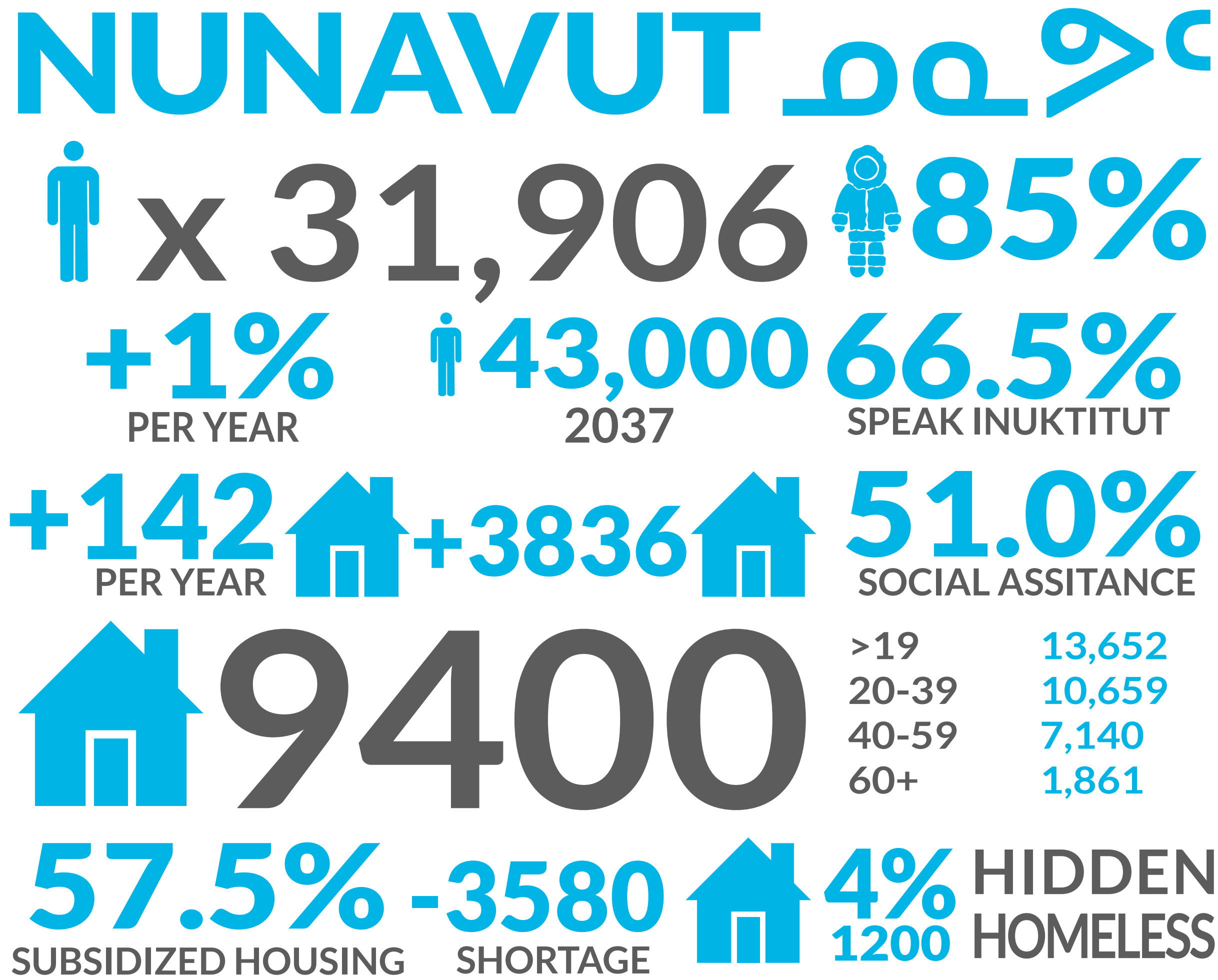


Figure 116: Nunavut Demographics

tics, 2011, p. 4). Another problem with housing adequacy is that living conditions are so horrible that families would like to find a new residence, but have no option. Thus, overcrowded housing and housing in disrepair has created an existing backlog of 3,580 households (Nunavut Housing Corporation, 2012, p. 34), which is an additional burden for the government.

In a territory already strapped for cash, population growth and an existing housing backlog creates a huge burden going forward, and as a result, much of the public housing being built is not appropriate for the environment and culture, but in order to meet this demand, ends up costing more in the long term. Thus, future designs of homes must respond not only to environmental and cultural issues, but must also be economically feasible, consider the long-term benefits as opposed to short-term gains, utilize an economy of scale, and have a relatively quick construction period.

One peculiarity to note about the household size, is that while many houses are considered overcrowded, the large household size is not the problem, but houses need to be designed to accommodate these larger numbers. As stated before, families often have more children in comparison to the national average, while larger household

	Nunavut	
POPULATION CHANGE	+8.3%	+5.9%
FERTILITY RATE	3.2	1.6
BIRTHS PER 1000	24.1	12
MEDIAN AGE	24.7	39.9
LIFE EXPECTANCY	M 67.2 | F 70.2	M 77.0 | F 82.0
HOUSEHOLD SIZE	3.84	2.50
MULTI-FAMILY	10.6%	2.0%
OWNERSHIP	21.0%	69.0%
ANNUAL INCOME	$43,305	$40,650
MEDIAN INCOME	$25,662	$29,878
DEPENDANCY	82.1	75%
FOOD INSECURITY	31.9%	7.7%
ADULT BMI	27.7	17.2
GRADUATION RATE	39%	75%

Figure 117: Nunavut Vs. Canada Statistics

numbers mean that more expenses can be shared, and is a more economically effective way of housing more people. Lastly, in Inuit culture, larger families are the norm, which is why in Nunavut 10.6% of the houses are multiple family houses, while the national average is 2% (Statistics Canada, 2011). Thus, as opposed to building the same two, and three bedroom units over and over again, and cramming large families into these spaces, there should be larger unit options and even options where two units share certain spaces.

As discussed in the previous chapter, while the average annual income in Nunavut is $43,305, compared to the national average of $40,650, the median is $25,662 meaning most of the population makes well below the average income. The cost of goods and services is also significantly higher, creating an additional burden on families and thus increasing poverty across the territory. Additionally, the dependency ratio on income earners is much greater in Nunavut, further stretching the limited family income. As such, over 51.7% is on social assistance (Nunavut Housing Corporation, 2012, p. 11), while 57.5% of the population is housed in public housing. Thus, by supporting so many families, the government faces a cash shortage that is only growing. This burden can be reduced if buildings are not only designed with a feasible budget, but are also built to reduce their long-term operating budget. Homes should be designed to encourage traditional subsistence practices in order to reduce the economic drain on families, and decrease the social assistance required from the government.

Some other peculiarities in the territory include graduation rate, which is 39%, compared to the national average of 75% (Nunavut Housing Corporation, 2012, p. 11). However, this will only increase as the economy improves, the younger generation matures, and the increase of local post-secondary options increases. Household food insecurity is also significant, with 31.9% of households facing food insecurity, while the national average is 7.7% (Nunavut Housing Corporation, 2012, p. 11). Food insecurity can be partially reduced if residents are able to produce their own agriculture during the summers, if sharing networks are established and fostered, and if houses are designed around the traditional subsistence culture of the Inuit. The average adult in Nunavut has a body mass index of 27.7, while the national average is 17.2, which even if the body mass index is flawed, adult Nunavummuit are still overweight in comparison (Nunavut Housing Corporation, 2012, p. 11). Design can tackle this problem by encouraging a traditional lifestyle out on the land, as opposed to the sedentary lifestyle that has been adopted from the *Qablunaat*.

05

PROJECT PROPOSAL

The following chapters will introduce the project that is being undertaken in an attempt to address the unique challenges and conditions found in the Canadian North. It will first highlight the architectural position taken based on conditions of the context. It will look to understand the role architecture can have in helping attain an ideal situation for the Inuit, while confronting the varying scale of challenges found in this region, including not only the unacceptable housing stock, but also its response to the greater sphere of influence in the economic, social and environmental realms.

Figure 118: Cambridge Bay Sunset

5.1 Position

The research undertaken for this thesis | project, whether from on site analysis or from the numerous publications and articles that have been analyzed, has resulted in two research questions:

How can future Inuit generations establish a connection to Inuit heritage and cultural identity while evolving to adapt to modern influences, ensuring sustainable inhabitation of the Canadian North?

How can architecture strengthen the twenty-first century Inuit identity through the design of their dwellings, while also responding to the technical and logistical challenges of building in the Canadian North?

Thus, this thesis | project takes the position that the status quo is not acceptable, and that significant changes must take place in order to establish an ideal setting for the Inuit to live in, and thus a prosperous and sustainable future to transpire in the Canadian North. The present design hierarchy values an economic approach above all. A recent trend has been an attempt to address environmental concerns, but primarily through how they impact the economic scope of design. Currently, there is little regard taken into account for the unique culture of the Inuit when houses are being built in the region, contributing to the loss of their identity. The future homes of the Inuit must still consider, but also be designed beyond economic and efficient practices, to address and embrace the unique conditions of living in the Canadian North. A new approach to home design is necessary in order to solve the existing and potential housing deficiencies of the developing region, and to reinforce the cultural identity of the Inuit, in order to ensure successful development and inhabitation of the region in the years to come.

The position taken is that a reinterpretation of what the Inuit home, the *iglu*, is in the twenty-first century will ensure that the essence of the Inuit identity is maintained and strengthened. The shift from housing to homes for the Inuit will be achieved through the representation of the Inuit identity in built form, in which a regionally responsive architecture is adopted. The response to the cultural conditions of the Inuit population will be at the forefront of the design process, while economic and environmental conditions will be addressed in their own right, and through an understanding of their cultural implications. To achieve the implementation of a regionally responsive architecture, the following ideas will be explored: the manner in which Inuit identity can be represented in the dwelling, the ways in which the dwelling can accommodate the unique hybrid lifestyle and values of the Inuit, the methods in which dwellings can engage with environmental forces, how local resources can be utilized and the creation of a variable and dynamic housing system.

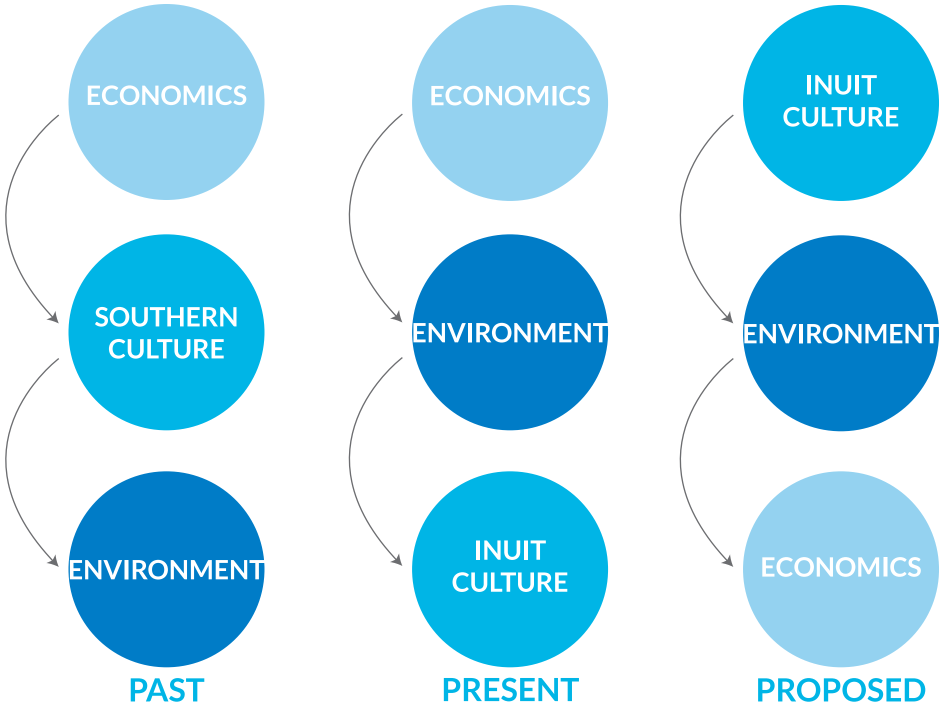


Figure 119: Nunavut Housing Design Hierarchy Evolution

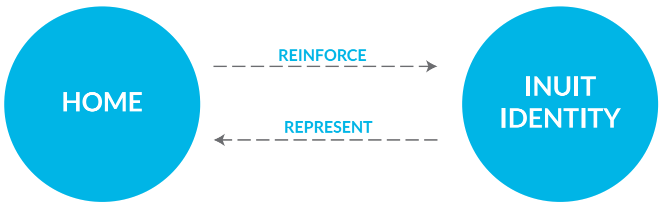


Figure 120: Why Architecture Matters for the Inuit

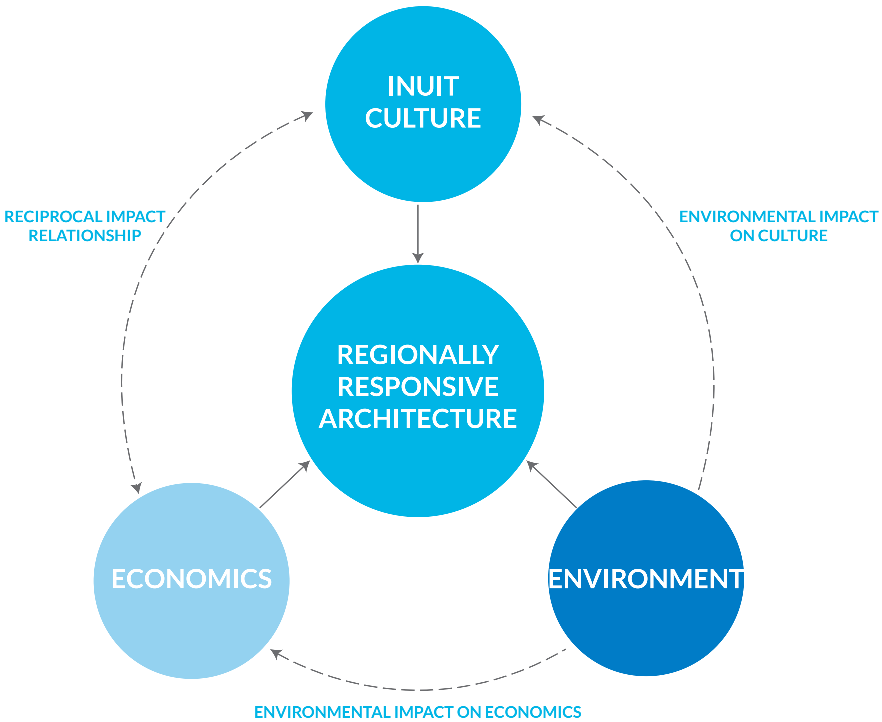


Figure 121: A Regionally Responsive Architecture for the Inuit

5.2 Project

In order to highlight the ideas expressed in the position taken in regards to the development of homes in the Canadian North, the following project was devised. Since this project is developed in response to attaining a hypothesized future state for the Inuit, it is not implied that the proposal is a solution for here and now, but rather a future project, while still containing relevant ideas of what can be applied at present. The project will first involve the establishment of a set of principles, strategies and tactics based on the general conditions and challenges found in the region, then a systematic approach based on these concepts will be explored, and it will then look at a prototypical application of this system in the Cambridge Bay, Nunavut.

In understanding the general conditions found in Nunavut, a response will be devised that can apply to the majority of the communities, as they share many characteristics and experience many of the same challenges. Thus, a system will be designed in response to the principles developed, which will consist of a standardized approach, a kit-of-parts, and a degree of flexibility that will allow it to be applicable in similar contexts, but with minor variations. It will be composed of a mix of pre-fabricated components and modules, and both standard and custom in-situ construction, allowing for the formation of different dwelling typologies, different size dwellings, adaption over time and variations between them. The idea is that this system will not only be transferrable across Nunavut, but a similar approach can be adopted all across northern North America where Inuit culture prevails.

One potential problem associated with this approach is its apparent generalness. One might question how one system can be applicable for the different Inuit groups, with their minor nuances and varying locales. While this is very true of the traditional Inuit, presently, many of their practices have been lost over time, while technology has connected many Inuit who might not have known of each other's existence. In response to this reality was the development of pan-Inuit culture based on the understanding that there is strength in numbers, and from the need to preserve the core values that are shared amongst all Inuit, in order to ensure their survival as a distinct people. Responding to core values found in the Inuit culture, as opposed to the minor variations, ensures not only that the system will be applicable across a large region, but that it will also remain relevant for a longer period.

Further comparisons may be made to current carpet-bombing approach to housing delivery in Nunavut. While this approach does seek to find a solution that can apply across multiple communities, it is not the replication of the same few *Qablunaat* imports over and over again. It seeks to find a responsive architecture to the shared values amongst the Inuit, while also allowing for a large number of variations to occur.

Since economic constraints have resulted in many of the current challenges to housing design, the economic conditions cannot be ignored, as new sets of challenges will emerge, and this project will become an impractical fantasy. While a single house or neighbourhood could have been perfectly designed in a specific community, the project would lose its effectiveness, as the challenges are regional, not local. A specific design for each community would not make sense from a feasibility standpoint unless it were a simple boring box, as there is no economy of scale, and there is limited potential for the growth of a regional construction network. However, the use of an adaptable system, where similar skills can be developed throughout the region, components can be mass-produced, and the design process can be streamlined would help respond to the economic constraints. Further, the assumption made is that the cost to do something of aesthetic interest in a one off design would be significant, but if the economy of scale is introduced, it will make an interesting design more feasible. Thus, the development of a systematic approach transferrable across the region is what allows this thesis | project to be critical of present approaches, and allows it to contribute to contemporary discourse.

Once the system has been developed, the next stage will look at the prototypical application of the system on a specific site. The site selected is located in Cambridge Bay, and is the next section of town to be developed as the town expands. The prototype will consist of a community of multiple dwellings of different sizes and types. It will highlight the different possible variations, and how everything can be laid out and adapted to a specific site. At the conclusion of this, an evaluation of where the system succeeds and comes up short can be accomplished, in order to determine where changes can be made, and what further complications may arise.

06

DEFINING THE 21ST CENTURY IGLU

In order to reinterpret what the twenty-first century *iglu* exemplifies, a variety of influences will be analyzed with varying elements and concepts, extrapolated to help define a new architectural vocabulary for the design of Inuit homes in Nunavut. As stated earlier, broadening the scope of what constitutes the North will allow for a broader sphere of influences to be drawn upon. As such, the following chapters in Part 6 will analyze Inuit aesthetic sensibilities, the traditional logic behind their home designs, contemporary architecture from other parts of the North, and other regional approaches to architecture.

Figure 122: Hunter and Iglu

6.1 Learning From Critical Regionalism

In the search for a contemporary, regionally responsive architecture of dwelling in the Canadian North, it would be imprudent to begin anywhere other than with the seminal essay, *Towards a Critical Regionalism: Six Points for an Architecture of Resistance* by Kenneth Frampton (1983). While slightly dated, and a point of debate for many, the work continues to showcase many significant lessons.

Frampton's text begins with a quote by the French philosopher Paul Ricouer, who rather eloquently highlights the struggles undergone by traditional cultures in the process of modernization. Often, cultures are forced to abandon their past in order to participate in the modern universal civilization. The question is therefore posed: "how to become modern and to return to sources; how to revive an old, dormant civilization and take part in universal civilization?" (Frampton, 1983, p. 16). The Inuit find themselves in a situation, wherein they remain trapped between two worlds, with no viable solution in sight.

Frampton argues that architecture has become overtly universal, resulting in placelessness, as similar buildings continue to appear all over the world. Cultural expression in built form has, as a result, been trumped by utility, and by industrial and universal techniques. The economy of production has therefore replaced idiosyncrasies in architecture. The only forms of architectural intervention occurring at the time of publishing were the manipulation of functional elements, in what is referred to as the high-tech style, or the masking of these universal buildings in superficial facades. Both mediations fail to produce meaningful buildings, respond to a particular culture, or create a sense of place. Despite the fact Frampton's essay was written 30 years ago, the described conditions are unfortunately similar to those experienced in the Canadian North today. *Qablunaat* structures are built en masse, and the only variations are an overly utilitarian aesthetic, or caricatures of the snow house.

Frampton argues that there is a need for a stable position between the two opposing forces, one that produces a resistant, identity-giving culture. As opposed to falling into the trap of sentimental regionalism, which results in the copying of the vernacular, critical regionalism seeks a more intelligent approach to architecture, wherein it "mediates the impact of universal civilization with elements derived indirectly from the peculiarities of a particular place" (Frampton, 1983, p. 21). Thus, while responding to context is important, adopting the progressive qualities of modern architecture is just as significant. The development of a place-conscious poetic and place-form is at the centre of the argument, which is an architecture that responds to topography, light, climate, tectonic form, and tactile senses rather than scenography or the visual. In so doing, idiosyncrasies will be created that are reflective of place, even when utilized in combination with modern construction processes. Difference and identity will result, reflecting both the context and culture of a particular place, that is yet still modern in its very essence.

Lessons Learned

Utilizing Frampton's way of thinking in designing in the Canadian North will result in dwellings that respond to the contemporary Inuit culture. The adoption of modern construction processes will be permitted that can respond to both the technical requirements and economics of building in the region. Further, it allows for the consideration of certain aspects of universal civilization, which the Inuit have adopted, yet also allows for a response to spaces for traditional practices that might not be found in other regions. An environmental response can also be achieved through the utilization of passive strategies as well, focusing on light, snow, and wind. The way in which the dwelling responds to the landscape also contributes to a place conscious poetic. The resulting idiosyncrasies created through this process will differentiate these buildings from those in other regions, giving them a particular identity that is reflective of place, further reinforcing the uniqueness of the Inuit identity.

Figure 123: Saynatsalo Town Hall by Alvar Aalto, 1951
One of the referred to buildings in the Frampton text

Figure 124: Muuratsalo Experimental House by Alvar Aalto, 1953
Represents a similar approach to Saynatsalo Town Hall

6.2 Learning From Inuit Vernacular Architecture

As discussed earlier, the traditional Inuit lived a lifestyle based on a seasonal dichotomy. As such, they had two primary dwelling types throughout the year: the *tupiq*, (skin tent) in the summer, and the *igluit*, (snow house) during the winter. In their very essence, vernacular dwellings respond to resource availability, local climate, and the specific needs of the cultures that produce them, reflecting their values, way of life and economies (Oliver, 1997, p. xxiii). Understanding vernacular architecture can help derive methods and principles for the relationship between environment and culture in a contemporary regional architecture (Rapoport, 2006, p. 183). Two methods of learning from vernacular have been utilized in the past. The most common has been to copy from the past, which is often based on a static romanticized notion of traditional architecture, which often fails (Rapoport, 2006, p. 182). This approach overlooks the fact fails that like culture, vernacular architecture is a changing, evolving entity, which reacts to the changing community (Asquith, 2006, p. 129). The valid way to learn from vernacular architecture is through analysis, through developing an understanding of their underlying principles and mechanisms (Rapoport, 2006, p. 182). Thus, by analyzing these examples of Inuit vernacular architecture, an understanding of their rational is developed, which is necessary in order to successfully design a contemporary dwelling for the Inuit.

Tupiq

The skin tent was utilized in the summer, the time of the individual family unit of roughly three to six people, when the Inuit traversed the land to hunt and gather (Lee, 2003, p. 5). The families needed to be mobile, thus the number of able bodied people, the environmental conditions, the spatial requirements of the family, and the limited building materials, all contributed to the overall design.

Tupiqs were located on open land, and conformed to the natural features of the landscape, utilizing existing depressions to limit assembly time and resources. Further, the dwellings would often blend in with the rocky landscape. Both of these facets highlight the importance of integrating the dwelling with the landscape.

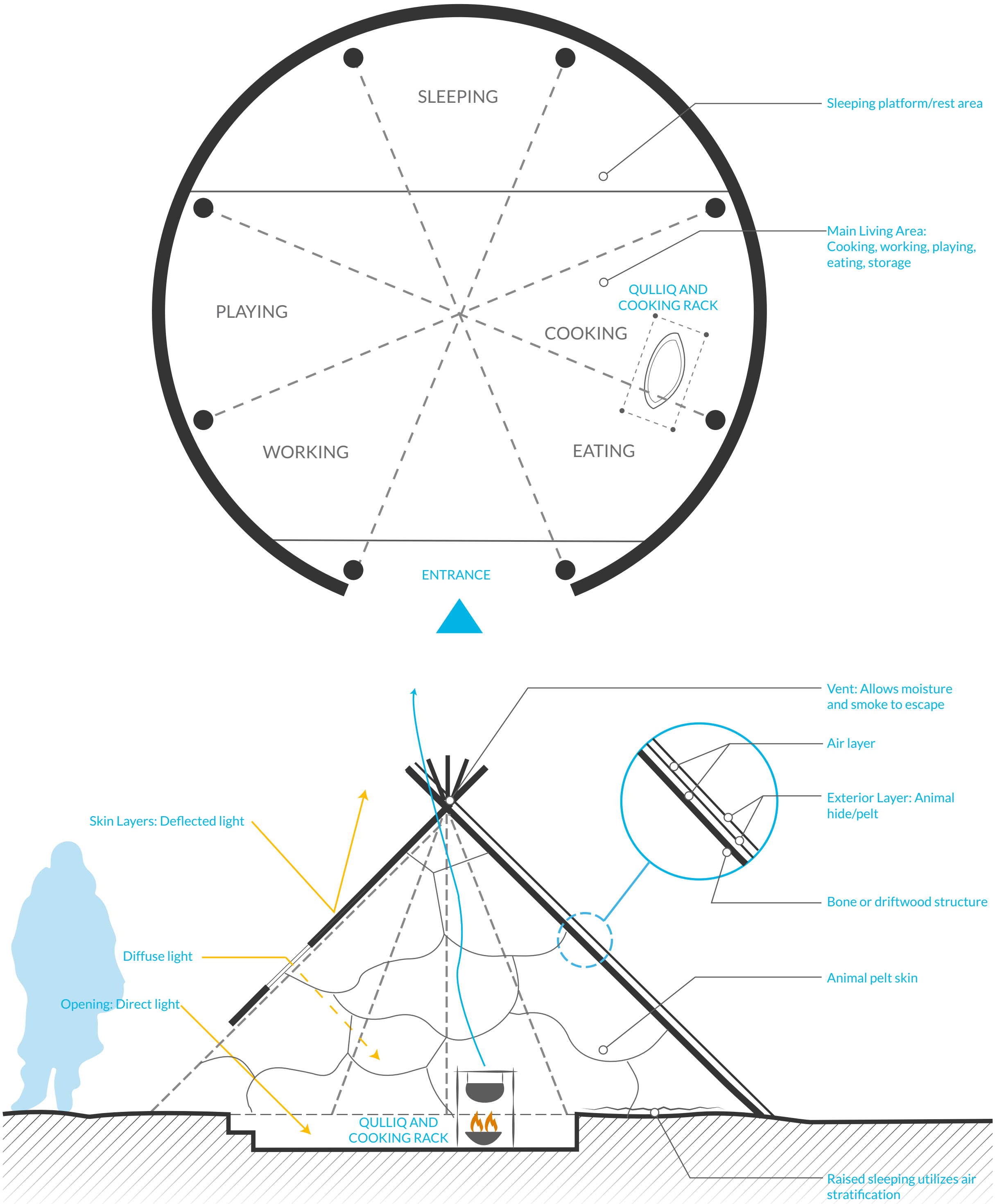
The poles utilized for the structure of the *tupiq* were scarce, often consisting primarily of whalebones or driftwood. Whalebones were found in coastal communities, while driftwood was found near rivers that originated in the south. The tent cover was primarily made from a variety animal furs and sealskin, which were stitched together with sinew, held down with weights and provided tensile strength to the whole structure. Further, as the family grew, more pelts could be added to make a larger dwelling. The materials used represented the need to utilize an efficient, lightweight structure, which could easily be adapted, transported, assembled, and reused. The materials were also all found within the region, representing the significance of the Inuit's relationship with the environment.

Figure 125: Tupiq

The way in which these dwellings responded to the climatic conditions is what made them such a significant source of inspiration. In utilizing animal pelts as the primary envelope, they allowed for a degree of adaptability to occur, as different species of animal pelts had different characteristics, and pelts could also be layered to create a warmer interior environment. Further, the use of pelts was quite ingenious, as it made use of the natural characteristics that allow animals to survive in cold conditions, as the fur creates air pockets, thus forming a thicker layer of insulation. The skins are naturally waterproof and windproof, further adding to their effectiveness. Also utilized were depilated oiled skins or gut strips, which are translucent, allowing light into the dwelling during the day, and covered with another pelt to create a dark interior when needed. There was a small opening at the top, which allowed the fire to exhaust, and removed bugs, while it was not big enough to let in significant drafts. If the interior happened to get too hot or damp, the pelts were propped up to increase ventilation. Sometimes, in the early summer snow was piled up on top of the tent to provide more insulation. The domed form of the dwelling also utilized an efficient surface to volume ratio, and was more resistant to wind, so less heat was lost. Heat and light were also provided by a *qulliq*.

The interior layout of the *tupiq* consisted of one large multi-functional living area, roughly 3 to 5m in diameter and 1.5m high. The rear area was a sleeping zone demarcated with a horizontal stick and pelts, which were sometimes raised using snow blocks or turf to take advantage of warmer temperatures. The lamp was located at the front of the dwelling, while sometimes a fire was located at the front or outside. Cooking was often done outside, while sewing and small tool repairs were completed inside in order to protect the inhabitants from bugs and inclement weather.

Figure 126: Analysis of Tuipq Design



There were two main types of *tupiqs:* conical and ridge tents. The conical tents were circular in plan, had dome like forms, and had no interior interruptions within the space, but were limited in size. Ridge tents utilized a horizontal ridgepole to create more headroom and enlarge the size of the tent. The ridge tent was bell shaped in plan, and interior support poles sometimes divided the interior space. Other variations included tents where the poles extended above the apex of the tent cover, while in others they did not. Each regional Inuit group adopted their own variation of the *tupiq,* depending on resource availability, climate variations, family sizes, historical happenstances, and aesthetic preferences (Lee, 2003, p. 163).

Igluit

During winter, the Inuit would form *igluit* communities on the ice sheet in order to be near the seal population as to efficiently hunt as a group and share food, while these snow houses were also relatively easy to construct and could be easily re-built if the community needed to move to find food (Lee, 2003, p. 38). The communities were developed near seal populations, but were also chosen based on prevailing winds and snow conditions. The communities had a population of up to 100, and consisted of multifamily households and a *qaggiq*, a large communal dancehall. These structures were much larger than the summer dwellings, as most activities had to occur indoors. Further, the organization of these structures was governed by socioeconomic alliances, such as food sharing relationships, which formed a dense network of relationships between extended family members, yet downplayed the relationships with other community members (Dawson, 1997, pp. 199-200).

Part of the ingenuity in the use of snow houses was the fact that minimal material needed to be transported, and they were relatively easy to build as snow is easy to modify, needing only two men to construct. All that was required was the right snow conditions and the knowledge, skill set, and a *haviit* (snow knife). Thus, it was an

Figure 127: Igluit Community

Figure 128: Igluit Construction

essential part of survival for the Inuit, as they could readily build one while out on the hunt, extending their hunting range, and they could readily move their community to new sources of food if needed.

Located on the ice, these dwellings utilized the most abundant material around, snow. As a result their dwellings were not only made from the land, they blended in with the white mass of snow that surrounded them. Much like the *tupiq*, it is further evident that integration with the landscape is an important part of the Inuit identity.

The design of the snow house utilized the void created by cutting away the snow blocks and lowering a significant part of the dwelling below the snow surface. Once the first layer of blocks were laid, they were trimmed on an angle in order to position the rest of the blocks in a spiral to create a dome that acted in compressive strength and was resistant to snow loads. The snow blocks acted as both structure and envelope, which is a very efficient use of material. Snowdrifts were encouraged to form on top of the dwelling. Also, because of the warmer interior temperature, a layer of ice is formed on the walls further reinforcing the structure. Skins were sometimes hung on the interior to create an air layer between the living environment and the snow wall, allowing the interior to be warming, while making sure the walls did not melt.

Aside from its structural and material use ingenuity, the snow house also responded to the harsh winter conditions very effectively. The use of snow acted as an effective insulator as air pockets were trapped inside, and as snow drifted or was shovelled on top of the dwelling and in between the domes, it became even more efficient. The dome shape used was also an energy efficient form as it has a low surface to volume ratio, while it was also effective at resisting wind. The interior ice layer also created a windproof shell, while there was a low external wall, which deflected the wind from eroding any of the snow from the more vertical elements. The gap in between this wall and the dwelling would also fill with snow, buttressing the dome. Since the

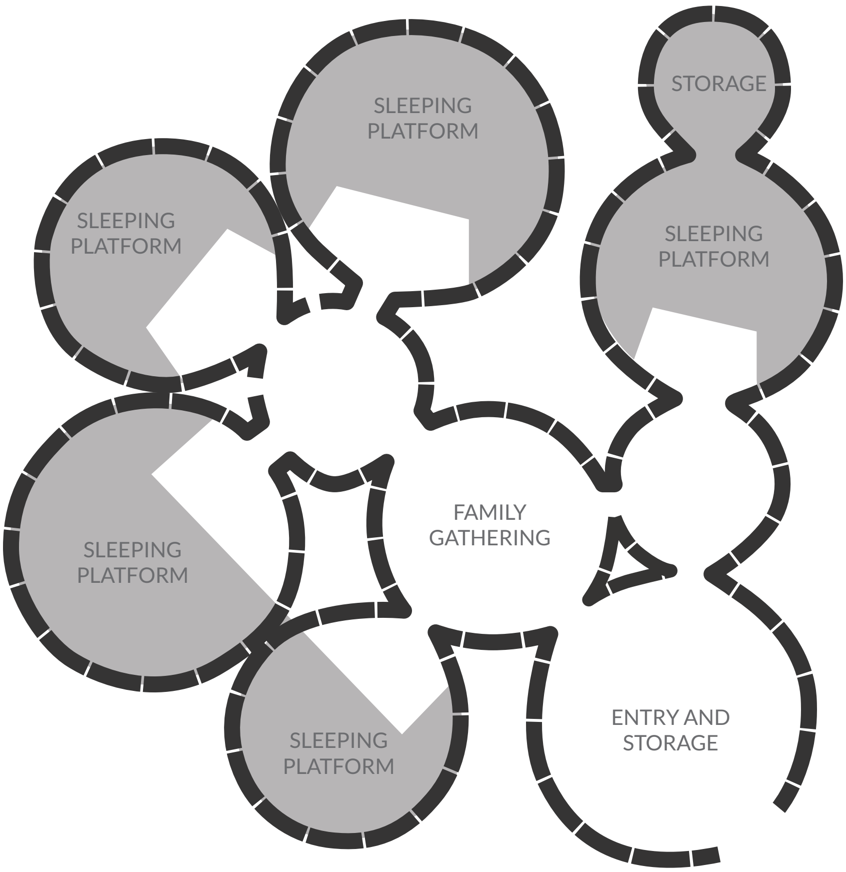
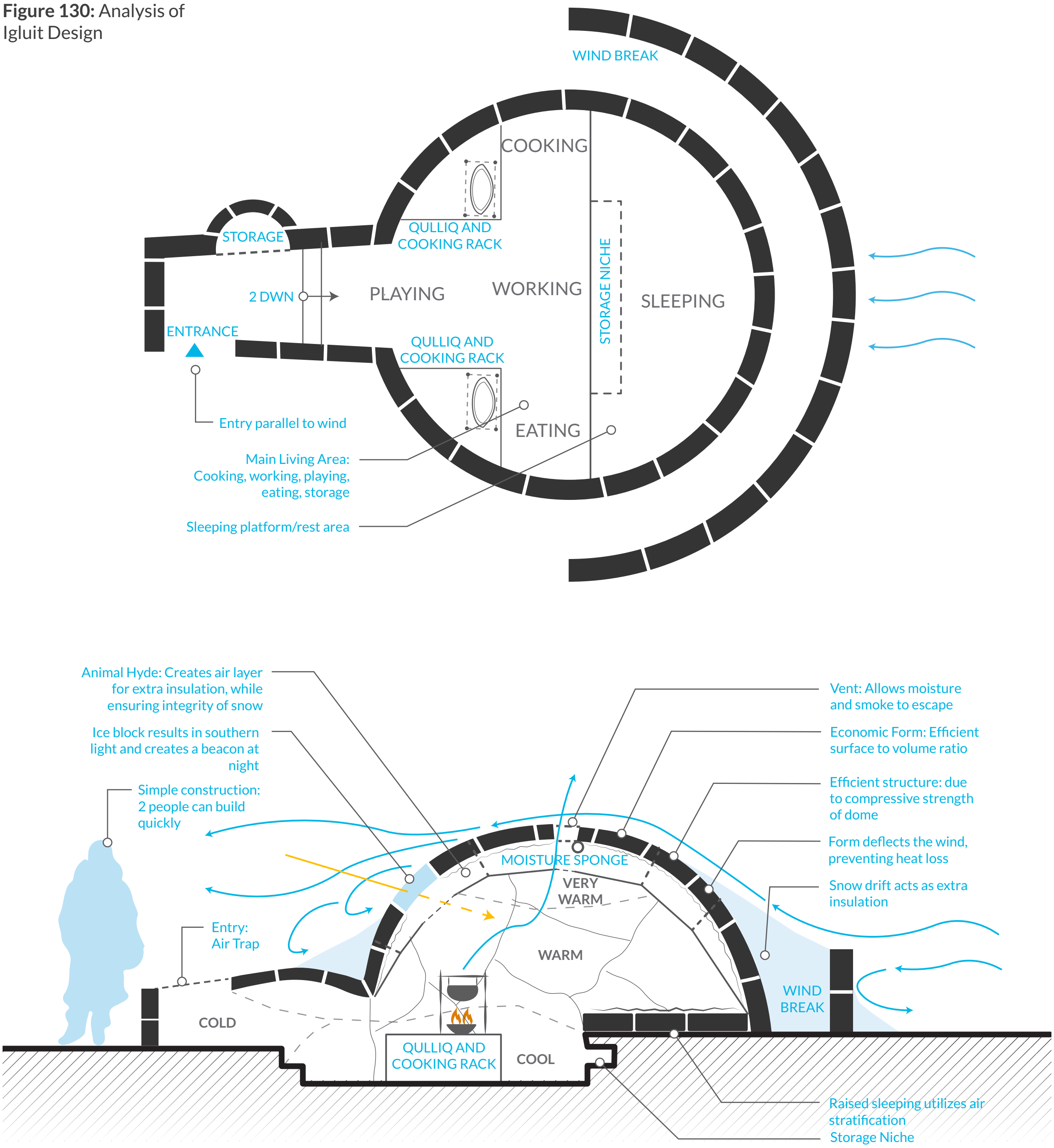


Figure 129: Igluit Cluster

interior level was below the snow surface, this added to the insulation, while the sleeping platform was raised to take advantage of the rising heat. A tunnel was used as an entrance on the south end, which acted as a cold trap preventing heat loss, while it was also angled to act as a windscreen, and had a snow block door. There is also an oval shaped block of ice located on the south side to let in light, while the translucency of the snow blocks allowed for diffused light to enter, and allowed the *igluit* to glow in the dark. A hole at the top of the dwelling was used to let out smoke, and allowed the humidity to escape, while there was also a snowball located adjacent to this which further gathered moisture, and could plug the vent hole if needed. A *qulliq* was also employed to provide light and heat within the dwelling. Due to these measures, with just body heat, the interior temperature would increase by 7°C, while the *qulliq* could create an interior environment of 2°C, which would not weaken the dome. Further, there was also a possible temperature gradient of 38°C from the bottom to top of the interior space, while adjacent to the walls the temperature would drop by 9°C.

The *igluit* could either be a separate structure or consist of a cluster of up to 15 linked domes, housing an extended family of up to 20 people. The extended families were determined by father-son relationships, with the father, mother, and unmarried youngest son occupying the central rearmost dome, and the elder sons and their families occupying the domes off to the sides (Dawson, 1997, p. 204). The main central dome connected the different families, and was approximately, 3.5 to 4.5m in diameter. Inside this central dome was the main working, playing, cooking and eating area, with a shelf, *qulliq*, cooking pot, supporting structure, and drying rack. The family domes were either conjoined, or linked through a tunnel to this central dome, and were approximately 2.5m in diameter, housing up to six people. Half of the floor area in these domes is raised for sleeping, containing mattresses made of baleen

Figure 130: Analysis of Igluit Design



strips covered in skin. Under these sleeping areas were cut outs for dry storage, and there were side platforms for other storage and lamps. Also radiating out from the main dome were the main entrance tunnel, storage domes for skins, meat and other goods, and a dome for the dogs. Storage was also found in built in-niches, while alcoves were built on top of existing domes for additional items. Other features of the snow house included animal skulls and antlers that were displayed above the entrance, and *qajags*, *aalliaks* and other large tools and weapons were stored on top of the dwelling. The *igluit* was also an adaptable dwelling, as domes could be added on to existing structures to expand if the family needed more space.

Much like the *tupiqs*, regional variations of the *igluit* existed. The sizes of the domes were impacted by local climatic conditions, family sizes, and the number of men able to work (Lee, 2003, p. 168). The linkage of different domes was also a point of variation as it could be achieved through tunnels or converging domes. The extended family hierarchy and the network of relationships between the different members would also govern the layout of domes. Further, aesthetic preferences and historical happenstances also had an impact on the regional variations of the snow houses (Lee, 2003, p. 163).

Transitional Dwelling

In the spring, some Inuit lived in a hybrid transitional building. When sunlight increased the temperature began to rise, the snow house would begin to melt. To prolong the period that the structure could be utilized, the crest of the snow house was removes, and replaced with a skin tent roof, which was held down with snow blocks or held up by poles. Holes that were created in the snow block wall would be stuffed with fur, allowing them to be effective for a longer time. These measures would extend the seal hunting season and the time of communal living, as the ice was still thick enough. Thus, the use of a transitional dwelling highlights how the Inuit made the most of what they had, emphasizing efficiency of both resources and labour.

Lessons Learned

Through the previous analysis of the vernacular dwellings utilized by the Inuit, some useful conclusions can be drawn based on the processes and principles that shaped them. The location, size, material composition, integrity, durability and orientation of the dwellings were the result of five environmental and geographic limitations: material availability, subsistence prospects, weather elements, human mobility, and people strength and numbers (Lee, 2003, p. 168). Further, socioeconomic relationships and daily lifestyles governed the layout of these dwellings. Despite the minor variations that occurred, the result was a cohesive vernacular architecture amongst most of the Canadian Inuit groups over a vast territory.

While some of these factors, such as mobility, no longer directly impact the design of dwellings, there are many common characteristics that can be utilized in the design of contemporary dwellings, allowing for the representation of their contemporary culture. The social and family structure of the Inuit highlights the need for a larger open multifunctional space for family and larger gatherings. The need for a variety of storage types is also important, and should be considered in new designs. Spaces in the community for communal gatherings were also important. The impact of weather elements such as sunlight, snow, wind, and cold temperatures should result in the reinterpretation of traditional techniques in order to drive the building's form, layout, and materials. The dichotomy of seasons, which was ever relevant in the land use patterns and different dwelling utilized, can be adapted for the contemporary dwelling. As found in the vernacular, it is this response to the environment that creates the identity of the home and represents the significant role that the environment has on their culture. To address seasonality, the functions within its spaces can adjust, the way the building performs can vary, and its aesthetics can change. Further, with the seasonal variations came the distinct periods of the individual and community, so the spaces within the building can account for this dichotomy. The importance of the Inuit's relationship to the land is also prevalent in the identity of their vernacular architecture. The significance of their subsistence hunting lifestyle and utilizing every opportunity the land gives them is highlighted in these dwellings, and should be encouraged in their new homes. Natural and local materials should be utilized in the design to not only symbolize this relationship, but also reflect their subsistence culture. Much like the vernacular dwellings response to the landscape, new homes should aesthetically and functionally respond to it. Lastly, what makes the *igluit* so clever is that it is actually an adaptable system that uses similar dome modules, other standard elements like tunnels, and snow walls, and one set of skills to achieve a high degree of variability with limited few elements. The system can be adapted to different sites, for different family sizes, to suit different family lifestyle preferences, and can even be expanded upon throughout the winter season. The same method of thinking can be applied to the design of a new housing system for the Inuit.

6.3 Learning From Nordic Architecture

In searching for a contemporary regional architecture that represents the Inuit identity and culture, a study of contemporary Nordic architecture should be undertaken, as it is a successful example of an architecture that responds to both its northern physical context and culture. While covering a broad spectrum, the majority of contemporary architecture produced in the Nordic countries has maintained a distinguishable Nordic sensibility and architectural culture, while also representing the progressive nature of modernism and embracing the positives of universalism (Pallasmaa, 2010, p. 29). The Nordic architecture that is essentially rooted in its physical and cultural reality can be seen as the embodiment of the Critical Regionalists approach to architecture, yet it goes beyond the physical determinates of site, representing the cultural heritage of the Nordic population.

When studying Nordic architecture, it must first be understood that architecture in this context is found at the "intersection of tradition and innovation, convention and uniqueness, practicality and belief, collectivist and individuality, past and present" and that it "mediates between culture, nature, landscape, and the continuum of time" (Pallasmaa, 2010, pp. 27-28). Culture in its relationship to architecture is seen as weaving together "an endless array of physical conditions, conscious and unconscious behavioural features, collective response, values, beliefs, and images" which are manifested in their architecture and physical settings (Pallasmaa, 2010, p. 28).

The relationship with the environment is also an important facet of the Nordic culture, and thus manifests itself in their architecture. However, it is not merely a physical connection with climate and landscape, but the notion that "they structure human character, experience, and processes of thought" (Pallasmaa, 2010, p. 27). Therefore, the environment has a double impact on the architecture in this region: through the physical responses it creates, and through its impact on culture and behaviour.

The evolution of Nordic contemporary architecture can be rooted in the vernacular building traditions found in this region. Ideas accepted from the vernacular include responses to the physical determinates of the site, such as landscape, topography, soil conditions, climate, local materials, and local crafts. The result are buildings that have a heavily insulated envelope to help retain heat, steep peaked roofs which shed snow, materials that come from the land, and textures and colours that fit the landscape. The impact of the vernacular is more than just a response to the physical world; it also deals with sociocultural and mental factors that contributed to these built forms (Pallasmaa, 2010, p. 29). Nordic architecture is thus a representation of the existential sphere of traditions, myths, beliefs and ideals of the Nordic people. Consequently, the architecture is more than just a romanticisation of the vernacular, which is very limiting in nature.

Figure 131: Vardehaugen Cabin by Fantastic Norway, 2008
(Top Left)

Figure 132: Mountain Hill Cabin by Fantastic Norway, 2012
(Top Right)

Figure 133: Split View Mountain Lodge by Reiulf Ramstad Arkitekter, 2011
(Bottom Left)

Figure 134: South Sami Museum by Ramstad Arkitekter, 2009
(Bottom Right)

Two other aspects of the Nordic culture are represented in their distinct architecture: their peasant past and socially responsible attitude. Nowhere else was modernist and functionalist architecture as readily accepted as it was in the Nordic countries, due to the formal simplicity of these styles which resonated with the traditions of their peasant buildings (Pallasmaa, 2010, p. 30). Further, "in the Nordic cultures, architecture…has become firmly rooted in the society, and during the past century, architecture was guided by its determined social mission" (Pallasmaa, 2010, p. 29). The result is that social responsibility trumps artistic expression to a certain degree, and because temperance, moderation, and restraint are seen as ideal social traits, these have become represented in their architecture.

The resulting architectural identity is derived from an attachment to nature and a practicality based in their peasant past and social responsibility. The architecture creates a distinct sense of place through its sense of human scale, careful detailing a preference for natural materials, a sense of democracy, interplay with nature, modesty, and a formal understatement (Pallasmaa, 2010, pp. 30-32). Social integration and equality also become defining characteristics along with the blending of nature and human settlement. The use of natural light is also representative of the Nordic mentality, as it is an essential quality of life; it is a source of both mental and physical health, yet scarce in the Nordic region, making it a crucial facet of their architecture. Most buildings show a sensitive articulation of light, utilizing an interplay of soft light, shadows and darkness. The identity of architecture can thus be seen as one that is "rooted in place, tradition, and fundamental existential experiences" (Pallasmaa, 2010, p. 34).

Lessons Learned

A contemporary regional architecture in the Canadian North needs to be more than just a response to the extreme physical conditions that act upon the dwelling. It has

Figure 135: New Town Kiruna, White Architecture, 2012

to go beyond the romanticisation of the vernacular, combining modern construction practices and a contextual response. An understanding of the unique qualities that make up the Inuit culture is necessary in order to successfully represent their identity in architectural form. Much like Nordic cultures, there is a metaphysical connection to their environment and past that impacts their culture, which must be embodied in their architecture. The power of landscape and place specificities must inform the architecture, as it informs their culture, creating a sense of place. Moreover, their traditions, myths, ideals, and beliefs must also impact their architectural form.

6.4 Learning From Greenland

Much like Nunavut, Greenland has an Inuit government with a great degree of autonomy, while it remains a part of the Kingdom of Denmark. Both territories share many similarities: the majority Inuit population, a sparse population, isolated communities, mostly coastal communities, a far north location, a large resource base, cold temperatures, lengthy periods of darkness and sunlight, abundance of ice and snow, similar wildlife and vegetation, a large public sector economy, a reliance on economic support from national governments, similar social issues, and similar languages. Despite these similarities, Greenland is still much further along in the push towards independence, running a tight fiscal policy, having some success in mineral development, having a successful fishing industry, and even establishing some manufacturing. Furthermore, there is also a move towards hydroelectricity production, potential for geothermal energy production, and the extraction of the vast reserve of hydrocarbons is under development. Thus, despite its shortcomings, Greenland is moving in the right direction, making it a good model for Nunavut to imitate.

As a result of this process towards independence, the urbanization process in Greenland is much further ahead, which has evolved a more mature architecture that responds to both the environment and culture of the Inuit. The emergence of this unique architecture is found in a blend of Nordic traditions and the Inuit's special relationship with the land and environment (Greenland Architecture, 2012). The common characteristics found here create a contemporary architecture that is unique, that signifies the Inuit identity, and encourages the preservation of traditional practices. Understanding these characteristics can help in the establishment of a culturally appropriate architecture in Nunavut.

Like Nunavut, the land in Greenland is publically owned, with only the physical buildings being leased. The result is a unique urban landscape void of fences and demarcation of property, where building follows no rational structure, and once you leave your dwelling, you step out onto common ground (Garcia, 2012, p. 25). As opposed to adopting the rational grid and property boundaries from the *Qablunaat*, dwellings in Nunavut can follow this approach as the ownership of land is non-existent.

The architecture in Greenland has a more significant colonial past than in the Canadian North, dating back to 1721, when timber kits were sent from Scandinavia. As such vernacular dwellings were abandoned much earlier, and the Inuit of Greenland had more time to evolve these Scandinavian houses into their own. One of the most striking characteristics of Greenland towns are brightly coloured houses that cover the landscape, which originally started as a colour coding of different building functions, but eventually gave way to personal preference (Garcia, 2012, p. 25). The coloured houses provide a sharp contract with both the white snow covered

landscape in the winter, and the low-lying tundra vegetation in the summer. Another common characteristic found in the architecture of Greenland is in the capturing the views of nature, whether it be natural landmarks, or the northern lights (Greenland Architecture, 2012). Usually, these views occur from the large open family room in the house. Further, recent examples of architecture here have broken away from box-like structures in an attempt to respond to the environmental forces acting upon the building, and in order to relate the buildings to the surrounding landscape, resulting in buildings with faceted and wave like forms. The use of natural materials has also gained more of an acceptance, in an attempt to blend buildings in with the landscape (Greenland Architecture, 2012). Most importantly, the idea of a unique identity has become one of the most important features of Greenland's contemporary architecture (Greenland Architecture, 2012). The unique structures, formed by the previously mentioned characteristics, which are derived from a relationship with nature, represents the Inuit identity, which is based on their relationship with the land, while also concerned with establishing its uniqueness amongst other cultures.

Figure 136: Brightly Coloured Houses of Qaqortoq (Top Left)

Figure 137: Queen Ingrid Health Centre (Top Right)

Figure 138: Greenland Institute of Natural Resources (Mid Left)

Figure 139: Taseralik Culture Centre (Mid Right)

Figure 140: Malik Swimming Pool (Bottom Left)

Figure 141: Katuaq Cultural Centre (Bottom Right)

6.5 Learning From Inuit Art

In order to establish an architecture that represents the unique hybrid culture of the Inuit and appeals to their aesthetic sensibilities, a study of their contemporary art is invaluable as it is a successful representation of their unique culture in the modern world (Auger, 2004, p. 147). Initially, Inuit art was simply folk art as there was no means of aesthetic expression other than the decoration of utilitarian objects. These were often very primitive and crude depictions of animals, hunting, camping and other representations of traditional values and lifestyles. However, Inuit fine art, or better put, art for art's sake, did not evolve organically from their folk art and their traditional culture, but was created for export in the 1950s out of economic necessity and at the encouragement of the *Qablunaat* for their markets (Hessel, 2002, pp. 188-189). The art was fashioned for a market, which was different then their own, and since it was produced first and foremost to make a living, the artists concerned themselves with creating what would sell. It should be noted that their art was produced not to gain wealth, but to survive, which is the driving force behind their entire way of life. Consequently, the art they developed portrayed a romanticized version of their traditional way of life, had fine workmanship that trended towards realism yet still felt primitive and naive, and was large in scale (Hessel, 2002, pp. 34-35). As the art industry matured and the Inuit artists were given more freedom, their art progressed into a hybrid form of commercial influences, while allowing for individual expression and imaginative composition. Further, their contemporary art has become a visual catalogue depicting their traditional culture, composed of a wide range of subjects telling the story, which has allowed for the preservation of their history, strengthening their shared cultural memory and distinct identity.

Themes

The art produced by the Inuit often reflects their traditions and beliefs, allowing them to hang on to their past, preserving their history. Their art is culturally relevant and communicative, allowing it to be successful in that it is an unpretentious art, accessible to most (Hessel, 2002, p. 186). One common theme found in Inuit art is the world of animals, which play a vital part of their everyday lives due to the hunt, whereby they must also respect and gain a significant understanding of their prey. Most Inuit artists focus on capturing the essence of the animal, exaggerating certain features to capture their personality, as opposed to a realistic depiction. Another common theme are scenes of everyday life, including games, entertainment, camps, and other traditional activities, which are executed with more detail and expression, transforming the ordinary into the sublime. Shamanism and the supernatural world is a subject depicted by many new artists who are curious about their heritage. This particular subject gives the artist more freedom, as they are able to create unusual compositions of spirits and rituals. Depicting myths and legends has also become a subject of interest, preserving oral tradition, capturing their origin stories, explaining natural forces, and bringing a sense of purpose to their lives in this world. The solitary human figure is also an important subject to capture, with the human being fully clothed with only the face exposed, as the human anatomy is not important, but capturing the persons essence is. The family, usually just mother and child is one of the most significant themes captured in their art. The mother and child almost appear as one, as the harsh climate necessitates a physical closeness between the two, yet it also symbolizes the close relationship. While not as common, some artists choose to tackle present-day social issues, and comment on their modernization.

Sculpture

While all Inuit sculptors are essentially carvers in that they employ a reductive process to end up with their final product, there are two categories of objects produced. Carvings are the small-scale objects that are considered folk art and tourist art, while sculptors are larger in scale and are considered a fine art. Within the spectrum of Inuit sculpture there is a diverse range of styles that do not necessarily follow regional or communal boundaries, as they emerged due to specific materials used, historical influences, and personal expression, which has trumped regional influences (Hessel, 2002, pp. 78, 115). However, there are some general characteristics that are present in the majority of Inuit sculptures, which will now be highlighted.

The first thing to note is the scale of the work, which is primarily determined by economics and logistics. Most are modest in scale due to the difficulty in transporting the material from a quarry, and the cost and ability to ship the complete piece. Further, more often than not, the larger the piece, the higher price the artist can receive for it, while the difference in effort is marginal. Thus, the scale is determined by push and pull forces of economic gain and practicality.

Figure 142: Dancing Bear by Saila Pauta, 1984 (Left)

Figure 143: Taleelayu by Oviloo Tunnillie, 1994 (Right)

Figure 144: Mother and Child by John Pangnark, 1965
(Left)

Figure 145: Shaman by Judas Ullulaq, 1997
(Right)

As the Inuit artist has a craftsman like approach, materiality is of huge importance to the final product. While bone, antlers, ivory, driftwood and other elements from the earth and animals are used for sculpture, the most common is stone, the most prominently used being serpentine, which varies from dark green and black in colour, followed by a sedimentary rock called argillite. In keeping with the craftsman like approach, the Inuit sculptor forms a dialogue with the material to determine the composition, style, and subject matter (Hessel, 2002, p. 74). Since each material has different qualities, the carving method changes while the variances within a material group ensure a different work every time. Thus, two approaches to sculpting are evident, either the artist comes up with an idea and searches for the perfect material to execute the idea, or they search through the available materials until a piece suggests an idea for them. For example, if stone is chosen, its colour is the least important, followed by its sheen while solidity is the most important characteristic (Auger, 2004, p. 103). The harder the stone, the more it dictates and restricts what the artist does, therefore less detail is expected, but if a softer stone is used, more detail is expected (Auger, 2004, p. 103). The material sensitive approach is what allows Inuit sculpture to go beyond mere representation of a subject, giving the piece a sense of originality, emotion, simplicity, and raw vitality (Hessel, 2002, p. 74). The most prominent characteristics of Inuit sculpture are thus the tactility of the material, simplicity of the form, and the visceral feel.

Since craftsmanship trumps aesthetics for the sculptor, a well-made sculpture is more important than a beautiful one, and the subject is more important than form (Hessel, 2002, pp. 75-76). Their attitude towards sculpting can be viewed as a realist approach, fitting into one of the following four views: a naturalistic expression of spiritual and imaginative beings; the precise depiction of people, objects and animals; expressionistic depiction of activities or actual events; or the depiction of actual beings in a stylized manner (Hessel, 2002, p. 77). Thus, truth is an important value in their work, something about it has to be true, which is what gives their work meaning, and is why there is no pure abstraction found in Inuit art.

The Inuit sculptors' material driven approach, and eagerness to capture an element of truth in their work has resulted in an aesthetic of reduction. In focusing on the material's expression, forms are often reduced to respect the materials inherent qualities. In trying to capture the essence of a subject and to enhance its meaning, the form is reduced to what is necessary. Thus, by stripping away the extraneous, attention is brought to the material and the content expressed in the form (Hessel, 2002, p. 123). According to Inuit art historian, Ingo Hessel (2002), there are three ways in which this formal reduction is achieved. The first is though the simplification of form, elimination of detail, and fusing the figure with the elemental quality of the material, resulting in a streamline form that emphasizes mass, bulk and volume. The second is through focus of a pure and distilled form that results in an abstraction of the subject. The third is to create a more open form, in opposition to the monolith, emphasizing the relationship between different parts.

Graphic Arts

Unlike Inuit sculptures, two dimensional art and design is a relatively recent art form practiced by the Inuit. However, the aesthetic sensibilities displayed in these works can be traced to traditional clothing decorations, tattoo design, and string figures. One specific successful art form is printmaking, which only occurs in a handful of communities due to the economics of printmaking, which requires significant labour costs, expensive facilities, equipment, and supplies. Consequently, there is a fear of poor reception, which has stifled innovation and individual expression to a degree, as they hang onto with what has sold in the past (Hessel, 2002, p. 139). In most communities, the stonecut medium is used, which takes advantage of the skills of stone carvers. These prints have a distinct, minimalist look due to the limitations of the medium. They are often very organized and coherent, and "have a cleaner, crisper look; lines tend to be sharper and thicker, areas of colour more even and bolder, and textures more schematized", resulting in them having more punch (Hessel, 2002, p. 148).

Drawing is another form of two-dimensional art practiced by the Inuit, while painting is not widely practiced. Drawings usually consist of coloured pencils, felt tip markers, and graphite pencils. These have become an expressive and experimental form of art, revealing much more about the artist, and it is a less costly medium leading to less fear of failure. Further, because of the medium, one of the defining characteristics of these drawings is the "spontaneity and immediacy" of which they allow to occur (Hessel, 2002, p. 144). As such, these drawings contain more energy and vitality in comparison to prints.

Just as in sculpture, the meaning and history behind the artwork has more importance than the aesthetic composition. They are descriptive and narrative, often telling a story or expressing a larger theme (Hessel, 2002, p. 148). The images are often

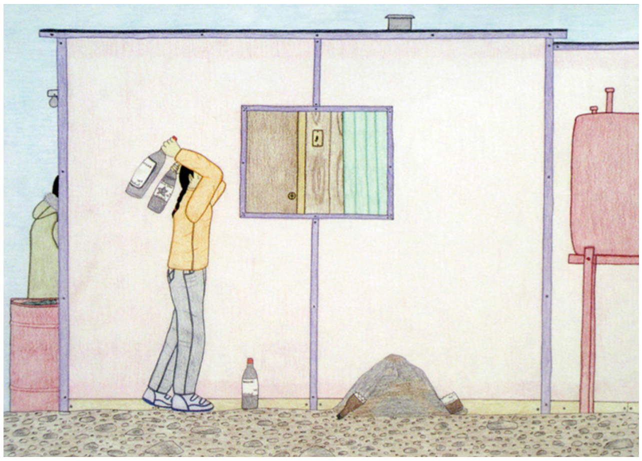


Figure 146: The Strange Drummer by Mary Okheena, 1992 (Left)

Figure 147: Breaking Bottle by Annie Pootoogook, 2002 (Right)

loaded with spiritual content, creating an emotional impact. Further, these images receive a symbolic treatment as opposed to a naturalistic approach to help express its meaning. Moreover, aesthetics are not totally disregarded, as value is placed on composition, colour and pattern in so much as they help with the overall expression of the piece. As these artists have been inspired by outside influences, they have become more self-conscious and innovative, resulting in two approaches: prioritizing accurate and clear information, or aesthetic expression (Hessel, 2002, p. 152). Some other common characteristics include syncretism, which is the combining of unrelated elements in one image; meta-realism, which is making thoughts or ideas visible; and the mixing of spatial and temporal perspective (Hessel, 2002, p. 152). Many of the artworks produced try to capture the essence of the old ways, and as such stress flatness, as opposed to portraying things in perspective, contributing to the primitive and unique appearance. Further, the images can either be processional or static; symmetrical and ordered, or free and unplanned; black or brightly coloured; and crude and elemental or naturalistic. Accordingly, there are varying approaches to two-dimensional image production, but what remains important is the overall meaning of the image, and how all the elements contribute to expressing this purpose.

Lessons Learned

In developing an understanding of these Inuit art forms, their values, general processes, conceptual framework, and aesthetic sensibilities can be revealed. These in turn can aid in the development of a culturally relevant contemporary architecture for the Inuit. Firstly, one must consider the importance of the natural world, traditional practices, and the family in the design of functional dwellings for the Inuit, as these are common themes found in their creations. The focus on the unique qualities of both materials and methods can translate into the use of quality materials that respond suitably to the unique conditions of the Canadian North, and utilizing them for their inherent beauty. Since sculpting has become such a significant part of the Inuit life, with many Inuit having this skill, the same process can be applied to their architecture, which will represent their unique identity. The formal development of their dwelling can explore how the different elements, such as sunlight and wind sculpt both the form and interior void. Since there is a focus on reduction in carving, the form should consist of a simple, streamlined, and broken down geometry, without fragmented parts. The focus on truth over the aesthetic whole in Inuit art can be translated to architecture in which the dwelling can be approached as a response to the cultural, economic, and environmental forces acting upon it, as opposed to taking a perspective focusing on formal beauty. With all the parts achieving what they are required to and no extraneous pieces, the dwelling will be an expression of its function and purpose, creating a meaningful environment for the Inuit to dwell in.

6.6 Learning From Contemporary Arctic Architecture

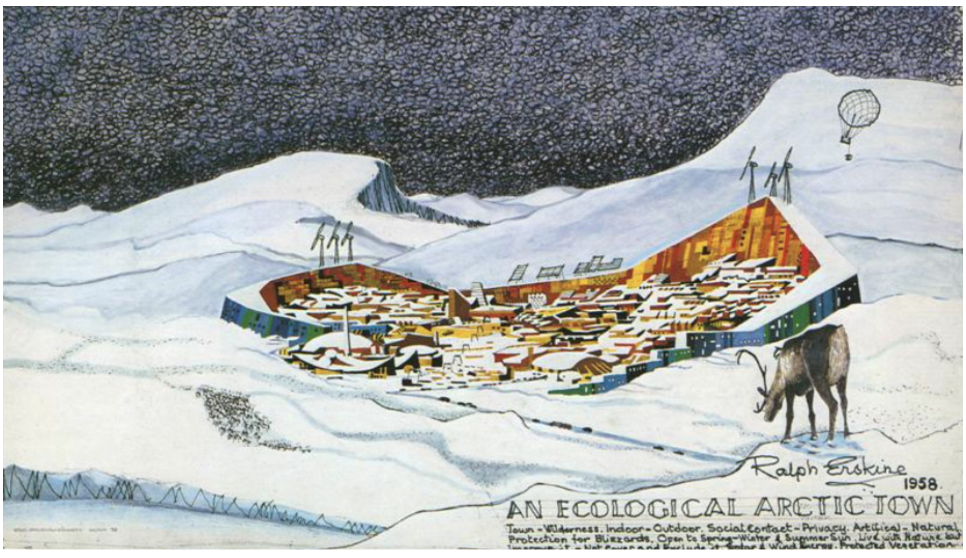
As discussed earlier, despite all the shortcomings in the evolution of architecture found in the Canadian North, there have been advancements in both realized and theoretical projects in the Arctic. The following five sections highlight some of these found in both Canada and abroad, which have generated success in dealing with an Inuit population, responding to the harsh environment, and creating an economically viable approach to building design.

Ralph Erskine: The Pioneer of Arctic Architecture

While Ralph Erskine's 1971 plans for a community in Resolute Bay, Nunavut were never realized and were filled with shortcomings, he remains one of the pioneers in developing an architecture that was truly befitting for the Arctic environment. Since the 1950s, he envisioned a rational and innovative approach to architecture in the Arctic that was rooted in a reinterpretation of the vernacular, and the exploration of new technologies for their innovative potential (Egelius, 1990, p. 74). For Erskine, it was not a matter of imitating the traditional type, but rather the exploration of a new solution to a regional challenge through the combination of the latest technologies and a response to both climate and terrain (Lund, 2008, p. 222). However, his creativity was demonstrated in his ability to combine his rationalist approach with his "intuitive feeling for form" (Egelius, 1990, p. 74). Consequently, he was successful in developing a distinct vocabulary for Arctic architecture, which can be incorporated in the development of a contemporary regional architecture.

The overarching principle found in the work of Ralph Erskine can be summed up as "form follows climate", in which the climate impacts the orientation, form, structure, material, and building elements (Egelius 1990, pg. 68). To Erskine, the most important elements in design in the Arctic are wind and sunshine, as he states:

Figure 148: Arctic Town Plan by Ralph Erskine, 1958



Houses and towns should open up like flowers to the sun of spring and summer, but also like flowers, turn their backs on the shadows and the cold north winds, offering sun-warmth and wind-protection. (Egelius, 1990, p. 68)

Consequently, his site plans are informed by this approach, being shaped like horseshoes, with the tallest buildings at the rear, protecting the inner spaces and buildings from the wind, and creating a suntrap within. The perimeter buildings act as a windscreen for the prevailing north winds, while blocking out the midnight sun in the summer, which also comes from a north. The result is the creation of a more comfortable microclimate within this inner space (Collymore, 1982, p. 30). The closed form of the horseshoe plan also creates a feeling of community and belonging, which is important in an isolated part of the world (Egelius, 1990, p. 70). Site plans are laid in a way whereby wind can be utilized to clear snowdrifts from roads and entrances. Further, while compact site plans make sense, buildings are spaced out far enough to avoid being cast in the long shadows of the low angled sun.

At the scale of individual buildings, Erskine ensures their long axis is oriented to the south and midday sun, and that they are composed of compact and simple forms to minimize heat loss. The southern elevations are taller, absorbing more sunlight, while north-facing elevations are lower, reducing heat loss and helping to reduce shadows. To prevent heat loss, window surface area is minimal on the north elevation, while south-facing windows can be more expansive as they absorb more heat then they lose (Egelius, 1990, pp. 69-70). Rounded corners are implemented to reduce wind resistance, exposing less surface area, and allowing the building to more efficiently retain heat. Roofs are shaped to collect snow, taking advantage of the insulating effects of snow, while also creating a seasonal variation in the building's aesthetics. Further, the

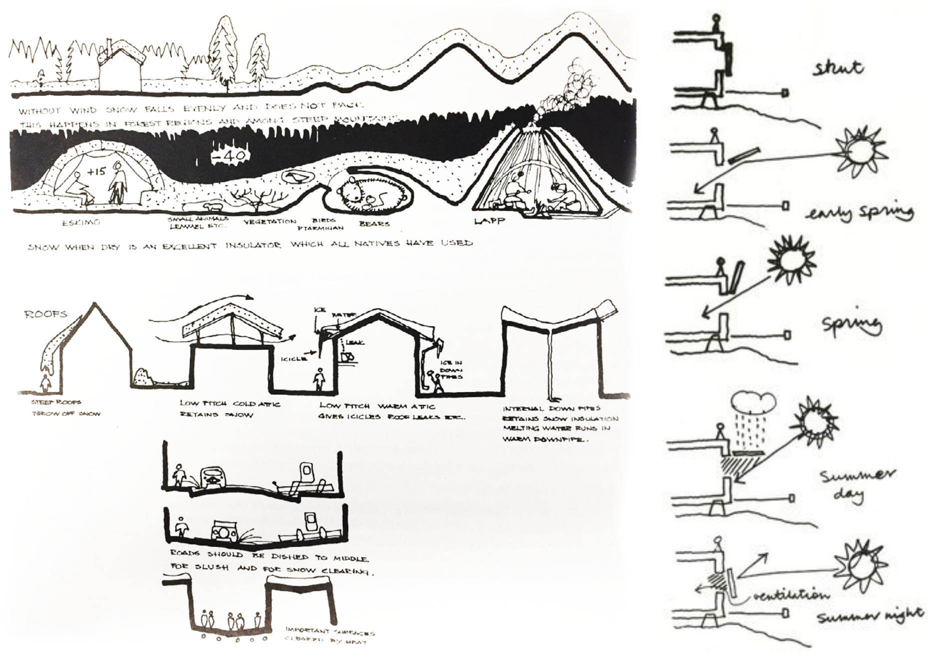


Figure 149: Erksine's Sketches on Cold Climate Design

collection of snow is combined with the use of warm internal downpipes, collecting the melting snow (Collymore, 1982, p. 28). Buildings are raised above ground to ensure permafrost stability. During winter, snow reflection and outdoor illumination are utilized to reduce the psychological effects of continuous darkness (Collymore, 1982, p. 27). The form and layout of buildings are shaped in a way that directs wind to clear snow from entrances and pathways.

Architectonic expression is also achieved through Erskine's use of specific elements, which respond to the climate. Insulating shutters deters the cold in the winter, and provides protection from the sun and glare, while offering opportunities to "express various functions during the climatic rhythms of the day" (Egelius, 1990, p. 71). External shutters and roof reflectors are used to help intensify the amount of light entering a building, allowing it to penetrate further into buildings. Porches are elements applied to protect building entrances from snow and wind. Overhangs on the south facing elevations protect balconies, pathways, and entrances from drifting snow. Further, Erskine manipulates these elements and characteristics through exaggeration, contributing to their distinct appearance (Lund, 2008, p. 90). All these components, which have been developed in response to the climatic conditions, have helped form an Arctic architectural language that can be utilized in the architecture of Inuit homes.

Unfortunately, certain aspects of the materiality and tectonics employed by Erskine are not transferrable. Most of his structural innovations pertain to larger scale and apartment style buildings, which are too large and dense for the Inuit culture. Further, the materials he used were conventional, and were selected based on economic grounds, but lacked reference to the Inuit, who place a significant value on materiality. However, he purposely utilized materials with dark colours and heat absorbing characteristics, and this approach can still be employed. Lastly, while his designs were envisioned to take advantage of prefabricated components in order to reduce the time labourers spent working in the harsh conditions, they never came to fruition because the cost benefits were lost when materials had to travel far distances from where they were manufactured. The solution for this is that a regional construction network be set up in the Canadian North.

Lateral Office: Vanguards of Contemporary Arctic Architecture

Currently, the design practice Lateral Office, based in Toronto, is one of the forerunners in developing and bringing awareness to architecture in the Canadian North. Through their Next North projects and their *Arctic Adaptations* exhibit for the Canadian pavilion at the 2014 Venice Biennale of Architecture, they have contributed significantly to the evolution of an environmentally and culturally responsive architecture. The following three projects address issues of food production, research, education, ecologies, and health, through the utilization of "soft systems that respond to climatic variation, programmatic needs and cultural diversity” (Lateral Office, 2011, p. 49). The ensuing will focus on the unique strategies that have been developed for these projects, which respond to the environment and Inuit culture and can be implemented in the designs of dwellings for the Inuit.

Caribou Pivot Station (2010)

As described by Lateral Office (2010a), the development of a new research station typology for the Canadian North was undertaken, which seeks to take advantage of the capital being directed towards research stations to improve the local ecology and increase the caribou population. The goal is realized through the creation of a microclimate adjacent to the building by deflecting and clearing snow. The mass of the building is shaped by the prevailing winds, which gather or deflect the blowing snow. The building further utilizes snow screens to manage snow for deflection, insulation, collection and concealment. In designing for the strategic placement of snow, the aesthetics of the building change throughout the year, creating a seasonal identity. Further contributing to the unique identity of the building is the faceted form, which is a result of its response to the environment.

Figure 150: Caribou Pivit Station Render

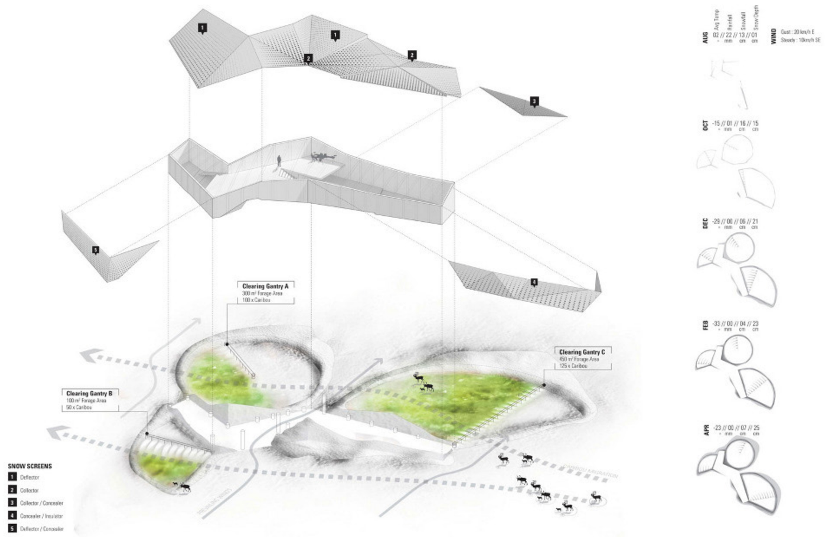


Figure 151: Caribou Pivit Station Exploded Diagram

Health Hangers (2010)

Lateral Office (2010b) has described the Health Hangers project as a new model for healthcare architecture and infrastructure in Nunavut, utilizing the relationship between air travel and healthcare delivery to create an airport/hospital hybrid. The project employs the use of a standing seam roof shaped to channel snow and ice towards ice walls. Thus, as in the previous project, the formal personality of the building is created through a faceted form that is a response to the environmental conditions. The ice walls take advantage of the aesthetic qualities of ice and use horizontal rails, a cable diagrid or horizontal fins to create differing effects with the ice, changing the identity for each space. Through the utilization of the aesthetic of ice in the winter, a seasonal registration is created.

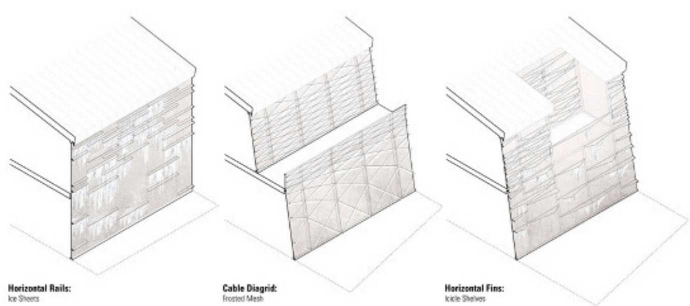


Figure 152: Health Hanger Forms
(Top Left)

Figure 153: Health Hanger Ice Wall Render
(Right)

Figure 154: Health Hanger Ice Wall Render
(Bottom Left)

Arctic Food Network (2012)

As indicated by Lateral Office (2012), the Arctic Food Network was developed in response to an under developed transportation system and the over reliance on the *Qablunaat,* which has resulted in obesity, diabetes, malnourishment, and a higher cost of living. The project seeks to reintroduce the traditional Inuit diet and practices to the youth, contribute to the small-scale local economy, and improve snowmobile transportation between the communities on Baffin Island. To accomplish this, they propose the creation of a regional network of Arctic farms, freezers, and camp hubs in varying sites on land, water/ice and coast along an Arctic snow highway that connects 11 communities. The design merges architecture, landscape and technology in the creation of an infrastructure of food production and exchange. The infrastructure includes outpost cabins, community kitchens, greenhouses/markets, offshore marine hubs, ice fishing huts, cool storage, cold storage, aqua culture infrastructure, lighting poles and communication poles, which are combined to form hubs out on the land, within towns and adjacent to towns.

The design of these structures bridges traditional practices and new technology, which responds to and represents the contemporary Inuit culture. The most recognizable element of these structures are smoke stacks, which allow for an interior fire pit where fish and meat can be smoked or cooked, allowing sunlight to enter, and as a beacon in the flat, monotonous landscape. The form is also shaped to retrieve water through snow, ice, and water collection. A copper skin is used, as it can adapt with the large fluctuation in temperatures, while it is also a material that bodes well for the Inuit's interest in materiality. Solar strip cell panels are used on the façade to take advantage of the long periods of sun in the summer for electricity production. Lastly, the design employs the use of CNC milled pieces, which allows for mass production and easy assembly.

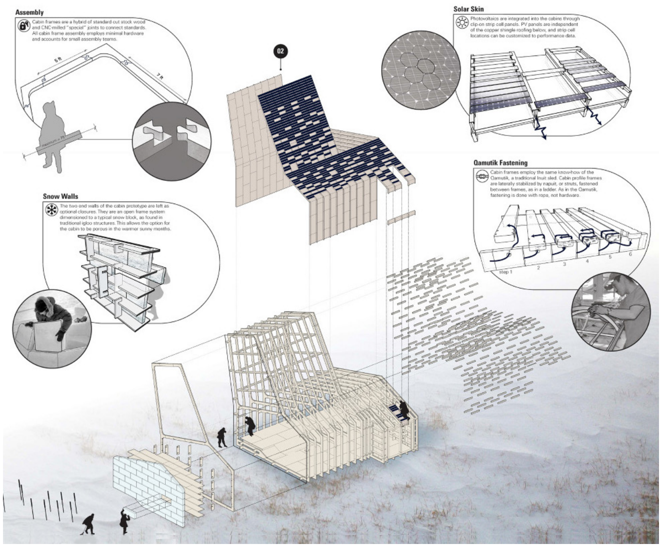


Figure 155: Arctic Food Network Diagram (Left)

Figure 156: Arctic Food Network Render (Top Right)

Figure 157: Arctic Food Network Interior Render (Bottom Right)

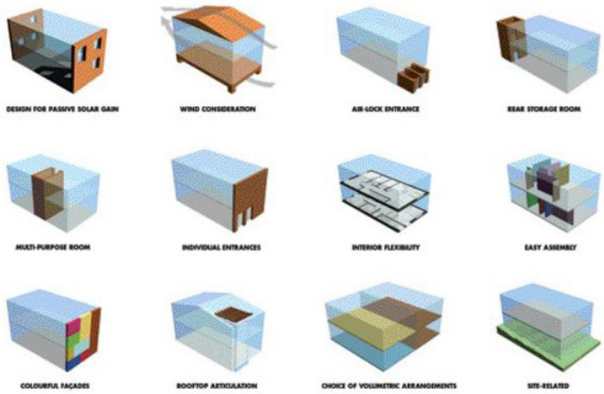
North-by-North Housing

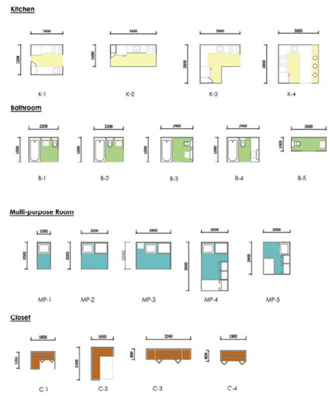
North-by-North housing is a proposed multi-unit public housing project in Iqaluit, Nunavut by Avi Friedman, first proposed in 2007. While formally not particularly appealing and having a foreign feeling, not reflecting the Inuit identity, the project crosses into the realm of significance in the way that it attempts to address the lifestyle of the Inuit, while also tackling the environmental and economic constraints of building in Nunavut. The building is oriented to take advantage of solar and wind exposure, with the long axis facing south, allowing the prevailing winds to provide cross ventilation. Unfortunately, views to the south are not considered and a hierarchy of space is not accounted for in this orientation, as in some units the living area faces south, while in others the laundry room and storage face south. Like many others in the Canadian North, is raised to prevent the thawing of permafrost and to allow blowing snowing to move under the house, preventing snow drifts. The roof slopes are shallow to prevent heat loss and gather more snow, creating more insulation. Also, at the main entrance, wind traps are created with an enclosed mudroom.

Figure 158: North-by-North Housing Render

Figure 159: North-by-North Housing Design Diagram (Left)

Figure 160: North-by-North Housing Room Option Diagram (Right)





In terms of program, both the site and individual unit consider the unique culture and conditions. The site incorporates reduced set backs to create a more dense site plan, while it also employs communal parking to save space. There is no demarcation of property, reflecting the Inuit value of shared land. The site contains spaces for carving, children's play, tool sheds, rock seating, arctic gardens, social areas, and foot and snowmobile paths, which are shared amongst the different families.

The units themselves incorporate cold porches for clothing, food and equipment, and other storage areas for hunting and fishing equipment. They also contain a multipurpose room for the preparation of hunted carcasses, while also providing additional storage, and can accommodate changing functions over the years. On the main floor, there is an open plan whereby the kitchen and living area creates a communal space that can facilitate the social interactions highly valued by the Inuit (Friedman & Debicka, 2012, p. 18). This flexible all purpose space can be used for large family gatherings, sitting, eating, studying and children's play.

One of the key characteristics of this design is its flexibility. The design is essentially a kit of parts, which can adapt to each family's needs, as they have a choice of rooms, interior features, and exterior design components (Friedman & Debicka, 2012, p. 15). A higher appreciation of the dwelling is created by having spaces that suit the user's needs more appropriately, resulting in less maintenance over time. The use of standardized measurements and materials is a "cost effective way to ensure that future housing can be economically retrofitted and adapted" changing households or new inhabitants (Friedman & Debicka, 2012, p. 14). Standardization also results in reduced construction budgets, easier maintenance and refurbishment, and is also environmentally responsible as it reduces material use and waste (Friedman & Debicka, 2012, p. 14). Thus, the flexible and standardized approach to home delivery in Nunavut is an effective strategy to respond to the design constraints

Longyearbyen Research Centre

JVA designed the Longyearbyen Research Centre, which was completed in 2006 and is situated on the Svalbard, a Norwegian archipelago located at the 79° latitude in the Arctic Ocean. While not responding to an Inuit culture, the project's identity is formed by its response to the environment, which can be utilized for dwelling design in the Canadian North. The design intent of the project was to focus on light, thermal control and durability, where the form branches out into limbs to create shallow depths for natural light penetration, while an angular form is created to respond to the flows of wind and snow (Decker, 2010, pp. 114-115). The formal response to the environmental conditions ensures snow will not build up near doors and windows, while it reduces heat lost through the envelope. The building is raised in order to prevent snowdrifts and the disruption of permafrost. The exterior of the building is clad in a copper skin, as it is workable and durable at low temperatures unlike many other metals, and reflects the low angled sun to create a microclimate (Slavid, 2009, p. 78; Decker, 2010, p. 115). Further, copper has long life span, requires no maintenance, and can sustain the wide temperature variations which surface materials experience throughout the year.

Figure 161: Longyearbyen Research Centre

In the interior, glazing is positioned to capture vistas of the surrounding landscape, while the formal response to the environment creates a spatial richness inside (Slavid, 2009, p. 78; Decker, 2010, p. 115). Further, the intention of the interior is to create a warm, light and welcoming space that counters the dark long winters (Slavid, 2009, p. 78; Decker, 2010, p. 115). This is achieved through the use of pine cladding on the inside, and incorporating warm colours to create an element of differentiation.

Greenland Inhabiting

The exhibit at the Danish pavilion for the 2012 Venice Biennale of Architecture

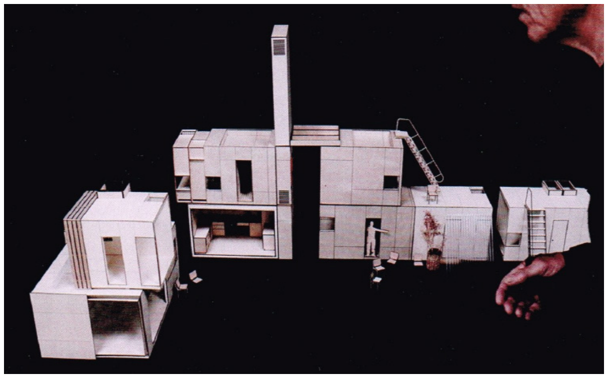


Figure 162: Greenland Inhabiting Render
(Top)

Figure 163: Greenland Inhabiting Model
(Bottom Left)

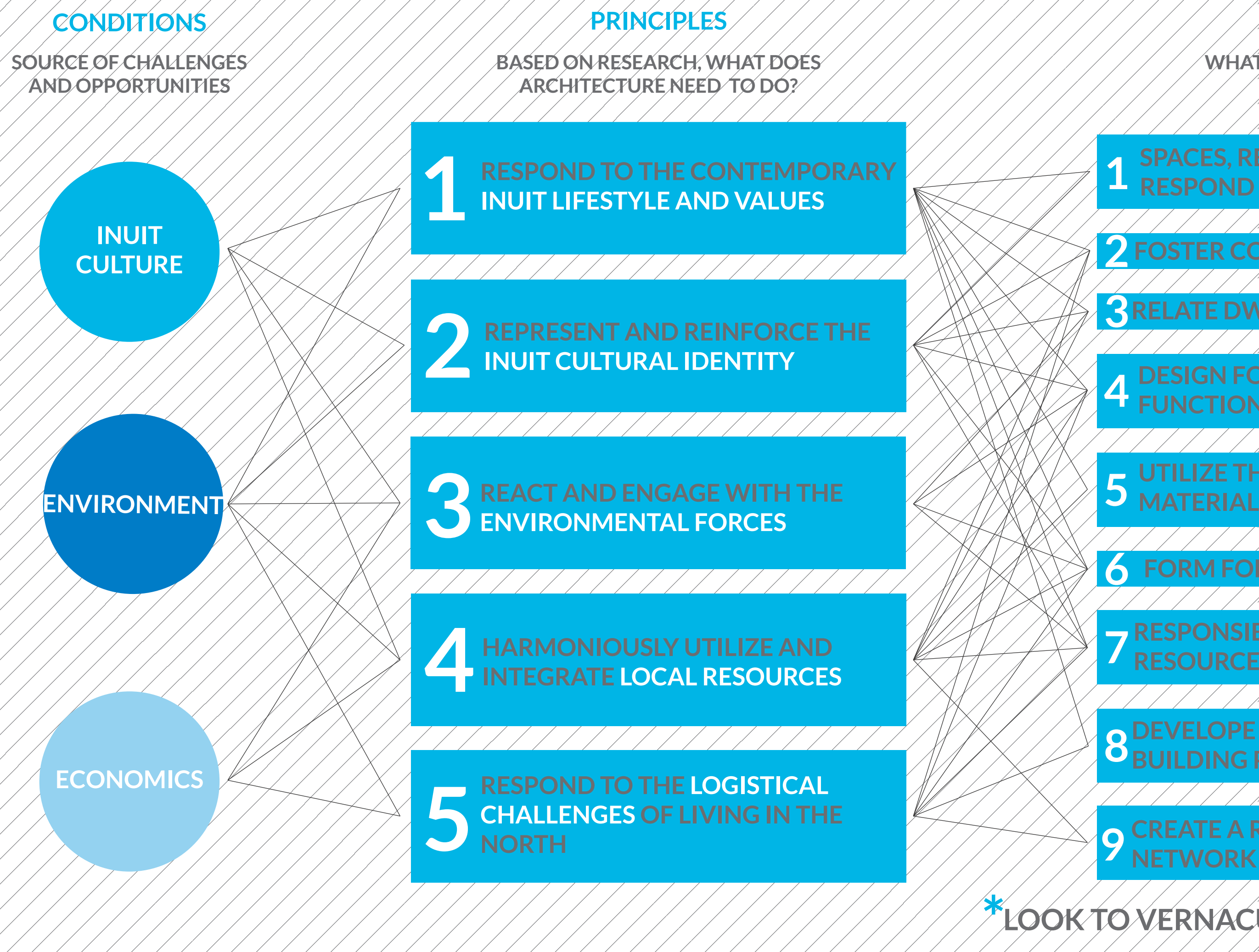
Figure 164: Greenland Inhabiting Paqibiq Box Model
(Bottom Right)

was titled *Possible Greenland*, which explored architectures relationship to different challenges found in Greenland. One such theme was housing, and a project titled Greenland Inhabiting was proposed by the architecture offices of Qarsoq Tegnestue from Greenland, and Tegnestuen Vandkunsten from Denmark. The project is significant because it seeks an innovative approach to addressing the unique culture of the Inuit in Greenland, while also attending to many of the other challenges found there.

Much like Avi Friedman's approach, this project utilizes a kit-of-parts, with standard dimensions, materials, and components that allow for a variety of combinations that suit the needs of different families. It is not a set in stone design, but envisioned as "method, a language, and a game, of almost infinite combinations" that forms a dialogue with context, and delivers multiple housing typologies such as the single family house, double houses, long houses, row houses or a cluster of houses (Team Greenland Inhabiting, 2012, p. 237). Developed as a response to landscape and climate conditions through the use of a "light weight assembly-friendly system" that allows for a degree of independence (Team Greenland Inhabiting, 2012, p. 235), a new Arctic building practice is formed, which responds to the unique situations found in Greenland.

The first architectonic element used is called the lifeline or access deck, which serves multiple functions. It is a shared entry deck, which cultivates the terrain, acting as an area for social interactions and where common functions occur, such as snowmobile parking, smoke ovens and shared laundry. It also acts as a service route, where water, heat, and electricity are supplied and sewage is removed. The next element is the base, which is a lightweight steel structure embedded into the rocky terrain, topped by a floor slab. It is a system that can easily be constructed and reduces the impact that buildings have on the landscape. Built within the floors is a hot water heating system and ventilation. Another element used is the skeleton, the primary structure of the dwelling, which is composed of wooden, prefabricated open trusses that are lightweight and allow for easy assembly. On top of the structure lies the skin, consisting of polycarbonate sheets of varying transparencies, a clear glass skylight at the top, and solar panels, which harvests energy from sunlight during the summer. Within the space created by the skin, is a semi-climatized zone that is warm in summer and cool in winter, and houses informal programs such as gathering spaces, workshops, greenhouses, and equipment rooms. The next set of elements are the insulated paqibiq boxes, which can be self built or prefabricated, and house functions such as cooking, resting, storage and hygiene. These boxes are attached to a technical core that provides services and allows for stack ventilation, they can be stacked, and can penetrate the skin to provide points of entry, balconies and bay windows. During the summer, these boxes can be enclosed to keep out the midnight sun while in the winter they create smaller insulated spaces that can be easily heated. There are thus two different climatic zones created inside, with the transitional zone acting as a buffer between the outside and interior boxes, resulting in an effective retention of energy. A clear spatial hierarchy is clear, where light conditions and temperature variations help define spatial organization, and where smaller rooms are made smaller, and larger rooms made larger (Team Greenland Inhabiting, 2012, pp. 240-241). Therefore, a unique architectural identity is created though the use of this flexible system that is developed from a kit-of-parts, allowing for a variety of dwellings to be constructed and a distinct architectural language to form that is derived from response to the environmental needs and the functional requirements of the Inuit.

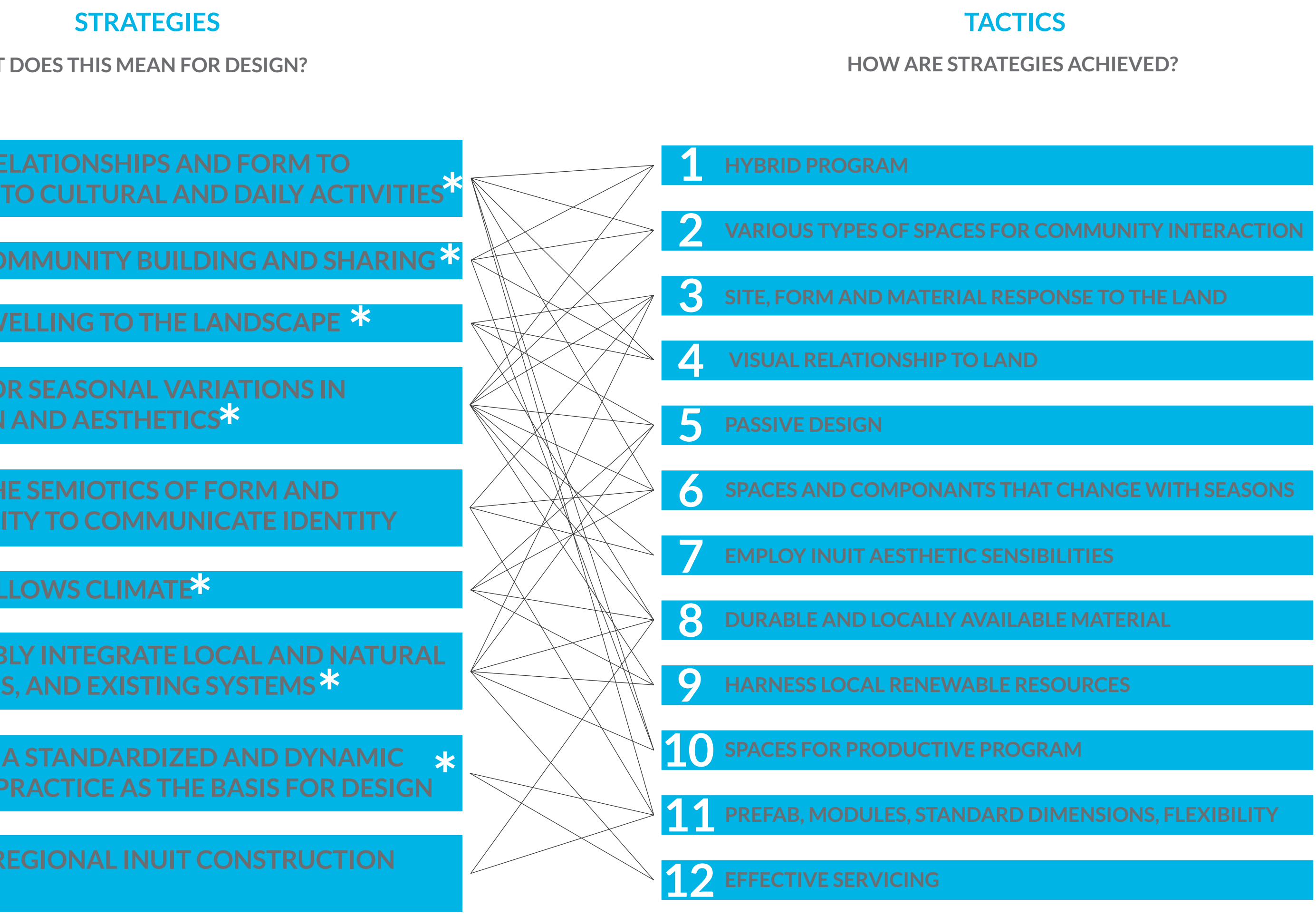
07


CONDITIONS
SOURCE OF CHALLENGES AND OPPORTUNITIES
INUIT CULTURE
ENVIRONMENT
ECONOMICS
PRINCIPLES
BASED ON RESEARCH, WHAT DOES ARCHITECTURE NEED TO DO?
1 RESPOND TO THE CONTEMPORARY INUIT LIFESTYLE AND VALUES
2 REPRESENT AND REINFORCE THE INUIT CULTURAL IDENTITY
3 REACT AND ENGAGE WITH THE ENVIRONMENTAL FORCES
4 HARMONIOUSLY UTILIZE AND INTEGRATE LOCAL RESOURCES
5 RESPOND TO THE LOGISTICAL CHALLENGES OF LIVING IN THE NORTH
WHAT
1 SPACES, RE
RESPOND
2 FOSTER CO
3 RELATE DW
4 DESIGN FO
FUNCTION
5 UTILIZE TH
MATERIAL
6 FORM FOR
7 RESPONSIB
RESOURCE
8 DEVELOPE
BUILDING
9 CREATE A
NETWORK
*LOOK TO VERNACU

AN ARCHITECTURE OF INUIT DWELLING

The following chapters express the architectural project that has been developed in response to the challenges encompassing Inuit dwellings that have been brought to light in this thesis | project. The first chapter will establish the principles, strategies and tactics that must drive the architecture of Inuit homes in order to respond to the unique conditions that exist in the Canadian North. These principles have been developed in accordance to the projects, theories and an analysis of the existing conditions, all of which have been analyzed in the previous parts of this thesis | project. The second chapter will depict the development of the system of home-delivery for the Inuit that has been designed in response to the principles. The last chapter will ascertain how this system can be adapted to a particular context at both the scale of the individual building and the community.

Figure 165: Principles/ Strategies/Tactics



ULAR FOR TRADITIONAL APPROACHES

7.1 Principles / Strategies / Tactics

The following principles have been developed to determine how architecture can impact the lives of the Inuit living in the Canadian North. They express the goals and objectives that the architecture of Inuit homes must achieve. Based off of these principles, a set of strategies was developed to portray their implications on design, and act as the groundwork for what needs to transpire. Next, specific tactics were established in order to realize the strategies, and act as guidelines for design.

PRINCIPLES

1. Respond to The Contemporary Inuit Lifestyle and Values

In order to respond to the unique Inuit culture and environment, dwellings designed for the Inuit must be programmed and organized according to their hybrid lifestyle. The program, spaces, and layout must reflect the Inuit values which include: living in harmony with the environment, the preservation of their oral history, the importance of family, the social and historical significance of hunting, maintaining communal sharing and relationships, learning practical skills, the impact of seasonal variations, and the value of doing things in a distinctly Inuit way.

2. Represent and Reinforce the Inuit Cultural Identity

Derived from a response to the environment and culture, the design of dwellings must represent the unique Inuit identity through its distinctiveness and reinterpretation of the vernacular architecture, its embodiment of their shared cultural memory and the present hybrid culture. It must also encourage practices that are distinctly Inuit, which will help preserve their cultural memory.

3. React and Engage with the Environmental Forces

When it comes to the harsh environment, Inuit homes must be more than technically sufficient; they must also allow the natural forces to impact the architectonic expression. Furthermore, the environment may be called upon for inspiration, as the building must be seen as an extension of the environment, not just an object in the landscape. In so doing the Inuit homes will not only respond to the environmental conditions, but also to their culture which is impacted by the environment, and by the economic challenges found in the region.

4. Harmoniously Utilize and Integrate Local Resources

The use of natural materials, renewable resources, and local people must be taken advantage of within both the design and the construction of the dwellings. Any aspects of the construction process that habitually occur far away should be pressed to remain instead, within the territory. As such, the dwelling will be firmly rooted in its context, respond to the environmental conditions, represent the unique culture and develop a more feasible approach to construction.

5. Respond to the Logistical Challenges of Living in the North

The isolation, remoteness, and harsh environmental conditions found in the majority of Inuit communities in the north, have created many economic challenges, which must be addressed in the design of dwellings. Challenges to be addressed range from construction methods, energy efficiency, material use, and durability; to accounting for the mixed economy that the Inuit practice.

STRATEGIES

1. Spaces, Relationships and Form to Respond to the Inuit Daily and Cultural Activities

The building program, spatial requirements and their relationships to each other should be determined by the daily lifestyle of the contemporary Inuit and the need to preserve their cultural memory. Consequently, the form will be impacted by these spaces.

2. Foster Community Building and Sharing

Since communal sharing and social activities are such important facets of Inuit culture, they must be accounted for in the design of the Inuit home. Spaces for communal gatherings, large family meals, and for potential random social integrations need to exist. Furthermore, sharing practices will help build social relationships, while eliminating redundancies and creating opportunities for economic savings. These spaces can be shared between buildings, while structures can be included in the site design to be shared by the entire community, with services being delivered through a shared network as opposed to each individual house.

3. Relate Dwelling to the Landscape

In response to the cultural identity of the Inuit and their lifestyle, both of which are rooted in the land, buildings must signify the importance of the relationship between land and identity, while also engaging with the landscape, much like the Inuit vernacular architecture which is integrated with the land in terms of materiality and form. The manner in which the building responds to the unique terrain conditions, and the utilization of local materials, are also important considerations for displaying the relationship between land and building.

4. Design for Seasonal Variations in Function and Aesthetics

In order to respond to the environmental conditions, energy use and the daily lifestyles of the Inuit, while also representing the Inuit identity, their cultural memory, and the duality of their vernacular architecture, the function of the dwelling must adapt with the seasons. Furthermore, the building's aesthetics should acclimatize with the elements, and through its engagement with the environmental conditions of each season.

5. Utilize the Semiotics of Form and Materiality to Communicate Cultural Identity

The form of the dwelling can represent the Inuit identity through its uniqueness by responding to the terrain and climate, and through an understanding of Inuit aesthetic sensibilities, derived from their vernacular architecture and art. The importance of materiality to the Inuit should not be understated, as they hold craftsmanship in high regard.

6. Form Follows Climate

To represent the Inuit's relationship to the environment, the functional limitations of the environment on the Inuit lifestyle and dwelling, as well as the opportunity to harness local resources; the form of the dwelling must respond to the climate, in part through a reinterpretation of vernacular techniques.

7. Responsibly Integrate Local and Natural Resources, and Existing Systems

Representing the Inuit value of living in harmony with the environment as found in their vernacular architecture, while also responding to environmental and logistical challenges, local and renewable resources should be important facets of dwelling design for the Inuit. Furthermore, where there is no other option for the use of alternative resources, a more effective approach wherein current utilities are delivered should be developed. As many locals as possible should also be involved in the construction process, as this not only keeps money within the community, but prevents the costly and environmentally damaging endeavour of flying in labourers.

8. Develop a Standardized and Dynamic Building Practice as the Basis for Home Design

Relating to the diverse and fluctuating nature of the Inuit family, their standardized and logical vernacular building system and the high construction costs, a standardized and flexible building system should be developed.

9. Create a Regional Inuit Construction Network

In order to respond to the economic conditions of construction in the Canadian North, to take advantage of local resources, reduce the negative effects of transportation on the environment, and to create more local opportunities, a regional construction network should be established. In part, a regional construction network is made possible through a standardized and systematic approach to home delivery.

TACTICS

1. Hybrid Program

In order to respond to the necessity for spaces required for the daily activities of the Inuit, communal and family gatherings, and spaces that alternate with the seasons, a hybrid program is essential to combine both facets of traditional Inuit life and the aspects of the *Qablunaat* that have been embraced.

2. Various Types of Spaces for Community Interaction

There are various types of space needed to foster community growth amongst the Inuit, activities such as: family and friend gatherings, meals and storytelling, larger communal gatherings for drum dances and singing, and daily interactions along shared spaces and paths.

3. Site, Form, and Material Response to the Land

In order to create a unique architectural identity, the building design must relate to the landscape, employ the semiotics of form and materiality, and integrate local resources. The site design must encourage engagement with the land; the form of the building must establish a dialogue with the land through contrast and integration. Additionally, materials from the land must be utilized, and they must relate to the land through colour and texture.

4. Visual Relationship to Land

In order to ensure that a relationship to the land is encouraged, great care must be taken to assure the visual connections to the land are maintained throughout the design of the dwelling.

5. Passive Design

To ensure that the dwelling responds to the land, adapts to seasonal variations, climate drives the form, and that environmental opportunities are taken advantage of, passive design techniques should be employed. These techniques should secure efficient energy use and affirm that solar gain and natural ventilation are taken advantage of, while also ensuring that the dwelling is a reinterpretation of the vernacular.

6. Spaces and Components that Change with Seasons

By incorporating spaces that change throughout the seasons, and building elements that adapt with the seasons, the dwelling will successfully respond to the daily activities of the Inuit; the building will respond to the environment, and the aesthetics of seasonality and its representation of the Inuit culture will be realized, creating a unique building identity.

7. Employ Inuit Aesthetic Sensibilities

Developing an understanding of Inuit aesthetic sensibilities through analyzing their contemporary art and vernacular dwellings helps to create a unique contemporary architecture for the Inuit. The aesthetic of reduction, an emphasis on materiality, and the goal of truth are the sensibilities found in their art, and the importance of seasonality and a response to the environment are the driving forces behind their vernacular architecture. These sensibilities can be utilized to represent the Inuit identity.

8. Durable and Locally Available Materials

The use of local materials can help signify their relationship with the land, create a seasonal aesthetic, and create a regional construction network. The use of durable, natural, and quality materials depicts the value the Inuit place on craftsmanship, while also responding to the harsh climatic conditions.

9. Harness Local Renewable Resources

The use of local renewable resources such as water, snow, sun, and wind are methods in which the home responds to climate, takes advantage of the local resource opportunities, integrates them in their design, and reacts with the seasonal variations.

10. Spaces for Productive Program

By including spaces for productive programs such as food growth, energy production, and activities that generate economic progression, the designs of both dwelling and site will respond to the hybrid culture of the Inuit, while encouraging communal interactions, which will take advantage of the opportunities provided by local resources.

11. Prefabricated Components, Standard Dimensions, and a Flexible System

Through developing a home delivery system that utilizes prefabrication, standardized components and dimensions, and allows for flexibility, dwellings will generate a regional construction network that is economical and allows for a dynamic approach, which will create variety and respond to the diverse nature of the Inuit families. The dynamic yet standardized approach will help establish a unique identity, while reminiscing of the vernacular *igluit* system used by the Inuit. Also, in developing a home grown construction practice, logistic challenges be overcome, but locals will also be more involved in the construction and design process and it will be benefit both the local economy and the environment.

12. Effective Servicing

In establishing a new source of utilities and a manner in which they can be more effectively delivered, both local resource opportunities and existing utilities can be taken advantage of, while also assisting in the development of a standardized approach to building.

7.2 Design Development

The following chapter will highlight the development of the home-delivery system for the Inuit in response to the established principles. The response to family type and size will be addressed, while different suitable dwelling types will be explored. The program and spatial relationships will be determined, which in turn will help define the dwelling layouts. The different factors that impact that building's massing will be presented. Some technical considerations, materiality, typical details, and their impacts on the design will also be discussed. The manner in which spaces and components are standardized, and how they can result in design variations will be investigated. The development of the site strategy will also be displayed. It will consider the programmatic requirements, service delivery, fostering communal interactions, and utilizing standard components. Further, the way in which seasonal variations and ecological sustainability are achieved will be highlighted.

Family Type and Size

The average household size is approximately 4 people; however, considering the median household size of crowded dwellings is 6, and the average female has over 3 children, a variety of home sizes is required. Further, there are many family types that inhabit a single dwelling, including a single family; an extended family where either the grandparents reside with them or one of their children's spouse and children; or a multiple family, with two siblings and their respective families inhabiting a household. In order to meet this need, the proposed housing system will allow for dwellings that range from three to five bedrooms, and will be designed for 4 to 8 people.

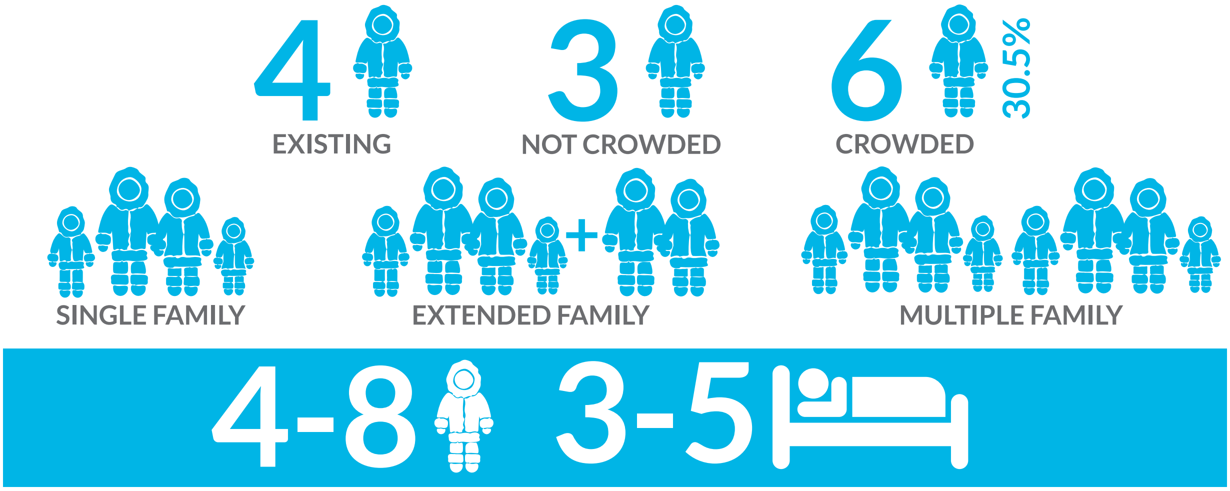


Figure 166: Dwelling Size

Dwelling Type

In order to create diversity in the built environment, to produce houses that respond to the varying economic status of families, and to accommodate personal preferences, a variety of dwellings types will be available. There will be detached dwellings for single families, there will be double houses that will house two families and enable them to share spaces or be completely separate entities, and row houses that will house three families, while also providing the opportunity to share spaces. Further, within each dwelling type will be a single storey option, the most common, and a two-storey option for larger families.

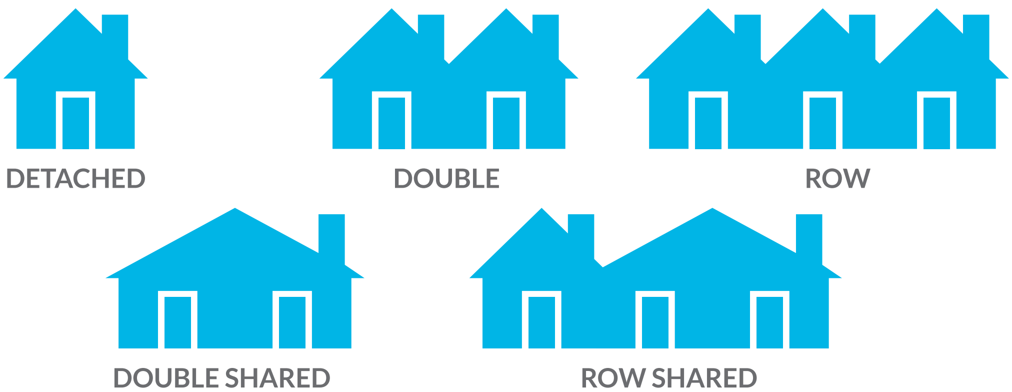


Figure 167: Dwelling Type

Program

The program will consist of a hybrid between spaces used for traditional Inuit practices and those found in the *Qablunaat* houses. The vernacular dwellings of the Inuit usually consist of an entry that acts as a cold trap, a single large multifunctional space, an elevated sleeping platform, and the exterior for activities that require more space and clean up. The *Qablunaat* houses on the other hand, consist of segregated bedrooms, a segregated kitchen, a formal dining room, a separate living room, bathrooms, usually a mudroom, closets, a utility room and, sometimes an office. In order to incorporate modern spaces, yet reflect traditional spaces utilized by the Inuit, the building will be grouped into three zones. The north zone will consist of private spaces such as bedrooms with work spaces and storage, and service spaces like a mudroom, storage, utility room and bathrooms. These will allow family members to seek the privacy they desire, now valued by the younger population, while also responding to the traditional need for seclusion in the summer. The integrated living area will be one large space that accommodates activities including eating, food preparation, children's play, computer access and social activities. The third zone will be the indoor/outdoor multifunctional space that will allow for traditional activities such as meals and food preparation, hunting preparation, the skinning of animals, sewing of skins, children's play and storage of outdoor clothing; social activities such as traditional feasts, story telling, and small musical performances; and productive activities such food cultivation, equipment maintenance, and carving.

VERNACULAR

ENTRY
COLD TRAP

UNIVERSAL OPEN SPACE
Food Preparation
Eating
Sewing
Crafts
Heat Source - Qulliq
Storage (Tools, Toys, Clothes, Hides)
Socializing
Children's Play
Preparing Hides
Drying Meat
Washing

ELEVATED PLATFORM
Sleeping

EXTERIOR
Cold Storage
Drying Of Char And Meat
Butchering Of Animal
Skinning
Storage Of Large Equipment
Maintenance

NORTH ZONE (PRIVATE AND UTILITY)

BEDROOM
Sleeping
Storage
Desk Work

WARM STORAGE SPACE

MECHANICAL ROOM
Water, Sewage, DHW, Pumps, Boiler/furnace, Wood Pellets

MUDROOM
Laundry
Storage
Entry Vestibule

COLD STORAGE

INTEGRATED LIVING AREA
Food Storage
Food Preparation
Eating Of Commercial Food At A Table
Socializing
TV Watching
Temporary Sleeping
Storage
Play Desk Work
Hearth

INDOOR/OUTDOOR SPACE
Hunting Preparation
Storage Of Hunting Equipment
Cold Storage For Game And Hides
Preparation Of Country Food
Food Sharing
Drying Of Meat And Char
Preparation And Drying Of Hides
Social Gatherings (Music, Dance, Games)
Sewing Of Hides
Art Making
Children's Play Area
Maintenance Of Small Equipment
Food Growing
Entry

MODERN

BEDROOM
Sleeping
Clothing Storage
Desk Work
Play

KITCHEN
Food Preperation
Food Storage
Equipment Storage

DINING ROOM
Eating

LIVING ROOM
TV Watching
Socializing
Play

OFFICE
Desk Work

BATHROOM

MUDROOM
Laundry

CLOSETS

UTILITY

Figure 168: Hybrid Program

Spatial Relationships

The spaces will be arranged according to a temperature gradient as found in their traditional planning, so that the spaces requiring less heat and are more enclosed will be located north where more heat is lost, while also creating a buffer for the warmer spaces. The mudroom located in this zone will also create an air trap, preventing heat loss from the main living area. The spaces requiring more heat and light will be situated south, taking advantage of the sun. These areas will take advantage of the view toward the outdoor communal area located to the south of the dwellings. Further, the service spaces requiring plumbing will be located in close proximity to each other to reduce plumbing runs. The children's bedrooms will be located farthest away from the main family space in order to allow for privacy, reflecting the dichotomy of the time of the individual and community found in the yearly cycles of the Inuit. However, the parents' bedroom will be adjacent to the family space, symbolizing their place as household head, which was also found in their *igluit* plan. Within the integrated living area, elements are arranged around the hearth and *qulliq*, representing the importance of that heat source to the Inuit. Further, two entrances at opposite ends of the building are necessary, reflecting the unpredictable nature of snow drifts, in order to ensure access is maintained during the winter months.

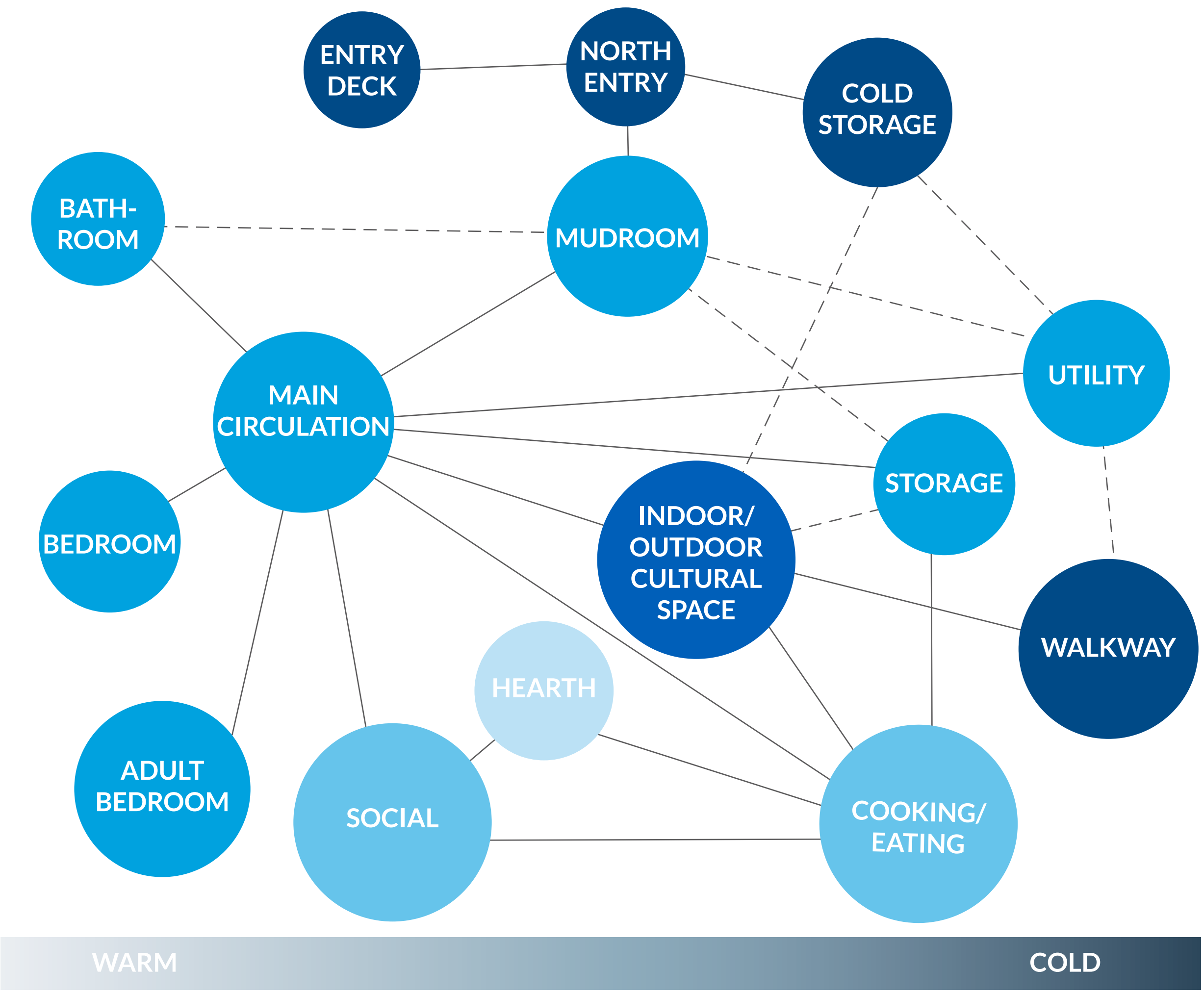


Figure 169: Program Diagram

Plan Development

Two approaches to the plan have been taken. The first is the single storey unit, utilizing a bent form to account for the difference in areas between the two zones, while allowing for a smaller surface area. Also, it results in the creation of a semicircular site plan, creating a protected zone for communal activities, while also directing focus to this central landscape. The second approach is the two storey for larger units, rectangular in plan, allowing for the surface area to be minimized.

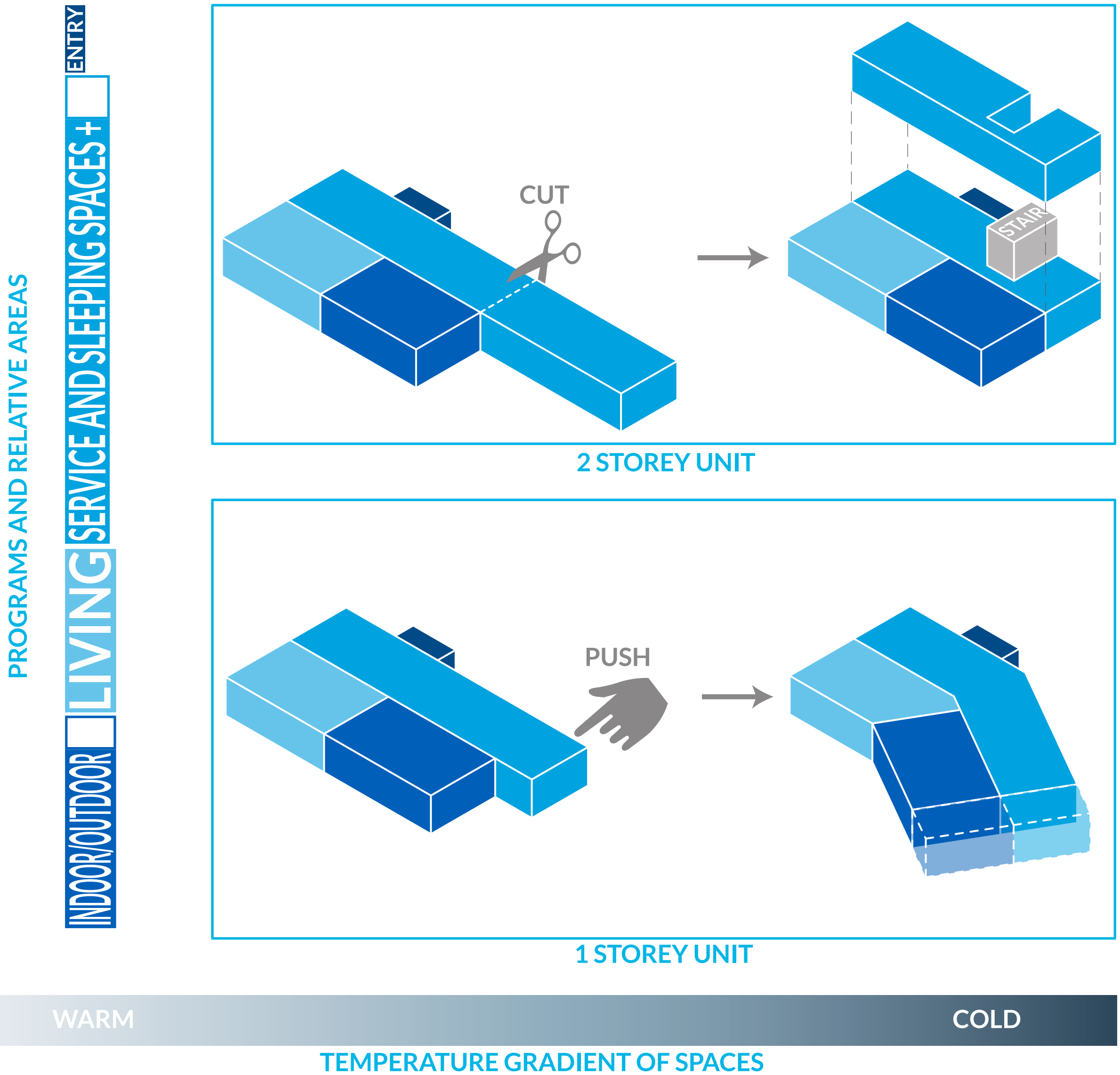
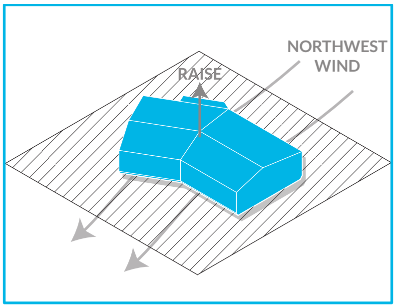


Figure 170: Initial Formal Concept Diagram

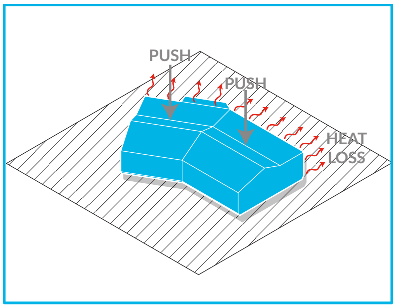
Building Massing

The primary determinates of the architectural language of the contemporary Inuit dwelling is the establishment of a distinctly unique dwelling form, which is a result of how the dwelling responds to the harsh environmental conditions, how it relates and respects the landscape, how it represents seasonality, and how it addresses Inuit aesthetic sensibilities derived from their art. Much like the vernacular *iglu*, the identity of these dwellings is representative of the Inuit's cultural identity which is derived from their relationship to the natural environment, in that its form is a response to sunlight, wind, snow, and natural ventilation. Further representing the significance of the natural environment, the dwelling's form must establish a dialogue with the landscape through contrast and integration. Due to the vastly mixed conditions experienced in winter and summer, the form must respond to this seasonality, while also representing these differences in the home's identity. Lastly, in utilizing aesthetic sensibilities found in Inuit art, the building first and foremost must be truthful, thus the forces that impact the dwelling must be legible in its form. The dwelling design must also employ a reductive and simple approach to form making, as this is the common approach found in Inuit art.

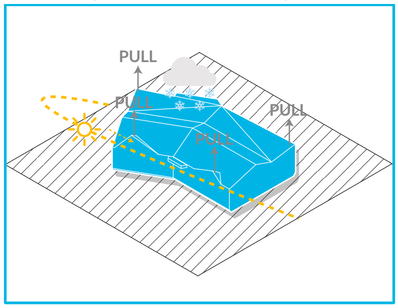
One of the first moves made is to lift the dwelling above the ground, ensuring that the stability of the permafrost is maintained, that snowdrifts do not form against the building, and that the building's impact on the land is minimal. Further, the underside edges of the dwelling will be truncated to increase the velocity of wind traveling under the structure, reducing snowdrifts. The height of the north facing elevation will be minimized in order to reduce heat loss from this elevation, to help reduce the interior volume that must be heated, and to minimize the size of shadows cast. The south elevation will be heightened, allowing for more



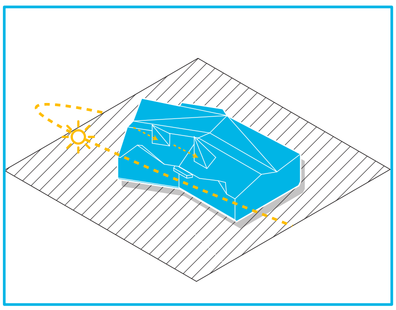
RAISE
To prevent snow drifts and permafrost thaw



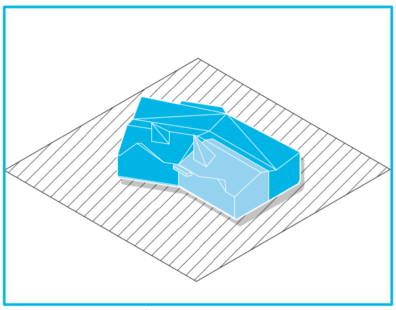
PUSH
To reduce interior volume and northern exposure



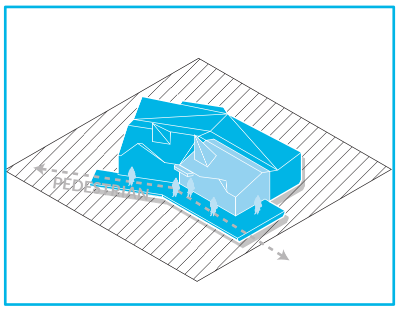
PULL
To create a landscape on the roof, allowing for the capture snow and rain, and let in more sunlight



LIGHT REFLECTORS
To let more light enter deeper into the dwelling, create a beacon at night, and contrast with the flat landscape



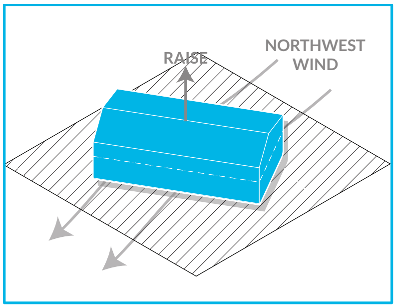
INDOOR / OUTDOOR SPACE
To create a space for traditional activities to occur



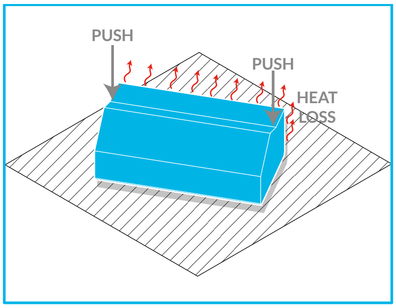
COMMUNAL DECK
To link other dwellings and allow for efficient service delivery

Figure 171: 1 Storey Form Development

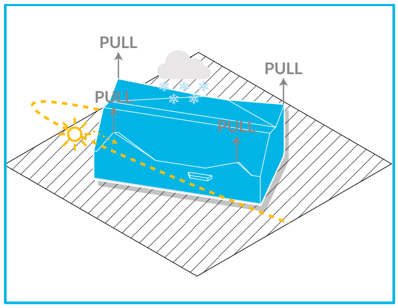
glazing to increase solar heat gain, and to open the building up and encourage views to the land. Since the sun has a lower altitude ranging between 0° and 50°, the building can have a lower profile, which will aid in reducing the interior volume. The form of the roof lifts at the south to admit more sunlight, while creating a valley in the north in order to collect snow and water, allowing for improved insulation, water retention, and the establishment of a seasonal aesthetic. Further, with the roof peaking in the centre in the direction perpendicular to the prevailing wind, eddies created by the wind are reduced, resulting in less heat loss. Protruding peaks from the roof are utilized for functional purposes such as allowing for natural stack ventilation to occur in the dwelling, to provide ventilation for *qulliqs*, and to act as light reflectors to improve the intensity of sunlight, in the interior spaces. Further, these protrusions help establish the identity of the building, creating tall beacons, contrasting with the flat nature of the landscape, which light up at night, much like the *igluits* did. Insulated shutters will also be incorporated, as they can help block out sunlight when it shines throughout the night, while also reducing heat loss when there is no solar gain. The building form will protect the entrances from snowdrifts and wind, with the north entrance being nestled in a sheltered form that is projected from the main building, with a canopy over the south entryway preventing blowing snow from the roof falling in front of it. Despite the two protruding elements, the form itself is relatively simple, reflecting the aesthetics found in Inuit art, while the faceted form created as a response to light, snow collection, and wind further reflects the reductive characteristics of the geometry employed by Inuit sculptors. Also prevalent is that the profile of the building is relatively consistent, reflecting the need to create an economy of scale and to use similar components to creating different sized dwellings. Thus, through the dwelling's formal response to the unique characteristics found in the Canadian North, it is a true representation of the Inuit identity.



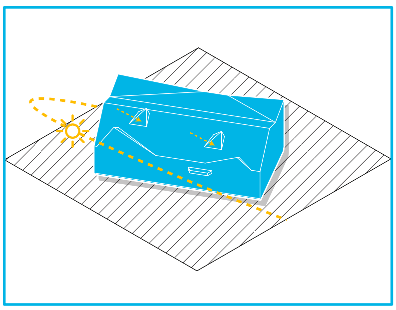
RAISE
To prevent snow drifts and permafrost thaw



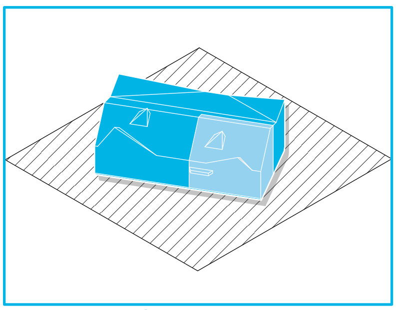
PUSH
To reduce interior volume and northern exposure



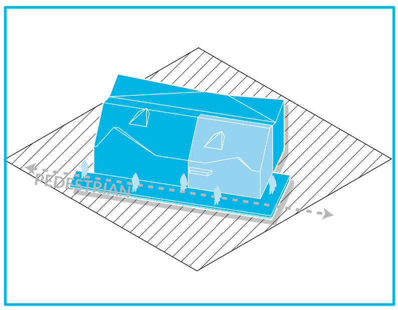
PULL
To create a landscape on the roof, allowing for the capture snow and rain, and let in more sunlight



LIGHT REFLECTORS
To let more light enter deeper into the dwelling, create a beacon at night, and contrast with the flat landscape



INDOOR / OUTDOOR SPACE
To create a space for traditional activities to occur



COMMUNAL DECK
To link other dwellings and allow for efficient service delivery

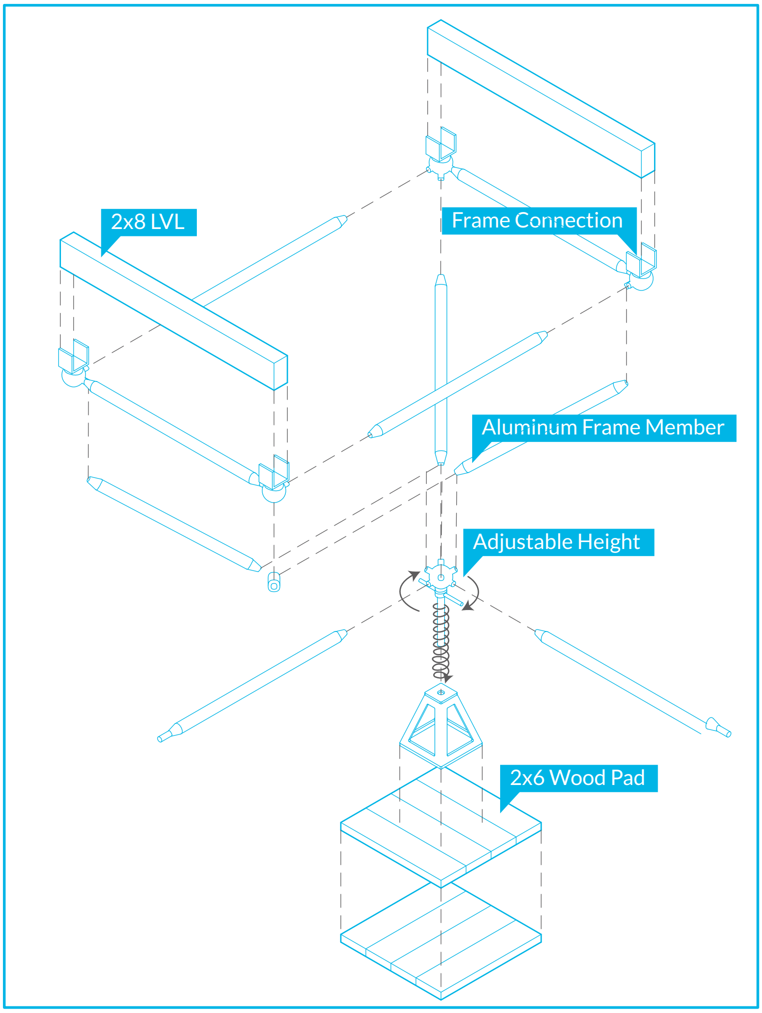
Figure 172: 2 Storey Form Development

Standard Grid and Measurements

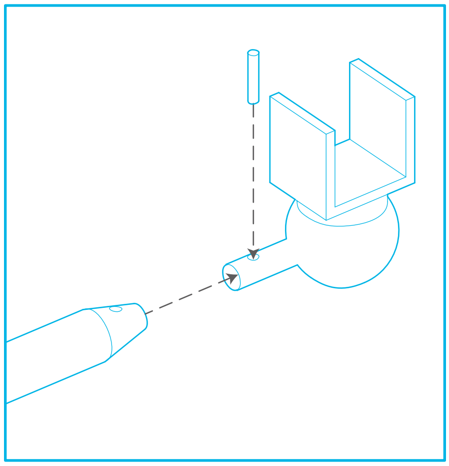
To allow for standardization and a flexible design using similar components, a metric grid of 600mm will be used, reflecting the nature of standard metric materials. Using this grid will allow for standard room sizes and module components to be developed, creating an economy scale, and allowing the design to adapt based on which components are selected.

Space Frame Foundation

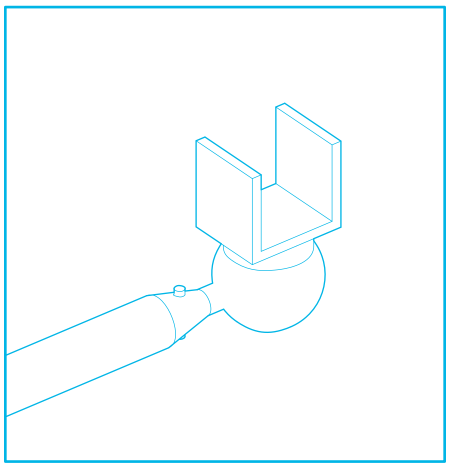
Space frames, in combination with a screw jack base, will be built on top of gravel pads on grade to act as the foundation for the building. Using this foundation type will elevate the building, ensuring that permafrost stability is maintained; while blowing snow can pass under them preventing snow drifts. The use of screw jacks allows for the supports to shift if the permafrost is disturbed. Further, using a space frame creates a rigid structure that will not distort if there is differential settling in the ground. Lastly, the frame will be designed according to the 600mm grid in order to work harmoniously with the modular system being employed.



EXPLODED SPACE FRAME STRUCTURE



SPACEFRAME CONNECTION ASSEMBLY

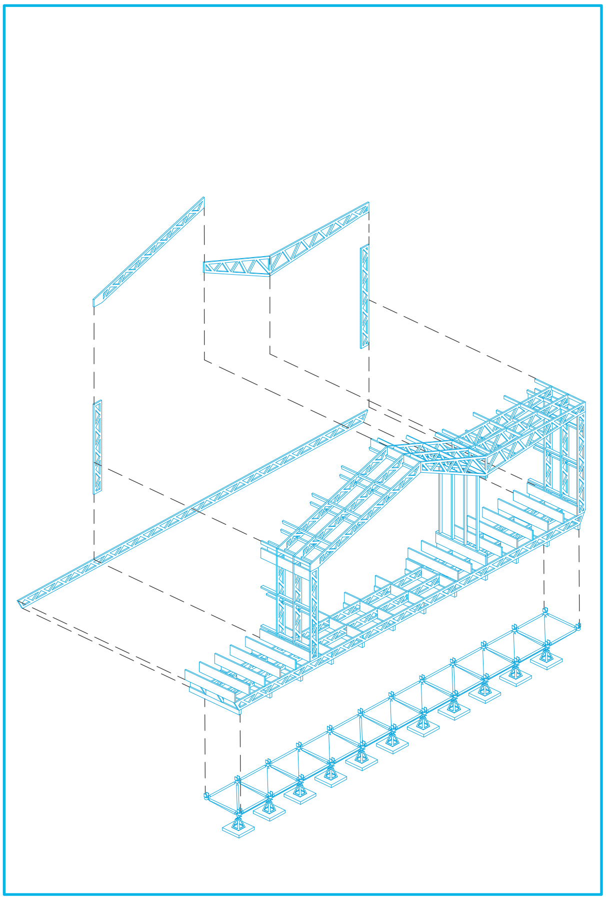


SPACEFRAME CONNECTION ASSEMBLED

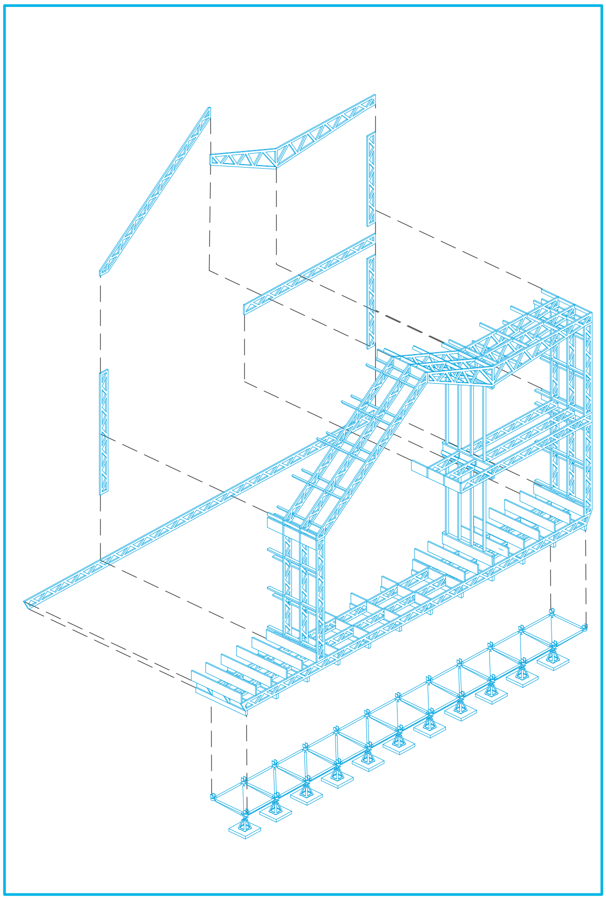
Figure 173: Space Frame Structure Diagram

Structure

The primary structure will be composed of a wooden open web roof, floor, and wall system. In doing so, a thick wall will be created, allowing for a higher thermal resistance to be achieved. It will create a more sturdy structure than the typical stick frame construction, allowing for further spacing between members that corresponds to the 600mm grid, reducing the material need for an effective thermal resistive wall assembly. Further, openings within the building envelope will fall in line with the structural spacing, reducing the material used and thermal bridging. By utilizing an open web structural system, thermal bridging will be reduced, creating a more effective thermal envelope. The spaces created through the open webs will also allow for easier installation of services like electrical, mechanical and plumbing when needed. Also, the structure for furred out elements that create some of faceted forms of the dwelling will consist only of self-supporting dimensional lumber members.

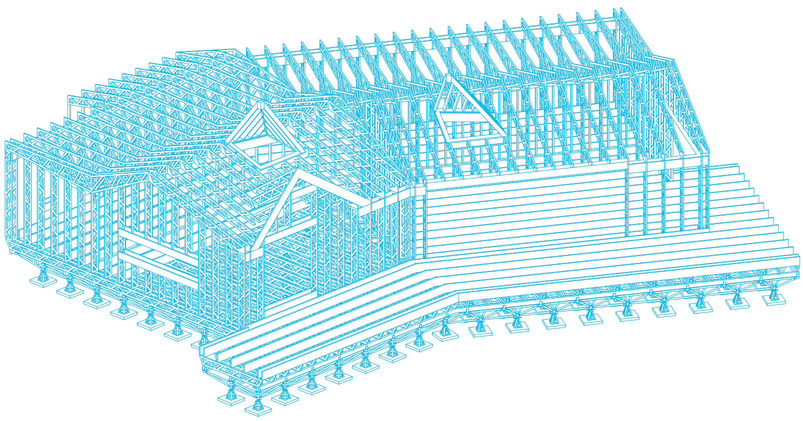


SINGLE STOREY EXPLODED STRUCTURAL AXONOMETRIC
Standard structural components to be repeated and mass produced for single storey dwellings

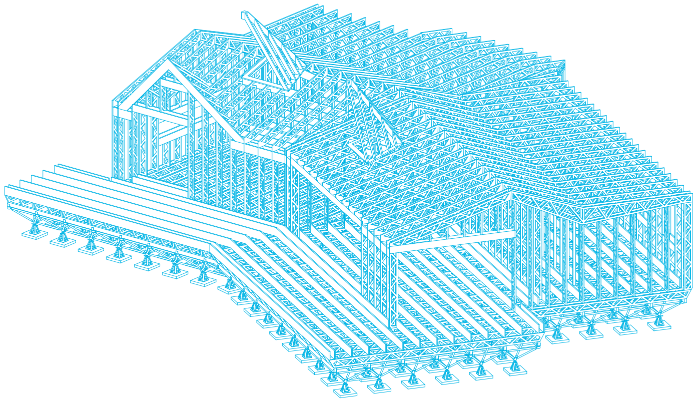


TWO STOREY EXPLODED STRUCTURAL AXONOMETRIC
Standard structural components to be repeated and mass produced for two storey dwellings

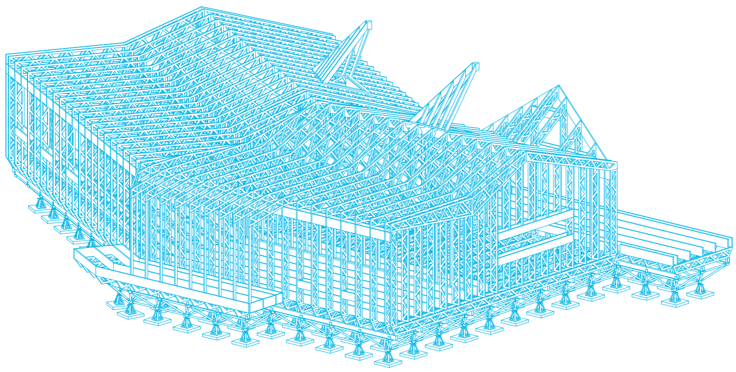
Figure 174: Exploded Structural Axonometrics



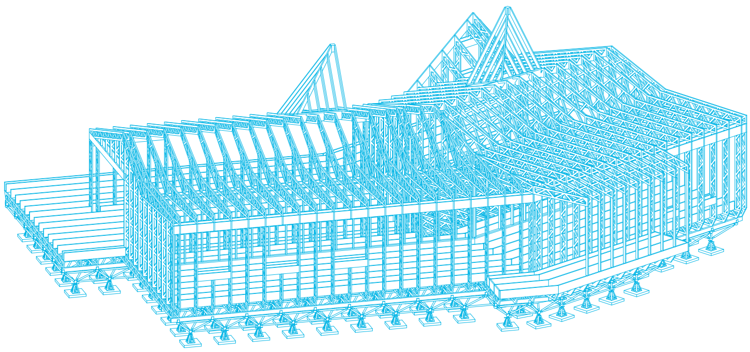
SOUTHWEST FRAMING AXONOMETRIC



SOUTHEAST FRAMING AXONOMETRIC



NORTHWEST FRAMING AXONOMETRIC



NORTHEAST FRAMING AXONOMETRIC

Figure 175: Framing Axonometrics

Insulation

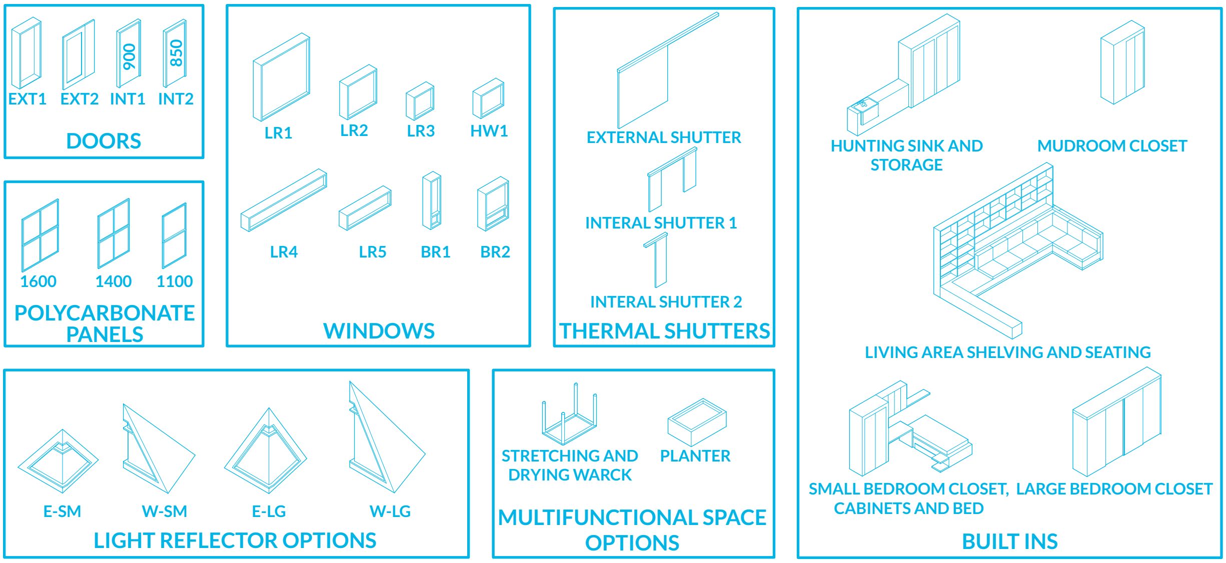
Ideally insulation like cellulose would be utilized for its thermal resistance properties, low toxicity, and low embodied energy; however, the conditions in the Canadian North make it undesirable at the moment. One barrier is the lack of skilled labourers in the region, but this can be overcome with training. Because the transportation of materials is such a long and challenging process, many problems with the use of cellulose arise from this. Since it must be very dense, it weighs more and takes up more room than alternative types of insulation, adding to costs relating to transportation, negating many of the environmental benefits. Further, there is a high chance that it may be damaged in transportation as well.

Closed cell spray foam insulation is thus proposed as the ideal insulation type for the Canadian North, despite the negative environmental effects caused by its blowing agents. Similar to cellulose, it has a high insulation value, but it is also an effective insulation to transport at long distances. Due to its durability and compact size, fewer damages will occur, while more insulation can be transported in comparison to the same volume of cellulose, offsetting some of the negative environmental effects. Also, while skilled technicians will still need to be trained to install spray foam insulation, it also acts as an air and vapour barrier, meaning a simpler construction process, less skills will be needed, and less time spent on site.

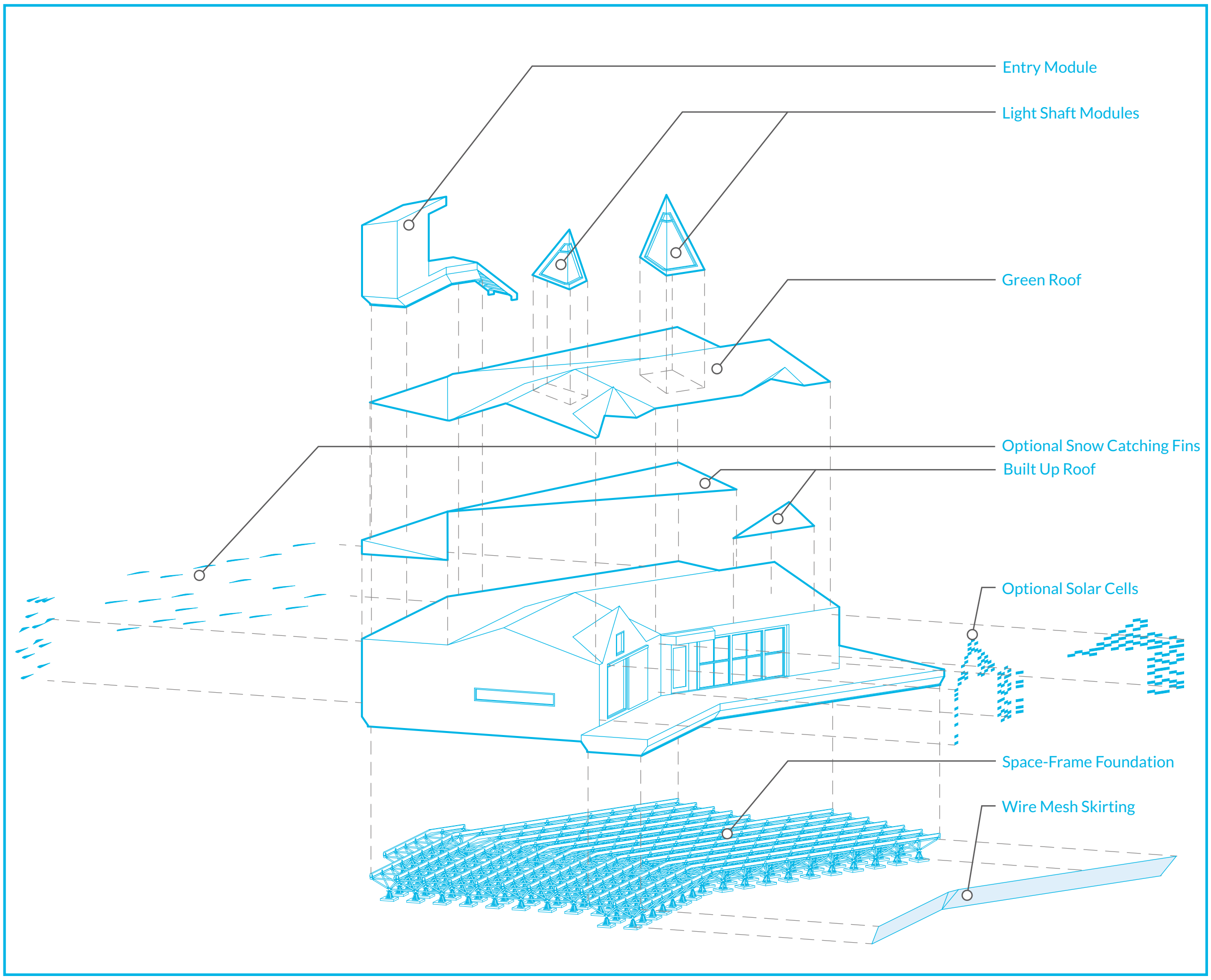
In regards to windows, all will be triple paned insulated glazing units, achieving the best thermal resistance at the most economical feasible cost. Also, to further reduce heat loss, insulated shutters will be utilized where some of these are located.

Standard Components

In order to create an economical feasible building system and to employ the same standardized logic as found in the *igluit* system, a set of standard components that can be mass-produced will form part of the toolkit for the proposed homes. The primary structure will be composed of a typical wall, floor and roof truss module, allowing the design to adapt with ease depending on the desired size, while there will be some additional roof truss variations to create main living space. The space frame foundation will also be constructed of a standardized system, which allows for variations, expandability, and mass production. There will be two types of interior doors, and two types of exterior doors, as well as two different sized windows for the bedrooms, one size for the hallway, and three to five for the main living space, depending on the typology. Along with the windows will be one exterior mounted insulating shutter, and two interior shutters for the bedroom windows. There will be two typical built-in designs for the parents' bedroom and children's bedroom. The multifunctional space will be enclosed by three different sizes of polycarbonate panels, which will accommodate different sizes and arrangements. Also within this space will be a typical storage unit, a fish and meat drying rack and skin stretching frame, and a typical planter module. Other elements such as kitchen cabinets, storage units, seating, shelving, and desks will be repeated for every unit, ensuing an economy of scale created. Further, optional elements on the exterior such as solar strip cell panels and snow-catching fins can be utilized in random patterns to create aesthetic variations between different dwellings.



STANDARDIZED BUILDING COMPONENTS



EXPLODED COMPONENT DIAGRAM

Figure 176: Component Diagrams

Materiality

The primary exterior cladding utilized in these dwellings will be a vertical flat lock copper panel system. The use of a quality material like copper is reflective of the value placed on craftsmanship by the Inuit, as it is durable, and has a variety of natural patterns and textures. The reddish brown colour of copper also allows the building to maintain a visual similarity to the land, yet still remain distinct. It is also relatively easy to assemble, and responds well to the harsh conditions found in the Canadian North. Further, the reflectivity of the copper can help create a warmer microclimate to the south of the dwellings. Wood will also be utilized for the communal deck, as it weathers well in cold climates, is a natural material, is lightweight, is easy to assemble, establishes a warm feeling, and expresses its tactility. Other elements such as the structure, skirting, and window and door frames will be comprised of a painted metal. Also located on the vertical southern facing surfaces will be solar strip cell panels that clip on to the copper cladding to take advantage of the solar exposure. Soil and native mosses will be utilized on the roof of the dwelling, representing the important relationship the Inuit have with the land. They also create additional insulation on the roof, utilizing material directly from the site. The exterior will also utilize the seasonal availability of ice and snow. Snow can be applied for its insulating properties; while along with ice can help establish a building identity that changes with the seasons.

Since so much time during the dark winter is spent indoors, the material pallet on the interior is selected to create a warm and light feeling. Simple installation, durability, and ease of maintenance and repair are also important factors in selecting an interior material. Thus, a high grade plywood is used, as it is durable, easy to replace, install, and there are no grooves to trap dirt, and even if it gets a little damaged, the aesthetics are not compromised. Further, where a more solid and water repellent material is needed, local serpentine or argillite stone will be used as a floor material in spaces like the mudroom, and the indoor/outdoor multifunctional space, and even for other surfaces like tables. The use of stone will help create a relationship with the land, minimizing material that has to be shipped in and takes advantage of the skills of local stone carvers.

Figure 177: Material Swatches

Standard Spaces

The following are typical spaces that have been designed to allow for different dwelling combinations. Some of these spaces are typical, some offer different alternatives, while the number and types of bedrooms can fluctuate in order to create multiple variations responding to differing needs of each family. Each of these spaces follows the same standard dimension of 600mm allowing for materials to be cut in bulk beforehand and used where needed depending on the finalized dwelling design.

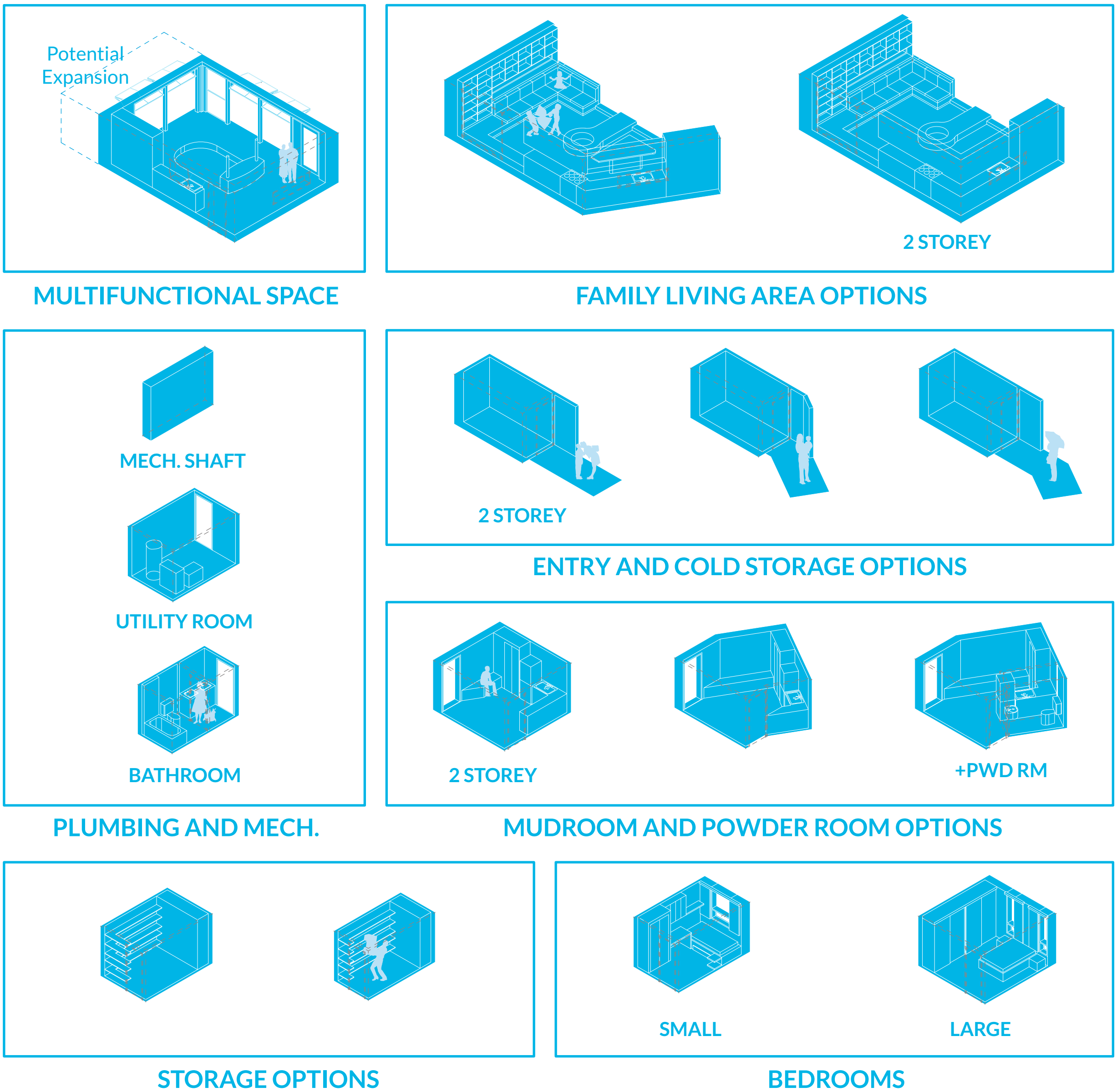
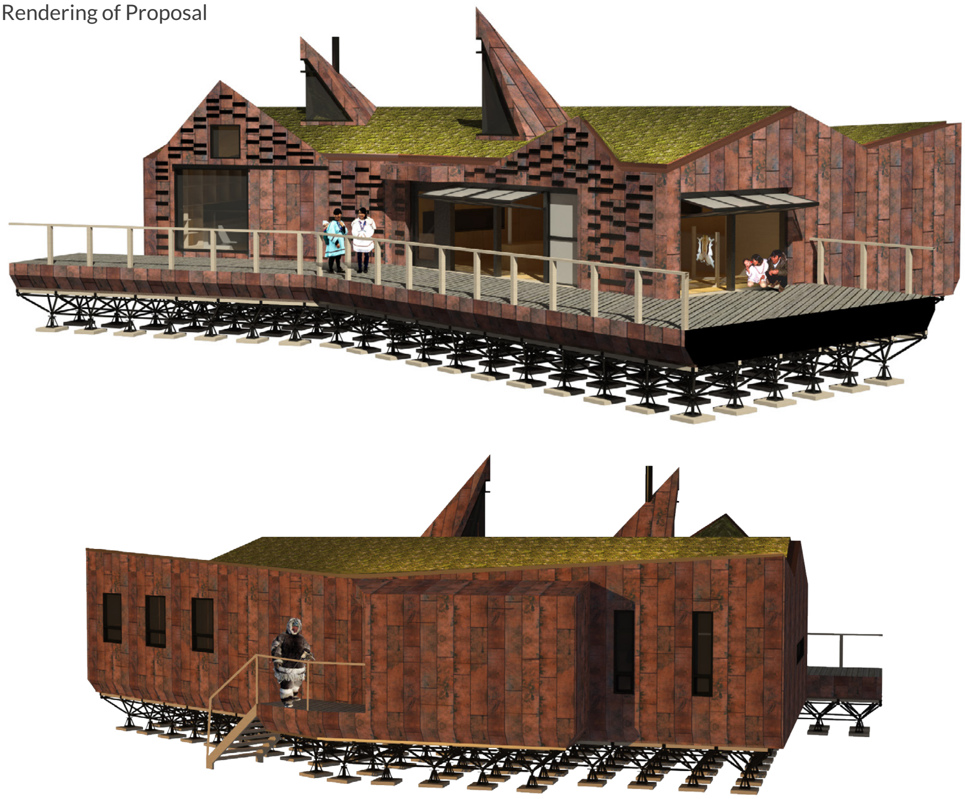
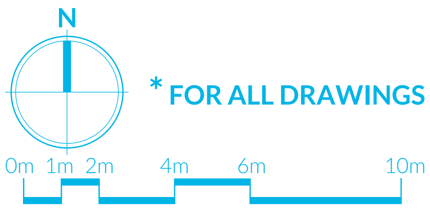


Figure 178: Standard Spaces Axonometrics

Figure 179: 3D Rendering of Proposal



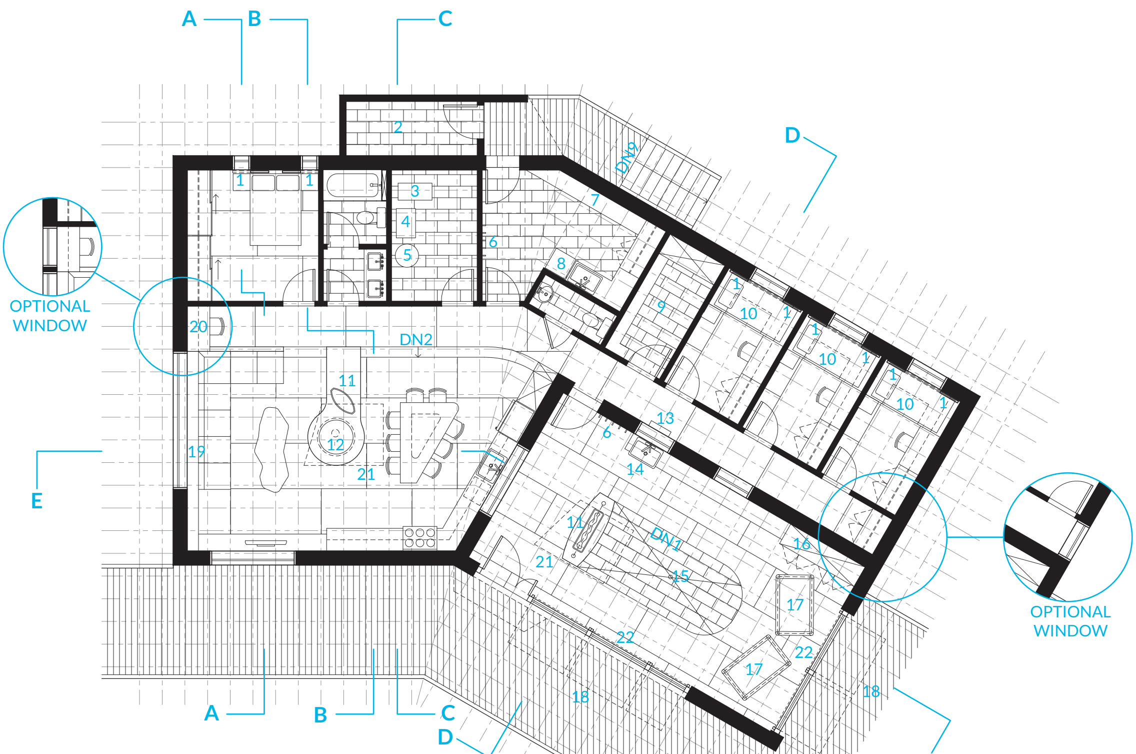
DRAWINGS



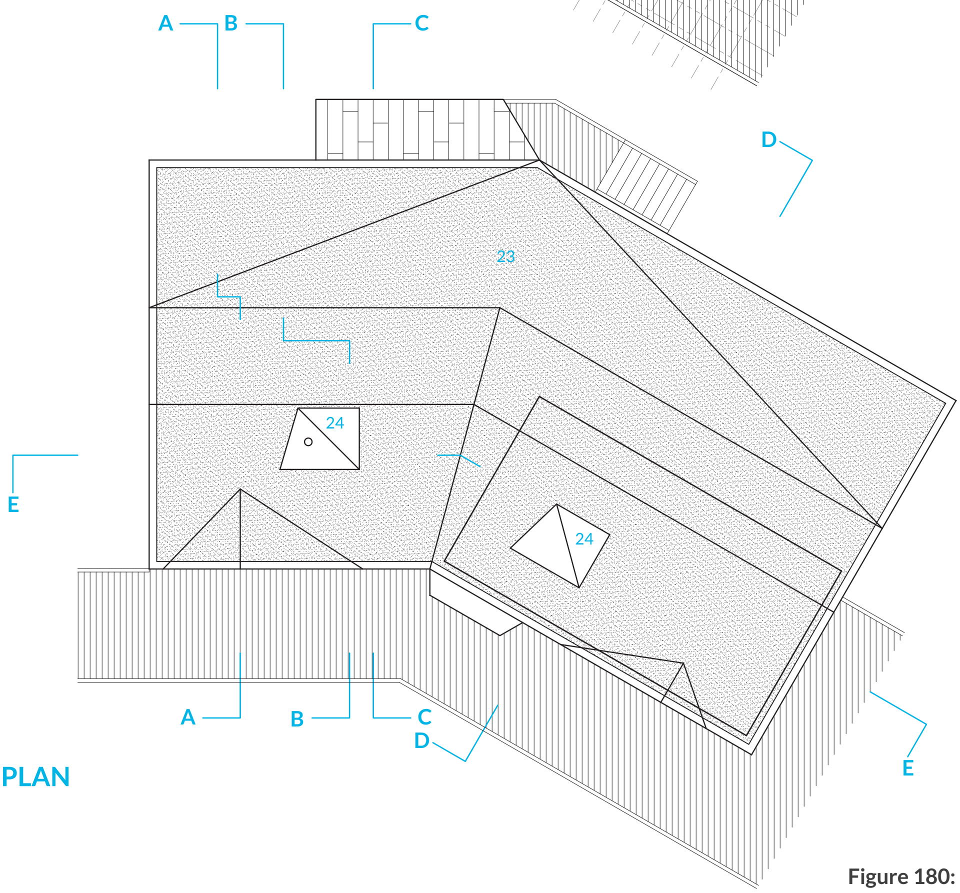
* FOR ALL DRAWINGS

Scale 1:200

1 Internal Insulating Shutter
2 Cold Storage
3 ERV
4 Water Pump
5 DHW
6 Jacket Hooks
7 Bench and Shoe Storage
8 Stacked Washer & Dryer
9 Storage
10 Underbed Storage Drawer
11 Qulliq
12 Fireplace
13 Hose
14 Hunting Sink
15 Floor Drain
16 Gun and Equipment Storage
17 Stretching & Drying Wrack
18 Polycarbonate Bifold Panels
19 Shelving
20 Desk
21 Line of Light Reflector Above
22 Roll Down Screens
23 Green Roof
24 Light Reflectors
25 Mechanical Shaft

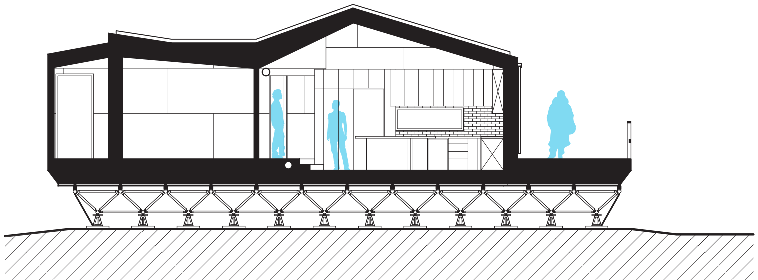


FIRST FLOOR PLAN

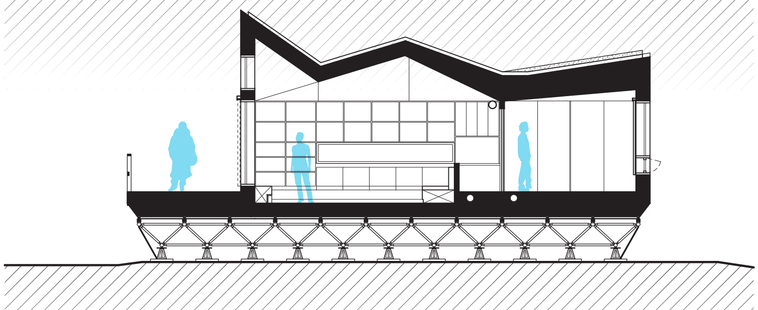


ROOF PLAN

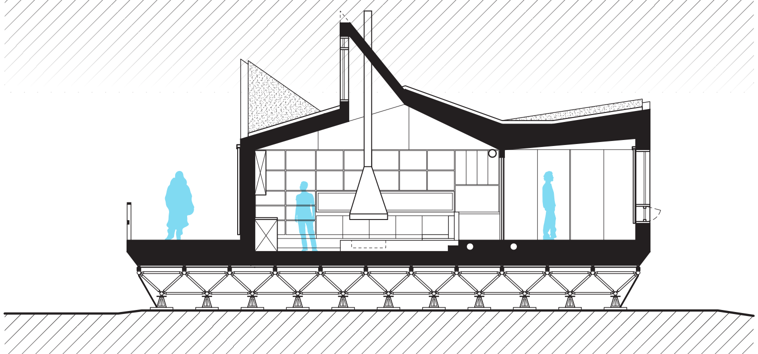
Figure 180: 1 Storey Unit Plans



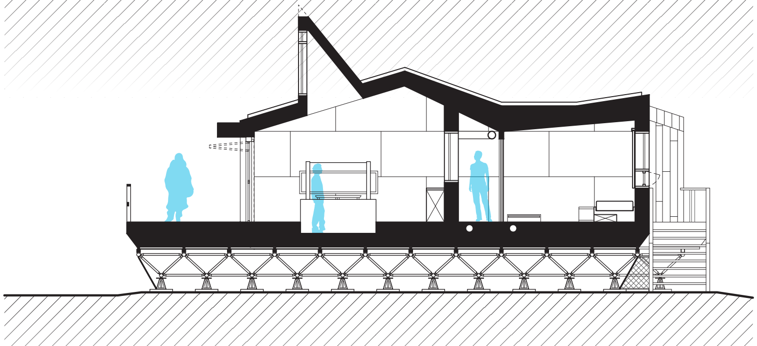
SECTION CC



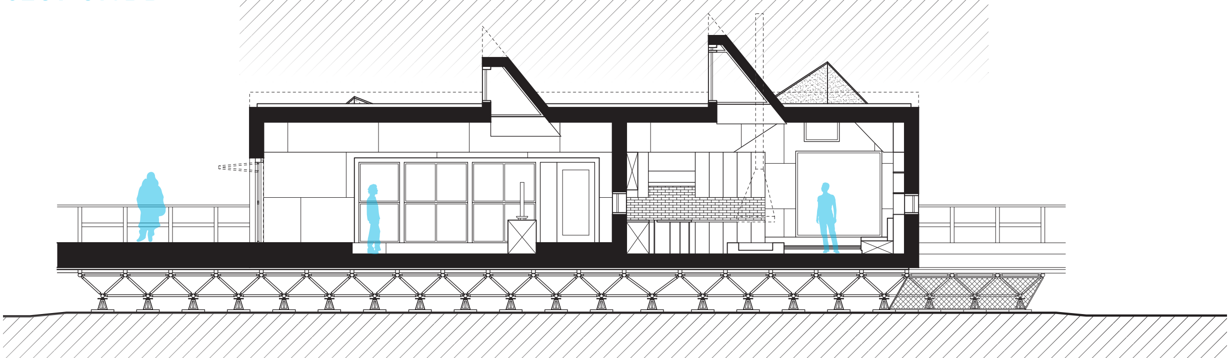
SECTION AA



SECTION BB



SECTION DD



SECTION EE

Figure 181: 1 Storey Unit Sections

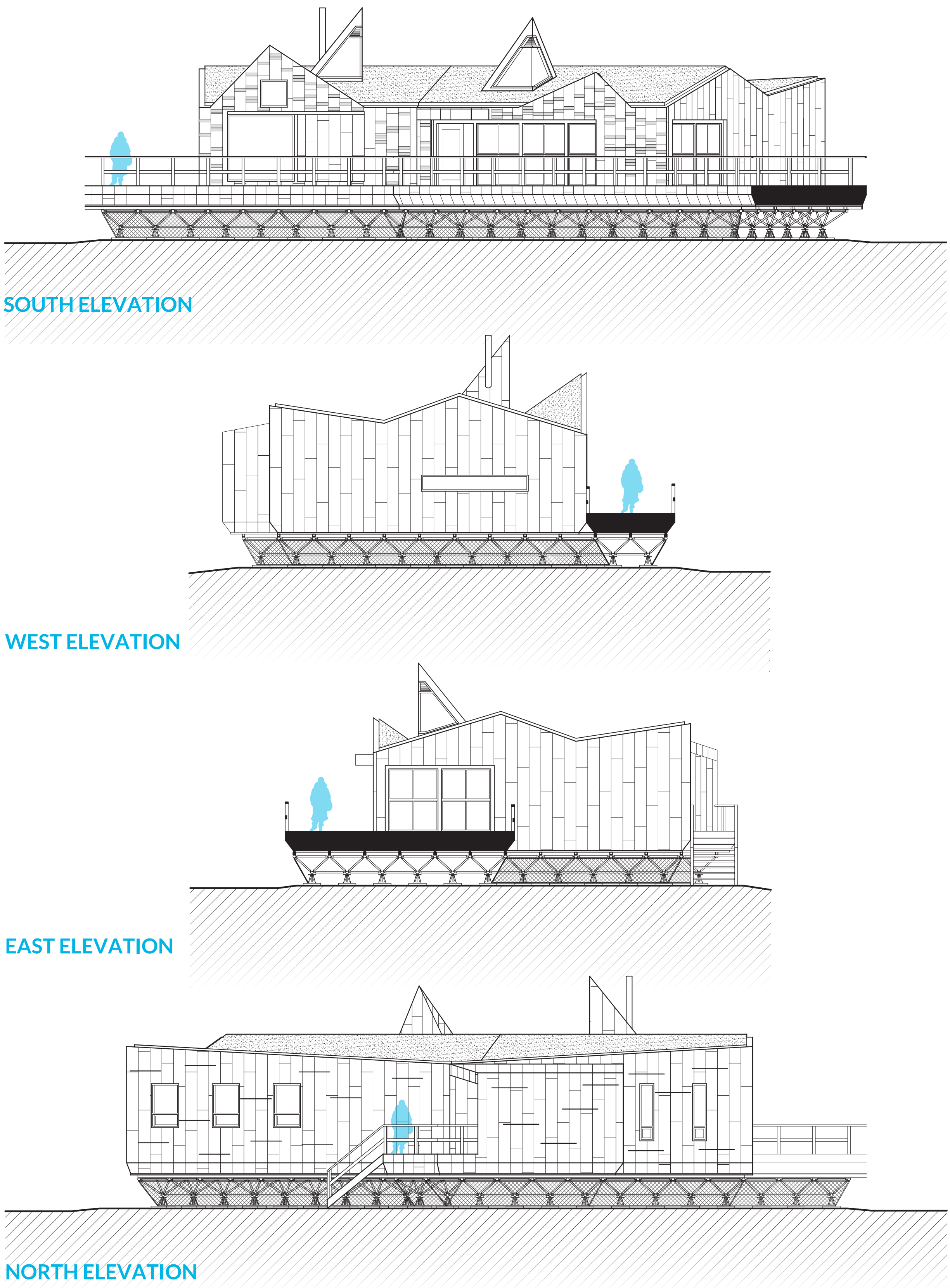
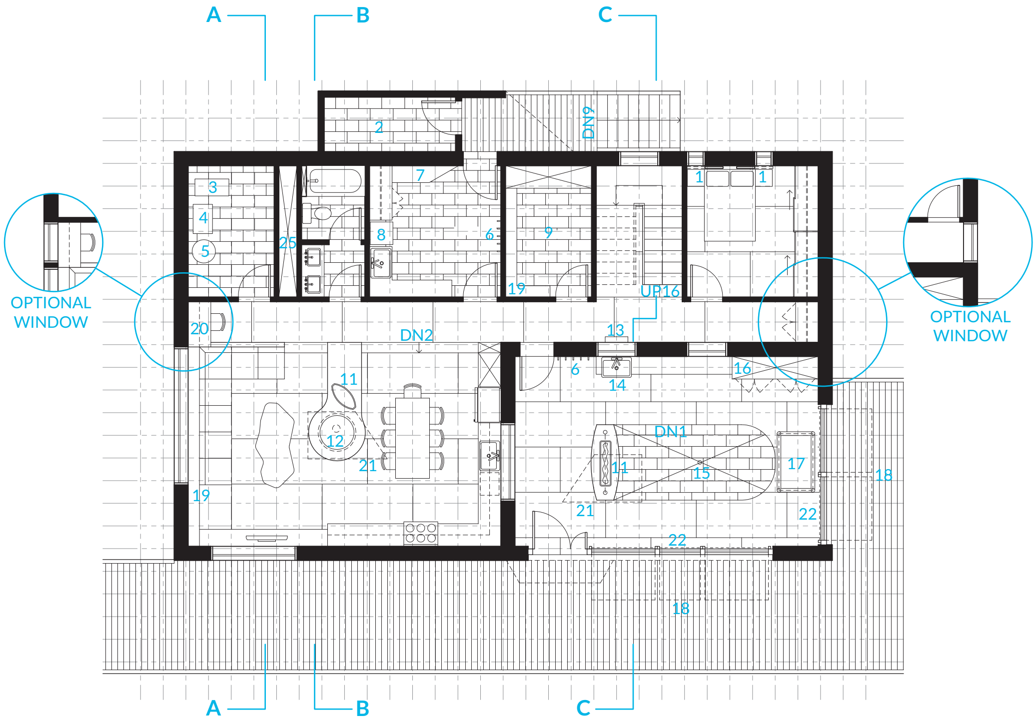
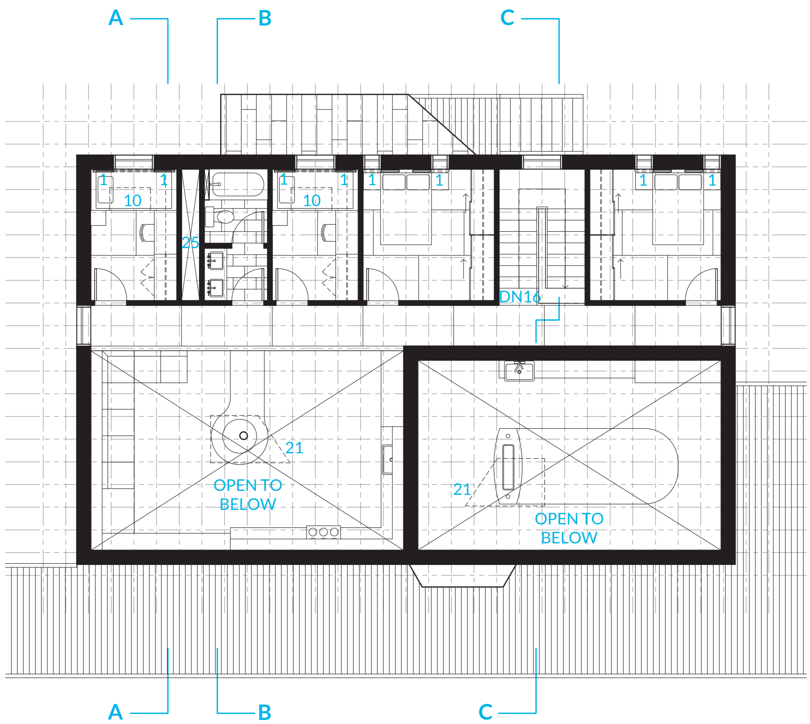


Figure 182: 1 Storey Unit Elevations

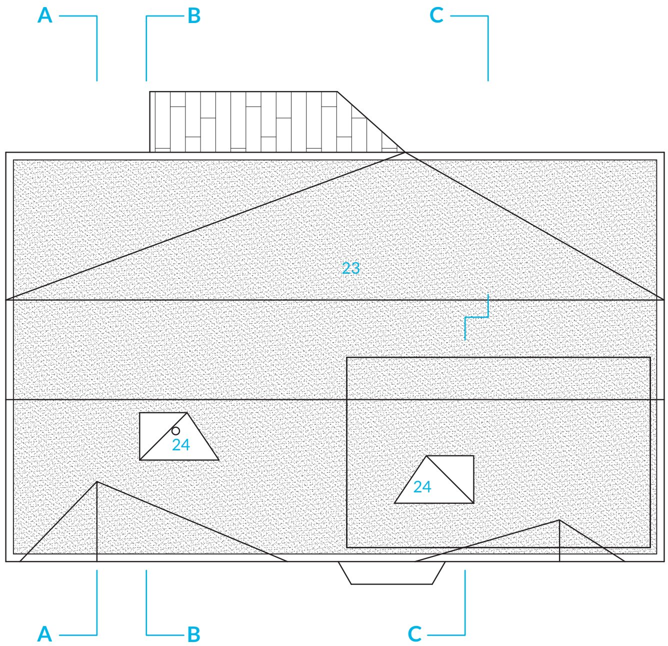


FIRST FLOOR PLAN

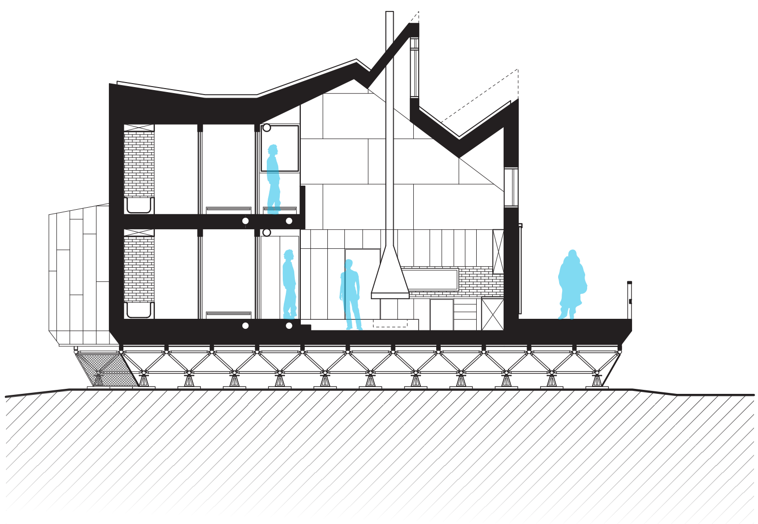


SECOND FLOOR PLAN

Figure 183: 2 Storey Unit Plans

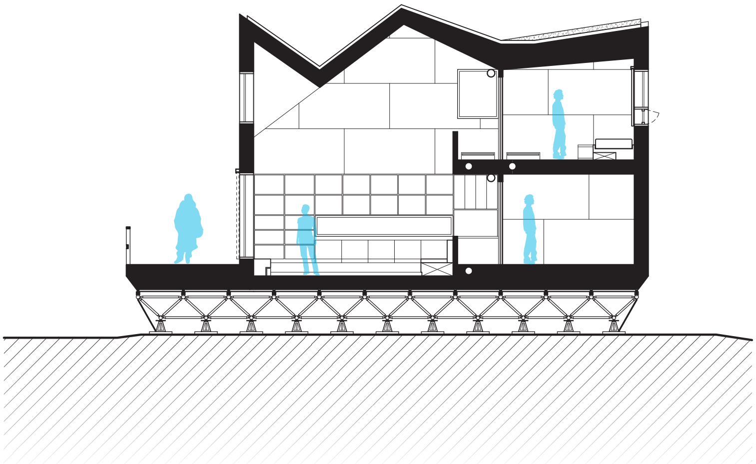


ROOF PLAN

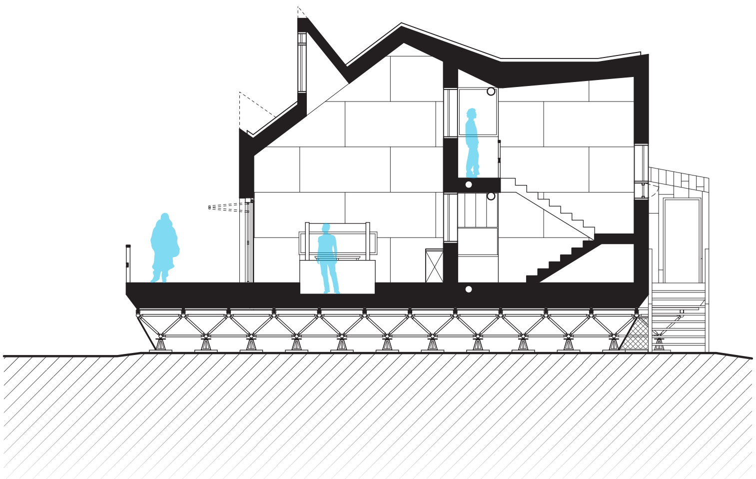


SECTION AA

Figure 184: 2 Storey Unit Plan and Section



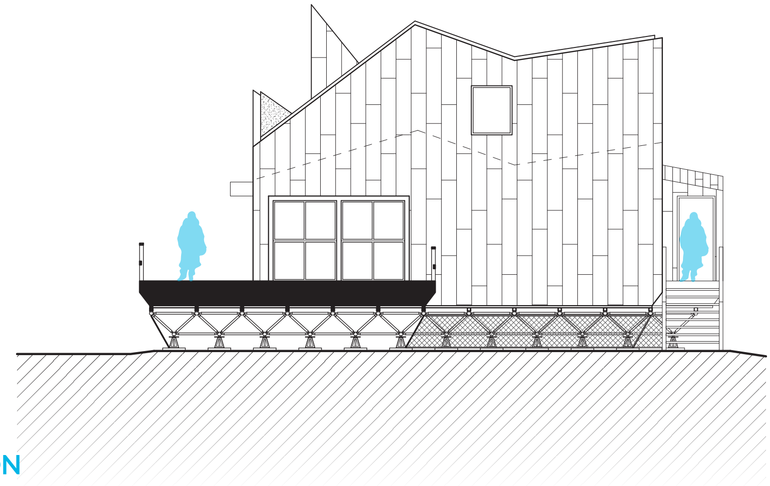
SECTION BB



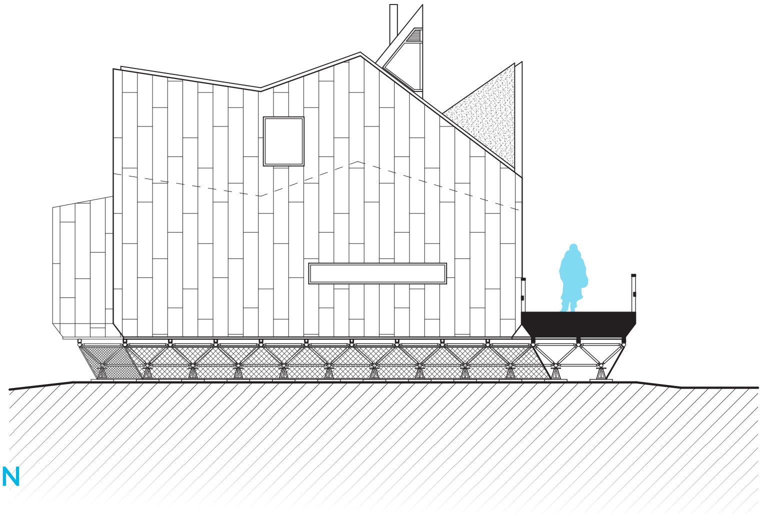
SECTION CC

SOUTH ELEVATION

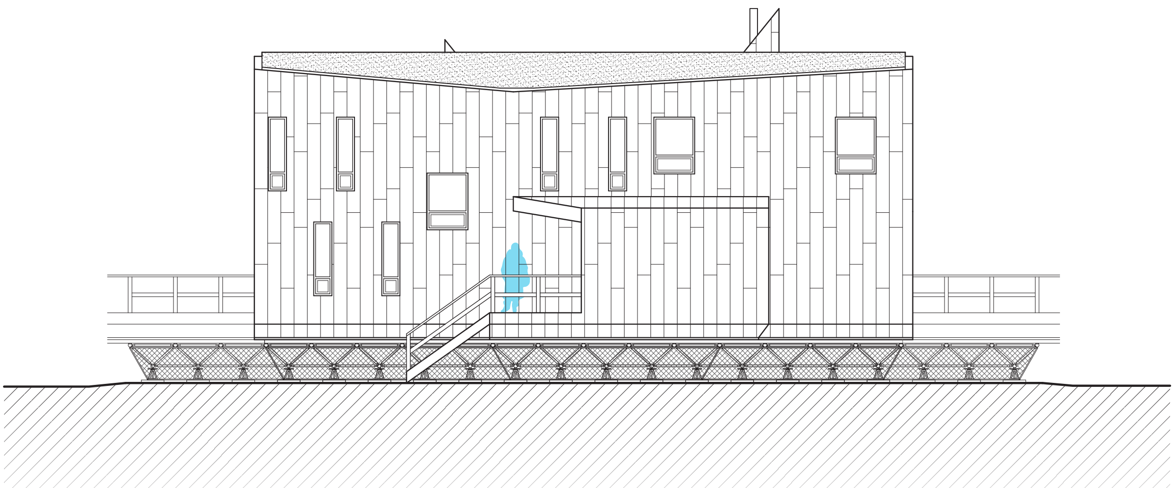
Figure 185: 2 Storey Unit Sections and Elevation



EAST ELEVATION



WEST ELEVATION



NORTH ELEVATION

Figure 186: 2 Storey Unit Elevations

Design Variations

The following data tree shows the numerous potential dwelling options available that result from different space combinations.

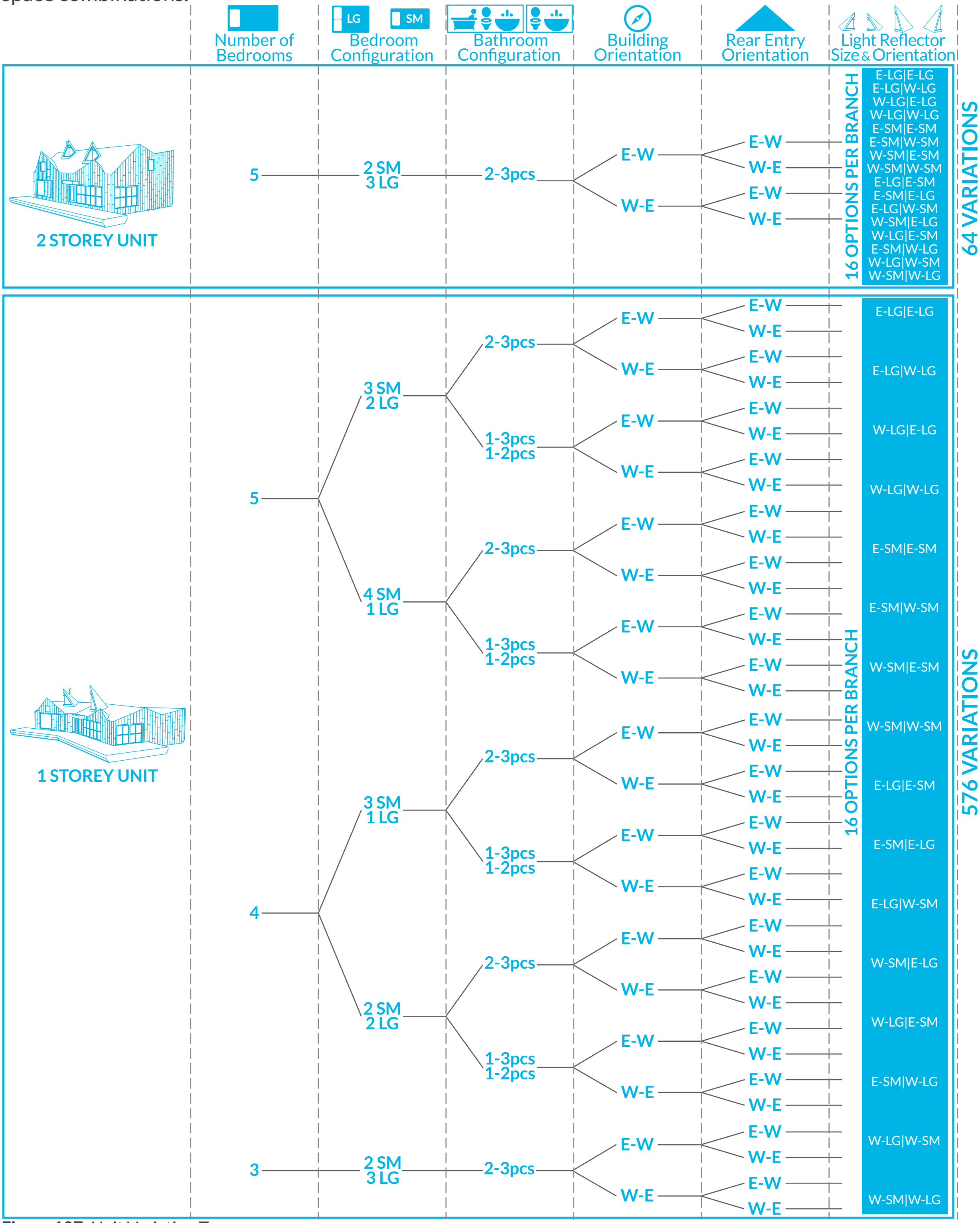
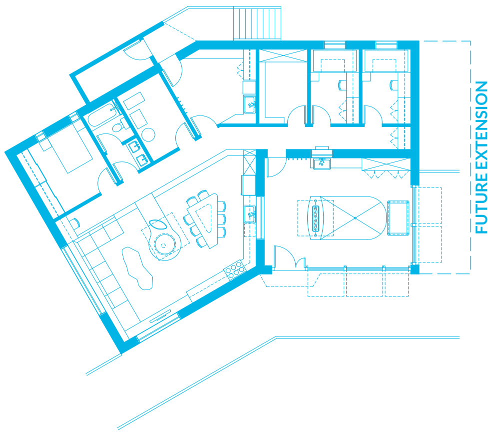
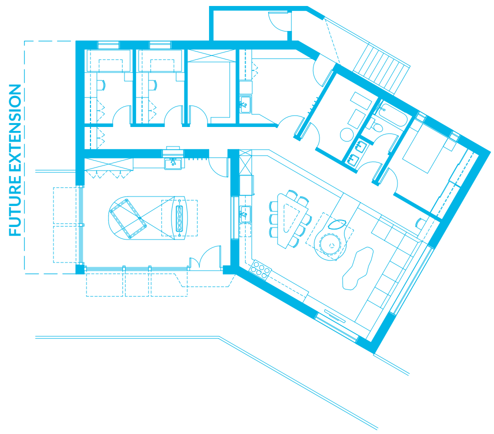


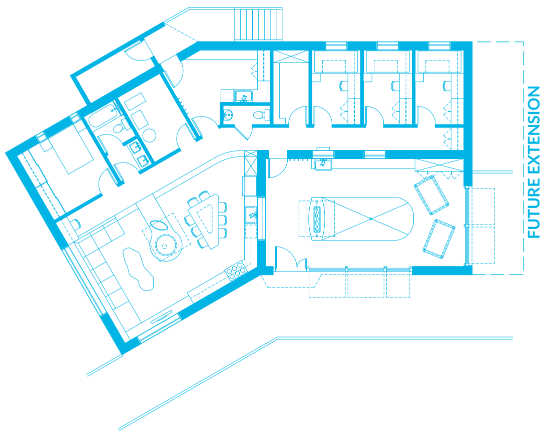
Figure 187: Unit Variation Tree



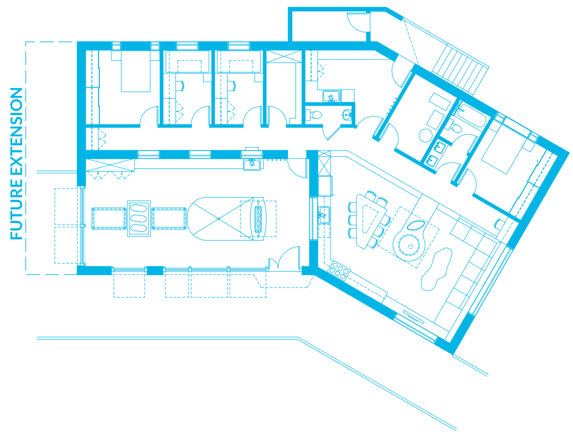
E-W 3 BEDROOM FLOOR PLAN



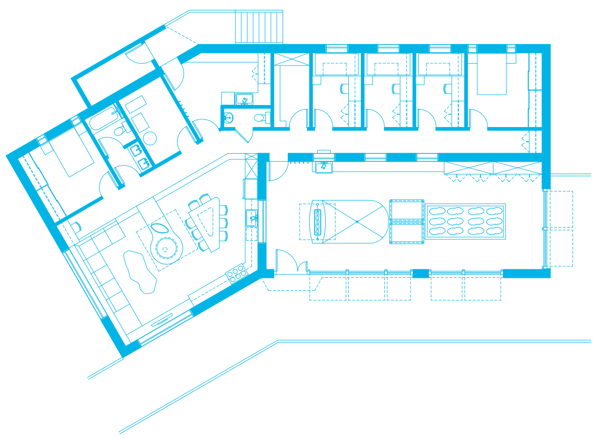
W-E 3 BEDROOM FLOOR PLAN



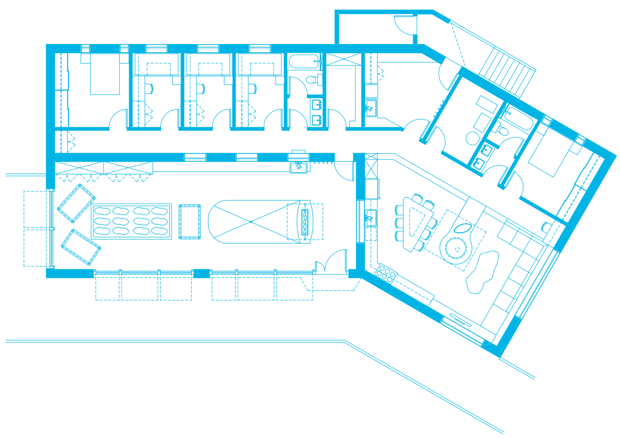
E-W 4 BEDROOM (3SM, 1LG) FLOOR PLAN



W-E 4 BEDROOM (2SM, 2LG) FLOOR PLAN



E-W 5 BEDROOM (3SM, 2LG) FLOOR PLAN



W-E 5 BEDROOM (3SM, 2LG) FLOOR PLAN

Figure 188: Single Storey Plan Variations

Site Program

While the design of individual dwellings is significant for the daily lives of the contemporary Inuit, the design of the site and community must also be considered. The site must contain different programs that promote sharing and communal interaction. While each house has a large indoor/outdoor multifunctional space for smaller gatherings, the site should also include a *qaggiq* (communal dance house), a communal open yard, shared portable sheds and smokehouses, shared productive spaces such as greenhouses, and a common utility room accessible by service trucks. The site must also account for vehicular and pedestrian routes, parking for snowmobiles and trucks, sheltered areas for vehicle repair, and access for service trucks.

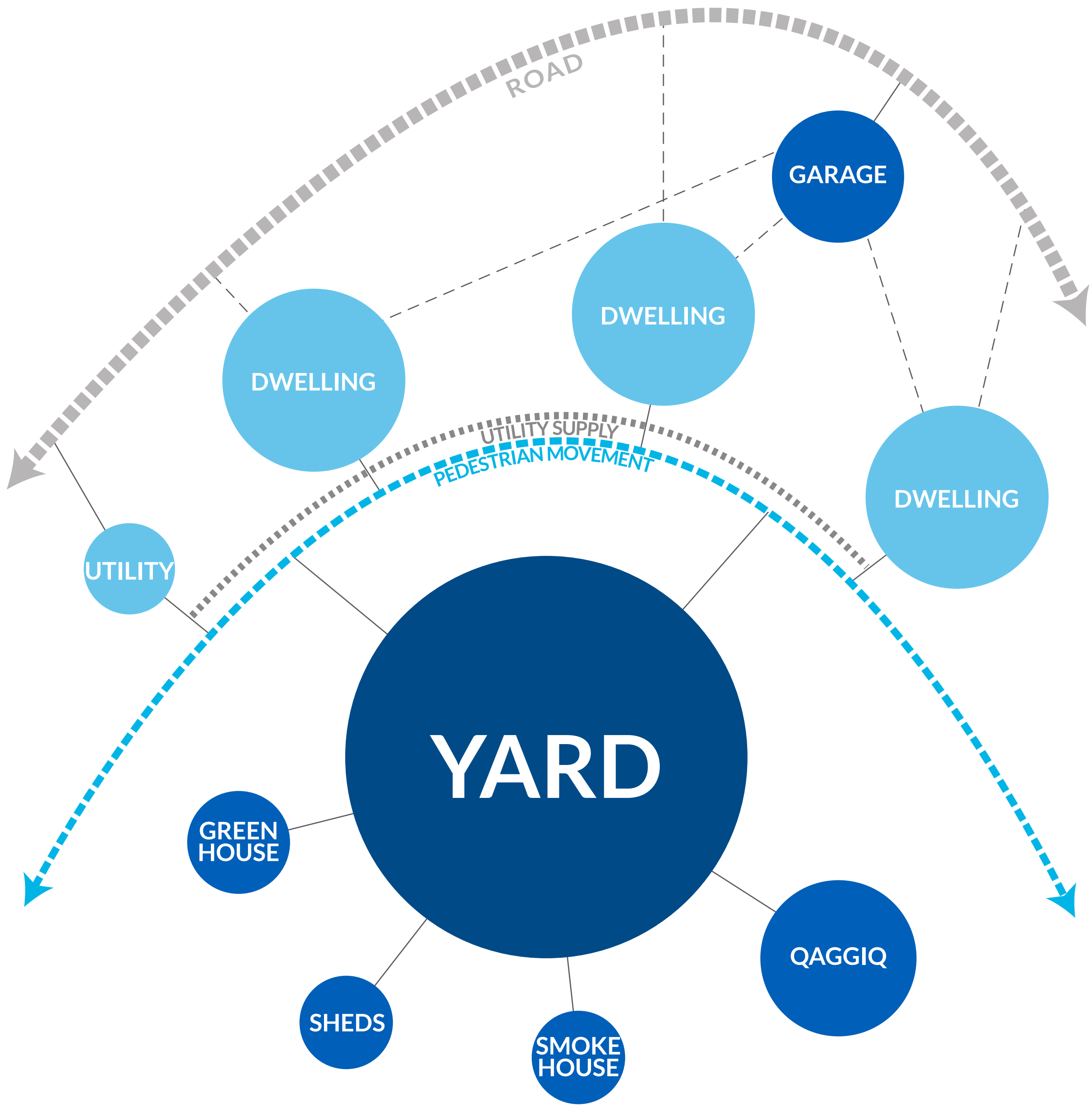


Figure 189: Site Program Diagram

Services

As mentioned before, due to the permafrost, most municipal utilities are either delivered via service trucks or utilidors. Since most communities employ service trucks, the proposal seeks to take advantage of this existing delivery system, yet attempts to increase its effectiveness through a hybrid approach. As opposed to truck delivery to individual units, clusters of dwellings will be serviced through one access point. From this access point, each dwelling will receive water, sewage removal, and heating through lines that run under a raised communal deck that links each dwelling. There will be one large utility room, with a large tank for water that will be filled up from a truck, while there will also be a rain water retention tank that will be utilized for irrigation and for other non potable uses. Also, within this room will be a tank for sewage and wastewater to be collected by sewage trucks. Heat will be provided to units through the use of a wood pellet boiler system. Wood pellets will be delivered to a large hopper in the main utility room where the pellets are fed into a boiler, heating water that is delivered to each dwelling through an insulated line, providing radiant heat. Further, solar thermal collectors can also contribute to this system in summer when there is an abundance of sunlight. Electricity will come from the municipal grid, connecting with the cluster of dwellings at the utility room, then running along with the rest of the services. Ideally, wind turbines located outside the town will supply the majority of this electricity, taking advantage of the abundance of wind found in the Canadian North. Further, any surplus electricity provided by individual dwellings through their solar strip cell panels will be fed back into this system.

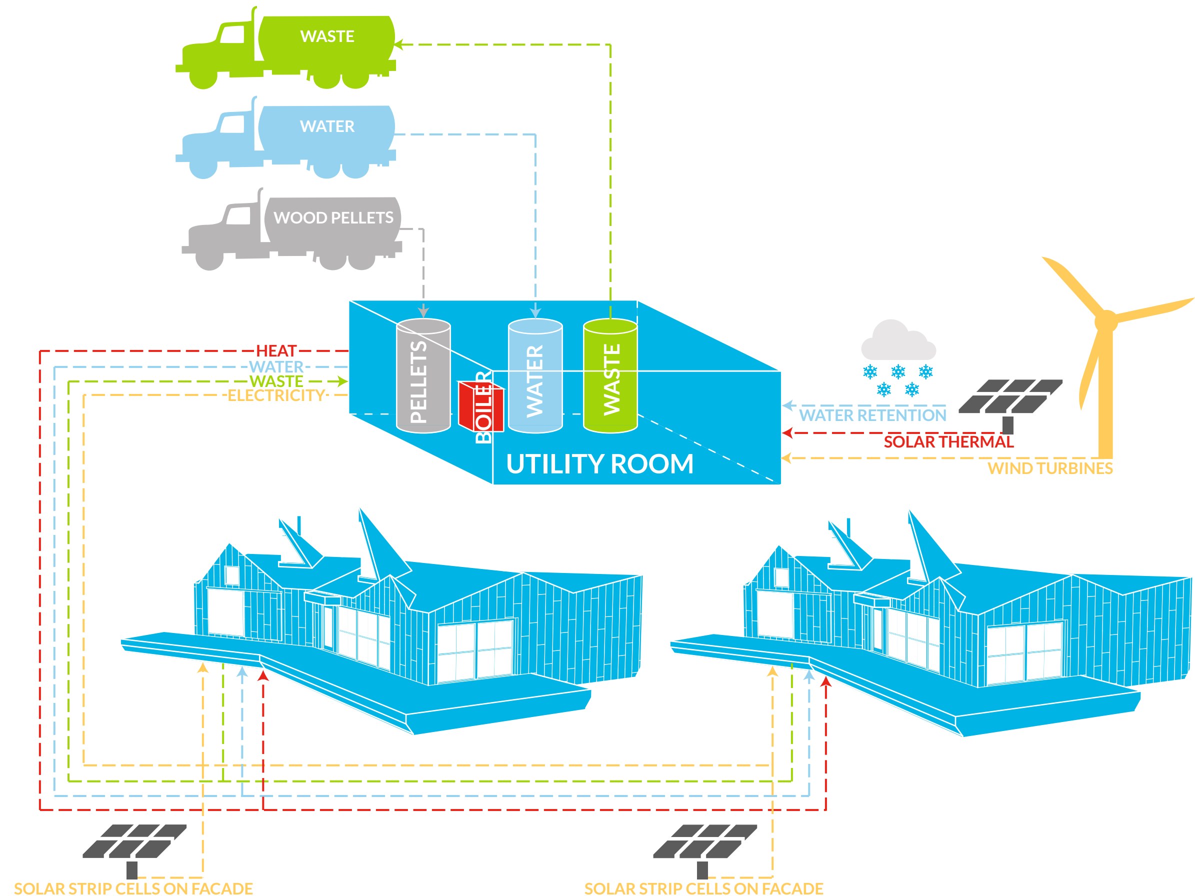
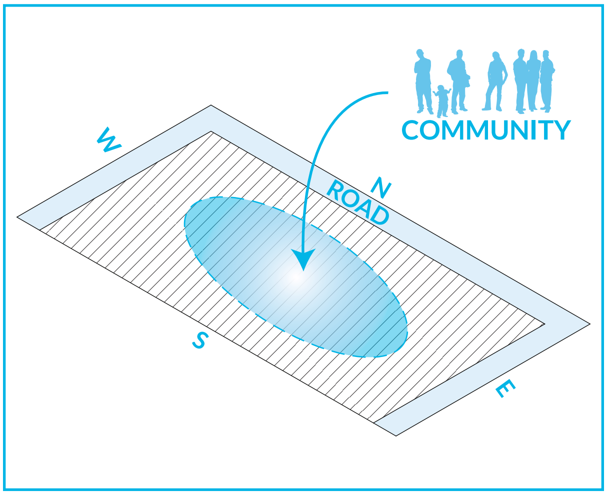


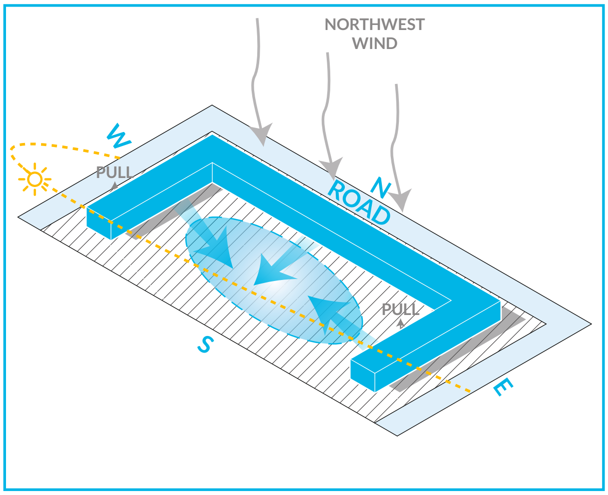
Figure 190: Site Service Diagram

Site Plan Development

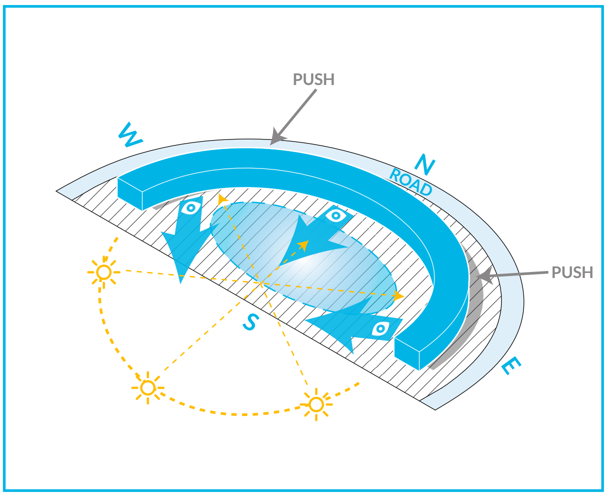
As opposed to following the *Qablunaat* approach to subdividing land into rectangular plots for housing development, the proposal will respect the traditional notion that land is not owned. Further, while the *Qablunaat* approach does not respect orientation, responding to the path of the sun and other natural forces is a critical facet of Inuit vernacular architecture, and reflects their relationship with the environment. Accordingly, the site will be divided into clusters of dwellings occupying common ground as opposed to individual properties. The dwellings will occupy the northern perimeter of the shared land, forming a semi circle, allowing each unit to receive similar solar exposure, have views to the shared land, and creating a protected microclimate within the centre. The cluster will consist of many different building variations, and if a two-storey type is used, it will be located furthest north to prevent it from casting shadows on adjacent buildings.



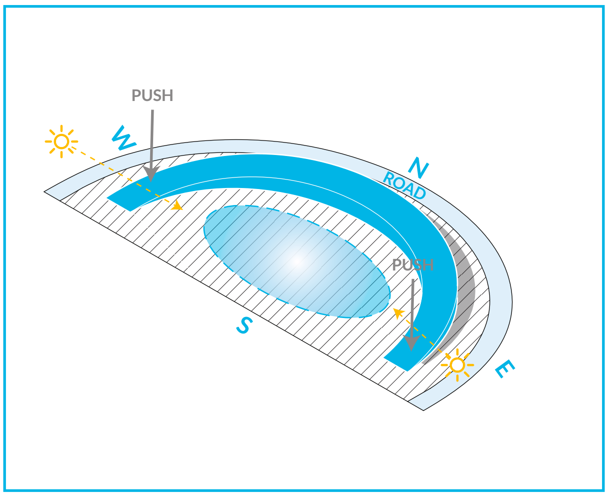
1. SHARED COMMUNITY SPACE
Create a central community space that is shared between the different dwellings as the focal point of the cluster



2. EXTRUDE PERIMITER, OPEN TO SOUTH
Use the building form to protect the centre from wind, and open the space up to the sun creating a microclimate



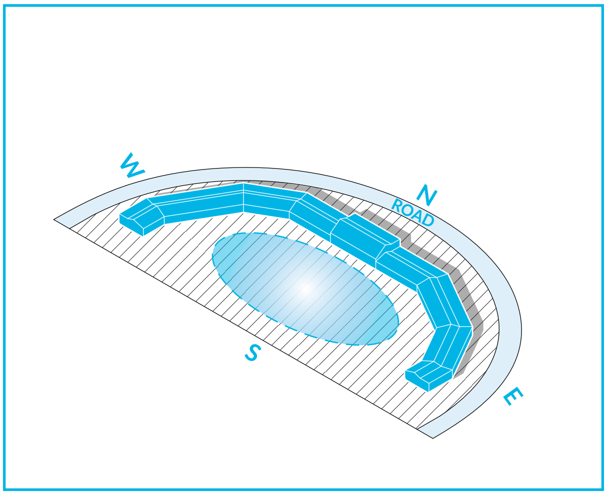
3. CURVE
To optimize solar exposure and views, so that no unit has a significant advantage over another



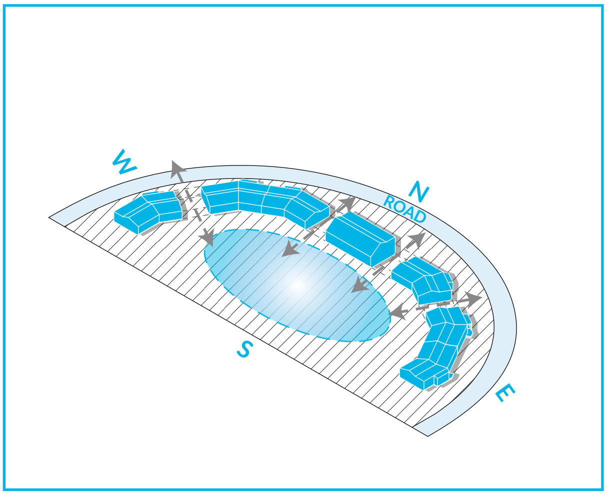
4. MINIMIZE HEIGHT TO SOUTH
Reduce the hieght of the southern dwellings to prevent shadows in the centre

Figure 191: Site Plan Development Diagram

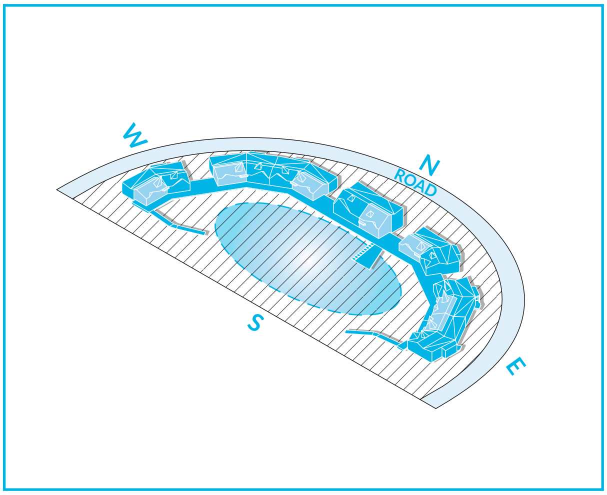
Linking these dwelling will be a communal deck on the south side, acting as a pedestrian route through the site, creating potential for different interactions, while also delivering services to each dwelling. Located off of the deck in each dwelling are the indoor/outdoor multifunctional rooms, which act as an extension of this deck, creating opportunities for sharing and gathering. Access to this deck will occur from multiple stairs located adjacent to the different parking areas, from two accessible ramps located at each end, and through larger snowmobile accessible ramps which connect the decks to the central outdoor space. From this deck the residents will have access to the central communal space where children can play, where shared smoke-houses, sheds and greenhouses are scattered across the site, and where the *qaggiq* is located. To the north of the dwellings, and in between some dwellings, snowmobile and truck parking spaces will occupy these inhospitable zones as they require minimal sunlight or protection from the elements. Also to the north will be a shared garage unit, which will be utilized for equipment storage and repairs.



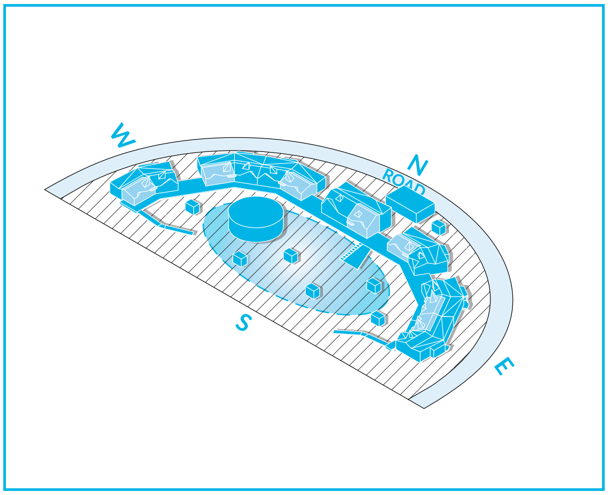
5. SIMPLIFY
Break downt he geometery into a variety of modular elements, allowing for the same outcomes with varying forms



6. PENETRATE THE PERIMITER
Creates a distinction between units, allows for better movement through site and creates areas for parking



7. DECK AND RAMPS
Links each dwelling, creates opportunity for communal interactions, and provides services to each dwelling



8. ANCILLARY BUILDINGS
Situated on the site is a Qaggiq, a shared garage facility, and shared portable sheds, greenhouses, & smokehouses

Site Components

The following are typical site components that are to be incorporated in each cluster of dwellings as needed.

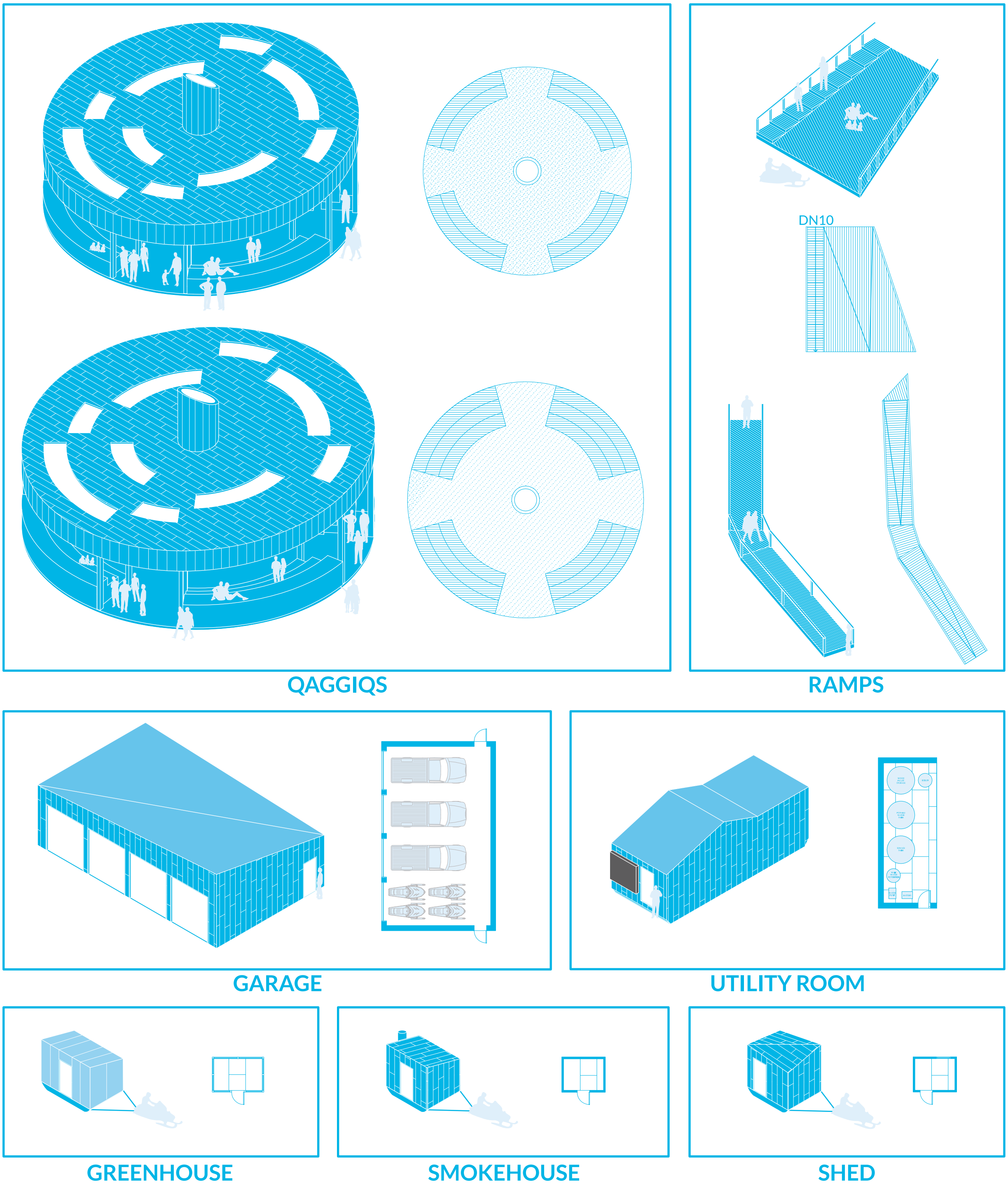


Figure 192: Site Components

Communal Deck

The communal deck acts as the lifeline for the cluster of dwellings. Not only does it provide essential services to each dwelling, but it links the residents to each other, encouraging communal growth, an important facet of Inuit culture. It creates the possibility for random encounters along the path, it draws people into the centrally shared space, and links the spaces in each dwelling where traditional activities occur, encouraging participation and their preservation. Thus, these communal decks play pivotal roles in encouraging the development of the contemporary Inuit culture and identity.

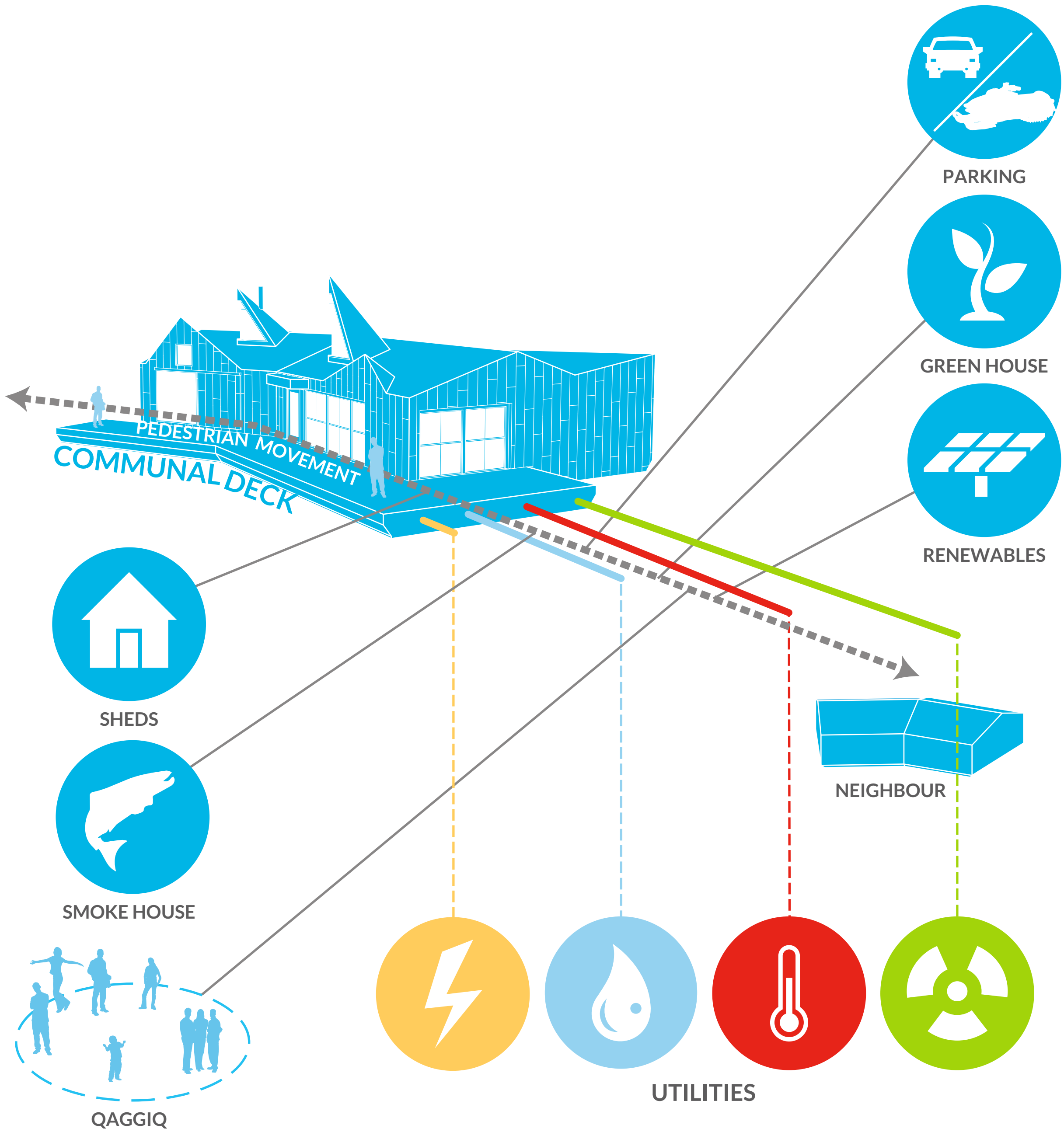
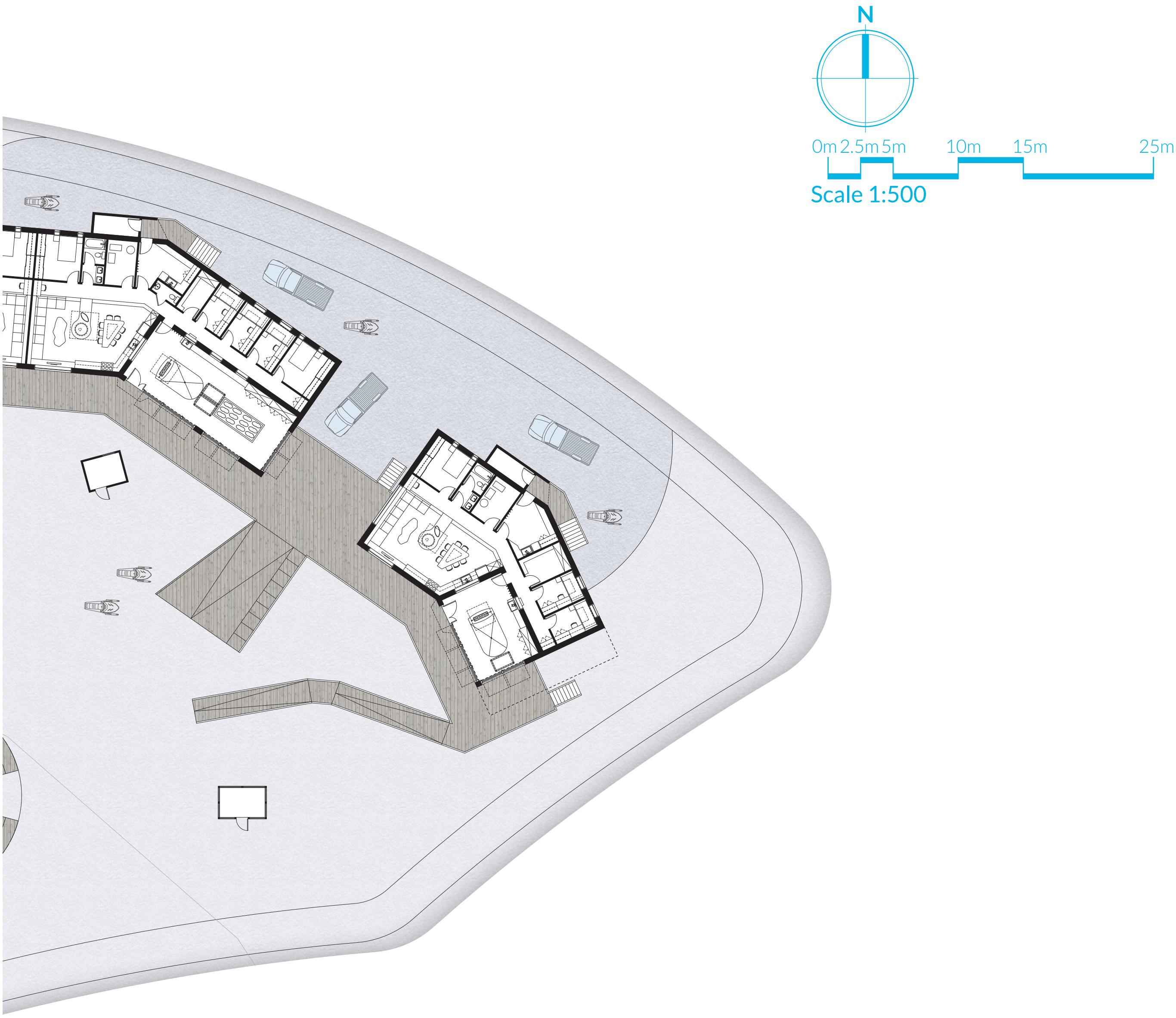


Figure 193: Communal Deck Diagram

Figure 194: Prototype Cluster Plan



Ecological Sustainability

As mentioned earlier, a significant Inuit belief is to live in harmony with the natural environment, thus their dwellings must represent this belief by employing ecologically sustainable practices. The best manner in which to achieve this is through the design of dwellings that consume less through passive low-tech strategies. A heavily insulated envelope, which utilizes snow for insulation when it is colder, and the employment thermal shutters over glazing, and the reduction of thermal bridging contributes to this goal. Taking advantage of solar gain in the summer, reducing the impacts of wind, utilizing natural ventilation, reducing the interior volume as much as possible and strategically laying out the floor plan help contribute energy use reduction and the creation of a thermally comfortable interior. For what heating is still required, as opposed to relying on oil burning furnaces, the municipalities can switch to wood pellet boilers, which are not only renewable, but a cleaner burning fuel. The use of solar thermal collectors can also be utilized for heating during the months when there is light, while a regular wood stove can be utilized to burn shrubs, mosses, driftwood, and construction waste as well. Also, because a diesel generator produces the majority of electricity, energy saving appliances and fixtures should be utilized. Further, renewable sources of energy can be utilized at both a community scale and at the scale of the individual dwelling. In this region, there are

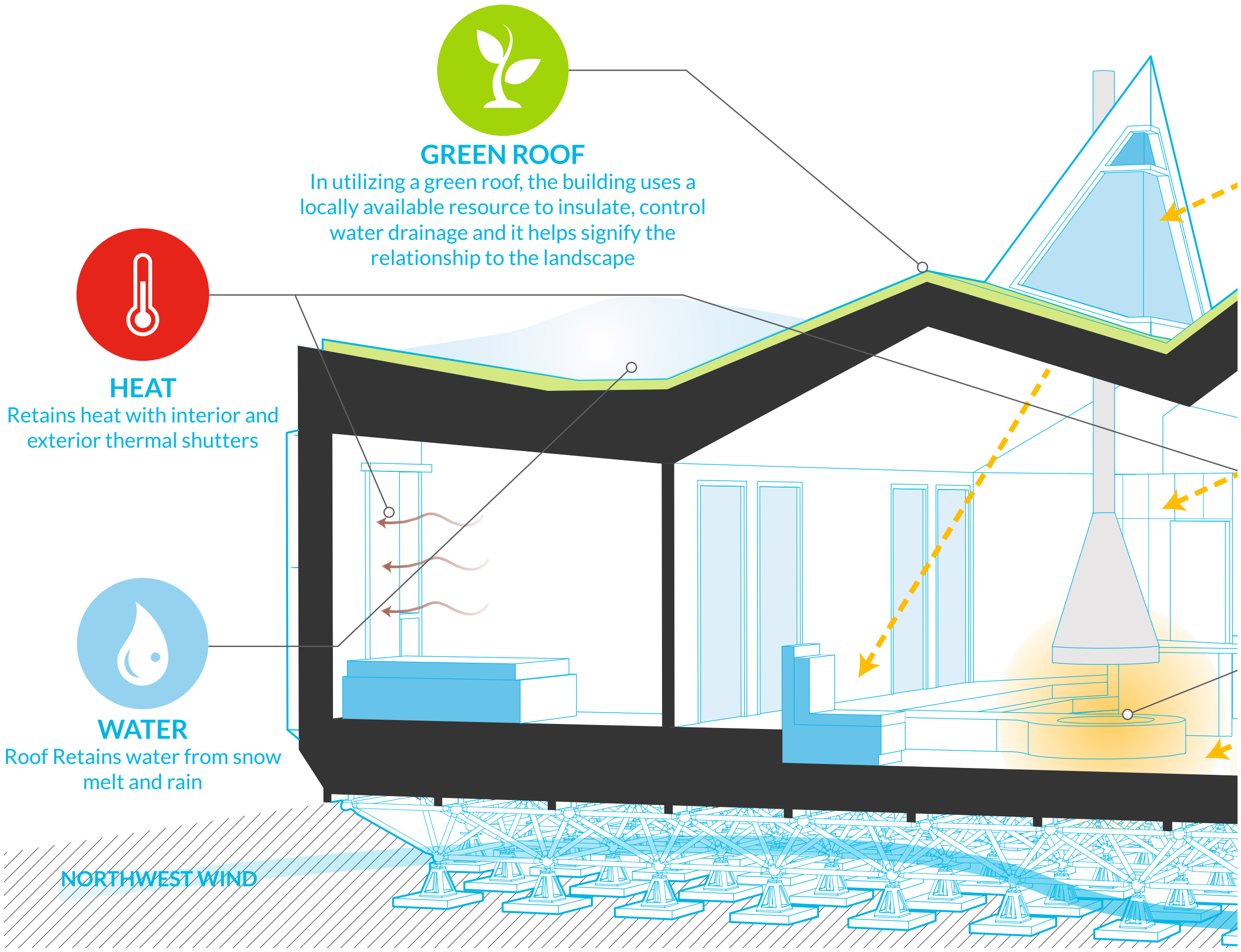
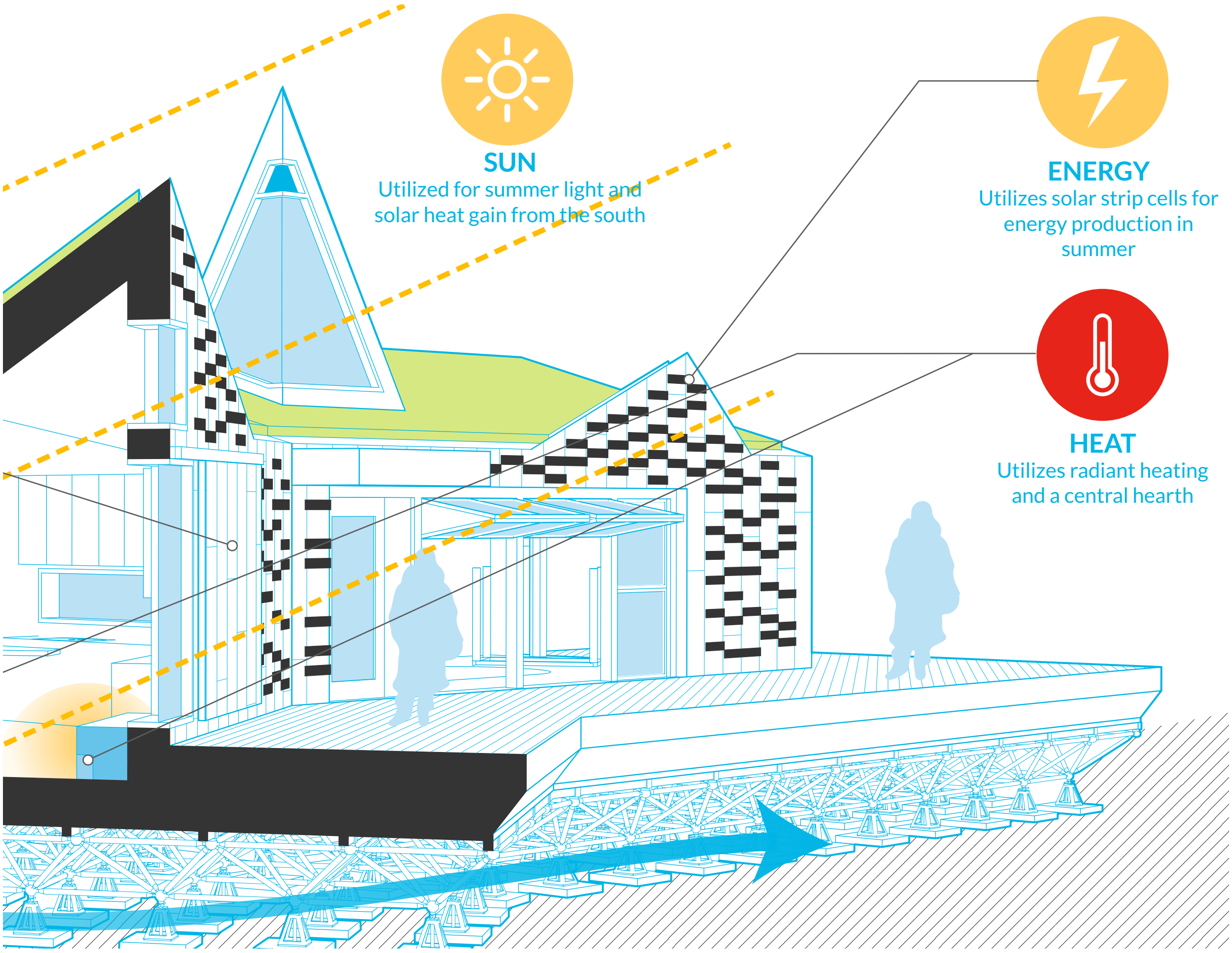


Figure 195: Sectional Perspective

opportunities for electricity produced from wind turbines and photovoltaic panels.

Also, since municipal potable water and sewage retrieval is such a laborious and energy burning endeavour in Nunavut, not only should water conserving fixtures and appliances be utilized, but the dwelling should retain as much water from rain and melting snow as possible.

Reductions can also be made in terms of the embodied energy and resources found in the construction of the dwellings. By utilizing a system that incorporates prefabricated components and repeated standard dimensions, waste can be reduced, especially as it becomes more common practice. Also, as more locals begin to take part in the construction process, less and less labourers will have to be flown in. As the understanding of planning for material delivery for the standardized approach improves, mistakes can be minimized, ensuring no missing or damaged materials have to be flown in. By employing materials and components that are lightweight, minimal in volume, and that can be effectively shipped can also increase the materials that can be delivered at a time, further diminishing the negative impacts of material delivery. In utilizing materials like snow and soil for additional thermal resistance, and local materials like stone for flooring and site features, not only does this reduce the need to use manufactured or processed materials with high embodied energy, but offsets the need to transport materials from afar.



Indoor/Outdoor Multifunctional Space

The indoor/outdoor multifunctional space can be viewed as the heart of this proposal, as it is the space that has been designed with the preservation of traditional practices and the growth of the contemporary Inuit culture in mind. Through its ability to open and close to the outside depending on the conditions, it represents and encourages the upkeep of seasonality of traditional Inuit life. It also faces south, and takes advantage of the views towards the central communal space, signifying the important place this space has in the dwelling. Further, its adjacency to the communal deck ensures that it is an integral part establishing communal relationships. The space is designed with the hunting culture of the Inuit in mind, in an attempt to maintain and encourage this practice. It allows for the storage of hunting equipment, is an area for the hunters to prepare, and allows for them to prepare the meat and skins of their prey. The prey can be divided, shared and traded, meat can be smoked and cured, and skins can be stretched and stored. Further, due to the close relationship to the hunt, traditional family meals can occur in this space when the hunters first return. Other traditional activities that can occur here include sewing of skins for clothing, and blankets, and the production of traditional tools and games still used. It will also be an area for the preservation of their oral history, as families can gather around the dropped area, facing the *qulliq* as stories are told and traditional songs are sung. It is also an area where more contemporary activities can occur like sculpting, the practice of other visual arts, the growth of food, and the maintenance of equipment. The dropped section of this area is intended to be where more messy activities will take place, as it will have a stone tile base and a drain so that messes can be easily washed away. It can further act as a means of economic generation for the contemporary Inuit mixed economy, since it is located along a pedestrian route allowing families to sell, trade or share any surplus food, artworks, clothing, and tools.

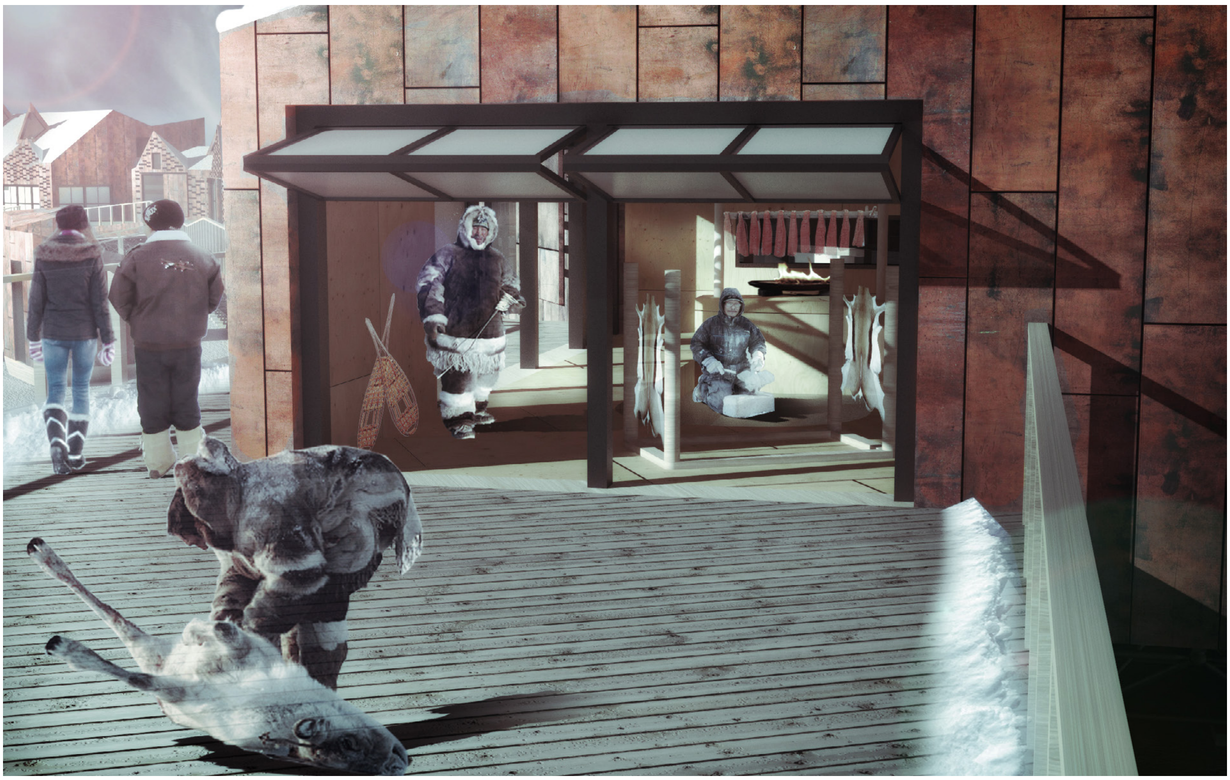
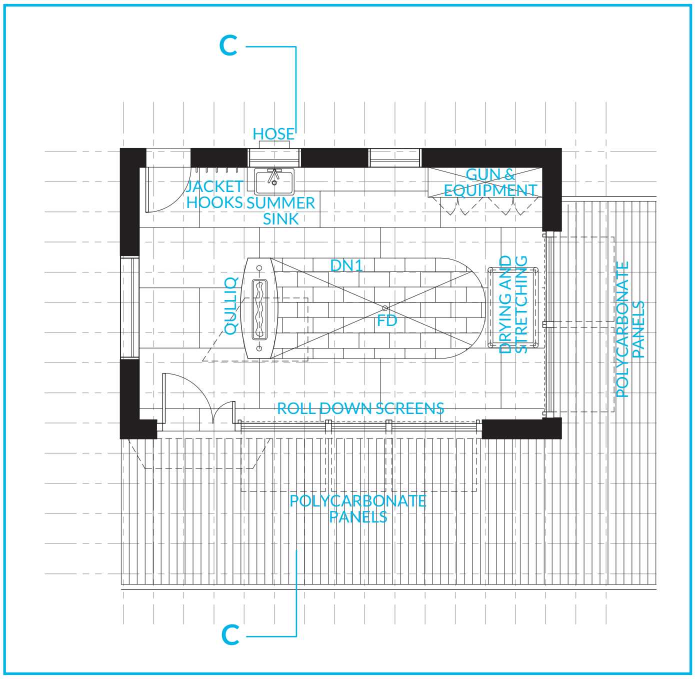


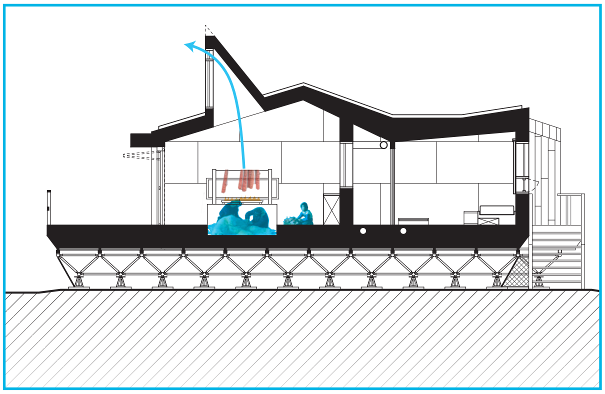
Figure 196: Indoor/Outdoor Multifunctional Space



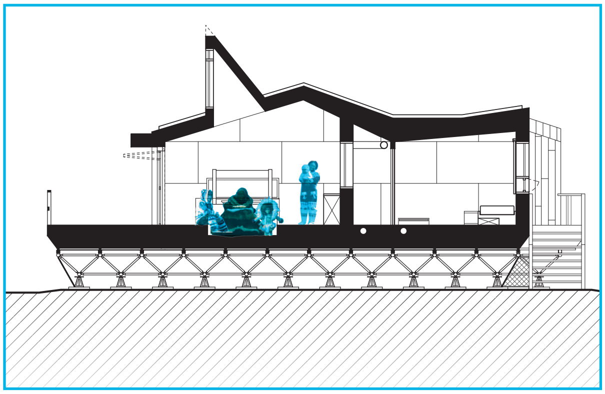
TYPICAL MULTIPURPOSE ROOM FLOOR PLAN

FOR THE WINTER, THE PEOPLE WOULD BUILD A LARGE SNOW HOUSE WITH A BIG WORKSPACE IN THE CENTRE ... THE CENTRE WAS A WORKSPACE OR A PLACE TO GATHER FOR GAMES, DRUM DANCES AND STORIES

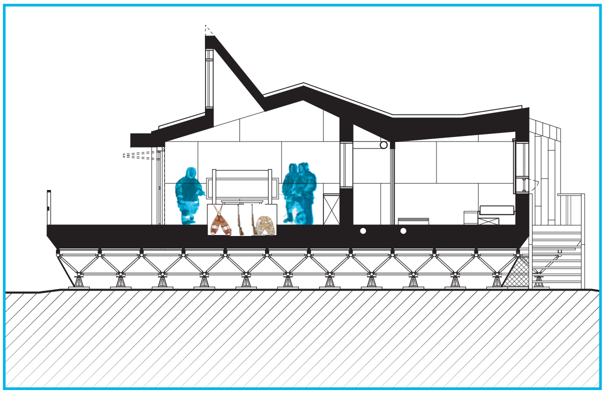
Ruth Nigiyonak, 1996
(Bennett & Rowley, 2004)



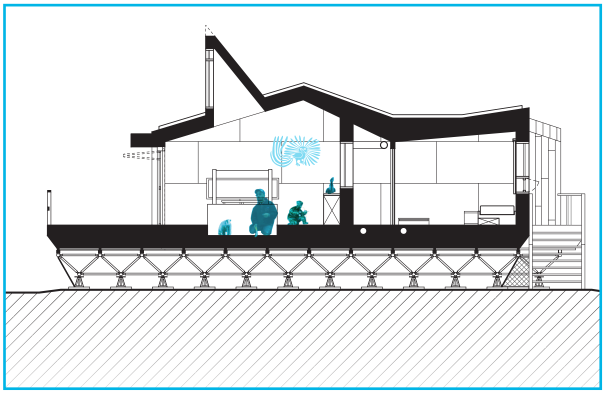
FOOD PREPERATION AND EATING



STORY TELLING



HUNTING PREPERATION



CARVING, SEWING AND OTHER CRAFTS

Figure 197: Multifunctional Space Use Diagrams

Seasonal Variation

Since the Inuit relationship with the natural environment is such a significant facet of their traditional culture, seasonal variations became a defining feature of their identity and way of life. Thus, their dwellings must represent these seasonal variations in both function and aesthetics. As such, the building utilizes elements that allow the dwelling to open up to the environment when the weather is nice, but enclose and protect the dwelling in harsh conditions. Not only do these components contribute to a building identity that changes throughout the year, but it also employs the aesthetic qualities of ice and snow to further create a seasonal difference.

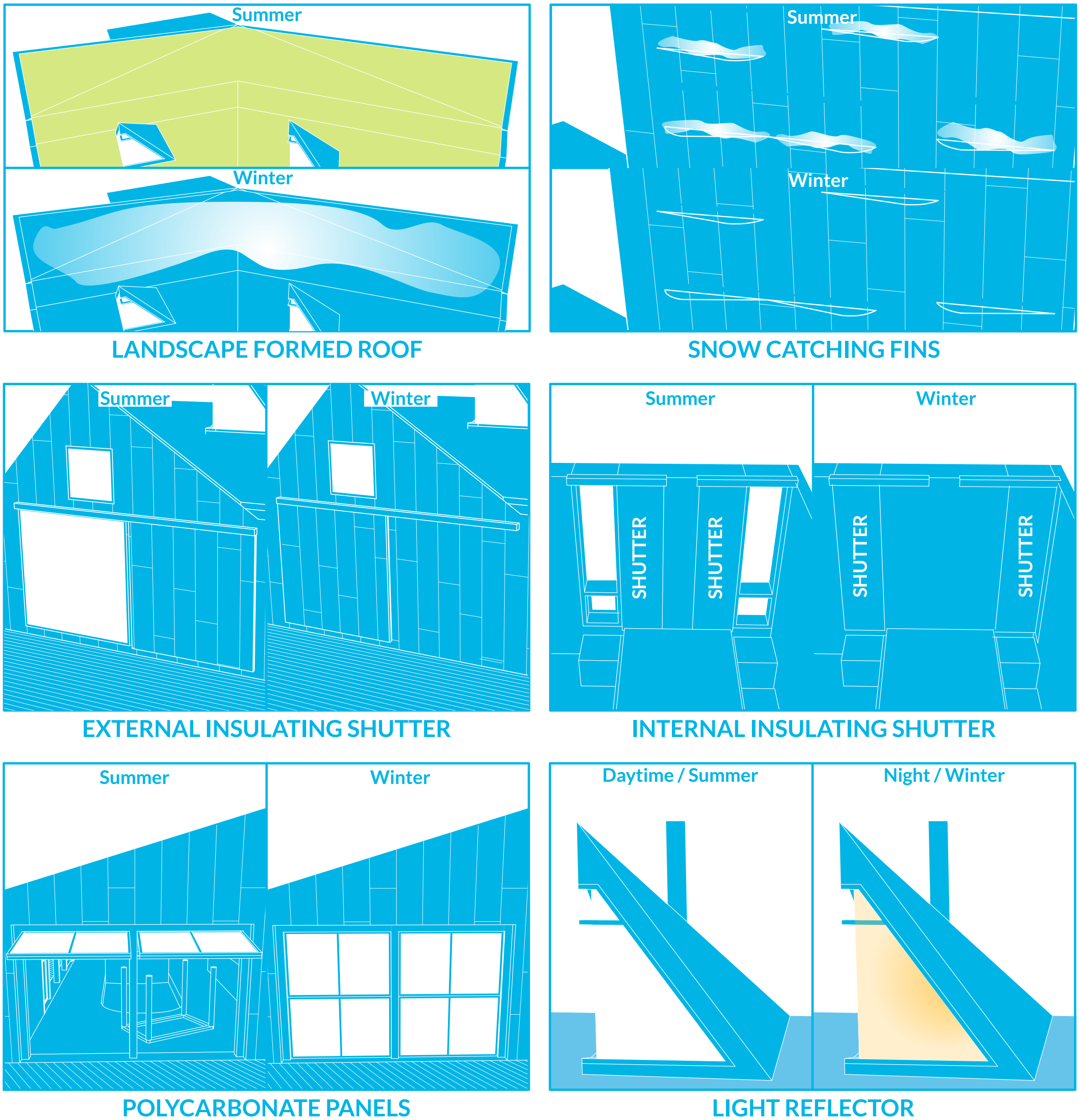
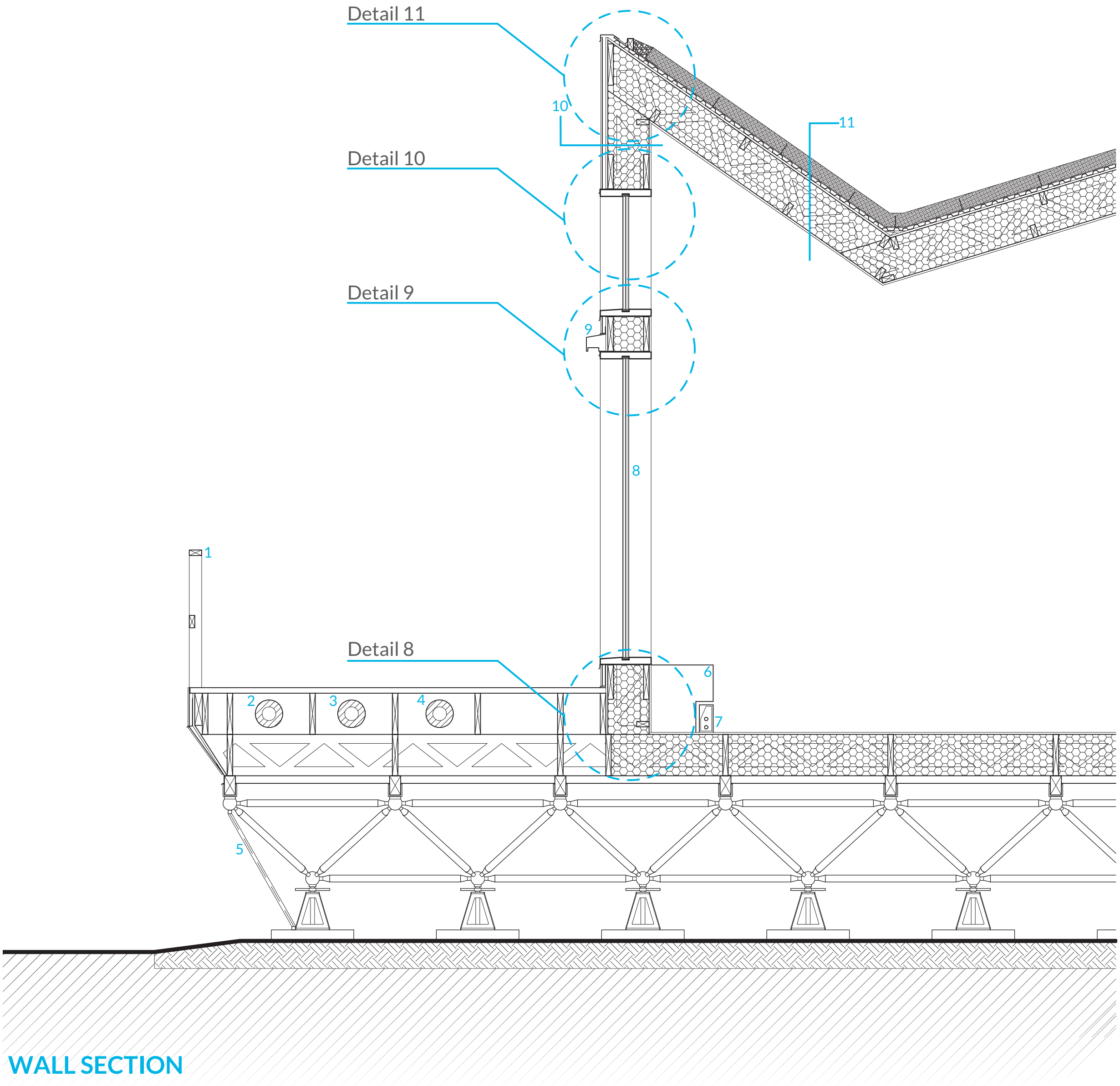


Figure 198: Seasonal Variation Diagram

Details

The following are some typical envelope details that have been developed for the project.



WALL SECTION
Scale 1:50

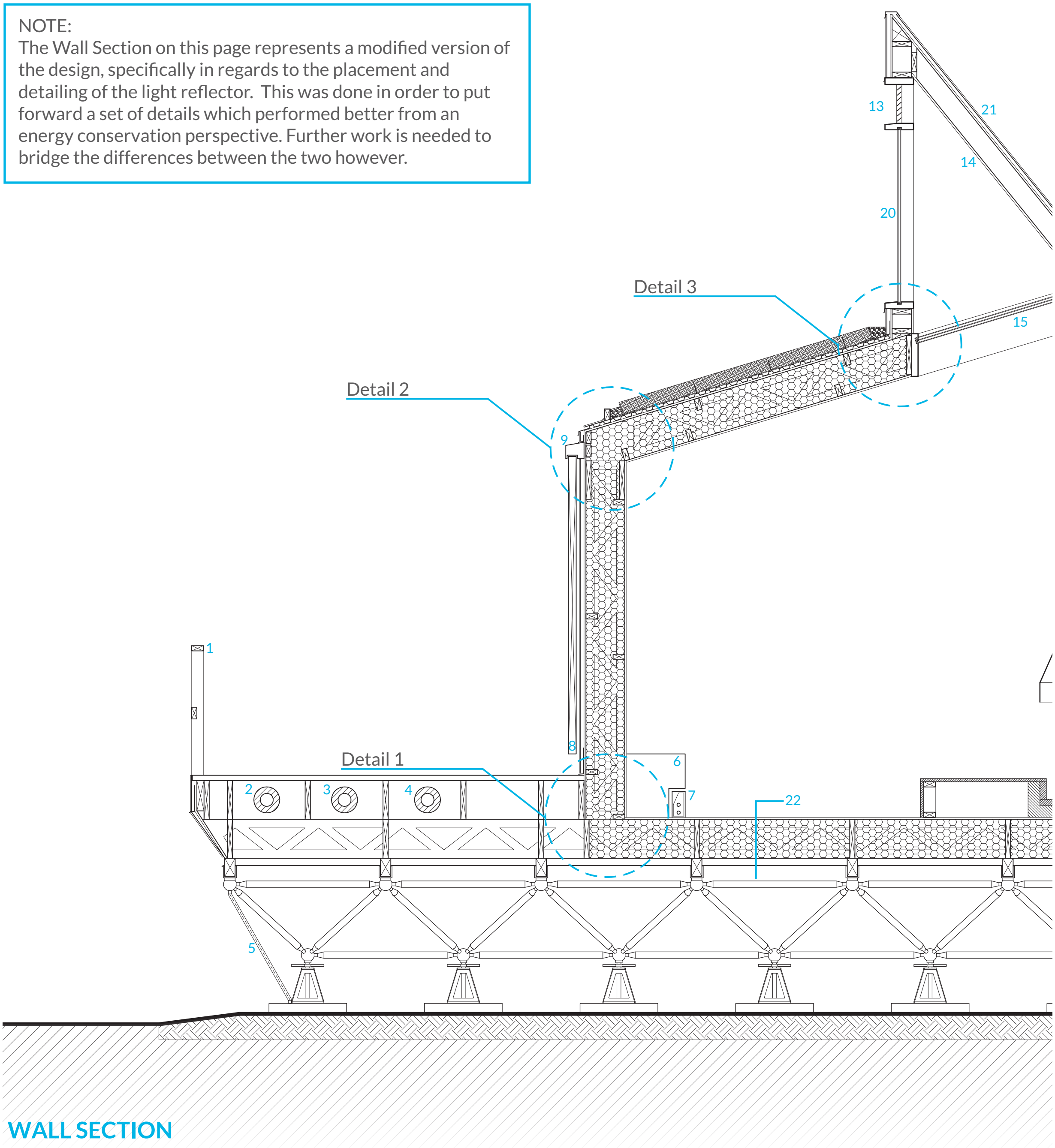
1 Railing
2 Insulated Water Pipe
3 Insulated Sewage Pipe
4 Insulated Radiant Heat Pipe
5 Wire Mesh Skirting
6 Built-in TV Cabinet
7 Radiant Heater

8 Triple Pane IGU
9 Insulated Shutter Track
10 Flat Lock Copper Cladding
25mm Air Space
Tyvek Building Wrap
15mm Plywood
300mm 2PCF Sprayfoam
Insulation (AB/VB) & Wall
Truss
15mm Plywood

11 100mm Soil Layer
Filtration Membrane
25mm Drainage Layer
60mil EPDM
300mm 2PCF Sprayfoam
Insulation (AB/VB) & Wall
Truss
15mm Plywood

Figure 199: Wall Section 1

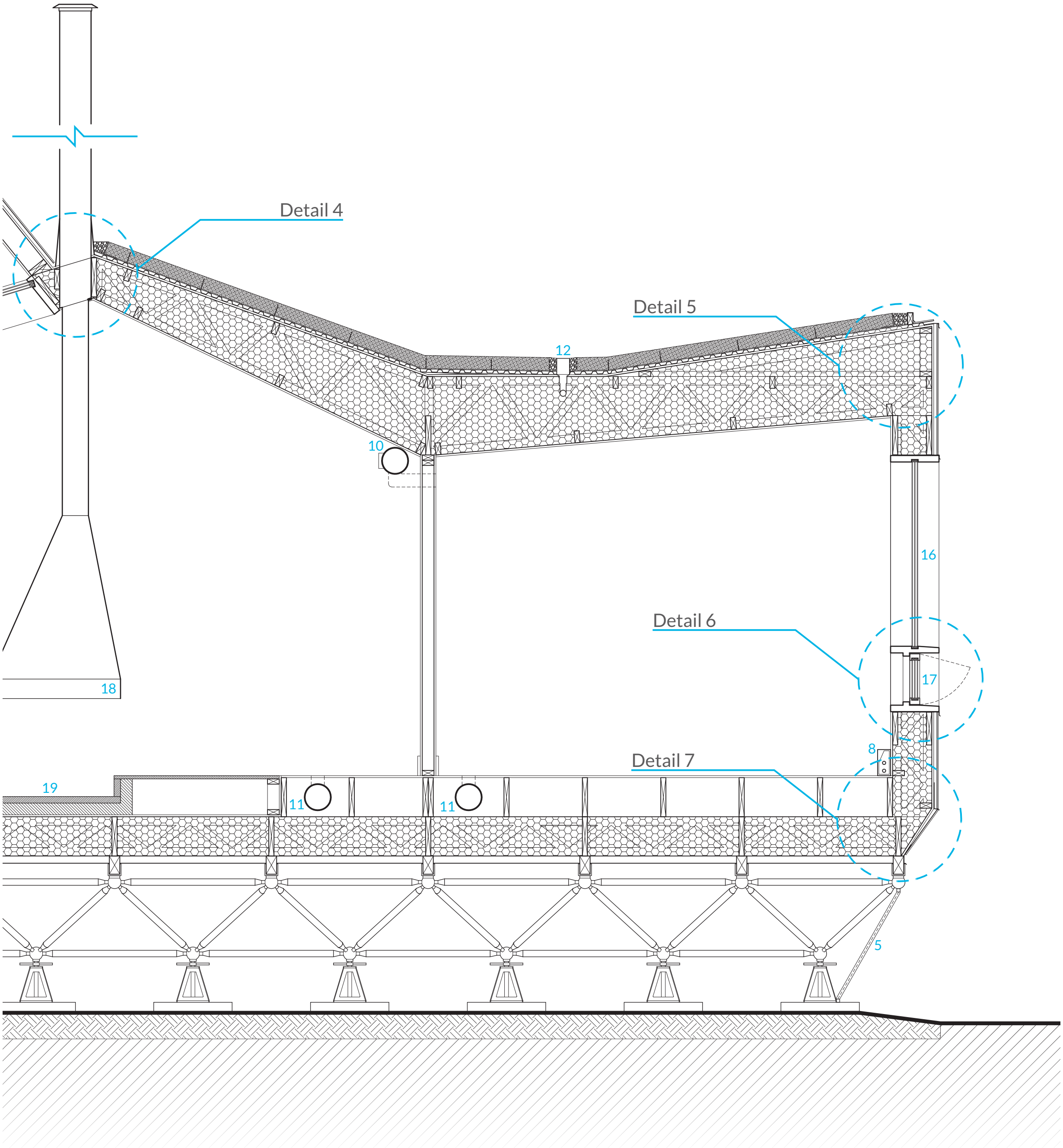
NOTE:
The Wall Section on this page represents a modified version of the design, specifically in regards to the placement and detailing of the light reflector. This was done in order to put forward a set of details which performed better from an energy conservation perspective. Further work is needed to bridge the differences between the two however.



WALL SECTION

Scale 1:50

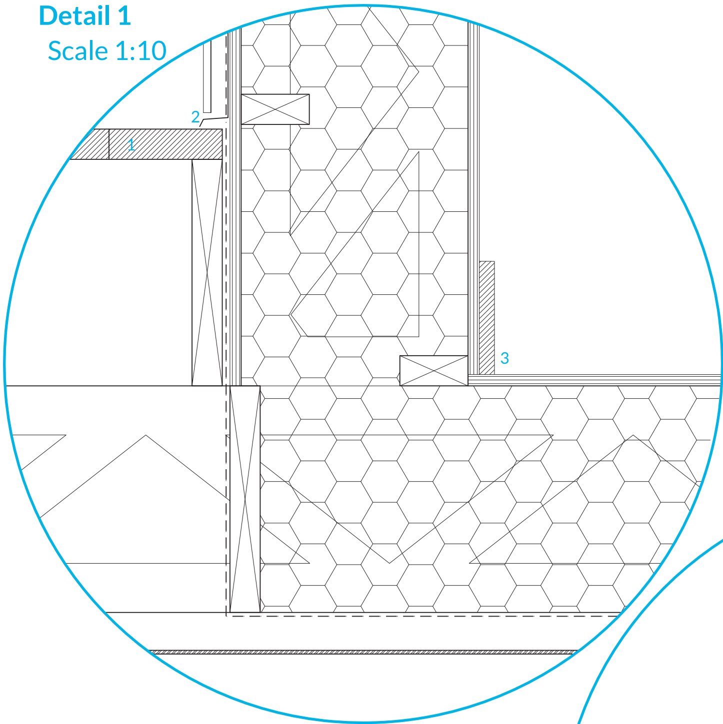
1 Railing
2 Insulated Water Pipe
3 Insulated Sewage Pipe
4 Insulated Radiant Heat Pipe
5 Wire Mesh Skirting
6 Built-in TV Cabinet
7 Radiant Heater
8 Insulated Shutter
9 Insulated Shutter Track
10 Air Return
11 Air Supply
12 Green Roof Drain
13 Vent
14 Reflective Surface
15 Triple Pane Skylight IGU
16 Triple Pane IGU
17 Operable IGU
18 Fireplace Exhaust
19 Fireplace
20 Double Pane IGU
21 Light Reflector



22 15mm Plywood
300mm 2PCF Sprayfoam Insulation (AB/VB) & Floor Truss
Tyvek Building Wrap
50mm Air Space
Aluminum Perforated Soffit

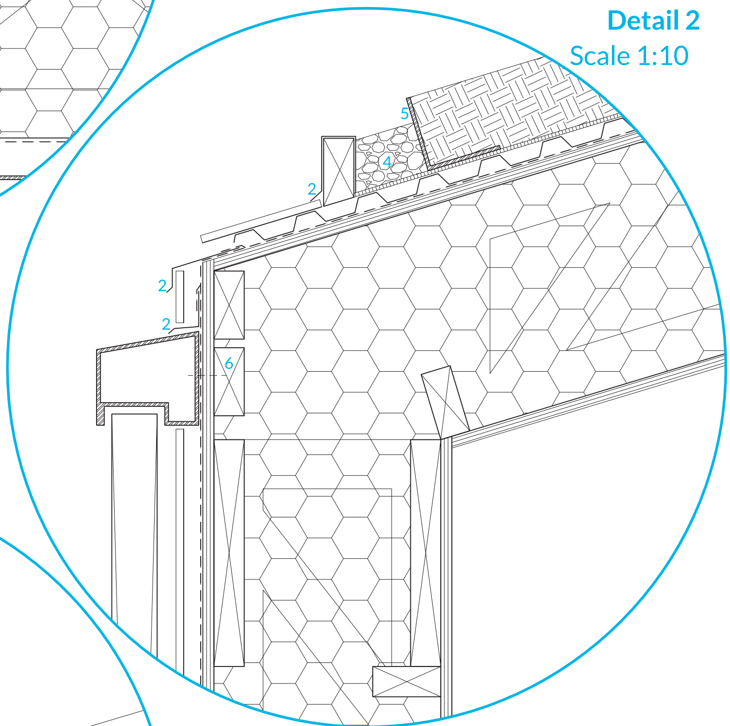
Figure 200: Wall Section 2

Detail 1
Scale 1:10

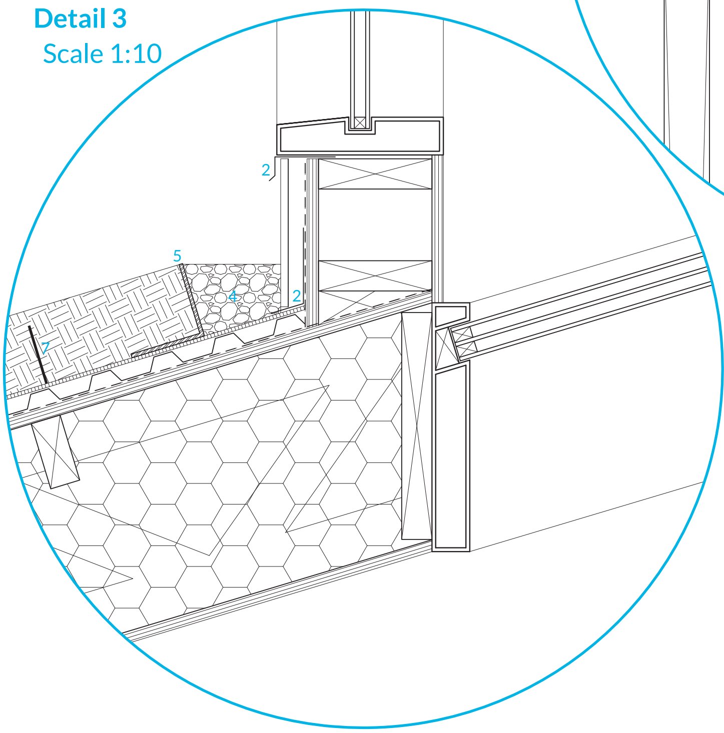


1	2 x 6 Deck Board
2	Flashing
3	1 x 6 Baseboard
4	Gravel Edge
5	8 x8 L Shelf Angle
6	Fastening Support for Track
7	Soil Divider

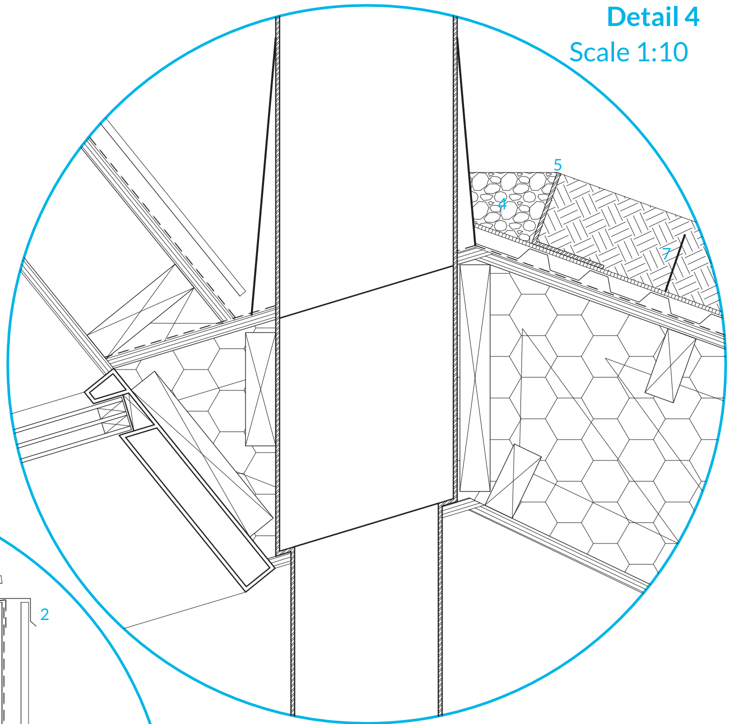
Detail 2
Scale 1:10



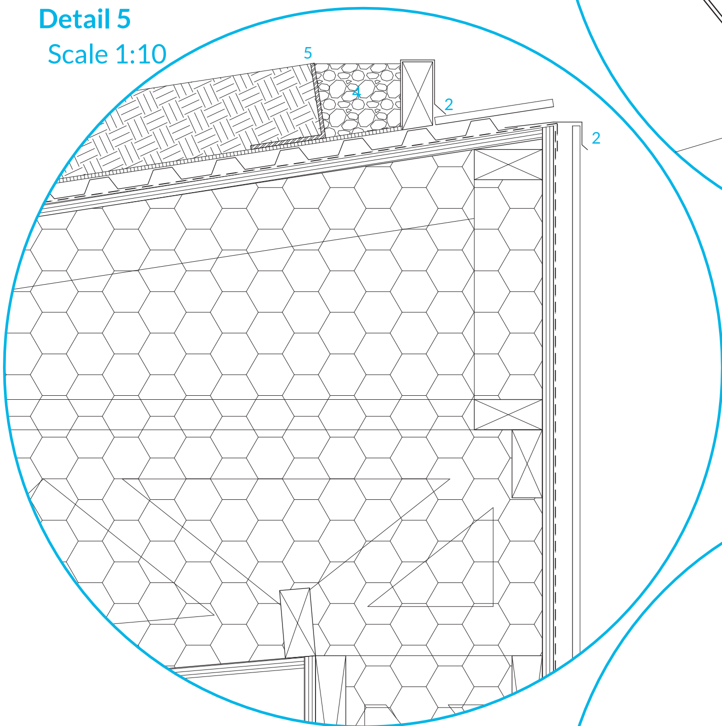
Detail 3
Scale 1:10



Detail 4
Scale 1:10



Detail 5
Scale 1:10



Detail 6
Scale 1:10

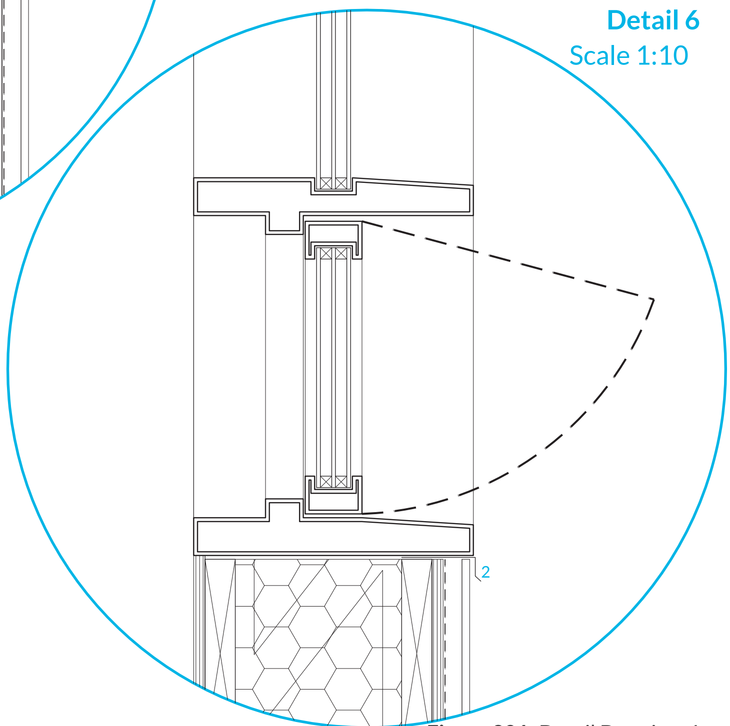
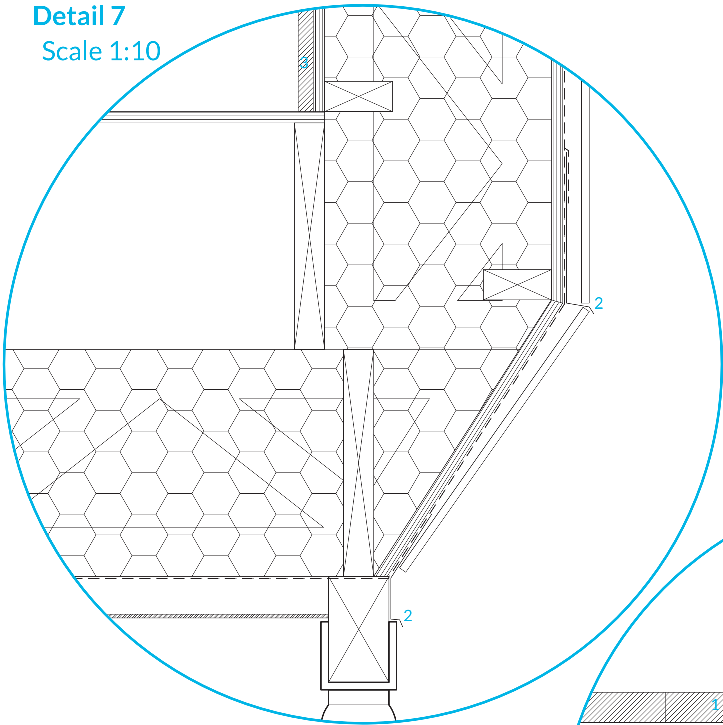


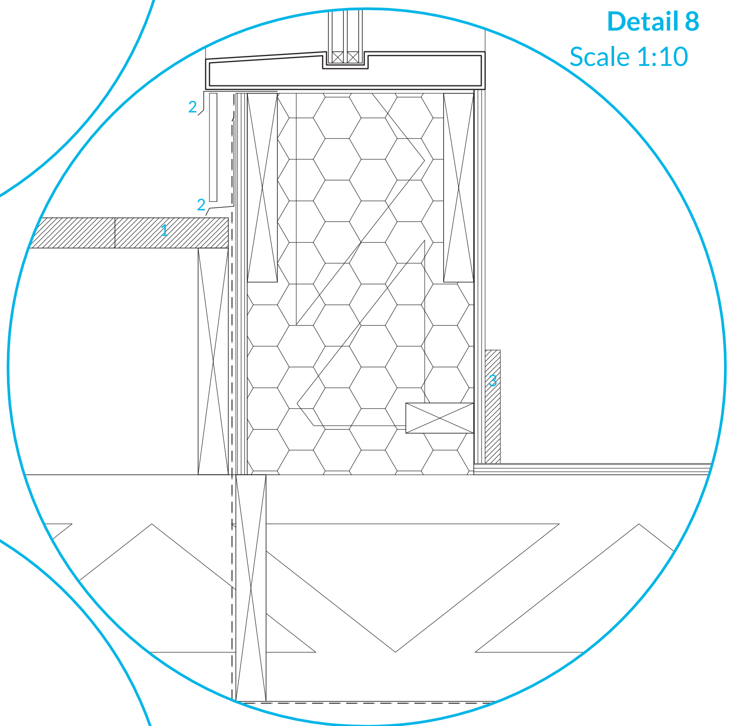
Figure 201: Detail Drawings1

Detail 7
Scale 1:10

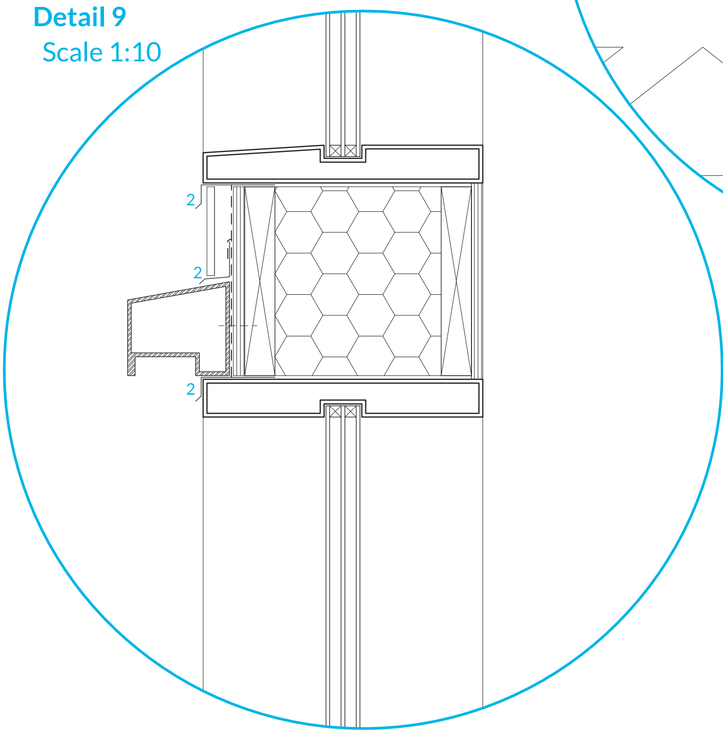


1 2 x 6 Deck Board
2 Flashing
3 1 x 6 Baseboard
4 Gravel Edge
5 8 x8 L Shelf Angle

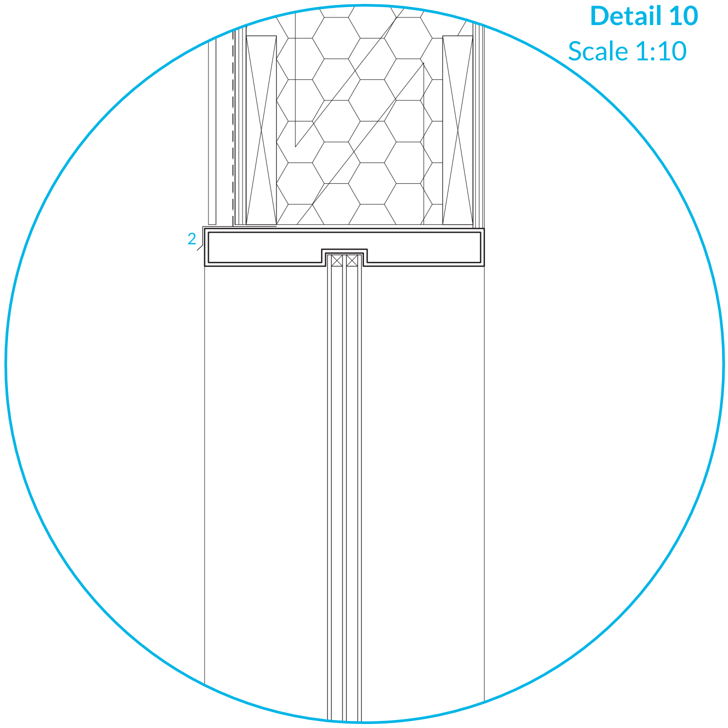
Detail 8
Scale 1:10



Detail 9
Scale 1:10



Detail 10
Scale 1:10



Detail 11
Scale 1:10

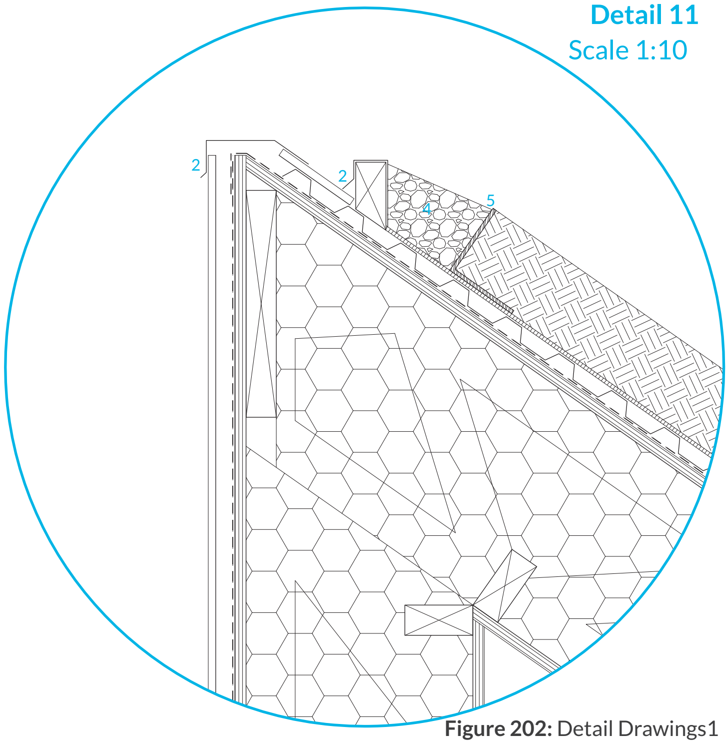


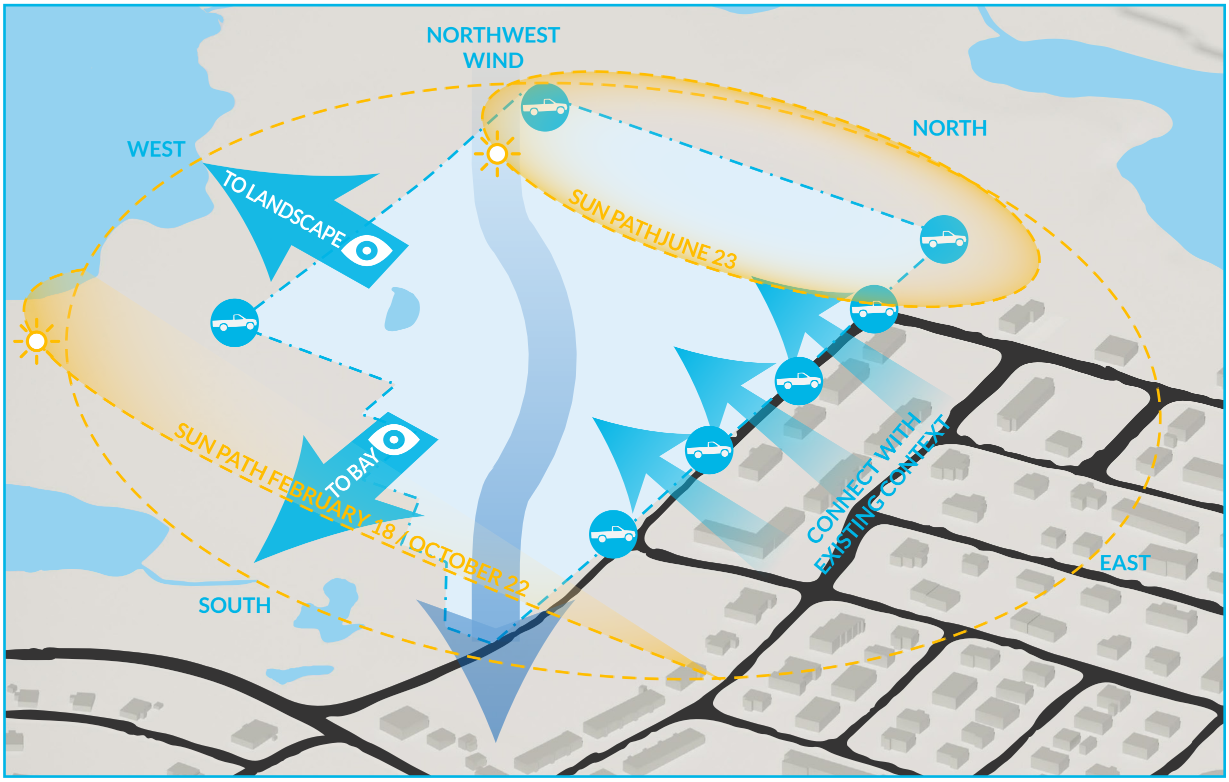
Figure 202: Detail Drawings1

7.3 Cambridge Bay Prototype

The following chapter displays the prototypical application of the home-delivery system for the Inuit in a particular context. In this instance, the town of Cambridge Bay is used as the test site to depict the potential outcomes. The site selected is the section of town that is allotted for expansion with a proposal for approximately 44 units organized in a typical grid layout. The proposal will seek to match this density, confirming that the proposed system can be economically feasible. Further, the proposal will highlight how the home-delivery system can adapt to certain site characteristics such as existing road networks, views, sun, wind and it's connection to the existing community.

Figure 203: Winter Rendering of Proposal
Depicts the use of the site in Winter, with the snowmobile access ramp in use to bring caught game to the dwellings

Figure 204: Interior Rendering of Proposal
Depicts the main living area in use by the family



SITE CONDITIONS

SITE PROPOSAL

Figure 205: Existing and Proposed Site


13
9
10
11
12
13
14
17
13000
14000

Figure 206: Proposed Site Plan

Figure 207: Summer Front Yard Rendering

Figure 208: Winter Night Front Yard Rendering

Figure 209: Spring Rear Yard Rendering

Figure 210: Winter Rear Yard Rendering

Figure 211: Winter Front Yard Rendering

08

Conclusion

The preceding thesis | project has sought to reinterpret what the Inuit home is in the rapidly changing conditions of the twenty-first century. It sought to define what the contemporary Inuit culture is, and the role architecture can have in preserving its essence, allowing their culture to organically evolve as the world changes. In doing so, the proposed project merely depicts one instance of the type of thinking that needs to be adopted in the development of homes for the Inuit of Canada's North. It is neither a perfect response to all the conditions, nor is it the only response. I must admit that it was particularly challenging trying to develop a home which responded to every discernible condition, as there are too many to account for, many of which have contradictory consequences. Thus sacrifices (design decisions) had to be made. The primary concern of this thesis was to flip the existing design hierarchy in order to explore the possibilities of what can occur if designing for the unique culture of the Inuit was given precedence. Accordingly, it is simply an example of what can be accomplished if new approaches to architecture are adopted in this region.

However, this did not mean avoiding the challenges that were presented by the unique environmental and economic conditions as they are intrinsically linked to how the contemporary culture of the Inuit that has evolved over time. The project displayed thought to seek a balance between all the different forces acting upon the building, with a priority given to a cultural response, then through an understanding of how economic and environmental conditions impact their culture, and lastly through general concerns in order to give the project more depth and credibility. Nontheless, the end goal was to produce something that would contribute positively to the discourse of contemporary architecture for the Inuit, which meant producing something different that may be too far to one end of the spectrum, as the majority of work has been at the opposite end for the past few decades. In doing so, this gives a direction to work toward, an idea that may never be accomplished, but will help in the progress of defining what the contemporary *iglu* is, and the fruition of perhaps a middle ground at the least.

In select instances, the necessity for a culturally appropriate architecture trumped certain environmental and economic concerns, which resulted in certain design shortcomings in regards to budget and technical proficiency. Make no mistake; at the scale of the individual dwelling the final proposal is a costly one. However, I have prioritized long-term benefits such as reducing operating and maintenance costs as one means to counter the initial construction costs. Further, it should not be viewed as a one off design, custom tailored to Cambridge Bay, but rather as a home delivery system which utilizes the economy of scale. It is achieved through the establishment of a set of standard parts and dimensions that can be adapted to different sites, allowing for the mass production of building elements, and the creation of a regional workforce. In terms of technical proficiency, while adequate, and certainly not worse than much of what is found in the context, it is by no means perfect. Further development would greatly benefit from collaboration with other building professionals to solve some of the deficiencies.

In the exploration of defining what the twenty-first *iglu* is, the thesis | project has succeeded on many fronts. The project has not only responded to the functional needs of the Inuit culture, but has represented their unique identity through form and architectonic expression. The investigation resulted in the attempt to reconcile two conflicting views of historical and technical culture through the creation of a hybrid form that responded to both contemporary and traditional needs, and taking advantage of commonalities and mutually beneficial relationships. The exploration of seasonal expression, the dwelling relationship to landscape, Inuit aesthetic sensibilities as found in their art, a formal response to climatic conditions, and the manner in which community and sharing networks can be established has helped give meaning to the Inuit's dwellings, which has been absent since they abandoned their *iglus* and *tupiqs* for permanent dwellings. If nothing else, I hope this document has compiled the necessary information an architect needs to gain valuable insight into designing homes for the unfamiliar context and culture of the Canadian North.

Despite these progresses, there is much exploration left to do, either through the progression of the ideas established in this paper, or through the discovery of other opportunities. As mentioned earlier, a potential area of further investigation would be how these ideas might exist in a more feasible and technically proficient building. The manner in which these dwellings relate to existing communities, and in fact how existing communities can adapt in response to these ideas, is another area for future research.

I know this has been a rather lengthy read, and that paragraphs, sections, chapters have probably been skipped, but I hope this has at least sparked some interest into the concerns of designing in this complicated and all to often forgotten region of Canada. Whether wrong or right, I would hope that this thesis | project will contribute to the discourse in a positive manner, and help get the ball rolling for interest in architecture in this context. Perhaps, one day my colleagues or myself may contribute to the creation of meaningful dwellings for the Inuit, ensuring the preservation of their unique identity and culture, and the sustainable inhabitation of the Canadian North. *Koana*.

Glossary

Aalliak: Dog sled

Amauti: Woman's parka for packing a baby on her back

Angakkuit: Shamans

Aujaq: Summer

Atigi: Parka

Haviit: A knife for cutting snow blocks

Hiku: Ice

Iglu: Home, dwelling or house

Igluit: Snowhouse or winter dwelling

Inuinnait: A regional Inuit group found in the western Canadian Arctic, also referred to as the Copper Inuit

Inuinnaqtun: Eastern Inuktitut dialect

Inuit: The people or people of the land

Inuk: Singular person

Inuit Quajimajatuqangit (IQ): Inuit traditional knowledge

Inuktitut: All dialects of the Canadian Inuit Languages

Iqaluktuuq: A place of many fish, original settlement in Cambridge Bay area

Iqaluktuurmuit: Community of Inuit found in the Cambridge Bay Area

Isuma: Reason

Kapuut: Harpoons

Kitikmeot: Administrative region in the western part of Nunavut

Koana: Thank you

Nuna: Land

Nunavummuit: Resident of Nunavut

Pihiit: Traditional Inuit song

Qablunaat: Non-Inuit or Southerner

Qaggiq: Large communal dancehall

Qajaq: Kayak

Qulliq: Soap stone oil burning lamp

Tupiq: Skin tent used for summer and spring dwelling

Tuurngait: Spirits

Ukiaaqqaq: The nearly young winter

Ukiaq: The young winter

Ukiuq: Winter

Upinngaq: The young spring

Upinngaaqqaq: The not so young spring

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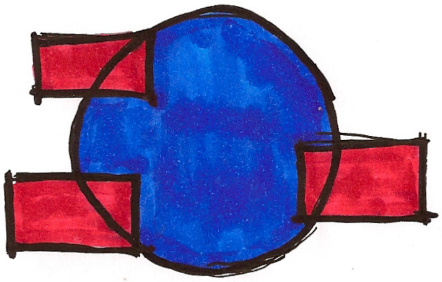
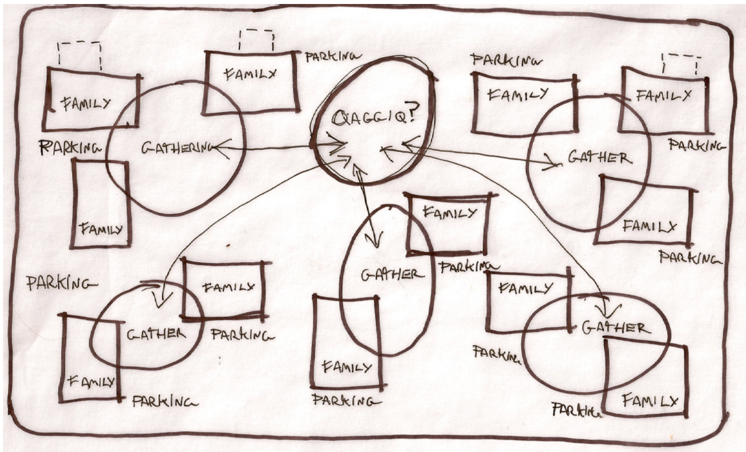
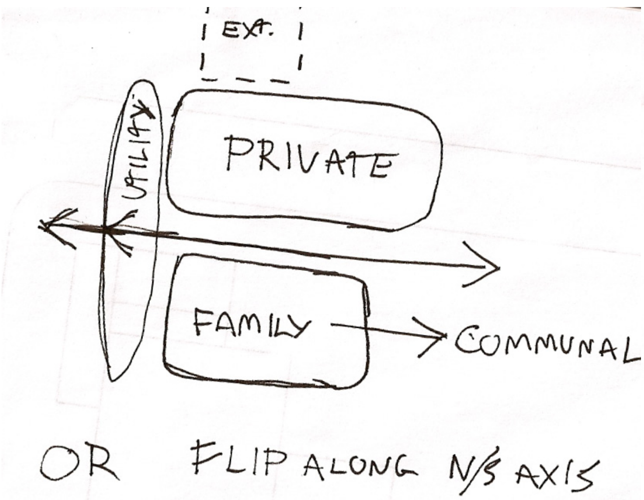
Appendices

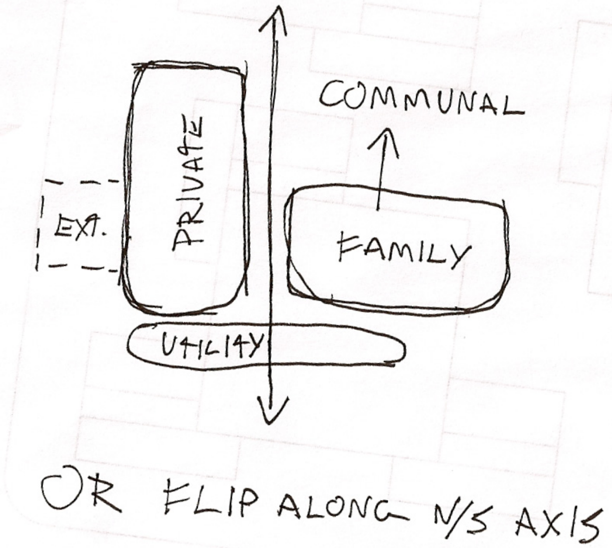
Appendix A : Design Sketches

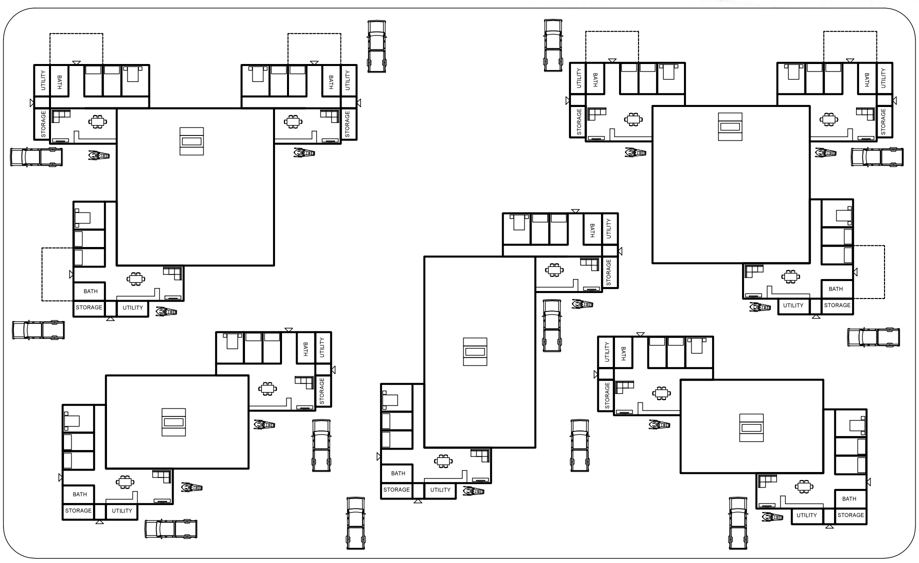
Exploration 1: Clustering

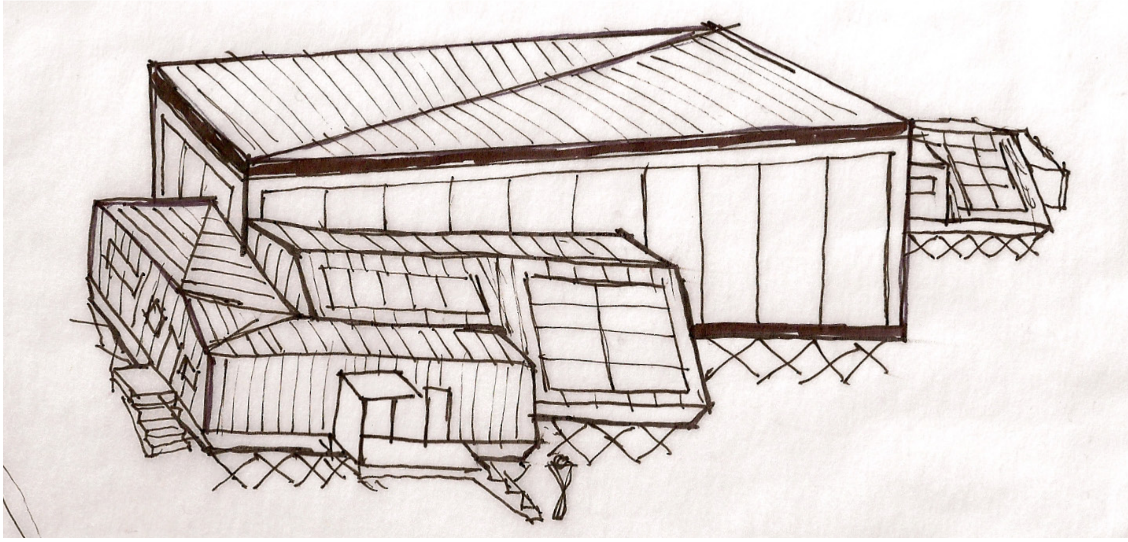




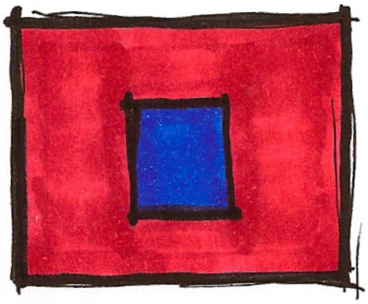


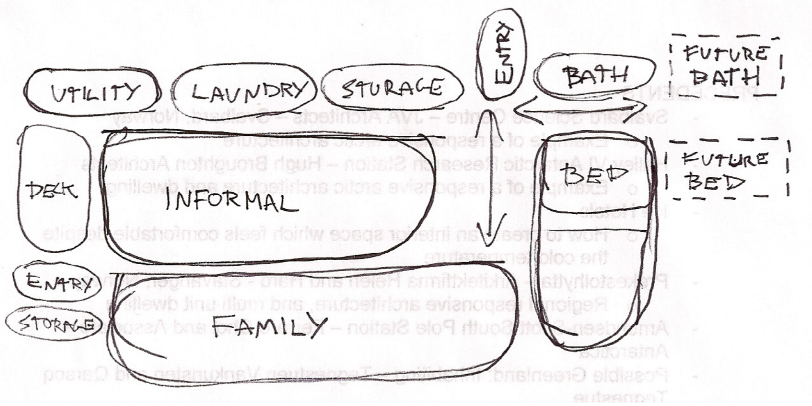


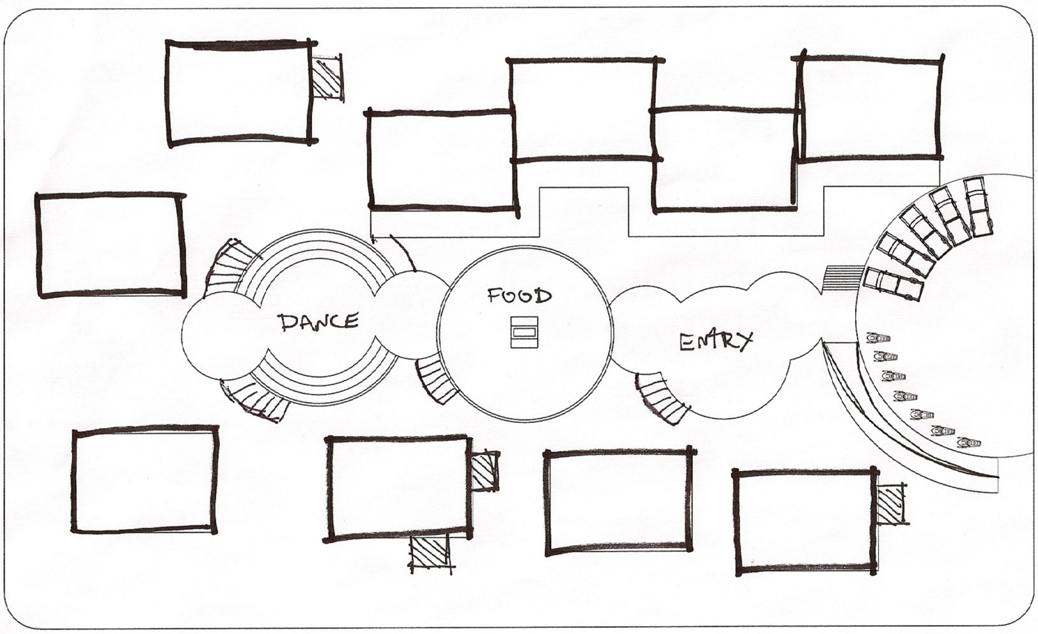


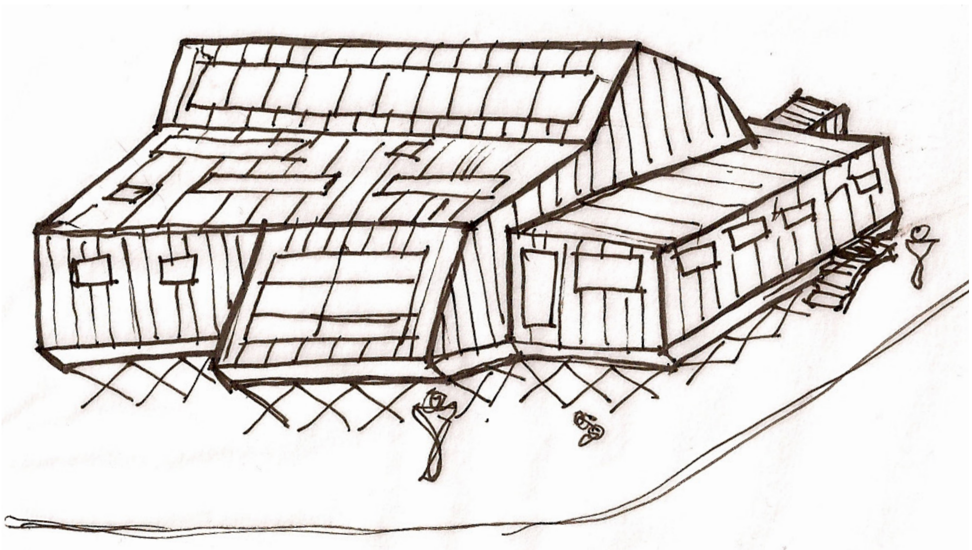


Exploration 2: Courtyard

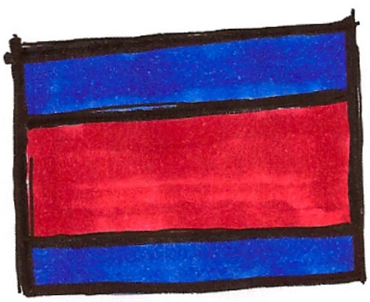


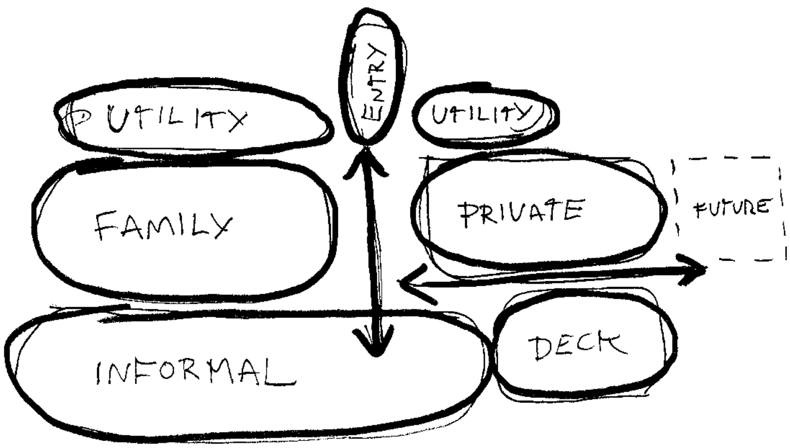


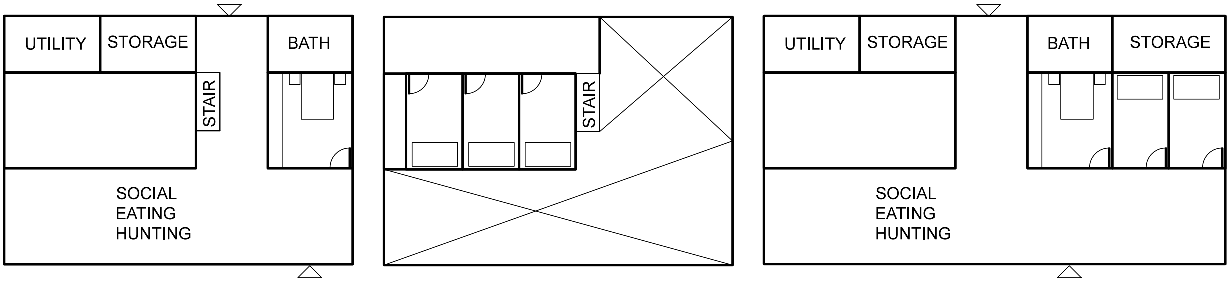




Exploration 3: Buffer Zone



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STORAGE
STAIR
BATH
SOCIAL
EATING
HUNTING
STAIR
UTILITY
STORAGE
BATH
STORAGE
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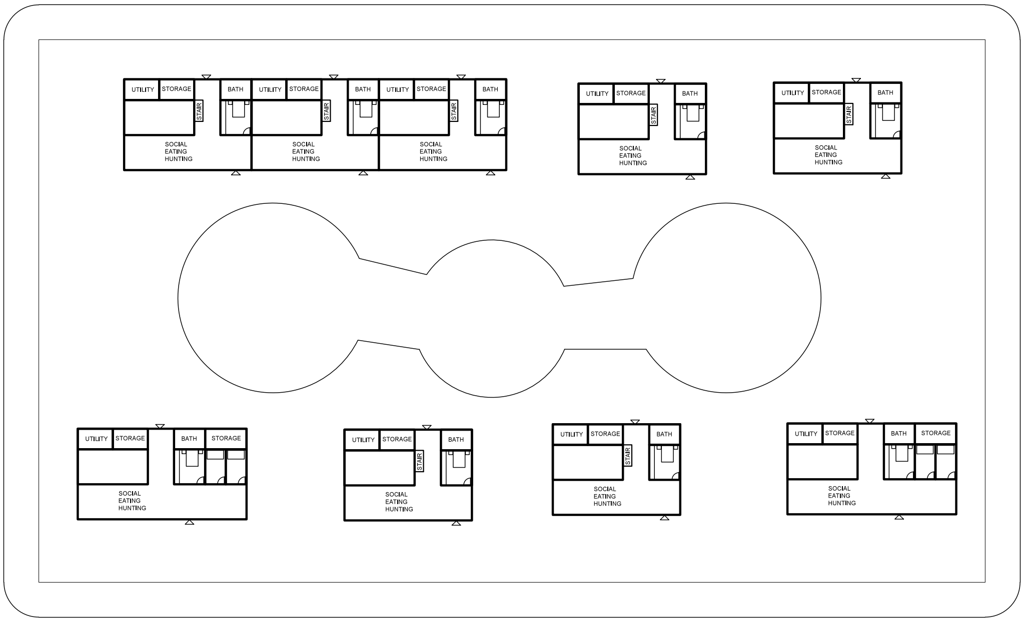
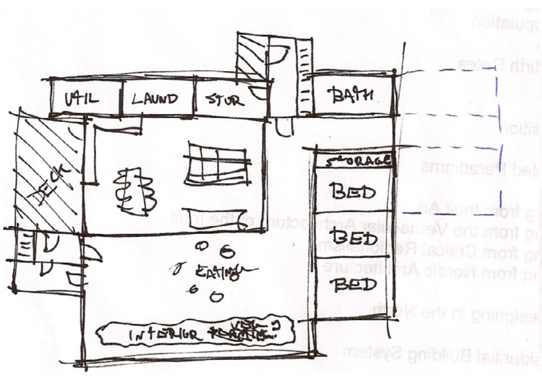
HUNTING

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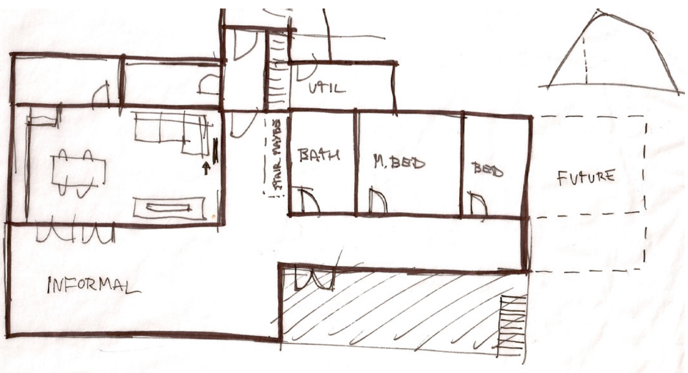
LAUND
STOR
BATH
STORAGE
BED
BED
BED
DECK
EATING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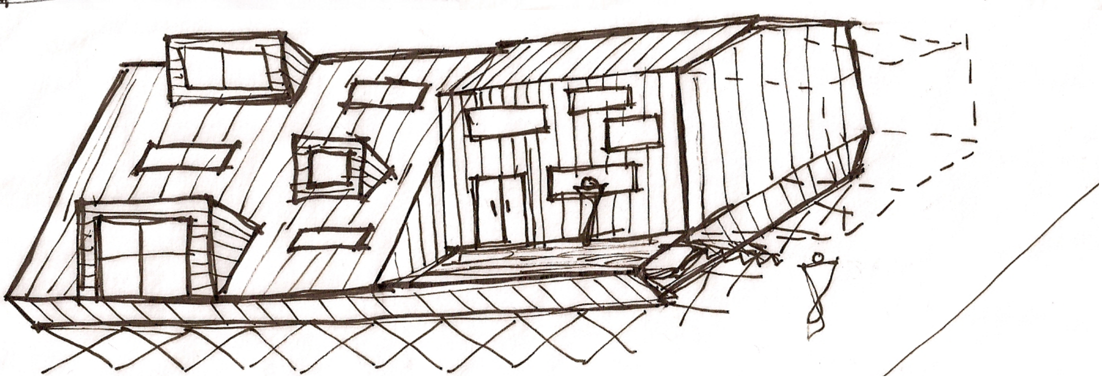
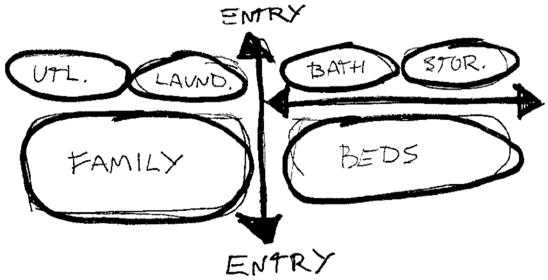
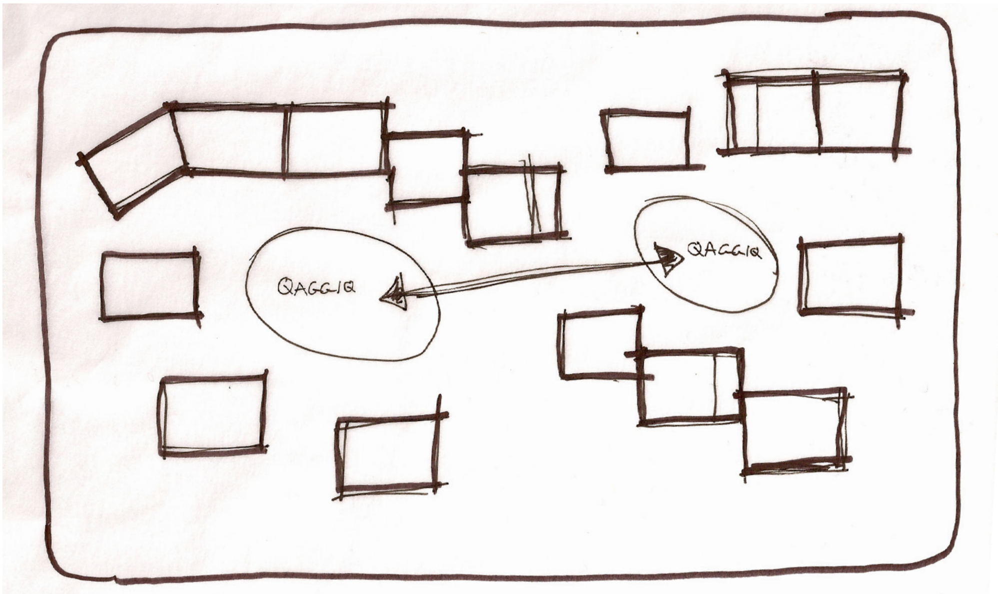
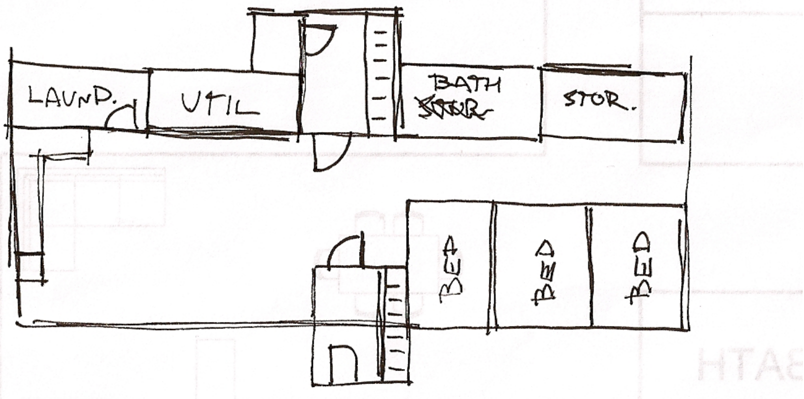
STAIR
BATH
M.BED
BED
FUTURE
INFORMAL

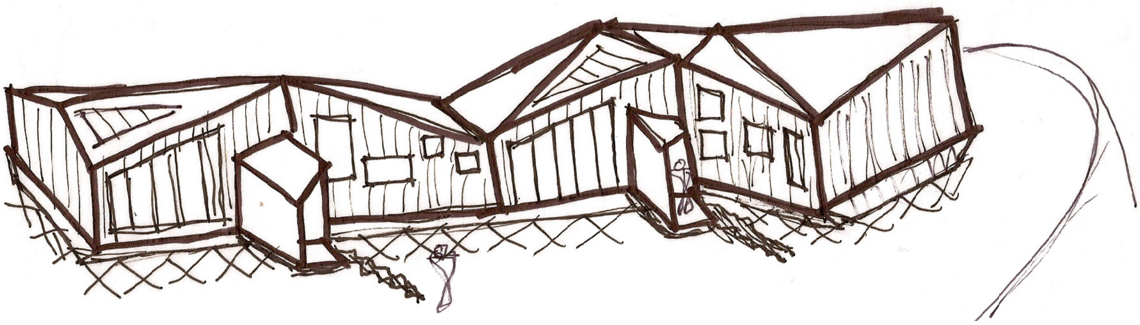


Exploration 4: Compact

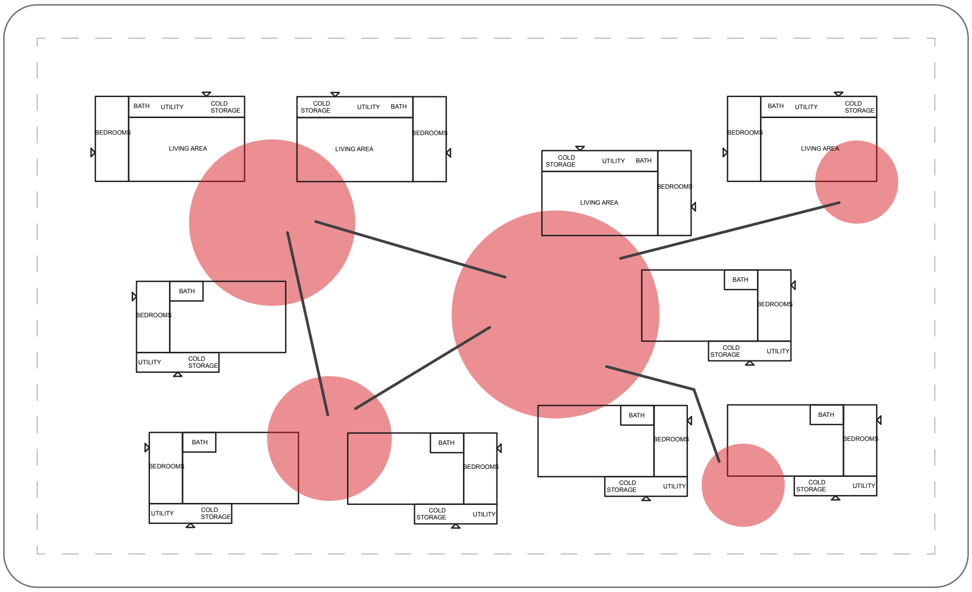


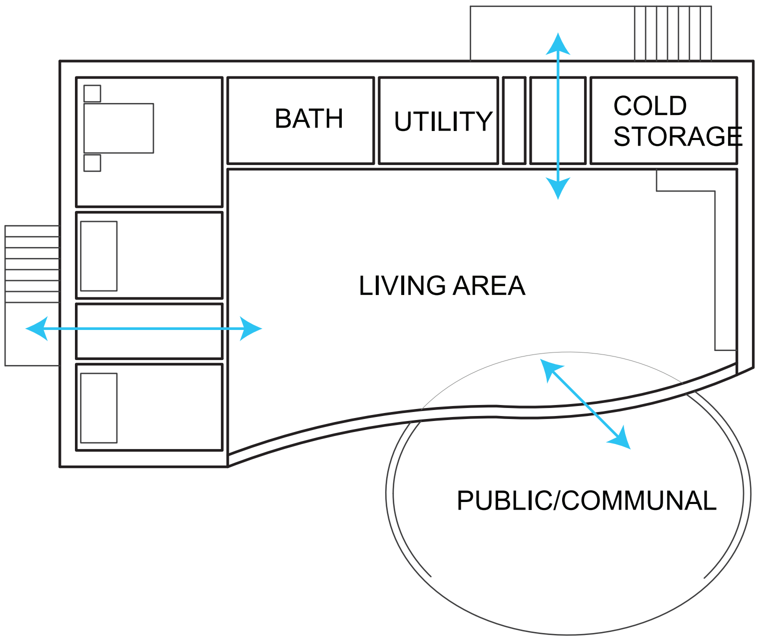


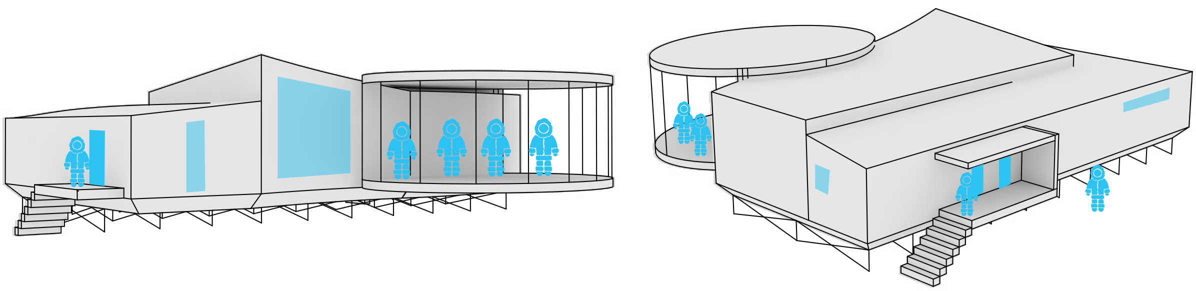




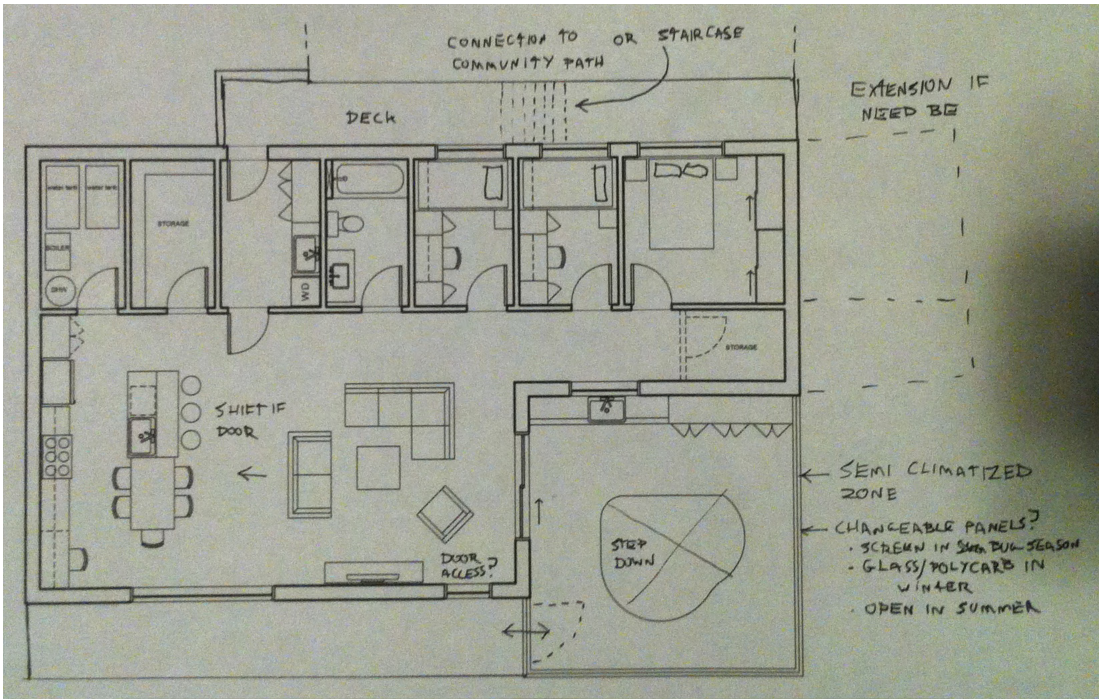
Exploration 5: Clustering 2

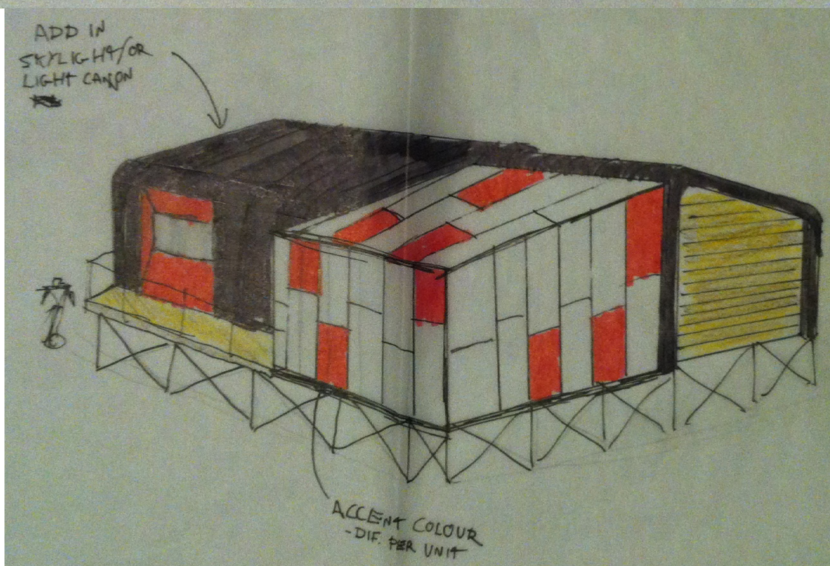


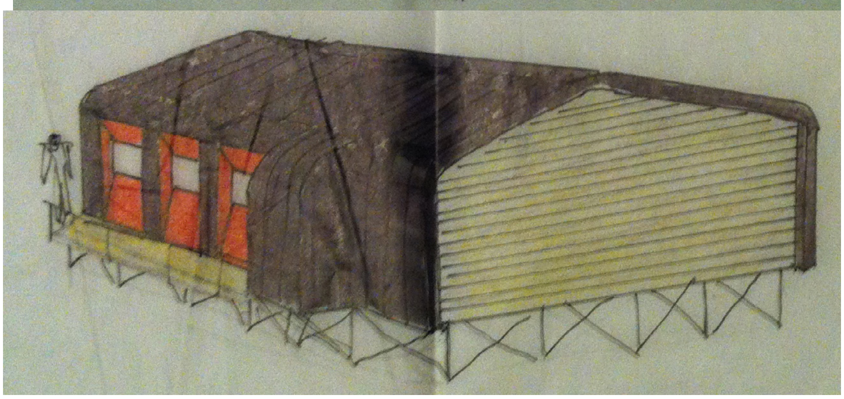


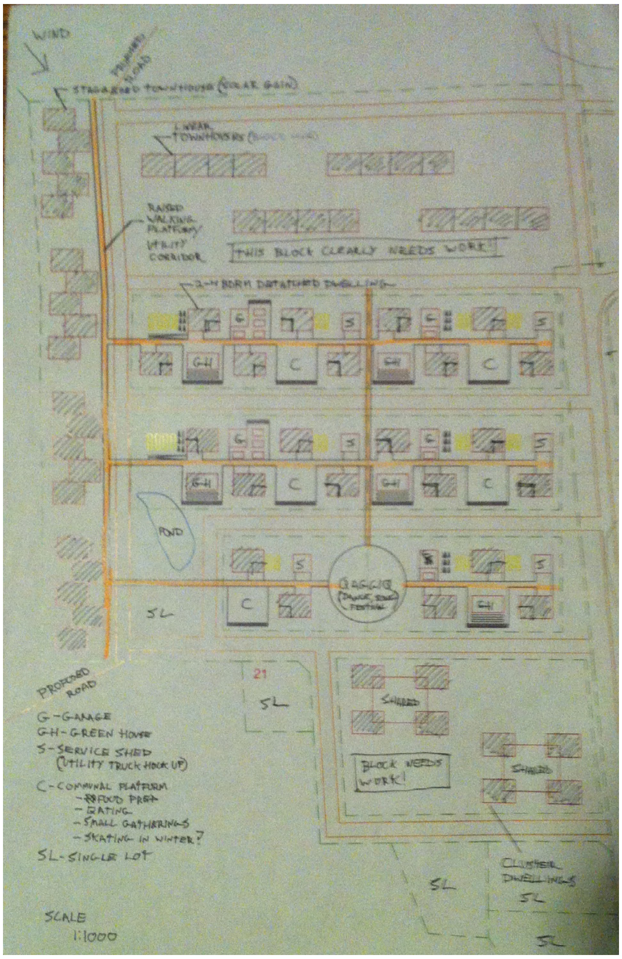


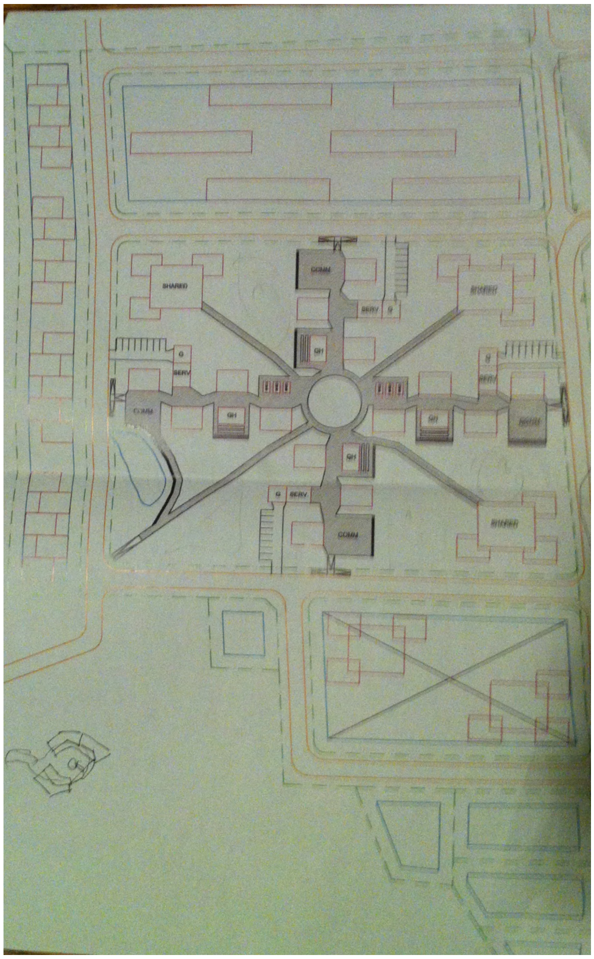
Exploration 6: Communal Deck



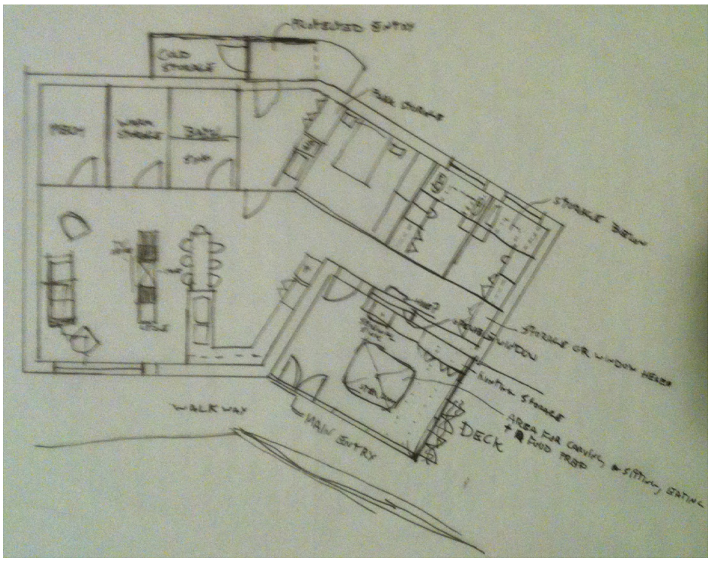


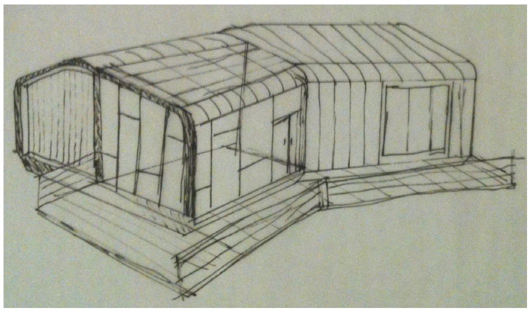


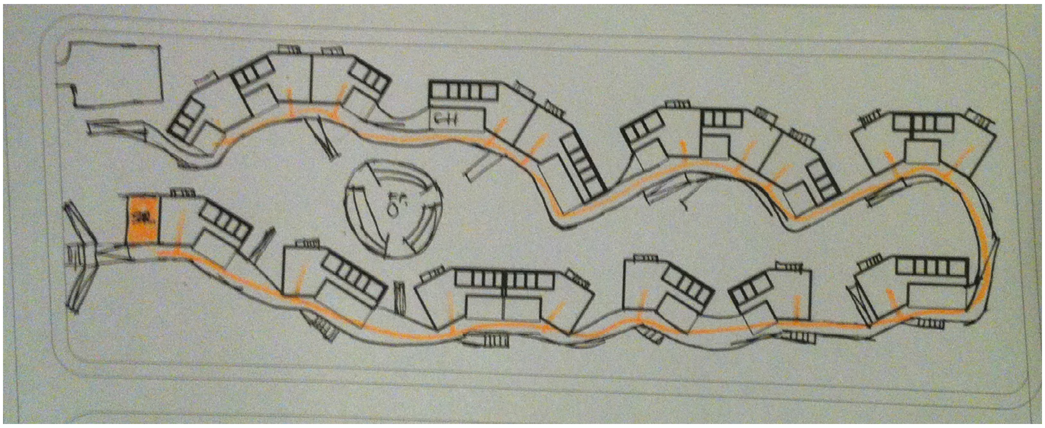


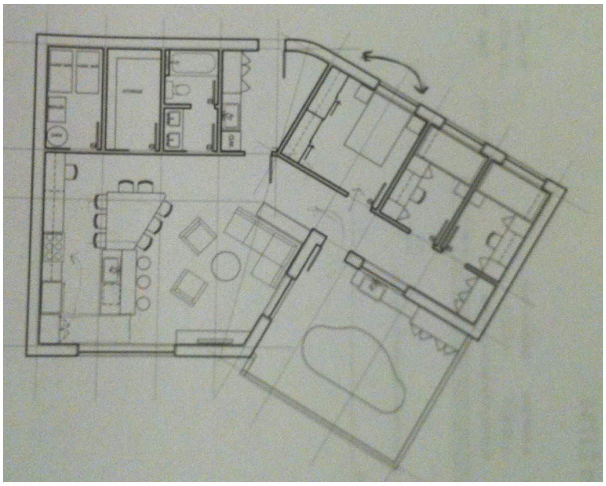


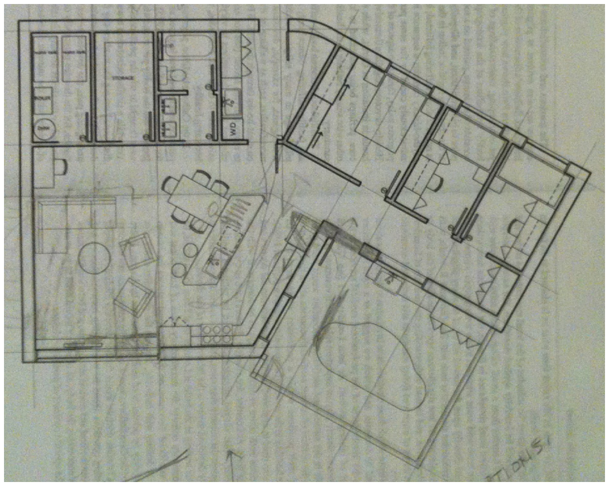
Exploration 7: Bent Plan

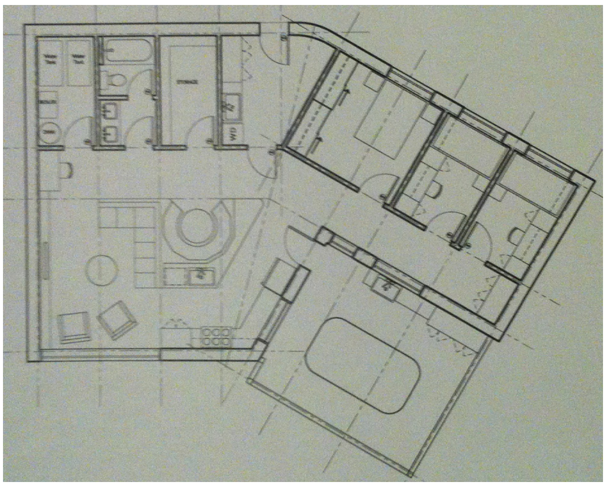






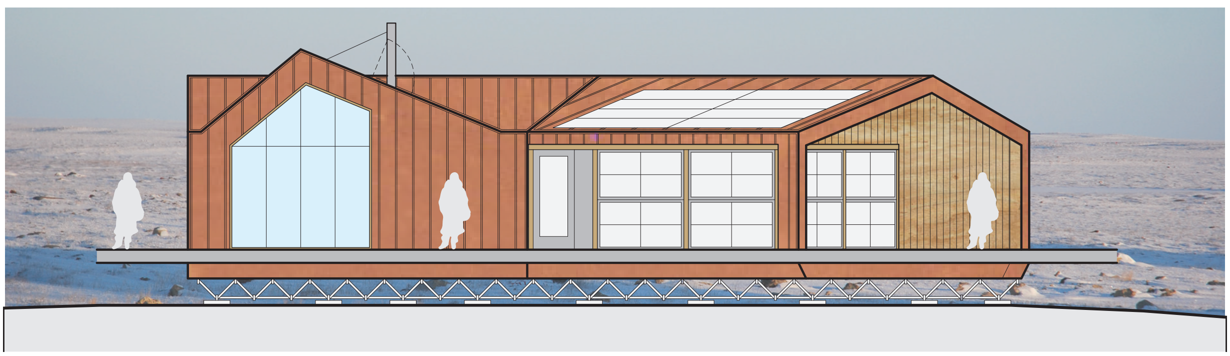


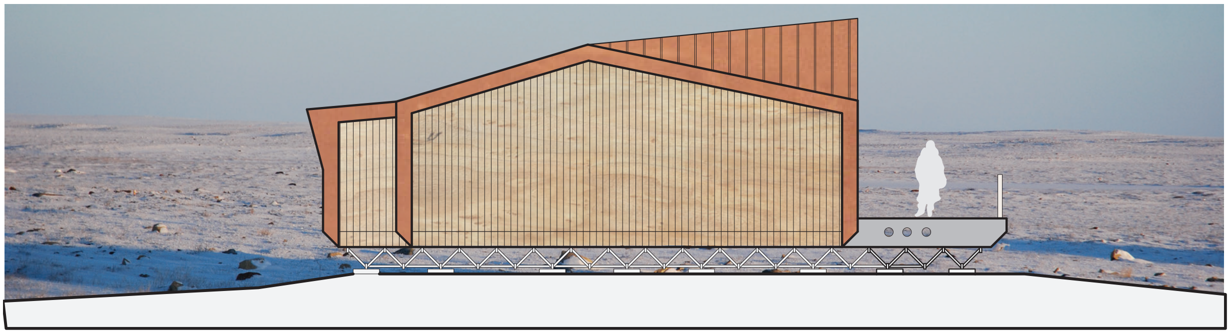




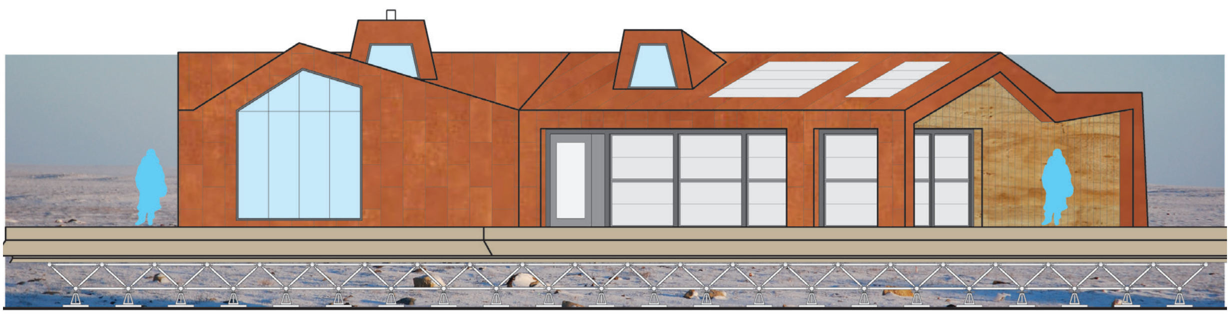
Appendix B : Substantial Completion Drawings

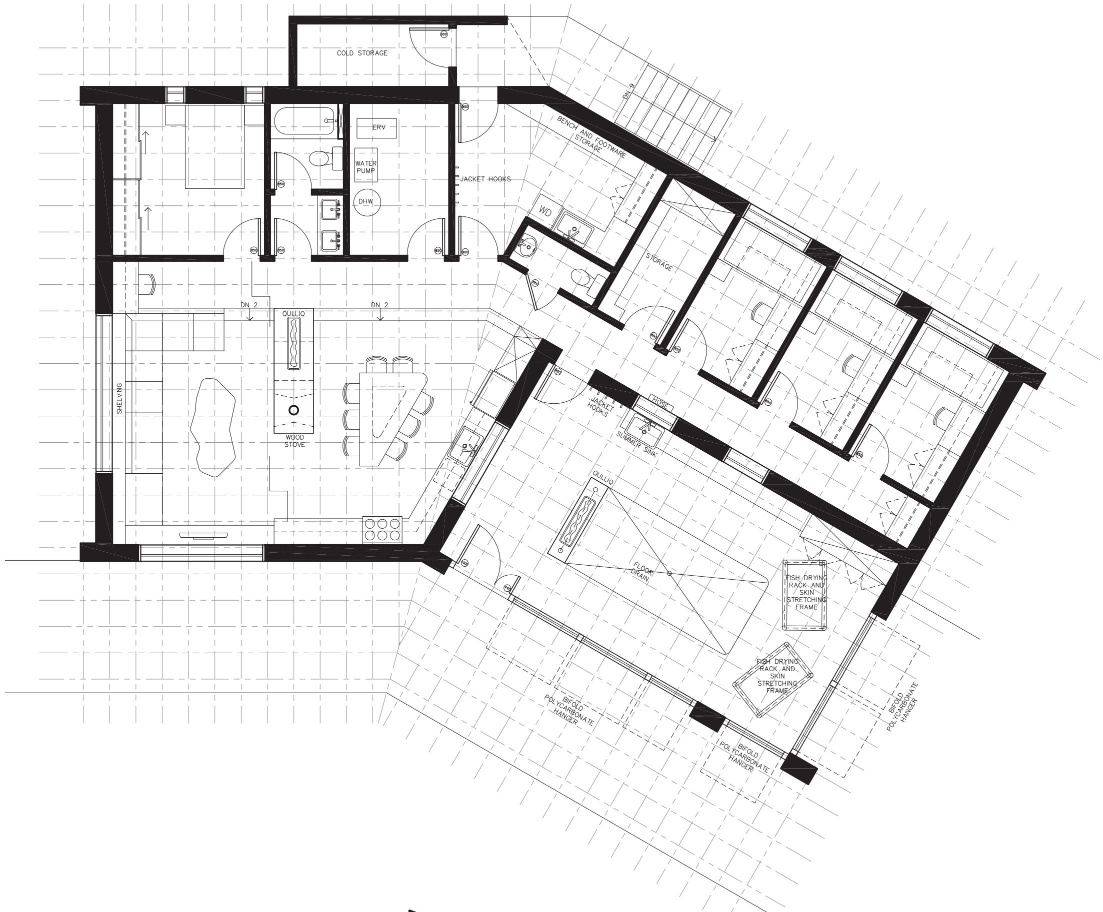
April Presentation

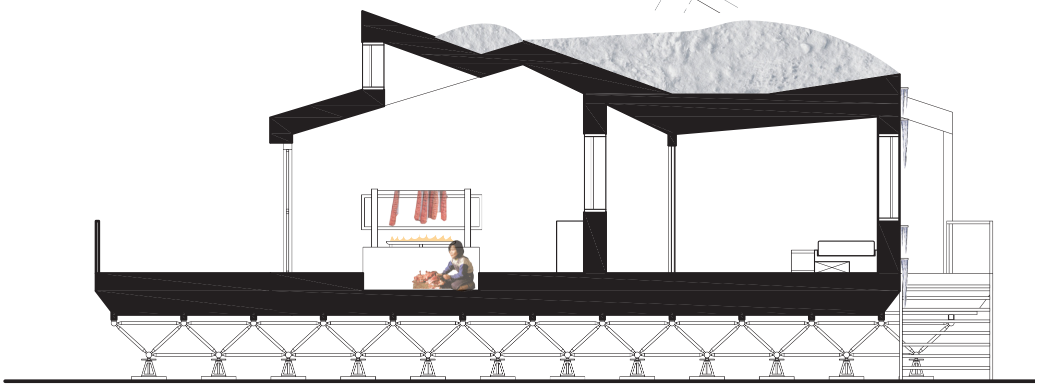


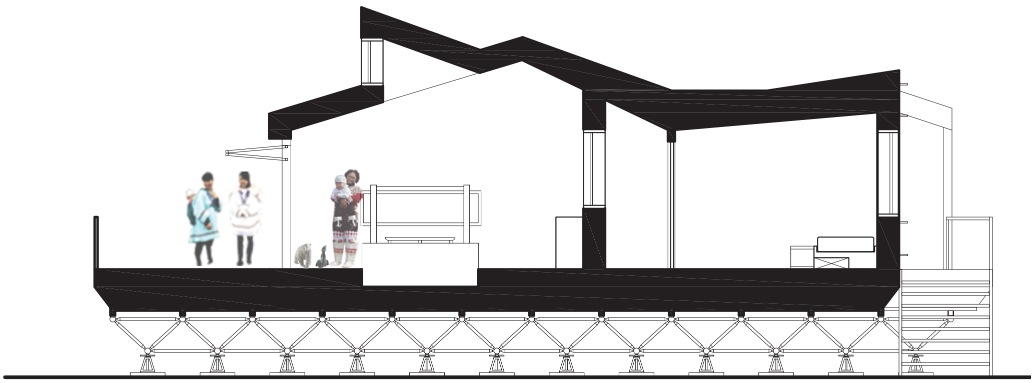


September Presentation

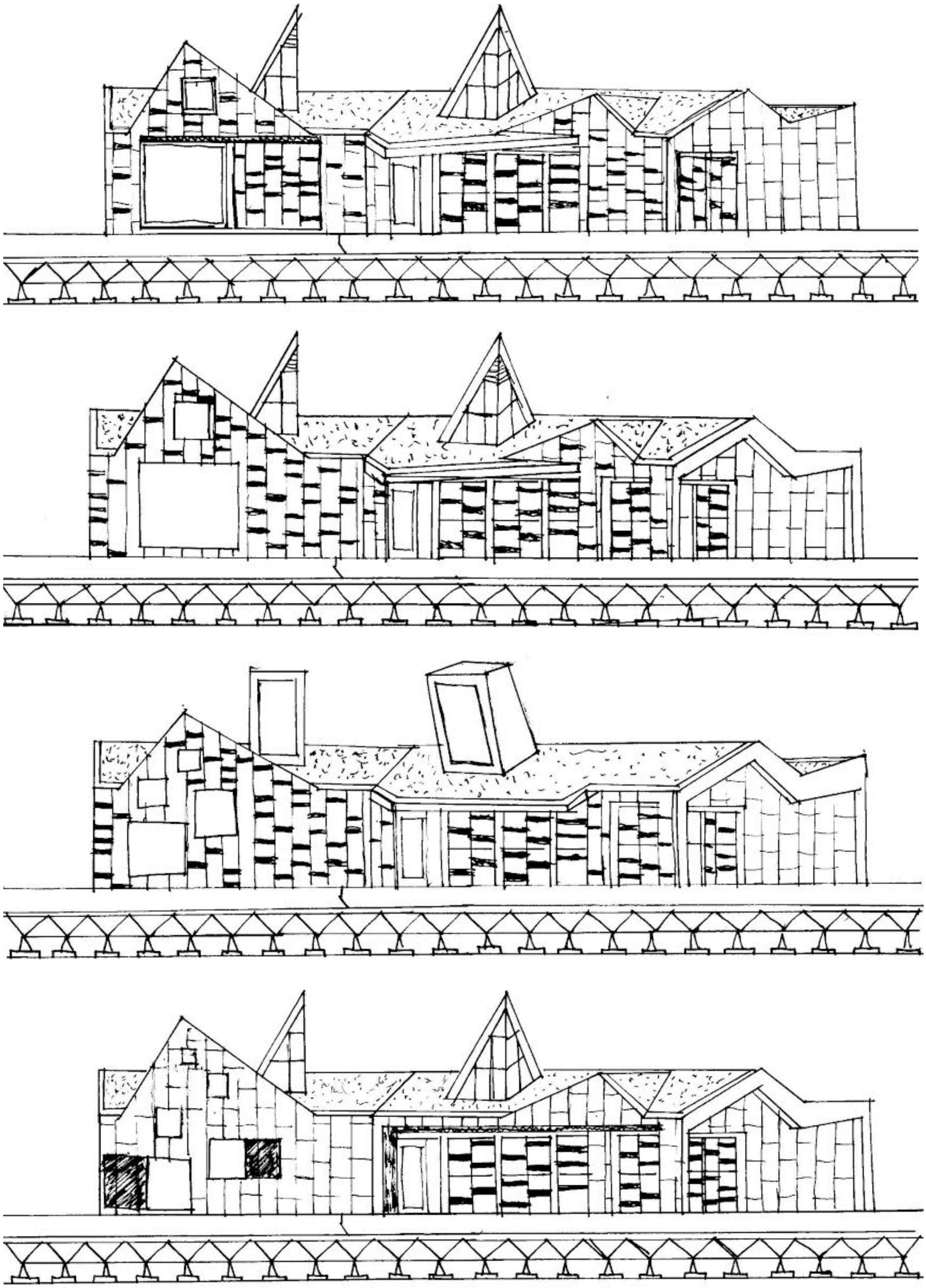


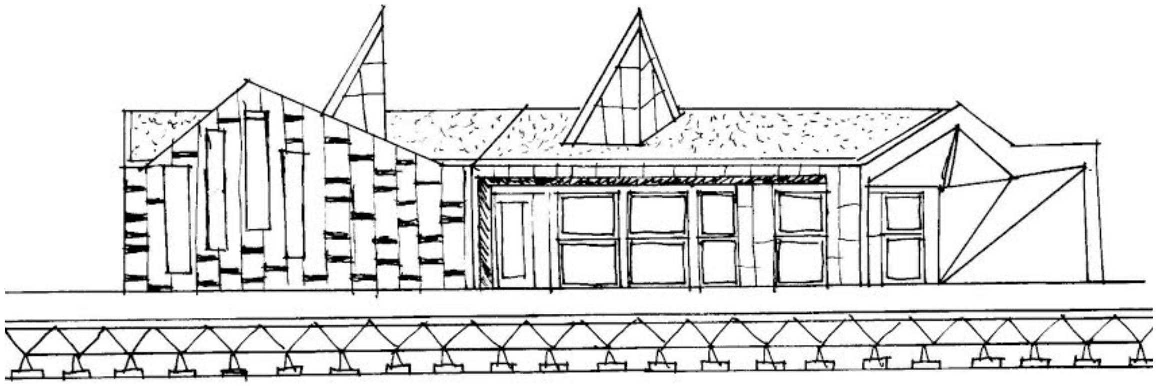

COLD STORAGE
ERV
WATER PUMP
DHW
JACKET HOOKS
BENCH AND FOOTWARE STORAGE
WD
STORAGE
DN 2
DN 2
QULLIQ
SHELVING
WOOD STOVE
JACKET HOOKS
HOSE
SUMMER SINK
QULLIQ
FLOOR DRAIN
FISH DRYING RACK AND SKIN STRETCHING FRAME
FISH DRYING RACK AND SKIN STRETCHING FRAME
BIFOLD POLYCARBONATE HANGER
BIFOLD POLYCARBONATE HANGER
BIFOLD POLYCARBONATE HANGER

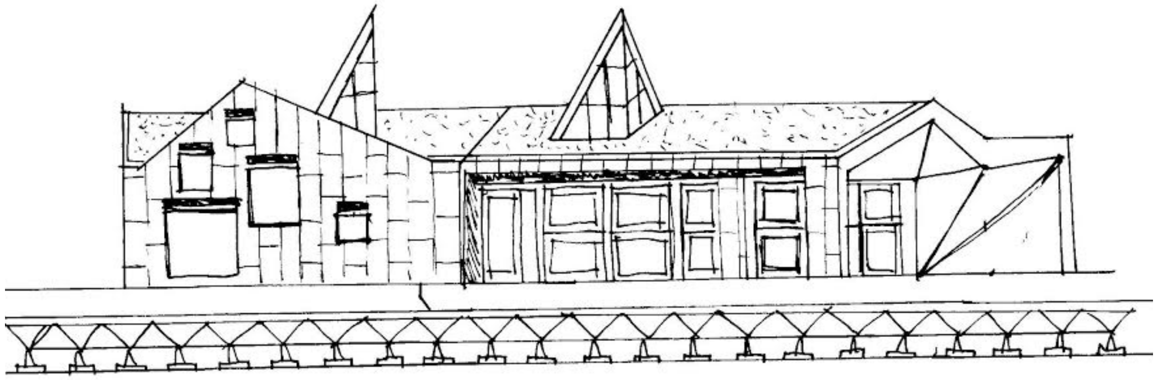


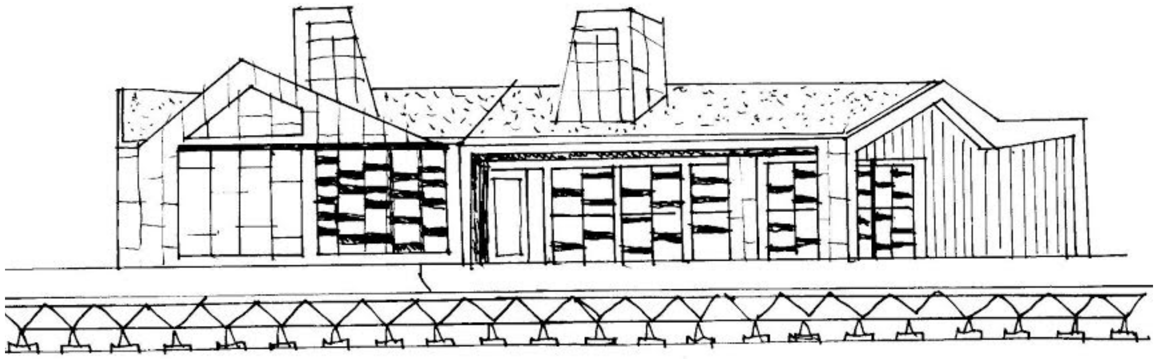


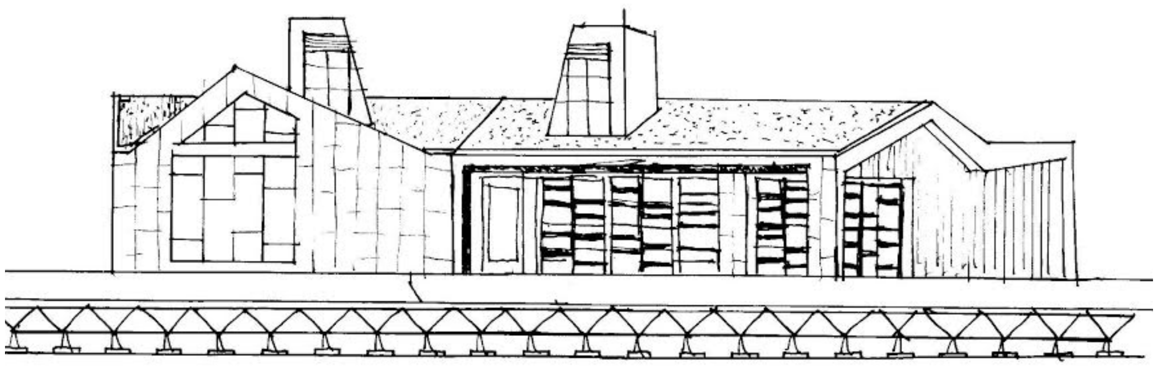
Appendix C : Facade Explorations

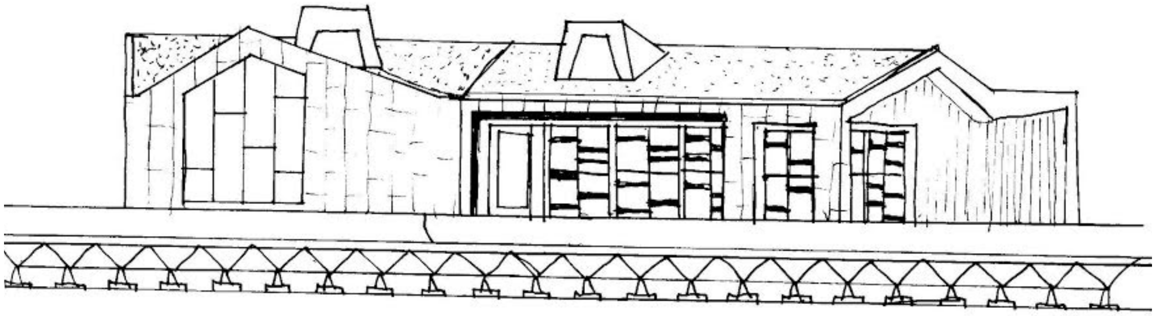


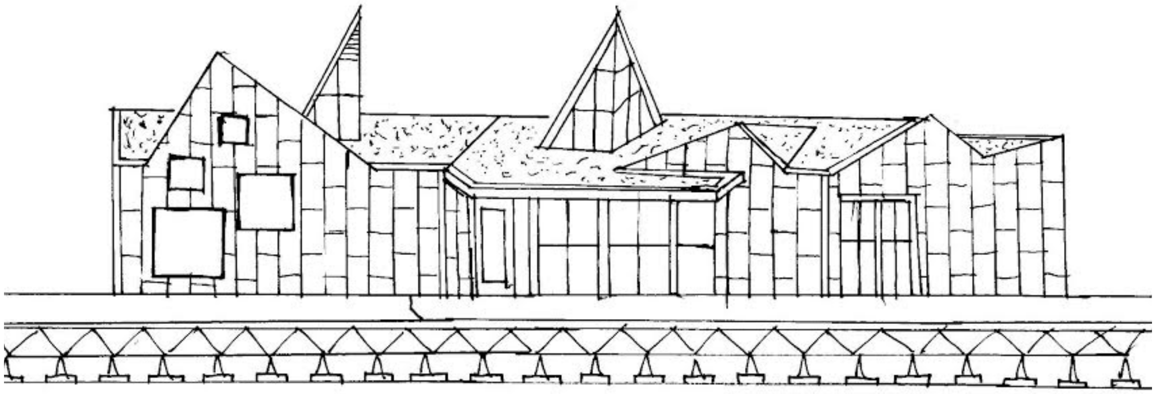




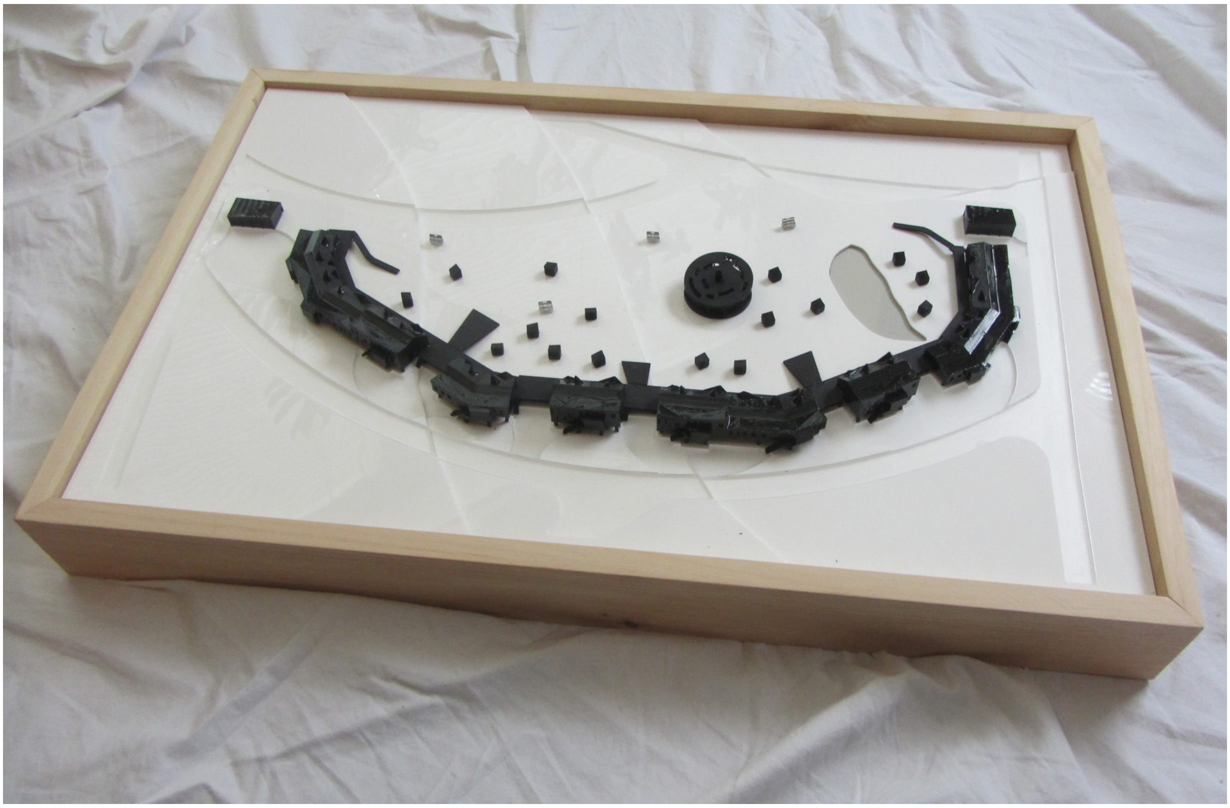




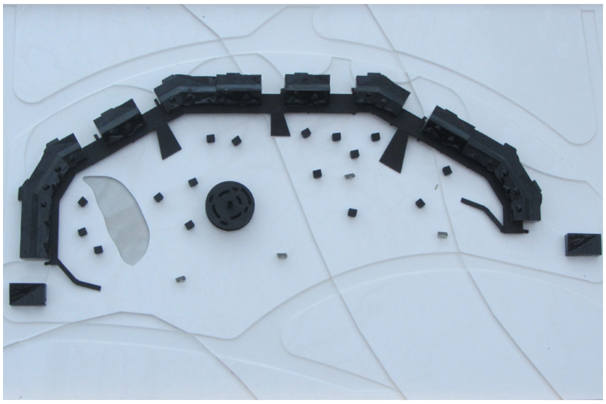
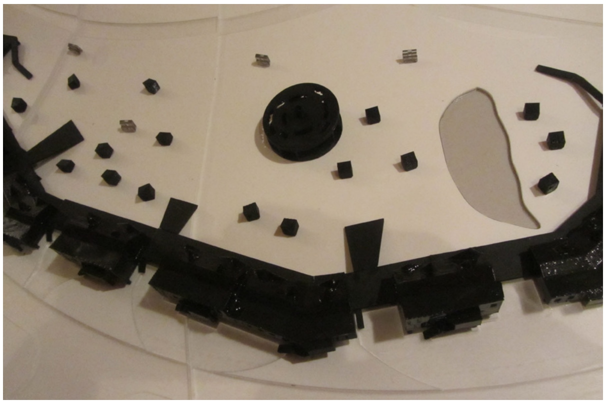
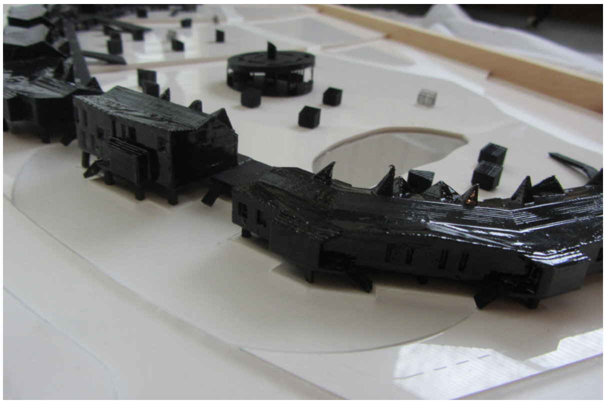
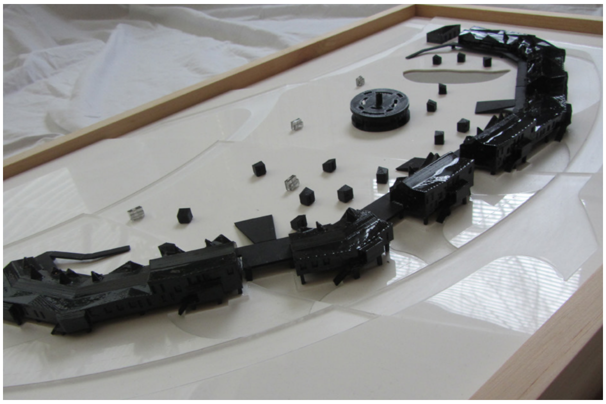
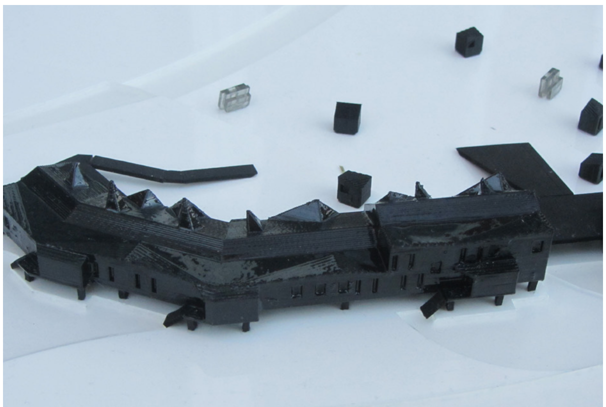
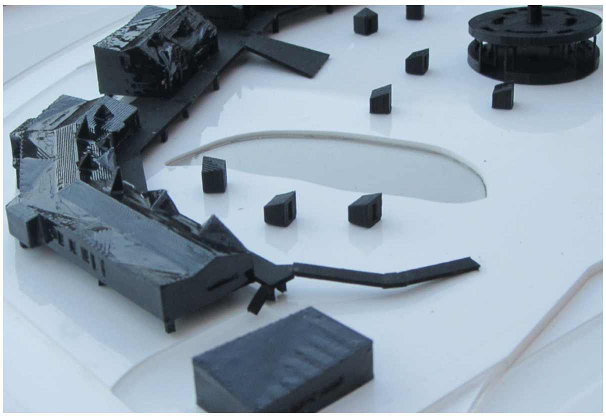




Appendix D : Site Model Photos





Appendix E : Building Model Photos